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Front Cover Picture: Seaflight Av. (VP-BSI departing Luton). Accredited Photo Terry Figg

focus ON COMMERCIAL AVIATION SAFETY

How do we know when we are good enough?

by Dai Whittingham, Chief Executive UKFSC

In a world where there is always pressure to do more with less, one of the first casualties in the quest for cost reduction is often training. This is perhaps not a surprise because training is a costly venture and it is difficult to argue for more when results at first glance seem to show that training is adequate. Our accident rates across the industry are generally excellent and hull losses are mercifully infrequent, at least for the western hemisphere, to the point where complacency is now a real threat.

However, loss of control in flight (LOC-I) and CFIT continue to feature in global statistics, and runway excursions are relatively common, especially in the business sector. Sadly, there are very few accidents where there is not some sort of human factor involved; many of these accidents could have been avoided had the crews had a better understanding of their aircraft systems and how to manage them. Management of automation is a case in point.

The investigation into the Asiana B-777 accident at SFO last year is not yet complete, but there seems to be plenty of evidence pointing towards shortcomings in training, allied to cultural factors that may have impeded early intervention when things started going wrong. The ongoing investigation into the B-787 go-around accident at Kazan also appears to be revealing shortcomings in pilot training.

The manufacturers have responded over the years with increasingly sophisticated designs aimed correctly at protecting us from our human frailties, which has normally involved automation. Autoland has been with us for years, but automation has now reached a level of maturity where remotely piloted systems are capable of landing on aircraft carriers and refuelling in the air – both demanding, high-fidelity tasks. Not strictly relevant to commercial ops, but the point is that almost anything is now possible with automation and with sophistication comes complexity. Allied to that has come commonality across aircraft families, again an understandable development in the interests of reducing the training burden which is a key factor in cost of ownership. The manufacturers are in business to sell aircraft and they will not want to produce a platform that requires extensive training to operate it because their customer will simply go somewhere else. The result is that type ratings produce a bare minimum standard deemed to be 'good enough'.

The evidence for 'good enough' comes from the fact that pilots completing a rating are capable of operating the aircraft to the satisfaction of a TRE, who in turn works to a set of standards laid down by the regulator. But is it 'good enough'? There are plenty of examples of type-rated pilots failing to understand their systems in sufficient depth to avoid so-called automation traps. For example, it is apparent from information already released by NTSB on the Asiana accident that at least one of the pilots did not fully understand the primary automation systems and the implications of the mode selections he had made. And is an MPL cadet really ready to operate a complex modern aircraft after as little as 15 days training on type? Perhaps, if everything is working as advertised and the environment is benign, perhaps not if he or she is faced with cascading failures, poor weather and complex ATC procedures. There is no substitute for experience and knowledge, and this combination is not arrived at overnight.

With regard to experience and knowledge, there is a greater need to share it than is perhaps being recognised by those responsible for crewing. For example, the Asiana crew included a captain on one of his first few sectors since converting to type, paired with an instructor who was on his first 'solo' instructional trip. Why? A recent incident in the UK involved a captain on his first day after initial line check being paired with an FO who was on his first week of ops since his own initial line check, coupled with a challenging destination. Did any element of judgement come into the rostering system? If not, why not?

The Kazan B-737 accident involved a captain less 2500 hrs and an FO with 1700 hrs, and it has also been reported that the captain had never flown a go-around. If, as seems probable, the crew fell foul of a somatogravic illusion while hand flying, experience may well have played a part in events; work for the UK MOD suggests there is a direct correlation between experience (including experience on type) and susceptibility to spatial disorientation. The 1500 hr ATPL experience threshold imposed by the US Congress in the wake of the Colgan Air accident may seem a blunt instrument but there is no denying it provides a certain element of protection in light of the above; whether it is a wholly appropriate measure is for another debate. And we should also remember that accidents are not restricted to short-haul operations; where pure hand-flying skills are concerned, it is sectors that count, not just hours.

There has been a considerable amount of work done in the USA looking at some of the fundamental principles underpinning training and flight operations today, particularly concerning the operational use of flight path management systems. The report on the Performance-based operations Rulemaking Committee work with the CAST Flight Deck Automation Working Group was published by the FAA in September 2013 and is available from the FAA website. It is well worth reading as it contains a number of stark conclusions and some far-reaching recommendations for designers, manufacturers, regulators and operators.

http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afs/afs400/parc/parc_reco/media/2013/130908_PARC_FltDAWG_Final_Report_Recommendations.pdf

The work identified inter alia vulnerabilities in knowledge and skills for manual flight operations and vulnerabilities in the use and management of automation. Its 18 recommendations to the FAA included:

- Revise initial and recurrent pilot training, qualification requirements (as necessary) and revise guidance for the development and maintenance of improved knowledge and skills for successful flight path management.

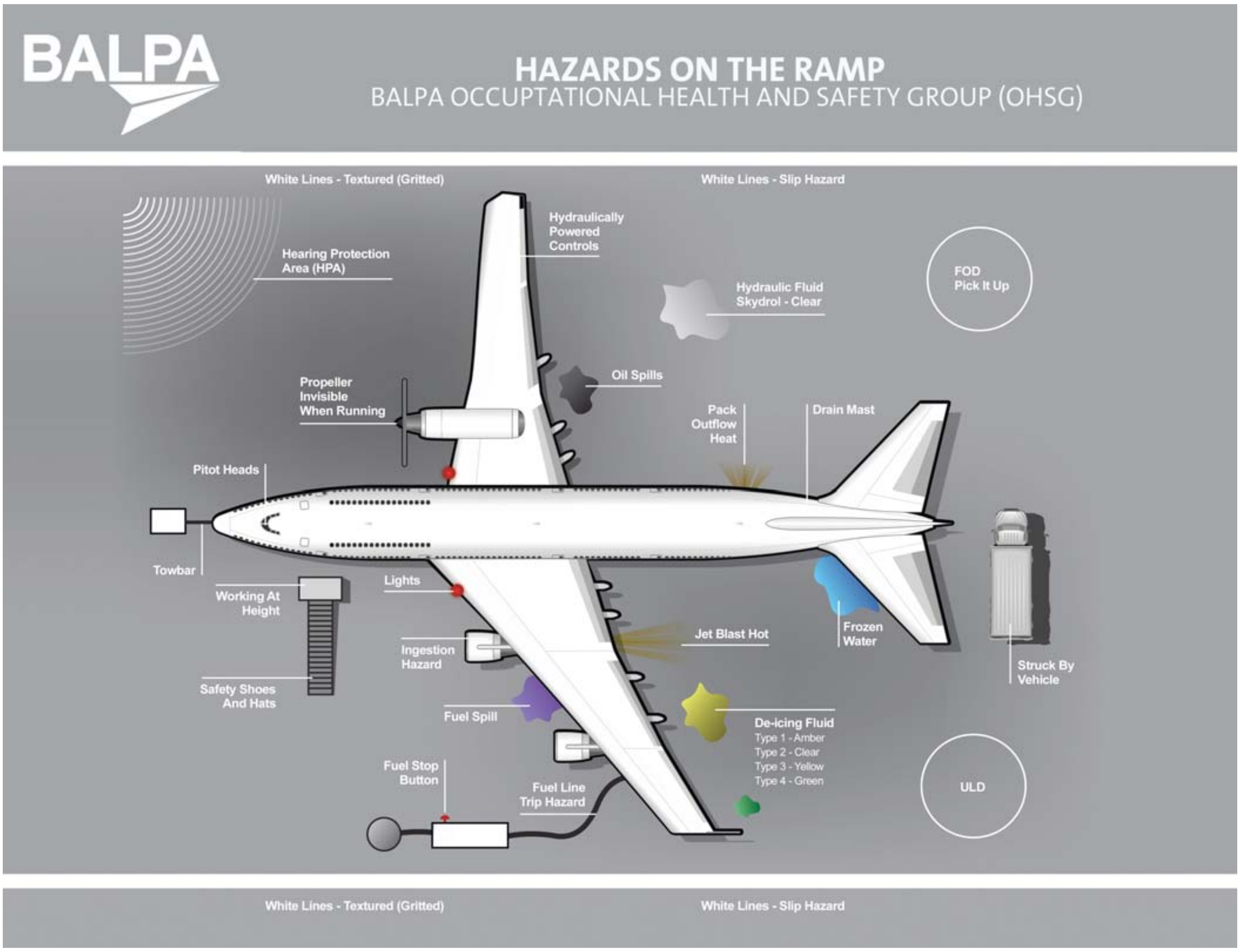
- Develop and implement standards and guidance for maintaining and improving knowledge and skills for manual flight operations...

- Emphasize and encourage improved training and flightcrew procedures to improve autoflight mode awareness as part of an emphasis on flight path management...

Prior to publication of the PARC/CAST report, Airbus had already moved to radically alter the way initial TR training for the A-350XWB will be delivered. Instead of commencing with routine, "automation" based operations and then working on degraded or reversionary modes, the handling element of the course will start with the aircraft being hand-flown in normal law so that pilots get to understand how the aircraft actually performs. Levels of appropriate automation will be increased thereafter, but this training will have been underpinned by a better knowledge of how the automation is assisting with flightpath management and it should therefore be easier for pilots to go back to basics when required.

