

Emergency and unusual situations in the air

This is a dangerous issue
by Professor Sidney Dekker

17 minutes
by John Barrass

**The small technical
problem...**
by Eileen Senger



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Summer 2012

HindSight15

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Serious about Safety



Joe Sultana is Chief Operating Officer of the Network Management Directorate. He graduated with an Engineering Degree from the University of Malta in 1975 and joined the Air Traffic Services Unit in Malta in the same year. He obtained ATCO Licences in Aerodrome, Radar and Area Control and was a Watch Supervisor for four years. In 1982, he was appointed Head of Air Traffic Services in the Maltese Department of Civil Aviation.

I am delighted to be given the opportunity to provide my perspective, as Chief Operating Officer of the Directorate of Network Management of EUROCONTROL, on how we view safety. **Simply put, our position is that we take safety very seriously because it is a cornerstone of our business.**

The Network Manager function is a key component of the Single European Sky. But what is the Network? It is the European ATM system working as one coherent function providing a safe and expeditious service to civil and military airspace users across the airspace of the 39 EUROCONTROL Member States. We are living in a world where information flows instantly from one part of the world to the other and where people and organisations are more closely linked, better connected and able to influence each other. Safety has to be addressed at local, European and global level and we have to learn and constantly support each other.

The following questions drive our common safety approach: Is the Network safe? Where are the safety threats in the Network? Where are the safety opportunities? What should be done to keep the Network safe and improve? Who do we tell to make it effective?

Keeping the Network safe is not a task of the Network Manager in isolation. Our role is twofold. On the one hand we support the various Network actors to improve their safety man-


agement. But our work does not stop there. We are also actively and directly involved in operational safety, in the identification and management of operational safety hazards across the Network. Our overview of European ATM operations and good channels of coordination with controllers and pilots give us a unique view of possible risks and safety threats.

I am confident that the Directorate of Network Management of EUROCONTROL can answer these questions and that we are up to the challenges they pose for us on a daily basis. We will leave no stone unturned in our task of constantly improving Network safety. **I believe safety is not a cost but a business done well.** Having a high safety standard for ATM is the best way to be more efficient and effective in managing the higher volumes of traffic. Take the example of adverse weather avoidance. The better we are prepared and the more efficiently we share and adopt good practices for ATCOs and ATC supervisors in situations of weather avoidance, the more we can improve not only safety but also overall local and Network perfor-

mance. The new performance-based ATM world we are now in is a fact of life.

I mention performance only in passing and do not want to dwell on it too much. But safety and performance are things which we deliver every day together: controllers, pilots, ANSPs, aircraft operators, airports and the Network Manager. As a network, we are as strong but also as weak as the component parts. Working together to deliver both is the *raison d'être* of the Network Manager.

HindSight is an important tool for sharing what we in the industry collectively know about safety threats and the ways of managing them. It is primarily aimed at the people on the front end – air traffic controllers – and it is read by thousands worldwide. The content of this issue is a very good example of how we facilitate the collection of the best pieces of information on a subject, carefully balancing different opinions and assembling it in a contemporary form. We are doing this not only to discharge our formal responsibilities but also to do all we can to have peace of mind and soul when we look at the contrails of aircraft in the sky or the steady stream of inbounds at a busy airport.

Take the journey with us, read the articles, think how this relates to your work, discuss things with colleagues and help us spread the knowledge. 



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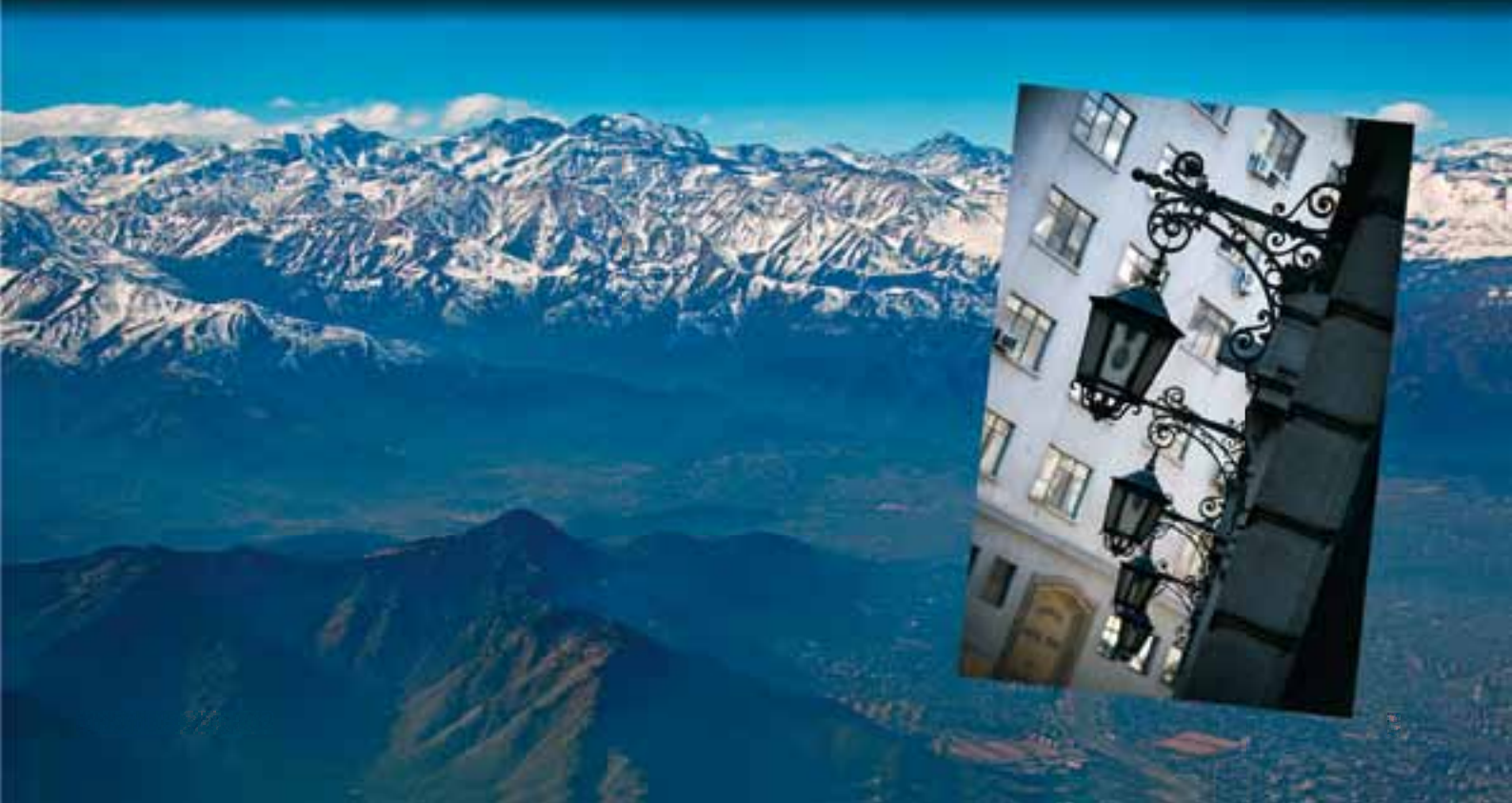


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Surprise, surprise...



Tzvetomir Blajev

Editor in Chief of Hindsight
Fellow of the Flight Safety Foundation

Can training and everyday practice with normal operations provide the skills and knowledge to deal with the unexpected, unfamiliar, and very often never-experienced-before, situations?

Surprising situations do happen to us. They sometimes trigger a physiological reaction known as the startle response. This is a knee-jerk and instinctive reaction to a sudden, unexpected external stimulus like someone firing a gun behind us when we were not expecting it.

Pilots and controllers are sometimes confronted with rapid-onset, dynamically developing situations with different, sometimes opposing, strategies available.

The startle reflex normally triggers within 100 milliseconds of the stimulus, it is pre-emotional and contains physiological and subjective dimensions. The subjective dimension is very similar to fear or anger. Startle prompts an increase in the speed of your reaction and helps to focus attention. The reaction is autonomic for at least the first 1-3 seconds but may continue for as much as 20 seconds in extreme circumstances. In the jungle this is the fight-or-flight response when encountering something unexpected. And unexpected in the jungle is rarely good. Even if it is good, it is better to err on the safe side. Pure survival!

Coming back to modern times – pilots and controllers are sometimes confronted with rapid-onset, dynamically developing situations with different, sometimes opposing, strategies available. How should the situation be assessed to find the best strategy in a blink of an eye? And at the

same time coping, potentially, with impulses for autonomic, startle-triggered, reactions.

Let us take as an example the situation where the stall protection system of an aircraft has been activated. In the past pilots flying multi crew public transport aircraft were generally advised that their response to such a warning should only involve the minimum reduction in aircraft attitude needed to recover from the 'edge' of the fully stalled condition. This advice implied that the loss of aircraft altitude resulting from the recommended response should be minimised. Thus implication soon became a widely accepted objective in its own right. The important strategy to recover became obscured by a secondary consideration. The result was that pilots who did not understand the aerodynam-

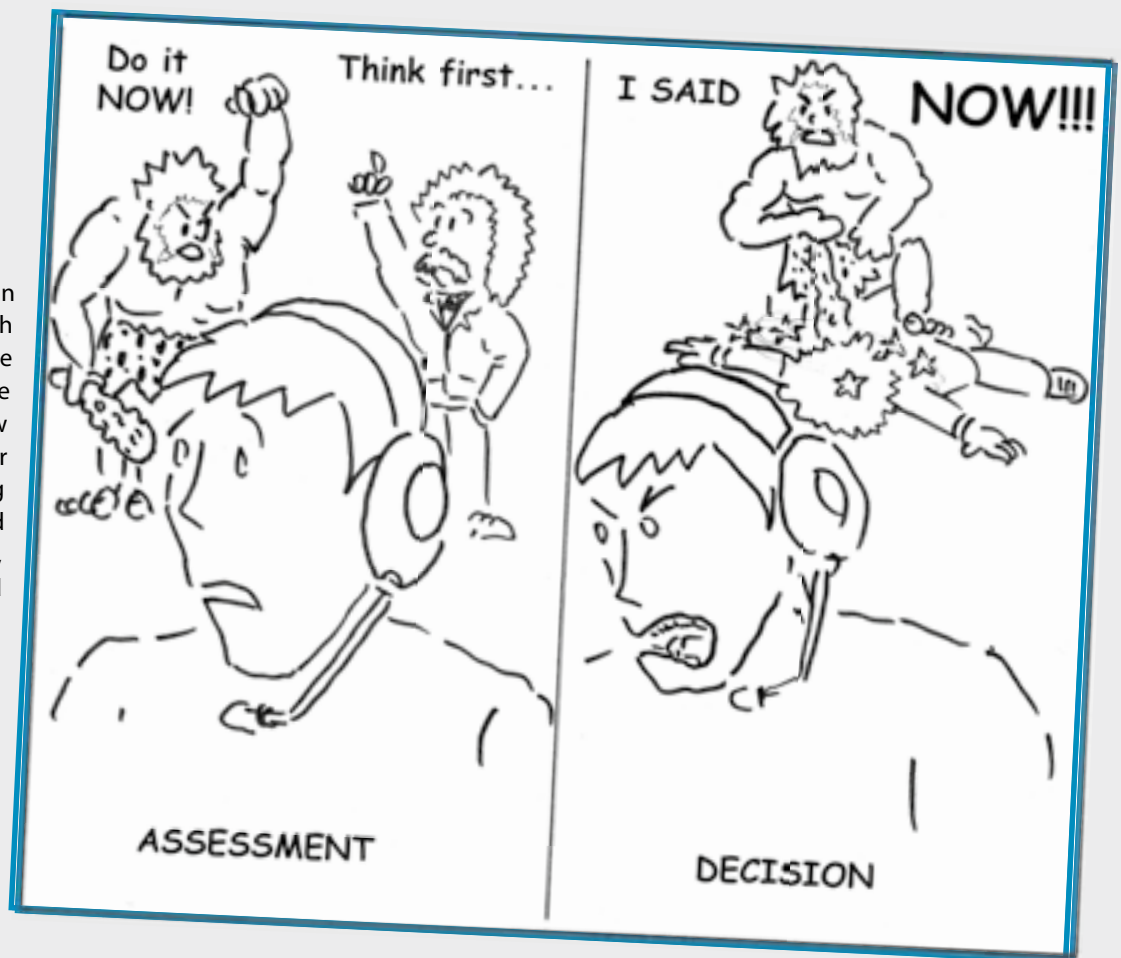
ics of the stall simply responded to this rare event in a way that failed to restore a normal flight condition. What is really important is that if an initial response is not effective, the result may be a much more difficult situation which in some flight conditions can follow very fast.

Do you believe that we in ATC never encounter similar situations? Really? Think about the example in the case study of this edition of Hindsight. On initial contact with the

crew there is an indication of 'fuel at minimum'. What should the Controller do first? Give the requested 'direct to the destination', ask if the crew wish to declare an emergency or first coordinate with the adjacent ATC centre? The Controller elected to immediately give a direct route and this, in hindsight, may have helped to save the lives of the people in the aeroplane.

Knowing in hindsight what happened and what would have been the best decision(s) is very easy, but how do we know this when the decision is still to be taken? More than one option may seem credible and there may not be enough time to analyse them. Hindsight bias is one of those features of human thinking that delivers results which are different from those we can get if we analyse the situation with the help of statistics. The idea of 'hindsight bias', which also inspired the name of our magazine, was formulated by two scientists in the 1970s – Amos Tverski and Daniel Kahneman.

A few months ago, Kahneman published another book¹ which I would like to spend some time discussing from the perspective of our current theme. In his new book Kahneman describes our thinking process as consisting of two systems – System 1 and System 2. System 1 thinks fast, is unconscious, intuitive and effort-free. System 2 thinks slow, is conscious and analytical. System 1 recognises patterns in a fraction of a second, and ‘automatically produces an adequate solution to the challenges’. System 2 is systematic but tires easily; therefore it usually accepts what the fast System 1 tells it.



These systems are not actually two distinctive agents in our head. Not really, says Kahneman. Rather, they are “useful fictions” – useful because they help explain the traits of the human mind.

One may think System 2 is in charge, but the reality is that System 1 is the boss most of the time. This is for good reasons, because System 1 is for the most part very good at what it does; it is very sensitive to subtle environmental cues and signs of danger. It kept our ancient ancestors alive. There is simply too much going on around us for System 2 to analyse everything in depth.

Another benefit of System 1 is the ‘expert intuition’ which comes from experience. Expert intuition can be learnt by prolonged exposure to situations that are “sufficiently regular to be predictable”, and provided quick feedback is given to the expert on whether he did the right or the wrong thing. This is how experts develop their unconscious “pattern recognition” mechanism to get the right answer quickly. A trained expert (Kahneman gives as an example a fire-fighter) can unconsciously, and almost immediately, produce the right response to complex emergencies.

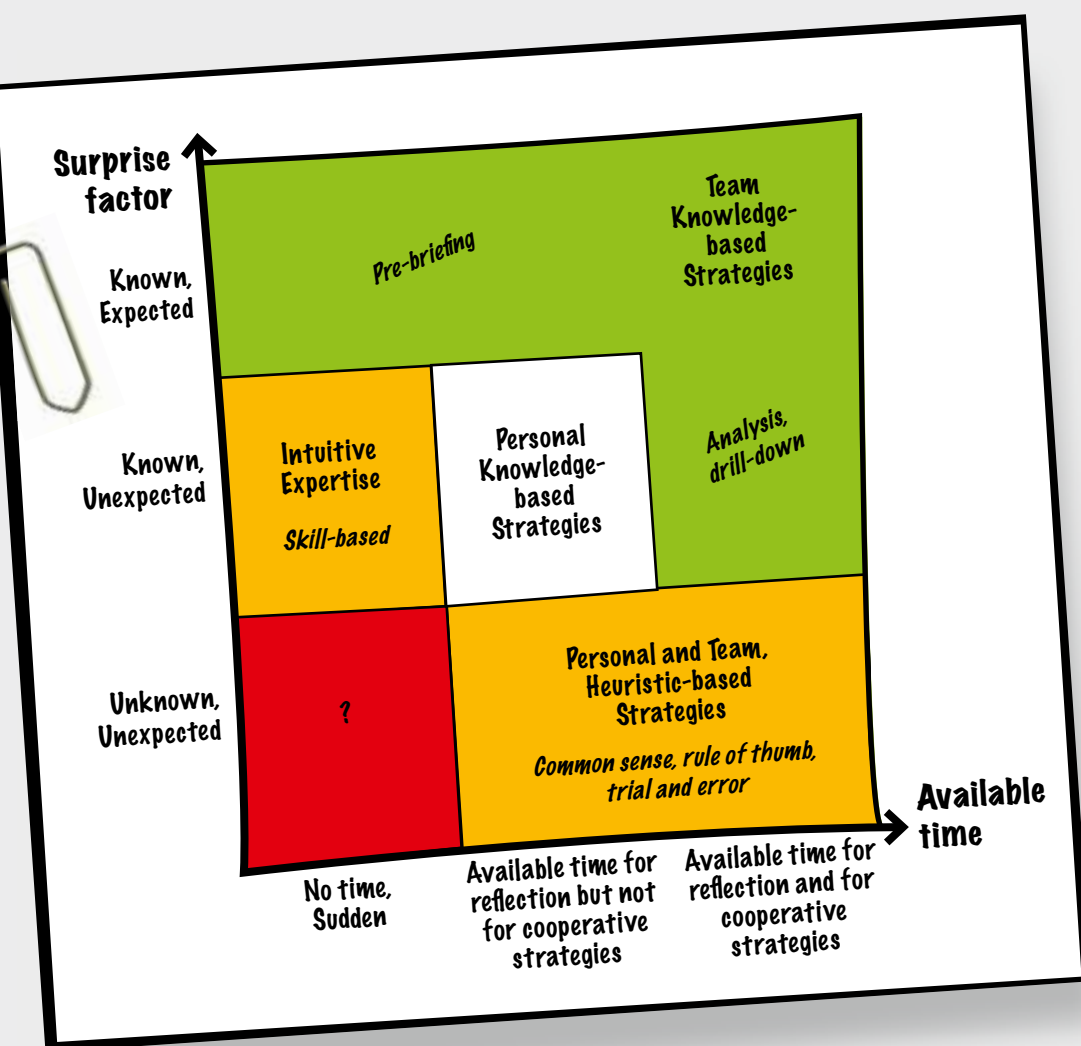
All the marvels of System 1 come at a price. The high speed is paid for. System 1 works in an oversimplified world, it as-

sumes WYSIATI (“what you see is all there is”), and it has no doubt whatsoever in its thinking process. System 1 is notoriously bad at the sort of statistical thinking often required for good decisions, it jumps easily to conclusions and it is subject to various irrational biases, including the already mentioned hindsight bias. Speed is achieved at the expense of precision. System 1 is “quick and dirty”. We do not want our reaction in aviation emergency situations to be like this, do we?

But System 1 does well most of the time; it is because of System 1 that we have our (good) performance and intuitive expertise. Not relying on it will deny us all the benefits as well. Kahneman implies that knowing the fallacy of our behaviour won’t help a lot to overcome it. It helps if more than one person is involved and they cooperate. Because it is easier to recognise someone else’s errors than our own, working in a trained team, with ongoing feedback mechanisms, is part of the ideal solution.

System 1 is always working, but the situations that happen to us occur with varying degrees of surprise for it. Similarly, the amount of time available for our System 2 to take over from System 1 and analyse in-depth the issue before making a decision varies. I was thinking how to map graphically

► ►



Sometimes, I hope very rarely, the situation will develop suddenly and will be both unexpected and unknown. Then there is not much in the way of a pre-formed strategy available. What one needs to do is to prevent or reduce the likelihood of such situations.

There are known but unexpected situations with sufficient time for personal reflection but not for use of team resources. An example of this would be the Airbus 320 ditching in the Hudson River in 2009 after the loss of almost all engine thrust following a multiple-engine bird strike at low level.

Finally, there are those cases that combine unexpected but relatively frequent and known situations with sudden development and no time for reflection. If these cannot be prevented then the best strategy is to train for them extensively so that

an optimum reaction becomes second nature and is more likely to be intuitively applied if needed. This is the famous rule for becoming an expert by spending 10,000 hours on training and practice. Take your time!

Intuitive reaction is not always bad; it helped us survive in the Darwinian sense. Flying and providing air traffic control to modern aircraft, however, is less of a reaction from the jungle and more about preparation.

It is true that the design of aircraft and ATC systems should be human-centred, accommodating instinctive human reactions. But this assumes that someone will know everything about humans and their reactions and will successfully integrate this into the design of machines and procedures. Obviously, this is not fully achievable and there will be situations that surprise us. If these situations have potentially dangerous outcomes, if what is at stake is an accident, then when confronted with emergencies one should be equipped to adopt the best available strategy which minimises 'blink' and maximises 'think'. The challenge is how to train the professionals to 'think slow' but faster.

the distinctive situations, which are associated by the different combinations of surprise for System 1 and available time for System 2. I have attempted to visually represent the diversity of these combinations above.

There are situations, represented in green, where there is either sufficient time for the crew to adopt knowledge-based strategies or which can be reasonably expected, such as wind shear encountered when approaching to land at an airport with significant convective weather in the vicinity. In this latter case the expectation can trigger a pre-briefing for the actions required if an actual encounter occurs, and although the situation is sudden and there is no time for System-2 type of thinking, after the encounter the strategy is still knowledge-based. An example of such a team knowledge-based strategy is the Airbus 380 emergency landing in Singapore in 2010.

Other situations involve unforeseen or highly unlikely events but with sufficient time available either for personal or team System-2 type thinking. The available knowledge-based strategies are generic rather than specific.

Enjoy reading HindSight!

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HindSight15

The ability or opportunity to understand and judge an event or experience after it has occurred



Front Line Reports

Emergency and unusual

By Carlos Artero

This article discusses not emergencies, but unusual situations. Fortunately, such situations do not happen very often, but we must be careful because they can appear at any time without notice.

It happened one morning in 2006. The sky was overcast around the airport where I worked. Traffic was so light that during the day one controller worked all positions, whilst at night two controllers were used.

During the day, there was hardly any IFR traffic, while at night there were many cargo flights. However, there was some VFR activity during the day, more in summer than in winter. VFR traffic flying through our CTA was supposed to call, but sometimes didn't. Departing traffic often failed to say goodbye before losing radio coverage. The airport had no radar, and the ACC radar could not detect traffic below 5000'.

starts, but departure ATC had told him to use the visual corridors and stay below the overcast.

I had a strip indicating the expected arrival and when the plane did not call me, I tried to reach it on the radio but there was no response. I called the ATC of the departing airport, who told me that traffic had been told to contact me ten minutes ago. I tried to contact the plane again with no success.

I looked at the flight plan. It was due to land at my airport, make a short stop and then fly to Germany IFR. I asked the airport office why it was coming to us and they told me

that it had to refuel before continuing because its departure airport had no fuel available. This was a common story.

I kept calling the plane from time to time, using tower, ground and emergency frequencies. There was no answer, so I spent some time on the tele-

Carlos Artero

has been an Air Traffic Controller in AENA, Spanish Air Navigation Service Provider since 2005. He works in Barcelona and he has experience with Tower and Area Control.

I kept calling the plane from time to time, using tower, ground and emergency frequencies.

That morning a southerly wind was blowing at 20 knots. The clouds hovered over the mountains south of the field. The cloud ceiling was low, but not low enough to prevent VFR operations.

