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focus

ON COMMERCIAL AVIATION SAFETY

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10 WAYS
To improve your situation awareness

1. **Be well informed.** Learn everything you can about the situation, so that you can make sound decisions. It is vital that you have appropriate and current information available, and use as much as is operationally useful.

2. **Plan well in advance.** 'Know before you go'. Research flight plans and obtain the timeliest data possible. Pre-flight planning can start days before a flight and includes knowing everything you can about the aircraft's capabilities, the weather and the airports at which you will operate.

   Having a 'Plan B' for an emergency or unexpected situation is important. Attempting to decide on a different course of action during an emergency can increase workload, cause attention narrowing and can contribute to loss of situational awareness. A 'Plan B' eliminates these stresses, and in unfavourable conditions, helps to avoid 'push-on-itis' because there is no alternative.

3. **Brief your plan.** Take a few minutes to review your flight plan and to brief yourself and your passengers and/or crew on each phase of the upcoming flight. Cover the necessities such as airports, fuel planning, emergencies and anything else that might be useful for that particular flight.

4. **Fly to your plan.** Continually monitor the flight's progress against the original plan you briefed prior to departure. Always know exactly where you are and be prepared for the tasks that are required next.

5. **Use an easily – repeatable scanning** technique ensuring that it takes in engine and flight instrument indications, aircraft heading, flight path, time, charts and the ground. Develop a scan to cover these key items without distracting you too much. The distracting you too much. The scan should be well-rehearsed and second nature; be careful not to fixate on any one item.

6. **Think ahead** and rehearse your actions at key points, such as your actions should the engine fail in cruise flight, or immediately after takeoff.

7. **Communicate clearly** when operating at, or in the vicinity of airports. Listen for key words indicating other aircraft's positions and intentions. Be aware that not all aircraft will be radio equipped and even those which are may not be listening on the appropriate frequency. Think ahead and have a plan for safe and oderly traffic separation.

8. **Fly the aeroplane** within your and the aircraft's performance limits.

9. **Avoid locking on to a problem or task** – such as your intended landing points – for too long, don't keep your head in the office, keep the scan going, be aware of the relative position and movements of other traffic, hold the heading and fly the aeroplane, at a safe airspeed appropriate to current atmospheric conditions and your height above the surface.

10. **Watch for the signs of degraded SA.**

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And here is one more...

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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: CHC S-92 G-CHCKs first offshore flight to the Forties Platform 2006. Reproduced with kind permission of Apache.

How well does training prepare today's pilots for increasingly automated aircraft?

In my editorial column in the Spring edition of FOCUS, I reflected on the state of UK airline safety and the public's perception of it. I mentioned the BA 777 accident at Heathrow which had taken place in the previous year when, had the skills and luck of the crew been any the less, and had the approach profile required more thrust just a few seconds earlier, we would now be discussing the safety status of the UK airline industry and the public's attitude to it in a somewhat different light.

Commercial air transport has undoubtedly got safer during every decade of the 20th century, but the new century has seen a levelling of this significant and welcome trend. However, there is an argument to be had that the past eight months has seen signs of stagnation, if not a reverse in airline safety. There have been more fatalities in air accidents this year so far than in any year after 2002. Moreover, had providence and skill not played their part in the Hudson and Amsterdam accidents, this year's already sad toll would have been even greater.

Is it possible to divine common causes from these high profile accidents or from the less publicised, but close-run incidents which rarely surface in the public arena? From the circles of aviation safety in which I revolve, there is one major causal factor which deserves much serious thought and subsequent action - loss of control. As potential solutions to this unwelcome phenomenon are being widely sought, I draw two conclusions. First, with today's aircraft becoming increasingly reliable and highly automated, there is a danger of the flight crew becoming mentally disengaged from the operational environment. Second, although today's aircraft are relatively straightforward to fly, there is ever reducing exposure and opportunity for hands-on flying. These areas of concern must be addressed through more effective pilot training, which must not only develop and maintain handling skills but also teach the particular competences required to undertake the monitoring role of the non-handling pilot.

This need for change in the training and preparation to operate today's aircraft not only applies to the current pilot cadre but is also required for the next generation. The education, skills and expectations of many new entrants, be they pilots, engineers or air traffic controllers, are significantly different to those who joined the aviation industry in the past. Please note that I did not say they are any worse or better – but different! Recognition of this fact demands that successful integration of newcomers necessitates a different approach – not least towards their training.

In my experience, the majority of people who joined aviation as a career in the past did so through a long-held interest in anything to do with flying. Most tended to learn a great deal about aviation and aircraft through a lengthy exposure to it from a young age and, in the process, they absorbed much knowledge through osmosis.

Today, the motivation can be somewhat different. Many decide to join the aviation industry after completion of school and university because it is seen as a lucrative, highly technical or progressive career path. It also offers status, worldwide travel and cheap holidays. But their decision to take up a career in aviation is often made much later in life, and with different expectations of it. From a negative perspective, this can mean that today's joiners are less passionate about aviation – and with significant gaps in their knowledge about the air environment which previous generations had gained through air cadets, aircraft spotting and reading innumerable aviation magazines and books.

However, on a very positive note, students now join the industry with an innate, intuitive understanding of computers and video gaming upon which today's training methods are based – and on the face of it, this skill is seamlessly carried over to the highly automated flight deck, where most will be entirely comfortable with glass cockpits and the complex, button-pressing procedures required to operate the FMS.

My major concern here, though, is a tendency to over-rely on, indeed totally trust, computer outputs. There are increasing examples where the unchallenged acceptance of an automatic response or a calculation from an aircraft system or computer has led to serious consequences. The non-aviators among the readership need only consider their attitude to the satellite navigation system in their car, to get a feel for the compelling nature of its commands. The temptation to become absorbed and ultimately fixated by the technology and to forget to look out of the cockpit or, even more importantly, think about flying the aircraft first in emergencies.

As I have already discussed, the limited exposure to manual flying in initial pilot training and later in day to day commercial operations is a serious challenge. The opportunity to develop a feel for the aircraft is a vital mechanical and optically based skill upon which to fall back when automation problems arise. In this regard, the Cranfield and the UK CAA studies into the manual flying skills of current pilots and the proposed changes to the training syllabus, which aim to better prepare pilots for highly automated aircraft operations, are welcome initiatives.

In conclusion, I remain convinced that further revision is still required to the design of initial training for newcomers to the industry. The computer and gaming skills are invaluable assets, but industry and the regulator need to seek ways to fill gaps in basic aviation knowledge, to encourage continuous development of airmanship and to ensure that the pilot's hands-on flying and monitoring skills are firmly established and then maintained over time.

Weathering the Storm

by Capt. Tony Wride, Monarch Airways

I ended my last column with a simple message "If You Think Safety Costs, Try An Accident" and that all of us in the aviation industry have a responsibility in maintaining a safe operation. I feel I may have tempted fate because shortly after writing that column, and sending it for publication, I heard the news of the tragic loss of the Air France A330-203 in the Atlantic. Although the interim report has been published we won't know for sure what caused the accident until the flight recorder has been recovered, if indeed they ever find it. However, right now some of the cost of that accident can be roughly quantified in terms of the cost of the aircraft, investigation costs, and effect of removing an aircraft from the revenue earning stream. What cannot be easily quantified, and by far the most important, is the loss of 228 lives and the effect of the accident on the public's perception of flying.

Once the lawyers start working, and I'm sure some were on the case within minutes of hearing of the accident, they will be looking to find somebody or some organisation on which to lay the blame. There have been all sorts of theories about what caused the accident including problems with the pitot system and severe weather plus the so called "expert opinions" that the media seem to be able to conjure up at short notice and quite frankly do not help matters. Even the UKFSC were approached to make comment but we have always adopted the policy of no comment preferring to leave it to the expert Investigation services to provide valid information. I must admit that there was a great temptation to suggest that the aircraft might have been hit by an inbound 'Decepticon' (see the Transformers movie if you don't know what a Decepticon is!) but I doubt that anybody would have bought that line!

For the sake of this article let us assume that the flight recorder is found and that the cause of the accident is identified as being that the aircraft encountered severe turbulence within a storm system sufficient to result in loss of control. So who are the lawyers going to blame and go chasing for compensation, Mother Nature? Even if it is proved to be the result of severe weather there is always the final scapegoat in any accident, the flightcrew. They will not be there to defend their actions and the phrase 'pilot error' will once again be banded around. Statistically we all know that the primary causal factor for aircraft accidents is pilot error.

Is it fair to constantly use the 'pilot error' term? It could be argued that in a lot of cases the pilots were in fact the final barrier in the 'James Reason Cheese' and if they had done the correct thing they would have provided the barrier and prevented the accident. A classic example of this can be seen in the A320 accident that happened in Perpignan. Whilst there was a problem with the angle of attack sensors providing false readings, the first hole in the cheese, the flight crew elected to carry out a test that should have been done at about 14,000ft at 3,000ft, another hole. There were also issues of pressure to complete the air test, yet another hole in the cheese. In the end the crew decelerated the aircraft to a point where it stalled and the final barrier was breached leading to the tragic loss of 7 lives. The report is worth reading and could even be used to highlight how a relatively benign situation can develop into a major disaster.

So what am I getting at you ask? To be an effective final barrier one of the main things that a pilot needs is to be a professional, having been trained to a high standard to deal with the unexpected. Airlines spend a large amount of money on ensuring that they have a well trained professional pilot force operating a robust set of Standard Operating Procedures (SOPs) which will hopefully reduce the risk to as low as possible. However, it is still down to the individual pilot to maintain their own professionalism and constantly consider all potential hazards that could be a threat to themselves and their aircraft. (If you're not sure what 'professionalism' is I class reading the newspaper in the climb as pretty unprofessional!)

The hazards are numerous but there is one hazard that has actually caused a number of serious accidents and that is the weather. Most recently the Bangkok Airways ATR72-500 that crashed into the disused tower at Samui was landing in bad weather as was the Air France A340 in Toronto that went off the end of the runway. In the case of the Air France A330 I'm sure the weather will end up being sited as one of the causal factors.

Before all of you non pilots out there reading this move on to the next article consider this. I have highlighted one hazard but there are loads of others that you, whether you are an Air Traffic Controller, an Engineer, or a member of Cabin Crew, can help ensure are identified and that the risks are reduced to as low as possible. Within your individual organisations the Safety Management System (SMS) should have, or be in the process of creating, a Hazard/Risk Register. One of the difficult tasks for the SMS team is actually identifying the hazards and I'm sure that they would welcome your involvement by telling them if you identify a hazard that may not have already been considered.

The UKFSC has always been committed to maintaining a high standard of aviation safety and one of the areas where we can work together as a community is with the identification of hazards. Unfortunately I missed the last meeting, (thought I had 'pig flu'), but I was pleased to see that a lot of very useful information on the subject was provided by the various speakers to the committee members. It is now planned to get the UKFSC Hazard register up and running and make the information available on the website.

As a final word all I ask is that everybody makes safety the top priority and don't take any chances.

