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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:** Emirates A380 taking off from Manchester Airport.*

Rockets and Risk

by Dai Whittingham, Chief Executive UKFSC

The appalling loss of MH17 is an event that will continue to resonate long into the future. The previously unthinkable has happened. Whether this was an accident in the strictest sense of the word or whether it should more properly be characterised as a crime, there is no denying the scale of the human tragedy involved. The understandable need for security meant that two weeks elapsed after MH17 was downed before official investigators could gain access to the crash site. Sadly, militia, media and local people have had almost unrestricted access from the outset. There is distressing TV and other evidence of bodies and personal effects being looted and even footage of journalists rooting round in baggage as part of their reports; clearly the wreckage has been disturbed and there are amid worrying suggestions that some parts have already been removed by 3rd parties. Given the size of the debris field, the nature of the terrain and the ongoing conflict it is also likely that some smaller pieces of wreckage will go undiscovered.

Fortunately, the CVR and FDR are in the possession of the investigators, though these may not provide any real answers as to why an apparently serviceable aircraft should suddenly break up in the air. However, photographs exist of wreckage showing the tell-tale signs of a blast fragmentation warhead; recovery and forensic examination of the physical items and passenger injuries will be crucial if there is to be absolute proof the aircraft was destroyed by a surface-to-air missile, as seems highly probable. Even with the addition of military intelligence information and the forensic results the conclusions of the inquiry will be rejected in some quarters, for one reason or another, and the whole sorry episode will for many remain wrapped up with web-based bizarre conspiracy theories.

So will an investigation tell us anything that will help prevent a recurrence? What lessons do we take from the aftermath? The relatives and friends of those who died want answers. Governments want answers. Aviation needs answers. But finding answers in zones where the rule of law has broken down is notoriously difficult, especially where there are strong political vested interests in play, and the answers on causation may not necessarily be found using traditional accident investigation methods. And what are the implications for future investigations?

In terms of preventing a recurrence, and as the Chairman points out in his column, operators and crews need to know where they can safely fly. Over-flight has a very different risk profile when compared with arrivals and departures, so operating over a conflict area needs to be considered separately. Lower altitudes can place you within reach of the smaller, man-portable missile systems (MANPADS) but you are already vulnerable to small arms fire on the approach if someone really wants to take a pop at you, as was recently demonstrated in Pakistan on 24 June when two PIA crew members were injured and a passenger fatally wounded by gunfire on approach to Peshawar. There is also no public indication as to whether the attack was deliberate or, for example, just poorly-timed celebratory gunfire. That said, it is actually quite hard to hit a moving aircraft without some sort of assisted aiming or specialist training, and most large CAT aircraft have a good chance of surviving a MANPAD hit because there is plenty of system redundancy, the warheads are small and the missiles are heat-seekers so will head for an engine, the loss of which pilots are trained to deal with. But if there is a serious risk that someone will have a go at you with an AK-47 or a MANPAD, you should not be there in the first place!

The same is not true when considering the larger vehicle-mounted SAM systems, like the Russian-built Buk (SA-11), which bring normal CAT operating altitudes firmly into the missile engagement envelope. But does the mere presence of a system make it a threat? It all depends where you are. For a threat to be genuine you require the capability (the equipment) and the political will to use it – one without the other gives you useless equipment or empty words; it is the principle on which deterrence is founded.

In responsible nation states there will be a set of conditions imposed, so-called 'Rules of Engagement', that govern the use of force by those people bearing arms on behalf of the state itself; you would rightly expect such conditions to be far more stringent in peacetime than in all-out war. Even in war there will be conditions, if only to ensure that you don't take out someone on your own side. However, if the rule of law no longer prevails and the institutions of government are weak or non-existent, the reality can be very different.

In the MH17 case it appears from anecdotal evidence that those in possession of the SAM fell into the "weak or non-existent government" category and so lacked the disciplined command and control arrangements that would have allowed them to properly identify MH17 as being non-military (squawking traffic, flight plan, track behaviour, origin etc). One could maybe argue that the attack was an unintended consequence of the internal conflict rather than deliberate targeting of a CAT flight, but the result is tragically the same.

So perhaps one of the lessons from MH17 is that, for our threat equation, political will as a form of restraint can quickly be subverted by lack of control. It follows that it would be wise to avoid areas where you have knowledge that SAM systems (and/or fighter aircraft) are present and where there appears to be no, or poor, political control over the people bearing arms. But instability and violence on the ground does not necessarily mean an area is unsafe for over-flight; you still need the capability to attack aircraft at high level for the threat to be meaningful.

Syria is a classic case for concern and possibly avoidance at the moment, simply because there is a known presence of highly capable SAM and a civil war that is seeing possession of some hardware passing to the opposition rather than remaining in government hands, whatever you may think of that government. A similar situation of instability prevails in Libya. There is understandable caution with Iraq because of the current ISIS insurgency and its extremist approach to life or, rather, to the casual taking of it; there is little doubt that a weapon system would be used without compunction if the opportunity arose, regardless of the consequences. While there is no information to suggest that ISIS has yet gained possession of a SAM system capable of hitting an over-flight, there will be a number of nations watching carefully for such a development. It would be very wise to heed the warnings when they are issued as they will be based on proper intelligence, but until such warnings are issued there seems to be no particular reason to avoid over-flying the area. However, the international response to ISIS atrocities appears to be swinging increasingly towards military air activity and this may prompt an 'avoid' recommendation sooner rather than later.

The residual question for crews post-MH17 is "How do I know my company is telling us the truth when they say it's safe?" when the decision is to continue operating into or across troubled turf. The simple answer is that it has to be taken on trust. But trust has to be earned, and the difficulty for the operator here is that it may not be able to reveal all its cards. Any confidential information, be it capability, commercial or security-based, must be protected if it is to remain confidential and the simplest way of achieving this is to restrict access only to those with a genuine 'need to know'. There will be times when the human source of information would be placed directly in harm's way should their identity or even the nature of the information become publicly known, and there will be capabilities and techniques that intelligence agencies would not wish to see compromised under any circumstances. But without this information any security risk assessment will be fundamentally flawed.

All operators have direct or indirect access to classified intelligence, though they may not always realise it as it will usually come in unclassified form; some information will be routed via NAAs, some may be given information more directly. It is not important that people know where the information has come from but it is important they know it is credible and they do need to act accordingly. For example, we do not need to know how or where intelligence on the recent terrorist bomb plots came from, but we must certainly ensure those working on physical security at airports know what they are looking for when they examine baggage. There may also be times when it is appropriate to give people a little more information about the nature of a threat and the accompanying risk assessment, particularly so when people believe they will be personally exposed to it. This is the essence of the trust relationship and the confidence generated when that relationship is solid. Crews need to understand the company risk assessment process and accept that it includes access to information that often cannot be released into the public domain. Management also needs to consider ways of enhancing trust in the process and building confidence that operations can be conducted without undue risk. In this respect it is always worth reinforcing the message that safety and security are essential pre-requisites for commercial success.

focus ON COMMERCIAL AVIATION SAFETY

Safe Skies?

by Chris Brady, Chairman UKFSC

It now appears certain that flight MH17 was shot down over the Ukraine from its cruising altitude by a ground to air missile. Regardless of who did it or why, and perhaps helped by the fact that there were so many different nationalities on-board and the subsequent delays in recovering the bodies, it has woken the world up to the hazards of overflying conflict zones.

Malaysian Airlines was not doing anything differently to many other airlines who had also been overflying this area since that conflict began; it was just desperately unlucky that a Malaysian aircraft was hit so soon after the loss of MH370.

Clearly, in retrospect the aircraft should not have been overflying the area; the question is how should the airline, or any of the others in that airspace, have known that beforehand?

Airlines cannot possibly have the resources to be global security experts and yet they have to make decisions about whether or not it is safe to overfly regions, countries or parts of countries in scenarios that could be changing in severity on a daily basis.

To assist this decision making, airlines have to gather intelligence from various sources to determine their safety and suitability, such as governments, ICAO, IATA and Eurocontrol.

MH17 was in airspace approved by ICAO. Its flight plan was approved by the Ukrainian authorities, as well as Eurocontrol, yet it was still brought down.

Interestingly the FAA has since extended its overfly warnings to eastern Ukraine, Iraq, Syria, Afghanistan, Kenya and Ethiopia. Yet countries like Nigeria and the Central African Republic which are listed as war zones with ongoing conflicts are not on the FAA banned list. Furthermore, these overfly warnings are only issued for US registered aircraft, so should they be taken into consideration by a non-US aircraft? Is the decision on if airspace is safe to overfly dependent upon the country of registration?

A recent attack which saw a rocket land quite close to Tel Aviv airport, led to some short term recommendations by the FAA and EASA not to fly into this airport. These only lasted for a day or so and when flights resumed crews understandably remain concerned about operating there given the daily TV news reports of rocket fire so soon after MH17. One of the concerns of crew is that either the operators are not fully aware of the situation on the ground or that they are choosing to continue for commercial or political reasons. Hopefully if there was ever any suspicion that the latter was occurring MH17 will have ended such practice.

What is now clearly needed is for a respected independent body to be established which is able to give real-time, accurate, security assessments and unbiased advice for any part of the world, based upon objective criteria. Only then will all operators, crew and passengers have confidence in the system that the flights will only fly over and into areas when it is safe to do so.

Flight data monitoring for Corporate Operators

by Dave Jesse, CEO. Flight Data Services

Flight Data Monitoring Regulations

Although extensive amounts have been written on the subject of Flight Data Monitoring (FDM) for airline operations, when it comes to the corporate world and FDM on private jets, the issues have been less well documented.

On 1st January 2005 the International Civil Aviation Organisation amended Annex 6 of the Chicago Convention and introduced requirements for a 'flight data analysis programme', which was mandatory for aircraft over 27 tonnes and recommended for aircraft over 20 tonnes.

Many of the larger corporate aircraft are well above the 27 tonnes limit in the ICAO mandate (see Table 1), and while the mandate is based purely on take-off weight and not use, large business jet AOC holders in the UK are all required to implement an FDM programme.

Equipment Installation

The ARINC standards that govern the manufacture and test of crash protected Flight Data Recorders (FDR's) have made it difficult to certify a new FDR, which as a consequence, mean that all aircraft large enough to require an FDR have been fitted with recorders with the same data interface.

This enables the fitting of small Quick Access Recorders (QAR's). These were developed for airliners but are equally suited for corporate jets and are the best solution for extracting data from the aircraft. These use removable memory cards, rather than more expensive 'wireless' solutions or 'milking' the FDR with a download unit which is inconvenient. For fixed base operators, maintenance crew can use a computer located in the hangar to transfer the data or alternatively aircrew can install software on a laptop to download and send flight data remotely, perhaps from their hotel at a later time. This method is more suited to a private jet operator where the aircraft owners' plans can change at short notice.

	Gulfstream G650ER	Embraer Phenom 100E
Passengers	8	6
Max takeoff weight (kg)	46,992	4,750
Range (nm)	7,500	1,178

(Table 1 Summary scale of aircraft)

Flight Data Analysis and Event Measurements

With similar recorded parameters as airliners, such as: Airspeed, Pitch Angle, ILS Deviation and similar exceedance events such as: overspeed, excessive pitch altitude and unstable approach, the conversion from airliner analysis to corporate jet analysis is technically straightforward, however there are some significant differences that complicate the practical implementation of the process.