The morning had passed peacefully when I received a call from the control tower of an airport 75 km to the south-east, which was surrounded by mountains and accessible via published visual corridors. My colleague there was coordinating a VFR flight coming to my airport. This traffic had asked to fly directly to the VOR where my airport approach

phone to other airports in the area but nobody had any news about it.

Knowing that the plane was going to Germany, I thought that perhaps the pilot had flown directly to Germany, after deciding that he had enough fuel to reach his destination or intended to stop elsewhere to refuel en route. I also felt that the apparent unwillingness to fly as filed, VFR, to reach my airport might mean that the pilot is going to do whatever he wants, so that required ATC contact may not be made before reaching a French airport to refuel and file a new flight plan.

situations in the air

However, it was strange. He was due to fly to my airport because he needed to refuel but he had not come. He had said goodbye to the departing airport, he had not contacted me or replied to my calls, he had a strong tailwind and there was a thick cloud layer. Nobody had any news of him. It was about time I activated the Uncertainty Phase, INCERFA.

I called the ACC, told them what was happening and declared INCERFA. I did not know exactly what that implied, but found out later that INCERFA means that all airports and ACCs which may have encountered the 'lost' plane are contacted to see if anyone knows anything about it. Suddenly, a lot of people began to call me: ACCs, airports... . Honestly, I thought I might be screwing up, giving too much importance to plane that was no doubt flying peacefully over France to Germany, but I saw that the situation was abnormal, the weather was bad and meanwhile I was complying with the safety protocol. If and when the aircraft were to be found, I would have done the right thing.

The ACC told me that there was no news after the established time for INCERFA, so I declared ALERFA. The ALERFA phase activates the Search & Rescue and State Security Forces and all ATC units along the whole route are contacted. I kept getting lots of calls from different places, including the Search & Rescue people.

Actually, we were all convinced that the plane was on the way to Germany, but ALERFA had been declared and the search by air and on the ground was initiated. A police helicopter arrived and, later on, a military Search & Rescue helicopter came from its base nearly 200 km away. The land teams were also mobilised. At this point I started to get scared. I hadn't been an air traffic controller for long, the destination of the plane was my airport and I had taken full responsibility for initiating the alert phases. In addition, I was alone. I should have called the Tower ATC Chief, but I didn't think about it. Everybody called me: the helicopters on the frequency, people at the airport, the military and the ACC over the phone.

More time passed. The missing plane was not located either in Spain or beyond. The helicopters could not see much because the sky was completely covered and the clouds were low. According to the flight plan, the complete flight to Germany should have been completed by now. If he had stopped to refuel in France, we would have known this from French ATC. So I called the ACC and declared DETRESFA. I learned that DETRESFA involves all State Security Forces from Spain to Germany. The man at the ACC asked me if I was sure. It was as if I were a boss or a director, whereas I was just a controller with not much experience, who was working alone and had taken a decision without properly appreciating the consequences. I just replied that I was neither sure or unsure. The regulations clearly stated when I had to declare DETRESFA, regardless of what I personally thought was going on. ▶▶




Emergency and unusual situations in the air (cont'd)

The DETRESFA phase was now active. This situation was obviously now an incident, so I searched for the official incident reporting form, which I had never filled in before, and I called the Tower Chief to ask how to fill it in. When the Chief learned that a DETRESFA was active, the first thing he asked was why he had not been advised of the situation earlier. Of course he was right. I had been alone when he could have been with me. He had twenty-five years' experience, had worked in several departments and knew a lot.

The Tower Chief came immediately to the airport. I told him what had happened and he spoke to the ACC, the military and different people at the airport. Then he left and went to gather information from the airport. Soon he called me from the flying club, to tell me to call up the helicopters and tell them to look at a particular location. When this message was passed on, the helicopters confirmed that they had been trying to check it but it was covered in cloud. The location was a peak that rose above the other mountains in the area where the terrain was flat except at

that peak. When the cloud cleared a bit, they were able to see the peak. And right there, the remains of the plane could be seen.

To sum up, I came to the following conclusions:

- We must comply with all security protocols, whether we think a plane is safe or not.
- We must be careful and aware in everything we do, as we may be slow to act if we assume that the abnormal situation is just an everyday problem, such as VFR traffic leaving without saying goodbye before leaving radio coverage.
- During any emergency situation, we must have another person to help us. If we are working on our own, we must secure the presence of at least one other person as soon as possible. 

Editorial note

In course of HindSight production Paul Neering, representing IFATCA, submitted a note to the article of Carlos. We thought it will be of benefit to our readers to include the note in the content of this HindSight edition:

A brave story by Carlos Artero. To my opinion there are however a few conclusions to be drawn before the ones mentioned in the article. It would also be interesting to know what changes in procedures and responsibilities were introduced after this accident. Are we talking history or do these circumstances still exist? (I'm afraid they do in many places).

- Training on incident and emergency procedures should be part of initial and refresher training. Even an ATCO with little experience should be convinced of and familiar with the actions to be taken, certainly in a situation of undesirable Single Person Operations (SPO). As described that wasn't the case.
- What had happened to the quality of the handling of the emergency and the handling of other traffic if traffic had increased during the process? The many generated calls because of the emergency are already an extra workload by themselves. Calling in a second person during undesirable SPO should be part of the procedures at a well determined early point in time in the process as well as the activation of traffic flow regulation measurements to mitigate the risk of SPO in combination with the handling of an emergency.
- Responsibilities of activation of SPO should be well described.

A lot less will then be left to personal interpretation.

EXPECT THE UNEXPECTED!



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Sudoku of teamwork

By Maciej Szczukowski

I've never been a fan of a Japanese game called Sudoku. I've always felt that the "need" to fill in a form with a scheme of numbers is fully satisfied by completion of my yearly tax returns and I don't need to bother with any complex calculations, even if only for fun. A few weeks ago though, the circumstances of a rather dull meeting pushed me into trying it.

The first attempt took me some time but the subsequent ones began to raise me above the "rookie" level. I found myself switching from a narrow consideration of only 9 fields (aviation experts might call it tunnel vision) to a broader perception of blank or already-filled in little boxes, all 81 of them. After a while, I could see that, actually, there is a certain system to it. And although it doesn't lead to an instant solving of each puzzle, I found that using memory or concentration tricks could make the game more fun and less of a calculation challenge – in effect less stressful.

On 1 November 2011, I had a morning shift at Warsaw airport tower, which was supposed to terminate, with no adventures, at 2.30 p.m. It was the only day of operational work during my new rating course (which had lasted for about 40 days). And then in the very last hour of this shift, with me on TWR position, unexpected news about LOT 16, a Boeing 767 inbound from Newark which eventually landed wheels-up, reached the tower. I am still wondering if I had no luck or all the luck in the world that I was at the tower at the time ...

Why am I writing about these two – a simple game and a complex aircraft emergency? What do they have in common? I would say that it is the problem of choice when no definitely right answer is apparent. Sudoku may sound trivial here but that is something that really fascinated me when I started playing. The rules

are clear, the "game plan" is simple – just like procedures or operational instructions are (or at least should be). In Sudoku, you select relevant information, compute it in your brain and then,

finding out that you can use three different numbers in a certain field, have to either look for more information which will lead you to the correct action or ... resolve the problem by risking a particular decision which may not actually be correct and accepting its consequences for the rest of the game.

Flying in a multi-crew environment or providing ATC is surely a "teamwork" activity. Sudoku can be teamwork as well, with a bunch of friends standing behind your back saying "you should put number 2 there" or "look, this one is easy" But in all these activities there are always moments in which you, and only you, have to make a decision which may have an uncertain outcome, in other words, take a chance. That is the moment which you may have to solve your problem. The Captain of LOT 16, though he took over an hour to try to deal with the situation with the help of the crew, eventually made an approach with the gear up. It was only he who could decide. It was also only he who was then and remained afterwards responsible for the decision.


An air traffic controller cooperates with his colleagues in, for example, establishing certain spacing minima on approach but when it comes to making the decision whether or not to fit in a departure between two landing planes, it is an individual controller who has to solve the problem. At that very moment only this particular decision counts. And if anything goes wrong, it is the controller who will have to answer the questions "why" and "what for". Not the team as a whole.

When I recall the day of the LOT 16 belly landing, I end up thinking about all the people involved in trying to help find the best possible outcome to the shared problem. Probably all the available manuals were open at the right page and checked, both in the air and on the ground. Everybody was trying to recall their simulator and ground school training sessions for ideas. All of us were trying really hard to take



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a broad view of all the 81 fields of our airfield-airspace-Sudoku board and gather as much information as possible from the fields already filled in. It was the teamwork we were trained to do.

However, I think that such an attitude, though widely accepted, leads to us missing an important point – our self-confidence. Many will agree that the “top ten” list of distress situation terms includes “coordinate”, “cooperate” and “collaborate”. I am sure that there is nothing wrong with that. We receive lectures and do exercises in communication, partnership and team actions but actually none of them mention confidence, self-esteem, self-respect or simply faith in, and pride in, our own decisions. In effect, and many situations prove this, we sometimes forget about the thin line between the time for cooperation and the moment of an individual decision and with it, awareness of its importance and consequences.

Now the question is where is this line between the common mind of a team and the single mind of a responsible pilot or controller? I recall one of many situations where this line was not defined. On 19 February 1996, a Continental Airlines DC-9 performed a gear-up landing at Houston. Part of the background to this outcome is that “the first officer was unwilling to overtly challenge the captain’s decision to continuing the approach” though “he did attempt to communicate his concern [...] to the captain” (by asking few times “want to take it around?”, “want to land it?” and “you want it?”)¹. It has been found, based on research, that the only value of challenging by monitoring pilots is to recognise hazards that flying pilots have missed; however, this ignores the value of independent thought and assessment by the monitoring pilot, and the potential ability of the monitoring pilot to influence the flying pilot’s decision-making through the power of suggestion.² Likewise it is now known that an individual may forget or incorrectly remember even recently acquired information, so that new information resembles other information processed recently.³ The last case definitely happens during intense teamwork, where the pace of information exchange may be high whereas individual thought processes, no less important after all, are unknown to the group.

A few weeks ago I played a game during a TRM (Team Resource Management) session, in which a group of people had 30 minutes to make a complex decision. For the first 15 minutes, I was quite passive and saw that, although almost all the members of the group had a chance to talk, the group itself was not able to get any closer to the decision. After 15 minutes I decided to send a rather explicit message to the group and within the allotted time we came to a conclusion. Yes, it was only a game but still, though some of the opinions about my intervention were not pleasant, our lecturer told us that if the leader had not stopped the unproductive part of the process, if a single mind had not guided the team and its actions, we would have demonstrated more or less correct teamwork but had no real product. In other words, nothing.

The now very well known “ASSIST” scheme contains the letter “T”, which means “time”. I think it is a guide but also proof of the fact that we, as a team, need not only to work with each other but also to give each other time to work on our own thought processes. This is not contrary to teamwork. It is to ensure that team members are effective contributors. And if we do not care about our own contribution, the team itself may not have enough time to act or may simply not see that their help is needed. This is, of course, true not only for emergency situations. And it was not only the first day of November 2011 that taught me this. Somehow, every game of Sudoku I play reminds me about it too. 

1- NTSB Aircraft Accident Report, NTSB/AAR-97/01 “Wheels-up landing Continental Airlines Flight 1943, Douglas DC-9 N10556, Houston, Texas, February 19, 1996”, pages 4 and 56 <http://www.nts.gov/doclib/reports/1997/AAR9701.pdf>

2- Fischer, U. and Orasanu, J. (2000). “Error-challenging strategies: Their role in preventing and correcting errors.” In *Proceedings of the International Ergonomics Association 14th Triennial Congress and Human Factors and Ergonomics Society 44th Annual Meeting*, Santa Monica, CA.

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This is a dangerous

By Professor Sidney Dekker

This issue of HindSight could turn out to be the most dangerous one yet. Here is why. A number of the stories shared in HindSight represent best practice in the field. They make, either implicitly or explicitly, suggestions about how emergencies and unusual situations can be handled well. This seems like a really good idea. Share ideas, publicise best practice, learn from each other.



issue

Until I got a letter. The letter is from two practitioners who have written a book about best practices in their domain. Among these are best practices for handling emergencies and unusual situations. The book is all but done, and ready to be published. The two authors write in this letter how professional organisations, like those that air traffic controllers have in their own countries and internationally, have pushed back really hard to prevent its publication. They do not want the book to come out. The reason is this. The professional organisations who have objected to publication feel that the book, and the examples in it, could easily be used by prosecutors around the world. They fear that, after an incident or accident, prosecutors will use the book's case studies to demonstrate how the person in question did not adhere to best practice. The best practices in the book will be used to show the errors in judgment, the prosecutable, criminal negligence of those involved in incidents or accidents.

People who censor themselves may end up affecting a lot of other people when they don't share what they have to say.

Against the background of more and more criminalisation of professional errors, this makes sense. Their fears are well-grounded. Prosecutors in a number of countries have been using incident and accident reports liberally as a basis for prosecution already. So it isn't a large stretch of the imagination that prosecutors would put the incident or accident report (which details how things were not done well) next to a book that shows how things are practiced well. The gap between the two will be an index for the strength of their case against the practitioner in question.

So publishing our best practices is like giving prosecutors all the answers in the back of our book – well before any test. The authors of the letter write, "Rather than alienating several of our international professional organizations, we have decided to put the book on hold." And then they warn, "to retreat and isolate ourselves and train our next generations of practitioners with a litigious, defensive mindset will bring advanced knowledge [of our best practices] to a halt."

It is incredibly sad if a profession feels that it cannot safely share lessons about its best practices. It is even sadder that this is the result of self-censorship imposed for fear of prosecutors. Self-censorship is defined as the act of withholding, classifying or hiding one's own work out of fear of how others may react or use the information—but without overt or prior pressure from these others, that is, from any specific body or institution or authority. Self-censorship has been more or less common in news reporting, in publishing, in politics, in science. Although there may be good reasons for it in some cases (taste, decency, ethical considerations), self-censorship is often seen as suicidal for democracy. It interferes with free speech, with democratic discourse, with openness of information.

People who censor themselves may end up affecting a lot of other people when they don't share what they have to say. But then, you cannot blame them at all. With the judiciary increasingly filling the moral vacuum in the wake of secularisation, we face a stark and awful choice. Either we share our best practices and learn from each other, but then we put individual practitioners at risk of prosecution. Or we don't share and do not give prosecutors the answers in the back of our book, but then we might well get stuck below our best practice, eventually increasing risk for a lot more people.

So how do we get out of this situation? The risk, most prominently, is in publishing stories about our own best practice as if they are authoritative, as if they are the final word. Because then others can read those stories, compare them to evidence of actual practice, and point out where our colleagues failed. What we need to do then, is make sure that our stories of best practice are never closed. That they remain forever open. What "best practice" is changes over time, it changes per perspective, per country, per operational centre. That way, we can never be pinned down by somebody who says: "this is your best practice!" We can always respond by saying, "Well, yes, it was, according to that person at that time. But look, here are twenty-six other publications on this particular practice, and it reveals a lot more possibilities of what 'best' means." If we keep the notion of best practice negotiable, we not only keep up the constant development and refinement of our professional excellence. We can also keep our colleagues out of trouble. **S**



Professor Sidney Dekker

is Professor and Director of the Key Centre for Ethics, Law, Justice and Governance at Griffith University, Brisbane, Australia. Author of best-selling books on human factors and safety, he has had experience as an airline pilot on the Boeing 737.

Being prepared — for worse than 'expected'!

By Captain Ed Pooley

OK, there is an Emergency – A multi crew public transport aircraft has declared a 'MAYDAY'.

You have rapidly 'woken up' and are temporarily saying goodbye to the predictable routines of your day-to-day comfort zone and beginning to respond – just as you were trained to.

But you know that as a controller you will, more often than not, be trying to assist the pilots by doing whatever you can to reduce their suddenly increased workload without knowing the full facts of the situation they are facing. Sometimes, you know that awareness of more of these facts would enable you to help more. Other times, it may not – possibly (but certainly not necessarily) because you cannot grasp the significance of 'technical' information. Either way, you usually (correctly) judge that the last thing an overloaded flight crew need is any more than the minimum of R/T to deal with.

From the pilots' perspective, I can tell you that:

- They will frequently delay declaring an emergency to the extent that you will suspect one exists before they do.
- If they want something specific from you they'll usually ask for it.
- As they have absolutely no idea how much you are likely to understand about the technical details of their emergency, they will usually communicate these based on their assessment of 'need to know'.

Many aircraft operators advise that at the onset of an emergency, a review of

roles between the two pilots – PF 'pilot flying' and PM 'pilot monitoring' – is sensible. Often, it will be a good idea for the aircraft commander to remain or become PM so as to be able to strategically manage the problem and act as chief communicator with the co-pilot flying / managing the aircraft. This may help the clarity of communications to ATC from the aircraft since communications are then direct from the decision maker instead of being routed through the junior pilot.

However, what I really want to 'discuss' is the presumptions that a controller handling an emergency might reasonably make about the professionalism of the flight crew they are trying to help. Having looked around at your fellow controllers, you will probably have decided long ago that some of them seem to perform better under the pressure of a relatively short lived emergency than others even though you've all received the same training and passed the same competency checks.

Well surprise, surprise, it's much the same for pilots who, like controllers, are trained and especially assessed in ways which largely remove any element of surprise from what occurs. For

pilots who train in pairs in their simulators, the value of the training to one pilot is often at least partly dependent on the aircraft knowledge, management and handling skills (relative to rank and experience) of the other.

If, as a controller, you make the assumption that, by and large, the two pilots don't usually make emergency situations worse even if their actions may have contributed to or even caused them in the first place, you may be wrong.





Being prepared – for worse than ‘expected’! (cont’d)

Interestingly, some pilots who realise that they’ve messed up sometimes perform with great skill when responding to the situation they’ve created. Many will remember the Air Transat pilot who ran out of fuel on the way across the Atlantic in 2001 and then successfully glided his Airbus A330 65 miles to a pretty creditable safe arrival at Lajes in the Azores. Many other pilots pull off successful outcomes after the onset of sudden emergencies they had no part in creating which invariably depend on both their flying skills and their knowledge of

how planes fly in general and how their particular aeroplane works. Recent examples include the well-known post bird strike ditching in the Hudson by a US Airways A320 in 2009 and the almost as well known British Airways Boeing

777 undershoot at London Heathrow in 2008 following almost complete fuel starvation due to fuel feed icing on short finals.

But then there are ‘the others’. Something which has been regularly, even

obsessively, trained for happens but the response ‘on the day’ ignores almost every critical element of that training. In June 2010, a ‘classic’ Boeing 737 being operated by what was then the low cost division of Royal Air Maroc, Atlas Blue, hit a flock of geese just after getting airborne at Amsterdam. It took a full four minutes (which is a very long time in an emergency) before the pilots got around to the thing they were persistently (and almost obsessively under current regulatory requirements) trained to do first and without delay – to carry out the memory actions for the (single) engine failure that they recognised had resulted from bird ingestion. And in what can only have been some sort of irrational panic response, the first action of the Captain, having just lost 50% of his thrust, was to order that the still in-transit landing gear be re-selected down because it was indicating unsafe. Yet all landing gear indicates unsafe when it is moving to a selected position. And even if the unsafe indication had been indicated by gear in a previously locked position, the imperative after losing half your thrust near the ground is to climb to a safe height using what remains and minimising drag by ensuring that the landing gear is up as quickly as it would normally be after any take off and the failed engine is ‘secured’. Those actions collectively and significantly reduce drag, which itself would otherwise reduce the rate of climb.

In this case, ATC were aware straight away ‘what’ had happened but could not have guessed what would come next. The requested and issued radar headings provided by ATC were completely ignored and as daylight faded, an erratic nine minute perambulation began which took the aircraft over some of the suburbs of Amsterdam



Captain Ed Pooley is an experienced airline pilot who for many years also held the post of Head of Safety for a large short haul airline operation. He now works as an independent air safety adviser for a range of clients and is currently acting as Validation Manager for SKYbrary.

at or below the height of the tallest buildings. It was accompanied by, at times, an almost continuous (and valid) activation of the on board Ground Proximity Warning System (GPWS). In this particular instance, the applicable ATC procedures – give radar vectors – seem to have completely failed to take account of the risks of giving such vectors below MRVA (although at least in this case the aircraft was in VMC). The message here is that the controller could not have known and could hardly have expected what was actually happening on board the aeroplane even when it was already clear that there were some major control difficulties.

The controller could not have known and could hardly have expected what was actually happening on board the aeroplane even when it was already clear that there were some major control difficulties.

Back in 2007, the controllers at London Heathrow were faced with a similar sort of situation in which an aircraft was being flown erratically around some of the busiest airspace in Europe, albeit at higher altitudes than in the Amsterdam example. In this case it wasn't a bird strike but a failure by the crew to set up the aircraft navigation systems properly before the flight began which disabled normal attitude



Joe... ATC is asking if we are declaring an emergency or not...

and heading instrumentation for both pilots. The evident difficulty which the crew were having in controlling their aircraft manually using the standby attitude display and the standby compass was compounded by insufficient language proficiency to properly communicate with ATC the nature and effects of their problem – surely an experience which many controller readers will have had at least once. Anyway, despite no emergency being declared, ATC (eventually) recognised the seriousness of the circumstances and provided a discrete radar frequency to help achieve a safe return. With the fortuitous addition of VMC below 1500 feet aal, a safe landing was achieved after 27 minutes of flight.

As with the Amsterdam event, the track flown by the aircraft from take off to touchdown and reproduced in the respective investigation reports is interesting to say the least. Contrary to the Amsterdam event however, the right seat co pilot was and remained PF – but had to fly from a standby attitude instrument available only in front of the aircraft commander and a

standby compass which is difficult to use in a turn – quite possibly the combined cause of his inability to fly headings. Despite the flight crew failing to recognise that their situation amounted to a MAYDAY scenario, instead describing it as just a 'navigation problem', ATC also came in for a bit of criticism on account of their slowness to recognise the de-facto emergency given that only the availability of a visual approach readily facilitated a safe outcome. It was also suggested that ATC could have made more effort to facilitate the positional awareness of pilots in IMC rather than confining their guidance solely to headings and track miles to go.

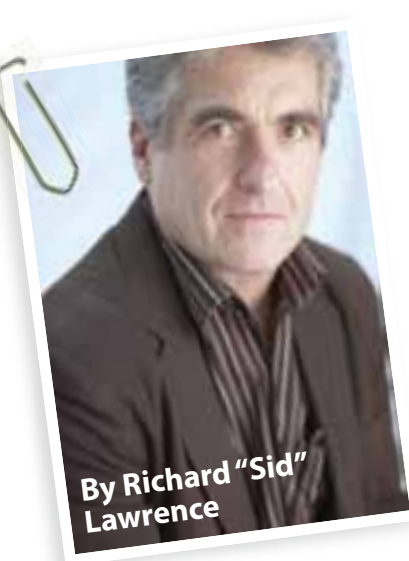
However, these are just details from particular examples. What is the purpose in telling you about the problem of what you don't know? You certainly can't do much about it.

Or can you? Sometimes, when faced with the unexpected, knowing what you don't know is almost as important as what you do knowbut do be careful how many questions you ask an overloaded crew if you can see some useful clues on your radar screen. **S**



SAFETY REMINDER MESSAGE

Interceptions of Civil Operation of SSR and



By Richard "Sid"
Lawrence

“ During the past few months the EUROCONTROL Safety Alert service has been approached by a number of stakeholders requesting the promulgation of a Safety Alert covering a variety of topics. In the pages that follow, I will describe two of the Alerts that I hope will spark your interest.