The USA work noted that it the increasing complexity of modern aircraft and avionics rendered it almost impossible to train for all eventualities (QF32...); instead the report recommends "developing ... flightcrew strategies and procedures to address malfunctions for which there is no specific procedure". In other words, have a set of basic principles that will keep you out of trouble when all else fails.

This brings us back to having a suitable knowledge base to inform any decisions you make, which takes time and effort. Until or unless operators promote or encourage this, there is little incentive other than professional pride for people to go the extra mile in developing in-depth knowledge of systems and procedures. Perhaps it is time we had some sort of post-graduate qualification - and not just a command position - that can be used to distinguish between those who know and those who know just enough.

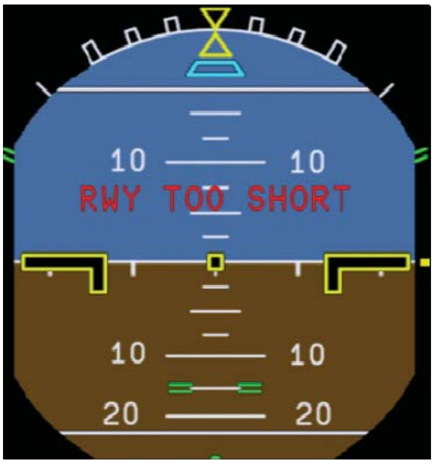


2013 the Safest Year Ever?

by Capt Chris Brady, easyJet

Data from respected sources such as Flight International and the Aviation Safety Network show that with 29 (or 26 depending upon what events are included) fatal airliner accidents resulting in 265 fatalities, 2013 was the safest year by number of fatalities and the second safest year by number of accidents.

The number of accidents was just below the 10 year average but the number of fatalities, 265, was significantly below the ten-year average of 720, which suggests that accidents are becoming more survivable. In fact, there have been a number of recent accidents in which the aircraft has been destroyed but all or most of the occupants survived; the Lion Air 737-800 and Asiana 777-200 being two notable examples.



Is it that accidents are becoming more survivable or is it that more accidents are of the survivable type? For instance mid-air collisions and CFIT are rarely survivable but low speed events such as landing accidents will be more survivable. Technology like TCAS and EGPWS and the associated training continues to reduce the number of mid-air collisions and CFIT events but the technology is less robust to help with landing events such as landing short, runway excursions and loss of control on go-arounds.

I wouldn't say that the industry has got as far as it can go with technological solutions, particularly those that help prevent landing events. For instance the new Runway Overrun Prevention System (ROPS), presently only fitted to the A380 and A350 but coming to a narrowbody near you soon, analyses weather, runway condition and topography, and aircraft weight and configuration in real-time on the approach and alerts a crew if the energy is too high to land safely. However ROPS is just a tool to help the crew to make the right decision and decision making is where the future focus must lie.

Technology is only part of the solution, similar advances must be made in the field of human factors to better understand human interaction not only with the various protection systems but also automation and decision making in general.

2013 saw accidents in which human interaction with automation appears to have been a factor in types as diverse as the 777 and the AS332. If we don't want 2013 to remain the safest year ever, i.e. we want safety to improve; the industry will have to make further improvements in human factors knowledge and application to aircraft design, documentation and crew training.

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Commercial Air Transport Operations in Class G Airspace – Are You Aware?

Every day in the UK Commercial Air Transport (CAT) flights safely operate in Class G airspace. For such flights the operator is required to conduct a comprehensive risk assessment and develop a safety case outlining how these risks are mitigated. However a recent serious Airprox has underlined the need to ensure the awareness of pilots operating outside controlled airspace of some of the inherent issues associated with such operations.

First though, three quick true or false statements on Class G operations:

You are flying to or from a regional airport in Class G airspace talking to Air Traffic Control (ATC). You know that the Aerodrome Traffic Zone (ATZ) is in 'uncontrolled' airspace but ATC will warn you of all other aircraft that might conflict with you. *True or false?*

You are on final instrument approach to an airport in Class G airspace. You can build your situational awareness of all other aircraft in the local area because they will always be in communication with the ATC unit. *True or false?*

You are in receipt of a procedural service, ATC will tell you about other traffic they can see on radar. *True or false?*

The answer to all three is false!

The aim of this article is to dispel any myths and misunderstandings on what CAT pilots can and cannot expect from ATC in Class G airspace, and to ensure that the operational issues are fully understood and risks adequately mitigated.

The recent Airprox highlights many of the above 'True or False' statements. The Airprox was recorded as Category A: Actual risk of collision existed. It featured an ATR42 aircraft on approach to a regional airport situated in Class G airspace and a privately operated Augusta A109 Helicopter. The event occurred 8.5nm southwest of the airport while the ATR42 was on an IFR flight in receipt of a procedural service from the airport. The helicopter was operating on a VFR flight transiting in the vicinity of the airport and not receiving an air traffic service at the time of the Airprox.

The airport was providing a combined aerodrome and approach control service without the aid of radar equipment because radar services had been withdrawn due to the unservicability of the primary radar equipment which had been NOTAM'd.

A procedural service is also provided at several airports in the UK that do not have radar. Under a procedural service, the controller provides restrictions, instructions, and approach clearances, which if complied with achieves deconfliction minima against other aircraft participating in the procedural service. Understandably neither traffic information nor deconfliction advice can be passed about unknown traffic. Bearing this in mind, pilots should remember that there is a high likelihood of encountering conflicting traffic without warnings being provided by ATC.

In this Airprox, using the limited remaining radar derived information provided by the aerodrome traffic monitor, the controller became aware of the presence of a potential conflict to the ATR42. He passed a warning and limited traffic information on the unknown aircraft (the A109). The ATR42 pilot reported that he had an aircraft in sight, although it was subsequently discovered the traffic sighted was another aircraft and not the helicopter.

The ATR42 crew subsequently received a TCAS RA (Descend) which they initially followed. However, they did not follow the RA to its conclusion as they had concerns about the proximity of tall chimneys below them.

Actually the crew could and should have followed the RA instructions completely as descent RAs are inhibited below 1,000ft agl and all RAs are inhibited below 900ft agl, where TCAS reverts to TA warnings only. Indeed ICAO requires that stall warning, windshear and ground proximity warning system alerts have precedence over TCAS.

Picture: Southend Airport

Picture: Newquay Airport

The A109 pilot was between frequencies and not in receipt of an Air Traffic Service (ATS) in the period prior to the Airprox, although he was in receipt of a Basic Service prior to and following the event. In this case it would obviously have helped to solve the event if the A109 pilot had been in contact with the ATC unit and generally pilots flying near aerodromes, ATS routes, or navigational aids where a procedural service is provided, are strongly encouraged to contact ATC.

So before embarking on a CAT flight in Class G airspace, there are some key questions that need to be answered:

- Has a thorough risk assessment and mitigation of the proposed route been completed in accordance with CAA CAP789?
- Is the assessment regularly updated and have the flight crew reviewed this as part of their briefing?
- Has the flight crew reviewed all relevant NOTAMs to ascertain whether there is any change to available ATS which might affect the flight?
- Has the crew included in the pre-flight briefing the fact that other airspace users in the vicinity of the destination/departure airfield are not obliged to be in receipt of an ATS, or to be in communication with the airfield, or even to be equipped with a radio?
- Has the crew briefed a 'Plan B' if the ATS they have planned on using is not actually available, either en-route or when arriving at the planned destination or departing from an airfield?
- Are the crew fully conversant with the Rules of the Air 2007 (as amended) and how they apply to their flight?

Also some important considerations apply. Is the crew aware:

- That if they are conducting an instrument approach to an airfield in Class G airspace, ATC may not be aware of all aircraft in the vicinity?
- An instrument approach to an airfield through Class G airspace has no priority over any other traffic? This applies even under a deconfliction service.
- Other traffic could well include gliders or paragliders, to which powered aircraft, including CAT aircraft, are required to give way.
- Of the operation of TCAS II equipment and specifically when RAs will be inhibited during the approach/departure?

The full UK Airprox Board report is available at www.airproxboard.org.uk (Airprox no: 2012/156).

CAA Safety Notice 2013/09 has been issued to highlight the implications of reduced radar and procedural air traffic control provision on aircraft operations in class G airspace.

CAP 789 Chapter 4 (3) and Annex 1 to Chapter 4 'The Safety Risk Assessment Process for CAT flights outside CAS' describes the process for conducting a risk assessment. Air Traffic Services Outside Controlled Airspace (ATSOCAS) guide available at: http://airspacesafety.com/atsocas/

Distraction

by Giles Wilson, Flight Safety Officer DHL Air

Over recent years the aircraft, while being essentially the same, seem to have become much more complex. The truth, as we all know, is that the systems and processes around the operation have become more complex with 'bolt-ons' like ACARS, ETOPS, TCAS & R-NAV to name but a few. This has meant that the procedures we follow are more complex and, in turn, the amount of distractions and 'threats' have increased. We have had to develop complex interactive relationships that allow us, as the flight crew, to work as a team to negotiate all the environmental 'threats' so as to safely fly the aircraft from A to B as efficiently as possible. We do this day in and day out extremely well using SOP's and our experience. However on ALL flights mistakes are still made. Some of these are small, some are big but we generally manage to find them and rectify them before they become critical.

