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Contents

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Front Cover Picture: The award winning TAG Farnborough Airport terminal building with a Gulfstream 500 and Dornier 328

FOCUS is a quarterly subscription journal devoted to the promotion of best practises in aviation safety. It includes articles, either original or reprinted from other sources, related to safety issues throughout all areas of air transport operations. Besides providing information on safety related matters, **FOCUS** aims to promote debate and improve networking within the industry. It must be emphasised that **FOCUS** is not intended as a substitute for regulatory information or company publications and procedures.

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FDM and Training

by Dai Whittingham, Chief Executive UKFSC

I attended an ECAST-sponsored FDM operators' conference last month and was struck by the wide range of cross-connecting issues that were being discussed. The variety of issues was perhaps not surprising given participants who themselves ranged from representing major wide-body airlines, through aircraft manufacturers and data service providers, to small business operators struggling to make sense of FDM when faced with very small numbers of pilots and suitably equipped tails. However, some threads emerged that I thought would be worth exploring further to see if more value can be gained from FDM programmes across the industry.

At the risk of starting with a sweeping generalisation, I believe that EASA Member States have it right when it comes to the importance placed on FDM as one of the best proactive safety tools available to us; I am not sure the same can always be said of matters across the Atlantic. I make the observation not to throw stones, but simply to suggest that this may affect the willingness of some manufacturers to fully embrace FDM, especially for the smaller business platforms where an FDM capability is not mandated. If you are building new aircraft for the business market it would be sensible to include FDM as an option from the outset regardless of size. If you have to generate the data for an FDR, why would you not go the extra mile and make it available to feed an FDM system? This is especially true if your customers are asking for FDM – it is not good enough to dismiss the request on the grounds that it is not mandated and is therefore un-necessary weight and cost. Some pressure from the insurance industry here would be useful in helping to make the economic case – the safety argument has already been won elsewhere.

If more of the lighter business jets and turboprops were FDM-equipped, there would be an enormous opportunity for data-sharing that could at a stroke remove one of the biggest obstacles to effective FDM for small operators, namely small samples and the resultant difficulties with trend analysis. This data-sharing is already happening in the UK in the form of CASE (Corporate Aviation Safety Executive), a gathering of corporate aviation operators that are now pooling de-identified data for mutual benefit. One of the spin-offs from this initiative may be the development of common SOPs between CASE members that could ultimately reduce the training bill for pilots new to the sector. CASE will rely heavily on commonality of data-frames to ensure that analysts can compare like with like. There are clear implications here for the wider industry too. Where is the definition of core values that should be common to all FDM programmes? Granted, there will inevitably be differences between aircraft types, but it should be possible to define some basic principles and events that could be aggregated for analysis. As we get ever safer in the air – and the raw statistics show this to be the case – teasing the trends out of small samples will become increasingly difficult, and we need to take every opportunity to gather and make best use of the available data. At this point, I will also offer another snippet from the ECAST conference, which was the need for mathematically rigorous statistical analysis rather than the more superficial 'top 10 events' approach. Implicit in this is a requirement either to employ a statistician, train your FDM team, or out-source the analysis. FDM data should be feeding your SMS, and you should not be making safety-related decisions on the basis of a poor analysis.

As an adjunct to the argument for extending FDM to lighter types, I believe there is also a case for bringing FDM into the initial training arena. There would be a number of benefits here, not least in making FDM routine business for all pilots regardless of which sector they end up in. The biggest impact would be in the quality of the flight training itself. Post-flight debriefs are crucial but are only as good as the recall and skills of the instructor. If we could now offer the student a real-time visualisation of exactly what he or she did when things started to go wrong (or right...), it would be a very powerful learning mechanism. It might also take some of the subjectivity out of the assessment of individual progress and would certainly allow instructor review of solo exercises. If such a mechanism allowed you to shave a few hours off the training bill, it should rapidly repay the investment.

This brings me to the linkages between FDM, training and flight simulators. The move towards evidence-based training appears to be unstoppable, and rightly so in my view. Evidence from FDM analysis is now routinely fed into initial and recurrent training programmes along with information gleaned from accident and incident investigation. However, the simulator itself is also a rich source of data on crew performance. A high speed RTO is likely to be investigated by a national authority but is an uncommon event. Conversely, hardly a simulator session goes by without one! If we had the facility to run FDM on our simulators we would be able to assess, for example, the average speed of response from detection to action for an RTO and hence gain a better understanding of the real over-run risk; it could also show whether the type airworthiness certification assumptions in this area were (or were still) valid. No doubt there will be issues of confidentiality raised, and there would clearly need to be protocols established for data handling, though these would be less acute where the operator owned the simulator rather than a third-party provider. That said, the volume of de-identified data generated by a simulator in near-constant use should offer some intriguing prospects for analysis.