Differences between Corporate Operators and Airlines

Firstly, there is the irregular flight pattern of the aircraft. Unlike airlines with a familiar and regular flight schedule, the corporate operator is rarely returning to the same airport twice. Then there is the issue of the small fleet sizes. While some larger operators can build statistically meaningful patterns of data, this is almost impossible for operators of a few or even a single aircraft, flying irregular patterns often with low utilization.

Aircraft variation is an added factor; an airline will have as few types as possible in its fleet to attain economies of scale, whereas corporate operators often manage a number of different privately owned aircraft. This is all combined with the way the aircraft is flown. If aircrew are trying to maximise passenger comfort then the aircraft will tend to rotate more slowly on take-off or float further down the runway on landing. Without passengers on-board, performance of these "pocket rockets" can lead to an enthusiastic pilot achieving remarkable rates of climb and steep bank angles.

Early Corporate FDM Operations

Typically of FDM, many early users installed the equipment and carried out a review of data with reluctance, or at least a lack of enthusiasm - after all, they had been flying safely for years and were approved operators prior to the change in the law. They had not become unsafe, just because some regulator in ICAO invented a new rule. That was until the safety events started to come in, at which point phrases like "that's not in our SOP's" or "I wonder why he did that?" were heard. At some stage the Safety Manager has to take action and how this is done depends upon a culture within an organisation. The significant points are that:

- All corporate operators who installed FDM found that the aircraft were being operated in ways that had previously not been anticipated.

- Often a common pattern emerged that characterized that operator/type combination.

- Tackling events that arose in the early days allowed the safety department to gain a "quick win" to demonstrate the effectiveness of the programme.

For example, an operator might find that crews were tending to float down the runway to achieve very gentle touchdowns, but as a result reducing the runway length available for braking and increasing the risk of an excursion on a short runway. Focusing on landing technique can increase the safety margins without significant reduction in passenger comfort.

Analyst comment	FSO comment
Max speed exceeded limit for 4 secs from 3269 ft AAL. Max speed = 252 kts.	noted
The speed was high for 16 seconds between 3985 ft and 3530 ft AAL with a maximum of 257 kts	Noted nothing to add at this time
The speed was high for 1 minute and 39 seconds between 5000 ft and 4205 ft AAL with a maximum of 296 kts.	all crew have been warned re speeding below 10.
The speed was high for 35 seconds between 5000 ft and 3000 ft AAL with a maximum of 309 kts	all crew aware of speeding below 10

(Table 2. Events Recorded)

The Corporate Aviation Safety Executive

A group of corporate Safety Managers recognised that the industry could benefit from a sharing of safety information and formed the Corporate Aviation Safety Executive (CASE). This entirely voluntary international group meets regularly to share safety lessons learned and build upon experience from their peers. It was through CASE that an initial step was completed to create a shared SMS platform.

Some of the larger operators within CASE with previous experience of FDM recognised the value and potential for this safety tool to be applied to smaller operators. Furthermore, they understood that, for this to be really effective, it had to be tied in with a data sharing mechanism to gain a greater depth of understanding and insight into the safety issues.

The first stage was to collect data from aircraft. Members of the CASE executive met with the UK Department for Transport (DfT) and the CAA, and it was agreed that a CAA funded and managed trial should be conducted to demonstrate the feasibility of fitting FDM equipment on smaller corporate aircraft (below the 27 tonne weight limit). This trial covered three different aircraft types at three different operators. During the year, 400 flights of data were collected from the trial aircraft proving that the aircraft could be modified to accept QARs. The trial has recently come to completion, proving that data capture and analysis was a practical proposition for this class of aircraft and operation. The final report is currently in preparation by the CAA.

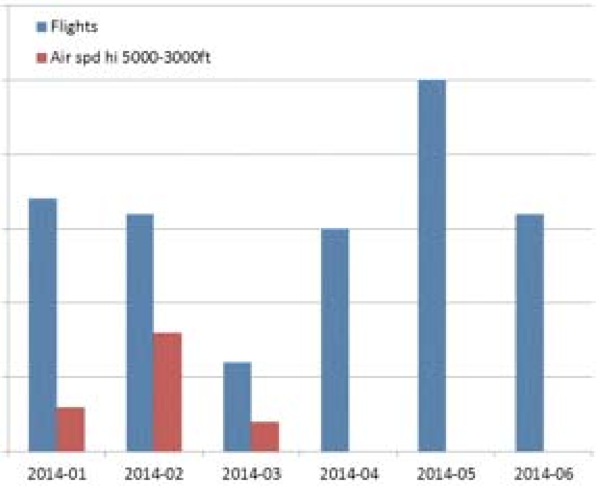
Although the purpose of the trial was to prove the feasibility of gathering data from this class of aircraft, the question that immediately followed was, were there any issues found? As with all operations new to FDM, different operators identified different issues, for example, low rotation rates at take-off occurred in one type while with another speedbrakes were used more often than expected. One enthusiastic approach led to a turn peaking at 60 degrees left wing low and 10 degrees nose down. The commander agreed this approach was "a little aggressive in its execution" and he would remember to "reduce the bank angle in future".

High Speed Descents

Although the trial was only run for a short period, there was one clear case of a safety event being identified and addressed during the course of this trial, specifically the event was high speed between 5000ft and 3000ft during the descent. The limit was set at 250kts to account for bird-strike speed limits, ATC needs and also operations in Class G Airspace.

During the first quarter of 2014, a number of these events occurred, with the peak speed often just over the limit. In these instances the Flight Safety Officer just recorded 'noted' but as the speeds increased he took action as shown in the sample event comments (see Table 2).

The Flight Safety Officer had, justifiably, monitored the first events but took action when the overspeed became excessive, this resulted in an elimination of this event during the following three months (see Table 3), which demonstrates a good example of how FDM is not used as a punitive tool but used to keep operations within the SOPs and achieve a consequential increase in flight safety through education and training.



(Table 3 High speed 5000-3000ft over six month period)

Conclusion

Introducing Flight Data Monitoring to corporate aircraft is not technically difficult, and many of the lessons learned about how to handle the information and how to communicate the safety lessons to the crews can be read across, if not directly, at least in principle, to corporate operations.

The trial, initiated by the Corporate Aviation Safety Executive, sponsored by the CAA and supported by the Department for Transport, demonstrated the practicality of gathering data from smaller corporate aircraft and as an added bonus, encouraging initial results were obtained from this programme.

All three operators involved in the trial have gained a better understanding of their operation, and thanks to continued CAA support all three are continuing to monitor their operations.

The Future

A second trial, to be sponsored by the Department for Transport, is now being planned to expand the available pool of data and explore the potential for statistical analysis of data across multiple operators. Anyone interested in collaborating in this second trial should contact the Corporate Aviation Safety Executive.

Flight Data Service (FDS) supplied the equipment for the trial and carried out the data analysis.

Temporary Reserved Areas (TRAs)

Information for Commercial Air Transport

An Airprox occurred recently between an E145 and a Tornado GR4 both operating IFR under IMC within Temporary Reserved Area (TRA) 007A. This was assessed by the UK Airprox Board as a Category B Airprox: avoiding action may have been taken but still resulted in safety margins much reduced below normal – safety not assured. During the investigation and debate by the Airprox Board it became apparent that the type of ATS provided in Class C TRA airspace was a potential source of confusion. Strictly speaking, within the TRA the CAT pilot was required by Rule 9 of the Rules of the Air to give way to the other aircraft, which was on his right as they converged.

The Single European Sky (SES) Airspace Classification Regulation (Regulation (EC) 730/2006) required EU Member States to adopt Class C airspace above FL195 by 1 July 2007 at the latest.

UK implementation of the rule was undertaken in 2 phases. The first of these took effect on 16 March 2006 with the introduction of Class C in UK airspace above FL245; the second phase was implemented on 15 March 2007 to introduce Class C at and above FL195, replacing all other classifications in the London and Scottish FIRs/UIRs.

In order to accommodate VFR and autonomous operations above FL195 it was necessary to introduce eight TRAs. The dimensions and activation times of these TRAs are detailed in the UK AIP at ENR 5.2.

A TRA is a defined volume of airspace normally under the jurisdiction of one aviation authority and temporarily reserved, by common agreement, for the specific use by another aviation authority and through which other traffic may be allowed to transit under an ATS authority.

TRAs may be used simultaneously by both civil and military aircraft, including aircraft in en-route transit through a TRA. Military aircraft may either operate autonomously within a TRA or be in receipt of an air traffic service (ATS) from approved ATS units.

Flights within a TRA should be conducted on Standard Pressure Setting (1013 hPa) unless instructed otherwise. The semi-circular rule applies above FL195 in Class C Airspace; however, the Quadrantal Rule still applies within an active TRA between FL195 and FL245. This will change later this year when the UK completes implementation of the Standardised European Rules of the Air (Regulation (EU) 923/2012) and adopts the semicircular cruising level system in all UK airspace. During periods of activation, while the airspace classification of a TRA doesn't change, but the rules associated with it do. In short, an activated TRA shall be treated as uncontrolled (i.e. Class G) airspace, and accordingly the ATS provided within it will be the UK Flight Information Services (UK FIS – often referred to as air traffic services outside controlled airspace – ATSOCAS). These are described in detail in CAP 774 "UK Flight Information Services" and the UK AIP at ENR 1.1 General Rules.

It's vital, therefore, that pilots understand the differences between the surveillance-based ATS provided above FL195. Outside a TRA, a radar control service will be provided to all aircraft. Aircraft shall be given avoiding action against conflicting traffic and traffic information shall be passed. Specific lateral and vertical separation criteria have to be achieved by air traffic control – the basic requirements are 5 nms laterally and up to 5000 ft vertically.

Within a TRA, the UK FIS will apply. These can be summarised as follows:

Deconfliction Service: A Deconfliction Service is a surveillance-based ATS where controllers provide specific surveillance-derived traffic information and issue headings and/or levels aimed at achieving planned deconfliction minima (basic deconfliction minima are 5 nms laterally or 3,000 ft), or for positioning and/or sequencing. However, the avoidance of other traffic is ultimately a pilot's responsibility. Deconfliction Service shall only be provided to flights under IFR, irrespective of meteorological conditions. Controllers will expect the pilot to accept headings and/or levels that may require flight in IMC. Pilots who are not suitably qualified to fly in IMC shall not request a Deconfliction Service unless compliance permits the flight to be continued in VMC. *Pilots that do not require ATC deconfliction advice or deconfliction minima to be applied should not request a Deconfliction Service.*

Traffic Service: Traffic Service is a surveillance-based ATS, where controllers provide specific surveillance-derived traffic information to assist pilots in avoiding other traffic. Controllers may provide headings and/or levels for the purposes of positioning and/or sequencing; however, controllers are is not required to achieve deconfliction minima, and the pilot remains responsible for collision avoidance.
Traffic Service is available under IFR in any meteorological conditions, or under VFR. If controllers issue headings and/or levels that would require flight in IMC, pilots who are not suitably qualified to fly in IMC shall inform of this and request alternative instructions.
Pilots must be aware that a Traffic Service might not be appropriate for flight in IMC or where lookout is significantly constrained by other factors, when other ATSs (e.g. Deconfliction Service) are available.