As previously, my intention is to try and bring new information to the table. The aim is to feature more in the way of feedback, responses, comment and analysis to get the most from each Alert.

If you would like to know more about the EUROCONTROL Safety Alert service, register as a subscriber, submit a suggestion or have a subject that you wish to consider then please contact me at richard.lawrence@eurocontrol.int.

The first alert is a Safety Reminder Message, "Interceptions of Civil Aircraft – Operation of SSR and ACAS II" ... ”

Released on 22 December 2011

Synopsis

EUROCONTROL has learnt of incidences where flight safety has been compromised and unnecessary TCAS Resolution Advisories (RAs) triggered during interceptions of civil aircraft because of misunderstanding regarding the operation of aircraft transponders and the properties of ACAS II.

ICAO Provisions – ACAS II

- **PANS OPS (Doc 8168, Vol I),**
Definitions: "Airborne collision avoidance system (ACAS). An aircraft system based on secondary surveillance radar (SSR) transponder signals which operates independently of ground-based equipment to provide advice to the pilot on potential conflicting aircraft that are equipped with SSR transponders."
Chapter 3, § 3.1.1 "Resolution Advisories (RAs)... propose vertical manoeuvres that are predicted to increase or maintain separation from threatening aircraft."
- **Annex 6, § 6.18.2:** "...all turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5,700 kg or authorized to carry more than 19 passengers shall be equipped with an airborne collision avoidance system (ACAS II)."

ICAO Provisions – Interception of Civil Aircraft

- **Annex 2, Chapter 3, § 3.8.1, Note.** "As interceptions of civil aircraft are, in all cases, potentially hazardous, the Council has formulated special recommendations which Contracting States are urged to apply in a uniform manner".
- **Annex 2, Appendix 1, Attachment A, § 3, 3.2:** "An aircraft equipped with an airborne collision avoidance system (ACAS), which is being intercepted, may perceive the interceptor as a collision threat and thus initiate an avoidance manoeuvre in response to an ACAS resolution advisory. Such a manoeuvre might be misinterpreted by the interceptor as an indication of unfriendly intentions. **It is important, therefore, that pilots of intercepting aircraft equipped with a secondary surveillance radar (SSR) transponder suppress the transmission of pressure-altitude information (in Mode C) replies or in the AC field of Mode S replies within a range of at least 37 km (20 NM) of the aircraft being intercepted.**" (Note: **Bold** text is EUROCONTROL emphasis)

Alternatively, register your interest through the EUROCONTROL Website – Safety Alerts Board http://www.eurocontrol.int/safety/public/standard_page/safety_alert_board.html or go to SKYbrary: http://www.skybrary.aero/index.php/Portal:EUROCONTROL_Safety_Alerts to access the Alerts featured here and all previous Alerts.

Aircraft - ACAS II

■ ICAO Doc 9863: Airborne Collision Avoidance System (ACAS) Manual, Appendix 7

"A7.2 ADVICE FOR NON-MODE S-EQUIPPED FIGHTER AIRCRAFT

A7.2.1 Arrangements to be used by military fighter aircraft for covert intercepts

A7.2.1.1 When closing in on an aircraft to be intercepted, the military pilot disables Mode C. (Some military users switch the transponder off or to "Standby" resulting in no reply to any interrogation.) In this procedure, the lack of altitude information will prevent all RAs.

A7.2.1.2 At least under peace-time conditions, Mode A transmissions should be enabled at all times to make the fighter aircraft visible for SSR/IFF ground radar systems (but without altitude information).

A7.2.2 Arrangements to be used by military fighter for demonstrative intercepts

A7.2.2.1 During this type of intercept, it is highly desirable to avoid RAs, even though the intercepted aircraft detects the approaching Interceptor. There is no other alternative for non-Mode S-equipped fighters than to eliminate the altitude value in Mode C messages. In this case, only the framing pulses will be transmitted. If there is no altitude value in the Mode C messages, ACAS will detect the military aircraft, but only TAs can be generated. Ground-based systems can track the fighter aircraft, but without altitude information.

A7.2.2.2 There should be an indication on the control panel or the IFF function display of the fighter aircraft when the altitude reply information is inhibited in this way.

A7.3 ADVICE FOR MODE S-EQUIPPED FIGHTER AIRCRAFT

A7.3.1 Covert intercepts are intended to prevent the fighter from responding to ACAS interrogations while the fighter can still respond to ATC ground-based interrogations.

A7.3.1.1 In this case, the intercepting pilot will select an Intercept Mode. Under these conditions all replies to UFΦ (short air-air surveillance) and UF16 (long air-air surveillance) interrogations will be suppressed. Nevertheless the fighter's transponder will respond to all ground-based ATC system interrogations. Therefore, the fighter remains visible to ATC.

A7.3.1.2 The fighter with activated Intercept Mode will continue to be a threat to all ACAS-equipped aircraft, if the Intercept Mode is not cancelled after the end of the mission.

A7.3.2 Demonstrative intercepts are intended to keep the Interceptor visible to both the intercepted aircraft and to ground surveillance.

A7.3.2.1 To avoid that an ACAS-equipped aircraft generates an RA against an approaching Mode S-equipped fighter, the height value in ACAS replies (DF 0 or 16) must be suppressed, but replies are still available for Mode S ground interrogations. If there is no altitude information in the replies to ACAS interrogations, the fighter will be recognized by ACAS, but only TAs can be generated. For ground-based Mode S interrogators there will be no difference from the normal behaviour, and the controllers have control of the whole air situation.

A7.3.2.2 A software change will be necessary to military Mode S transponders on fighter aircraft, and when the Intercept Mode is enabled there should be an indication within the pilot's normal viewing area."





SAFETY REMINDER MESSAGE (CONT'D)

Analysis

Regarding the actions when an RA is generated, according to **PANS OPS, Chapter 3, § 3.2.(c)** "...in the event of an RA, pilots shall respond immediately by following the RA as indicated, unless doing so would jeopardize the safety of the aeroplane." So, pilots will "follow the RA".

Regarding the suppression of Mode C data, the situation varies between those aircraft that are Mode S-equipped and those that are not. For the latter, depending on the type of intercept being conducted, the intercepting aircraft's SSR Mode C should be inhibited as per **ICAO Doc 9863, § A7.2**. This will preserve flight safety whilst still permitting the prosecution of the intercept.

However, for those fighter aircraft that are Mode S-equipped the picture is less clear. Only very few air forces' interceptors currently have the Mode S Intercept Mode available and pilots of these aircraft can follow the advice in **ICAO Doc 9863, § A7.3** above. This de-activates the air-to-air communication of Mode C data but preserves the air-to-ground link so that controllers can still see the interceptor and its altitude. For those Mode S-equipped fighters that do not have Intercept Mode capability, the issue is that Mode S continues to send out altitude information to all air and ground receivers even if the Mode C element is suppressed.

The solution to this difficulty, adopted by a number of air forces, is for the interceptor to switch OFF the Mode S transponder, in total, at the appropriate point in the interception. The pilot can still relay altitude information to the military control authority who in turn can advise their civil-

ian counterparts. To enable this to happen safely there needs to be explicit and detailed cooperation and coordination between the military authorities controlling the interceptor and the civilian authorities controlling the intercepted aircraft (as is required by ICAO Annex 2).

Finally, military flight crews should also be aware that, since ACAS II will not track any aircraft with a vertical rate in excess of 10,000ft/min, operating outside these parameters during an intercept will render ACAS II ineffective.

Your attention is required

State Military and Civil Authorities are invited to take note of the subject and ensure that their national regulations and administrative directives relating to the interception of civil aircraft comply with ICAO Annex 2 and follow the advice contained in ICAO Doc 9863.

Aircraft Operators and Air Navigation Service Providers are invited to note the subject for information and awareness.

EUROCONTROL Comment

The interception of civil aircraft clearly requires close cooperation and coordination between the authorities prosecuting the mission, i.e. the military pilots and military air defence/ATC, and the civil ATC provider looking after the civil aircraft.

Within Europe, the NATO EUROCONTROL ATM Security Coordination Group (NEASCOG) monitors these activities and takes any necessary steps to ensure such operations are conducted safely and efficiently. 

Further reading

- SKYbrary - ACAS
- EUROCONTROL ACAS II Training Brochure:
http://www.eurocontrol.int/msa/gallery/content/public/documents/ACAS_training_ver20.pdf
- ICAO Annexes 6 and 10 (Volume IV).
- ICAO Doc 4444, PANS ATM.
- ICAO Doc 9433 - Manual concerning Interception of Civil Aircraft: (4.1.2.16, Note).

Reduced Runway Length Operations during Construction/ Work in Progress – ATIS and Radiotelephony Messages

published on 17 January 2012

Synopsis

EUROCONTROL had been requested by IATA to raise awareness about an FAA InFo notice (11015 dated 1 September 2011) which informed aircraft operators about ATIS messages and additional R/T phraseology associated with reduced runway length operations during and following aerodrome/ runway construction work in the USA.

Purpose

The purpose of this Request for Support message was twofold: first to highlight the FAA approach to advising reduced runway length available; and second to gain a better appreciation of European practices, procedures and phraseologies being applied in these circumstances with a view to assessing if a consistent, harmonised global position could/should be considered.

FAA Provisions

FAA InFo Notice 11015 states that, *“For runways that are undergoing construction or have recently completed construction. Operators and pilots can expect to hear the following messages via the ATIS recording. In situations where the runway has been shortened, operators will hear “WARNING” and “SHORTENED”*

- For example: *“WARNING, RUNWAY (number) has been SHORTENED, (length in feet) FEET AVAILABLE.”*

In addition, it states that, *“SHORTENED” will be used as part of the take-off (or line up and wait) and landing clearance...’*

- For example: *“RUNWAY (number) SHORTENED, CLEARED FOR TAKE OFF.”*

Note: These procedures will apply for the duration of works or until a permanent shortening of the runway is reflected accordingly in aeronautical publications.

ICAO Provisions

ICAO Annex 11, Air Traffic Services, 4.3.7, states that ATIS broadcasts shall include, *“k) other essential operational information.”*

ICAO Doc 4444, PANS ATM, 7.5.2 *“Essential information on aerodrome conditions shall include information relating to the following:*

- a) Construction or maintenance work on, or immediately adjacent to the movement area...*
- h) any other information.”*

ICAO Doc 4444, PANS ATM, 7.5.3: *“Essential information on aerodrome conditions shall be given to every aircraft, except when it is known that the aircraft already has received all or part of the information from other sources. The information shall be given in sufficient time for the aircraft to make proper use of it, and the hazards shall be identified as distinctly as possible. **Note** - “Other sources” include NOTAM, ATIS broadcast, and display of suitable signals.”*



REQUEST FOR SUPPORT MESSAGE (CONT'D)

ICAO Doc 4444, PANS ATM, Phraseologies 12.3.1.10:

- "d) CAUTION CONSTRUCTION WORK (location;
- e) CAUTION (specify reasons) RIGHT (or LEFT), (or BOTH SIDES OF RUNWAY [Number];
- f) CAUTION WORK IN PROGRESS (or OBSTRUCTION) (position and any necessary advice)."

(EUROCONTROL Note: "Necessary advice" includes "essential information" such as reduced TORA/LDA that may be associated with any WIP/construction work.)

Analysis

When construction work reduces the length of the runway distance available for take-off and landing, it is imperative that this information is made available to aircraft operators and flight crews in a timely manner. In turn they must be aware of, and fully understand, the messages they may hear/see on the ATIS/DATIS and/or receive from ATC as part of their air traffic clearance.

There are existing ICAO provisions covering these circumstances and the FAA has complemented them by introducing its own bespoke phraseology as a safety risk reduction measure. Flight crews should therefore be aware of specific (regional and local) procedures and phraseologies that exist to inform them about reductions in TORA/LDA associated with runway construction/WIP scenarios.

Information requested

Air navigation service providers, aircraft operators, aerodrome operators, local runway safety teams, and national aviation authorities are invited to note the subject and submit their national/local procedures relating to such cases, including ATIS and/or ATC phraseology to be used and aerodrome (temporary) signage.

Respondents are also invited to indicate the need, or otherwise, for a more harmonised approach regarding the procedures and phraseology to be used in the circumstances described.

Summary of responses

There were only 8 responses to this particular RFS message: Four ANSPs, two civil aviation authorities and two aircraft operators.

The general findings were that:

- ANSPs followed the existing ICAO provisions and phraseology. There was no call to introduce similar wording in Europe. However, 2 CAAs (one European, one African) thought that it might be worth debating the merits of adopting the US FAA phraseology.
- ANSPs are aware of the impending proposed change to ICAO EUR SUPPS to replace "TAKE-OFF" with "TOR-AH" in the context of runway intersection departure clearance phraseology. (See below for more about this specific issue)
- One aircraft operator recommended that all runway dimension changes should be promulgated in metres in addition to feet.

After discussions with EUROCONTROL Agency in-house runway safety and procedures experts, it was decided that no further follow-up action should be taken. However, the situation will continue to be monitored through mechanisms such as EVAIR (EUROCONTROL Voluntary ATM Incident Reporting), the Safety Improvement Sub Group (SISG) and the European Working Group for Runway Safety (EWGRS). At national/local level, Local Runway Safety Teams (LRST) can also maintain an overview.



Further reading

- FAA InFO Notice 11015 dated 1 September 2011.
http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/info
- FAA Air Traffic Organisation Policy Notice N JO 7110.564 - 22 September 2011.
http://www.faa.gov/air_traffic/publications/
- ICAO Annex 14, 2.8 Declared Distances.
- ICAO Annex 14, 2.13 Coordination between Aeronautical Information Services and Aerodrome Authorities.

Reduced runway length operations – Intersection departures – revision to ICAO EUR SUPPS, ICAO doc 7030, phraseology

As part of the research for the Alert, it was found that the ICAO EANPG (European Air Navigation Planning Group) was in the process of proposing changes to the phraseology in the EUR SUPPS, ICAO Doc 7030, relating to the provision of information for intersection departures.

Specifically, the EANPG had recommended that, to bring the EUR SUPPS into line with the guidance in ICAO Doc 9870, Manual for the Prevention of Runway Incursions, the phrase “TAKE-OFF” should be removed from the EUR SUPPS phraseology for intersection departures because it contradicted the advice given in ICAO Doc 9870, which says that the words “TAKE-OFF” should only be used as part of a take-off clearance. Instead, the acronym TORA (to be pronounced “TOR-AH”) should be used.

Thus, typical phraseology to be used by ATC to warn pilots of reduced runway length from an intersection should be:

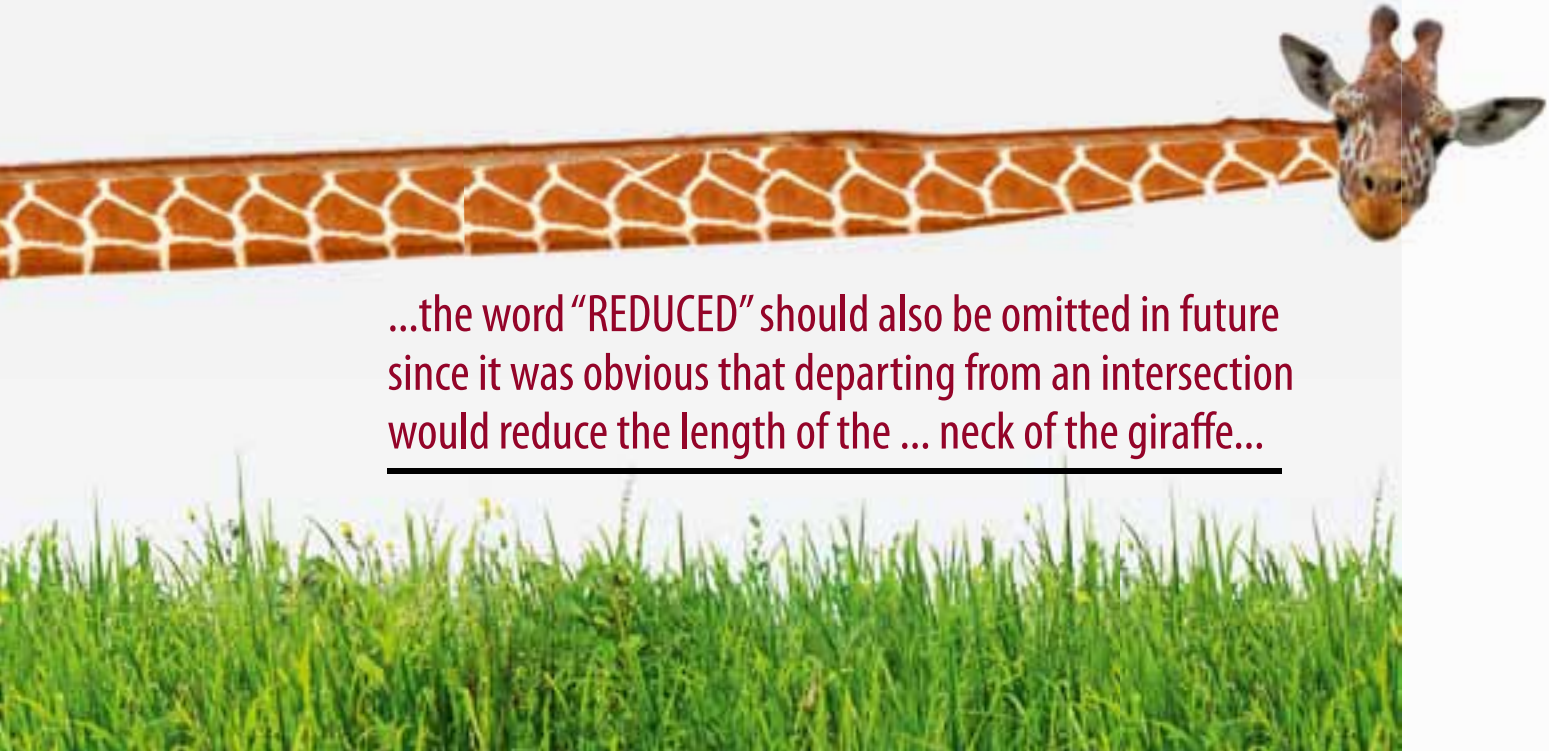
“CALL SIGN, TORA (TOR-AH) RUNWAY 09, FROM INTERSECTION ALPHA, 2800 METRES”.

In addition, the EANPG recommended that the word “REDUCED” should also be omitted in future since it was obvious that departing from an intersection would reduce the length of the TORA.

An ICAO State letter was circulated in January 2012 asking States to comply with the revised phraseology.

To supplement the oral message, ICAO Annex 14, Aerodromes, recommends that an intersection take-off sign should be provided, when there is an operational need, to indicate the remaining TORA for intersection take-offs. In addition, Annex 14 § 5.4.3.29 says that, *“the inscription on an intersection take-off sign shall consist of a numerical message indicating the remaining take-off run available in metres plus an arrow, appropriately located and oriented, indicating the direction of take-off...”*.

ANSPs should cooperate with aerodrome operators to clarify the signage requirements at individual aerodromes. **S**



...the word “REDUCED” should also be omitted in future since it was obvious that departing from an intersection would reduce the length of the ... neck of the giraffe...

Case Study - The garden party

By Bengt Collin, EUROCONTROL

One hour after the time announced in the invitation, late visitors kept dropping in. Irritating! Why couldn't people show some respect? He was a well respected man in his best years, known for his strict principles. He was dressed in rather formal leisure clothing. Although the weather had stayed warm and dry, the sky was as blue as the water in his swimming pool. He would never dream of wearing shorts, shorts are for boy scouts, not real men he thought, overlooking his large mansion with a stiff upper lip.

Alberto, his butler, barbecued. After some mild persuading he agreed to use the new barbecue sauce found in a glossy magazine, olive oil, garlic, soy sauce and black pepper, all topped with a large glass of Jack Daniels. Why should Alberto always have a different opinion? "It is unnecessary to use that barbecue sauce, it's too expensive", Al-

berto moaned before giving up. The visitors seemed happy, he especially noted Anne, dear old Anne. Instead of bringing her usual boyfriend, she had brought a compact dog named Davidic. For the moment Davidic was lying on the grass enjoying life, eating a Chorizo sausage. At least the dog liked the new barbeque sauce! "He understands everything I say to him", Anne explained. "He even understands French". She was abruptly interrupted by the noise from a big aircraft passing straight over them on a very low altitude. They are not allowed to fly over here, it is forbidden. He would call the airport immediately and complain!



The airline had a restricted budget, not that this was unusual, a lot of companies were suffering this way. Most of the aircraft were legacy types, not necessarily unsafe, just old. He did not really think much about it, he had been flying for the company for so long that he'd got used to the minor snags that were more of a routine than surprises out of the blue. Finally, following a delay caused by a problem with closing one of the cargo doors, they got airborne. They made a right turn northbound. "Gear up" he called, but they could still hear noise from outside. The gear is still down, his First Officer said, even though it was very obvious. The Captain started picking up the emergency abnormal check list at the same time

as he was talking to his First Officer. They had never trained for situations like this in the simulator; it was always landing aids out of service, TCAS, engine failures, but never this.

"Recycle the gear". This did not help, the gear remained down, by how much they did not know. He could read his First Officer's mind like an open book. "No, we do not need to return, we can continue with reduced speed and at a lower altitude. Tell control we request flight level one one zero initially and with lower speed. We don't want to end up back at an airport with no engineering support". The First Officer received the clearance. They'd better contact their company about the now-necessary transit stop, it was obvious they couldn't reach the final destination without refuelling.

He was an experienced controller; after passing his final tests ten years ago, he'd always thoroughly enjoyed his job. Now it was even better after he'd met Sandra, another controller, a dark-eyed beauty with an impressive intellect. He spent the first two hours of his shift in the radar simulator; it was years since they'd had a full day's periodic training. The shortage of controllers was more or less permanent and the increase in traffic didn't make things better either. This year they were being trained for radar failure. Yet again, he thought; it had been the same last year too. Might as well be trained in the kitchen, one of his colleagues commented; if you have no radar picture, why not sit somewhere comfortable with a nice cup of coffee and a sandwich, after all it's only a simulation, isn't it?

The pilot of the diverting aircraft called him, requesting an immediate turn and direct route to his new destination, "Control E-line 123 fuel at minima".

He was working the South sector. The Planner informed him of a revision. One of the aircraft heading northbound, instead of passing at high altitude, would be diverting to an airport in his FIR. It would enter at a much lower flight level than normal. His work went on like it always did while he kept this information stored somewhere deep inside his brain. Suddenly he started thinking about the time when during a holiday he'd visited a bar in beautiful Leyton, a picturesque part of east London. A tall, enormous scary looking guy had come up to the bar on his right-hand side, and ordered a small bottle of Babycham (a light sparkling perry). Why was he thinking about things like that? Better not mention this to Sandra. The pilot of the diverting aircraft called him, requesting an immediate turn and direct route to his new destination, "Control E-line 123 fuel at minima". Although the aircraft was still in the airspace of the adjacent FIR, he approved the request straight away. Long afterwards he thought about why he had done that; nothing had forced him, nothing had indicated that something was seriously wrong. He certainly wasn't allowed to do so without prior coordination, after all the aircraft wasn't in his own airspace. He had just felt he should

approve the direct route, without really knowing why. Perhaps it was his old training to react to trigger words, who knows? When he heard the word fuel, he definitely reacted. Today students were instructed to ask whether or not the pilots had declared an emergency, strict and time consuming he thought.