I am sure that if 2 pilots working together were isolated from distraction then the aircraft would always be prepared on time or without significant error. The trouble is we don't have that luxury. We have technical problems to resolve, ATC clearances to collect and reconcile to the machinery, dispatchers with vital questions, de-icing procedures to organise and operations assistance on several radio frequencies. In fact the list is endless. The first thing to suffer, when the crew get distracted by external influences, is the crew communication and cross checking, and so errors can creep in. An Airbus report into managing distractions in the cockpit describes the primary effect of interruption or distraction as:

Break in the flow of ongoing cockpit activities. This includes:

- *SOP's*
- *Normal Checklists*
- *Communications*
- *Monitoring tasks and*
- *Problem solving activities*

The 2008 LOSA survey highlighted that DHL Air had significantly more 'environmental' threats than the average but dealt with them efficiently. Not surprisingly therefore we have seen many ASR's which site distraction as a significant reason for the SOP breakdown or operational deviation that necessitated the report.

1. A classic example, which I am sure everyone is familiar with, is the TNT B737 making a CAT III approach into EMA. The airlines operations called the tower with a message for the aircraft to divert to Liverpool while the aircraft was on the ILS at around 500' ARTE. The message was passed, and in the confusion (the aircraft had been cleared to land and this was extremely unexpected) the captain pressed the autopilot disconnect button rather than the PTT. An attempt was made to re-engage the autopilots and the aircraft deviated from the glidepath drifted left of the runway. A late decision to go-around caused the aircraft to

impact the ground heavily on the left wheel and wingtip, leading to the loss of the left hand undercarriage. It continued the go-around and diverted to Birmingham for an emergency landing, suffering serious control difficulties. The crew did not mean to deviate from the SOP'S, especially as they were performing a CAT III autoland. A minor distraction led to the pressing of the wrong switch, the aircraft deviation and the subsequent disaster as the crew tried to catch up with the situation.

2. Another example is the Tristar accident into the Everglades where the whole 3 man crew, pre-occupied with a small undercarriage indication problem, were distracted from flying the aircraft and crashed into a Florida swamp. The 'gators' were the only winners.

3. Recently, and closer to home, we have many, thankfully minor, examples of this, like a typical ASR for an unstable approach into JFK. Despite crew briefing for a significant tailwind on a challenging approach to an autoland, the crew allowed an ATC transmission to delay the flap extension and compromise speed control. This lead to the approach being fast and unstable all the way to short final. The final flap selection was made at 745' and the thrust increased to a normal power setting at 236' ARTE. We can only assume the landing checklist was completed prior to touchdown. The crew, when quizzed, admitted that distraction started the chain of events but were sure that they were stable by 7-800' ARTE. This is a classic distraction which as a casual observer we would say, "how did this happen, surely we fly before we talk, we wouldn't allow the situation to develop like this".

4. A B767 took off from BRU en-route LOS and flew the wrong SID. The crew describe the event of one of distraction. The ACARs was slow to process the clearance but the route had been downloaded from the ACARS, checked against the flight plan and apparently briefed from the Jeppeson chart. The chart, however, did say that the departure was not available for the aircrafts ETD. When the clearance arrived the First Officer acknowledged and printed it while the captain was distracted by radio calls to both ATC and the ground crew. The result was the clearance was not reconciled to the FMC CDU and the wrong departure, a CIV 8D, was flown instead of the CIV 2C.

This crew, who had flown extensively from BRU, thought the SID seemed wrong, checked the clearance and realised the error. Luckily BRU ATC did not seem too upset and the aircraft continued on to the next frequency. The crew, submitted an ASR IAW company policy, so that we can all learn from the mistake.

The truth is that there are many examples that can be sited, these are just 4 different stages of flight where either one or more distractions led to an 'undesired aircraft state'. The highly trained, professional crew, deviated from their normal practice, due, in part or wholly, to distraction and arrived at an 'undesirable aircraft state'. NASA and the FAA have researched this topic and have come up with 5 basic strategies to reduce our (as aircrew) vulnerability to distraction. I have copied the findings in an excellent article in the ARSA directive in 1998. These make good solid sense and many have since been incorporated to standard company procedures world wide.

1. *Recognise conversation is a powerful distractor.* Unless a conversation is extremely urgent, it should be suspended as the aircraft approaches a critical stage in flight. During high workload situations crew should suspend discussion frequency to scan the aircraft and their situation. We know this as a 'sterile cockpit' and it is DHL SOP and policy that a sterile cockpit is mandatory below FL100. EASA is currently working to make this an EASA regulation.

2. *Recognise that 'head down' tasks seriously reduce the ability to monitor the other pilot and the status of the aircraft.* If possible, reschedule head-down tasks to low workload periods. Announce that you are going head-down. In some situations it may be useful to go to a lower level of automation to avoid having one crew member remain head-down too long. For example, if ATC requests a change when cockpit workload is high, the crew may set the speed in the Mode Control Panel instead of the FMS. An FMS entry might be made later, when workload permits. Also, DHL Air, in common with modern airlines, have a policy that FMS entries should be commanded by the Pilot Flying, implemented by the Pilot Monitoring and checked prior to execution. This approach minimizes the amount of attention the Pilot Flying must divert from monitoring the aircraft.

3. *Scheduling and rescheduling activities to minimise conflicts especially during critical junctures*. When at a critical period, like approaching or crossing an active runway, both pilots should suspend all unrelated activities until the aircraft has either stopped or safely negotiated the event. Crews can reduce their workload during descent by performing some tasks while still at cruise, for example, obtaining ATIS, briefing the anticipated instrument approach, and inserting the approach into the FMS (for aircraft so equipped).

4. *When two tasks must be performed concurrently, set up a scan and avoid letting attention linger too long on either task.* In many situations pilots must perform two tasks concurrently, for example, searching for traffic while flying the airplane. With practice, pilots can develop the habit of not letting their attention linger long on one task, but rather switch attention back and forth every few seconds between tasks. This is somewhat analogous to an instrument scan, and like an instrument scan it requires discipline and practice, for our natural tendency is to fixate on one task until it is complete. Pilots should be aware that some tasks, such as building an approach in the FMC, do not lend themselves to time-sharing with other tasks without an increased chance of error.

5. *Treat interruptions as red flags.* Knowing that we are all vulnerable to preoccupation with interruptive tasks can help reduce that vulnerability. Many pilots, when interrupted while running a checklist, place a thumb on the last item performed to remind them that the checklist was suspended; it may be possible to use similar techniques for other interrupted cockpit tasks. Try developing a mnemonic like "Interruptions Always Distract" for a three-step process: (1) Identify the Interruption when it occurs, (2) Ask, "What was I doing before I was interrupted" immediately after the interruption, (3) Decide what action to take to get back on track. Perhaps another mnemonic for this could be *Identify-Ask-Decide*.

6. *Explicitly assign Pilot Flying and Pilot Not Flying responsibilities, especially in abnormal situations.* The Pilot Flying should be dedicated to monitoring and controlling the aircraft. The Pilot Flying must firmly fix in mind that he or she must concentrate on the primary responsibility of flying the airplane. This approach does not prevent each pilot from having to perform concurrent tasks at times, but it does ensure that someone is flying the airplane and it guards against both pilots getting pulled into trying to solve problems.

It is important also that operators endeavour to simplify the ramp procedures and reduce the interruptions so as to minimise the crew distractions and increase the general safety and efficiency of the operation. The SOP's can be changed when an incident or a short coming is highlighted. For us, as pilots though, it is up to individuals to manage distraction with discipline and the guidelines outlined above using the SOP's as a framework making sure we return to the same place we were at prior to the interruption.

References:

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- Airbus FLT safety foundation 'Flight Briefing Notes- Managing Interruptions & Distractions'.
- ASRS Directive issue 10. 'Cockpit Interruptions and Distractions' By K. Dismukes Ph.D, G. young Ph.D and Cpt. R Sumwalt.

Helicopter safety: Everybody's concern

By Jos Stevens, Senior Scientist National Aerospace Laboratory (NLR) – EHEST member, EHSIT ST Technology Team Leader

The long-term helicopter accident rates on a worldwide basis have remained unacceptably high and trends have not shown significant improvement during the last 20 years. In late 2005, the International Helicopter Safety Team (IHST) was launched as a government and industry cooperative effort with the goal to reduce the worldwide civil helicopter accident rates by 80% in the year 2016 (1). According to an extensive IHST analysis, groups most likely to have helicopter accidents are general aviation pilots, trainees and small operators. Their accident rate is higher than the rate for more prominent mission types such as emergency medical services, law enforcement and tour operators.

Fig. 1: "Dangerous operations": The long-term helicopter accident rates on a worldwide basis have remained unacceptably high and trends have not shown significant improvement (Photograph: S. Burigana/Elilombarda)

The basic principle adopted by IHST is to improve helicopter safety by complementing regulatory actions by voluntarily encouraging and committing to cost-effective safety enhancements. The process is directly linked to the analysis results of real accident data, which results are used as a basis to develop safety-enhancing material addressing the highest rating safety issues. In Europe, the European Helicopter Safety Team (EHEST) has adopted the IHST objective.

EHEST: a safety improvement partnership

The European Helicopter Safety Team took off in 2006 as the helicopter component of the European Strategic Safety Initiative, ESSI (2), and as the European branch of the International Helicopter Safety Team, IHST. EHEST is committed to the IHST objective with emphasis on improving European safety.