The Criminalisation of Air Accidents

by Edward Spencer – Barlow Lyde & Gilbert LLP

Almost exactly 10 years after the tragedy, employees of Continental Airlines Inc, the manufacturer Aerospatiale and France's Civilian Aviation Authority are set to face criminal manslaughter charges for their role in the shortcomings which led to the Air France Concorde crash of July 2000, with the loss of 113 lives. This is a major headache, not just for the aviation community but also for its insurers and reinsurers. The so-called "criminalisation" of air accidents threatens to have wide-ranging implications for the industry.

The Concorde trial, which is due to open in February 2010 in Paris is the culmination of a growing trend that seeks to apportion criminal blame to individuals and organisations following major air disasters. Activity of this nature has been witnessed in connection with a number of high profile European incidents since the turn of the century, including a mid-air collision over southern Germany in July 2002 which resulted in the loss of 71 lives, a ground collision at Milan's Linate Airport in 2001 that killed 118 and the crash of a Boeing 737 near Athens in 2005 which left 121 people dead.

The development is of considerable concern to airlines and their insurers for two main reasons. Firstly and most directly, any prospect of a successful criminal prosecution is likely to have an adverse impact on the efficient resolution of related civil claims. In many jurisdictions around the world, findings in a criminal court will either bind or strongly influence civil courts and, as a result, reduce or eliminate the obstacles which civil claimants will often have to confront in achieving desired levels of compensation. In turn, this will have the effect of generating leverage for yet higher levels of damages.

Criminal convictions are also worrying because the culture in aviation has increasingly been for participants in investigations to dedicate themselves unrestrainedly to finding the true cause of an accident in the hope that lessons can be learned and similar accidents avoided. Undoubtedly, this culture has contributed to a marked decrease in the volume of major air accidents over the past 10 years. By way of illustration, the development of Doppler radar technology as a direct response to the Delta Airlines L-1011 disaster at Dallas Fort Worth in 1985 has virtually eliminated low level windshear as a cause of major air accidents. Between 1964 and 1985, windshear directly caused or contributed to 26 major civil transport aircraft accidents in the USA alone with over 620 deaths and 200 injuries. Since the early 1990s, when Doppler began to be introduced commercially, the number of windshear-related accidents involving major carriers worldwide has dropped to approximately one every ten years.

Not surprisingly, rates of premium since the aftermath of the September 2001 terrorist attacks have generally been in decline, thereby reflecting the diminishing risks associated with commercial aviation on a global scale, notwithstanding higher exposures for individual occurrences. Ignoring the vagaries of individual operations and geographical regions, which will always attract their own peculiar risk considerations, a mounting enthusiasm for criminal charges following an air accident has the potential to reverse the lesson-learning culture that has developed steadily over the last 25 years and which has contributed immeasurably to the improved safety record that exists today.

The wider consequences of an increased vulnerability to criminal liability are not difficult to envisage. Interested parties are likely to become much more guarded about what they volunteer to investigators in the conduct of their enquiries. Concern already exists that a confidential safety reporting programme which operates amongst pilots in the USA may have to be reconsidered in the light of attempts to have the reports publicised for the purposes of litigation. Meanwhile, spoliation of evidence is recognised as one of the major challenges facing the investigation sector today.
Although investigation techniques are becoming ever more sophisticated, there is a very real risk that the openness and transparency required to find the true causes of accidents will seriously hamper progress in this sphere. At a time when air traffic volumes within Europe are projected to increase by an average of 2.3% - 3.5% per year over the next 20 years, any compromise to safety is likely to be magnified. At the same time, the prospect of criminal prosecutions being successfully brought against organisations and their employees will strain attempts to seek an early and pragmatic resolution of related civil claims.

It follows that the airline community will need to take careful note of those jurisdictions which show a particular appetite for resorting to their criminal institutions in the interests of "scapegoat justice".

Fuel Saving – Food for thought...

by Captain Martin Alder – BALPA Flight Safety Group

In our first article on fuel saving we gave a taster as to what might be done to reduce fuel burn. In this second part we explore further ideas that might be considered as part of the fuel burn reduction , contributing not only to leaving more money in the pot for benefits (?), but also reducing our carbon footprint as well. Remember, these are ideas and in some cases examples of practises used by carriers. Not all may be suitable for your operation or type, but they may stimulate some thoughts as to what could be safely done. Airline operations can be notoriously conservative, rightly so, but comments on SOPs such as "we do that because we did it on the Hermes" are not always as far from the truth as we might think. Some free thinking, followed by sound analysis and assessment of risk versus benefit, may provide some clear benefits and even get rid of pointless flight deck activity that distracts from the task of managing a safe and efficient operation.

So, continuing the ideas from last time:-

- Sensible use of any take-off configuration options by the crews using operator guidance, so as to reduce fuel burn, even if a small increment in take off power is required to do so because of the changed configuration e.g. less flap requiring a higher thrust, but still with a large de-rate, lowering overall fuel burn for the departure phase. Provide guidance as to what the trade off is of fuel burn versus de-rate value, as perhaps surprisingly, the fuel burn tends to increase with increasing de-rate.

- Consider whether the existing noise reduction profile used by an operator is a costly compromise that could be altered to good effect. Use as the norm the minimum fuel burn technique with small changes in the all engines Thrust reduction and /or Acceleration Altitude variations to cater for some difficult airports, rather than blanket single values for all locations. This may also give a better payload for the sector. The early achievement of a clean configuration saves fuel.

- Sensible use of speed control as part of the permitted procedures and training to avoid excessive track distance during departure turns. As we all remember, the maximum speed for a rate 1 turn with 25 degrees of bank is 180 kts, (IAS /10 +7), but there may be other constraints such as RNAV procedures. Wherever possible, do not create extra track distance by flying fast turns and try to minimise the time flown with the aircraft not clean.

- Accurate wind information for input the FMS through out the flight profile including the alternative cruise altitudes. Do not forget the importance of the descent winds.

- Clear guidance to crews for any step climbs required to be taken or not taken. That is, provide the reason for the optimum level planned, e.g. due wind or optimum due weight. Not all seem to appreciate why the FMS says step and the flight plan says don't, especially if weights assumed and actual are different enough to create significantly different step positions.

- Crews should request direct routes as a matter of course, but do consult charts for what may be achievable or, allowed by their OPS manual. Remember that depending on the day and time, other airspace users may be the reason that no directs are possible. ATC should expect to offer direct routings whenever possible. Most do, but not always, so as a pilot, always ask if it is sensible to do so and R/T loading permits.

- Crews must be given clear guidance on the use of the Cost Index. In some cases, an operator may find that small increments in speed via the CI in the cruise phase can save time with no perceptible fuel penalty. Not all seem to be aware of what the CI does and why, resulting in frequent discussion as to what is being done and why. Knowing the "ballpark" figures for fuel and time related costs can help crystallise why a 300kgs fuel burn increase saving only 2 minutes on the flight time, is not a good idea!

- A practise of flying at or, near holding speed rather than optimised cruise speed for reasons of ground handling resources, is an inefficient means of achieving a particular end and should be ended. Much better to take any early arrival delay on the ground, both for cost and safety reasons.

- The crews may find it beneficial, that when determining what the optimum direct routing request should be, that they look further ahead than most tend to currently, do. For example, try the option of Direct To the Final Approach Fix to determine what absolute optimum direct is. Bear in mind that if a significant deviation from track occurs, the wind may not be correct and undermine the benefits of the direct route.

- Consultation by the operators with ATC to determine what optimum descent profiles, both laterally and vertically really are, assuming the best balance for optimum overall benefit. Some current ones are very penalising and relatively small changes could cumulatively save large amounts.

- Allow free speed to be used in en-route descent, optimised for fuel burn via FMS Cost Index. Speed control in descent is very inexact, with the effects of both wind and TAS due altitude difference between aircraft as factors which undermine any benefits for its use as a separation tool for ATC. It only really works if both aircraft are following identical vertical paths.

- ATC should provide early information on any approach delays and permit early speed adjustment by the crew to absorb these. A crew should not be penalised, i.e. position in the sequence maintained once the above information is passed. Crews need to be clear about understanding optimum speeds for range (LRC) and time (holding speed). They will not be same unless at higher altitudes where they may be very close. Flying at holding speed at medium to low level saves about 15 to 20% of fuel burn per unit time compared to flying at the average cruise speed for the same level. e.g. typical A320 values, 2500kgs/hr at 250 kts, 2100kgs/hr at 210 kts.

- ATC should always give timely information on distance to touchdown during approach vectoring, updated sufficiently often for the crews to correct any off optimum from the ideal Continuous Descent Approach profile.

- Operators should provide crews with guidance and training to achieve Continuous Descent Approach profiles. A side benefit, is a substantial increase in energy and situational awareness, which should give a reduction in the number of high energy approaches.

- There are some interesting and exciting variations in ATC speed requirements during final approach, that make stabilised approaches difficult to achieve in any variation. The 180 kts to 4nm at one airport springs to mind. There are sensible values that have been used for many years and could easily be universally applied. This would take a lot of guesswork out of the "will or will we not be stable" and worst still results in crews ignoring the speed requirements of ATC and creating a loss of separation and fuel eating go -arounds.

- Operators should review their stable approach criteria, as there are significant variations within the industry that are possibly counterproductive. Some can adversely impact capacity and also result in avoidable go-arounds. There are currently variations that do not reflect reality and cause unnecessary distraction when they do not actually fit the approaches flown. A suggested practical approach that all approaches passing 1000ft above the landing threshold should be stable for the configuration specified for the approach and at 500 ft must be stable in the landing configuration. This permits small variations to account for circling approaches and variations caused by atmospheric conditions that were unforeseen, e.g. tailwinds, or the use of anti ice, which may result in slightly higher speeds or vertical deviations, or configurations required of the procedure being flown.. The risks in a go-around can be considerable, especially the risk of a badly executed one, e.g. flap over speed, departure from controlled flight, disorientation and CFIT. This flexibility would then act to prevent, what are in terms of safety, capacity and environmental issues, the counterproductive go arounds that can occur when stabilised criteria do not reflect reality and what are small variations of no consequence, assume overly large importance. For example an acceptable circling approach could be at 600ft AAL manually flown at Vref plus 8 and up to plus 15kts on that, resulting in the landing config being established at 500ft AAL at Vref plus 10kts. How unsafe can it be in comparison then, if you are on an ILS in the landing config but at Vref plus 20kts at 1000ft AAL autopilot and auto-thrust engaged with every likelihood of being Vref plus 5 at 500ft AAL?

- Guidance needs to be produced, on what is best practise to cater for situations that may arise giving cause for concern over energy state, so that optimum recovery strategies are available to crews. This recovers wasted energy with least cost and may assist in minimising the risk of an unstable approach and incorrectly flown go-around

- Use only reverse idle thrust whenever possible. Reverse thrust creates noise, uses fuel and puts another cycle on the engine. The engine will also need a cool down cycle, so it delays shutdown for taxi on one engine. Of course if needed for safety reasons it must be used, but remember that all normal wet and dry landing performance is based on not using reverse thrust. The operator will have guidance from the manufacturers on the brake wear aspects, which for example, will differ between carbon and steel brakes.