The First Officer calculated the fuel using the FMS; "we'll be below minima if we continue", he quietly informed his Captain. "We're actually already below the fuel level where the book says we should divert to the nearest suitable airport. But company ops has chosen this for us, they initially thought we could continue even further to one

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Bengt has a long background as Tower and Approach controller at Stockholm-Arlanda Airport, Sweden

Case Study The garden party (cont'd)

of our standard airports", the Captain replied. They were handed over to the next frequency, this time in the FIR of the destination airport and the exchange stopped. "Ask for a direct route", the Captain instructed the First Officer. "We could always have Bollibompa airport as a final alternate". They received the direct route immediately; on box two, the Captain called on the approach frequency for the airport and, in an extremely modest and humble way, advised that if a direct approach to the closest runway wasn't possible, they would have to divert to Bollibompa. Six minutes later the Fuel Low Level warning light came on. They'd never seen that warning before; of course they understood what this was – it was a far from ideal situation. "How could we have used this much fuel?" the captain complained, whilst still maintaining a calm and relaxed demeanour, "you checked the fuel consumption in the FMS didn't you?" They still had more than 100 nm to fly.

The approach controller got the aircraft on his frequency. It was heading 340° towards a short final for runway 03; he needed to turn the flight slightly to the left to avoid a Restricted Area just south of the airport. This area had been introduced because of political reasons some years ago, at least that was what the rumours said. The wealthy house owners living in this exclusive area didn't like to be disturbed. How, he always wondered, had they missed noticing that there was an airport close by? After all, the airport had been there long before they'd started building their houses. He instructed the aircraft to turn 30 degrees left, nothing happened. "Control E-line 123 we'd like to continue on present track" one of the pilots replied. What should he say, he had to turn. "E-line 123 turn left heading 310 now", he could still



That was a hell of a direct!

.....

avoid the restricted area. "We cannot turn E-line 123". Cannot turn, why can't he turn? "We are short of fuel E-line 123". What a shock, "OK copied, continue on present heading". The Planner alerted the Supervisor.

"I still don't understand why the FMS gave us inaccurate information". The Captain started talking to himself more than to his First Officer; "we should make it anyhow, we've only got 25 miles to go". The First Officer descended the aircraft relatively slowly. "I can see the runway", the Captain pointed straight ahead, "should be OK. Is the cabin ready?"

"Cleared visual approach runway 03, contact tower 119.4". He looked at the radar screen; the aircraft was passing straight through the Restricted Area.

"Thank you, cleared to land runway 03, E-line 123". They turned final 2 miles from touch down, wheels down, all indications normal; one mile, the runway was waiting in front of them, a warm, happy welcoming runway. Touch down! Finally touch down – the engines stopped.

There were five persons sitting together in the warm meeting room – the Chairman of the investigation commission, himself, the area controller, a person from their union and a secretary.

"We have found two annoying discrepancies", the Chairman, dressed in a grey suit, a blue shirt and a green tie with a red big fish motif on it, spoke in a measured and formal way. He had a military bearing and exuded an air of 'Old Spice'.

"First we noticed", the Chairman continued, "that the aircraft was, without any coordination at all, allowed to proceed directly to the revised destination. Secondly, and this I find even more disturbing and annoying", he talked straight out into the room, keeping his eyes closed; "it was cleared to cross the Restricted Area south of the airport. I have to inform you that we have received some serious complaints which as I speak are reverberating around the top floor, so you'd better be prepared to face the consequences of your actions".

Case Study Comment 1

by Captain Ed Pooley

You have seen that this incident was a near disaster – how near we are not told but it doesn't matter. The analysis of the circumstances up to the safe landing is the same as if the aircraft had run out of fuel and crashed on short final.

So this was a 'Serious Incident' as defined by ICAO Annex 13 and in real life would have generated an independent inquiry conducted by the State Accident Investigation Agency. Of course when this happens, if the involved parties have any corporate sense, they carry out their own internal review and seek to implement any necessary corrective actions well before the Official Investigation Report is published. This allows their 'Safety Action' to be noted in the Official Report and the issue of any Safety Recommendations directed specifically at the agency involved to be avoided.

Here we are focussed on aspects of the internal response of the ANSP¹ and it's not a pretty sight! It should be clear to all that the attitude we see displayed by the 'Chairman' of this investigation represents an appalling way of dealing with the aftermath for the front liner who had to deal with it. No balance here! No context for the performance of the controller ap-

This knowledge-based decision-making got lost en route and only returned as things began to get critical and there was no longer any alternative plan left.

pears to have been considered. No just culture in sight.....No mention of the connection between what professionals do and the effectiveness of the training they are provided with. And on what documented basis was the penetrated Restricted Area established?

What seems to have happened from the flight crew perspective is a bad case of confirmation bias². A perfectly reasonable decision by the pilot in command to press on in the direction of the original destination after the gear failed to lock up after take off then degenerates into an attempt to reach the 'ideal' en route diversion. The key violation is the failure to divert to an alternative airport when the fuel on board reached the level where a direct track to the nearest suitable airport was mandated by operator procedures. Once a direct route is approved, confidence that the doubtful will be possible is restored and later the controller is effectively obliged to

approve penetration of the Restricted Area. The remark about the crew not being trained to deal with the precise 'gear not locked up' scenario is, by the way, not a factor with much bearing on the development of the event. The use of both the FMS and raw data manually checked to monitor fuel use when in an abnormal gear down flight condition is about professionalism in decision-making and flight management based upon basic system and aircraft knowledge. This knowledge-based decision-making got lost en route and only returned as things began to get critical and there was no longer any alternative plan left.

The featured controller is 'old school' – his career began before the days of institutional risk management and the panoply of procedures which have been universally introduced to allow safety standards in ATM to be



1- Since a Regulator is not supposed to prejudice an Independent State Investigation by carrying out one of their own in parallel and then discussing their findings with regulated personnel, I am assuming that the reference to "CAA" here is in respect of their role as ANSP.

2- The state of mind in which you see what you expect to see rather than what is actually happening. In this case, a plan which had originally seemed practicable has subsequently become objectively risky to continue with, but this risk is countered by an unconscious interpretation of the current evidence as continuing to favour retention of the now-flawed plan.

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is an experienced airline pilot who for many years also held the post of Head of Safety for a large short haul airline operation.

He now works as an independent air safety adviser for a range of clients and is currently acting as Validation Manager for SKYbrary.



Case Study Comment 1 (cont'd)

improved despite the concomitant growth in traffic. He certainly reacted inappropriately in granting the direct routing before the aircraft entered his airspace without coordination. He also ignores the absence of any declaration of urgency (PAN, PAN) or emergency (MAYDAY) from the aircraft in support of the successive requests for expeditious routing, and responds without the normal question on fuel endurance which would follow a PAN or MAYDAY declared because of concern about fuel endurance.

The Aircraft Operator doesn't come out of this saga too well either. However Operations Control seeks to assist their en route pilots in command by telling them what would be commercially helpful, this should not be able to be perceived as anything more than assistance given without knowledge of all the pertinent facts or their short-term forward projection.

But of course, the root cause of this incident is solely the pilot in command, who pressed on in the face of compelling evidence that it was foolhardy to do so. As often, not much notice was taken of the First Officer whose contributions were typically deferential – the oft-vaunted theory that a Co Pilot can readily influence the thinking of a pilot in command who has both much greater experience and individually carries all the responsibility for the safe and expeditious operation of the flight is a lot more complex than is often admitted.

Anyway, because the theme of this HindSight is how controllers can and should respond to aircraft in actual or potential difficulty, I'm going to focus on the actions of the featured area controller. Did they help avert an accident? Or did they encourage a dysfunctional flight crew to press on towards a potentially hazardous outcome? Actually, I'd say the controller's initial response was counterproductive to safety. Had he sought both a declaration of urgency or emergency and some more information from the crew before giving a direct routing, this might, just might, have jolted the crew into realising that what they were attempting was indeed a foolhardy violation. But of course nobody (except of course the Chairman of the ANSP Investigation!) would argue with the help given by the con-

troller once there was no alternative, including allowing routing through the Restricted Area given that no actual hazard to anybody was created by allowing this....

A RECOMMENDATION

As I'm only allowed one, I'll go for a comprehensive and independently conducted review of how the ANSP conducts internal incident investigations predicated on a guarantee that the undoubted recommendations for safety improvement which it would generate would be adopted. But I'd also suggest the instant removal from the ANSP payroll in any capacity of the Investigation Chairman on the grounds that it's probably unrealistic to expect him to be capable of genuine attitudinal reform.



Case Study Comment 2

by Dragan Milanovski

A big plane at low altitude passing straight over the garden party spiced up the seemingly dull event. I also find it very difficult to understand why someone would complain about an isolated case, probably interesting for most of the people at the party, and how a barbecue sauce can be too expensive?

The fortunate outcome of this incident might lead us to believe that the actions taken by the two controllers were appropriate to the situation and that by exercising their best judgment and expertise they significantly contributed to it. Furthermore, the controllers had to face consequences for infringing “stupid” rules during the process, just because people with very little or no understanding of the job had powerful political influence. Typical... or maybe not.

Let's look at whether the controllers from the story could/should have taken a different course of action and rule out pure luck in combination with favourable weather conditions. More importantly, let's try to find out why they acted as they did. Was it just their personal negligence, ignorance, or perhaps something else?

The area controller in charge of the South sector received a revision for a flight about to enter at a much lower flight level than expected and divert to an airport in his FIR. When the aircraft called he reacted instinctively and approved the direct routing as requested without prior coordination. The argument that he had no time (which at the end proved to be crucial), and that he had to do it, is not entirely correct. Valuable time, from receiving the revision until the initial call, was not used effectively to understand the situation,

evaluate different options and provide information later on. He could have asked the transferring controller for the reason for the diversion. An aircraft experiencing a landing gear problem (as described in the story) is likely to be short of fuel and ask for direct routing.

Was it just their personal negligence, ignorance, or perhaps something else?

With this in mind, asking the previous controller for a release for turn makes a lot of sense. Information about the suitable airports in the vicinity, which could have been essential to pilots for decision-making, was not provided (although it wasn't essential in this case). More importantly, prior coordination with the approach controller should have taken place well in advance and the pilots should have been informed about the restricted area and the expected distance to fly to touchdown.

The last opportunity was missed by the approach controller when he received an early call from the Captain. He also did not inform the pilots about the restricted area and the 30 degree-turn that the aircraft is expected to make later on to avoid it. After this the

scene was pretty much set, and there were no other options. The story suggests that if this information had been available to the pilots, they would have decided to divert to another airport (Bollibompa) where the risk of running out of fuel before landing would have been a lot lower than in this case.

I have to rule out the stress/pressure of having to deal with an unusual/emergency situation, especially for the area controller, as well as inexperience in the job. A bit of ignorance from the approach controller probably played a very small contributing role in the event (restricted area established due to political reasons – according to his understanding), as well as a bit of negligence from the area controller (allowing his mind to wander to



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Most of his operational experience comes from Skopje ACC where he worked for a number of years on different operational posts.

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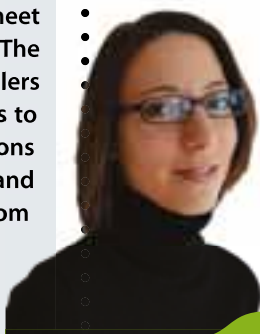
thoughts of his new girlfriend while in position). However, we have to look “at the top floor” for the main reason and possible consequences.

The situation required immediate reactions, but as explained above, the reason why the controllers had to rely on their instincts is probably lack of appropriate knowledge and skills. It appears that it has been several years since they received a full day of periodic refresher training. In addition, the controllers did not think the two hours they had was relevant content-wise or effective.

The ANSP from the story has to ensure that periodic refresher training, as appropriate and as effective as possible, is delivered to controllers unless... the managers prefer to deal with a military bearing and an “Old Spice” odour.

A RECOMMENDATION

Despite the story being fictitious, the situation with the refresher training is definitely not. We can learn a valuable lesson and understand that providing periodic refresher training is about a lot more than just ticking boxes to meet regulatory requirements (if any). The training has to ensure that the controllers possess enough knowledge and skills to deal with unusual/emergency situations whenever they happen. I understand that this is a big challenge, not just from a resources point of view, but also from a training design aspect. However, economic crises, tight performance targets and lack of staff cannot be used as an excuse not to deliver refresher training at a frequency and in an amount which are considered appropriate to the job and with relevant content.



Eileen Senger

is an Air Traffic Controller at EUROCONTROL's Upper Area Control Centre in Maastricht. She works in the Hannover Sectors which cover north-western Germany and is an OJTI.

Case Study Comment 3 by Eileen Senger

Communication seems to be good between the pilots but not between the flight crew and company ops...

Ops make it clear what they want and there does not seem to be any attempt to overrule that decision. Although it should always be the Captain who has the last word when it comes to the safety of his plane. Still, the two pilots do not even discuss whether or not they should press ops for a diversion to the nearest suitable airport, as probably recommended in their checklist. They just accept the decision that is made for them and try to improve it by asking for a direct with ATC. But, just like Ops, they underestimate the gravity of the situation. A contributing factor may be that such an abnormal situation was never trained for in the simulator. Simulator time is valuable and expensive but it should be possible as well to have input from the pilots as to what emergencies and situations they want to train for rather than always just sticking to the required minimum simulator time per

person. Wishful thinking in difficult economic times like these, especially for aircraft operators, I know, but again a lost chance to learn and another missed opportunity for communication.

The South Sector controller is informed of an imminent diversion but not of the reason why. He does not ask. So when the aircraft concerned finally calls in and surprises him with the reason, “fuel at minima”, precious time has already been lost. Had the fuel status been known to the controllers earlier, they could have already begun co-ordination to shorten the track and save time – for both themselves and the aircraft. When the pilots informed the previous ATC unit of their diversion they must have sounded relaxed. Maybe they mitigated their situation a little bit (“small technical problem” maybe?). Enough to make that ATC unit feel that there was no need to treat them as a priority. Did they ask for the reason for the diversion? They should have! Did they get an honest reply or just the usual “company instruction” answer? Did they pass the revision with the reason or without it? Or did the planner just not inform his radar controller? There are so many places where valuable information can get lost!

Apparently, the reason for the diversion was not passed on from the South Sector to Approach. So, for the second time, the pilots are talking to a controller who has no clue to the real situation they are in. Then again, there is room for improvement in their communication to the approach controller as well. The pilot is described as calling in an extremely modest and humble voice for the direct routing rather than giving the facts and communicating urgency. Later on, when the controller instructs them to turn to avoid the

restricted area, at first the pilots do not reply and then first try to talk their way out of complying with the instruction without giving any information before eventually revealing the real reason. Once they have done so, the controller immediately helps and does all he can to get them on the ground as swiftly as possible. All he can do is react. Only then is the supervisor alerted.

Managers and supervisors should be there first and foremost to protect their staff, provided they acted with good intentions and followed their best judgment.

It is a pity to see that the “top floor” of the ATC provider does not seem to be interested in the story the people who were working that particular aircraft have to tell. On the basis of only a few facts, the staff are threatened and intimidated. There is one-way communication – top down: “You acted wrongly! Prepare for the consequences!” With such behaviour there will never be open and honest communication about what was going on and what could be learnt from it. Managers and supervisors should be there first and foremost to protect their staff, provided they acted with good intentions and followed their best judgment. There are always going to be situations where you have to act first and ask questions later. The South Sector controller later remembers his instant reaction to the trigger words “fuel at minima” instead of thinking



coolly about the situation and getting the necessary release first. But had he not done so, the landing of the aircraft would have been delayed even more and aggravated the circumstances which were already underestimated by everybody involved. Only when the Fuel Low Level warning light came on was the gravity of the situation clear. So in the end his training led him to do the right thing to help the aircraft. The approach controller could only react as the real situation revealed itself bit by bit. He is the last one in the chain and he is the one who has to suffer from the accusations made by the Investigation Commission. The aircraft crew might have backed him, but I doubt that there will ever be any exchange about the incident between the pilots and the controller. As long as the aircraft landed safely there is nothing to talk about – that is how many people think. Exchanging experiences usually implies admitting one's mistakes or revealing operational procedures you would rather keep inside the company or both, so it hardly ever happens.

And finally: The neighbours of the airport have to understand that there are

certain situations in aviation where noise abatement is no longer important. Maybe they could have been informed that the ATC provider would stick to the noise abatement procedures in normal operations. But an aircraft low on fuel is no longer “normal operations” and in any case, I'm sure that, at the end of the day, the neighbours would prefer a safely landed aircraft to one which crashed in the vicinity but on the noise abatement track. They should be able to complain and be told what was going on, perhaps via a hotline, but if a reasonable explanation is then given, they should accept it. If such events were to happen every week of course, it would be a different story.

A RECOMMENDATION

Communicate! Talk and ask. Ask again until you have understood fully. Involve other people, colleagues, supervisors, hear their opinion and get their help. Then in the end no one is confronted with an unpleasant surprise.

Case Study Comment 4

by Sami Laine

This story is a great example of how the aviation system is formed and affected by various expectations from various domains.

The aviation playground is open, e.g. as regards the political, economic and operational perspectives, which are spiced up with unexpected events. The framework is a combination of multi-level and multi-dimensional decision-making processes. The high-end players are added to the playground to comply with the social, technical and economic constraints. It would be possible to consider many perspectives in this story. In my comment I will focus on a single safety issue, which could have had a positive impact on the event.

We know that aviation is a complex system. When the unusual happens, it is typical that things start to pile up. In many incidents and accidents it is possible to see – especially in hindsight – a continuous chain of events. In the story here, the situation was similar. Dominos were falling down and the situation was moving fast towards the conclusion. Or was it?



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Seen more closely, it seems that the events described were often independent and that the causal connection was rather loose for the actors involved. Also the possibility of different people controlling the factors governing the actual situation was not obvious. The captain failed to respond rationally to the reducing fuel endurance, the controller was not aware of how bad the situation was in the aircraft and his attempt to avoid the restricted area was rejected by the pilots.

It can be said that the situation could have been clearer for everyone. The outcome was fortunate – a catastrophe like the New York accident in 1990 where an aircraft burned all its fuel without declaring an emergency was avoided.

Communication plays an essential role in every abnormal situation. In an American study the most prominent communication problem in accident cases was recognised as communication never starting. Another big issue was unclear or incomplete communication.

According to EU OPS, the pilot in command is allowed to deviate from the rules and regulations if necessary for safety reasons in an emergency. That gives a lot of freedom to the Captain, but what exactly is an emergency? Was the plane in the story in an emergency situation, or was the situation merely escalating towards an emergency?


By declaring an emergency, all the players are on the same wavelength.

After a MAYDAY call there should not be any doubts that the flight concerned may not be able to comply with all clearances, restrictions or limitations. Without a declaration of emergency, the controller needed to help the aircraft based on his gut-feeling and professional assessment. At the end of the day it may be that his “mistake” averted a catastrophe.

It may be that pilots are not very keen to declare an emergency if it seems that the situation can be managed without it. Use of a MAYDAY call may be avoided even if it would clarify many things in the handling of abnormal situations.

Avoiding the use of MAYDAY may have deep roots in aviation history. It is a known fact that culture is not changed overnight – sometimes not in decades. The clear declaration of an emergency is not just a pilot-ATC communication issue. It is also an important CRM issue inside the cockpit. Efficient communication is essential for the modern aviation system and appropriate use of emergency communications should be a top priority in the industry-wide safety debate.

A RECOMMENDATION

The aviation community should initiate cultural discussion of abnormal and emergency communications and the use of MAYDAY and other distress or emergency communications. 

E.R.

By Alberto Iovino

For family reasons, I happen to be acquainted with the first aid emergency protocol for the management of pulmonary oedema. ...

The relevant list of actions is sometimes deployed on posters, hung on a wall in the emergency room, so that, if you were allowed inside, you might watch patient and doctor fighting their way through life and death right under the list of actions which are supposed to be taken in such a circumstance. Amazingly, you would be able to follow the meaning of most of what you would see, as it would perfectly

correspond to what you could read behind what was happening. Or possibly not, and this might, incidentally, be among the reasons why you would not actually be allowed inside.

Emergency rooms are, by definition, places where people deal with emergencies. From an ATC perspective, it is as if, in a corner of control towers and control centres, a couple of working positions were consistently reserved for individuals with a remarkable sense of self-importance and spasmodic muscular movements of the face, often smoking cigarettes (yes, it is forbidden, but what the hell, those folks deserve some privileges): the emergency team, tough people in charge of getting going when the going really gets tough.

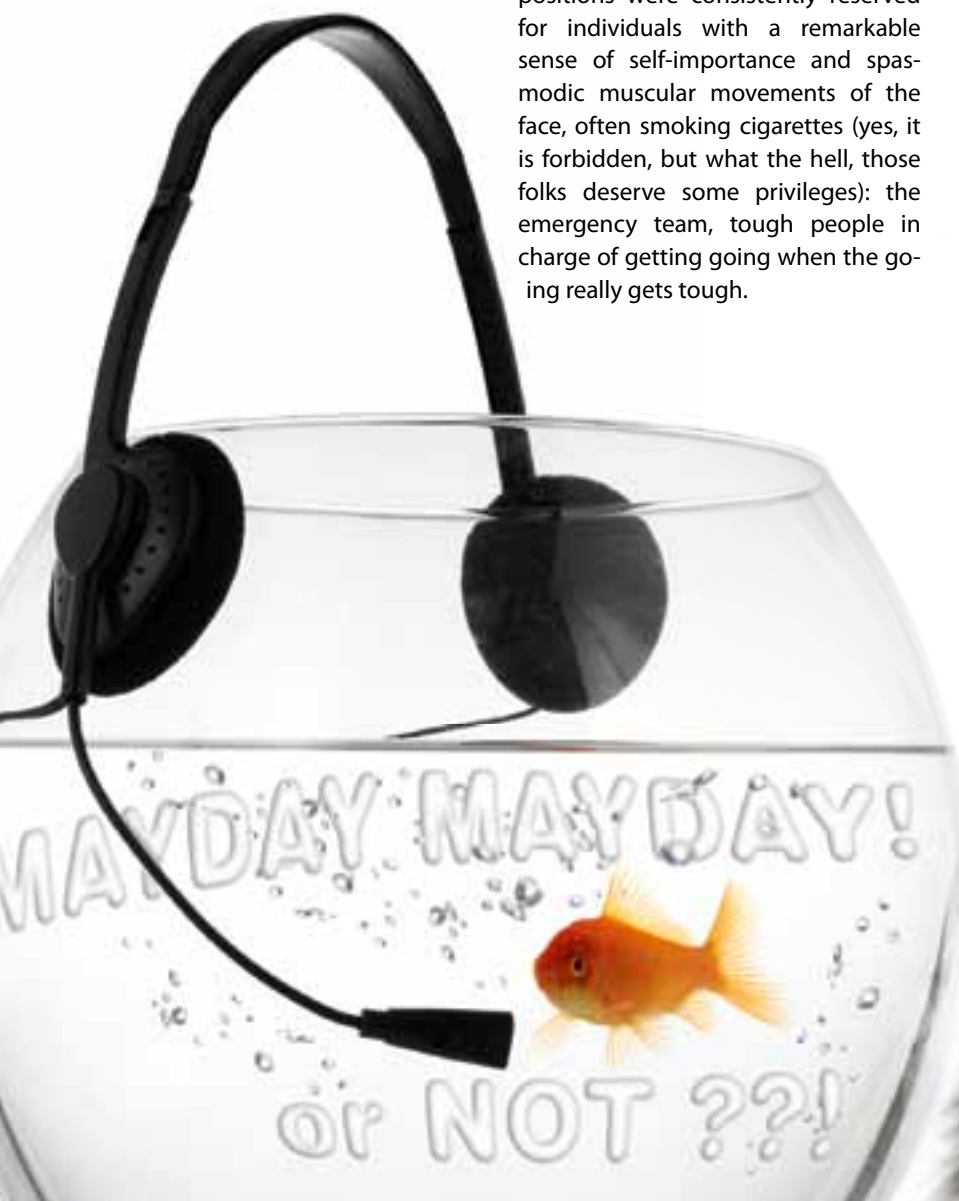
Alberto Iovino

is currently head of ATS Operational Procedures Unit of ENAV Italy. Formerly an airline employee for 8 years, he became an ATCO in 1997, working as tower, approach and area controller.