A Basic Service may also be requested, however this will not afford pilots the same degree of protection as Deconfliction or Traffic services. Basic Service is an ATS provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights. This may include weather information, changes of serviceability of facilities, conditions at aerodromes, general airspace activity information, and any other information likely to affect safety. The avoidance of other traffic is solely the pilot's responsibility. *Basic Service relies on the pilot avoiding other traffic, unaided by ATS providers. It is essential that a pilot receiving this ATS remains alert to the fact that, unlike a Traffic Service and a Deconfliction Service, the provider of a Basic Service is not required to monitor the flight.*

The basic rule that pilots of aircraft operating within an activated TRA must remember is that they are responsible for avoiding collisions in accordance with the Rules of the Air.

Therefore given the prevailing operating environment within TRAs, consideration of flight through them must be included in the Operator's Safety Risk Assessment for Operations Outside Controlled Airspace.

To summarise, aircraft in Class C airspace above FL195 are provided with a Radar Control service and standard separation. CAT may well be operating in active TRAs under the assumed protection of a Radar Control Service above FL195, when, in fact, they will be provided with a UK FIS and ultimately responsible for their own collision avoidance. This means that active TRAs is effectively Class G and must be treated as such. Unlike other Class C Controlled Airspace, aircraft in area TRA can be receiving different types of ATS, and military aircraft are able to act autonomously.

The message is, therefore, know your UK FIS and ask for the one most appropriate to your transit of an active TRA, taking prevailing meteorological conditions into account. Or route around an active TRA under Radar Control.

Further information:
Regulation (EC) No 730/2006
Regulation (EU) 923/2012
CAP 493 Manual of Air Traffic Services
CAP 774 UK Flight Information Services
CAP 789 Requirements and Guidance Material for Operators
UK AIP ENR 1.1 General Rules

European Legislation can be found on the LEX-Europa website, www.eur-lex.europa.eu. CAPs can be downloaded from the publications section of the CAA website, www.caa.co.uk.

AIP content can be accessed through the AIS website, http://www.nats-uk.ead-it.com/public/index.php.html

Civil Aviation Authority

Brave New World

by Wayne Rosenkrans

Social media pressures and expanded use of portable electronic devices disrupt conventional cabin safety.

Novel risks involving airline passengers' behavior with social media and/or inflight use of portable electronic devices (PEDs) are being validated a bit at a time, say two U.S. cabin safety specialists. Early signs lead them to expect these changes to be a lasting consequence of governmental decisions to accommodate public demand for expanded in-flight use of passenger-supplied PEDs and media they produce. So they recommend that training programs specifically prepare flight attendants to be resilient in coping with the effects.

Speaking at the World Aviation Training Conference and Tradeshow (WATS 2014) in April, Larry Parrigin, manager of curriculum development, Southwest Airlines University, focused on disruptive changes that social media have brought to the cabin environment, airline classrooms and the lives of flight attendants — especially when crewmembers' decisions and on-the-job actions "go viral" within minutes on the Internet. Candace Kolander, coordinator for air safety, health and security, Association of Flight Attendants–Communications Workers of America (AFA-CWA), addressed what she described as a rushed method of enabling all-phase PED use that in October 2013 resolved concerns about electromagnetic interference risks but so far overlooks some of the human factors.

Social Media Disruption

"Social media [use] is now the no. 1 activity on the web," Parrigin said. "Social media are used by our employees and passengers. How do we incorporate that and deal with that in our training environments? … It also allows our customers to air our goofs and blunders in a matter of seconds — and a lot of times before we can actually be prepared to respond. … This is the new reality that our flight attendants are currently facing."

Relevant training begins with education about the potentially harmful consequences that can arise from any aviation professional's communication through social media. Typically, formal training first covers the airline's social media policy for employees, he said.

"All of our employees have a right to free speech, but a paycheck comes with a certain level of responsibility, and I think we owe it to [flight attendants] to really educate them," Parrigin said. "But there are very few policies in place if any of our passengers utilize social media. We don't spend a lot of time training our folks on that 'ever-present watchdog' in the cabin — and I think this has taken on increased relevance, especially now that most [U.S. airlines] have gate-to-gate PED policies in place [with a] WiFi system active gate to gate. Now we say, 'Work every flight as if someone is taking a photo or video of what you're doing in the airplane — because they are.'"

The new normal is that, at the first sign of trouble in the cabin, passengers immediately retrieve smartphones to take photos and make video recordings, cabin crews report. Increasingly, the resulting digital media are uploaded to social media sites just as soon as these incidents occur, he said.

Among diverse subjects captured have been aircraft anomalies, crew responses to disruptive passengers and abnormal behavior of aircraft crewmembers. Parrigin showed that an Internet search during the conference, for example, for the phrase "flight attendant meltdown" produced tens of thousands of web page hits.

The recordings made with PEDs can result in a benefit or can do harm, or both, from the standpoint of cabin safety. "The good side is that recording on the airplane … gives us a raw, unfiltered [look] as to what is actually occurring in the cabin," Parrigin said. "This is not a flight attendant report. This is not a customer letter. This is not a re-creation scenario. It is what is actually occurring. Now on the flip side, these photos and videos rarely show the lead-up to any particular event. All of our patient interactions with difficult customers do not warrant any kind of social media update. …. So we have a very skewed perception. We get all of the drama with none of the context. Without that context, these events are very easily misinterpreted by anyone who wants to play armchair quarterback."

Flight attendants and other cabin safety specialists — as aviation professionals — have a responsibility not to draw conclusions about an event based on a single source. This includes caution about how any externally sourced videos and photos from the Internet are presented during flight attendant training, he said.

New Training Resource

"If you ask, 'Should we use social media in training?' I think we can because there's a ton of it [sometimes reflecting] exactly what's happening on the airplane," he said, acknowledging that instructors and trainees also need to apply their judgment, their "credibility filters" and "a healthy dose of skepticism" about the possibility of false information being communicated through social media. Parrigin used as an example a Southwest Airlines Boeing 737 landing accident at La Guardia Airport, which a number of passengers documented by taking photos and videos from inside and outside the airplane.

"The first images that we actually saw on the news were taken by these passengers on the airplane," he said. "Several videos were shot in the cabin — several videos of the landing, several videos of the evacuation." In the edited version of the video clip shown at WATS, a flight attendant directs passengers to bring along the smaller carry-on bags and purses already in their hands as they jump onto slides. This instruction is inconsistent with training on telling passengers to leave behind all carry-on items.

However, Parrigin said the video clip omits contextual and explanatory information. A more complete version shows that the evacuation flow already had been impeded by numerous passengers asking for exceptions to her initial "Come this way, leave everything behind!" command and that she exercised judgment per training and made a decision to override the standard command with "Just bring your small stuff — let's go!" to successfully expedite evacuation in these specific circumstances, he said.

"The biggest issue … was a huge shock for the crew coming down the escape slide [and] facing a line of passengers with their cell phones out who were photographing and filming the accident scene," Parrigin said. During the airline's debrief process, one flight attendant also recalled feeling "assaulted" by critical comments left on social media sites, especially some posted by people who identified themselves as flight attendants. "The comments questioned their actions, questioned their decisions [and] criticized the decisions without taking into account the conditions [and emotional states] that the flight attendants were actually facing, and without really knowing what was occurring on board that aircraft," Parrigin said. Particularly trivial, he said, was criticism of the flight attendant wearing an apron while conducting the evacuation.

Flight attendants assume that part of performing safety duties on any aircraft, anytime, is psychological readiness for emergency situations. But some training professionals now are expressing concerns that in the current environment — and especially among those unprepared for today's likely scenarios — crewmembers "may hesitate for fear of being judged wrong out there on the World Wide Web, and they could hesitate when critical thinking and quick decisions are called for," Parrigin said. "That hesitation could cost lives."

Assuming that passengers' in-flight use of PEDs and social media treatment of airline crews really have become the daily reality for crewmembers, Parrigin believes that shifts within training can make a difference. "We need to establish a culture that empowers our crewmembers with critical thinking skills … to make decisions and take actions without fear of being judged wrong," he said. "That assertiveness and decisionmaking process [are] critical in any sort of safety environment. We need to have that frank discussion of the presence and possible impact of social media … in the classroom before they encounter this on board the aircraft — especially in a critical situation."

One tactic for introducing these realities during training is to incorporate PEDs into cabin event–management scenarios, especially those involving emergencies. Parrigin said that as he watched another U.S. airline's recurrent training, he saw a person playing the role of a passenger filming the emergency situation in a manner likely to induce distraction and stress. Another way to help overcome these factors is to record scenarios with mobile phones, tablet computers and other PEDs for immediate feedback to the participants and to strengthen their resolve to disregard the presence of such devices.

"We could use our cell phones, we could use our iPads, to actually record student performance in the cabin mockups then use those videos to debrief the flight attendants and say, 'Hey, here's your door drill … right here … you forgot to assess the conditions.' … That increases the flight attendant's comfort level with facing the camera when they're having to perform tasks."

Finally, flight attendants should be able to cope more easily with social media fallout by knowing that their airline's seasoned investigators and cabin safety professionals generally bring a sophisticated perspective from their long experience using scientific methods of interpreting human factors. "Our flight attendants have got to be reassured that their performance in any given situation — if it was proved to be necessary, reasonable and appropriate — is not going

to be judged based solely on a single piece of evidence that's been posted out there on social media," Parrigin said. A YouTube video by a passenger, for example, does need to be considered as part of the airline's or the U.S. National Transportation Safety Board's (NTSB's) investigative process but will not be the sole criterion for judging a flight attendant's decisions and actions.

In flight attendant training, Southwest Airlines nearly always uses accident-scene photos deemed to have educational value, to be reflective of a vetting process by the NTSB, and available from the NTSB's public docket. After a discussion with company flight attendants involved in the La Guardia accident, however, a decision was made not to use in training passengers' video recordings of flight attendants. "Once that [NTSB] process is complete, then we'll include the training recommendations," he said. "[We asked the accident flight attendants,] 'How comfortable are you with us addressing that accident in training?' They're not there yet, and to protect their anonymity and allow them time to process and to heal, we decided not to do that [with social media videos]."

Regarding use of social media to share cabin safety-related experiences, the company's flight attendants are covered by a generic company policy that says, in essence, that an employee posting anything that would harm the airline or harm the airline's reputation violates the policy, Parrigin said. "We have one [social media arena] specifically for cabin services, so there's a lot of activity and we do encourage that sharing — as long as it is respectful and does not cause harm," he said.

Cautions About PEDs

AFA-CWA's Kolander said that the labor union's resistance to the dismantling of restrictions on U.S. airline passengers' in-flight use of PEDs echoes the resistance expressed in documents prepared by the U.S. Federal Aviation Administration (FAA) Civil Aerospace Medical Institute (CAMI). "The new policy allows portable electronic devices to be used throughout all phases of flight," she said. "The consequence of the relaxation of the PED policy [is fewer] passengers paying attention to what we do in the cabin — the important safety message. We've gone through extensive efforts trying to figure out how [to] grab the passenger's attention. We've spent decades on it."

The union's continued issue advocacy on this subject partly stems from a trend of member flight attendants expressing frustration about setbacks in performing their safety communication duties. "We know there are studies that say that the passengers [who listen to] exit-row briefings gain knowledge that helps them to evacuate when an aircraft is burning," Kolander said. "And yet we've just shut off that [benefit] by allowing the earbuds and the noise-canceling headsets. … With passengers now able to use PEDs during all phases of flight, including during crewmember briefings, flight attendants are concerned that important safety information is being ignored.
… Eventually, this frustration will lead to our front line safety professionals throwing up their hands [as they] stop caring about safety because we have failed them."