- Flexible landing configurations to be used whenever possible i.e. reduced flap when possible, to minimise overall fuel burn during flight, balanced against any difficulty in stabilizing the approach, resulting taxi time, effects of wind, brake cooling and surface conditions. Guidance to include how to identify unsuitable circumstances, what to do if the low drag configurations unsuitability is identified during an approach, e.g re-configuration options, considerations for any go-around.

- Guidance to be provided on when an engine or engines being shut down is safely and sensible achieved during taxi in. For example, when taxi times or routes make it inadvisable, such as runway crossing, wet or contaminated surfaces etc. The fuel savings are not quite as simple as fuel flow per engine shut down, as the APU burn and lower taxi speeds need to be considered. On the other hand, brake applications may well be reduced and if there is any stationary delay, fuel will certainly be saved.

- Use fixed ground electrical power and low pressure conditioned air supplies when available on stand to minimise APU use.

- Operators to remove multi sector catering where hygiene permits, to save weight.

Longer Term

- Better ATC routes with flexible airspace use increased should be the target. Free Flight is still along way off, but many benefits could be realised now with a better use of existing airspace. Really long direct routes are often given now within Europe and with some political pressure, more ought to be available.

- Departure and arrival procedures need to be improved, with better tracks and profiles designed matching optimums, flexibly dealing with performance variations whenever possible. A one size fits all approach for all loadings of traffic may not get the best out of the system, One sees pressure today for flexibility to be removed in the interests of standardisation. However, flexibility must remain as an option, both by design and also by willingness to execute it, to improve fuel efficiency whenever safely possible in the few quieter periods that remain. The environmental balance is sensitive in this area, but by having an overall view of the various elements presented on these issues, the balance between fuel saving and other aspects may be better served, as there may be a common solution that is more acceptable to all.

- ATC and operators should increase the application of flexible flight plan routings on a tactical basis to minimise delays and overall fuel burn. Operators need to agree as to what is an acceptable variation in route versus time and the balance of delays and fuel burn and fuel carriage to permit such tactical changes. Operators would need to provide standard alternative plans for reference in the crew documentation in the flight deck, or a means to get relevant information to the crew.

- Optimisation of departure profiles to permit advantages for higher performing types, e.g. short haul versus long haul aircraft, with quicker climbs and shorter route options for those able to comply.

- Industry to standardise the speeds used during approach radar vectoring for ease of use by the crews and to optimise ATC capacity. Without ATC speed control this is nigh on impossible to achieve. Improving capacity will reduce delays and thus fuel burn

- Industry to invest in the increased provision of fixed Ground Services to reduce APU usage. Printing pages of airport APU running restrictions of no practical effect is not the way ahead. The industry will be accused of speaking environment but doing something else, let alone the adverse effect of those trees felled for the paper to print the stuff on!

- The weight saving and safety benefits gained by removing duty free goods from the aircraft could be substantial. The sale of duty free on arrival is practised in some countries already. Standardising on that process would save the weight of the carried items. If the passengers were to provide ticket information, the airlines could even take a share of the commission on sales and passengers gain access to airline specific goods on arrival.

I hope that this has been of some interest to you all. May I wish you safe and efficient flying.

Flight Crew Response to In-Flight Smoke, Fire, or Fumes

by William A. McKenzie, Flight Crew Procedures Manager

Smoke, fire, or fume (SFF) events can occur suddenly in commercial airplanes. Yet information about the source of the event may be vague, incomplete, inaccurate, or contradictory. Additionally, there is a wide range of possible sources and situations.

Historically, airlines have provided flight crews with checklists to help them identify and deal with smoke, fire, and fumes. Until recently, manufacturer and airline checklists varied in format and content. In response to this situation, Boeing worked together with airlines, pilots, and other manufacturers to develop a philosophy and a checklist template to standardize and optimize flight crew responses to non-alerted SFF events (i.e., events not annunciated to the flight crew by onboard detection systems).

These efforts have produced a set of new, industry standard procedures that:

- Define a common approach for manufacturers and airlines to take when developing checklists.
- Define a common set of actions for pilots to expect across multiple models.
- Create an SFF checklist template that addresses key issues that were widely divergent in the industry.

Flight crews worldwide now have a single integrated checklist that can be used for all non-alerted events.

Providing the best possible crew guidance

The objective of the checklist template is to provide the best possible crew guidance for managing in-flight SFF events while acknowledging that every SFF situation is different.

As a result, flight crews worldwide now have a single integrated checklist that can be used across all non-alerted SFF events (see fig. 1). The guidance provided by the new template addresses:

- SFF source identification.
- Actions to perform regardless of source
- Crew communication.
- Timing for diversion and landing initiation.
- Smoke or fumes removal.
- Additional actions to perform if smoke persists.
- Loss of capability and operational consequences.

Industry concensus regarding SFF events

The Flight Safety Foundation sponsored this international industry initiative to improve checklist procedures for airline pilots confronting smoke, fire, or fumes. It also published the Smoke/Fire/Fumes Philosophy and Definitions, which was used to construct the SFF checklist template. Here are the key components of this philosophy.

Figure 1: Smoke, fire, or fumes (SFF) checklist template

Boeing used this template to develop new SFF checklists for all passenger models of the 737,747,757,767, and 777 airplanes and is in the process of developing and evaluating similar checklists for the MD-80, MD-90, 717, MD-10, and MD-11 airplanes. The template is designed to be used by all manufacturers and operators to standardize and optimize flight crew responses to non-alerted SFF events.

STEP	ACTION	RESPONSE
1	Diversion may be required.	
2	Oxygen masks (if required)	On, 100%
3	Smoke goggles (if required)	On
4	Crew and cabin communications	Establish
5	Manufacturer's initial steps	Accomplish
	Anytime smoke or fumes become the greatest threat, accomplish separate Smoke or Fumes Removal Checklist.	
6	Source is immediately obvious and can be extinguished quickly: If YES → go to Step 7. If NO → go to Step 9.	
7	Extinguish the source. If possible, remove power from affected equipment by switch or circuit breaker on the flight deck or in the cabin.	
8	Source is visually confirmed to be extinguished: If YES → consider reversing manufacturer's initial steps. Go to Step 17. If NO → go to Step 9.	
9	Remaining minimal essential manufacturer's action steps [These are steps that do not meet the"initial steps" criteria but are probable sources.]	Accomplish
10	Initiate a diversion to the nearest suitable airport while continuing the checklist.	
	Warning: If the smoke/fire/fumes situation becomes unmanageable, consider an immediate landing.	
11	Landing is imminent: If YES → go to Step 16. If NO → go to Step 12.	
12	"X" system actions [These are further actions to control/extinguish source.] If dissipating, go to Step 16.	Accomplish
13	"Y" system actions [These are further actions to control/extinguish source.] If dissipating, go to Step 16.	Accomplish
14	"Z" system actions [These are further actions to control/extinguish source.] If dissipating, go to Step 16.	Accomplish
15	SF continues after all system-related steps are accomplished: Consider landing immediately. Go to Step 16.	
16	Review Operational Considerations.	
17	Accomplish *Smoke or Fumes Removal Clecklist*, if required.	
18	Checklist complete.	

General

- The entire crew must be part of the solution.
- For any smoke event, time is critical.
- The SFF checklist template:
  - Does not replace alerted checklists (e.g., cargo smoke) or address multiple events.
  - Includes considerations to support decisions for immediate landing (e.g., overweight landing, tailwind landing, ditching, forced off-airport landing).
  - Systematically identifies and eliminates an unknown SFF source.
  - At the beginning of an SFF event, the crew should consider all of the following:
  - Protecting themselves (e.g., oxygen masks, smoke goggles).
  - Communication (e.g., crew, air traffic control).
  - Diversion.
  - Assessing the SFF situation and available resources.

Source elimination

- It should be assumed pilots may not always be able to accurately identify the smoke source due to ambiguous cues.
- It should be assumed alerted-smoke-event checklists have been accomplished but the smoke's source may not have been eliminated.
- Rapid extinguishing or elimination of the source is the key to preventing escalation of the event.
- Manufacturer's initial steps that remove the most probable smoke or fume sources and reduce risk must be immediately available to the crew. These steps are developed by the manufacturer and typically have the pilot turn off components or systems having the highest probability of addressing a smoke/fire/fume source. These steps should be determined by model-specific historical data or analysis.
- Initial steps for source elimination:
  - Should be quick, simple, and reversible.
  - Will not make the situation worse or inhibit further assessment of the situation.
  - Do not require analysis by the crew.

Timing for diversion/landing

- Crews should anticipate diversion as soon as an SFF event occurs and should be reminded in the checklist to consider a diversion.
- After the initial steps, the checklist should direct diversion unless the SFF source is positively identified, confirmed to be extinguished, and smoke or fumes are dissipating.
- The crew should consider an immediate landing anytime the situation cannot be controlled.

Smoke or fumes removal

- The decision to remove smoke or fumes must be made based upon the threat being presented to the passengers or crew.
- Crews should accomplish procedures in the Smoke or Fumes Removal Checklist only after the fire has been extinguished or if the smoke or fumes present the greatest threat.
- The crew should be directed to return to the Smoke/Fire/Fumes Checklist after smoke/fumes removal if the Smoke/Fire/Fumes Checklist was not completed.

Additional steps for source elimination

- Additional steps aimed at source identification and elimination:
  - Are subsequent to the manufacturer's initial steps and the diversion decision.
  - Are accomplished as time and conditions permit, and should not delay landing.
  - Are based on model-specific historical data or analysis.

Checklists for Boeing Airplanes

Boeing has used this new template to develop a combined checklist that addresses electrical smoke, air-conditioning smoke, cabin smoke, and fumes.

In 2007, Boeing published new Airplane Flight Manual and Quick Reference Handbook checklists for all passenger models of the 737, 747, 757, 767, and 777. Boeing is in the process of developing and evaluating similar checklists for the MD-80, MD-90, 717, MD-10, and MD-11 airplanes.

Summary

By working through a logical checklist, flight crews can better isolate the cause of SFF events and take appropriate action.

For more information, please contact Bill McKenzie at william.a.mckenzie@boeing.com.

Reprinted from AERO Magazine, courtesy of The Boeing Company

MCRM – Background

MCRM – Multi-Crew Resource Management – is an initiative which combines controllers and pilots in a days' facilitated workshop. The objective of this activity is to enable pilots and controllers to share experiences and information to enhance both parties understanding of their operations.

It has been known since controllers talked to pilots that R/T and understanding of the rules, practice and procedures in both environments are vulnerable to mistakes and misunderstandings. The principle of the MCRM workshops is to use the knowledge of the two groups to debate and discuss the human performance issues which both deal with. These topics typically include communication and situation awareness.
The workshops were developed from discussions held during the Safety Partnership Agreement – SPA – meetings which have been held for the last two years between NATS safety specialists and the safety managers from the major UK airlines, the business jet community and CAA.