I have no knowledge of any provider organised in this way, for reasons that can be quite easily presumed. On the other hand, if the idea somehow sounded appealing to you, then it might be worthwhile asking ourselves why.

In an emergency, you feel more comfortable when handled by someone you consider a specialist. One may be able to become so through training and experience; an emergency team member would be somebody specifically trained to deal with emergency situations beyond the average of his/her colleagues, having had the opportunity to become more and more familiar with the matter through repeated exposure to such situations. In the emergency team scenario, negative features peculiar to those circumstances, such as uncertainty, unfamiliarity and excitement, should

►►



E.R. (cont'd)

be almost eliminated. So the question would be whether this can be achieved, and to what extent, with "normal" controllers, those who remain on frequency when, during an otherwise ordinary shift, an emergency situation arises. Or, in other words, whether operational people are placed in the position of offering a high standard of service in critical moments.

Controller training does include emergencies. Some controllers may not have much real-time experience in the field, luckily some would say, though a pilot actually in need might be of a different opinion. They are in any case constantly called on to be professionals and practice the art of overcoming their emotions. All these aspects are given due consideration; where this is not enough, or not adequate in some way, every individual and organisation should re-evaluate their policy and effort. Still, in everyday operational life, one specific item might be given some extra care.

In an emergency, you feel more comfortable when handled by someone you consider a specialist.

On a clear Friday night early this year, an almost one-thousand-feet long cruise ship with more than 4,000 people on board struck a reef, a few hours after setting sail from its port of origin on the Tyrrhenian Sea. Around 2200, local time, a lady on board used her mobile to call her daughter at home and report that there was a blackout on the ship, and passengers had been told to put on their life jackets. Her daughter, understandably not being familiar with the alerting procedures for search and rescue, called the Carabinieri (Italian Police), who relayed the information to

the Coast Guard. It took a while before the latter succeeded in identifying the relevant ship and its location – not even its name having been initially communicated. When they finally did and called to check what was happening, the first reply was a confirmation of the electrical problem, and no need for assistance.

Shortly afterwards, after admitting the vessel was holed below the waterline and asking for a tugboat, the crew eventually declared a

distress situation. In the meantime, and in the following minutes, the ship partially capsized and began to sink a few hundred metres off an island about ten miles from the mainland. On the morning after, you could watch on the news this huge luxury ship lying on its side, partly under water, with a two-hundred-feet long hole on its starboard side, the rock which the ship had struck still embedded in the hull. So far, twenty-five fatalities with seven more unaccounted for, plus some still largely unpredictable environmental consequences, to say nothing of the damage

to the reputation and financial situation of the operator of the vessel.

As these lines are being written, it is far too early to draw conclusions about exactly how this came about and how it was at first perceived by the crew, nor would I be in possession of all the elements (and qualifications) to express much more than an educated personal opinion. Nevertheless, what you have just read is there in the official Coast Guard log book and linked to recorded communications, so that it can be considered factual. From the time the lady looked for some domestic comfort, which by the way took place after the collision occurred, to the time the crew acknowledged their emergency status, more than half an hour had passed.

Just one example, not even aeronautical; still, more than one reader might have recalled from personal experience a feeling of being made aware a little too late. In this issue of HindSight, Captain Pooley, in his usual clean and straightforward style, warns controller readers about the probability that pilots will be so prone to delay a MAYDAY call that, when they eventually make it,



This is your Captain speaking... We are facing a slight technical problem... The good news is now you can enjoy the pleasure of glider flying...

ATC will have already developed a feeling of something going wrong.

There is no arguing that declaring an emergency is something that should be done as soon as that is the case, neither before, nor afterwards. What people from the ops room might sometimes ask for is a reasonably earlier involvement whenever rush moments don't spring abruptly, but instead gradually develop from some initial "early warning" signs, or through subsequent steps which evolve from a relatively insignificant anomaly into genuine distress. This already widely applies whenever such anomalies (the classic red light on the cockpit panel) imply unusual behaviour, such as the request to delay take-off after a twenty-minute taxi to "perform some checks". Otherwise, when there are no immediate outward consequences, the flight crew might simply not deem informing ATC to be a fitting action.

Seen from below, perspective changes a bit. Let us focus on the fact that we are not talking here about circumstances that could take place on the ground, such as a power failure in a control centre, or a full loss of surveillance data, which are commonly referred to as contingencies, and for which backups and recovery procedures are also in place; instead, this is about an on-aircraft crisis which the people on board have to cope with on the basis of their procedures, judgment and skill. What we are asked to do is to act on the remaining traffic, in order to avoid additional trouble, and to provide it with all possible assistance, which eventually means getting everything and everyone ready for a possible unfavourable outcome and, before that, passing on useful information to contribute to a happy ending. This information, such as the infamous nearest suitable airport, is something which it is nice,

whenever practicable, to have some extra time to look for.

In the case of the shipwreck, some "at first glance" elements may sound unpleasantly familiar: there is a problem, the crew tries to handle it and only when it overwhelms them is information spread outside. Once again, it makes sense, you do not declare an emergency for a mere trifle; in fact, the precise moment when MAYDAY needs to be called is sometimes obvious, sometimes hard to decide. Simply sharing pilots' concerns with those they may later on call for help could sometimes save the day.

This is not an invitation to 'cry wolf', nor to offload responsibilities. Relevant calls should be very explicit about the fact that no special assistance is needed thus far (unless it is), but not unnecessarily specific, merely pointing out that something non-routine is under scrutiny, and that the situation might potentially evolve into a higher degree of complexity. I guess any sur-

veillance controller would highlight that position indication and start considering who is below, what aerodromes are in the vicinity, and so on. In a future which is already here, we will talk much less on frequency, as information will flow on CPDLCs, Mode S downlink parameters and stuff like that; there, you are available for what may become very useful residual voice communications. If those who are asked for assistance are involved at the potential outset of the problem, they will be more aware and ready to assist; today's emergency team member on duty is the same guy who earlier gave an update on QNH, and there is really nothing to complain about. **S**

MAYDAY MAYDAY!!



The small technical

By Eileen Senger

Everyone knows it, everyone fears it: the “small technical problem”. The reason why we controllers fear it is because most of the time it is not what it is claimed to be: small. It grows. With every transmission we get more details that require action.

A very important factor during these situations is pilot-controller communication. In a technical emergency the pilots are usually so busy troubleshooting and working checklists that communication with ATC is some way

down their priority list. I was once allowed to witness a flight simulator emergency training session for the annual pilot check, and it was very impressive to see the workload they were confronted with.



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is an Air Traffic Controller at EUROCONTROL's Upper Area Control Centre in Maastricht. She works in the Hannover Sectors which cover north-western Germany and is an OGTL.

orities as well as possibly deal with the violation of active military airspace. In the case of an emergency descent it is more reaction than action, but it has to be coordinated, sooner or later.

Usually, “small technical problems” aren't small technical problems. Pilots seem to have a tendency to play down the significance of the problematic situation they find themselves in, God knows why. Whenever I hear those key words, I go to red alert. I make sure no aircraft is passing right underneath that other aircraft. I pick up my pen and blank sheet of paper. I pick up the telephone without dialling. Because 95% of the time the next transmission of that aircraft will be “...request immediate descent”, “...request diversion to XXXX” or sometimes a very technical description of the once small problem that now requires a lot of questions and explanations back and forth for

a non-pilot to understand.. And of course to be able to communicate it to the next unit so that they understand as well.

Over the years I have also got the feeling that pilots try to avoid having to declare an emergency for as long as possible. The trouble is that without emergency status, it becomes rather difficult to coordinate good direct tracks or arrange priority landing, and no transit through active military areas is possible.

Probably all of us have witnessed a situation where we look in disbelief at our colleague with the “did he really say that?”- question mark on our face. “Radar, we have a woman giving birth

They have a plane to fly plus have to go through all the paper work. Plus communicate with their crew and ATC. But we can only help if we know what is going on, if we get proper information and know their intentions. Then we can coordinate, in serious emergencies even two controllers in parallel on the phone to different units, to find shortcuts and set pri-



problem...

on board, do you have any tips or maybe a doctor you could call?" – "Eh..." I guess there is no training for such situations. All one can do is use common sense. No, we don't have a doctor hanging around the operations room for situations like this. ATC cannot solve every problem. But how about a diversion to get mother and child on the ground as quickly as possible?

And after the situation is over? After these few very intensive minutes have passed and the aircraft is handed over to the next unit, the mind starts spinning. We take a deep breath and try to understand what has just happened to us. Some of us are able to continue working on the position, some need a break and some need professional help. Luckily, nowadays CISM is widespread in ATC and it is generally accepted that people need help and that

help should be provided promptly. A change of culture has taken place and it is not considered a weakness anymore to admit problems and to ask to be relieved and supported by CISM peers.

After these few very intensive minutes have passed and the aircraft is handed over to the next unit, the mind starts spinning. We take a deep breath and try to understand what has just happened to us.

But what about the men and women on the other side, on the flight deck? First of all, they experience a greater range of abnormal situations than we do as controllers. A TCAS RA may look very serious to us, to them it may be

just following another procedure (unless the other plane gets so close that they can see it and judge it). Then again, the death of a person onboard seems abstract to us, to them it may be shattering.

They cannot just unplug the headset and get relieved, they first have to complete their flight and land their plane. A long-haul flight may have to continue as planned to destination, sometimes for many more hours. There may be operational pressure not to disrupt the schedule with a diversion even if the pilots consider themselves unfit to continue their duty after touchdown.

But their minds must sometimes be spinning as well! They must suffer from critical incident stress every now and then just like controllers do. They can chat a bit with the colleague next to them about it but when one of them is hit by a reaction to heavy stress, there is not much one can do. All of us who have witnessed a colleague having to go through this know how much this affects even the observer.

Still, when I tried to find out from the web if airlines have CISM programmes at their companies, I found nothing. In Germany there is the "Stiftung Mayday", an independent foundation which provides support to pilots and their relatives in difficult situations. Interestingly though, they state that the majority of their interventions were the consequence not of airborne situations or emergencies but of people passing away during their time on board. Some German airlines like Lufthansa or TUIfly cooperate with them. This organisation provides CISM to anyone calling their hotline, but they have a response time for first contact (usually via telephone) of up to six hours. Logistically it makes quite a difference to have a CISM peer present in an air traffic operations room or at major centres, not to mention in smaller units or even abroad. But this cannot be done when working with a team of volunteers in their free time. I must say that I had expected that at least the big airlines would have such a programme in place at their main hubs. Maybe the shift in awareness and attitude towards critical incident stress that struck ATC in Europe after the Überlingen midair collision still has to take place in the flying industry. **S**



It all went quiet

By Harry Nelson

Many years ago, during a routine military training flight during my RAF service, it all went quiet for me and my crew.

We had been chosen to take part in a bombing competition against the might of the USAF. Our aircraft was the Avro Vulcan Mk 2 powered, at least at the start and end of the story, by four Rolls Royce Olympus 301 engines. The exercise in which we were engaged was called a "timing and tracking run". It involved the pseudo-bombing from high altitude of two targets each 20 nm apart. The run was measured by a military radar ground unit which looked after the "bomb scores". The scoring system awarded 5 points for each nautical mile between the two targets when within 100 metres of the bombing track line, 4 points if within 200 metres and so on until outside 500 metres one scored a zero. Clearly, the maximum score possible was 100 points per run, (20 x 5) but, and it was a big but, the aircraft also had to be on time to a very strict timing limit.

This exercise created a pretty high workload situation for the crew and as we worked up for the competition, we

developed a classic division of duties which involved myself looking after the tracking aspects whilst working closely with the radar bombing navigator and my co-pilot looking after the speed control whilst taking the timing from the plotter navigator. All was proceeding well until I heard a loud call from the plotter announcing that we were "20 seconds too early". My co-pilot who was already quite tense and gripping the throttles, immediately throttled back and as he did so he unintentionally closed the HP (high pressure) fuel cocks on all four engines. Yes, it went very quiet!

I should say at this juncture that the HP cocks were operated as the outer sleeve of the throttles and, with time, the spring loading which was designed to protect against their unintended operation had become weak and therefore overcame the design safety criteria.

The fifth crew member that day was the Air Electronics Officer (AEO). He was a laconic individual and certainly was not one to get upset easily, but on this occasion his voice was the first to speak. He normally called me 'Skip' or some other less polite name but on this occasion I heard loud and clear, "Harry we have a problem". He was looking at a bank of warning lights on his generator panel and he was right.

We did indeed have a problem.

I took control of the aircraft and remember well my first thoughts. I must keep the speed up by descending to keep the Ram Air Turbine (RAT) working. It had dropped automatically as per design. The RAT would provide us with the necessary power to control the aircraft whilst we attempted relights. My second thought was, "which way do I turn for the nearest airfield? Without being aware then of the now famous mantra, I was indeed flying, navigating and later would also be communicating. In fact, by chance our nearest airfield was ahead of us and well within gliding range of our aircraft. Luckily, it was not needed as I also managed to get some fingers stuck into the ends of the throttles whilst opening them up and hit three of the four quick relight buttons. My co-pilot hit the final one and together, we were successful in regaining three out of the four engines – sufficient to continue.



Harry Nelson has had a flying career spanning some 46 years which has focussed on flying training and test flying as the two main activities. A graduate of the Central Flying School and the Empire Test Pilots School he has operated in all parts of the world and worked at 5 flight test centres throughout Europe ending up in Airbus where he now holds the post of Executive Operational Advisor to Product Safety. He has over 10000 flight hours on over 76 types of aircraft.

Our air traffic controller, being a sharp guy, came on the ether and demanded to know why we were descending, at which point I had a difficult decision to make. Dear reader, please remember that this was the "V Force" and they did not take lightly such mistakes and errors. Therefore, I am quite proud of my instinctive response which was that we had "suffered a pressurisation problem" which indeed we had. You do not have much pressurisation when the engines are not working, so whilst telling a hopefully forgivable white lie, I tried to save us all the formal embarrassment of what would surely follow plus all the beers we would have to buy in the bar later when the other crews discovered our story.

So what is this story all about and why do I tell you it now? This whole tale came to mind not long ago when I had the chance to talk to Captain Sullenburger following his amazing landing on the Hudson, which I was able to discuss with him. One of the most interesting questions is what, if any, real assistance ATC can provide under such circumstances and he shared with me his immediate need for directional assistance to the nearest airfield. The first turn is critical if you are at low altitude. It can make the difference of making it or not. In his case he was indeed too low and chose a well known alternative. In my case, I was higher and was able to regain the power I needed to land normally. Had my engines not re-lit immediately, I know that the key information I would have needed was – what is my nearest suitable airfield, what are the weather conditions there and what is their contact frequency.

In the Hudson story I was incredibly impressed by the controller's reaction and the determination to assist as much as possible even faced with an apparent change in plan. In the end it reached a point where Captain Sullenburger was rightly so focused on flying the last part of the approach to the water that he was unable to respond to the final offers of assistance.

the time it did not seem that way! Certainly, Captain Sullenburger had much less with his 3mins and 31 seconds of flight ahead of him, which only goes to show what a remarkable performance it was, not just from the crew perspective but also from the controlling team who assisted him.

There were two post scripts to my own story. The first happened many years later when I was having a beer in some hotel bar and was joined by another pilot. It turned out he too had flown Vulcans and after a couple more beers he decided he wished to make a "confession to me". Yes, you have guessed it, during a routine landing his co-pilot had inadvertently shut down all engines, in this case as he flared to land, just as my own co-pilot had done. With some considerable shame and much more wisdom than I had then I confess that neither of us had declared our respective experiences with the result that this design weakness continued and probably there are other guys out there somewhere who can tell similar stories. The need for a non-punitive culture could not be better demonstrated.

The second post script was that as we dropped from 40000ft to about 25000 in our "de-pressurised" emergency we "fell" straight ahead through the timing and tracking box, but there was no limit on the height accuracy, so we ended up achieving one of the best bomb scores we had all season for that exercise. Some days you get very lucky!!

If ever you are faced with an aircraft which has lost all useful engine power, it is necessary for the controller to imagine the workload in the flight deck under such circumstances and to mentally put himself or herself there alongside the crew. Initially, following such a failure, there is quite a lot to do to stabilise the emergency. In priority order:

- Establish a glide descent at the right speed. Normally, crews will know the speed to fly but will probably not have an instinctive idea of the glide rate which can vary quite a lot depending on the nature of the engine failure(s) and the configuration of the aircraft.
- Head in the right direction. This is where a good controller can surely assist and it helps if that controller also knows the weather situation at any potential suitable airfield.
- Get on with the drills and procedures that may improve the situation. Here again the controller can assist by being aware and rather than trying to "over control", leave the crew to get on with their work of systems recovery.

Of course the biggest variable is always the likely time available and this is dictated normally by the height at which all this starts. In my case we had lots, although at



Emergency and unusual situations – whose world view?

We have always known that wise people learn from their mistakes and that all groups of specialists, from medical surgeons to elite athletes, can relate how, when things go wrong, they learn from reviewing the circumstances of their actions...

The grand slalom skier who misreads a turn through a gate and tumbles down the side of the run, the Olympic diver who mis-times their exit from a multiple twisting somersault, and the rally driver who trusts in the friction of their high performance car on a slippery road, all reflect on the moment they lost control. At the point that the pre-programmed motor sequence of these highly skilled actions is being executed, the human has little to do but wait for the outcome. In the examples above, the sequence of motor programmes has been disrupted by inputs which were adaptive: weighting too much on one ski, initiating the twist a nanosec-

ond too soon and compensating for a wet surface too late. What few people realise is that the brain will now have learnt another slightly different sequence from the original motor programme, which it will match to the new context if the same circumstances are encountered. I will return to this later in this paper.

These are all examples of split-second adjustments made when things go wrong, but what of the situations in aviation, with which we are typically more familiar, and in which we often have a slightly longer time frame to recover? Interestingly, humans usually have a similar response to unusual or emergency situations and these follow a set pattern – indeed they can be found in any traumatic response. Firstly we may have a shock or startle reaction. The strength of this will depend on both the individual involved and on how many times they have encountered this situation before. At this point we will suspend belief, for a moment (classically we look to any other person in the direct vicinity for confirmation that what has just been experienced is shared).

Once it has been established that something has indeed gone wrong, we attempt to compare the situation with past experiences and start a se-

quence of pattern matching and decision making. It is at this point that the brain defaults to the situation explained above, and the outcome often relies on the quality of unusual circumstance and emergency training, experience and the ability to accept what the facts of the situation are rather than what we would like them to be.



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pilot/controller interface in NATS, UK. She gained her PhD in Cognitive Neuropsychology at Otago University in New Zealand. Her previous work has been in the development of incident investigation tools and techniques in European ATM, the introduction of TRM into the ATC environment and the introduction of Day to Day Safety Surveys techniques into NATS. She has written several book chapters, academic papers and the book *Air Traffic Control: the human performance factors*.



This final response is a very strongly developed behaviour which promotes survival in extreme situations, but this behaviour often leads us to ignore the unusual facts in favour of disbelief since we want and need a safe outcome.

Knowing how humans respond to unusual or emergency situations has led airline manufacturers to support crews with emergency protocols which support their decision-making and can eliminate failures in a systematic manner. This leads to a more comprehensive approach

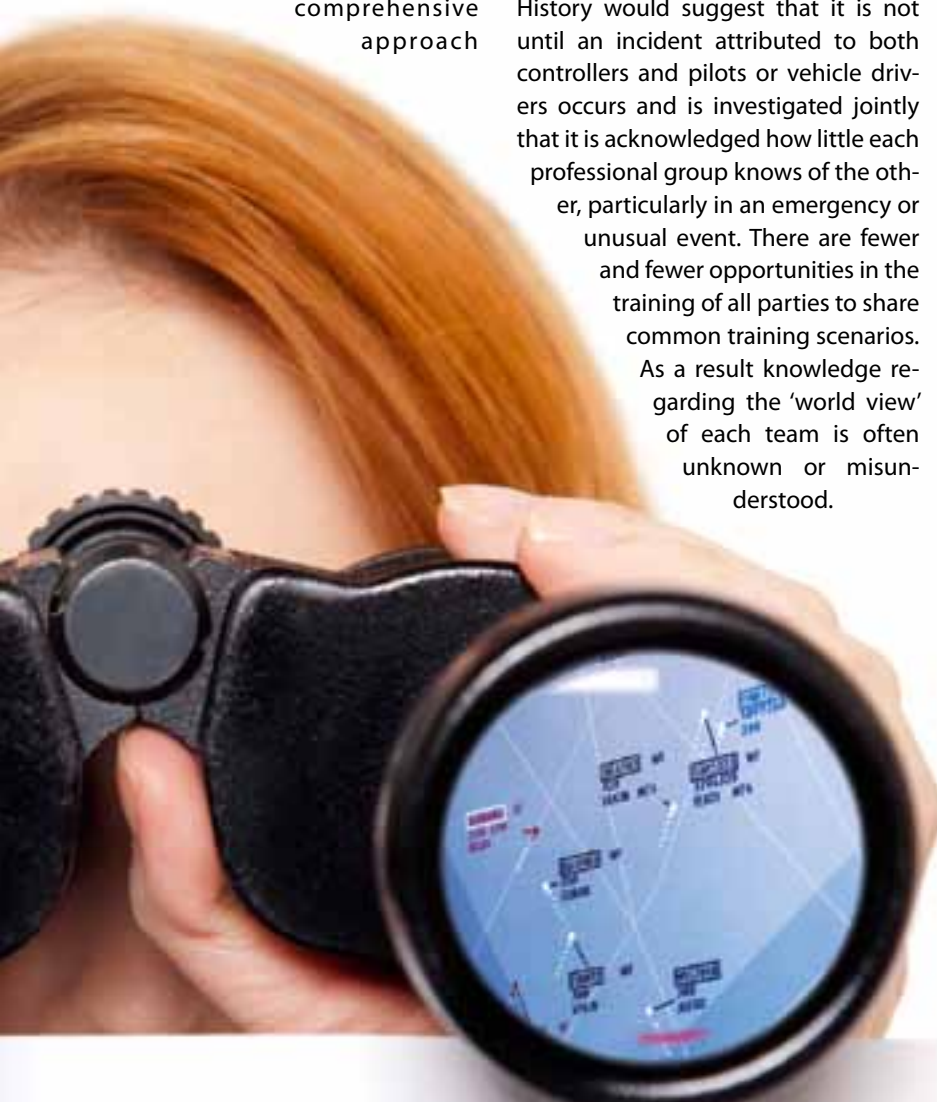
to tackling these situations and, typically, supports a safe and expeditious outcome. However there will still be examples in which highly trained crews simply don't believe the indications from instruments and tragically their training, as individuals or crews, leads them to disbelieve what is presented to them. In extreme cases they may even ignore the warnings. In the air traffic environment checklists are less evident; however, training in unusual circumstances and emergencies is practiced with regular periodicity.