Two FAA guidance documents that accompanied the Oct. 31, 2013, policy announcement emphasized the securing vs. stowing aspects of PED safety, she said: InFO 13010, *Expanding Use of Passenger Portable Electronic Devices (PED)*, and a supplement to InFO 13010, updated June 9, 2014, *FAA Aid to Operators for the Expanded Use of Passenger PEDS*. (The links to the principal FAA PED documents for passengers and airlines are available at <www.faa.gov/about/initiatives/ped/>.)

While the union expected tactical advice, for example, that would prepare flight attendants to direct all passengers to remove their sight/sound-blocking electronics at safety-critical times, the guidance (see "U.S. Flight Attendant Training on Expanded Use of PEDs," p. 20) instead emphasizes that it is not necessary for flight attendants to check for compliance with PED-related crewmember instructions, she said.

Since the new U.S. policy took effect, member flight attendants also have raised the following issues: performing all of their duties has become harder; they consider passenger use of headphones during takeoff and landing to be hazardous; they increasingly find PEDs in seatback pockets left with the cords of earbuds/headphones draped across an aisle, especially in exit rows; and their safety duties are complicated when improperly stowed devices become lost.

The union participated in the Portable Electronic Device Aviation Rulemaking Committee (PED ARC), formed by the FAA in January 2013. Beyond ensuring adequate aircraft protection against electromagnetic interference, the committee's key issues were impact-injury risks; size/ weight limits for PED seat pocket stowage and the influence of such stowage on emergency egress; overall impact on public safety and cabin safety; management of cabin electrical receptacles to prevent impediment of egress; and the question of whether uncased, thin PEDs placed under seats would pose evacuation risks, she said.

The committee, including FAA aviation safety inspectors (cabin), conducted lengthy discussions on safe stowage versus securing of PEDs in the cabin, and how flight attendants would need to be trained for this change. "They were very supportive, recognizing our concerns for safety … once we launched PEDs in the cabin. They realized our concerns when [we] dealt with evacuation," Kolander said. "So the issues were raised. The PED ARC did have to address

U.S. Flight Attendant Training on Expanded Use of PEDs

In issuing new policy and guidance on how airlines can obtain approval to expand the use of passenger-supplied portable electronic devices (PEDs), the U.S. Federal Aviation Administration (FAA) said in October 2013 that "the FAA believes that sufficient risk mitigation can occur to allow for safe operation of PEDs during critical phases of flight. … The administrator will evaluate the rest of the [PED Aviation Rulemaking Committee's (ARC's)] longer-term recommendations and respond at a later date."

The FAA also explained to its aviation safety inspectors, "[The PED ARC] report contains recommendations that can be implemented in the very near term, as well as changes in policy and guidance that need additional time to be considered and implemented. … Allowing expanded use of passenger PEDs into the takeoff and landing phases of flight may change the flight attendant's (F/A) responsibilities from confronting and reporting passenger noncompliance to informing passengers of the content of PED policy. " With exceptions, flight attendants are not expected to police passenger compliance or even to know whether any passenger's PED is on, off or in airplane mode, said the guidance to operators.

One reason passenger-compliance checks are discouraged is that the overriding safety priority is to ensure flight attendants can remain in their jump seats with their seatbelts and shoulder harnesses fastened in preparation for takeoff or landing, according to the FAA.

However, the FAA's *PED Aid to Operators* notes that "on an extremely rare basis, the flight crew may require the flight attendants to coordinate and check for compliance to ensure that all devices are turned off (e.g., potentially harmful interference noted with flight instruments)."

Focus areas for revised flight attendant training include the individual airlines' revisions to flight manuals, handbooks and checklists covering procedural changes in normal, abnormal and emergency operations; revised predeparture safety briefings; and airline-specific details of PED securing and stowage.

The areas require operational knowledge that large PEDs — such as full-size laptops or other PEDs that weigh more than 2 lb (0.9 kg) or that could impede egress — must be safely stowed in an approved carry-on stowage location during takeoff and landing so as not to present a hazard in the event of severe turbulence, crash forces or emergency egress. Small handheld PEDs such as tablets, e-readers and smartphones may safely remain powered on — in airplane mode only — and be connected to a WiFi network installed in the aircraft (if allowed by the airline) and to Bluetooth accessories. Passengers' small PEDs must be secure (i.e., not loose) during surface movement, takeoff, descent, approach and landing, typically by being placed in a seat pocket or "on their person," that is, by being hand-held (although not preferable) or placed in a belt or arm holster, or placed in a pant pocket. PED cords or accessories must not impede emergency egress.

The FAA adds that flight attendant training also must "clearly address" what PEDs are approved for use aboard the specific aircraft make and model (including medical PEDs and portable oxygen concentrators); the times when approved PEDs can and cannot be used; how and when PEDs must be secured or stowed; PED modes of operation that can and cannot be used; and how and when to inform passengers of the airline's PED policies and procedures.

Other expected training content covers how and when to report suspected or confirmed electromagnetic interference events (including transient or intermittent problems); coordinating the aircraft crew's management of passenger PED use; effective teaching of passengers about the new PED policy; how and when passengers will be informed about these PED procedures; responding to passengers who use PEDs in a disruptive or unsafe way; and applying procedures for nonroutine, abnormal or emergency scenarios such as suspected or confirmed interference and the detection of smoke or fire in a PED or battery.

Moreover, to support cabin crews, the FAA's public-awareness campaign now tells all passengers: "Put down electronic devices, books and newspapers and listen to the safety briefing. In some instances of low visibility — about 1 percent of flights — some landing systems may not be proved PED-tolerant, so you may be asked to turn off your device. Always follow crew instructions and immediately turn off your device if asked. Make safety your first priority."

— WR

some of these issues very specifically in the final report."

Holding Small PEDs

The question of whether it is acceptable for passengers to hold small PEDs in their hands during takeoff or landing needed close examination before a change in guidance and practice.

"The [PED] ARC final report … defines a stowage location as 'one that is approved for stowage by the operator, and placarded with a maximum weight restriction' and refers to a secure location as a 'place that lacks formal operator approval or a maximum weight placard, but where it is considered, in the judgment of the operator, that in a survivable incident … the item is unlikely to threaten any occupant's safety,'" Kolander said.

The PED ARC's final report in September 2013 represented about three years of work by RTCA technical committees. "A lot of time [was] spent on engineering aspects. … [The PED ARC] had 29 recommendations for the FAA … basically [answering the question] 'How can we launch a program dealing with expanded PED use on aircraft?'" she said, noting that the new FAA policy was announced a few weeks later. "The FAA didn't say 'Let's [set] a timeline, let's take a break, let's say that all aircraft will be PED-tolerant in six months."

From AFA-CWA's perspective, the FAA's guidance for cabin crews has not gone far enough beyond content of a PED-related announcement to passengers prior to takeoff and landing. This announcement first seeks to gain passengers' attention to and cooperation in minimizing PED distractions during the safety briefing itself. Especially for the predeparture safety briefing, the reason for paying attention should be stressed, it says. The announcement also should instruct passengers to secure their PEDs and other loose items, and tell them the types of devices permitted, when they are permitted, and how to prevent personal injury. As noted, it also says that "an operator's flight attendants are not expected to conduct a compliance check to ensure PEDs are stowed or secured."

Another factor behind the union's concerns is flight attendant training that emphasizes that every second lost to distractions after the decision to evacuate an aircraft could mean the difference between life and death, Kolander said. The passenger-made evacuation video shown by Southwest's Parrigin, she said, showed the extra difficulty that can occur in getting people moving.

"Everyone is trying to collect some of their personal [PEDs]," she said of the video. "Now, they want to make sure that their cameras or cell phones are available and ready to start taking videos and pictures. So that even slowed the evacuation."

The memo from CAMI, which accompanied the PED ARC's final report to the FAA, said in part, "CAMI cabin safety researchers recognize the attraction of 'PED-tolerant' airplanes, including the allure of allowing these devices to operate during all phases of flight. However, in addition to … scientific data and analysis pertinent to maintaining a 'clean cabin environment,' accident data show that takeoff/initial climb and final approach/landing are critical phases of flight for accidents and fatalities. … The research and accident statistics indicate that added distractions (e.g., usage of PEDs) during critical phases of flight would unnecessarily increase risk, discount passenger safety, and disregard the many serious efforts to rectify the shortcomings related to passenger safety awareness.

"In particular, use of PEDs should continue to respect the clean cabin environment during the pre-flight briefing and critical phases of flight, since the focused attention of passengers to PEDs creates competition for passenger mental capacity. People can selectively attend to only one thing at a time. … It seems inexplicable to promote PED usage during the very times when passengers might need to engage that safety information the most."

Overall, the human factors dynamics in the cabin, although covered in the PED ARC deliberations, did not get the level of attention that AFA-CWA expected. From the union's perspective, FAA has yet to address a number of other ramifications, such as how cabin crews will get adequate time built into their airline procedures to educate passengers about PED safety.

"Flight attendants' concerns nowadays are reflecting exactly what the [PED ARC wrote], they're saying the exact same things," Kolander said. "For any country, any company, that is looking at doing this on aircraft, [note how] we spent years looking at the technical issues … and we spent no time to decide what was going to happen to us in the cabin. … Had [the United States] done it by saying, 'OK, we mean this as a six-month period when all airlines can get PED-tolerant, and we will launch on the same day' — maybe that would have been a better way to do it."

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Datalink: the story continues

by Jenny Beechener

Projects proceed apace on both sides of the Atlantic to implement the latest data communications technologies and procedures

Trials are underway to test data communications between the cockpit and tower controllers at two US airports: Newark Liberty International Airport and Memphis Airport. Departure clearance (DCL) messages are sent digitally to the cockpit in place of voice, and are acknowledged by the pilot by simply pressing a button. The DCL messages use the controller pilot datalink communications (CPDLC) already onboard aircraft equipped with Future Aircraft Navigation Systems (FANS-1/A).

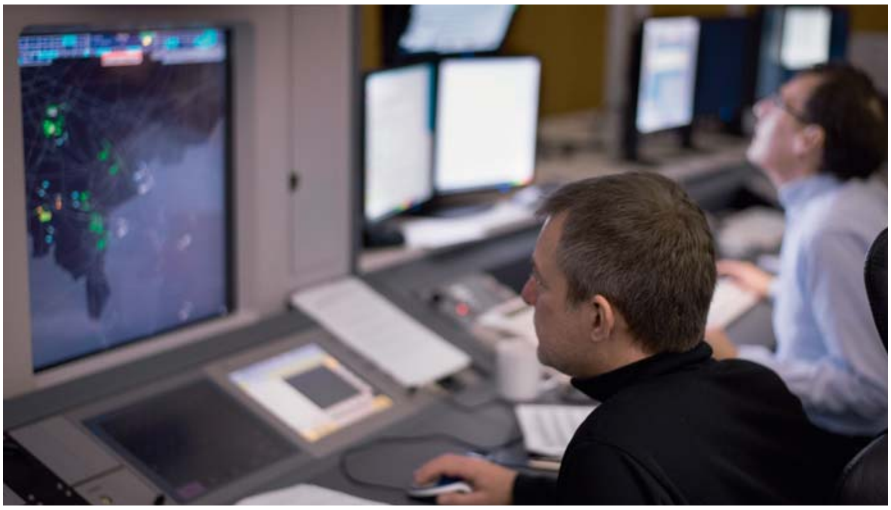
Participating airlines include British Airways, Federal Express, Lufthansa Airlines, United Airways, and UPS. The messages are sent during the surface departure phase and include the flight plan route, initial and requested altitude, beacon code assignment, and departure frequency. The digital communications are faster and more accurate than voice messages, and significantly reduce the workload for controllers and pilots.