EHEST brings together European helicopter manufacturers, operators, authorities, helicopter and pilots associations, research institutes, universities, accident investigation boards and some military operators (totalling around 130 participants from 50 organisations). EHEST addresses the broad spectrum of European helicopter operations, from Commercial Air Transport to General Aviation, and also includes flight training activities.

EHEST itself is the strategic and decision-making body and within its structure, two main working groups have been created to deal with different steps in the process:

- The European Helicopter Safety Analysis Team (EHSAT) analyses helicopter accident investigation reports and identifies suggestions for safety enhancements, called Intervention Recommendations (IRs); EHSAT will also be involved in the measuring of results and effectiveness of safety improvements developed within the initiative;

- The European Helicopter Safety Implementation Team (EHSIT) uses the results from the EHSAT accident analyses and their IRs to develop safety enhancement strategies and action plans.

Communication is also an important part of the safety initiative, as this can raise awareness and can contribute to improve safety by making available and sharing good practices. The EHEST-wide Communication Working Group has defined a process to efficiently communicate with the helicopter community, especially General Aviation and small operators. The Group addresses the global helicopter community through publications in professional journals and linking to international forums such as the Forum of the American Helicopter Society (AHS) and the European Rotorcraft Forum (ERF).

EHSAT: analysing helicopter accidents

The EHSAT accident analysis aims at identifying all factors, causal or contributory, that played a role in the accident. In order to tackle the variety of languages in the accident reports and account for regional characteristics, regional teams have been formed in various countries like France, Germany, United Kingdom, Italy, Spain, Switzerland, Norway, Sweden, Finland, Ireland,

Fig. 2: The EHEST-wide Communication Working Group has defined a process to efficiently communicate with the helicopter community, especially General Aviation and small operators (Photograph: J.P. Brasseler/Eurocopter)

Hungary and the Netherlands. The countries covered by the regional teams account for more than 90% of the helicopters registered in Europe. In order not to interfere with ongoing accident investigations and to ensure the data analysed are to the same ICAO Annex 13 standard, only those accidents where a final investigation report is available, are analysed.

The first step is the collection of factual information on the accident, such as occurrence date, state of occurrence, helicopter registration, helicopter make and model, type of operation, phase of flight, meteorological conditions, the flight crew's flight experience as well as damage and injury level. Next, the team identifies all the factors that played a role in the accident, using standardised taxonomies to ease accident aggregation and statistical analysis. Two complementary taxonomies are used, the Standard Problem Statements (SPS) and Human Factors Analysis and Classification System (HFACS) by Wiegmann and Shappell (3).

Standard Problem Statement

The Standard Problem Statements (SPS) taxonomy has over 400 codes in a three-level structure. The first level features the following 14 categories:

- Ground Duties
- Safety Management
- Maintenance
- Infrastructure
- Pilot Judgement and Actions
- Communications
- Pilot Situation Awareness
- Part/system Failure
- Mission Risk
- Post-crash Survival
- Data Issues
- Ground Personnel
- Regulatory and
- Aircraft Design

The second and third levels go into more detail. A single causal factor identified in the accident can be coded using multiple SPSs. E.g. when one of the causal factors was a pilot lacking proficiency for a certain type of operation, this can be coded as "inadequate pilot experience" and additionally as "inadequate supervision"; and maybe even as "customer/company pressure", depending on the narrative in the accident report.

Human Factors Analysis and Classification System

In order to address human factors in a structured manner, EHSAT also uses the Human Factors Analysis and Classification System (HFACS). HFACS allows describing and analysing human errors in four levels (Fig. 3):

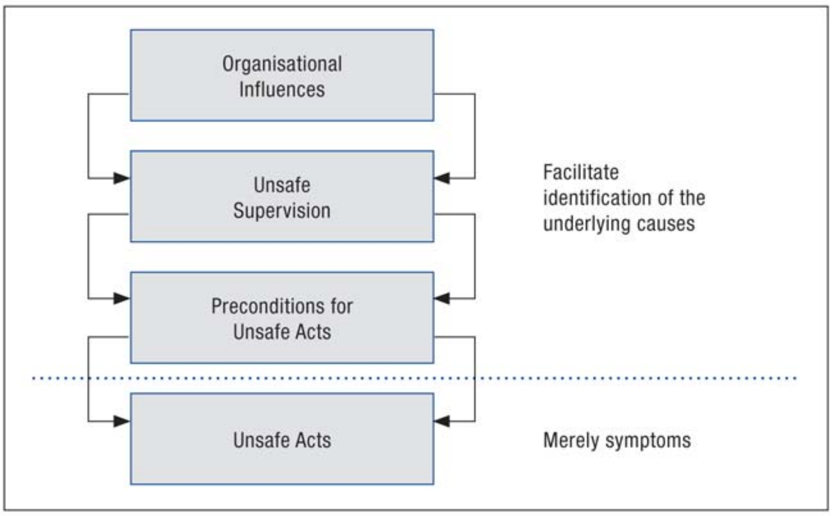


Fig. 3: HFACS Model Structure (5)

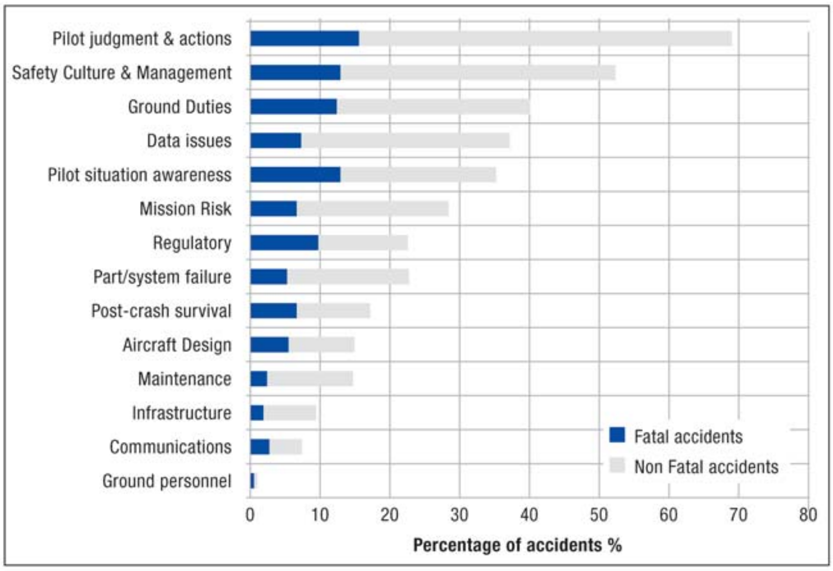


Fig. 4: Standard Problem Statement (SPS) Analysis Results: Percentage of accidents where SPS has been identified at least once in the accident dataset 2000-2005, based on Van Hijum M et al. (2010)

1. Organisational Influences
2. Unsafe Supervision
3. Preconditions for unsafe Acts and
4. Unsafe Acts of Operators (e.g. flight crew, maintainers, air traffic controllers etc.)

Only focusing on unsafe acts (the "lower" levels) would be like focusing on merely symptoms without looking at the disease that caused them (the "higher" levels). HFACS divides each level into a series of causal factors. HFACS contains over 170 codes in the four main areas. In addition to providing more detail on human factors, it also encourages the analysis to not only identify the human error at an operator level, but also to search for underlying management and organisational factors.

For maintenance related human factors, the HFACS Maintenance Extension (HFACS ME) was introduced. Developed by the US Naval Safety Center, this is an additional coding system adapted for maintenance. The system features the following main categories: Maintainer acts, Maintainer conditions, Working conditions, and Management conditions.

Accident Analysis Result

Analysis results for the timeframe 2000-2005 were published in October 2010 in the Final Report – "EHEST Analysis of 2000-2005 European Helicopter Accidents" (4), available on the EHEST website. Results are based on the analysis of 311 European helicopter accidents. The scope of the data set is accidents that occurred within an EASA Members State where a final investigation report from the Accident Investigation Board (AIB) had been issued. Of the accidents analysed, 140 accidents (45%) involve General Aviation operations; 103 accidents (33%) involve Aerial Work operations; 59 (19%) were Commercial Air Transport operations; and 9 (3%) involved State Flights. Most accidents analysed by the EHSAT occurred during the en-route phase of flight.

For the accidents in the dataset more than 1,800 Standard Problem Statements have been recorded, with the top three SPS categories at level 1 being (Fig. 4):

- "Pilot judgement and actions", identified in almost 70% of the accidents; this includes issues like pilot decision making, unsafe flight profile, and procedure implementation;
- "Safety culture and management" identified in more than 50% of the accidents; with issues like Safety Management System, training and pilot experience;
- "Ground duties", identified in 40% of the accidents, including mission planning and helicopter pre- and post- flight duties.

The lower SPS levels provided insight into why "pilot judgement and actions" figures were the highest amongst the top three accident factors. E.g. when a helicopter is being used for aerial work, this can result in pushing the helicopter and pilot towards the limits of their capabilities, and operating close to terrain or obstacles. Therefore, aerial work is highly prone to accidents related to the mentioned category. The use of the HFACS taxonomy provided a complementary perspective on human factors. In most accidents, unsafe acts or preconditions of unsafe acts were identified. In fewer accidents supervisory or organisational influences were found. For the SPS as well as for the HFACS taxonomies, different patterns were observed for various types of operation (see Table 1). These patterns provide an understanding of a 'typical' accident scenario.