History would suggest that it is not until an incident attributed to both controllers and pilots or vehicle drivers occurs and is investigated jointly that it is acknowledged how little each professional group knows of the other, particularly in an emergency or unusual event. There are fewer and fewer opportunities in the training of all parties to share common training scenarios. As a result knowledge regarding the 'world view' of each team is often unknown or misunderstood.

But first we need to appreciate the different 'world views'. A controller's responsibility is focussed on separation of individual aircraft (although often they will consider aircraft in pairs or in some cases multiple pairs); however, they have many of these to consider and as such, arguably, their world view is a 'many to one' dynamic. By contrast, pilots are responsible for the safety of their aircraft and as such their flight is associated with a 'one in many' dynamic. Both the controller and the pilot seek the same safe outcome but their perspectives or 'world views' will differ and as such their priorities may be misunderstood, especially in an emergency.

Both the controller and the pilot seek the same safe outcome but their perspectives or 'world views' will differ and as such their priorities may be misunderstood, especially in an emergency.

One way to support a better understanding of these two professional groups is to put them together in a facilitated workshop to explore the issues faced by each team in unusual and emergency situations. At NATS, our considerable experience of Multi-Crew Resource Management workshops¹ has included the following discoveries:



What PILOTS should know about CONTROLLERS:	What CONTROLLERS should know about PILOTS:
<ul style="list-style-type: none"> ■ The priority for controllers is to <ul style="list-style-type: none"> - communicate - calculate - coordinate 	<ul style="list-style-type: none"> ■ The priority for pilots is to <ul style="list-style-type: none"> - aviate - navigate - communicate
<ul style="list-style-type: none"> ■ Although controllers will probably have more emergencies in their shift cycle than pilots, they remain uncertain if they are not given what they perceive as essential information. Their priority in an emergency is to move any conflict traffic, which means their workload increases in the area of communication and coordination. A good example of these different priorities can be heard in the last R/T exchange from the US Airways A 320 aircraft which ditched in the Hudson River. 	<ul style="list-style-type: none"> ■ Many airlines use an emergency acronym to brief flight-deck and cabin crews which helps simplify the communication exchange. One example is the use of a NITS brief which includes – <ul style="list-style-type: none"> - Nature of the problem - Intention - Time needed – to sort out the problem - Special instructions if required ■ The priority for the pilots, depending on the emergency, is to fly their aircraft and inform their crews about intended decisions. Often ATC is low on their priority in the first minutes of the emergency.
<ul style="list-style-type: none"> ■ Selecting 7700 helps controllers to identify aircraft which need ‘special attention’ or have an emergency. Controllers will treat all 7700 squawks as needing priority and arrange their traffic accordingly. The other advantage is that the 7700 squawk is also ‘seen’ on radar by all controllers throughout their airspace, which increases their situation awareness and readiness to assist. 	<ul style="list-style-type: none"> ■ At all times, but particularly in an emergency, pilots prefer to be given distance information – in miles, not periods of time – in minutes ■ Pilots have advised that they find it very helpful to receive ATC guidance that is prefixed or suffixed with the statement “when able”
<ul style="list-style-type: none"> ■ Controllers will assume pilots will announce “PAN PAN” for special attention regardless of the outcome. Controllers will assume pilots will announce “MAYDAY MAYDAY” when requiring immediate support. Both ‘PAN’ and ‘MAYDAY’ announcements carry almost equal attention and the controllers will allocate a dedicated controller and frequency if required. 	<ul style="list-style-type: none"> ■ ‘PAN’ and ‘MAYDAY’ does not necessarily mean a pilot needs immediate landing or the nearest airfield. ■ Pilots also advise that in most unusual or emergency situations they prefer to be given airspace to sort themselves out. The only exception is an explosive decompression or smoke/fire in the flight-deck or cabin.

COMMON INFORMATION FOR BOTH CREWS/TEAMS:
<ul style="list-style-type: none"> ■ At all times, but particularly in an emergency, the ‘world view’ of the two crews/teams differs. This clearly dictates the priorities of the two parties and therefore the reason these situations can be difficult to manage. In these situations each team can lose overall situation awareness of the other team and this may introduce unwanted communication, and this uncertainty may increase stress for each team. ■ In emergency situations, which require an immediate climb/descent, each airline (and often different fleets within the same airline) may fly a profile not anticipated by the controller. Some pilots prefer a straight ahead climb/descent and some prefer a turning descent. What an airline/aircraft type requires and what controllers expect they want, or will do, are often completely different.

1- Multi-Crew Resource Management is a workshop which is facilitated by TRM facilitators together with CRM instructors and focuses on a discussion regarding the interface risks found between pilots and controllers. The participants are made up of a mixture of pilots from different flying disciplines and controllers who also have different controlling experience.



“Although expert decision makers may make small errors, they generally avoid major mistakes. They seem to have discovered that for many decisions, coming close is often good enough: the key is not to worry about being exactly right, but to avoid making really bad decisions.”

Finally, let us return to the phenomena of motor programmes and the recognition of unusual or emergency situations. The response of the brain, and the consequent behaviour, is always a result of experience and expertise. Once any professional has learned the basic skills, rules and procedures of their work they will have sufficient knowledge to work in a normal situation. However, once an unusual or emergency situation is presented, the person will be limited in their response and also subject to several decision-making, behavioural biases. These include any of the following:

- **Frequency bias:** The risk of an event occurring is almost always over or under evaluated because evaluation is based solely on reference to personal experience;
- **Selectivity bias:** This occurs when, as we select information, our preferences lead to a strong tendency to select a restricted core of facts;
- **Familiarity bias:** This is a tendency to choose the most familiar solution, even if it is not the optimum solution for the situation;
- **Conformity bias:** This happens when we look for results which support our decision rather than information which would contradict it;
- **Group conformity:** This is a bias due to group pressure 'Group Think' and/or a tendency to agree with a majority decision.

We can recognise all of these decision-making biases in aviation accident reports both in Europe and beyond. It is therefore essential that all flight crews and teams are exposed not only to 'normal' unusual or emergency situations, but also to the recovery from unexpected and unforeseen situations. This has become even more important since both professional groups are increasingly exposed to highly automated systems demanding more monitoring and perhaps less 'hands-on' collaborative activity. 

As on nearly every manned flight since 1965, lift-off of Apollo 12 went smoothly – but only until seventy-eight seconds after ignition when, unknown to anyone, including the astronauts on board, the booster was struck by lightning. Pete Conrad radioed down the alarming news that the bottom had fallen out of nearly every reading on every electrical system aboard his ship. In the seconds following in which the abort decision would have to be made, John Aaron in Houston took another look at his screen and noticed that the readings on the console were showing about 6 amps, well below what they should have been, but well above the zero that would be expected if the system had truly failed. It had been a few years earlier, when he was monitoring a simulated countdown of another mission, when he had seen a similar pattern as the rocket accidentally tripped the circuit breaker on its telemetry sensors. In a split second, and with conformation from flight command, John Aaron pushed the reset switch and instantly the numbers were restored.

Minutes later Apollo 12 was in Earth's orbit and went on to complete a successful mission to the moon.

Lovell & Kluger, 1994.



THE NEW BEAUJOLAIS HAS

TCAS II version 7.1 has arrived

by Stanislaw Drozdowski

New "Level off, level off" RA

“My article in the July 2007 issue of *HindSight* about TCAS mentioned a forthcoming change to TCAS II the introduction of the new version 7.1. After an admittedly rather lengthy process, a regulatory decision was published on 20 December 2011: all existing TCAS II version 7.0 installations must be upgraded to version 7.1 before 1 December 2015 and new aircraft must be equipped with version 7.1 from 1 March 2012 if operating in European airspace¹. The first aircraft equipped with version 7.1 are probably already operating in the skies above us, so it is important to understand the effect on ATC operations which the new version will have.

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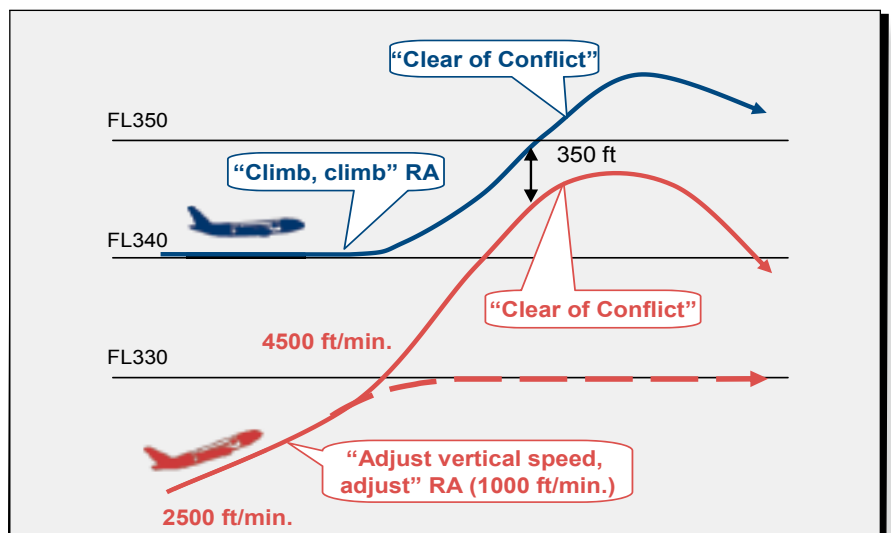
1- The European version 7.1 mandate sets earlier equipage requirements than those published by ICAO (1 January 2014 – new installations, 1 January 2017 – existing units).

The development of version 7.1 was initiated by EUROCONTROL following the discovery of two safety issues with the current TCAS II version 7.0. Since its introduction in Europe in 2000, TCAS II has been the subject of monitoring. In the course of analysing recorded and reported events, many cases were found in which pilots did not respond correctly to the "Adjust vertical speed, adjust" Resolution Advisories (RAs). In a few of these cases a midair collision was avoided by chance.

The "Adjust vertical speed, adjust" RA requires the reduction of vertical speed to 2000, 1000, 500, or 0 ft/min., as indicated on the flight instruments. In those cases involving an incorrect response, the pilots increased their vertical speed instead of reducing it, consequently causing a deterioration of the situation. This is currently the most common RA, representing up to two-thirds of the total RAs.

Additionally, there have been numerous cases of level bust when pilots following the "Adjust vertical speed, adjust" RA went through their cleared level, often causing a follow-up RA for the other aircraft above or below, and disrupting ATC operations.

In version 7.1 the "Adjust vertical speed, adjust" RA is replaced with a new "Level off, level off" RA. The new RA always requires a reduction of vertical rate to 0 ft/min, i.e. a level off which needs to be achieved promptly, not at the next standard flight level (e.g. FL 200, FL 210, etc.). The "Level off, level off" RA may be issued as an initial RA or as a weakening RA following, for instance, a "Climb, climb" or "Descend, descend" RA as the vertical distance between the aircraft increases due to the initial response taking effect.



ARRIVED

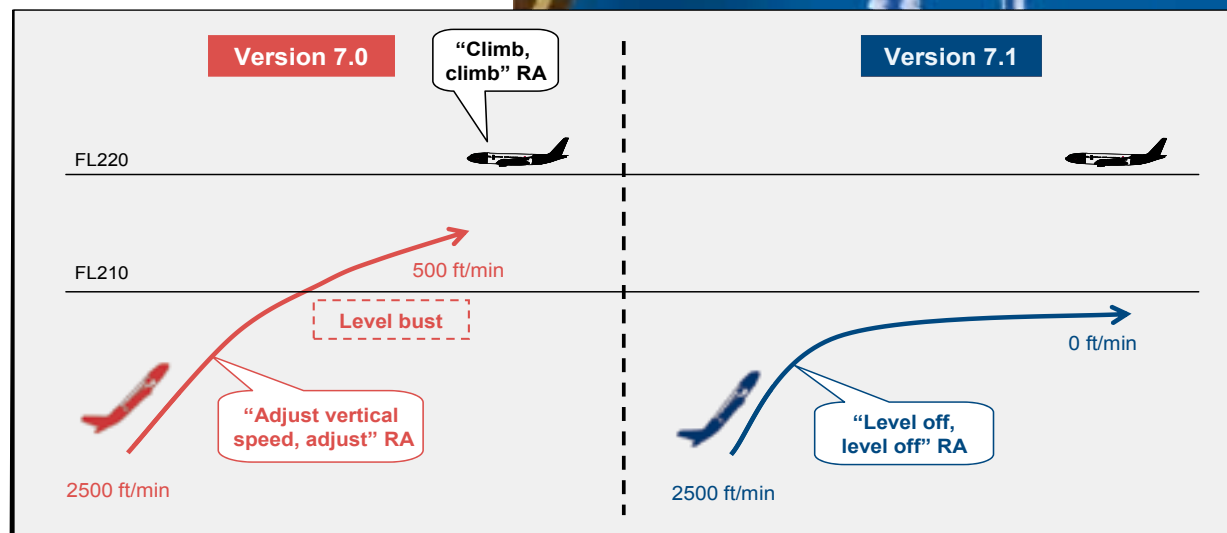
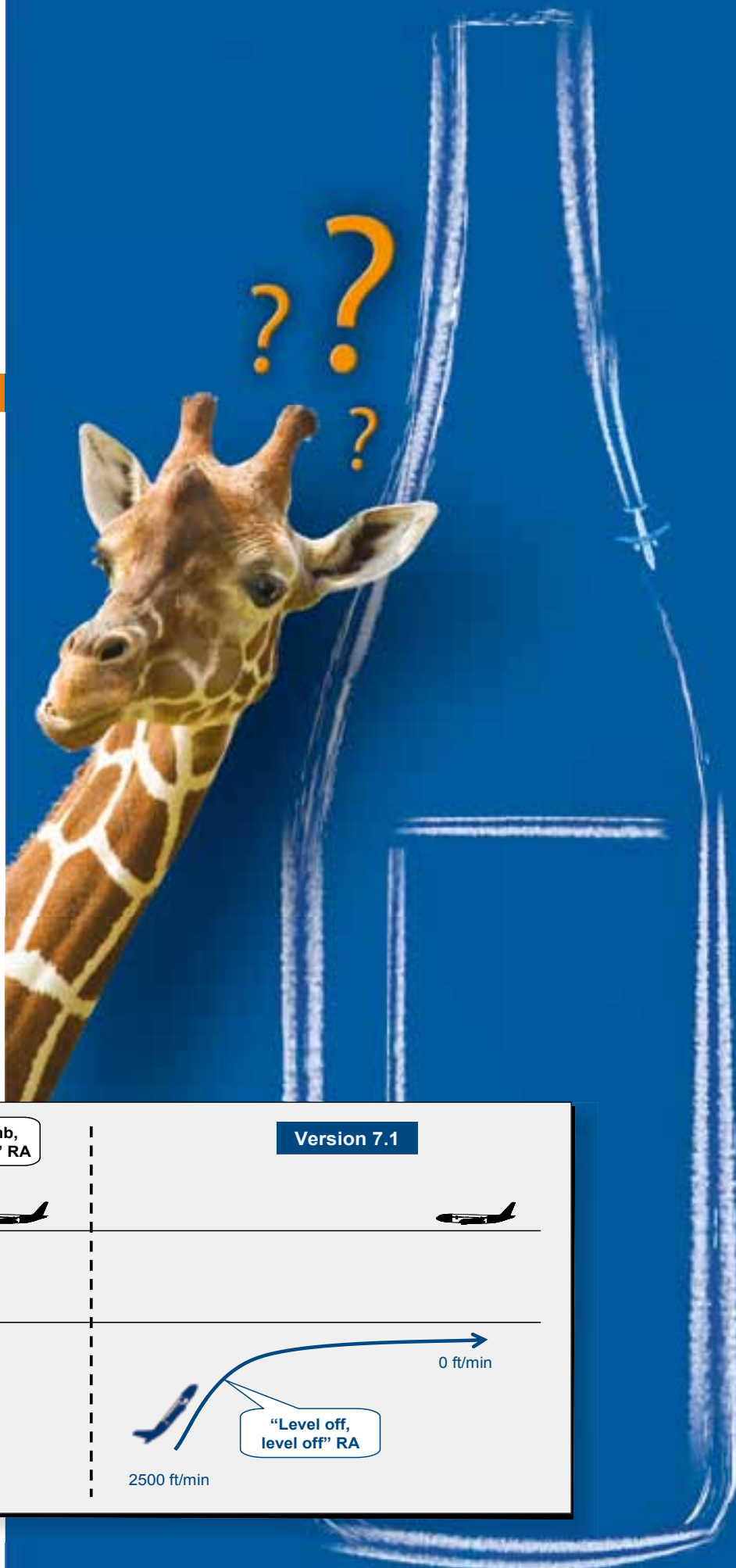
The new RA will have an effect on

ATC operations:

aircraft may level off hundreds of feet before the cleared level when responding to the "Level off, level off" RA.

At this point, I can see many air traffic controllers getting concerned that an aircraft leveling off hundreds of feet before its cleared level may get into a conflict with third aircraft.

This issue was considered during the design stages of version 7.1. The decision to replace the "Adjust vertical speed, adjust" RA with the new "Level off, level off" RA was preceded by detailed analysis of events and radar data from several places in Europe and from two busy TMAs in the USA. The radar data analyses indicated that the new RA will not cause secondary conflicts with third aircraft more frequently than occur with the current version of TCAS. The new RA is also expected to contribute to an overall reduction in the number of RAs because follow-up RAs should not occur any more.



TCAS II version 7.1
has arrived (cont'd)

Improved reversal logic

A second change is also introduced in version 7.1 – improved reversal logic, which is also expected to enhance safety. This change is transparent to controllers and pilots.

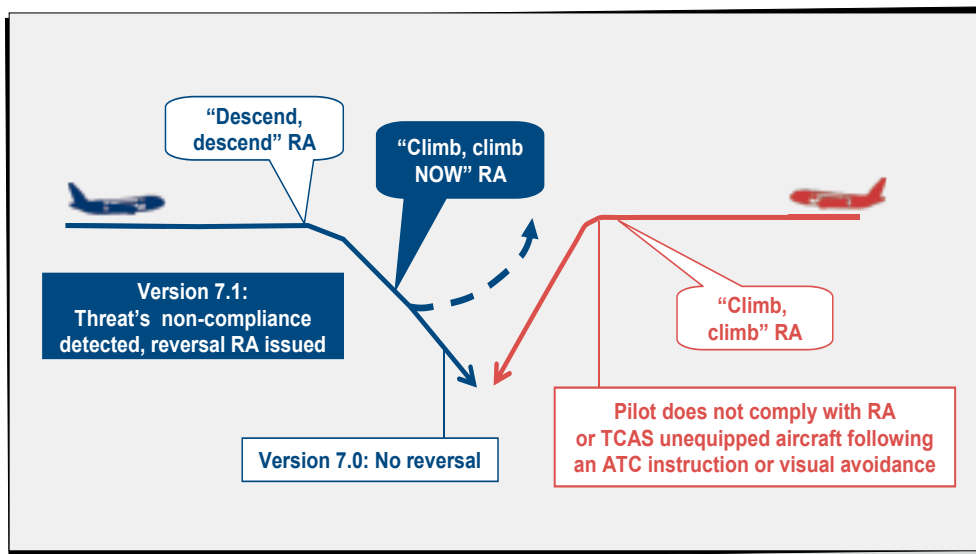
Version 7.0 allows reversal RAs (i.e. “Climb, climb NOW” and “Descend, descend NOW”) to be issued when the current RA is no longer predicted to provide sufficient vertical spacing.

However, there have been cases in which a reversal RA failed to occur when two converging aircraft remained within 100 feet of each other. This scenario can occur when one aircraft is not following the RA properly or is not TCAS II equipped and follows an ATC instruction or performs an avoidance manoeuvre based on visual acquisition. Significant examples of such events include the Yaizu (Japan) near midair collision (2001) and the Überlingen (Germany) midair collision (2002).



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is an ATM Expert at EUROCONTROL HQ in Brussels, working in the area of ground and airborne safety nets. Previously, he worked as a system engineer with Northrop Grumman and as an Air Traffic Controller in Poland and New Zealand.



The new version 7.1 is compatible with all existing versions being operated today, both version 7.0 and version 6.04a (which is still in use by some aircraft, mainly outside Europe). There is therefore no need for ATC to know which version of TCAS II the aircraft operates because proper TCAS-TCAS coordination is taking place in all coordinated encounters.

Version 7.1 improves the reversal logic by detecting situations in which, despite the RA, the aircraft continue to converge vertically. A feature has been added to the TCAS logic which monitors RA compliance in coordinated encounters (i.e. when both aircraft are TCAS II equipped). When version 7.1 detects that one of the aircraft is not responding correctly to an RA, it will

issue a reversal RA to the aircraft which is manoeuvring in accordance with the RA on the basis that it is this aircraft which is more likely to respond correctly to a reversal RA.

In single equipage encounters (i.e. when only one of the conflicting aircraft is TCAS II equipped), version 7.1 will recognise the situation and will issue a reversal if the unequipped threat aircraft moves in the same vertical direction as the TCAS II equipped aircraft.

Compatible versions

Until the whole fleet of aircraft operating in European airspace has been upgraded, conflicts will occur between aircraft using different versions of TCAS II. The new version 7.1 is compatible with all existing versions being operated today, both version 7.0 and version 6.04a (which is still in use by some aircraft, mainly outside Europe). There is therefore no need for ATC to know which version of TCAS II the aircraft operates because proper TCAS-TCAS coordination is taking place in all coordinated encounters. In fact, ATC does not need to know whether the aircraft is TCAS equipped or not or is operating with TCAS temporarily inoperative (as allowed under Minimum Equipment List exemptions), because the provision of air traffic services to aircraft equipped with TCAS shall be identical to those that are not equipped.

17 minutes

Smoke from an onboard fire is likely to contain toxic substances that irritate the skin, eyes and respiratory system. Furthermore, the two main smoke gases, carbon monoxide and hydrogen cyanide, are very rapidly disabling if breathed in. Smoke can therefore quickly incapacitate the crew unless they wear goggles and breathe 100% oxygen. Smoke also reduces visibility, making it difficult, if not impossible, for the crew to see instruments or see out of the window. In such circumstances, a crew can become disorientated, lose situational awareness and then lose control of the aircraft.

Many airlines conduct smoke training sessions where, for example, crews are given experience in locating and fighting simulated fires, while wearing breathing apparatus, in a smoke filled cabin.

Many years ago now, I participated in such a smoke evacuation exercise. Sat on the flight deck in a very controlled environment, entirely pre-briefed, thick white smoke was pumped into the aircraft, quickly reducing visibility. We carried out immediate actions, donned smoke goggles and oxygen masks, set oxygen to 100% with over-pressure, and then checked communications with the rest of the crew. There was no immediate evacuation; we were encouraged to consider how the reduced visibility and the wearing of masks and goggles might affect performance.

With mask and goggles on, it's like being in a separate world. You look out at the scene around you as if through a window. That separate world is dominated by the sound of your own

breathing and you have an increased sense of self-awareness and alertness, possibly because of that enclosed feeling and possibly also because of the increased levels of oxygen and adrenalin in the blood stream.

Because of the oxygen masks, the voices of other crew members are slightly muffled and your own voice sounds as if it is coming from somewhere else, just like it does when you have a heavy head cold. Add to that the reduced visibility, and there is a sense of detachment and isolation. In a benign environment, such as an exercise, when there is no actual threat, it is actually quite relaxing and in similar training I have noticed how many people have their eyes closed.