Although results of the tests at Newark and Memphis will not be published until late 2014, airlines have already been able to take advantage of earlier departure times during bad weather, jumping the departure queue by receiving digital clearances while other aircraft wait for voice clearance to depart.

The trials form part of the six year USD331 million Data Communications Integrated Services (DCIS) programme awarded to Harris in 2012. This includes deployment of Tower Datalink Services (TDLS) at some 57 sites from 2016, starting at Salt Lake City International, Houston Intercontinental, and Houston Hobby airports.

The introduction of digital clearances, plus the capability to send a revised clearance, to the flight deck, is the first part of a two-phased programme. The second phase envisages datalink communications between controllers and pilots during the en route flight phase to transfer information such as altitude assignment and revised route information. This requires CPDLC capability to be installed at 20 en route centres across the United States beginning in 2019.

The programme also includes an incentive programme for airlines to invest in avionics to support CPDLC. Harris Government Communications NextGen Initiatives for Civil Programs Vice President John O'Sullivan told IHS Jane's in March 2014: "We already have six airlines signed up, with two more pending. So we have 1,636 aircraft taking advantage of the incentives, out of 1,900 requested by the FAA." He expects more than 2,000 to be included in the programme by April 2014.



SESAR partners aim to make air travel more perdictable by developing and validating Initial 4D (i4D) trajectory management – connecting aircraft and ground systems to optimise the aircraft trajectory in three dimensions plus time.

Harris is working with service providers ARINC (now part of Rockwell Collins) and SITA to provide the VHF datalink communications infrastructure, and avionics suppliers include Rockwell Collins, Honeywell, and GE Aviation. Thales ATM Inc is providing the ground infrastructure for TDLS.

"We have started the integration and test phase at the FAA Technical Center," said O'Sullivan. "We will then move to a production system ready for airport deployment." Harris is also responsible for providing training services for the programme. The company participates in the joint US-Europe datalink working group, comprising RTCA Standing Committee 214 and EUROCAE Working Group 78, which sets out to define standards and interoperability requirements for air-ground datalink communications. While datalink programmes in North American and Europe have slightly different time lines and requirements, they have agreed to adopt common standards to ensure global interoperability.

SESAR I4D

In Europe, the second Initial 4-Dimensional (I4D) test flight in March 2014 demonstrated that trajectory information can be shared in real-time between the air and the ground to optimise flight profiles.

The I4D flight was part funded by the SESAR Joint Undertaking (SJU) to validate new technology that will support more efficient flight operations in Europe. The first flight in February 2012 demonstrated the feasibility of using the aircraft's flight management system (FMS) to exchange data directly with the ground to achieve more accurate flight profiles.

Both flights recorded extremely accurate predicted arrival times (well within the 10-second envelope) paving the way to begin certification of some of the equipment used.

The industrial partners include Honeywell and Thales (each of which developed a prototype FMS for the flight trials and simulations); Airbus (who provided the MSN001 A320 test aircraft and the cockpit simulator at Toulouse); Thales and Indra (who supplied the dedicated controller displays at the Maastricht and Malmo control centres); and air navigation service providers LFV of Sweden, Naviair of Denmark, and Eurocontrol Maastricht Upper Area Centre.

Honeywell Advanced Technology Leader Stéphane Marché told IHS Jane's: "Everyone has worked on maturing the prototypes. We have improved the standardisation and we are capturing the needs of several stakeholders."

Marché said all the systems have been improved and the second flight shows the robustness of the system. Honeywell is now looking to build a solution for pioneer airline operations. "We carry out cockpit evaluations when we build an aircraft system, but here is another dimension that includes the ground. It is important to have all the actors involved."

Much of the detailed work has been carried out in a series of simulations over the last 18 months. This has included human factor analysis, generation of different scenarios, different traffic levels, and different weather patterns. "The main function of the flight test is to make sure your simulation is representative of real life in terms of winds that you will encounter, in terms of pilot reactions to real situations," said Marché.
"You have the most interesting scenarios in the simulator, but you have to check that what you are simulating is right."

The SJU anticipates that I4D will be available in Europe from 2018. The programme has already confirmed important safety and environmental gains with reduced fuel costs, increased flight predictability, and overall network efficiency. While the benefits will initially be limited to the en route flight phase, I4D is an important step towards trajectory-based operations.

In the longer term, the combination of I4D with more widespread use of sequencing tools in the terminal area is expected to contribute to improved network efficiency. Among several SESAR programmes looking at arrival sequencing, a simulation by Italian air navigation service provider (ANSP) ENAV in Rome in the second half of 2014 plans to combine I4D with interval management to more accurately predict arrival times.

European deadline looms

ANSPs in Europe have until February 2015 to comply with a mandate to support air-ground datalink services in European upper airspace. Datalink communications form a central part of ATM modernisation programme, as Europe moves from routebased to trajectory-based airspace management. While a number of ANSPs have implemented CPDLC, many more have yet to comply with the deadline.

The Maastricht Upper Area Centre (MUAC) was first to introduce CPDLC in 2003, when it began exchanging digital messages with suitably equipped aircraft for routine communications. A decade later, other service providers added CPDLC to area control centre air-ground communications including DFS of Germany, skyguide of Switzerland, NATS of the UK, and the Irish Aviation Authority (IAA). CPDLC offers a fast alternative to congested VHF radio channels, and is less prone to misunderstanding. Messages can also be printed out in the cockpit or control centre for reference. The aeronautical data is transmitted via a network of VHF datalink (VDL) Mode 2 ground stations, the majority installed by ARINC and SITA, and European carriers are also preparing to meet the datalink mandate through new deliveries and retrofit avionics. VDL Mode 2 provides a data radar of 31.5 kbps, compared with the legacy aircraft communication and reporting system (ACARS) rate of 2.4 kbps in the same channel width of 25 kHz.

This Airbus A320 test aircraft completed the second Initial 4-Dimensional demonstration flight in March 2014 as part of a joint project with SESAR Joint Undertaking partners.

SITA supplies a datalink front end processor (DL-FEP) gateway, developed with partner company Egis Avia. DL-FEP is designed to handle messages from aircraft equipped with FANS 1/A and aeronautical telecommunications network (ATN) capability. The gateway is installed at many large area control centres in Europe including in Belgium, France, Ireland, Luxembourg, the Netherlands, Switzerland, and the United Kingdom.

The increase in datalink activity has brought attention to some performance issues with the digital messaging at the start of 2014. Some CPDLC messages were disconnecting, especially in the busy core area of Europe. The Datalink Implementation Steering Group (DLISG) is looking into these 'provider aborts' to establish the cause. The industry is also looking at ways to introduce multi-frequency VDL Mode 2.

Meanwhile, a demonstration project by the SJU is testing the use of ATN communications to handle routing messages such as clearances, handover, and routing instructions. The ATC Full Datalink (AFD) project is led by the Italian service provider ENAV and includes SITA, NATS UK, Selex ES, Airbus, Boeing, Air France, and NATS UK.

Tests carried out in 2013 demonstrated successful message exchange between the ENAV AFD platform and airframe manufacturers' testbed equipment in Seattle and Toulouse. In 2014, NATS UK extended the tests to include the lower airspace, below FL285. Between March and June 2014, live flight trials are taking place between Bristol and Edinburgh, Bristol and Rome Fiumicino and four routes between Scotland and Scandinavia.

The aim is to demonstrate datalink use in busy airspace at low altitudes, where it can enhance safety and efficiency. Routine voice messages are replaced by datalink, leaving congested voice channels free for urgent communications. Under the European implementation rule, datalink is only mandated in European airspace above FL285.

STR-SpeechTech monitors datalink messages

STR-SpeechTech has added new functionality to its Digital-Automatic Terminal Information Service (D-ATIS) solution.

The D-ATIS Response Monitor is being installed at a new approach control facility at Natal in Brazil, where STR-SpeechTech is supplying a bilingual English/Portuguese StarCaster ATIS system.

The StarCaster text-to-speech system is already used to broadcast ATIS messages, including runway use, notices to airmen, and weather information.

The new D-ATIS Response Monitor is now able to monitor and log data link requests made by aircraft. It logs aircraft identifier, time, message contents, and whether successfully delivered.

The D-ATIS server collects the data and makes it available to the D-ATIS Response Monitor on the StarCaster ATIS computers. A separate application that resides on the operator workstation in the control tower is able to access the D-ATIS request and make this available to controllers to view.

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Why and when to perform a Go-Around maneuver

by Michael Coker, Lead Safety Pilot, Flight Services

Industry statistics indicate that while only 3 percent of commercial-airplane-landing approaches meet the criteria for being unstabilized, 97 percent of these unstabilized approaches are continued to a landing, contrary to airline standard operating procedures. Most runway excursions can be attributed at least in part to unstabilized approaches, and runway excursions in several forms are the leading cause of accidents and incidents within the industry. Airlines should emphasize to flight crews the importance of making the proper go-around decision if their landing approach exhibits any element of an unstabilized approach.

According to industry sources, no single decision has the potential impact on the overall aviation industry accident rate than the timely decision to execute a go-around maneuver. The reason is that runway excursions or overruns — which are typically the result of an unstabilized approach with a failure to perform a go-around — account for 33 percent of all commercial aviation accidents and are the primary cause of hull loss.

This article explains the relationship between unstabilized approaches and hull loss, why flight crews continue landing despite an unstabilized approach, the factors that govern landing outcomes, when flight crews should choose a go-around maneuver, and industry education efforts related to go-arounds.

The relationship between unstabilized approaches and hull loss

Boeing developed an analysis to help visualize runway events. This Boeing Runway Track Analysis combines multiple sets of investigation data, including time-based flight-data-recorder data, distance-based ground-scar data, and the calculated track (see fig. 1).