The accident analysis teams were also tasked to develop suggestions for safety enhancements, the so-called Intervention Recommendations (IRs), for all identified safety issues. Most recommendations fall into the following categories:

- Flight Operations and Safety Management/Culture
- Training/Instructional and
- Regulatory/Standards/Guidelines

EHSIT: developing safety-enhancing products

The EHSIT defined a process to aggregate, consolidate, and prioritise the intervention recommendations produced by the EHSAT and to develop suitable and effective safety enhancement action plans. To address the top IR-categories identified by the EHSAT, the EHSIT has launched Specialist Teams (STs) focussing on specific topics:

- ST Operations and SMS, focussing on risk management, Safety Management System (SMS) and Standard Operating Procedures (SOPs);
- ST Training, developing safety leaflets and videos;
- ST Regulation, identifying potential areas for rulemaking;
- ST Maintenance, developing a maintenance toolkit (in co-operation with IHST);
- ST Technology, developing a tool linking the results of the EHSAT analysis to technological developments.

All safety products developed by the teams are selected because of their potential to resolve the identified top safety issues, thereby also taking into account economic and other considerations. The following products have been developed or are under development, all of which are published on the EHEST website.

Fig. 5: Various training (safety) leaflets published by EHEST

Type of operation	Top issues SPS	Top issues HFACS
Commercial Air Transport	- Pilot decision making - Pilot in command, self-induced pressure - Inadequate oversight by the Authority	- Inattention - Decision-making during operation - Channelized attention
Aerial Work	- Mission involving flying near hazards, obstacles, wires - Mission requires low/slow flight - Pilot decision making	- Risk assessment during operation - Mission planning - Channelized attention
General Aviation	- Pilot decision making - Mission planning - Pilot misjudged own limitations/capabilities	- Risk assessment during operation - Overconfidence - Mission planning

Table 1: Top safety issues (at the lowest taxonomy level) per type of operation

Standard Operating Procedures

Standard Operating Procedures (SOPs) are being prepared for Helicopter Emergency Medical Service (HEMS) operations. Several more SOPs are being considered.

Safety Leaflets

Four training leaflets have been published, regarding

- Safety Considerations (addressing important subjects such as Vortex Ring State, Loss of Tail-Rotor Effectiveness, dynamic and static rollover and loss of visual references)
- Helicopter Airmanship
- Off Airfield Landing Site Operations and
- (Single Pilot) Decision Making

Other leaflets regarding Risk Assessment in Training and Autorotation, Weather Anticipation and Passenger Management are under development.

Videos

Videos on Flying in the Degraded Visual Environment (DVE) and on Helicopter Passengers Management have been published. A video on Helicopter Mission Preparation Including Off-Airfield Landing is under development.

Guides

Development of a Helicopter Flight Instructor Guide that addresses Threat and Error Management is planned for 2013.

Tools and toolkits

A Helicopter Maintenance Toolkit has been published. This toolkit enables operators to assess their existing maintenance activities against guidelines for maintenance procedures, quality assurance, training and competence assurance, record keeping, HUMS, maintenance support equipment and fuel systems. The toolkit shows best practices used by many operators throughout the world.

Fig. 7: The EHSIT aggregates, consolidates, and prioritises the EHSAT suggestions for safety enhancements and defines safety strategies and action plans (Photograph: A. Pecchi/Eurocopter)

A Pre-flight Risk Assessment Tool has recently been published, and the same team also published a Safety Management Manual (SMM) and toolkit. The manual was developed to comply with the Annex III to the future EU regulation on Air Operations, to be published end of 2012. It aims at assisting 'complex operators' (a regulatory concept defined in the AMC) with little experience of running an SMS.

Technology matrix

The ST Technology has been created to assess the potential of technologies to mitigate safety issues. Technology is not high on the list of highest-ranking SPSs, as it is merely the lack of technology that may have led to an accident. Technology however provides a variety of solutions that can (directly or indirectly) address the identified safety issues and that can contribute to prevent different types of accidents or to increase survivability. Technology can be a powerful means to improve safety, as it can bring solutions to known safety problems, including those of operational nature.

Rotorcraft technological developments have not been as fast as, for instance, fixed wing jet fighter developments. Current technologies are focussing on 3rd generation rotorcraft versus 5th generation fighter aircraft. Technologies that may have been in use on fixed wing aircraft for many years, are transferred to rotorcraft at a (much) later date. And only few technologies have been developed specifically for rotorcraft. Fig. 6 shows a miniature Voice/Flight Data Recorder (standard "Coke" can size).

The ST Technology consists of a range of stakeholders, with various expertise and backgrounds. The main goal of the team is to list technologies and link them with incident/accident causes and contributing factors. The

Fig. 6: Miniature Voice/Flight Data Recorder (Photograph: Cassidian)

team developed a tool that contains a listing of technological developments (technology database) and a technology-safety matrix providing rows with technologies and columns with the top 20 (level 2) SPS items as revealed by the EHSAT analysis of more than 300 accidents.

The process consists of two steps:

- The technology database is filled with relevant technologies for the period 2006 till present; the basic selection criteria for the technologies are: new (emerging) technologies, existing technologies not yet used on helicopters and existing technologies used on large helicopters, but not yet on small helicopters;
- The listed technologies are scored against each of the SPS items; this process involves two rating elements, the results of which are automatically summed and colour-coded: impact (how well can the technology mitigate the specific SPS) and usability (can the technology be utilised for a specific SPS and against what relative cost), each on a scale from 0 to 5.

The results can be used in three ways:

- Which technology best addresses a specific safety problem. By scanning the coloured cells, one can easily identify those technologies that are rated highest, that are the specific technologies with the highest potential in mitigating certain safety issues. These technologies can then be promoted to make them more widely available.
- Where can (additional) safety benefits be expected from a technology. New technologies are predominantly aimed at a specific goal. By rating this technology against the top SPS items, it can become clear that the technology also can be used to mitigate other safety issues. For instance, a certain sensor that aims at mitigating visibility/weatherrelated problems may turn out also to be useful to mitigate unsafe flight profiles or to aid landing procedures.
- Which safety problems are not (sufficiently) addressed by technology.

Safety issues lacking (sufficiently promising) technological mitigation means, stand out as a result of the colours used. Manufacturers, research organisations and alike can address these specific safety issues, thereby creating new incentives and justification to perform research and to develop technologies.

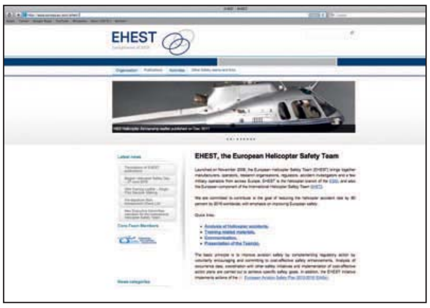
Based on the limited number of technologies that have been listed and scored so far, a few promising technologies stand out already:

- Predictive ground collision avoidance using digital terrain referenced navigation, bringing improved situational awareness to the pilot and reducing the workload;
- Flight data monitoring for light helicopters (Helicopter Operations Monitoring Program, HOMP); during flight, predefined events are recorded, thereby helping to set priorities on training and maximising awareness of potential dangers;
- Synthetic vision system (vision augmentation); the system will bring improved situational awareness to the pilot through a 3D-terrain with obstacles rendering on a head-up or helmet-mounted display.

Concluding Remarks

The European Helicopter Safety Team (EHEST) started its work in 2006 as the helicopter component of the European Strategic Safety Initiative (ESSI) and the European branch of the International Helicopter Safety Team (IHST).

The team is committed to the IHST objective to reduce the helicopter accident rate by 80 percent by 2016 worldwide, with emphasis on improving European safety. Within EHEST, the European Helicopter Safety Analysis Team (EHSAT) analyses accident investigation reports. The analysis aims at identifying all factors, causal or contributory, that played a role in the accident, and identifying suggestions for safety enhancements. The European Helicopter Safety Implementation Team (EHSIT) aggregates, consolidates, and prioritises the EHSAT suggestions for safety enhancements and defines safety strategies and action plans. For this, the EHSIT has launched Specialist Teams that develop various safety products. All products are selected because of their potential to resolve the identified top safety issues and are published on the EHEST website. Helicopter safety cannot be improved by developing tools and disseminating information alone. In the end, it will be up to the various individuals and organisations to apply those solutions for the benefit of the helicopter community.



For more information, visit: ›››
http://easa.europa.eu/essi/ehest/

NLR

The National Aerospace Laboratory (NLR) is the main knowledge enterprise for aerospace technology in the Netherlands. NLR carries out commissions for government and corporations, both nationally and internationally, and for civil and military aviation. The overarching objective is to render aviation safer and more sustainable and efficient. In this way, NLR has been making essential contributions to the competitive and innovative capacities of Dutch government and industry for more than 90 years.

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Acknowledgement

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2014 Safety Forum: Airborne Conflict

Following the success in 2013 of the Go-Around Safety Forum, The Flight Safety Foundation, The European Regions Airline Association, and EUROCONTROL will be hosting another event to bring together stakeholders from across the aviation industry to discuss measures to further reduce the airborne conflict risk.

The Forum will provide bespoke safety knowledge and intelligence. The agenda includes guest speakers from FSF, Airbus, FAA, Dassault Aviation, UK CAA, DGAC France, ERA, IATA, ECA, NATS, IFATCA, aircraft operators and EUROCONTROL experts will set the scene during sessions on level bust, safety nets for airborne conflict and airspace built-in safety as introduction to the interactive break-out sessions.