The problem with the above lies in the technology – the simulators simply aren't equipped for data extraction that could be read easily into an FDM programme and there is currently no requirement of financial imperative for them to be so. However, the fact that the simulator is software driven offers the possibility of translation into a compatible format. If we now reverse the polarity of the question (often a useful technique) a translation capability should also make it possible to use FDM or FDR data to feed the simulator directly, which could be used for remedial training purposes as well as for accident investigation. It might be costly initially, especially to retro-fit existing simulators, but it would be a very useful addition to the certification requirements for a new type. But until there is a requirement, I acknowledge it will not happen. Over to you, Regulators....

Maintaining an Open Reporting Culture

By Capt. Neil Woollacott, flybe

We, the industry, have always tried to engender a culture of free admission of mistakes and the courage to tell others so that everyone can learn. The UK Civil Aviation Authority are world leaders in this approach to Flight Safety, and has been the driving force to encourage industry to meet and discuss its own Flight Safety issues. This was the very foundation and principle of the UK Flight Safety Committee back in 1959.

The Mandatory Occurrence Reporting Scheme (MORs) although legislated in the UK Air Navigation Order, still relies on the integrity of the individual crew member to submit reports- confidentially if appropriate. The statement by the Chairman of the CAA at the front of the MOR publication also includes the following:

"Where a reported occurrence indicated an unpremeditated or inadvertent lapse by an employee, the Authority would expect the employer to act responsibly and to share its view that free and full reporting is the primary aim, and ensure every effort should be made to avoid action that may inhibit reporting. The Authority will accordingly make it known to employers that, except to the extent that action is needed in order to ensure safety, and accept in such flagrant circumstances as are described under the heading 'Prosecution' (dereliction of duty amounting to gross negligence), it expects them to refrain from disciplinary or punitive action which might inhibit their staff from duly reporting incidents of which they may have knowledge".

In most cases where Human Factors are a cause, the mere fact that the incident occurred is usually enough to prevent re-occurrence- any reflection on the aircrew's professionalism is usually enough embarrassment for them!

The last few years have also seen an increase in the CAA's interest in the management of Safety within organisations. They, quite rightly, expect to see a written statement of the company system of Safety management. A principle concept of this system is that the ideal safety culture is one that is supportive of the staff and systems of work, and, most importantly, recognises that errors will be made and that apportionment of blame will not resolve the problems.

Flight Data Monitoring (FDM) has also seen the need for a great deal of trust between the company and its employees with the establishment of sound protocols to ensure harmonious working relationships. All levels of staff in those companies using FDM have quickly recognised the benefits of the system both for improved safety and cutting costs.

The UKFSC, as we know and can justly boast, is unique. We have many of the UK airlines (and other countries) a lot of providers and, most important, the Regulators (not just the UK) in the same room. We are able to share our thoughts and exchange critical Safety information. We can do this by admission with no fear of recrimination from our contemporaries but rather the certain knowledge that we will get help and advice if available. This culture can only lead to better confidence in reporting and more scope to take appropriate action to stop other errors.

Over recent times a decision by a European court to hand out punitive action as a result of an accident between two aircraft at an airport, has given the aviation industry cause for serious thought. It has probably led to, as another publication has already commented; "the message to other individuals is keep your head down". We must, of course, all take responsibility for our actions, but the level of blame is a tricky assessment. If we are, as an industry, to continue to build the levels of trust that we have so far, the way ahead needs to be clear. This is particularly the case if we are going to be more involved with the EU and thus EASA.

V_1 and 'Unsafe' to fly...? Welcome to the Wilderness

by Tahlia Fisher, Senior Safety Specialist

Most pilots are familiar with the photo of Kalitta Air, broken into three sections and perching precariously over a railway embankment beyond the end of runway 20 at Brussels. Most pilots would probably give you the same answer if you asked them how it got into that state – something along the lines of "they rejected past V_1". There are, after all, some things that you just don't do in an aircraft if you want to walk away safely and rejecting a takeoff beyond V_1 is well up that list.