In the reduced visibility, it becomes increasingly difficult to read instruments. The mask and goggles also restrict the field of vision. Warning lights and popped circuit breakers go un-noticed. Radio calls are missed. Calls from other crew members are misunderstood. Calls you make to other crew members get no response.

Situational awareness gradually deteriorates.

If the aircraft is on the ground, then evacuation is the best option. Evacuating a smoke filled aircraft requires concentration. You have to feel your way out based on a model of the aircraft in your mind – much as a blind person does every day of their lives. You have to take care not to acciden-

UPS flight 006, en route from Dubai to Cologne, recently levelled off at FL320 when the crew advised ATC that the fire warning systems for the cargo compartments indicated an onboard main deck fire and advised ATC that they needed to land as soon as possible. *

ATC advised the crew that Doha International Airport was at the 10 o'clock position at 100 nm. Although Doha was closer, the Captain elected to return to Dubai and the crew declared an emergency.

3 minutes after the first alarm bell, the flight crew put on their oxygen masks and goggles. The crew experienced difficulties communicating via the intercom with the masks on.

5 minutes after the first alarm bell, the Captain told the Co-Pilot to pull the smoke evacuation handle and advised ATC that the flight deck was "full of smoke".

7 minutes after that first alarm bell, the Captain declared a lack of oxygen and left his seat, possibly to get a portable oxygen bottle, but he did not return.

9 minutes after the first alarm bell, the Co-Pilot advised ATC that he would remain on the Bahrain frequency, as it was not possible to see the radios.

14 minutes after the first alarm bell, the Co-Pilot asked for radar guidance due to difficulty viewing the instruments...

Smoke from an on board fire reduces visibility and can be very rapidly disabling

tally breathe in any smoke – not so easy if you've disconnected from the aircraft oxygen system.

I have had the misfortune to experience 3 smoke events whilst on an aircraft, 2 of them while airborne.

In the worst case, while flying as a competition judge on a Canadian Forces CC130 at 250 ft AGL, thick white smoke began pouring out of the overhead panel. Being so close to the ground, the loss of visibility clearly represent-

17 minutes (cont'd)

ed an immediate threat to the safety of the aircraft. The Captain opened his side window and someone, possibly me but I can't remember, opened the roof escape hatch. The impact on visibility on the flight deck was instantaneous – the smoke disappeared completely – there was a lot of noise but the pilots could now see. Of course, opening the windows is not an option at FL320.

I recall the flight engineer being busy attempting to isolate the source of the smoke but to no avail – it later transpired that the source of the smoke was an autopilot unit under the flight deck and the smoke was working its way up behind the panelling before entering the flight deck from above. It is worth noting that many flight crews experiencing a smoke event may never succeed in identifying the source of smoke and any associated fire in the time available to them. While it is of course important to make every effort to isolate the source of the smoke and fight the fire, the top priority is to get the aircraft on the ground as soon as possible.

Luckily, we were just 10 nm to the south of the nearest airfield. I recall that the radio call I made did not adhere to standard phraseology but ATC certainly got the



John Barrass

served for 20 years in the UK Royal Air Force and Canadian Forces in a variety of flying, instructional, and command appointments before becoming an aviation consultant.

John has worked on most of EUROCONTROL's safety enhancement initiatives and is the current editor of SKYbrary.

Articles on SKYbrary relating to the events and issues discussed above:

http://www.skybrary.aero/index.php/Smoke_Gases

http://www.skybrary.aero/index.php/In-Flight_Fire:_Guidance_for_Flight_Crews

http://www.skybrary.aero/index.php/In-Flight_Fire:_Guidance_for_Controller

[http://www.skybrary.aero/index.php/B744,_en_route,_Persian_Gulf,_2010_\(AW_FIRE\)](http://www.skybrary.aero/index.php/B744,_en_route,_Persian_Gulf,_2010_(AW_FIRE))

message. ATC reacted quickly to our emergency call. Although the active runway was 24, we were given immediate clearance to land straight in on Runway 36. We were on the ground within 6 minutes of the first signs of smoke and probably in the bar within another 6 minutes.

It's all about time. Crews need to develop a mindset that, following any indication of fire, an immediate landing is essential.

Masks, goggles, hoods and oxygen provide protection from the effects of smoke. Depressurisation, and opening flight deck windows, vents and hatches, help to clear the smoke, and there are devices available to improve visibility on a smoke filled flight deck. However, an aircraft oxygen system has finite capacity. It was not uncommon in my experience for the portable oxygen bottles to become exhausted well before the time advertised – masks leak, people breathe more heavily when engaged in physical activity, and oxygen bottles may leak between periodic servicing, etc.

An on board fire can affect aircraft systems and the structural integrity of the aircraft leading eventually, and inevitably, to loss of control

A fire in the air can affect aircraft systems and the structural integrity of the aircraft – out of control, a fire will eventually result in loss of control.

On 11 May 1996, a fire broke out on board a ValuJet DC9. The fire damaged the aircraft flying controls before the crew were able to land the aircraft and it crashed in the Florida Everglades. All of the occupants were killed. The first indications that the crew had were an unusual sound followed swiftly by major electrical problems and physical signs of fire. Little more than 3 minutes after those first indications of a fire, the aircraft crashed.

On 2 September 1998, while cruising at flight level 330, the crew of Swissair Flight 111 smelled an abnormal odour in the cockpit. Their attention was then drawn to an unspecified area behind and above them and they began to investigate the source. Whatever they saw initially was shortly thereafter no longer perceived to be visible. They agreed that the origin of the anomaly was the air conditioning system. When they assessed that what they had seen or were now seeing was definitely smoke, they decided to divert. They initially began a turn toward Boston; however, when air traffic services mentioned Halifax, Nova Scotia, as an alternative airport, they changed the destination to Halifax International Airport. While the flight crew was preparing for the landing in Halifax, they were unaware that a fire was spreading above the ceiling in the front area of the aircraft. About 13 minutes after the abnormal odour was detected, the aircraft's flight data recorder began to record a rapid succession of aircraft systems-related failures. The flight crew declared an emergency and indicated a need to land immediately. About one minute later, radio communications and secondary radar contact with the aircraft were lost, and the flight recorders stopped functioning. About five and a half minutes later, the aircraft crashed into the ocean about five nautical miles southwest of Peg-

gy's Cove, Nova Scotia, Canada. The aircraft was destroyed and there were no survivors.

A smoke or fire event on an aircraft presents a challenging situation for a controller. Initially, the controller might be advised of a technical problem and a possible need for a precautionary diversion. This is understandable – the crew may be unsure of the nature of the problems they are experiencing. Several minutes may therefore have elapsed before an emergency is formally declared. Nevertheless, the controller should use this time to consider options and warn those he may need to call upon if the situation develops into an emergency.

An immediate landing is essential following any indication of an in-flight fire

As with all emergency situations, the controller will need to pass timely and appropriate information and guidance to the crew. In the case of an in-flight fire, the support provided to the crew may include:

- Information on the nearest airfield with sufficient runway length, ceiling and visibility,
- Airfield information including ILS frequency, threshold elevation, and runway/ILS centreline, and
- Vectors for a minimum track mile approach, regularly advising the crew of the track distance to touchdown.

All of this information will support the situational awareness and decision-making of the crew.

The crew will wish to minimise frequency changes in order to reduce workload and avoid the chance of an incorrect frequency selection and loss of communications.

Communications with the aircraft may be particularly difficult. The situation on the aircraft may mean that the aircraft does not respond to calls, information passed to or by the aircraft may be misunderstood, information may need to be relayed through other aircraft or ground stations, frequency changes may not be possible, and communications may be lost altogether. If communications are lost completely, then the controller will need to anticipate the actions of the crew based on previously declared intentions.

A team effort will be required to carry out all the necessary coordination between sectors, airports, and other airspace users to ensure system safety and facilitate getting the Mayday aircraft on the ground as soon as possible – direct routings, expedited descent, straight in approach. Numerous other airspace users will need to be rerouted, passed to alternative frequencies, told to enter holding patterns or divert. As the situation develops, the plan will likely need to change and change again.

Ordinarily, the definition of a "suitable alternate" might rightly include considerations such as aircraft and passenger handling facilities, customs and immigration availability, or a contracted service provider. With a fire on board, "suitable" very quickly simplifies to a long enough runway. Sometimes, getting an aircraft "on the ground" might necessitate an off-airfield landing or a ditching.

On 16 May 1995, an RAF Nimrod suffered an uncontrollable fire in one of its four engines, which subsequently spread to the adjacent engine and threatened the structural integrity and therefore likely controllability of the aircraft. Hearing a report from the rear crew that the wing was "melting", and fearing that he may have only seconds before the wing failed, the captain decided to ditch the aircraft into the sea. All of the occupants survived. It is most likely that, had he tried to reach the nearest runway, he would not have made it.

To handle an emergency such as this, where time is critical, controller overload is likely if support and supervisory back-up is not immediately forthcoming. To do this successfully requires well thought through and regularly practiced contingency plans – there isn't time for an ad-hoc response.

Similar examples of in-flight fire show that the average time between first indications of fire and loss of control, either through structural/system failure or crew incapacitation, is just 17 minutes.



26 minutes after the first alarm, UPS 006 was approximately 10nm from Dubai. ATC advised, through a relay aircraft, a 360 degree turn as the aircraft was too high and fast. The Co-Pilot responded "negative". Shortly afterward, the Co-Pilot indicated that the landing gear was not functioning.

28 minutes after the first alarm, UPS 006 was overhead Dubai. The aircraft was advised to turn left for Sharjah. The pilot acknowledged. The autopilot subsequently disconnected and the aircraft entered a descending turn to the right.

29 minutes after the first alarm, radar contact with UPS 006 was lost.



Beyond the outcome

by **Bert Ruitenber**

A friendly warning, dear reader: don't expect any dramatic descriptions in this article about emergency situations that happened while I was working as a controller. If that sort of thing is what you're after, I'm sure there are other articles in this HindSight issue that will satisfy your curiosity. This article will look at what happens after an emergency situation has been dealt with. Boring? Maybe – but if you want to know, you have no option but to read this article anyway.



Bert Ruitenber

is a retired TWR/APP controller, supervisor and ATC Safety Officer who worked at Amsterdam Schiphol.

As is evidenced by this very issue of HindSight, a lot of attention in the ATC world is currently being focused on the handling of emergencies and unusual situations. And rightly so, I say, for ATC can be a powerful resource for pilots who find themselves in an unusual situation or an emergency (which will be US/E from now on). I'm a supporter of controller recurrent training programmes that focus on US/E, especially where these include sessions in which pilots interact with controllers to analyse and discuss such events. But I'm not sure that everywhere in the ATC world the same amount of consideration is given to what happens in an operations room or tower in the moments immediately after a US/E has been dealt with, i.e. after the outcome of the US/E.

There can be two different outcomes: either the US/E has been successfully re-

solved and the flight was able to make a safe landing somewhere, or the US/E couldn't be resolved and there was an accident. (Admittedly this is a somewhat simplistic view, but please indulge me for the sake of the point I'm trying to make.) Now it's important to realise that US/Es normally don't happen in isolation – there is other traffic in the sector or at the airport that also expects to be handled in a safe, efficient and orderly manner. And this applies both during the "lifespan" of the US/E and after its outcome. So how is your ATC working environment organised to help controllers cope with handling regular traffic after the outcome of a US/E turns out to be an accident?

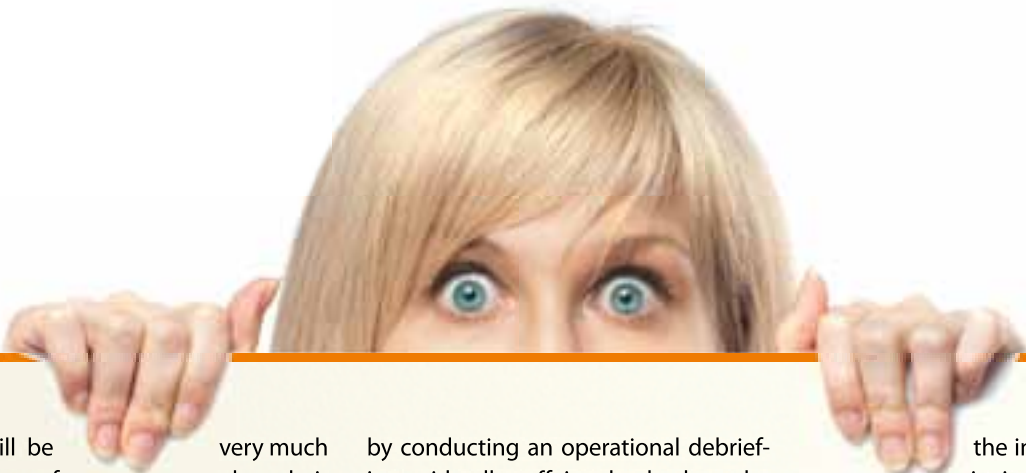
Issues that should be considered include, but are not limited to, urgent relief from their position for the controller(s) who last communicated with the aircraft that had the US/E; reduction of the traffic complexity, if necessary by establishing temporary traffic restrictions, for the airport or sector(s) concerned; counselling of the controller(s) involved, e.g. through a critical incident stress management programme; conducting an operational debriefing with the participation of

all staff involved in handling the US/E; arranging access for accident investigators to the controller(s) involved; and last but not least, providing factual information on the event and what's being done about it to all ATC staff (or indeed all employees of the ANSP) and the media.

To start with the first item from the list above, there's nothing worse than leaving a controller who just lost an aircraft to handle subsequent traffic at a working position. Even if the US/E aircraft was the only one that the controller was working with, the controller should be relieved and taken to a quiet place to await initial counselling (e.g. critical incident stress debriefing). And please don't let this poor controller wait unaccompanied for the counsellor to arrive – make sure that a trusted colleague is with him/her during that time, if possible.

Meanwhile, the other controllers in the operations room or tower have the difficult task of handling the other traffic as if nothing happened. They prob-





ably will be very much aware of what their colleague(s) experienced a few moments earlier, yet they have to face the well-intended “good day” check-in calls from unsuspecting pilots on their frequencies. Depending on how close they were to the handling of the US/E before it resulted in an accident, they too may require relief from their working position in order to go and receive counselling. But there simply may not be sufficient relief staff available on short notice for that to be realised, hence the second item in the list above: reduction of the traffic complexity. If you can’t get all controllers off position after an accident has happened, then at least make their work as easy as possible at such a time.

A further item from the list above is an operational debriefing. This is something I strongly suggest be done after either of the two possible outcomes of a US/E, by the way. Where the outcome was an accident, it almost goes without saying that all staff involved are at some point interviewed by an investigation commission or are at least invited to provide a written statement on their actions at the time of the event. The aim of this investigation of course is to determine what happened, how it happened, and what can be done to prevent a similar event from happening again. But why wait for an accident when your aim is to improve safety?

I submit that there is potentially as much to learn for future improvements

by conducting an operational debriefing with all staff involved when the outcome of the US/E is a happy one. Was internal and external communication adequate during the event? What was it that saved the day? Was the contribution from ATC in resolving the event a structural one, or was it something that strongly depended on the individual skills and knowledge of the controller(s) involved? In the case of the former, was everyone happy with the way things went internally or is there still room for improvement? And in the case of the latter (above), how can that same level of skills and knowledge be instilled in the other controllers?

Earlier I equated an accident investigation to an operational debriefing, but that equation is of course incorrect. To the participants an investigation is often perceived as more threatening than an operational debriefing, and one of the reasons for that is that in an investigation there are usually outsiders involved, i.e. State safety investigators, people from outside the ANSP. And whilst they are working in the interests of aviation safety, they often want to interview the controller(s) involved in the accident as soon as possible after the event, which can cause a conflict with the counselling process and thus be inconvenient for the controller. Or it can even interfere with the controller’s private life if the investigators insist on interviewing the him or her at their home (be it in person or by telephone). To avoid emotional complications at a time when they are least needed, it is advisable to develop a protocol with

the investigating authority in which controller access is described and agreed, and have it in place before an actual accident happens. And if I may volunteer any guidance for such a protocol, arrange for priority to be given to counselling over investigation, and for meetings with controllers or other staff at a suitable location in an ANSP building rather than at the private homes of those concerned.

The final point from my list above is on communications about the event to the workforce in the organisation. In fact, the communications requirement is broader than just the workforce itself, for after an accident the organisation will be in the media spotlight almost instantly. EUROCONTROL have produced a superb document called “Just Culture Guidance Material for Interfacing with the Media”, which I believe provides excellent guidance for ANSPs on how to prepare for having to communicate about an accident, both internally and externally.

In conclusion, in this article I hope to demonstrate that there’s more to handling unusual situations and emergencies than “just” the technical ability of the air traffic controllers. Providing recurrent training with tailored simulator scenarios is one thing, but it also pays to give serious thought to managing what happens after the event is over. If you only start thinking about that while an event is unfolding, chances are that you’re too late to manage it effectively. **S**



Fixed wing or helicopter?

Editorial note: Situational examples are based on the experience of the authors and do not represent either a particular historical event or a full description of such an event. The scenarios are rather exemplified facts aligned to illustrate operational safety and human performance considerations.

► p58

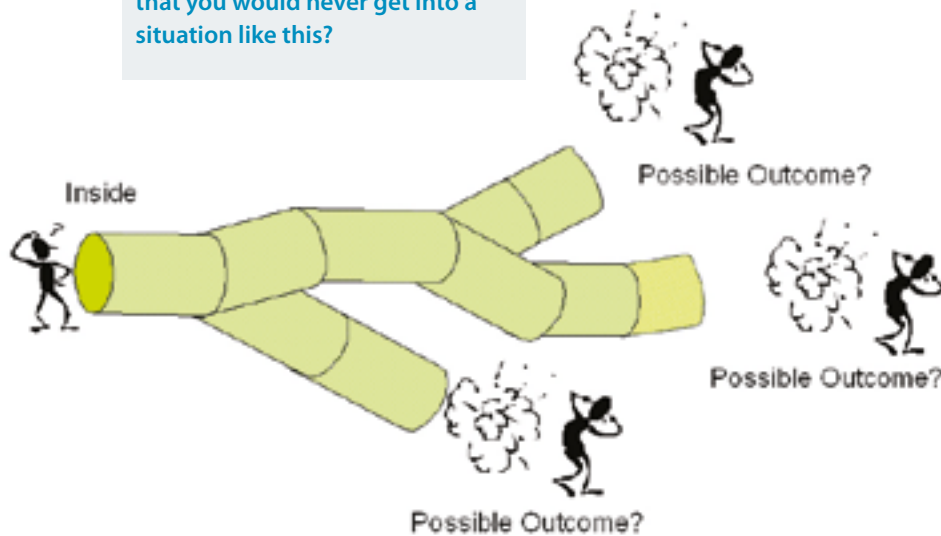




Fixed wing or helicopter? (cont'd)

THE FACTS

Read the story as it develops, position yourself in the context without knowing the actual outcome. How confident are you that you would never get into a situation like this?



It's a quiet day at the regional airport where you're working as a radar approach controller. The weather conditions are marginal, or at least below the limits for VFR operations. You've just finished a coordination phone call with details about an inbound IFR flight, a twin turbo propeller aircraft, which is a scheduled passenger flight to your airport.

An aircraft checks in on your frequency, but you're unable to understand the full call sign because the quality of the radio transmission is poor. After asking the pilot several times to repeat the call, you finally are able to get the five characters that make up the call sign (and aircraft registration). You also understand that the aircraft is a helicopter on a VFR flight plan, and that the pilot is requesting clearance to cross the control zone of your airport from the southeast to the northwest.

You are aware that normally requests for VFR crossing of the control zone are handled by the tower at your airport.

What would you do?

You decide you'll transfer the aircraft to the tower frequency in a proper manner. Since you have no flight plan data for this particular flight, you carry out an electronic search for the flight in the automated flight data system to which the radar equipment at your airport is linked. The search does not produce any results, but that is not unusual for VFR flights in your area. Consequently you make a manual flight plan input for the flight to appear in your automated system as a VFR crossing helicopter, using the minimum amount of required data to get the input accepted by the system. This input also produces a related flight strip in the tower.

You use the intercom system to coordinate with the controller in the tower about this flight. Since it's a helicopter, different limits for special VFR operations are applicable than for fixed wing aircraft and the tower controller and you both agree that the flight can be given permission to cross the control zone under special VFR procedures. You call the pilot and you give the clearance to cross the control zone special VFR at an altitude of 1200 feet. After the pilot acknowledges the clearance, again in a poor quality radio transmission, you instruct him to contact the tower for further guidance. The pilot switches to the other frequency, and you turn your attention to the inbound IFR passenger flight that has just checked in on your frequency. While providing the inbound passenger aircraft with radar vectors to the instrument landing system (ILS) for the runway in use at your airport, you monitor the conversation between the helicopter and the controller on the tower frequency. The quality of the transmissions by the helicopter is still poor, but you hear the pilot acknowledge the request from the tower controller to "report one minute before crossing overhead the airport".

What would you think?

Shortly thereafter the pilot of the IFR passenger flight reports established on the ILS, so you transfer that flight to the frequency of the tower controller. You continue to monitor the conversations on the tower frequency, and on your radar screen you also monitor the progress of the helicopter. You hear the pilot of the helicopter reporting "one minute before overhead" to the tower controller, and at the same time you see that the flight track of the he-

DATA, DISCUSSION AND HUMAN FACTORS

licopter will bring it rather close to the final approach track of the passenger flight on the ILS.

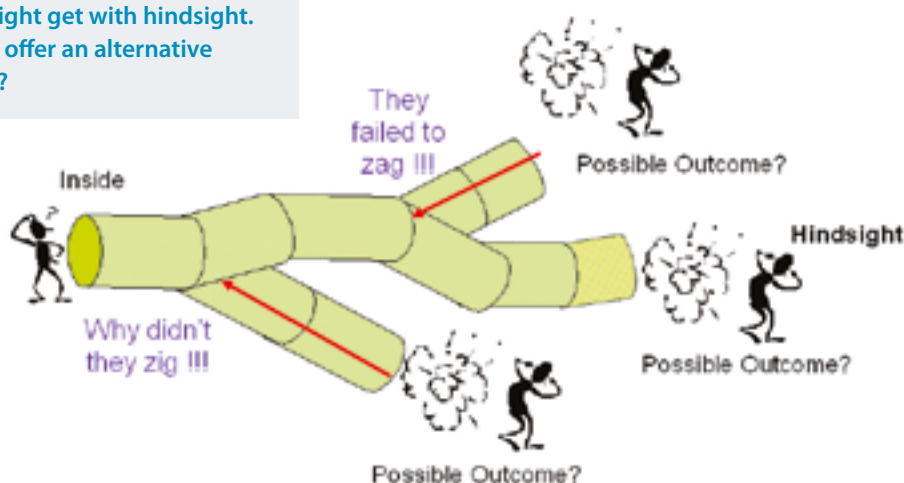
What would you think?

You hear the tower controller informing the helicopter about the presence of the inbound flight on the ILS and instructing the pilot to stay on the east side of the airport and well clear of the final approach area. It seems like the pilot acknowledges the instruction, but because of the poor radio quality you're not sure that this is what he said. You observe the helicopter making a rather wide right turn that initially will take it even closer to the final approach area.

What would you do?