Attendance at the Forum is free of charge with a maximum attendance of 230 people.

Join us and meet aviation safety experts from around the globe. For more information and registration see the SKYbrary website http://www.skybrary.aero/index.php/Portal:Airborne_Conflict. Invite your colleagues to join us!

To be held at EUROCONTROL HQ Brussels on Tuesday 10 June and Wednesday 11 June 2014

Hard Landing, a Case Study for Crews and Maintenance Personnel

by Nicolas Bardou – Director, Flight Safety & David Owens – Senior Director, Training Policy.

Introduction

In this article, Airbus would like to take you through a case study and use it to learn some lessons and share our safety first culture.

The article is split into three distinct parts:

- **The first will describe the event**
- **The second, targeted at flight crews, will discuss and develop the stabilization criteria and present a prevention strategy against unstable approaches. It will also insist on the need to use the appropriate level of automation at all times.**
- **The third part, targeted at maintenance personnel, will illustrate the need to always use the Aircraft Maintenance Manual (AMM) as the source document for maintenance operations.**

Description of the Events

Approach and Landing

An A330 is on an ILS in rain. The Captain is PF, with AP1, both FDs and A/THR engaged. At 6 NM from touchdown the aircraft is in flap configuration 3, on glide slope and localizer at Vapp. ATC provided the flight crew with latest weather information: 10 kt tailwind with windshear reported on final.

Passing 1,500 ft, AP and A/THR are disconnected and the approach is continued manually. An initial LOC deviation of 1/4 of a dot is corrected by PF. Passing 1,000 ft, the crew report runway in sight. Passing 500 ft, several flight parameters (localizer, glide slope, vertical speed, pitch, bank...) briefly exceed the published “approach stabilization criteria” but each is corrected by PF.

However, by 150 ft radio altitude, the aircraft is above the glide by more than one dot and two nose-down inputs are applied. The rate of descent increases to -1,100 ft/min and the EGPWS alert “SINK RATE” sounds twice, the second time below 50 ft. Despite a nose up input during the flare the aircraft impacts the ground at -1,260 ft/min with a vertical acceleration of 2.74 g.

After Landing

The flight crew reported the hard landing in the tech logbook and passed the information to the station’s maintenance. The technician applied customized technical notes that specified that in the absence of load report 15 - generated by the Aircraft Condition Monitoring System (ACMS) in case of hard landing - and if the Data Management Unit (DMU) is functioning properly, no aircraft inspection was required and the DAR disc was to be replaced and kept in the aircraft for further analysis at the home base.

On that particular case the DMU was considered to be functioning because messages had been received by the home base during the flight. Load report 15, however, was not transmitted via ACARS until the following day, due to an internal failure known as a DMU lock up (REF A).

The aircraft was cleared to be dispatched for the return flight.

After take-off, due to the damage sustained during the hard landing, the landing gear failed to retract and the flight crew elected to perform an In Flight Turn Back after enough fuel was burnt to land below MLW. The aircraft landed safely.

Operational Recommendations

Stabilization criteria

The Flight Crew Training Manual (FCTM) and Flight Crew Operating Manual (FCOM) both state that deviation from the normal stabilization criteria should trigger a call-out from Pilot Monitoring. These calls should in turn trigger, at the very least, an acknowledgment from PF, and, where necessary, corrective action. The criteria vary from type to type but typically a call should be triggered if:

- The speed goes lower than the speed target by 5 kt, or greater than the speed target by 10 kt.
- The pitch attitude goes below 0°, or above 10°.
- The bank angle exceeds 7°.
- The descent rate becomes greater than 1,000 feet/min.
- Excessive LOC or GLIDE deviation occurs: 1/4 dot LOC; 1 dot G/S.

There are generally considered to be three essential parameters needed for a safe, stabilized approach:

- Aircraft track
- Flight Path Angle
- Airspeed

What could the crew have done to prevent this event?

Preventing unstable approaches

The prevention strategy against unstable approaches may be summarized by the following key words:

- Train
- Anticipate
- Detect
- Correct
- Decide

Train

Prevention can be emphasized through dedicated training for:

- Stabilized approaches
- Pilot Monitoring

- Difficult and unexpected reasons to initiate a go-around as part of recurrent training – not just go-around from minima, "nothing seen!" Try introducing a sudden, late wind shift…

Anticipate

First, define and brief a common plan for the approach including energy management and the use of automation.

Then, identify and discuss factors such as non-standard altitude or speed restrictions, approach hazards, system malfunctions.

Finally, brief several scenarios in readiness for anticipated ATC requests or other needs to change your initial plan: What if?

Detect

Make time available and reduce workload by avoiding all unnecessary / non pertinent actions, monitor flight path for early detection of deviations and provide timely and precise deviation call-outs. Be alert and adapt to changing weather conditions, approach hazards or system malfunctions.

Correct

It is very important to correct as early as possible any deviation throughout the approach. To do that, various strategies can be used such as using speed brake to correct excessive altitude (not recommended in final approach), early extension of landing gear to correct excessive airspeed or extending the outbound or downwind leg will provide more distance for approach stabilization.

Acknowledge all PM call-outs for proper crew coordination and take immediate corrective action before deviations develop into a challenging or a hazardous situation.

Decide

Assess whether stabilized conditions will be recovered early enough prior to landing, otherwise initiate a go-around.

Be go-around-prepared:
Discuss the go-around maneuver during descent preparation and approach briefing. Keep it in mind while monitoring the descent, task sharing... Be ready to challenge and change plans as necessary.

Be go-around-minded:
"Let's be prepared for a go-around and we will land only if the approach remains stabilized, and we have adequate visual references to make a safe landing"

In this regard the flight crew need to:

- Maintain stable approach criteria throughout the approach and into the landing flare.
- Ensure that the necessary ATC clearances have been received in a timely way.
- Ensure that the visual references below DH or MDA are maintained.
- Ensure that the runway is clear.
- Be open and ready for a go-around until the thrust reversers have been selected.

Remember - a go-around is always possible until the reversers have been selected. Up to that point, it is never too late to go around.

Appropriate Use of Automation

Before and during that approach there were plenty of clues that should have warned the crew of the high probability of a challenging approach. Indeed, the crew subsequently reported that they had to, "fight to maintain the airplane on track".

Passing 1,500 ft, PF disconnected AP and A/THR, thereby depriving himself of additional help that automation offers. Keeping A/THR engaged longer would have reduced the workload of the flight crew in the management and control of the airspeed.

During the very last part of the approach, the tailwind may have been seen as a threat as regards idle thrust values and slow spool up times in the event of a go-around. The use of A/THR in this situation might have stabilized the thrust more quickly than a pilot could using manual thrust, especially with such high workload. This would have resulted in a higher thrust setting, above idle and enabled a more rapid thrust response in the event of a go-around.

The issue here is that the workload required to maintain stability became excessive at a very late stage, when the crew experienced the rapidly changing winds on short final, making the last part of the approach rather difficult to handle in terms of trajectory and speed. But there were clues that the workload was building throughout, long before it became critical. In other words, the workload had become so great that the crew had lost their capacity to fly the aircraft at the required level of precision!

Stability is therefore not just a matter of numbers (speed, pitch etc) but also the effort PF is applying to maintain stability. If that effort equals or exceeds his ability, a go-around must be immediately performed. On this approach, an appropriate use of automation might have allowed the flight crew to better gauge the need to go around, thereby avoiding the hard landing.

This is lesson one, in fact, the appropriate use of automation is one of our Golden Rules (fig.1).

Fig. 1: Airbus Golden Rule for Pilots #2 states "Use appropriate level of automation at all times"

Lesson number two can be considered as follows. Perhaps we would now summarize the criteria for a stabilized approach in a slightly different way. We can now take the three essential quantitative parameters needed for a safe, stabilized approach plus one additional qualitative consideration:

- Aircraft track
- Flight Path Angle
- Airspeed
- Workload Capacity

Note: The first three are "classical' measures of achieved performance. The last is a judgment of how hard the PF is working to control the aircraft. Achieving all the numbers is only fine if the crew are still capable of dealing with something else unexpected. Capacity will be reduced in cases of high manual workload. Therefore, using the right level of automation helps.

Maintenance Recommendations

In this event, customized technical notes were used by the operator, instead of the Airbus originated AMM and as a result the aircraft was cleared to be dispatched for the return flight.

The AMM states that the primary source for a suspected hard landing is the flight crew. From this point on, a hard landing situation has to be fully considered until damage is assessed and it is clearly proven that there are no "downstream effects".