Airlines have spent over 28 years building their Crew Resource Management (CRM) programmes and ATM organisations have developed a similar concept of Team Resource Management (TRM) in the last 10 years. Both programmes discuss similar concepts but each programme delivers their materials slightly differently. The programmes are very effective in developing knowledge, attitudes and behaviours for each of the professional groups, but there continues to be a growing number of serious incidents in which both parties contribute causal factors. These risks are exacerbated by a lack of understanding between the two groups in terms of their roles, skills and ways of working; it is for this reason that MCRM has been developed.

The programme is being developed and managed by the Division of Safety at NATS in collaboration with the Swanwick Safety team, although there are plans to include the Scottish centre and the IAA in further work. To date there have been three courses run at Swanwick with a TRM facilitator and a CRM instructor. These were attended by 30 controllers (including a Union representative), 16 pilots and a CAA ATM Inspector. It is hoped that at least sixteen further courses will be

run in the next 15 months, divided between Swanwick and ScOACC.

The feedback thus far has been very encouraging – the overall total rating from the first 3 courses was 9.0 (out a possible 10) and we believe that this programme, in conjunction with other pilot/controller fora, will become an essential safety discussion. The team will also be monitoring the ongoing pilot/controller incident statistics to try and understand whether there has been an improvement of this interface risk. There is also a strong desire from both professional groups to expand the one day to two, which may enable an increased opportunity for the visiting pilots to observe the live controlling environment.

If you would like more information about this programme, please contact Anne Isaac at anne.isaac@nats.co.uk

Meeting of Minds

by Captain Barney Wainwright - flybe.

Recently I was privileged to be invited as a delegate to a prototype of a new kind of CRM training session with a joint group of about 16 pilots and air traffic controllers run by NATS (National Air Traffic Services) at the Swanwick national air traffic control centre near Southampton. It was called Multi-Crew Resource Management or MCRM - in order to distinguish it from the CRM sessions we pilots do and the TRM (Team Resource Management) sessions that the controllers go through.

After beginning with the usual introductions, we were given an 'ice-breaking' group exercise which got people talking, and we then had three modules or topics to discuss: Pilot/Controller Communication, Situational Awareness and the LOT 282 incident (4 June 2007) at Heathrow*. Although timekeeping was constantly challenged by numerous side discussions between pilots and controllers, we managed to successfully finish by 5pm, following which there was a short tour of the radar rooms for the pilots.

So. what did I learn? The most striking thing by far was that, contrary to popular banter, we are all 'on the same side' and although there are many occasions when it doesn't appear that way from the flightdeck, it is usually because we really don't have the big picture in the air. On the other side of the coin, the other pilots at the session and I were able to explain some of the intricacies and problems of working in the flightdeck environment to the controllers.

Some of the other points I learnt along the way were:

Frequency congestion

- Don't get stressed when the frequency is so busy that you can't get a word in to check in. As long as you are listening out they will call you if they need to, so just relax and wait.
- Submit an ASR (Air Safety Report) if frequency congestion has been a major problem for you... Even after the event, if NATS know the frequency and time it helps them to build a picture so they can adjust the manning to improve the service.

Engine failure after take-off

It's quite likely that the controllers will not be aware of what our 'emergency turn procedure' is. (This is a procedure used in IMC to ensure that the aircraft maintains terrain clearance even if its rate of climb is very poor after an engine failure.) As we practice in the sim, we should make a MAYDAY call which ideally includes telling ATC what we are going to do. However, from an ATC point of view, if your hair is on fire and you haven't got the time or ability to do that pretty soon, squawking 7700 will get their attention immediately and they will clear all traffic out of your way.

Weather avoidance

It has always surprised me that ATC can't see where the weather build-ups are, though they become aware of the general location after a while. However, they do find it helpful to be told where the cell is, and also an estimate of the cloud tops is very useful indeed so they can formulate a plan knowing whether some traffic will go over the top of the build-up.

Read-Backs

Controllers are sometimes pedantic for very good reason. Pilots can be somewhat sloppy about read-backs, so. one of the RT phrases which is really important to read back verbatim because it is designed specifically to reduce confusion between altitudes and flight levels, - and the resulting alt bust - is: "Descend to altitude [n] thousand feet QNH [xxx] millibars".

There was a lot of animated debate and interesting discussion and overall it was a very worthwhile day. NATS is now going to run a series of these sessions, both at Swanwick and at the Scottish ATC centre at Prestwick, with aim being to get all their controllers through a joint pilot/controller session in the next 18 months-2 years. . A small handful of Flybe pilots will be included whenever possible... so by the time you read this you may well have had the MCRM treatment as well. I hope you enjoy it as much as I did.

* The LOT 282 incident involved a Boeing 737 that lost all its main flight instrument and navigation displays just after take-off from Heathrow into IMC. Their inability to navigate combined with poor spoken English and an initial reluctance to request assistance provided a real challenge for Heathrow ATC. You can read the report on it in the June 2008 bulletin at http://www.aaib.qov.uk/publications/bulletin.

Grace Under Pressure

Dr Simon Bennett looks at how pilots are able to perform under physical and psychological stress and the importance of 'expecting the unexpected'

It is fair to say that the media has a schizophrenic relationship with aviation. Pilots and cabin crew are either saints or sinners, depending on the circumstances. A pilot guides her stricken aircraft away from a populous suburb: saint. A fatigued pilot elects not to go into discretion resulting in inconvenience to passengers: sinner. One travel writer has suggested that pilots do little actual work for a great deal of money. As a human factors specialist who has worked in aviation for 12 years I can say with confidence that such opinions are ill-founded. My overwhelming impression is that pilots work extremely hard for their salary (which, in many cases, bears no relation to the responsibilities and physical and psychological demands of the job). Commentators need to remember one key fact about pilots: when crisis beckons the captain and first officer are the last line of defence. Captain Chesley Sullenberger's successful ditching of his A320 in the Hudson River is a case in point. Having lost both engines to a bird strike the fate of 150 people lay in the hands of Captain Sullenberger and his first officer Jeff Skiles. Despite their shocking situation they worked the problem to a successful conclusion. In doing so both pilots earned their lifetime salaries many times over.

Spectacular upsets are relatively rare, of course. Most pilots will never face the sort of situation faced by the crew of flight 1549. That fact does not diminish other pilots' contributions, however. The industry's reputation is built upon the decisions and actions of every pilot. A pilot's ability to function under conditions of physical and psychological stress is, I think, an important attribute. In my experience most flights produce at least one significant problem. Each problem has to be identified in a timely manner, analysed, a solution devised and applied, and the outcome evaluated. Sometimes problems and remedies run concurrently, requiring the pilot to multi-task. Not easy when you are stressed, fatigued and possibly hungry and dehydrated. During my time with a freight company I witnessed some exemplary problem-solving. I recall one flight where a young captain was presented with a blizzard of challenges, all of which she successfully met. It was her second sector in the left-hand seat. The first challenge was a last-minute route-change (to Germany rather than back to the United Kingdom). The second was a crew bus that arrived at the hotel 30 minutes late (we waited for it outside on a bitterly cold night). The third was a change of first officer. The fourth was a ramp decontamination for snow and slush (the tug could not obtain sufficient purchase). The fifth was an aircraft de-icing. The final challenge (on the ground) was a fuel pump malfunction, necessitating an engineering inspection and second fuel uplift. Because of these events the aircraft departed some 70 minutes late.

Pilots at risk managers

It could be argued, of course, that such challenges are to be expected and that in meeting them pilots are merely 'doing their jobs'. The flaw in that argument is that it glosses over the complex nature of the job and fails to recognise the numerous stressors it throws up. It is one thing to solve problems while sitting at a desk in a warm, well-lit office with numerous colleagues close at hand and ready access to food and drink. It is quite another when you are sitting in a cold, cramped cockpit with manuals balanced on your knees, using a headset and mobile telephone to garner information and advice, while being interrupted by dispatchers, fuellers, engineers and de-icing operatives. Add in commercial pressure, the need to ascertain your first officer's experience level, the prospect of a long, three-sector night with no access to hot food and other stressors and you have a personal and leadership challenge par excellence. The fact that pilots successfully meet such challenges every day makes them deserving of our respect.

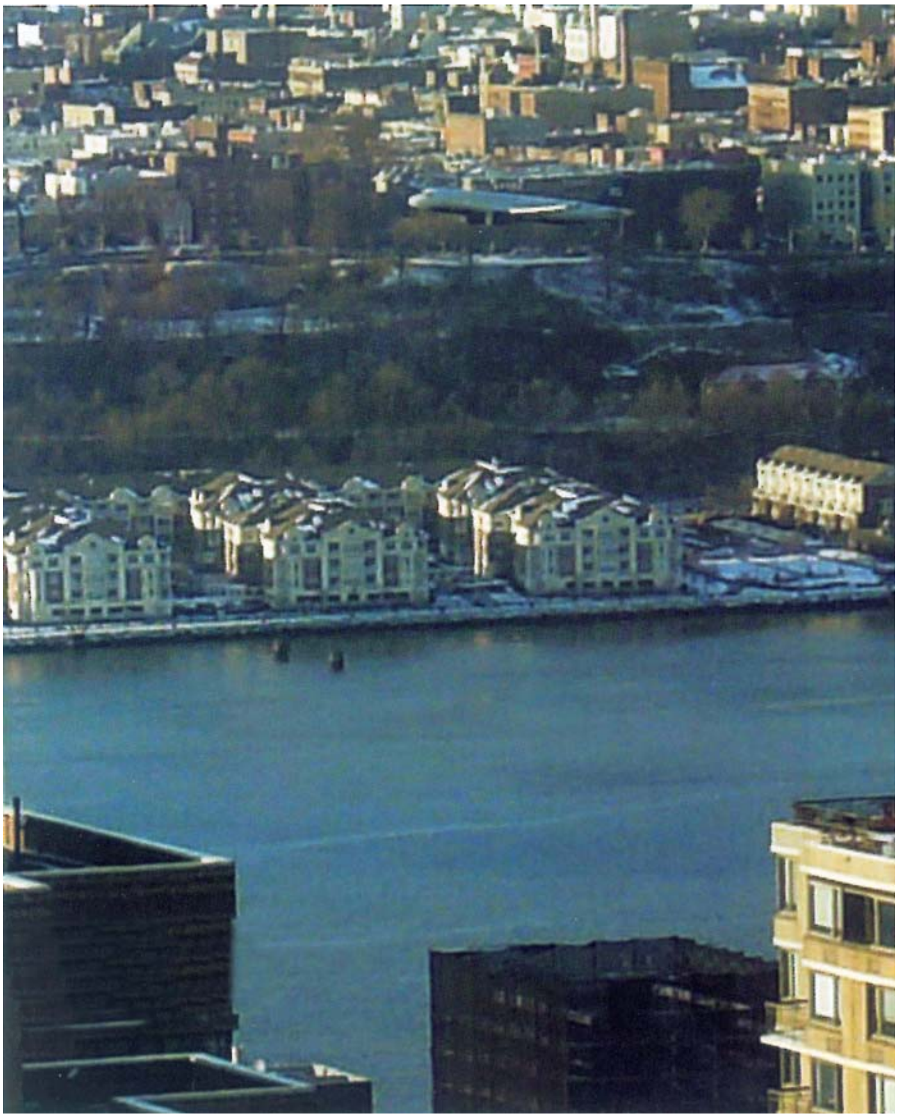
As we can see from this example, a pilot's ability to deliver the required service to the required standard may be compromised by events over which he/she has little or no control. Such 'threats' (to borrow a term from the line operations safety audit proactive risk management system) may reside without (as in the case of a bird strike) or within (a technical malfunction, for example). Occasionally systems designed to support pilots work against them. On October 7th 2008 a malfunctioning air data inertial reference unit (ADIRU) caused an en-route Airbus A330 to pitch nose-down by over eight degrees. After a second upset the crew disengaged the automatics and diverted. The