The takeoff safety statistics speak for themselves and for many years now the message has been pushed hard: rejected takeoffs beyond V_1 are a leading cause of runway excursions. Pains have been taken over the years to clear up the confusion that used to surround V_1 – it's not a decision speed; the decision has already been made. The question must be asked then; why, when we have powerful statistics which clearly illustrate the dangers of rejecting a takeoff beyond V_1, are we still seeing accidents such as Kalitta Air in 2008? Or the BMI B737 event at Birmingham in 2009? Or the Air Berlin overrun at Dortmund in 2010? The answer lies with a seemingly simple statement which is provided to all pilots by manufacturers and airlines alike. However, it is the remarkable simplicity of the statement which actually makes the issue so tremendously complex. The events at Brussels, Birmingham and Dortmund all shared this common factor – each captain believed that his aircraft was unsafe to fly.

Takeoff Overruns – They're Still Happening.

During the 14-year period from 1995 to 2008, there were 417 runway excursion accidents involving commercial transport aircraft (jets and turbo props) – that's an average of 30 excursion accidents per year. Of those excursion accidents, 91 (about 22%) occurred during takeoff. Unfortunately, while takeoff excursions have decreased over that 14 year period, the trend rate has levelled off (see figure 1).

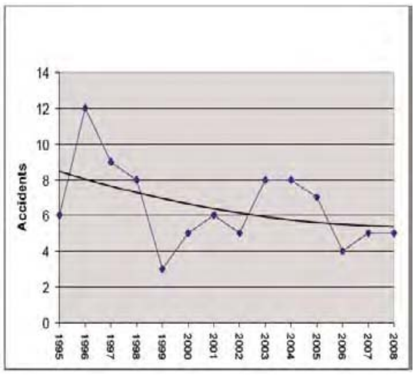


Figure 1. Takeoff excursion accidents have decreased over the past 14 years, however, the trend (black line) appears levelling indicating we are still experiencing just over 5 accidents per year.

It appears that over that period of time we, as an industry, have only managed to bring the rate of takeoff accidents down by an average of 3 and we are sitting at a pretty steady rate of about 5-6 accidents per year. So, why has the trend levelled? A good place to start is to look at the causes of takeoff accident overruns. Analysis conducted by the Flight Safety Foundation is shown in Figure 2.

Not surprisingly, rejecting a takeoff beyond V_1 is the leading cause of runway excursions. This is relatively logical given that rejecting beyond V_1 on a balanced field takeoff does not leave sufficient distance to stop on the runway. Even if an aircraft is below the field-limited weight and additional runway length is available, rejecting a takeoff at high speed greatly increases the risk of an overrun or excursion event. With this information in mind, the question now changes from a 'what is happening' to a 'why is this happening'?

Rejecting a takeoff after V_1... why does it (still) happen?

This was the title of a paper[1] which was presented at the annual European Aviation Safety Seminar held in Lisbon in March 2010. The presentation outlined a study conducted by the NLR-Air Transport Safety Institute which reviewed 135 high speed rejected takeoff events involving turboprop and jet aircraft which occurred between 1980 and 2008.

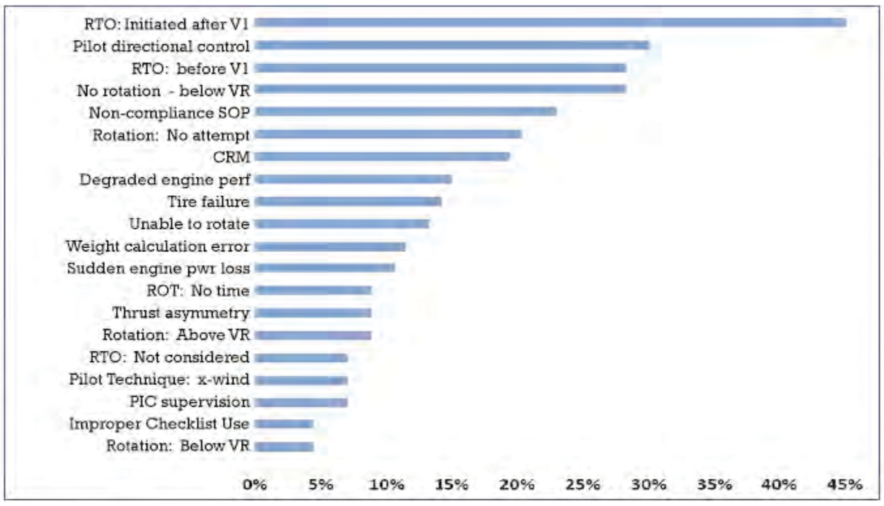


Figure 2. Flight Safety Foundation data analysis of takeoff excursion events 1995-2008. Rejecting a takeoff beyond V_1 is the number one cause of takeoff excursions.