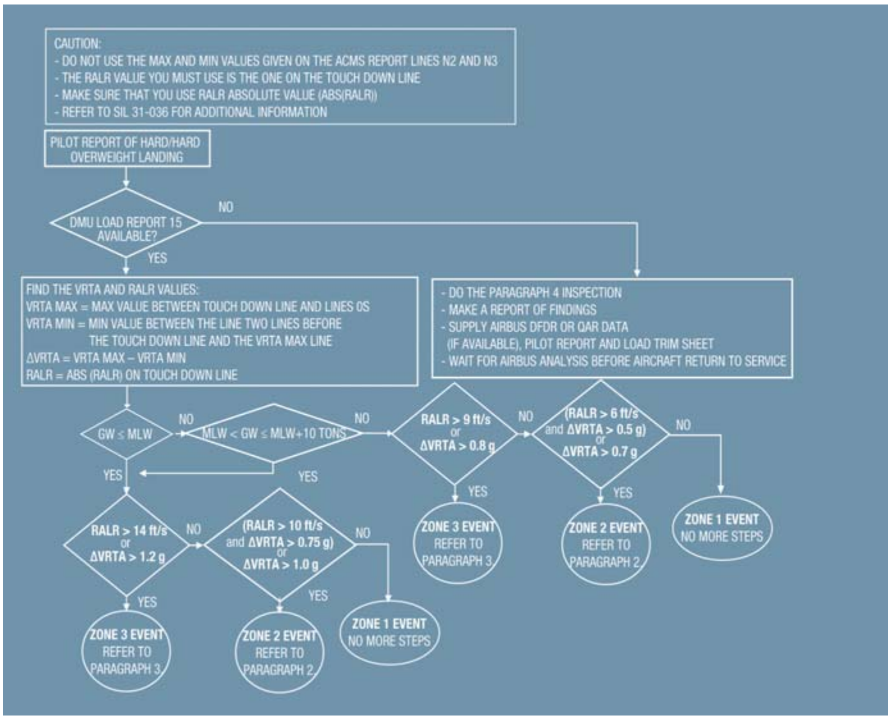

Figure 2: Hard landing flowchart to be added to the A330/A340 AMM in April 2014

This will trigger some aircraft inspections defined in AMM 05.51.11 that could be alleviated by using load report 15 or DFDRS (DFDR, QAR, DAR...). The load report 15 should not to be used to confirm a hard landing but used in a way to determine easily the level of inspection that may be needed.

At the time of this event, AMM 05.51.11 B (2) (b) "Procedure to Confirm a Suspected Hard/Hard Overweight Landing", stated:

"If you do not (or if you cannot) read the landing impact parameters from the load report 15, or the DFDRS, do these steps before the subsequent flight:

- Supply DFDR or QAR data (if available) to Airbus with the pilot report and the load trim sheet.
- Do the inspection in paragraph 4 and make a report of damage or what you find.
- Airbus will do an analysis of the incident to find if the aircraft can return to service. (The aircraft cannot return to service without Airbus decision)."

To avoid any possible confusion, A330/A340 AMM 05.51.11 will be amended in April 2014 to include:

- A modified wording of the first phrase of the above procedure, which now reads: "If load report 15 or the DFDRS data are not available or you cannot read them..."
- A flowchart to guarantee the same level of readability as on the A320 Family AMM (fig 2).

Figure 3: Damage on the aircraft following the hard landing: aircraft's Landing Gear

Figure 4: Damage on the aircraft following the hard landing: ripples on the fuselage

The load report 15 is generated automatically by the ACMS memory right upon landing and should be available via the MCDU / ACMS MENU / STORED REPORTS. DMU reports can be obtained by 4 non-exclusive manners:

- Manual print out by crew
- Automatic print out (depending of equipment via MCDU (AMM task 31-36-00) or ACMS (ground programming vendor tool)
- ACARS transmission
- ACARS request (depending on A/C configuration)

Operators are encouraged to review their policy to optimize the access to the load report 15, by being made aware of the four alternative ways that the DMU report can be accessed. Note: The DMU is not a No Go item. An aircraft can be dispatched with none operative and the repair interval is fixed at 120 calendar days in the MMEL.

Conclusion

This in-service case study allowed to illustrate three messages that ought to be highlighted:

- Use the appropriate level of automation at all times
- There are four essential parameters needed for a safe, stabilized approach:
  - Aircraft track
  - Flight Path Angle
  - Airspeed
  - Workload capacity, which may be reduced in case of high workload
- Always use the Airbus AMM as the base documentation for maintenance operations.

Reference:

A: Technical Follow-Up (TFU) ref 31.36.00.070 LR Honeywell DMU Lock-up issue

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Accident review - Fairchild SA 227-BC Metro III, Cork Airport, February 2011

by Dai Whittingham, Chief Executive UKFSC

On 10 February 2011, an SA 227-BC Metro III (EC-ITP) crashed during an attempted landing in low visibility at Cork Airport. Both crew members and 4 of the 10 passengers died, and 4 passengers were seriously injured. The investigation revealed a number of operational, organisational and regulatory oversight issues and generated 11 Safety Recommendations.

The Event

The crew commenced duty at Belfast Aldergrove (EGAA) at 0615 hrs and downloaded flight documentation including weather for Belfast City (EGAC), Cork (EICK) and Dublin. The Operational Flight Plan and weather briefing information had been prepared by a Spanish service provider the previous evening, before up to date weather information was available.

The aircraft departed on a short positioning flight for EGAC at 0640 hrs with the Commander as PF, arriving on stand at 0715 hrs. A fuel uplift of 800L was made, sufficient for EICK and return with required reserves. Although the actual weather conditions required two alternates, a single alternate of Waterford (EIWF) had been declared in the ATC flight plan, which had been filed by an FBO in Denmark earlier that morning. Boarding was delayed because the flight crew were working on the passenger seats – the aircraft had been on a cargo flight overnight. There was no requirement for cabin crew and the ten passengers were random-seated.

The aircraft took off for EICK at 0810 hrs, climbing to FL120 for the transit with the Co-pilot as PF. On contact with Cork Approach at 0848, the ATIS was broadcasting RWY 35 as the active, with Low Visibility Procedures in operation (meaning that the cloud-base was less than 200ft and/or IRVR was less than 550m). Having been advised that a Cat II approach was available for RWY 17, the crew established for an ILS; they had already been advised that the IRVR for RWY 17 was below Cat I minima. The first approach at 0858 hrs was continued beyond the Outer Marker equivalent point and below the 200 ft Decision Height (DH). A missed approach was carried out at 0903 hrs, TAWS recording a minimum altitude of 101 ft.

Following discussions with Cork ATC the crew asked to position for RWY 35, believing that the down-sun approach would make visual runway acquisition easier. At 0919 hrs, when the aircraft was handed over to Cork Tower at 8 nm from touchdown, Tower reported IRVR below Cat 1 minima. The approach was continued, again passing through DH, with a missed approach carried out at 0914 hrs. The lowest recorded height on this approach was 91 ft.

At 0915 hrs the crew requested to hold for 'fifteen to twenty minutes' to see if the weather conditions would improve and were accordingly directed to the ROVAL hold at 3000ft. The crew asked for an update on the weather at their single alternate, EIWF, which was reported as being below required minima. They then nominated Shannon (EINN) as the alternate and asked for the weather there; its conditions also were below minima. Cork offered to obtain the weather for Kerry (EIKY), which was good with visibility of 10 km+. At 0933 the IRVR values for RWY 17 increased slightly and, after a further slight improvement at 0939, the crew elected to attempt a further approach. Even with the IRVR improvement, the visibility was still below required minimal.

At 0945 hrs the aircraft was established on the ILS for RWY 17. A short time later, when EC-ITP was at 11 DME, the touchdown IRVR improved to 550m and the crew was informed of this by Cork Approach. Passing 9 DME the aircraft was handed over to Cork Tower, by which time the latest IRVR readings passed to the crew had again reduced to 500m, below minima. As previously briefed by the Commander, he operated the power levers during the latter part of the approach with the Co-pilot remaining as PF, contrary to SOPs.

Descent continued below DH, the Commander calling "OK, minimum ...continue". This was followed by a reduction in power and a significant roll to the left of 40°: the investigation found that the power levers had been selected momentarily below the flight idle stops into the prohibited-in-flight 'beta' (reverse) range, where the effect of a minor but continuous mismatch between the torque delivered by the engines at any given Power Lever Angle had been aggravated. Just below 100 ft radalt the Commander as PNF called a go-around, which was acknowledged by the PF.

At 0950 hrs, coincident with the application of go-around power by the PNF and a TAWS annunciation of 'FIFTY', control of the aircraft was lost. The aircraft rolled rapidly right beyond the vertical, its right wing contacting the runway; the aircraft continued to roll right and impacted the runway inverted, coming to rest almost 200 m from the initial contact point. The airport fire service was quickly on scene and extinguished fires on both engines and a separated wing, preventing fire reaching the fuselage and the surviving occupants.

At 0956 hrs, six minutes after the accident, IRVR values for RWY 17 exceeded Cat I minima and by 1008 hrs visibility exceeded 2000 m.

The Background

The aircraft was owned by a Spanish bank and leased to a Spanish undertaking trading as Air Lada, deemed for the purposes of the investigation to be the Owner as it was the entity with direct control of the aircraft; the Owner did not hold an Operating Licence or AOC. EC-ITP was sub-leased to another Spanish company, Flightline BCN, which held the AOC and was therefore assumed to be the Operator. Two of the Owner's directors were also pilots flying as part of the operation.