A330's three ADIRUs are designed to self-monitor: inter-unit polling is meant to screen out erroneous data. In this case the fail-safe routine did not function as designed. The Australian Transport Safety Bureau (ATSB) judged that the pilots performed satisfactorily under duress: 'The crew's timely response led to the recovery of the aircraft trajectory within seconds. During the recovery the maximum altitude loss was 650 ft.' (ATSB Media Release 2008/43). 14 passengers and crew were seriously injured and up to 60 required hospital treatment. This was a major incident. The ATSB's assessment of the crew's performance fails to convey the skill and self-control required to resolve such a serious in-flight upset. A fail-safe system that fails-unsafe is one of the most difficult situations a pilot will ever face – especially when that system fails at 37,000 ft.

Failures are shocking

Although pilots plan for the unexpected (by envisioning as many scenarios and get-outs as training, experience and time permit), the shock-inducing potential of a technical failure should not be under-estimated. Even time-served pilots will experience some sort of emotional reaction, as evidenced by Captain Chesley Sullenberger's response to his bird-strike on climb-out from LaGuardia. In his first television interview after the incident he told CBS's Katie Couric that the bird-strike induced 'the worst sickening, pit-of-your-stomach, falling-through-the-floor feeling' he had ever had. He told ESPN: '[I felt] calm on the outside, turmoil on the inside ... to have zero thrust coming out of those engines was shocking – the silence.' The fact that these statements were made by an ex-military pilot with many thousands of hours experience of commercial flying evidences the emotional impact of major in-flight upsets. Captain Sullenberger, First Officer Skiles and cabin crewmembers Donna Dent, Doreen Welsh and Sheila Dail were widely praised for their coolness and professionalism.

Understandably, perhaps, Captain Sullenberger was singled out for special praise. 'It would appear that the pilot did a masterful job in landing the plane in the river and then making sure nobody else was left on board,' said Michael Bloomberg, Mayor of New York.



'[Sullenberger] landed at precisely the right speed, completely under control, wings totally level. If one wing dips and catches the water, the aeroplane cartwheels, breaks up and some people would definitely have died,' wrote David Learmount in *Flight International*. Praise was also directed at the pilots of Qantas Flight 72. 'The pilots deserve credit for their prompt recovery,' said Fellow of the Royal Academy of Engineering Martyn Thomas CBE. Thomas also asked: 'Why wasn't the fault in ADIRU 1 screened out by comparison with the other two ADIRUs?' and 'Why were "spikes" treated as valid input by the primary flight computers?' (*Risk Digest*, volume 25, issue 38).

Most incidents offer learning opportunities. The flight 1549 and flight 72 incidents are no exception. One of the most interesting features of the flight 1549 incident is the initial disbelief of those involved that an airliner could lose both engines to a bird strike. As Captain Sullenberger put it: 'To have zero thrust coming out of those engines was shocking.' The disbelief extended to those on the ground, too, as evidenced by this exchange between New York Terminal Radar Approach Control (TRACON) and LaGuardia:

TRACON: 'Tower, stop your departures. We got an emergency returning.'

LaGuardia: 'Who is it?'

TRACON: 'It's 1529 [sic]. He, ah, bird strike. He lost all engines. He lost the thrust in the engines. He's returning immediately.'

LaGuardia: 'Cactus 1529 [sic], which engine?'

TRACON: 'He lost thrust in both engines, he said.'

There was disbelief too when Captain Sullenberger told TRACON he was ditching:

TRACON: 'Cactus 1529 [sic], turn right 280, you can land runway one at Teterboro?'

Flight 1549: 'We can't do it.'

TRACON: 'OK, which runway would you like at Teterboro?'

Flight 1549: 'We're gonna be in the Hudson.'

TRACON: 'I'm sorry. Say again Cactus.'

Parties' initial disbelief suggests that while everyone knows they should anticipate and plan for the unexpected, when the unexpected happens (for example an in-flight fire, fuel leak or loss of power) there is a moment of incomprehension – a period of cognitive adjustment during which the old mental model is abandoned and a new one assembled. In 1995 organisational psychologist Karl Weick coined the term 'sense-making' to describe this process of perceptual adjustment. Sense-making is a process whereby 'people make sense of confusing or ambiguous events by constructing plausible (rather than necessarily accurate) interpretations of those events' (taken from *Psychology at Work* edited by Peter Warr). The process of sense-making involves scanning the environment for cues, interpretation of those cues and scenario-building. Sense-making is informed by training, knowledge, experience and context. Ideally sense-making involves questioning accepted practice (praxis) and one's own preconceptions and assumptions. Weick's term for this kind of introspective reflection is 'mindfulness'. In deciding to ditch his stricken aircraft in the Hudson River Captain Sullenberger demonstrated mindfulness. Air traffic control assumed he would attempt a landing at one of New York's smaller airports. Sullenberger questioned this paradigm, to good effect: his mindful review saved the lives of 150 passengers. (Mindfulness may be referred to as double-loop or adaptive learning.)

The shock of the new

Captain Sullenberger was shocked at the loss of his engines. He experienced an emotional response. LaGuardia initially failed to comprehend that the A320 had lost both engines, while TRACON initially failed to understand that Captain Sullenberger intended to ditch. These reactions suggest that while pilots and controllers plan for the unexpected – and practise appropriate responses in simulators – their initial reactions in time of crisis are influenced by the largely uneventful and routinised character of modern commercial air operations. Aircraft taxi, accelerate, rotate, climb, cruise and land (on runways). Thanks to reliable power plants, accurate navigation aids, well-managed airports and a professional work force they do this mostly without serious incident. The *ordinariness* of commercial air operations generates a powerful shared mental model, both amongst aviation professionals and passengers, of a reliable and safe transport system. The fact that passenger aircraft fly at close to the speed of sound in a hostile and unforgiving environment, contain many miles of wiring, are laden with kerosene and weighed down with ever-more complex and power-hungry in-flight entertainment systems tends to be pushed to the back of the collective consciousness. This is not complacency. It is just human nature. In his February 24th testimony to the House Transportation and Infrastructure Subcommittee on Aviation, Captain Sullenberger acknowledged the need for pilots (and, indeed, cabin crewmembers and other aviation professionals) to expect the unexpected: 'We understand that our passengers put their lives in our hands. We know that we must always be prepared. We must always anticipate. We must always be vigilant. Expecting the unexpected and having an effective plan for dealing with it must be in the very makeup of every professional airline pilot.' It is important that aviation professionals are also prepared for the 'psychological punch' that accompanies a major upset and develop strategies to overcome whatever psychological or physical reactions they may experience. It is clear that the pilots and cabin crewmembers involved in the flight 1549 and flight 72 incidents did just that. Each demonstrated grace under pressure.

Biography

Dr Simon Bennett works at the University of Leicester's Civil Safety and Security Unit where he directs the MSc in Risk Management. He has worked as a consultant to both the rail and aviation industries and has taught in Russia (Siberia), China and the Middle East. He researches flight-deck human factors. His latest book, *A Sociology of Commercial Flight Crew*, is published by Ashgate.

Attitude Adjustment

by Wayne Rosenkrans

Advances in standardization and new evidence of effectiveness make airplane upset recovery training a more robust element of airplane strategies for managing the risk of loss of control accidents than 10 years ago. Although ongoing research and development efforts expect to improve existing aircraft-based solutions, many specialists still see technology as complementary to pilot training – not an alternative. Urgency about addressing loss of control risk (Table 1) was reflected during 2008 in more than 40 scientific papers on relevant issues presented at conferences of the American Institute of Aeronautics and Astronautics (AIAA) alone.[1]

Technology promises improvements in, and wider use of, flight envelope protection provided by the software in fly-by-wire airplanes; an aural "overbank" alert when a transport category airplane reaches an angle of bank exceeding normal operating parameters; directed guidance, an immediate aural message to pilots about required control inputs; micro-tactile alerts about incipient unusual attitudes from electronic devices in a seatback or clothing; and perhaps a pilot-activated automatic recovery switch that would transfer airplane control to a future autopilot designed for this purpose, specialists say.

"Enhanced training and procedures are a countermeasure relatively easy to implement, but might be only partially effective," says William Bramble, senior human performance investigator, U.S. National Transportation Safety Board (NTSB), and a presenter at Flight Safety Foundation's International Air Safety Seminar (IASS) in October 2008 in Honolulu. "Recent accidents suggest that [automation] might improve safety for civil transports. Solutions such as modified attitude displays and directed guidance… [also] might only be partially effective."

Various NTSB safety recommendations in recent years have urged the U.S. Federal Aviation Administration (FAA) to require upset recovery training for air transport pilots. Among risk scenarios of concern have been stalls caused by airframe icing, stalls without icing, wake encounters, spatial disorientation leading to a spiral dive or misjudged flight path, and mechanical failures. Although this training has yet to be required, the FAA has collaborated with airlines, manufacturers and academic institutions on a common reference aid for upset recovery training, simulator fidelity requirements and proposed training standards.

High Altitude Supplement

Among valuable resources for airlines contemplating or updating upset recovery training is the November 2008 release of Revision 2 of the *Airplane Upset Recovery Training Aid*—including a new "High Altitude Operations" supplement (ASVI, 1/09, p. 10). An international industry team led by Airbus, Boeing Commercial Airplanes and Flight Safety Foundation began work on the revision in 2007. The supplement focuses on known safety issues in the high altitude

MAJOR CAUSES OF AIRPLANE UPSET AND LOSS OF CONTROL ACCIDENTS, WORLDWIDE AIR TRANSPORT, 1993-2007

Causal Category	Accidents/Aircraft Included	Accident in Category	Fatalities
Aerodynamics stall	9 events involving contaminated airfoils, 6 events involving autopilot-induced stalls (only common factor was no flight envelope protection)	27 (36%)	848 (26%)
Flight control system	7 events involving flight control malfunctions or failures, 6 events involving autopilot malfunctions or failures (excluding autopilot-induced stalls), 3 events involving flight control software issues	16 (21%)	604 (19%)
Spatial disorientation	5 events involving spiral dives (only common factor was no flight envelope protection), 3 events involving upset/misjudged flight path	8 (11%)	630 (19%)
Contaminated airfoil (ice)	9 events involving contaminated airfoils were listed instead among the 27 events in the "Aerodynamic stall' causal category	8 (11%)	200 (6%)
Atmospheric disturbance	3 events involved wake encounters	6 (8%)	477 (15%)
Other causes combined	Not specified	6 (8%)	122 (4%)
Undetermined causes	Not specified	4 (5%)	380 (12%)
	Total Accidents	**75**	**3,261**

Note: Total of percentages may not equal 100 because of rounding error.