All 135 events were either accidents or serious incidents which involved a high speed rejected takeoff where the aborting action was initiated after V_1 (note the actual decision to reject may have been prior to V_1). Two of the objectives of the study were to identify the reasons pilots were rejecting under these circumstances and also the 'correctness' of those decisions. Thanks to the large body of educational information which has been made available to industry, pilots are all very aware of the significance of V_1, and that if the takeoff is to be rejected safely, initiation of the manoeuvre must have taken place by this point. There is one caveat to this rule, that being that the takeoff may be rejected beyond V_1 if the captain deems the aircraft unsafe or unable to fly.

So what's causing pilots to reject beyond V_1? In around 80% of the events, pilots rejected for non-engine related problems indicating that it is the non-engine related events that are proving difficult for crew to diagnose as 'unsafe'. Appreciatively, split second time-frames in which to try and make more complex 'knowledge-based' decisions is not ideal. Unfortunately however, that is exactly what is required of flight crew in this kind of situation.

With regard to whether or not the decision to abort the takeoff was the correct one to make, the study identified that roughly only a third of the decisions were (see figure 3), however, there is no explanation as to why they were deemed to be correct.

The most common issues that pilots were aborting for when, in hindsight, they could have continued safely were engine failures, engine indication warnings and also wheel/tire issues. The word hindsight is key here, and the researchers acknowledge the difficulties crew face in these circumstances:

"A relatively large number of decisions to abort were incorrect. This is clearly in hindsight as most pilots really thought they were making the right decision at the time. Often it was related to complex situations e.g. an engine failure combined with significant vibrations, which was judged by the pilots as an unsafe condition. Assessing such complex situations is difficult and often not well trained. There are often no references to what might make the aircraft unsafe to fly, making it difficult for the crew in recognizing such a condition. The reliance on perception then provides the opportunity for errors in decision making."

Another study also recognises the complexities involved with this issue. The FAA Takeoff Safety Training Aid (TSTA) reviewed data from 97 rejected takeoffs which had subsequently resulted in an overrun accident or incident. These accidents occurred between 1959 and 2003. The analysis of this data is presented in the TSTA and the following statement is made:

"Review of the data suggests 82% of the RTO accidents and incidents were avoidable and in 52% of the events, the airplane was capable of continuing the takeoff and either landing at the departure airport or diverting to an alternate airport. In other words, the decision to reject the takeoff appears to have been "improper".

Examples of Flight Crew Guidance for Rejecting Beyond V_1

"Rejecting the takeoff is not recommended unless the captain judges the aircraft incapable of flight" – *Boeing Flight Crew Training Manual*

"Do not attempt an RTO once the aircraft has passed V_1 unless the pilot has reason to conclude the aircraft is unsafe or unable to fly" – *FAA Takeoff Training Safety Aid*

"Although a reject beyond V_1 may be necessary and is fully within the emergency authority of the captain, it should not be attempted unless the ability of the aircraft to fly is within serious doubt." – *Rejected Takeoff and the Go/No Go Decision, video component of the FAA Takeoff Training Safety Aid*

"RTO training that a pilot receives should include guidance on the initiation of RTO after V_1 only when the aircraft is considered incapable of safe flight" – *UK CAA Aeronautical Information Circular*

"The captain can consider to reject a takeoff when the aircraft is above V_1, only in the event that the aircraft is not able to ensure a safe flight" – *Airbus Flight Operations Briefing Notes*

However, acknowledgement is made regarding the difficulties in assessing what makes an aircraft 'unsafe' to fly – both for investigators in hindsight, and even more so for the crew at the time the decision has to be made:

"It is not possible, however, to predict with total certainty what would have happened in every event if the takeoff had been continued. Nor is it possible for the analyst of the accident data to visualise the events leading up to a particular accident "through the eyes of the crew", including all the other factors that were vying for their attention at the moment when the "proper' decision could have been made. It is not very difficult to imagine a set of circumstances where the only logical thing for the pilot to do is to reject the takeoff. Encountering a large flock of birds at rotation speed, which then produces loss of thrust on both engines of a two engine airplane is a clear example".