Maintenance for the 2 aircraft involved in the Isle of Man/UK/Ireland operation was contracted out to a Part 145 approved maintenance organisation based in Barcelona. The investigation revealed a catalogue of weaknesses in the Continuous Airworthiness Maintenance regime, with sufficient, serial Part M Level 1 regulatory non-compliances to have prevented operation of the aircraft. In particular, a technical defect had existed on the aircraft at the time of the accident that was not recorded, rectified or deferred appropriately; and the maintenance requirements for a remote operation had not been not properly established or provided for by the Operator. Of the flight crew who had routinely re-configured cabin seating as part of the operation, none was properly authorised to do so. (Note: for a detailed technical explanation of the cause of the torque split referred to in this review, please see the AAIU original report at http://www.aaiu.ie/sites/default/files/report-attachments/REPORT%202014-001.pdf)

The undertaking selling the passenger air transport service was an Isle of Man company, Manx2, although there was no direct contract or communication between the Operator and Manx2. Pilots operating on Manx2 flights were required to wear uniforms and other items of equipment that identified them with the ticketing company and the UK CAA had previously expressed concerns that Manx2 was allowing the impression to be created that it was a licensed airline in its own right. The investigation found that Manx2's marketing and operational activity was such that it was portraying itself as an airline.

The Crew and the Operator

The Commander of the accident flight held a valid JAA CPL issued by Spain; he had flown most of his 1800 hours of flying time as a Co-Pilot on the Metro II/III and had recently been promoted to the left hand seat. He flew his first sector as a captain four days prior to the accident. The Co-Pilot had a UK-issued JAA CPL and had amassed 589 flying hours, of which 289 were on type. Both pilots were found by the investigation to have been employed by the 'Owner' rather than the 'Operator' but all their training and checking had been carried out by the latter.

Neither pilot had received the minimum specified training/checking for their respective crew positions before being released to unsupervised line flying. The Commander's captaincy check had been abbreviated and CRM training specified in the OM had not been delivered. It was noted that the Captain had been trained for his upgrade and checked by the same examiner, which was considered to be "contrary to good practice"; this weakness has since been rectified by enhanced regulatory requirements subsequent to the accident.

Both accident pilots were Cat I qualified but neither had been approved for Cat II operations. Moreover, with no autopilot or flight director system equipage the aircraft itself was only approved for Cat I approaches. For reported visibilities of less than 1200 m, the OM Part 'A' required an ILS Cat 1 monitored approach with the Commander as PM until the required visual reference for a landing had been achieved, but there was no reference to this requirement in the OM Part 'B'. Whilst the monitored approach procedure was trained on the Operator's EMB 120 fleet, this did not occur on the Metro II/III fleet.

A check of the OM found that, contrary to widespread practice elsewhere, there was no limit on the number of consecutive approaches which could be made without significant improvement in the prevailing weather conditions. There was also no limit on pairing of pilots new to their respective roles, which had allowed a new Commander to operate with an inexperienced Co-Pilot contrary to EU-OPS 1.940 and despite an Operator's audit 8 months prior to the accident that stated experienced crews were required to conduct the operation.

Analysis of crew records revealed repeated and routine breaches of FTLs in conducting the operation, which included night cargo flights in addition to the scheduled air transport flights; the investigation considered that monitoring of the implementation of FTL the scheme by the Operator "was of dubious quality".

Both Commander and Co-Pilot had exceeded FTLs in the preceding days, the Commander having commenced duty 4 hrs 30 mins prior to achieving minimum rest on the previous day, reporting for duty over an hour early on the day of the accident. The Co-Pilot was also over an hour short of rest prior to the accident and had exceeded his FDP by 2 hrs 30 mins only two days before that. Whether the Co-Pilot knew the details of the FTL scheme is open for debate: the Operator's FTL manual was only available in Spanish and the Co-Pilot did not speak the language.

In examining the duties of the 7 pilots involved in the operation, other breaches were identified by the investigation, including a gross exceedence involving a duty of 20 hrs

10 mins. 'Tiredness and fatigue' were cited as contributory causes of the accident.

The investigation considered extensively the human factors involved in the run-up to the accident. It was determined that the crew departed EGAC without a clear understanding of the prevailing weather conditions. The CVR analysis showed a flat authority gradient but an increasing level of stress as events unfolded. There was no formal appraisal of options with regard to fuel, time and weather constraints, though the Commander was clearly aware that Kerry (EIKY) was only a short distance away. There was also no structured consideration of anything other than a plan to land at the destination.

The decision to make a third approach needed to be viewed in light of a Commander who was tired and almost certainly under self-imposed pressure to achieve the task. Moreover, he had never landed at EIKY previously, or diverted, and he would have been aware of the additional work and costs associated with passenger disruption arising from diversion to an alternate. The investigation noted that ATC personnel at Cork actively assisted the crew following their initial request for weather information, but pointed out that the decision to make any approach was the Commander's alone: an ATC clearance does not relieve a pilot of responsibility for regulatory compliance.

The Commander's decision to operate the power levers was probably to reduce the workload on his Co-Pilot, who was about to fly his 3rd consecutive raw ILS in IMC without an autopilot or flight director. However, the result of this unusual arrangement was that the PF was unable to carry out a normal go-around when necessary. The 'continue' call below DH may well have introduced uncertainty such that the PF began to level the aircraft with the power still at approach settings, reducing the airspeed to the point where the stall warning sounded. It was also possible that the crew had been unaware of the applicable RVR limitations.

Oversight

The investigation identified a range of systemic deficiencies in the oversight arrangements which ranged from EASA, through national authorities to the Operator. These were identified as contributory causes, providing the conditions for poor operational decisions to be made on the day of the accident. The Competent Authority did not identify the remote operation or its inadequate resources, and the commercial model of intra-Community (EC) air service provision could allow a ticket seller to exercise an inappropriate and disproportionate role with no accountability regarding air safety. Some of the AOC holder's responsibilities were being exercised by the Owner and the ticket seller (Manx2), neither of whom held an AOC or Operating Licence.

Although EU Regulations do not apply in the Isle of Man, which is a Crown Dependency, the operation was being carried out under Regulation (EC) No 1008/2008. Three other air carriers from the UK, Germany, and the Czech Republic were participating in Manx2 flights from the Isle of Man to, and within, the UK and Ireland. All flights used the IATA designator for the German carrier.

"This situation, where a commercial air service was being operated within the EU and the air carrier was not the 'aircraft operator', was in contravention of Regulation (EC) No 1008/2008." (AAIU)

The Results

The Investigation determined that the Probable Cause of the accident was "loss of control during an attempted go-around below Decision Height in Instrument Meteorological Conditions".

Nine Contributory Causes, not listed in any order of priority, were identified:

1. Continuation of approach beyond the outer marker equivalent position without the required minimal.
2. Continuation of descent below Decision Height without adequate visual reference.
3. Uncoordinated operation of the power levers and the flight controls.
4. In-flight operation of the power levers below Flight Idle.
5. A torque split between the engines that became significant when the power levers were operated below Flight Idle.
6. Tiredness and fatigue on the part of the Flight Crew members.
7. Inadequate command training and checking during the command upgrade of the Commander.
8. Inappropriate pairing of Flight Crew members.
9. Inadequate oversight of the remote Operation by the Operator and the State of the Operator.

Eleven Safety Recommendations were issued:

1. that the Director-General for Mobility and Transport, European Commission should review the obligations of Member States to implement penalties, in accordance with the Standardisation Regulation (EU) No 628/2013, as a result of transgressions including Flight Time Limitations as provided for in Regulation (EC) No 216/2008

2. that the European Aviation Safety Agency should provide guidance to Operators concerning successive instrument approaches to an aerodrome in IMC or night VMC where a landing cannot be made due to weather reasons and incorporate such guidance in Commission Regulation (EU) No 965/2012 accordingly.

3. that the European Aviation Safety Agency should review Council Regulation (EEC) No 3922/91 as amended by Commission Regulation (EC) No 859/2008, to ensure that it contains a comprehensive syllabus for appointment to commander and that an appropriate level of command training and checking is carried out.

4. that Flightline S.L. should review its current operational policy of an immediate diversion following a missed approach due to weather.

5. that Flightline S.L. should implement suitable and appropriate training for personnel responsible for flight safety and accident prevention.

6. that the Director-General of Mobility and Transport, European Commission should review the role of the ticket seller when engaged in providing air passenger services and restrict ticket sellers from exercising operational control of air carriers providing such services, thus ensuring that a high and uniform level of safety is achieved for the travelling public.

7. that the European Aviation Safety Agency should review the process by which AOC variations are granted to ensure that the scope of any new operation is within the competence of the air carrier.

8. that the Agencia Estatal de Seguridad Aérea should review its policy with regard to continuing oversight of air carriers, in particular those conducting remote operations.

9. that the Director-General of Mobility and Transport, European Commission should review Regulation (EC) No 216/2008 in the context of implementing Regulation (EU) No 628/2013 in order to improve safety oversight including efficacy and scope of SAFA Inspections and to provide for the extension of oversight responsibilities, particularly in cases where effective oversight may be limited due to resource issues, remote operation or otherwise.

10. that the Director-General for Mobility and Transport, European Commission should review the scope of the Air Safety Committee, and consider including oversight of Operating Licences issued by Member States and the processes by which oversight is carried out.

11. that the International Civil Aviation Organisation should consider the inclusion of information regarding the flight-specific approach capability of aircraft/flight crew within the proposed ‘Flight and flow-Information for a Collaborative Environment (FF-ICE)’.

Sources:

AAIU Report 2014-001 accessed at http://www.aaiu.ie/sites/default/files/report-attachments/REPORT%202014-001.pdf) SKYbrary:www.skybrary.aero/index.php/SW4,_Cork_Ireland,_2011_(LOC_HF_FIRE)

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