Source: U.S. Federal Aviation Administration

Table 1

A forceful nose-down pitch input can be essential to some upset recoveries.

environment –above Flight Level 250 (approximately 25,000 ft) – and particularly on knowledge gaps identified among pilots who routinely operate there. Revision 2 initially was distributed on paper and compact disc in a binder, but the component elements are more readily available, either together or separately, as free electronic documents that can be downloaded from <www.flightsafety.org/upset_recovery.html>.

In a transmittal letter to the FAA, the team's co-chairmen said, "This [supplement] was developed in response to an FAA request for us to convene an industry and government working group to develop guidance to flight crews as it pertains to issues associated with operations, unintentional slowdowns and recoveries in the high altitude environment… No reference material published is of value unless it is used. To that end, we implore the FAA to produce language to support implementation of this material that will motivate operators to use it"

Unlike the full training aid, which addresses airplanes with 100 or more seats, the information in the supplement also is directly applicable to pilots of nearly all jet airplanes that routinely operate at high altitudes. Aviation professionals familiar with Revision 1 of the training aid will find a limited number of changes called out for review in Revision 2—many for consistency with the supplement content.

The second update since 1998 has been designed so that adoption, integration or adaptation by airlines can be simple and straightforward. "Loss of control accidents can have widely varying causes and solutions, so our goal is to get to all the pilots - wherever they might be - to give them the knowledge, the understanding and the training necessary to address this killer in aviation,' David Carbaugh, chief pilot for flight operations safety at Boeing Commercial Airplanes and a team cochairman, told IASS attendees. "What is lacking today is a consistency of application throughout the industry of this training.... Only when such training becomes mandatory will air carriers be getting knowledgeable and fully trained pilots who can handle these situations consistently"[2]

One aim is to help airline pilots avoid repeating the errors of others, such as selecting maximum cruise thrust rather than maximum continuous thrust in response to a gradual, environmentally induced slowdown at high altitude, or selecting inappropriate automation modes that can lead to excessive banking and a stall during routine high altitude operations, such as navigating around en route weather.

The supplement emphasizes practical ways to apply aerodynamic principles, such as avoiding high altitude flight in the slow flight speed range, any speed less than L/D Max;[3] recognizing gradual airspeed decay and its effects; expecting slow cruise speeds to shorten time available to respond to an inadvertent slowdown; avoiding inappropriate vertical speed modes during high altitude climbs; and responding correctly to a thrust-limited condition.[4] Also covered are the risks of operating at maximum altitude, such as reduced bank angle capability and insufficient thrust to maintain altitude (Figure 1); the advantages of operating at optimum altitude; the importance of recognizing airplane buffet as the first indicator of a high altitude stall; the differences between responding to an impending stall versus a full aerodynamic stall; the criticality of exchanging altitude for airspeed during upset recovery; and the threats in inadvertent excursions into extremely high speeds.

A longstanding issue is that the aerodynamic envelopes of simulators—specifically the angle of attack range and sideslip range—simply are not extensive enough.[5] One NTSB scientist has noted that fidelity of simulators for upset recovery training becomes a significant practical issue only in the post-stall flight regime, whereas many loss of control accidents have occurred after upsets within the nominal aerodynamic data envelope (Figure 2)[6]

Evidence of Effectiveness

When Alteon Training, a Boeing company, recently planned to introduce upset recovery training into all of its initial, transition and recurrent simulator training courses, the course developers could find no scientific study showing that such training would achieve what was intended, according to William Roberson, a senior safety pilot for Boeing Commercial Airplanes and an IASS presenter.

Another research goal was to identify significant negative training in light of findings about a pilot's rudder inputs in the NTSB investigation of the November 2001 in-flight separation of the vertical stabilizer of an Airbus A300, operating as American Airlines Flight 587, in Belle Harbor, New York, U.S.[7] "That accident did, in fact, have a chilling effect on upset recovery training throughout the world:' Roberson said.

Alteon hypothesized that Boeing 737 pilots who completed academic work and simulator exercises derived from the training aid would be more successful in coping with upset events than they were before they participated in the study. Thirty-three 737-qualified Boeing pilots received academic training with videos and a simulator session, in which they trained to proficiency—until common errors were eliminated—on each recovery technique.

Each pilot was told to "just fly the airplane — do what you would do if you had this event," which meant to keep the airplane inside the aerodynamic envelope, not induce a stick shaker warning of approach to stall, and not stall. "We re-evaluated each pilot to see if performance had improved one to six months after this training, using the exact same initial test and scoring method," he said. Performance on each test element and overall was quantified by subtracting points—for example, for failure to disconnect the autothrottle, a stall, excessive speed or excessive altitude loss—from a perfect score of 10.

Upset events in the simulator comprised one scenario of a 737 that was 40 degrees nose

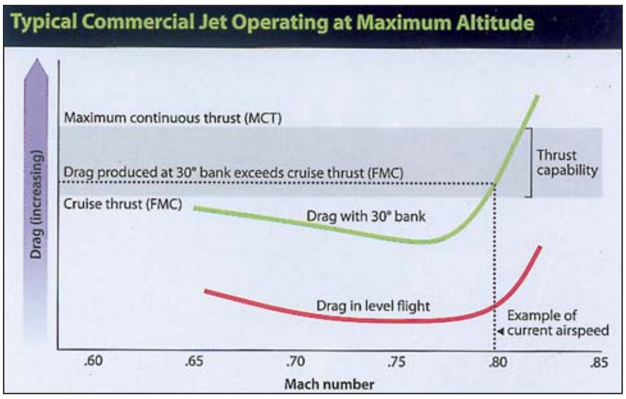


Figure 1

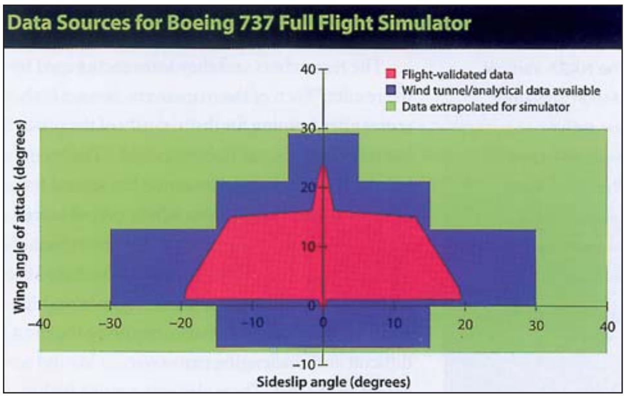


Figure 2

high with zero degrees of bank and twice the amount of aft trim required for normal flight; one scenario with the airplane 25 degrees nose low with 60 degrees of bank and trim neutral; and one scenario with the airplane 25 degrees nose low, with 120 degrees of bank and trim neutral.

"Pilots who scored zero, one or two points on the first nose-high [scenario] predominantly used the roll recovery technique versus the push recovery technique; those who scored eight, nine or 10 points on that [scenario] predominantly used the push recovery technique," Roberson said.

Taking these pilot decisions and other factors—such as adequate control of airspeed and altitude loss—into consideration, the study concluded that for the nose-high scenarios, training made a positive difference, three points on average. For the nose-low and medium-bank angle scenario, training made a positive difference, two points on average.

"Improvement occurred because of better recovery technique [after training], such as rolling to level more quickly and pulling more positively once they got the wings level," Roberson said. "For the nose-low and high-bank-angle scenario, considered the most difficult recovery, training made a small—0.4 point—positive difference. Qualitatively, this was important because this result was not expected given the relative difficulty".

The researchers said they were encouraged by the results. "Each of the maneuvers showed higher scores after training for the majority of the pilots, but not all the pilots," Roberson said. "Twentynine out of 33 pilots did better on the second test, four did worse . . . and those whose overall scores deteriorated went from 25.8 to 23.0 points [out of a possible 30 points]. These pilots demonstrated the largest increase in average score for the nose-high and zero-bank-angle scenario, requiring the most difficult and challenging maneuver.... We did not expect to see that. There also was a much higher level of consistency of performance among all the pilots after the training".

A second report presented at LASS had been eagerly anticipated by the upset recovery research community.[8] FedEx Express and Calspan Flight Research Group developed the "advanced maneuver-upset recovery training program" using full flight simulators with motion and an in-flight simulator—a Learjet 25—then evaluated the program's effectiveness in a simulator and in flights in the airplane, said copresenters Brian Ward, managing director of training, Federal Express, and Bob Moreau, experimental test pilot, Federal Express Flight Test.

"Over the past six years, FedEx has experienced six upset events that could have led to loss of control," Ward said. "[One goal,] for the first time in the industry, was to 'connect the dots' by evaluating transfer of training from the full flight simulator to the real world of the airborne environment".

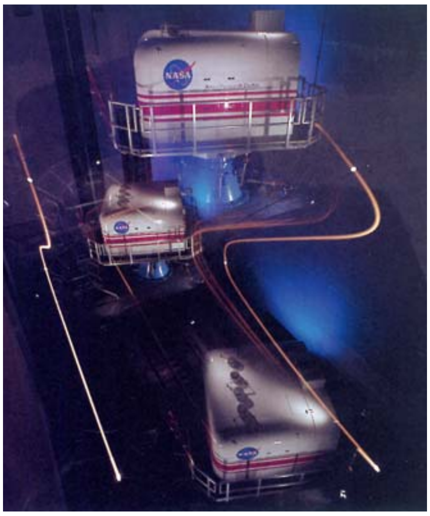
Ten FedEx pilots from the A300 fleet and 10 FedEx pilots from the MD-11 fleet participated. Performance evaluations were conducted before each of three portions of training: aerodynamics, full flight simulator training and airborne training. Training events comprised unusual attitude recoveries, in which the evaluator maneuvered the simulator or airplane to a nose-high unusual attitude and a nose-low unusual attitude; and preprogrammed upset recovery events in the roll axis and the yaw axis of the simulator and airplane.

The A300 pilot group and MD-11 pilot group were divided into two subgroups, a full-program group that received academic training, then advanced maneuver upset recovery training in a simulator, and a control group that received the academics but with equal time in a simulator focused on scenarios unrelated to upset recovery.