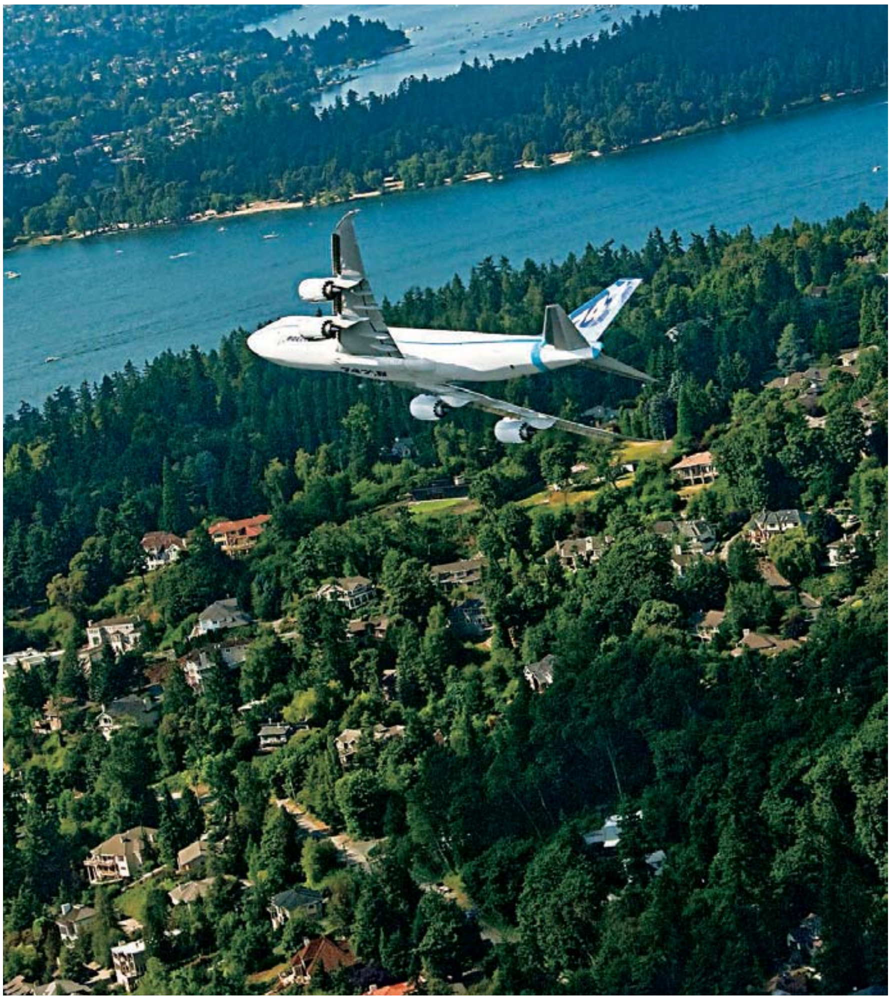
This analysis shows the relationship between unstabilized approaches and hull loss, due to runway excursion (see fig. 2). In every instance of hull loss, the outcome may have been very different if the flight crews involved had elected to perform a go-around instead of attempting a landing. According to a Flight Safety Foundation (FSF) study, more than half of all commercial airplane accidents in 2011 could have been prevented by a go-around decision. In fact, according to FSF's analysis 83 percent of approach-and-landing accidents could be prevented by a go-around decision.

The conclusion from this analysis is that flight crews need to know when to abandon an approach to landing and perform a go-around maneuver because the decision to go around is an essential element of conducting a safe flight.

Why flight crews continue landing with an unstabilized approach

According to the FSF, a number of factors contribute to a flight crew's decision to continue landing with an unstabilized approach, including:

- Fatigue.
- Pressure of flight schedule (e.g., making up for delays).
- Any crew-induced or air-traffic-control (ATC)-induced circumstances resulting in insufficient time to plan, prepare, and conduct a safe approach.
- ATC instructions that result in flight too high and/or too fast during the initial approach.



Flight crews should execute a go-around maneuver instead of continuing an unstabilized landing approach.

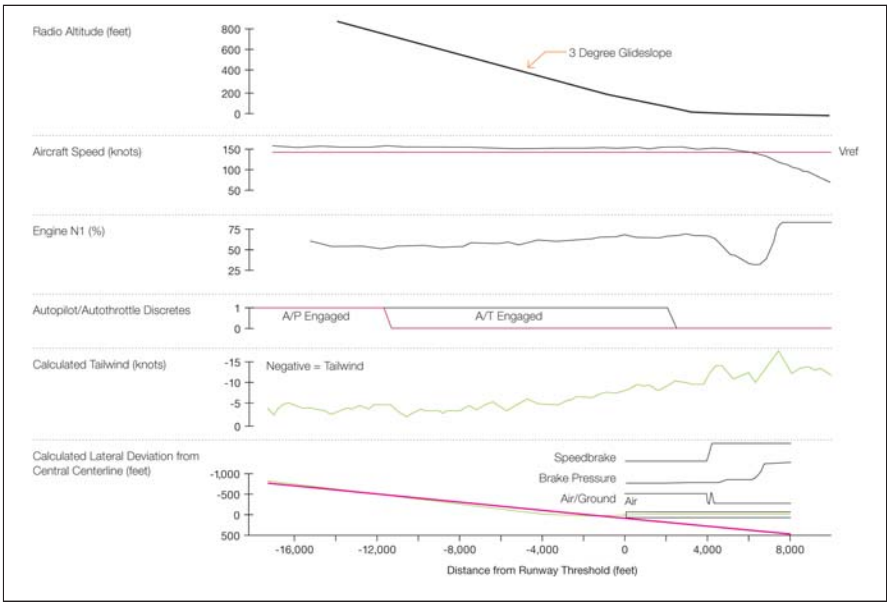


Figure 1: Boeing Runway Track Analysis
Boeing Runway Track Analysis uses a variety of data to analyze runway events.

		Touchdown Point (TD)		Touchdown Speed		Deceleration				Result	
						Speedbrake (SB)	Thrust Reversers (TR)		Runway		
	Approach	Point (feet)	Runway Used (% LDA)	Airspeed >Vref (knots)	Tail Wind (knots)	When SB Deployed (sec)	When TR Deployed (sec)	When TR Reduced (feet)	Braking Action	Overrun Speed (knots)	Hull Loss
Long	Unstable	7,000	72%	23	0	TD	TD + 3	Departure	Good	81	Yes
Long	Unstable	6,200	70%	12	5	TD	Never		Dry	50	No
Long	Unstable	5,300	60%	16	3	TD	TD + 4	Departure	Good	35	No
Long	Unstable	5,150	48%	20	0	TD + 5	TD + 7	900	Med	70	No
Long	Unstable	4,700	52%	30	-1	TD	TD + 2	1,000	–	100	Yes
Long	Unstable	4,500	60%	-3	1	TD	TD + 2	Departure	Good	47	Yes
Long	Unstable	4,500	56%	6	3	TD	TD + 3	400	Dry	90	Yes
Long	Stable	3,950	44%	0	14	TD	TD + 3	Departure	Med	63	Yes
Long	Stable	3,260	41%	20	-1	TD	TD + 3	2,000	Med	40	No
Long	Stable	3,200	48%	-7	4	With TR	TD + 2	Departure	Good	30	No
Long	Stable	3,120	42%	10	10	TD	TD + 2	Departure	Good	50	No
Long	Stable	3,000	37%	-5	6	TD	TD + 2	Departure	Med	30	No
Long	Stable	3,000	34%	3	5	TD	TD + 3	Departure	Med	5	No
		13									
Fast	Stable	1,600	20%	12	10	TD	TD + 27	Departure	Good	25	No
Fast	Stable	1,500	20%	20	10	TD	TD + 3	600	Med	5	No
Fast	Stable	1,450	20%	11	15	TD	TD + 3	1,250	Med	20	No
Fast	Stable	1,450	20%	6	9	TD	TD + 3	Departure	Med	0	No
Fast	Stable	1,250	18%	4	11	TD	TD + 2	Departure	Poor	45	No
				5							
Deceleration	Stable	2,700	30%	0	0	Never	Never		Med	45	No
Deceleration	Stable	400	6%	2	-6	Never	TD + 22	Departure	Med	48	No
Deceleration	Stable	500	8%	3	4	With TR	TD + 20	Departure	Med	32	No
Deceleration	Stable	1,250	21%	0	9	TD	TD + 16	Departure	Poor	42	No
Deceleration	Unstable	1,720	27%	6	5	TD+9	TD + 13	Departure	Good	20	No
Deceleration	Unstable	1,800	23%	10	2	With TR	TD + 11	Departure	Poor	28	No
Deceleration	Stable	1,900	26%	6	-2	TD	TD + 8	Departure	Med	20	No
Deceleration	Stable	1,150	24%	5	-5	TD	TD + 6	100	Med	12	No
Deceleration	Stable	2,900	28%	0	-6	TD + 3	TD + 5	2,800	Poor	10	No
Deceleration	Stable	2,600	31%	0	2	TD	TD + 2	2,250	Good	25	No
Deceleration	Stable	2,200	27%	5	7	TD	TD + 2	2,000	Med	45	No
						11					

Figure 2: Relationship between unstabilized approach and hull loss.
This analysis shows that four out of seven unstabilized approaches in this study resulted in hull loss.

- Excessive altitude or excessive airspeed (e.g., inadequate energy management) during the initial approach.
- Late runway change.
- Excessive head-down work.
- Short outbound leg or short downwind leg (e.g., because of traffic in the area).
- Late takeover from automation.
- Premature or late descent caused by failure to positively identify the final approach fix.
- Inadequate awareness of wind conditions.
- Incorrect anticipation of airplane deceleration characteristics in level flight or on a three-degree glide path.
- Excessive confidence by the pilot monitoring (PM) that the pilot flying (PF) will achieve a timely stabilization.
- PF and PM too reliant on each other to call excessive deviations or to call for a go-around.
- Visual illusions that cause a crew to misinterpret the airplane's position, such as a narrow runway that may give the impression that the airplane is higher than it actually is.
- Lack of airline policy, cultural norm, and training to direct pilots to perform a go-around instead of continuing an unstabilized approach.
- Lack of practice in performing a go-around maneuver.

Factors that govern landing outcomes

Three primary factors govern the outcome of every landing:

- **Touchdown point.** Defines runway remaining to dissipate energy. Having a stabilized approach contributes heavily to a proper touchdown point.
- **Touchdown speed.** Defines energy to be dissipated.
- **Deceleration after touchdown.** Defines the effectiveness of dissipating the energy.

An analysis of overruns indicates that if two out of three conditions exist, an overrun is likely. But if one condition is removed, the overrun risk is reduced.

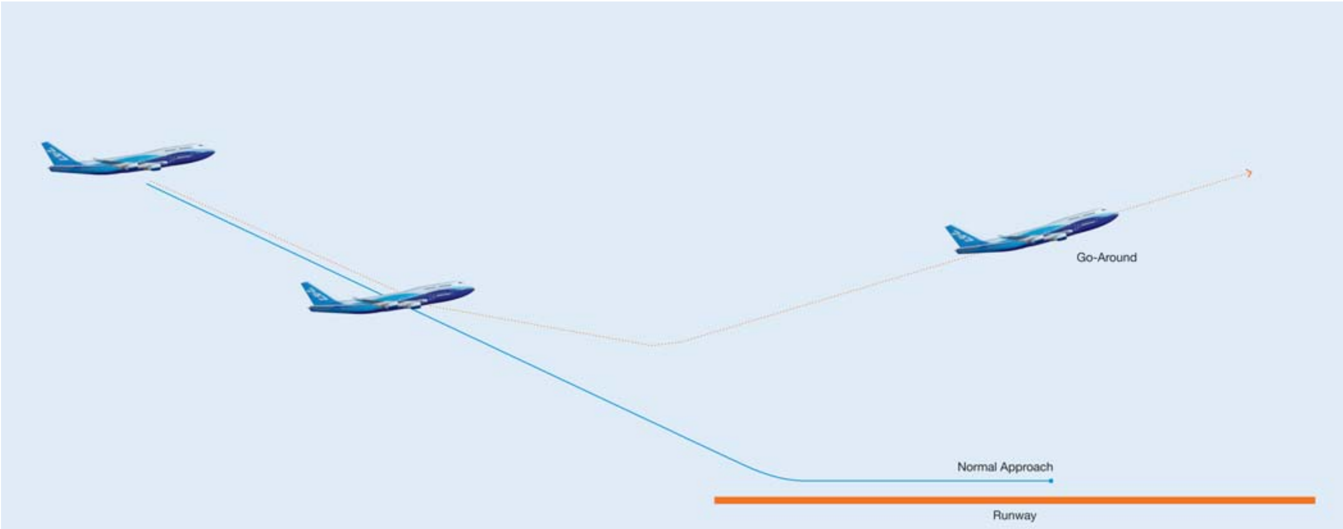


Figure 3: When to perform a go-around
The timely decision to initiate a go-around if the approach is unstable or conditions have changed, such that a safe landing is at risk, allows the crew to safely conduct a follow-on approach. There are several reasons to perform a go-around maneuver, including a request by ATC, an unexpected event (such as wind shear), an unstabilized approach, or the determination that the landing cannot be made within the touchdown zone.