Via the intercom you warn the tower controller about the developing conflict situation. The tower controller instructs the helicopter to turn further to the east, which is acknowledged by the pilot, and on your radar screen you see to your relief that the distance between the helicopter and the passenger flight is indeed increasing. The passenger flight lands without further problems, and after completing a full turn the helicopter continues its flight to the northwest. 5

This section is based on factors that were identified in the investigation of this occurrence. Read the story knowing the actual outcome. Reflect on your own and others' thoughts about the case, and see how easily judgmental these might get with hindsight. Can you offer an alternative analysis?



Factors that were identified in the investigation of this occurrence included:

Of the five characters that make up the call sign and aircraft registration, the approach controller got the first one wrong. When he searched for a corresponding flight plan in the automated flight data system, his input included the incorrect first character and consequently did not produce any result. Since there was no doubt in the controller's mind about the call sign and aircraft type ("helicopter"), he made a manual flight plan input in the automated system based on this information.

The crossing VFR aircraft was in fact a vintage fixed wing, a single engine advanced military training aircraft

from the World War 2 era. The pilot mentioned the aircraft type in his first contact with the approach controller, but because of the poor quality of the radio transmissions from this aircraft the controller missed that piece of information.

The controller later stated that he was not familiar with that particular aircraft type, which may have contributed to him not noticing that it was mentioned by the pilot.

Expectation bias. The poor quality of the radio transmissions from the historic aircraft was, in the experience of the approach controller, similar to transmissions from certain types of helicopters that he was used to working with.



Fixed wing or helicopter? (cont'd)

Furthermore the weather conditions may have subconsciously influenced the approach controller's impression that the crossing aircraft was a helicopter: it was below limits for VFR flying with fixed wing aircraft in the CTR, so logically there could only be helicopters asking to operate under special VFR rules because of the lower applicable criteria for that category.

Ignoring contradictory signs. With the benefit of hindsight it seems perhaps strange that the controller didn't notice that the speed of the "helicopter" was higher than usual, or that its turn radius was greater than expected. Similarly, it may seem odd that the controller accepted that the aircraft call sign consisted of an unusual combination of characters (compared to other call signs that normally operate in the area). Don't forget however that

these anomalies become apparent in hindsight, i.e. after more details about the event are known than the controller had available at the time. The controller never doubted that the aircraft was a helicopter, and he also was convinced that he was using the correct call sign in his communications with the aircraft. He therefore wasn't looking for any clues that might suggest otherwise; he was just providing ATC service to an aircraft flying VFR in marginal weather that wanted to cross the control zone.

HUMAN PERFORMANCE - TEM ANALYSIS

NOTE: This section is offered as an alternative way of analysing the occurrence. For more information about the Threat and Error Management (TEM) framework, see [TEM item in Skybrary]

From the perspective of the radar controller the following Threats can be identified in the scenario: call for VFR crossing of the control zone on the approach control frequency; poor quality of the radio in the VFR aircraft; pop-up traffic (i.e. a call from an aircraft that was not previously announced or co-ordinated); no flight plan available for the VFR flight; marginal weather conditions. The controller made an Error when he started using an incorrect call sign for the VFR flight. He also made an Error when he assumed an incorrect aircraft category for the flight (helicopter instead of fixed wing). Arguably there was one more Error made when the controller didn't notice that the pilot mentioned the type of aircraft in one of the first transmissions, but since the controller wasn't familiar with the name of this type of aircraft there is room for discussion about how this should be classified in the TEM framework. The Errors were not adequately managed by the controller, which contributed to an Undesired State: the controllers in the APP and TWR believed they were dealing with a helicopter operating under special VFR where in fact they were dealing with a fixed wing aircraft that was operating below VFR limits.



FLIGHT DECK PERSPECTIVE

NOTE: the following item addresses aspects that strictly speaking are outside the ATC domain, and therefore the item may seem out-of-place in this article. It is only included to enable a more comprehensive understanding of this occurrence.

On the flight deck of the passenger flight the pilots had monitored the conversation between the tower controller and the crossing traffic. When passing 1350 feet on final approach they received a TCAS traffic alert; however, because of the marginal weather conditions they were unable to see the other aircraft. Since there was no TCAS resolution advisory or any instructions from ATC for avoiding action, they continued the ILS approach and made an uneventful landing.

While executing the descent manoeuvre, the pilots of Airline907 heard a TCAS Resolution Advisory that said “climb, climb, climb”¹, but since they already were committed to descend the captain decided to continue doing so.

It was established afterwards that the closest distance between the two aircraft had been less than 300 metres (i.e. less than 0.2 Nautical Miles). The encounter was within the parameters for the generation of a TCAS resolution advisory, but this advisory was suppressed on the flight deck of the passenger flight in accordance with the TCAS design criteria because at that time the altitude was below 1000 feet AGL.

Prevention Strategies and Lines of Defence

If the controller had correctly understood the aircraft call sign (registration), his subsequent action to look for the flight plan in the automated flight data system would have produced the flight plan, including the type of aircraft.

The controller was not familiar with that particular aircraft type, but he would have been able to look up the relevant characteristics for it, such as “fixed wing, single engine”. It seems logical that in that case the aircraft would not have been given permission to operate in the control zone, for the weather was below (special) VFR limits for fixed wing aircraft, thus preventing the event from happening.

It therefore comes down to the poor quality of the radio transmissions from the VFR aircraft; however, there is very little (if anything) that an individual air traffic controller can do about that. Yet if the flight plan data for this flight had been actively provided (e.g. in printed form) to the controller, rather than being passively available in the automated system, the controller would have been able to anticipate a call from this aircraft, and he probably would have been in a better position to deal with it.

The radar controller eventually helped manage the situation by monitoring the progress of the “helicopter” after he had transferred the flight to the tower. He provided relevant information to his colleague in the tower, who used that information to give an additional turn instruction to the VFR aircraft which resolved the conflict.

KEY POINTS

As a result of poor radio quality the radar controller misheard the call sign of a VFR aircraft asking to cross the control zone in marginal weather conditions. The controller had no flight plan data available, and believed the aircraft was a helicopter whereas in fact it was a fixed wing aircraft. When the aircraft later was instructed by the tower controller to stay clear of the final approach area for a runway where a passenger aircraft was making an ILS approach, its turn took it closer than expected to the passenger aircraft. Because of the marginal weather conditions, none of the pilots involved were able to establish visual contact with the other aircraft.

Skybrary download

If you need to find out something about aviation safety, we suggest you go first to **www.skybrary.aero**. It doesn't matter whether you are a controller, a pilot or a maintenance engineer, SKYbrary aims to have either the answer you are looking for or a direct route to it.

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An article taken from **SKYbrary** is reprinted in **HINDSIGHT**. This time we have chosen something which can affect us all – **ATC Operations in Weather Avoidance Scenarios**.

Description

This article provides generic advice only on the effective management of air traffic during periods of convective weather avoidance. The guidance provided in this article must not take precedence over local operating instructions and air traffic management strategies that controllers are required to follow when adverse weather avoidance is in progress.

Cumulonimbus Clouds

Convective clouds present a serious hazard to aviation. Aircraft entering a **Cumulonimbus** (Cb) cloud may experience severe **turbulence, icing, lightning**, precipitation (especially **Hail**), and strong winds (both vertical and horizontal). These hazards, individually and collectively, can lead to structural damage, injuries to crew and passengers, **loss of separation/level bust** as a result of an inability to maintain assigned height, and **loss of control**. Where possible, flight crews will wish to avoid passing within 20 nm of a cumulonimbus cloud.



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ATC Operations in Weather Avoidance Scenarios

Particularly intense Cbs, often associated with **squall lines**, may also present related phenomena such as **Tornados**, **Gust Fronts**, and **Microbursts**, all of which can have an impact on air traffic management and airport infrastructure.

Aircraft equipped with **Weather Radar** are able to identify the areas of cloud with the greatest vertical wind shear and navigate through (or if not possible around) areas of convective activity.

Controllers should note that flight crew workload increases significantly in a weather avoidance scenario not just because of the decision-making associated with weather avoidance but also because of **Turbulence**, management of **In-Flight Icing**, and increased communications. Particularly dense cells, or groups of cells, can attenuate radar and radio signals, thereby causing loss of radar contact and poor quality or lost communications.



Weather Avoidance Characteristics

When air traffic is avoiding **Cumulonimbus** cells, particularly in congested airspace, the **workload of the controller** increases significantly. In such scenarios the increase in workload is caused by:

- **Non standard traffic flow** – the traffic flow is irregular and not easy to anticipate because of:
 - the changing intensity of cells, both vertically and horizontally (for further information see the article “**Life-cycle of the Thunderstorm**”)
 - the situational awareness of the flight crew and routing decisions they take based on the display on their weather radar (for further information see the article “**Weather Radar: Storm Avoidance**”)
- the altitude of aircraft,
- the onward routing of the aircraft,
- the training and experience of the flight crews, and
- operator's procedures.
- **Reduction in available airspace** – controllers will have less airspace volume available for conflict resolution tasks with a consequent impact on sector capacity;
- **New conflict points** – new random crossing points are likely to occur as a result of the disrupted and non-standard traffic patterns;
- **Increased frequency occupancy time** – radio communication is likely to be prolonged due to the necessity to clarify the details associated with the avoidance actions as well as revised onward routing clearances. Usage of non standard RTF is likely to increase;
- **Increased manual (telephone) coordination** – telephone coordination with adjacent sectors or ATS units is likely to increase due to the necessity to coordinate the details associated with the avoidance actions (change of routes and flight levels);
- **Rapidly changing situation** – isolated Cb cells can quickly evolve into a squall line and make navigation through the line of Cbs increasingly challenging for the pilots;

ATC Operations in Weather Avoidance Scenarios

- **Degradation of RVSM capability** – convective weather conditions are associated with moderate to severe turbulence, hence it might be advisable to downgrade the RVSM airspace and introduce 2000 ft vertical separation in areas with reported severe turbulence;
- **Lack of information about traffic in own sector (not on frequency)** – situations may arise when traffic deviating from its planned/cleared flight route, due to bad weather, penetrates (or flies close to the boundary of) another sector's airspace without prior notification of the controller in charge of that sector who is not aware of the crew's intentions;
- **Limited applicability of radar vectoring** – use of radar vectoring to resolve potential traffic conflicts might be limited due to crew inability to maintain the required headings. This is a very significant factor in busy environments where controllers rely heavily on radar vectoring to provide separation;
- **Airspace constraints** – ATC sector overloads can be aggravated by the combination of weather factors (majority of these are Cb-related) and airspace constraints in particular in busy TMAs.

ICAO Procedures

Weather Avoidance Information for Flight Crews

Controllers are expected to provide the most appropriate advice/information to pilots of an aircraft requesting navigational assistance when avoiding areas of adverse weather. ICAO Doc 4444 (PANS-ATM) contains the following provisions on information to be given to flight crews in weather avoidance scenarios:

■ Doc 4444 - 8.6.9 Information regarding adverse weather - 8.6.9.1

Information that an aircraft appears likely to penetrate an area of adverse weather should be issued in sufficient time to permit the pilot to decide on an appropriate course of action, including that of requesting advice on how best to circumnavigate the adverse weather area, if so desired.

Note: Depending on the capabilities of the ATS surveillance system, areas of adverse weather may not be presented on the situation display. An aircraft's weather radar will normally provide better detection and definition of adverse weather than radar sensors in use by ATS.

■ Doc 4444 - 8.6.9 Information regarding adverse weather - 8.6.9.2

In vectoring an aircraft for circumnavigating any area of adverse weather, the controller should ascertain that the aircraft can be returned to its intended or assigned flight path within the coverage of the ATS surveillance system and, if this does not appear possible, inform the pilot of the circumstances.

Note: Attention must be given to the fact that under certain circumstances the most active area of adverse weather may not be displayed.

Weather Avoidance Communications in Oceanic Airspace

In controlled airspace, a pilot using an aircraft radar and intending to detour around observed weather must obtain clearance from the controller before doing so. Even so, controllers should not be surprised if, perhaps because of com-

munications difficulty and the flight safety risks, an aircraft alters course without clearance. If it is necessary to leave controlled airspace the pilot must request permission to re-join. ICAO Doc 4444 (PANS-ATM) provides the following procedures intended for deviations around adverse meteorological conditions:

■ **Doc 4444 - 15.2.3.1 Procedures related to emergencies, communication failure and contingencies - 15.2.3.1.1**

When the pilot initiates communications with ATC, a rapid response may be obtained by stating "WEATHER DEVIATION REQUIRED" to indicate that priority is desired on the frequency and for ATC response. When necessary, the pilot should initiate the communications using the urgency call "PAN PAN" (preferably spoken three times).

■ **Doc 4444 - 15.2.3.1 Procedures related to emergencies, communication failure and contingencies - 15.2.3.1.2**

The pilot shall inform ATC when weather deviation is no longer required, or when a weather deviation has been completed and the aircraft has returned to its cleared route.

Weather Avoidance Procedures in Oceanic Airspace

The crews should notify ATC and request clearance to deviate from track, advising, when possible, the extent of the deviation expected, expressed in a new heading, and for how long the crew intends to proceed on the deviation heading.

■ **Doc 4444 - 15.2.3.2 Actions to be taken when controller-pilot communications are established - 15.2.3.2.2**

■ **Doc 4444 - 15.2.3.2 Actions to be taken when controller-pilot communications are established - 15.2.3.2.3**

The pilot should take the following actions:

- comply with the ATC clearance issued; or
- advise ATC of intentions and execute the procedures detailed in 15.2.3.3.

Effects

Possible effects of adverse weather avoidance include:

- Pilots may be unwilling to execute a turn, as instructed by the controller to avoid conflict, due to the proximity of adverse weather;
- Pilots may be unwilling to descend due to the proximity of an adverse weather area;
- Pilots setting a heading or altitude not expected by the controller;
- Pilots changing the assigned heading after clearing weather (CB) without informing ATC. In general pilots request deviation from the planned route due to CBs but sometimes, when clear of weather, they turn back to their planned route without prior notification to ATC;
- Increased communications with pilots;
- Increased communications with adjacent ATC units to coordinate avoiding actions;
- Some flights may not be able to follow missed approach procedure due to thunderstorm areas near the airport (APP/TWR environment);
- Some flights may initiate a go around on final due to severe turbulence, wind shear, or a flooded runway (APP/TWR environment);
- More requests to use a different runway for departure or arrival due to sudden changes of wind components in combination with wet runway and radar-derived information on adverse weather on the climb out route, (APP/TWR environment);
- Increased controller and pilot workload;
- Reduced sector capacity - The complexity of the traffic situation (traffic demand, non-standard routings, potential conflicts) may necessitate the implementation of flow measures in order to ensure safe ATC service provision during periods of massive adverse weather avoidance.

ATC Operations in Weather Avoidance Scenarios

Defences

Operational Supervisor's (SUP) actions. The ATC shift supervisor should be able to mitigate the impact of severe weather avoidance by air traffic on the controller's workload by facilitating and engaging in the following actions:

- Establish a coordination pattern with the MET office for the provision of periodic weather updates and forecasts for the affected area. Following an established protocol, which outlines the roles and responsibilities of those involved, will be of advantage;
- Use all available information: MET updates/forecasts, traffic load forecasts and availability of ATC personnel to assess the situation and establish with the help of the local flow management position (FMP) possible tactical measures;
- Inform affected adjacent units of the (flow) measures taken;
- Assess whether it is safe and possible to follow the procedures described in local letters of agreement (LoAs) with adjacent ATC units. As necessary, agree with the SUPs of the neighbouring unit(s) special coordination procedures to substitute the normal operating procedures (i.e. flight level allocations, points of transfer etc.). It is important to point out to the controllers the need for dedicated coordination in these exceptional cases;
- Provide additional (third) controller as necessary at the sector to help the sector team with coordination / monitoring / planning tasks, as applicable;
- Apply dynamic sectorisation management – the OPS Supervisor should monitor the situation and activate the most appropriate sector configuration depending on the traffic volume and complexity, and the scale of the weather avoidance. For example, in the case of major deviations from planned routes, vertically split sectors may be more appropriate than laterally split ones;
- Open additional sectors in order to deal with possible capacity problems and avoid sector overloads;
- Consider the application of a reduced departure rate or of a specific departure separation (e.g. individual approval request; departure interval of 5 minutes, etc.) for aerodromes within the affected airspace and coordinate this course of action with the relevant units;
- If relevant, coordinate with the respective parties the release of temporary restricted airspace for use by general air traffic or its use under special crossing coordination procedures (e.g. use of dedicated SSR code);

- Consider the rejection/adjournment of planned maintenance work on any technical equipment used for ATS provision;
- Consider application of the so-called "one-airway" procedure, i.e. closely situated airways are considered as one airway for traffic separation purposes.

Flow Management Position's (FMP) actions. The FMP should provide the necessary assistance to the OPS Supervisor and facilitate the management of the severe weather by timely activation of coordinated flow control measures in order to prevent sector overloads. During the normalisation period, special consideration must be given to possible bunching of traffic at the end of the regulated period. It is felt that the return to normal capacity following flow control measures is usually more efficient if implemented on a gradual (step-by-step) basis.

The FMP should consider passing timely information to the regional flow management unit (CFMU for the European region) about the forecast and actual convective weather and its impact on ATC operations.

Controllers' actions. Controllers should exercise their best judgment and expertise when dealing with adverse weather avoidance scenarios; in particular they should be prepared to:

- Maintain awareness of the adverse weather location, its evolution (laterally and vertically) and of the possible deviation routes. A controller may be alerted to the presence of adverse weather by a variety of sources;

Organisational measures

- Provision of sufficient number of controllers during periods with forecast severe convective weather;
- Use of weather radars/ weather displays to enhance information provided to controllers;
- Use SIGMETs and associated weather forecasts to improve prediction of sector loading;
- Train controllers to deal with weather during live training; use simulator training to build in more resilience in controllers' skills;
- Provide a periodic refresher course to OPS supervisors
- Consider adoption of a generic checklist for OPS supervisors.

es including: radar observations, adjacent ATS units, MET office reports, unit briefings and reports from pilots. Being constantly aware of any ongoing deviations and flight crews' intentions should provide precious time for the separation of affected nearby traffic;

- Develop strategies – the executive (radar) and planner controller should develop strategies and practice mutual crosschecks of the current, planned and intended weather avoidance actions;
- Provide timely information to and coordinate with the adjacent sectors regarding any deviations which will affect them;
- Pro-actively seek information regarding traffic which is likely to enter their own sector;
- Request any necessary details from the flight crews on the planned avoiding actions i.e. heading(s) on which the aircraft will be flying, as well as the estimated duration and/or the distance the aircraft will proceed on the heading(s);
- Provide extra room for manoeuvring, if in doubt that the traffic will request further deviation provide extra space for separation, issue instructions for flight level change as necessary, provide traffic information, as necessary;
- Inform pilot if weather avoidance will take pilot outside controlled airspace, and offer an appropriate service.

Weather Avoidance Decision Support Systems

It is generally agreed that decision support tools may be instrumental in the management of convective weather avoidance scenarios in congested airspace. Such tools will use the weather forecasts to estimate the impact on ATC provision and consequently suggest air traffic management strategies.

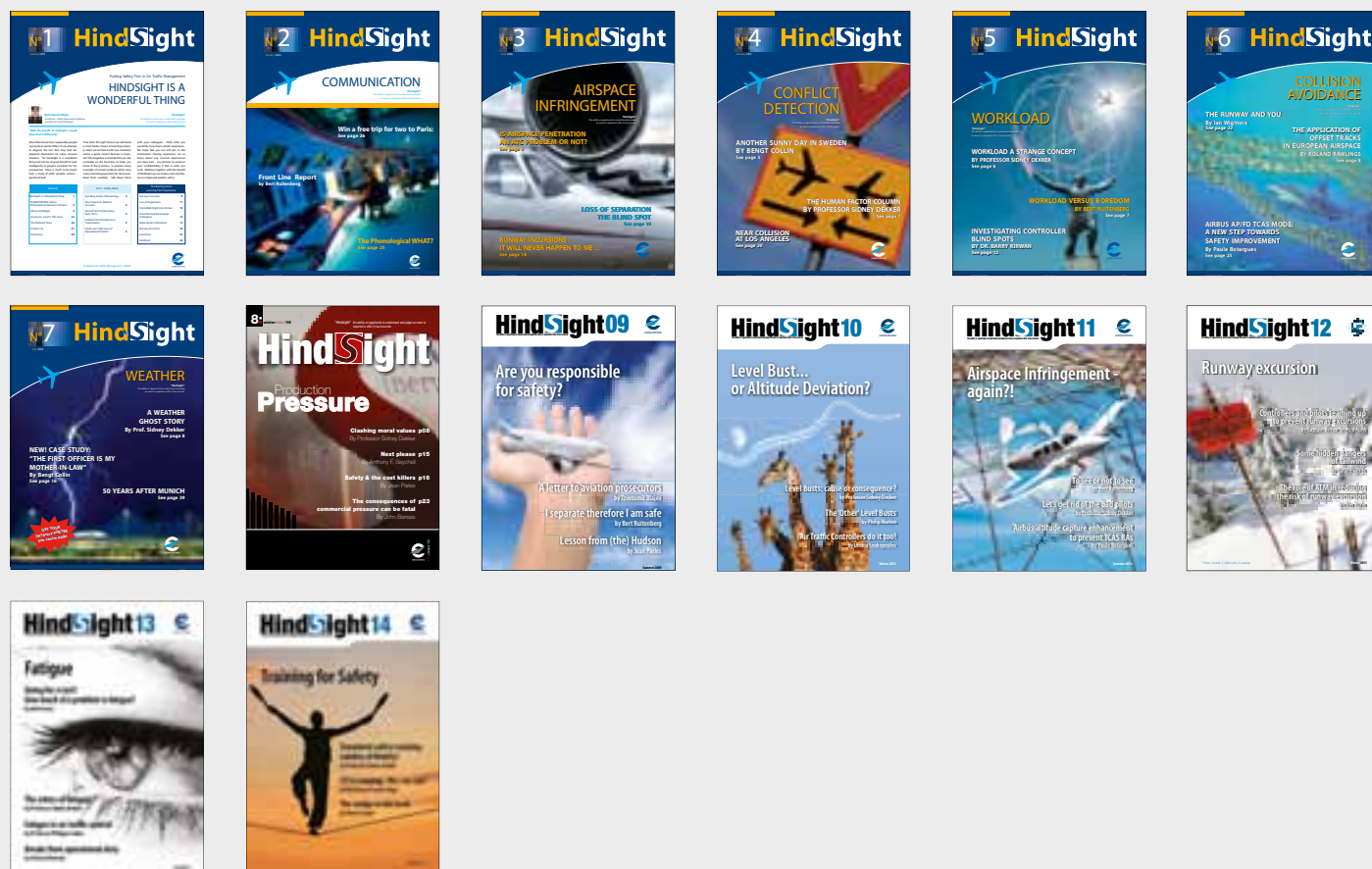
In research funded by the NASA Ames Research Centre, the MIT Lincoln Laboratory has developed an en-route Convective Weather Avoidance Model which outputs three-dimensional weather avoidance fields. "The probabilistic Weather Avoidance Fields identify regions of airspace that pilots are likely to avoid due to the presence of convective weather" (for details see Further Reading).

The concept for the future trajectory-based operations is that it will be necessary to automatically generate flight trajectories through or around convective weather which pilots will find acceptable. **S**

Further Reading

- **Aircraft Emergency and Unusual Situations -**
http://www.skybrary.aero/index.php/Category:Aircraft_Emergency_and_Unusual_Situations

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In the next issue of HindSight: Understanding (modern) aircraft performance



Putting Safety First in Air Traffic Management

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