The study found that training in the full flight simulator—despite the deficiency in motion cuing and g (load) cuing—produced the largest cumulative training effect, especially in teaching aircraft-specific techniques; airborne training produced a relatively small training effect; and prior experiences exerted a relatively large training effect on performance even compared with the academic work.

For the study, the full flight simulator was equipped with a g-meter display as a reference for the pilots during recovery maneuvers. The meter showed, for example, some pilots exceeding g limits—with up to 8g displayed on video recordings—while incorrectly performing a rolling pullout maneuver that would have subjected real airplane to the maximum aerodynamic loads.

The upset recovery training in general revealed pilots' inadequate knowledge about the relevant aerodynamic principles and how to apply them. Therefore, the academic portion of the program alone produced a large increase in training effect. "What stood out was a lack of



The NASA Vertical Motion Simulator, shown here in a multiple-exposure photo, exceeds capabilities of conventional full flight simulators

[understanding of] fundamental aerodynamic concepts, as well as alternate control strategy concepts, among the pilots—concepts required for upset recoveries," Moreau said.

Little of the improvement in pilot test scores on upset recoveries could be attributed to the full flight simulator; instead, the lack of adequate motion cuing worked against pilots in identifying what type of event, such as a yaw event or roll event, was occurring. "This often led to the incorrect technique being applied, and that aggravated the situation,' Moreau said. "In comparison, the inflight simulator provided critical motion cues, and the pilots were better able to correctly identify the event and respond with the correct control technique"

In the tests of unusual attitude recoveries in the simulator, the group with full training showed "markedly better" results than the control group. This difference disappeared when each group flew the Learjet, and this was attributed to pilots having had equivalent motion-cue experiences from earlier unusual attitude training in airplanes.

For airlines to make effective use of full flight simulators, their programs must emphasize pilot understanding of simulator limitations compared with control inputs that may be required for upset recovery in the airplane, the researchers concluded. "Motion cues also should be de-emphasized due to the limitations of the motion cues that we have in simulators today," Ward said. "A g-meter readout is essential for effective training"

Conducting upset recovery training in a full flight simulator with motion off—as some airlines already do—is still advocated by some specialists to sidestep misgivings about insufficient fidelity and unrealistic spatial disorientation practice. "When you enter an upset or have an illusion, your inner ear already is telling you the wrong thing, so our simulator training [with motion on] is about making the picture look right," Boeing's Roberson said. "You cross-check your displays to make sure you don't have a display that is lying to you. The fact that the simulator will give you the wrong vestibular cue, although problematic, is another opportunity for the pilots to override what their vestibular senses are telling them, and to do the correct recovery no matter how they feel".

Airlines cannot afford to wait for perfect hardware, however, or access for thousands of line pilots to the advanced motion and sustainable g-load fidelity of one-of-a-kind simulators such as the Vertical Motion Simulator at the U.S. National Aeronautics and Space Administration Ames Research Center; the generic large transport/757 configuration of the GyroLab-2000 simulator, which is used for upset recovery training at the U.S. National Aerospace Training and Research (NASTAR) Center; or the Desdemona research and demonstration simulator developed by TNO Defence, Safety and Security and AMST Systemtechnik in the Netherlands.

Glenn King, chief operating officer of the NASTAR Center, expects his facility to be part of the solution to loss of control. "Granted, not all airliner upset situations place the aircraft in an inverted attitude, but some upsets have, and it is for these extreme situations that only a full, multi-axis simulator with sustained g [loads] will have a positive transfer of training," King said. "Our advantage is the ability to provide sustained motion cues and g forces during an upset or loss of control in flight. We have the ability to physically place pilots in an inverted flat spin, hanging in the harness, while sustaining up to 2.5g. When a pilot is hanging in the straps, suffering from facial suffusion and disorientation, legs dangling off the rudder pedals, etc., all this affects the response time and ability to quickly effect a safe and proper recovery. Being able to feel and know the 'energy state' of the aircraft determines the pilot's course of action. The ability to provide sustained g cues to pilots is critical in their upset recovery training/loss of control decision-making process".

Boeing's Roberson expects the updated training aid to enable airlines to sufficiently prepare pilots for the recent types of scenarios. "In most of the loss of control accidents and incidents that we have seen in the last five years, simply levelling the wings and putting the thrust where it needed to be would have solved the [problem]," he said. "They were not really complicated events—at least at the outset".

Notes

1. Bürki-Cohen, Judith; Sparko, Andrea L. "Airplane Upset Prevention Research Needs.'' In proceedings of the AIAA Modeling and Simulation Technologies Conference and Exhibit, Honolulu, Aug. 18-21, 2008. AIAA 2008 6871.

2. Carbaugh, David. "Simulator Upset Recovery Training and Issues" AIAA 2008-6866.

3. The training aid notes that on a graph plotting lift (L) and drag (D) values against airplane speed values, the lowest point on the total drag curve is called L/D Max (or VMD minimum drag speed).

4. The training aid notes that some environmental conditions, such as a temperature increase or a mountain wave, may cause a jet to enter a thrust-limited condition in which the desired altitude cannot be maintained and/or airspeed may decay, requiring a descent.

5. Crider, Dennis A. "The Need for Upset Recovery Training" AIAA 2008-6864.

6. Crider.

7. Ibid.

8. Bürki-Cohen; Sparko.

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Not So "Soft" On Training – BA's New Philosophy and Emphasis

by Chris Long

British Airways continues to analyse real flying events to identify lessons, which can be rapidly fed back into its training patterns. Such considered and active change to training should be one of the few constants in the business. Chris Long reports.

When CAT Magazine undertakes an airline training profile the accent tends to be on the numbers of crews and fleet sizes, closely followed by details of the training equipment and syllabuses used to train the team. The technical details (the "hard" science) are usually the main thrust of interest, complemented by a study of the "soft" skills used in the process.

The latest British Airways training patterns neatly illustrate the adoption of the new industry-wide philosophy of enhancing the critical soft skills, which in the aviation training business have too often been seen as bolt-on competencies.

For instance, a couple of decades ago when CRM was first introduced it was treated as a supplemlentary course, not as a core and integral necessity. The role and importance of human factors training and awareness has similarly come to the fore, again not as an add-on, but as a critical element, which runs through all training and operations. Consequently training organisations are now recognising this imperative and are adapting their training patterns accordingly. To better understand the scale and nature of the task that BA has been tackling, it is worth a quick run through of the basic numbers.

As a major legacy carrier the route network covers large swathes of the globe as well as a dense regional (European) operation. The aircraft fleet is diverse (see table) and, with 3,200 flight deck crew and 13,000 cabin crew, initial and recruitment training is no small challenge.

The need for a high level of technical skill is taken as a given and although the training system has evolved to embrace new technologies and methodologies, the process of teaching and verifying the purely technical competencies required to operate the aircraft.

ATQP

This emphasis of human factors is clearly illustrated in the advanced training and is incorporated into EASA (QPS) regulation. There is now much more attention being given to teaching people how to training them to better challenge unexpected events. This programme has to be tailored to a specific operator to take into account the culture, route structure and aircraft types of an individual airline. BA has been quick to initiate such a process.

The start point for this requires that the skill sets essential for flight deck crew be examined holistically. The airline has taken a step back from the immediate training task and, starting with data mining to identify critical skills in the operational world, has carefully established a comprehensive suite of relevant competencies.

Aircraft Type	Number in Fleet
B747-400	57
B777-200 (777-OOER for delivery in 2009)	42(4)
B777-300 (For delivery from 2010)	(6)
B757	11
B767-300	21
B737-300/400/500	25
A319/320/321	77
A318 (For delver in 2009)	2

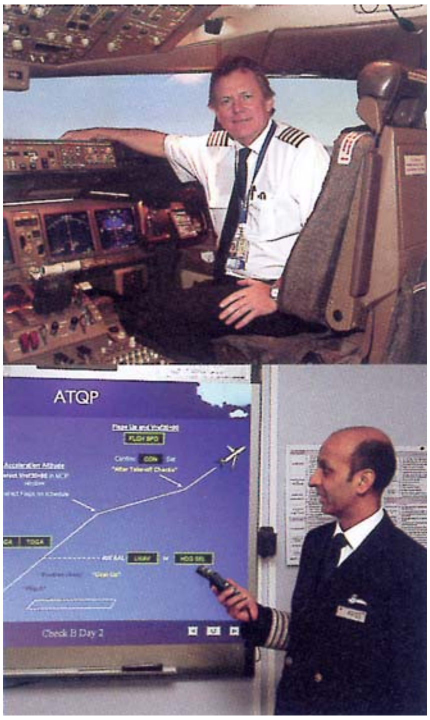
Analysis of the behaviours observed in crews trained using the earlier philosophy of training crews to become proficient in a programmed response to a series of preset situations, has revealed that some crews had difficulty in adapting to an unexpected event. Consequently the present and future training has been designed to integrate appropriate behavioural and communications skills with the technical competencies right from the start.

The critical role of cognitive skills such as problem solving and situational awareness, the social skills of leadership / management and effective team working are all seen as essential for safe and commercial operation. Another cognitive skill, which can be taught, is prioritisation - learning how to load-shed effectively. Recorded data shows that crews who have this much broader range of capabilities can cope much better with unexpected situations.

Since this enhanced training has been introduced and the new mindset established the number and severity of incidents cited in routine air safety reports (ASR) have both been reduced an encouraging indication of the value of increased emphasis on these soft skills.

Patterns

Training patterns must not only be effective, they also have to be efficient. The rapid rate of introduction of the new A320 family of aircraft resulted in a high demand for the two A320 FFSs (an additional one will be delivered by CAE in April 2009). It was decided to transfer the low-fidelity training material from the simulator to the classroom using electronic whiteboard technology, which can be used to show whole system operation in real time and thus prepare more thoroughly for the simulator details. The programmes were produced in-house integrating system failure and failure management capabilities. FFS sessions were then cut from four to three hours' duration, but the combined training



Top: Steve Sheterline, head of flight technical and training at BA.

Below: Captain Minesh Patel leading an ATQP course.

Image credit: British Airways

value of the classroom / FFS session was just as effective, enabling real-time practice of complex failure scenarios in the simulator without using the freeze facility Learning from the trials has been incorporated into training programmes for all fleets, although there are no plans at present to reduce simulator time on long-haul types.

Identify

Steve Sheterline, head of flight technical and training at BA, mentions that the airline has already started on a process similar to the ICAO ITQI. This identifies key hazards through data analysis, works out mitigation strategies and then designs competency-based training to address the issues. Data sources are not only internal to the airline but are also derived from within the industry, embracing IATA, major safety agencies such as the Flight Safety Foundation, as well as through selective use of the internet.

One main driver is to try and find out what crews were actually thinking at the time of any occurrence: Had previous training helped them? Was it suited, or not, to the situation in which they found themselves? Was the situation entirely unfamiliar, in which case how did they work out a solution? These are early days in this project but Sheterline expects it to bear fruit within about 12 months. However, benefits are already being realised in addressing pilot/cabin crew communications and mindsets and such topics as potential runway excursions.