When to perform a go-around maneuver

A go-around maneuver should be performed whenever the safety of a landing appears to be compromised (see fig. 3). Typically, this occurs for one of these reasons:

- **Requested by ATC.** ATC may request a go-around for a variety of reasons, including tight airplane spacing, an airplane on the runway, or an airplane too close on a parallel landing runway.
- **Unexpected events.** The flight crew may determine that something is not correct for landing — such as a flap gauge or gear indication — and that a checklist is needed to configure the airplane for landing. The presence of wind shear is another unexpected cause of go-arounds. These unexpected events may warrant initiation of a go-around even after the airplane has touched down following a stable approach. Runway conditions, surface winds, friction coefficients, or unknown conflicts may be different than those reported to the crew during approach. A successful go-around maybe possible after touchdown up to the point where the crew initiates the use of thrust reverse if conditions warrant. Because these types of go-arounds involve unexpected events, it is difficult to anticipate them.
- **Unstabilized approach.** An unstabilized approach occurs when an airplane fails to keep one or more of these variables stable: speed, descent rate, vertical/lateral flight path, and configuration for landing. It is important to understand that the stabilized approach recommendations do not apply only to the "gates" of 1,000-foot (305-meter) instrument meteorological conditions (IMC) and 500-foot (152-meter) visual meteorological conditions (VMC). Those altitudes are merely a snapshot analysis of the approach, and the elements need to be maintained throughout the landing. (See "Recommended elements of a stabilized approach" on page 18.)
- **Landing cannot be made within the touchdown zone.** This is defined as the first 3,000 feet (915 meters) or first third of the runway, whichever is shorter. Crews should calculate a landing distance based on current conditions and compare that distance to the runway available for every landing. Touchdown at the far end of the accepted first 3,000 feet (915 meters) or first third of the runway may not be appropriate if conditions change at the last moment during the flare or touchdown.

Industry education efforts

Numerous airline pilot associations and regulatory authorities have efforts under way to educate flight crews about go-arounds. These include the FSF, International Civil Aviation Organization (ICAO), International Air Transport Association, Commercial Aviation Safety Team (CAST), and European Commercial Aviation Safety Team.

Resources include:

- FSF Approach-and-Landing Accident Reduction Tool Kit Briefing Note, *Being Prepared to Go Around* (http://flightsafety.org/files/alar_bn6-1-goaroundprep.pdf).
- ICAO Working Paper, *Measures for Preventing Runway Excursion Caused by Unstabilized Approach* (http://www.icao.int/Meetings/a38/Documents/WP/wp302_en.pdf).
- CAST Go-Around Safety (http://www.skybrary.aero/index.php/Portal:Go-Around_Safety).

Recommended elements of a stabilized approach

All flights must be stabilized by 1,000 feet (305 meters) above airport elevation in instrument meteorological conditions (IMC) and by 500 feet (152 meters) above airport elevation in visual meteorological conditions (VMC). An approach is stabilized when all of the following criteria are met:

1. The airplane is on the correct flight path.
2. Only small changes in heading/pitch are required to maintain the correct flight path.
3. The airplane speed is not more than Vref + 20 knots indicated airspeed and not less than Vref.
4. The airplane is in the correct landing configuration.
5. Sink rate is no greater than 1,000 feet per minute (FPM) or 305 meters per minute; if an approach requires a sink rate greater than 1,000 FPM, a special briefing should be conducted.
6. Power setting is appropriate for the airplane configuration and is not below the minimum power for approach as defined by the airplane operating manual.
7. All briefings and checklists have been conducted.
8. Specific types of approaches are stabilized if they also fulfill the following: instrument landing system (ILS) approaches must be flown within one dot of the glide scope and localizer; a Category II or Category III ILS approach must be flown within the expanded localizer band; during a circling approach, wings should be level on final when the airplane reaches 300 feet (91 meters) above airport elevation.
9. Unique approach procedures or abnormal conditions requiring a deviation from the above elements of a stabilized approach require a special briefing.

An approach that becomes unstabilized below 1,000 feet (305 meters) above airport elevation in IMC or below 500 feet (152 meters) above airport elevation in VMC requires an immediate go-around.

Source: Flight Safety Foundation Approach-and-Landing Accident Reduction Task Force

Summary

Runway excursions are the leading cause of accidents and incidents within the industry. Airlines can avoid most runway excursions if flight crews choose to execute a go-around maneuver instead of continuing an unstabilized approach to a landing. Flight crews should understand the importance of making a go-around decision if they experience an unstabilized approach or conditions change during the flare or touchdown up to the point of initiating thrust reverse during the landing rollout.

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UAV - Are they a threat to you?

by Captain Sarah Clachan, DHL

We've all been asked the question, "Do you ever think there will be a day when there are pilotless aircraft?" That time may be closer than thought with aircraft the size of a Jetstream being developed for unmanned flight.

The time of the Unmanned Aerial Vehicle (UAV/UAS) is upon us. The number of UAVs licensed for commercial flight rose from 30 in January 2013 to over 300 by time of writing. Last month the Army's Watchkeeper came into service after years of testing. The skies are getting crowded. These UAVs are opening up opportunities previously too expensive or difficult to arrange. Sporting events, festivals, natural disasters all attract camera platforms, the images are then beamed into the media hungry homes around the world. The cost of these platforms starts from as little as a few hundred pounds enabling many new ventures to spring up, it is much cheaper to hire a company to send a camera platform up to check your roof than it is to hire scaffolding and engineers.

Whether you regard these developments as a nuisance or not, this technology is here to stay. In the USA, there is a lobby seeking to legalise the shooting down of such aircraft as fears are that sooner or later, someone will be hurt or killed by a UAV.

The CAA's Richard Taylor states that complaints about drones are only in double figures, with the limited overseeing capability of the authority, it is more a matter of trust that operators will stay within the regulations. In the USA, the first test case is going through the courts to decide whether domestic drones should be treated as a commercial activity, therefore attracting more regulations. It may fall to the individual to raise a complaint against privacy invasion that will lead to greater regulation in this field. CAP722, Unmanned Aircraft System Operations in UK Airspace states, if a System does not have a Detect And Avoid capability, the aircraft shall not be flown :-

- In controlled airspace, except with the permission of the appropriate ATC unit;
- In any aerodrome traffic zone except with the permission of either the appropriate ATC unit or the person in charge of the aerodrome;
- At a height exceeding 400 feet above the surface; At a distance beyond the visual range of the Remote Pilot (RPA) observer of the said aircraft, or a maximum range of 500 metres, whichever is less;
- Over or within 150m of any congested area of a city, town or settlement; or
- Within 50 metres of any person, vessel, vehicle or structure not under the control of the Remote Pilot; during take off or landing, however, the aircraft must not be flown within 30 metres of any person, unless that person is under direct control of the Remote Pilot."

The requirements for licensing and training of UK civil Remote Pilots have not yet been fully developed. It is expected that UK requirements will ultimately be determined by EASA regulations and ICAO Standards and Recommended Practices.

The CAA currently regulate UAVs according to purpose and weight. Those weighing more than 20 kg are currently banned from UK civilian airspace other than a large zone in West Wales and a temporary zone above Boscombe Down. Although the use of a temporary zone offers a flexible tool for segregating specific portions on a temporary basis, this segregation effectively denies airspace to otherwise legitimate users. A TDA will normally be established for 90 days. The next time you fly to Lasham, take a good look at the TDAs in operation, you might be sharing

the sky with Watchkeeper. Those weighing less than 20kg are allowed to fly in civilian airspace providing the operator does not intend to use data or mages from the flight acquired by flying close to people or objects.

According to the CAA, " a significant increase in both civil and military UAS is anticipated, most of which will require access to all classes of airspace if it is to be both operationally effective and commercially viable. To achieve this, UAS will have to be able to meet all existing safety standards applicable to equivalent manned aircraft types, appropriate to the class (or classes) of airspace within which they are intended to be operated."

There are two elements to Detect and Avoid, namely separation assurance and collision avoidance. The systems must be able to:

- Detect and avoid traffic in accordance with the Rules of the Air; Detect and avoid all airborne objects, including gliders, hang-gliders, paragliders, microlights, balloons, parachutists etc;
- Enable the Remote Pilot to determine the in-flight meteorological conditions;
- Avoid hazardous weather;
- Detect and avoid terrain and other obstacles; and
- Perform equivalent functions, such as maintaining separation, spacing and sequencing that would be done visually in a manned aircraft.

UAVs with such capabilities include the Watchkeeper Tactical UAV operated by the British Army. The Watchkeeper UAV gives the UK armed Forces intelligence, target acquisition and reconnaissance capabilities.

The Watchkeeper can be pre-programmed to carry out fully autonomous missions and can also be redirected from an operator on the ground. Take off and landings can be piloted or done automatically using Elbit's MAgic X-band automatic take off and landing system. The air vehicle is fitted with GPS, dual computer systems and dual datalinks. The electrical and avionics systems have built in redundancy for increased reliability. It is powered by rotary engines from UAV Engines Ltd and uses a two bladed pusher propeller. For endurance missions, Watchkeeper can be fitted with two 50 litre auxiliary fuel tanks, giving a total endurance of 17 hours. It can carry a payload of 150kg including night sensors, a laser designator and synthetic aperture radar/ground moving target indicator. The UAV is connected by satellite datalink to a network of containerised ground control stations.

CAA policy is that all UAS must be under the command of a Remote Pilot. Depending on the level of autonomy, a Remote Pilot may simultaneously assume responsibility for more than one UAS. In an emergency, the decision making function of any autonomous UAS must be capable of handling the same range of exceptional and emergency conditions as a manned aircraft as well as assuring that failure of the decision making function itself does not cause a reduction in safety. As with any manned operation, the Remote Pilot is potentially subject to a degradation of situational awareness due to remote operation and associated lack of multi-sensory feedback. The Remote Pilot's risk perception and behaviour are affected by the absence of sensory / perceptual cues and the sense of shared fate with the vehicle. CRM is as vital in the ground station as it is in a conventional flightdeck, all good CRM practices are therefore required in UAV operation as well. Fatigue and stress are contributory factors to human error. The UAV can only perform to it's maximum ability if the human interface is as free of error as possible. When thinking of UAV operation it must always be treated as any other form of manned flight. Mistakes are possible, treat with caution.

Thus far, the majority of requests for permission to operate have come from those wishing to use UAVs for photography. The CAA is now under mounting pressure to remove the restriction from drones weighing over 20kg from flying in Civilian Airspace. With the enormous number of possible applications, a blanket legislation is not deemed appropriate. At the moment the CAA is reviewing each application very much on a one off basis. As numbers increase, this will become very difficult to maintain.

The number of UAVs in operation has grown rapidly over the last couple of years. It is reasonable to expect this growth will continue especially as the technology improves and prices drop. At present there is little evidence of UAVs coming into conflict with commercial aircraft, it is worth however remembering when you accept clearance outside controlled airspace or fly near a TDA that not every other aircraft has a pilot in it.

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Prepare to be Surprised

Sunjoo Advani, Jeffery Schroeder and Bryan Burks provide a summary of the current thinking and provide practical perspectives on upset prevention and recovery training.