So what makes an aircraft unsafe to fly?

Reviewing the statistical data as well as reading the comments above from the research studies, it is apparent that pilots have difficulty recognising what is an 'unsafe to fly' condition. An extensive review of what guidance is provided to flight crew reveals that there is virtually no information on what might make an aircraft unsafe or unable to fly. The box, at the bottom of the previous page, lists some examples of when it is appropriate to reject a takeoff beyond V_1, but unfortunately, despite the prevalence of such statements, there is little or no information provided as to what would render an aircraft unsafe to fly, or how a pilot is expected to be able to make that decision.

Look at the words which are used: *'captain judges'*, - but how does one judge? *'Has reason to conclude'* – what reason would that be? *'Serious doubt'* – what constitutes serious? The following three events are presented, not to criticise the actions of the flight crew, but in order to demonstrate the complexities of this issue:

N704CK, B747-200 at Brussels National Airport

At 11:29z on May 25th, 2008, Kalitta Air B747-200 was cleared for takeoff from Brussels National Airport. The cargo aircraft carried a crew of four plus one passenger and began the takeoff roll from the B1 intersection giving a TODA of 2675m. The runway was wet and EPR was set at 1.447 for a reduced thrust takeoff giving a V_1 speed of 138kts and a V_R speed of 157kts. Having been cleared for takeoff, thrust was set and the aircraft accelerated normally. The CVR showed that the standard 'airspeed', '80kt' and 'V_1' call-outs were made. The following is a selection of the CVR transcript:

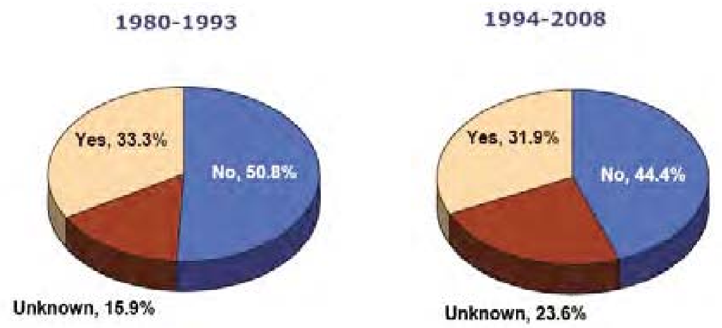


Figure 3: A study of 135 rejected takeoffs initiated beyond V_1 attempted to identify whether the decision to reject was correct.

11:30:41s – "V_1" (F/O)
11:30:46s – sound of bang
11:30:46s – "whoa" (Flight Engineer)
11:30:47s – sound similar to thrust lever hitting throttle quadrant stops
11:30:48s – sound of decreasing engine thrust
11:30:48s – "Reject" (Captain)
11:30:51s – "Tower, Connie 807 Heavy…207 re-re- rejecting runway" (F/O radio)
11:30:55s – "Connie 207 roger, can you vacate to the right?" (Tower)
11:30:58s – "Negative" (Captain)
11:30:59s – "negative" (F/O radio)
11:30:59s – "negative negative negative" (Flight Engineer)
11:31:00s – "We're gonna take the overrun" (Captain)
11:31:01s – "We're taking the overrun" (F/O radio)
11:31:02s – "Roger" (Tower)
11:31:04s – sound of impact and metallic grinding noise

The aircraft departed the end of runway 20 and travelled a further 225m into a field before dropping 4m over a railway embankment. The crash fire bell was rung at 11:31:30 and the Brussels Airport Fire Brigade reached the aircraft within three minutes. Fortunately all onboard survived the runway excursion with only minor injuries. While there were several factors which contributed to the accident, the captain's decision to reject beyond V_1 was significant. The subsequent accident investigation report which was prepared by the Belgium authorities, analysed the captain's decision-making and reported the following:

- Following the ingestion of a Kestrel, the number 3 engine stalled approximately 5 seconds after V_1. The stall caused a load 'bang' and vibration was felt within the flight deck. The captain stated that he "had the feeling that the aircraft was no longer accelerating".
- Flight crews who have experienced an engine stall at takeoff have reported that the 'bang' is louder than any other noise they had previously heard in the cockpit. It is often compared to a shotgun being fired a few meters away.
- The 'bang' caused by the engine stall was as loud, if not louder, than the noise (which was caused by a genuine engine failure) the captain had experienced in the same aircraft on takeoff a few years earlier.
- The captain stated that, after hearing the 'bang' he was under the impression "that the aircraft could not fly".