Instructors

The role of instructors and examiners remains critical, so that selection and training of individuals is particularly important. All of those who become trainers are volunteers and one of the desired characteristics is that, through their attitude towards the company and the job, they can serve as role models to other pilots. Obviously they need to be technically competent (at the upper end of the competency scale), but they must also have plenty of spare capacity and strong cognitive skills. Finally they must be self-motivated. Uniquely within UK CAA regulatory responsibility, all BA training captains become qualified not only as type rating instructors (TRI) but also as type rating examiners (TRE). Once selected for this responsibility candidates move sequentially through the, SFI/TRI core course, the TRI practical course and shortly after that the TRE course.

For the individual this leads to an all-embracing remit in the training and checking environment, thus engendering considerable job satisfaction. This range of responsibility, which goes from line training through to LPCs, results in better standardisation and a boosted commitment to the role. The company also directly benefits through greater flexibility in the rostering and planning of its instructional and examining team.

BA is taking a considered view on the introduction of electronic flight bags (EFB) and head-up displays (HUD), because it is not entirely convinced of the maturity of these options. The first aircraft on which both these features will be standard equipment will be the B787; while there is an EFB integrated into the A380, the HUD option has not been chosen. Sheterline acknowledges that there will be some interesting times ahead when these aircraft arrive. Training packages for the new types will follow the present trend of adopting the OEMs' defined processes with as few changes as possible. A recent trial to validate the Airbus cross crew qualification course for transfer from the A320 family directly to the A380 was recently undertaken by a volunteer from BA, who was a standard average captain on the A320 fleet and who had some widebody experience some years ago as a first officer. It was a great success and the transfer of skills went very smoothly. The lucky individual now has to wait a while before he can operate the aircraft in BA colours.

Unique

A more immediate task is to prepare for entry into service of the A318, which will be used on the London City Airport to New York JFK route. The range of skills to operate this flight is unique within BA. A single aisle aircraft will be flying inter-continental routes under ETOPS, operating on a 5.5 degree steep approach into London City and managing the challenging Carnasie arrival procedures at JFK. The plan is to develop RNP.3 for the A318 initially and then to seek approval for this on the Carnasie to JFK 13L. In the initial stages it will be flown as LNAV, visual transition autopilot engaged (to min disconnect height).

The training issues are fascinating, including as they do base training in the steep approach into selected airfields away from high traffic density. One of the options being considered is painting the demanding dimensions of the London City runway directly on to the training airfield runway, to better reinforce the visual cues. Although normally the crews on the Airbus fleet are rostered freely across the route structure for those aircraft and also include low-time pilots, the extra demands of this particular operation will initially require that crews will be drawn from the pool of experienced pilots who will then specialise in this innovative operation.

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CAT THE JOURNAL FOR CIVIL AVIATION TRAINING

Waiting is Over –

The Alternative Training and Qualification Programme Goes Live

by Norman MacLeod

ATQP is here to stay. Commercial aviation has undoubtedly been slow to pick up on an idea that is generally recognised as no more than "best practice" in training design and management. But the momentum is building, writes Norman MacLeod.

NATO military pilots from the early 1970s, especially from the US and the UK, may well remember the application of systematic models of training to aviation. In the UK it went under the name of the Systems Approach to Flying Training (SAFT) and heralded the era of training objectives, performance standards and programmed learning booklets. Fast-forward to 1990 and we see the same approach being adopted by the FAA under the banner of the Advanced Qualification Program (AQP).

Airlines enrolling in the program, and that included all of the majors, were allowed to extend the interval between recurrent training events to 12 months, thus representing a considerable saving on existing requirements. Although AQP was mentioned in the early drafts of JAR-OPS, it was not until Amendment 7, issued September 20, 2004 that EU-OPS carriers had a regulatory framework that permitted the same flexible approach to proficiency checking, through the implementation of ATQP (EU-OPS 1.978). Despite this long track record, one post holder flight operations observed: "Operators (even the ones who are familiar with FCL/OP) usually do not have any idea about ATQP One reason might be that people believe they will have to do training and checking anyway and it does not matter in which kind of system this will be performed." What, then, is ATQP and why has it been slow to get going with EU operators?

Back in the early 1960s the US military was looking for ways to, in effect, industrialise its training system. The size of its armed forces generated a huge training bill, especially given that a largely conscript army created a significant turnover of personnel. The origins of systematic training analysis and design, known as SAT or ISD, lie in the need to develop efficient and effective instruction; proficiency at least cost. The migration to civil aviation though, was prompted by a view that existing training and checking methods were not offering sufficient protection; aircraft were being lost because of inadequate proficiency, a view echoed by the UK CAA in a recent review of commercial aviation accidents. The idea behind AQP/ATQP is that by conducting a thorough analysis of the skill set needed within a particular operation, training can be targeted better. Training inputs can be tailored in terms of content and delivery and checking can be set at intervals that best capture the level of proficiency.

Although the first drafts of ATQP attempted to differentiate between the EU version and the earlier AQP framework, the similarities outweigh the differences, which is hardly surprising given their common derivation. The ATQP drafters were able to build on 10 years' AQP experience. For example, the use of flight data was incorporated from the outset. When AQP was developed, flight data analysis was far from routine. The use of flight operations quality assurance (FOQA) data became a bolt-on in later AQP implementations.

The main difference between the two codes is also its main weakness. Whereas AQP applies across all airline training and checking, ATQP was written into JAR-OPS and so only applies to recurrent programmes. Operators still have to meet their obligations under EU-FCL. Furthermore the benefits are not available to the rotary world. However, there is some suggestion that, under the EASA Integrated Regulations, ATQP will be incorporated into the appendix material and so will be more broadly applicable.

Controlled

Another major difference is that AQP is centrally controlled from a single office, AFS-230 at Washington-Dulles airport. Approval of an ATQP application is the responsibility of individual national authorities.

The UK CAA published its criteria for approving an application in July 2008 but as yet, no common framework has emerged and none is provided in the regulation. Ironically ATQP has some elements that make it an incremental improvement on AQP but, because of poor drafting, these have been undermined. The first of these refinements is that ATQP calls for training organizations to develop a safety case (SC) (see CAT 03/2006) but then fails to develop a process for airlines to follow. The SC approach is rather like building an SMS for the training department and, given the rise in training-related accidents, this is no bad thing. The lack of clear guidelines, however, could result in flawed - or even negligent - SC execution.

The second area of innovation is a requirement for line operations quality evaluation (LOQE). Similar in concept to LOSA, LOQE is a technique for sampling areas of operational proficiency that might not be captured through other methods of data collection. Unfortunately the regulation is framed in such a way that LOQE is a discretionary component and thus can be avoided with no adverse effect on the approval process - an opportunity lost. ATQP, then, suffers from a lack of clarity in framing the requirement and a failure to enforce some elements whose intent is sound.

Both Aer Lingus (in the mid-'90s) and Swissair (now Swiss) made attempts to adopt AQP but paid the price for being "first movers". Their efforts were frustrated by a lack of applicable regulations and aviation authorities unable to offer guidance.

Even though ATQP has been available for four years, uptake has been slow. SAS Norway received approval to implement for its F50 fleet in July '08 and was due to roll out across its B737 fleet on January 1,'09. BA went live on November 1, '08 for its B777 fleet, closely followed by easyJet. In Germany both Hapag-Lloyd and Lufthansa have ATQP under development, although Lufthansa's will be a partial implementation.

Benefits

Despite the anticipated benefits of reduced checking costs - OPCs can be conducted every 12 months and line checks every two years under ATQP, increased flexibility and greater safety, airlines are not rushing to adopt the new framework. The cost of implementation and ownership of ATQP are, as yet, not clear. At the moment ATQP is remarkably free of bureaucracy, unlike the FAA's AQP. The route taken in the US was influenced by a desire to minimise risk of training failure through centralised control. The sheer cost of moving to AQP has forced some carriers to drop out of the scheme.

Ballpark metrics from the US experience point to project times of two to four years and costs of $3-5m. However, ATQP only covers recurrent training and qualification and much of the cost of AQP can be put down to the approval administration, which is not required under EU-OPS rules, and project management, an area of huge inefficiency in some US implementations. Part of the problem also seems to be a poor sales job done by JAA, but perhaps the position is best summed up in this view from a pilot:

"As I frequently take prof-checks in the simulator I do believe that the gap between sim-rides of six months when performed the usual way is already rather long and I do not think that any reduction or stretching would be desired - at least from my point of view. Our airline is not a bad example, as we do have to travel to our sims anyway, either to CDG or AMS, thus our simulators are not just across the street. Despite this I would rather tend to shorten the intervals between training / checking than prolonging them."

View

Interestingly, those airlines that have implemented ATQP seem to take the same view. Rather than shift to an annual training event encompassing an LPC, OPC and the ATQP requirements, BA has retained a six-monthly training cycle with the intermediate OPC being replaced by the ATQP-driven line-oriented evaluation (LOE). The LOE shares some of the characteristics of a LOFT scenario in that it is representative of normal operations and is conducted in a simulator. Where it differs is that it is carefully constructed to provide a standardized sample of data across the pilot cadre. It is primarily a measure of fleet proficiency, a benchmark.

SAS, equally, expressed no interest in reducing visits to the simulator. Instead, and hke BA, it is looking to make better use of an existing training budget to deliver and sustain skills. The emphasis is on meeting company operational needs rather than rehearsing imposed manoeuvres simply to be compliant with regulatory demands that are not always operationally relevant. ATQP was always intended to give airlines flexibility in how they configure training and checking. Its main goal is to improve safety through better training, and this seems to be the main benefit recognised by the first wave of implementers.

But what of the future? Clearly, now that the regulation has been adopted by a small group of airlines, others will follow. However, we are already seeing differences emerge as regulators get to grips with the approval process. Whereas some countries seem wiling to allow the LOQE element to be omitted, others have insisted on its application. One authority has imposed even more stringent requirements before granting an approval. In one case an authority has dictated a process to alow one single easement - moving line checks to 24 months - to be accomplished without following the full ATQP process.

The lack of a single point of control seems to be leaving the field open to multiple interpretations. And the requirement for flight data monitoring is denying access to a large sector of aviation that probably would benefit most from the discipline imposed by ATQP - corporate jets.

That said, one corporate operator is looking to apply ATQP to its fleet of two aircraft on the grounds that, given that its prestige customer base includes European heads of state, it sees the process as offering a quality benchmark that will differentiate it from its competitors.

ATQP, then, is here to stay. Commercial aviation has undoubtedly been slow to pick up on an idea that is generally recognised as no more than 'best practice' in training design and management, but the momentum is building. The recently-issued EASA NPA on flight operations has spooned the content of EU-OPS 1.978 into the broader regulatory framework and, needless to say, there are some teething problems which will be addressed during the consultation period. A Users Conference is planned for later in the year. By then at least 2 airlines will have a year's worth of experience and so it will be useful to take stock.

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