The airplanes we operate are reliable by design, and training is so solid that we can respond to nearly all situations without allowing them to escalate beyond control. However, perfectly good airplanes can rapidly transgress from an upset state to a Loss-of-Control In-Flight (LOC-I) condition when a pilot is not trained to react properly. LOC-I is still the number one threat, and while rare, LOC-I events are likely catastrophic. The Boeing/CAST (August 2012) indicates that LOC-I killed 1648 passengers during the past ten years, and EASA's Annual Safety Review 2012 indicates that it is also the category with the highest fatalities.

When faced with the unexpected, pilots will need to refer to their learned skills and apply best judgement within a very small window of time. It is no wonder that this subject has received focused attention during the past five years following a number of compelling accidents: Colgan Air 3407 (Q-400, Buffalo, 12 Feb. 2009), Turkish Airlines 1951 (B737, Amsterdam, 14 Mar. 2009) and Air France 447 (A330, Atlantic Ocean, 31 May 2009). While other causes of accidents have been systematically addressed through technology (CFIT, powerplant-related, mid-air collisions), LOC-I prevention requires better awareness, recognition and avoidance, and recovery training. In today's cockpit, the pilot's training is the final safety net to prevent LOC-I.

While the seeds for the Royal Aeronautical Society's ICATEE (International Committee for Aviation Training in Extended Envelopes) had already been planted prior to these events, a conference in London by that society launched an earnest effort to understand the causes of these upsets and to define the best training solutions.

What triggers upsets? They can be triggered by pilot, environment or system-induced conditions as shown in the table opposite, based on Jacobson [2010].

Startle - the LOC-I Catalyst

According to Lambregts [2008], aerodynamic stall is the leading cause of fatal LOC-I accidents, contributing to 36%. Surprisingly, some crews (e.g. Colgan 3407 and AF 447) responded inappropriately to the stall warning and protection systems. Other flight crews appeared unaware of the flight condition, or reverted to maintaining altitude whatever the cost - a major systemic training deficiency. True, stall is an end product of poor energy management, inattention, inaccurate flight path monitoring, or weather-induced events. Yet, despite the escalation of the events leading to the stall, the recovery at any stage (prior to the g-break, or after loss of lift and the resulting unsteady aerodynamic conditions) remains the same: an immediate reduction of angle-of-attack is requisite.

Why then do upsets invariably become Loss of Control events? When combined with a situation that causes a pilot to become alarmed, leading to an inability to properly resolve the problem - a condition commonly known as "startle," the upset can rapidly become a LOC-I event. Most of the LOC-I events are believed to occur when an upset provokes a startle reaction. If this is true, then unfortunately knowledge and the traditional maneuver-based training alone will not prevent LOC-I. Startling scenarios are needed.

The crew's startle reaction is the leading catalyst that can take an upset airplane into an LOC-I condition. Can we create startle in training? Yes. Can enough startle scenarios be developed and used appropriately so that they remain effective? Possibly. Do we need to train startle management? Absolutely.

Stall Tactics

Until 2012, the aeronautical community had a misplaced emphasis on minimizing altitude loss during a stall recovery. While the safety intentions of such an emphasis may have seemed sound, it led to the inappropriate establishment of specific standards for altitude loss in proficiency checks, and that was accompanied by an unintentional hiding of stalling physics. Training events that instilled minimizing altitude loss consisted of preplanned, announced, stall recovery maneuvers. Invariably, a pilot only needed to apply power, quickly break the stall with a short nose drop, and adjust the airplane attitude to continue recovery - without compromising altitude. It was a hand-eye co-ordination task, and because the maneuver was planned, it caused no startle reaction or startle management from the pilot. However, if those are the ONLY skills that one has acquired, are they enough to prevent reoccurrences of the recent stall accidents? Perhaps not.

Light aerobatic-capable aircraft can be a beneficial learning environment, and are recommended for at least initial training at the licensing level. A good instructor can demonstrate and hone the flying skills of the pilot in UPRT and provide the bridge of knowledge that pertains to transport category aircraft. Part of the complete initial UPRT program, and the subsequent type-specific training, must rely on flight simulators with a representative flight-deck environment, even for stall training.

In a stall, the aircraft behaviour may be unpredictable as the aerodynamics are unsteady. No two airplanes or situations are the same, and no two stalls are the same. Unpredictability is not the kind of behaviour we commonly want from our simulation software, especially when qualification is required. However, with a major focus on stall training, simulator models that do represent stalls "accurately enough for the training objectives" are now becoming available. Boeing and NASA Langley Research Centre developed an accurate stall model for one aircraft type nearly a decade ago. Boeing has developed a full stall model for the 737NG using data from hundreds of flight-test stalls. "Type representative" models, depicting the needed random behaviour are also becoming available (for example, from Bihrle Applied Research), while other consortia continue to develop convincingly realistic real-time models based on wind tunnel and computational fluid dynamics data. Hence, there is no technical obstacle that prevents full stall training.

Simulator Stall Training Requirements

Is training the recovery from an approach-to-stall in a simulator sufficient? The viewpoints differ. While US Public Law 111-216 and recent Part 121 revisions require training to full stalls and upsets, some argue that this could lead to negative training transfer. While they argue that improvements in prevention alone are sufficient, others believe training should go beyond that.

As the aircraft comes close to the aerodynamic stall, the aircraft flight characteristics degrade and the controls become sluggish. Buffet cues may help the pilot to respond, and in some cases, the vibrations can be so severe that instruments become unreadable. Pilots could be drawn into a tendency to maintain the nose-up attitude or try to control bank angle at the expense of recognizing and recovering by reducing the angle-of-attack. Therefore, there is a strong argument in favour of exposing pilots to the complete threat environment in a properly controlled manner.

Pilot-Induced	Environmentally-Induced	System Induced
Improper/inadequate training	Weather (turbulence, icing, adverse winds, wind shear)	Reduced envelope/ mode protection
Poor energy management	Wake vortices	Poor energy management (systems-induced)
Changing pilot skill base	Visibility (for VFR flights)	Propulsion-related
Automation/mode confusion	Foreign Object Damage	Erroneous sensor data
Destabilized approaches		A/C systems failures
Improper procedures (e.g. poor monitoring)		

What triggers upsets? Based on Jacobson [2010].

The FAA conducted a study in Oklahoma City in late 2013 involving 45 Boeing 737 airline pilots who had been previously "approach-to-stall" trained in their company simulators. They were all briefed on, and indicated they were familiar with, the recently published OEM Stall Recovery Template explaining how to recover at first indication of stall by applying a nose-down pitch input until the stall warning is eliminated.

During the study, the airline pilots were presented with an unexpected surprise stall situation. The result was as startling for the researchers as it was for the pilots: Only one-fourth of the pilots applied the proper stall recovery procedure correctly when surprised. Most of the pilots - for a significant length of time - applied back pressure, worsening the stall. The advanced stall models also tempted pilots to deviate more from the proper recovery technique through actions such as applying significant pedal inputs.

The bottom line of this eye-opener was that reverting to the old recovery technique was a dominant response when pilots were surprised. Clearly, the approach-to-stall maneuver-based training leaves something to be desired. Exposure to the startle effect acting as a psychophysical catalyst in combination with the stall reveals errors that simulator training can correct. Both aeronautical knowledge and exposure to the threat environment can be used to develop the confidence that is needed to avoid startle and learn to recover properly. In other words, remaining calm during an emergency can only be fully realized after one has been shown that they are indeed capable of resolving that emergency.

Using today's technology to get the most out of UPRT is strongly recommended. While modifications to stall models and the presentation of UPRT-critical information on the instructor operating station may involve time and investment, airlines should applaud the fact that over half of the required training can be accomplished by making better use of current-day simulators, when combined with proper knowledge-based training. The Airplane Upset Recovery Training Aid (AURTA) is the distinguished source of the aeronautical knowledge, covering causes and cures for most upsets.

Investing in Risk Reduction

UPRT can provide the biggest bang for the buck when properly implemented and quality assured. The forthcoming ICAO Manual of Aeroplane Upset Prevention and Recovery, a manifestation of several international committees including ICATEE, promises to define the training elements necessary to ensure pilots develop the requisite knowledge and skills for a successful program. However, the development or revision of those programs is left to the operators and local authorities themselves.

An innovative development is taking place at South African Airways (SAA), whose underwriter has pledged assistance with the implementation of their UPRT program. According to their Chief Training Captain Johann Du Plessis, "Being faced with an upset condition which takes a pilot out of their comfort zone cannot be successfully recovered from, unless ingrained recovery techniques have been developed. Therefore, our insurers and underwriters appreciate the risk associated with loss of control in flight and have been extremely supportive with the introduction of a recognized and comprehensive upset prevention and recovery training programme". This includes acquiring a tablet-based version of the AURTA, development of the entire training program, and a complete "Train-the-Trainer" program for their instructors utilizing on-aircraft and simulator training.

"The airline industry recognizes that LOC-I is the leading cause of fatal accidents", states SAA's Chief Standards Pilot, Captain Sandy Bayne. "A lot of the actions you take in recovering from an upset are really counter-intuitive." Following completion of the course at Aviation Performance Solutions in Mesa, Arizona, Captain Bayne felt "I now have the ability to impart this knowledge, to understand the concepts behind an upset and recovering from it."

While not every nation, airline or pilot may have the luxury to impart on-aircraft training (it is recommended though as part of CPL or MPL training), the message is clear: Properly designed and carefully instructed programs that integrate knowledge and practical exposure to the upsets - that develop the confidence pilots need to bring an airplane back into its flight envelope - can be powerful in preventing upsets and avoiding Loss of Control In Flight.

And don't forget that important catalyst: Surprise!

Ab Initio Students

There has been general recognition over the last few years that some form of upset prevention and recovery training should be introduced into ab-initio pilot training. Whilst such training forms a mandatory part of an approved MPL course, until recently there was no such regulatory requirement for the modular and integrated routes to professional pilot qualifications.

The inclusion or otherwise of this training had therefore been left to individual training organisations or those airlines who want new pilots to have completed it.

One training organisation which has gone ahead with the design of such training is CTC Aviation – based in the UK and New Zealand. In response to the specific request of British Airways, whose Future Pilot Programme (FPP) Ab Initio Pilot Training programme is overseen by CTC Aviation, and with the approval of easyJet, who also support an ab initio pilot course, a standardised upset prevention and recovery training package has now been integrated into the training. Presently delivered at Bournemouth, UK, this consists of one day of lectures/discussions on the reasons for the training and the theory behind it, followed by 3 hours in the aircraft. Some of that will be in an aerobatic aircraft – for the moment the platform is ex-RAF Bulldog aircraft, and part in a light aircraft, the Diamond DA 40. The two types are used because the stress is not on aerobatics as such, but rather on the skills which an airline pilot might have to call on during her/his career. The emphasis is very much on the relevance to airline operation, so the final part of the training is on a representative type – a Boeing 737 Full Flight Simulator. A cadre of specially qualified instructors is used to deliver this training, and increasingly airlines are requiring it to be incorporated into their bespoke cadet programmes.

Maybe such a course should form part of best practice in all future ab initio pilot training programmes. – Chris Long

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About the authors:

Dr. Sunjoo Advani, the owner and president of International Development of Technology b.v., is an aerospace engineer and pilot. He has chaired the ICATEE team in the development of the content that became the core of the ICAO Manual of Aeroplane Upset Prevention and Recovery.

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