Kalitta's FAA-certified Operations Manual stated the following:

It may be safer to reject a takeoff when approaching V_1 only if there is doubt of the aircraft's ability to maintain flight. The problem may be more safely handled as an in-flight problem than a rejected takeoff.

At or after V_1, unless a malfunction occurs that renders the aircraft uncontrollable, do not reject the takeoff. Statistics indicate that rejected takeoffs at V_1 are very seldom successful.

G-OGBE, B737-300 at Birmingham Airport

On February 6th, 2009, G-OGBE was scheduled to depart on a commercial passenger flight from Birmingham to Edinburgh. The previous night, the aircraft had been left on lay-over with the stabiliser in the full nose-down trim position as per the company operating procedures. The next morning, due to the fact that the aircraft was undergoing de-icing, the stabiliser was not reset at the usual time (during checking of the load sheet as part of the pre-flight procedures). After start-up, the crew became preoccupied with the flap position, determining that they would need to leave the flaps up for taxi through the slushy conditions. Snowfall became heavy as the aircraft approached the runway and the crew's attention then became focused on the required holdover time. Flap was selected at the hold point and at 07:37z, the aircraft began the takeoff run. With an all-up weight of 46,776kg, V_1 was set at 126kts and V_R was 132kts.

The first officer was PF. On attempting to pull back at V_R, there was no effect on the aircraft. The first officer then doubled his effort on the control column and informed the captain that he could not rotate the aircraft. Four seconds after the first attempt at rotation, the captain rejected the takeoff and closed the thrust levers at approximately 155kts. The aircraft was able to stop on the runway and taxi back to the stand following a brake inspection by the fire service. The subsequent investigation determined that when using the electric trim to position full-nose down during layover, the limit is 2.5 units. The takeoff configuration horn will sound only if the trim is outside of the permissible take-off trim range (1.0 to 6.3 units). A simulator trial to recreate the conditions determined that although more force was required on the control column, the aircraft was able to be rotated and climbed safely. Analysing the decision-making of the crew, the following was determined by the UK Air Accident Investigation Branch:

- The captain was acutely aware that the takeoff was commencing just within the revised hold-over time limit. Consequently, when he heard the first officer state that he could not rotate the aircraft, the captain immediately thought that the aircraft was incapable of flying due to ice accretion.
- When the first officer was unable to rotate the aircraft, his thought was that there was some sort of problem with the control surfaces.

C-GCPF, DC-10 at Vancouver International Airport

Canadian Airlines with a flight crew of four, was scheduled to depart on runway 26 bound for Taipei on 19th October, 1995. The V_1 call was made at 164kts and 2 seconds later at 170kts a loud bang was heard followed by significant vibration, shuddering through the airframe, and subsequent banging noises. 1.3 seconds after the initial bang, a call to reject was made by the captain and 0.8 seconds later the power levers were retarded. The aircraft could not be stopped on the runway and the nose-wheel collapsed as the aircraft ran off the end of the runway. The DC-10 finally came to rest approximately 400 feet beyond the declared end of the runway (255 feet past the end of the paved area). Minor injuries were suffered by some passengers during the emergency evacuation which followed. The source of the engine noises was found to be a compressor stall.

The Transport Safety Board (TSB) published the following in their accident report:

- In the crew's simulator training, compressor stalls were simulated by a series of muffled thumps. Simulated engine failures were identified by yaw, an engine fail light and instrument indications.
- The captain's decision to reject was based on the fact that he did not recognise the initial sound and subsequent thumping noises, and that, because he thought the bang could have been a bomb, he had concerns about the integrity of the aircraft and its ability to fly.
- The captain stated that, based on the rejected takeoff provisions in the DC-10 flight manual and on a fatal DC8 accident that he had witnessed, he had developed a mental rule not to take an aircraft into the air if he suspected that there was a structural failure.

Takeoff Overruns – is it any surprise they're still happening?

Each of the three events described, I believe, shed some light into the nature of the 'beyond V_1' conundrum and may answer the question as to why our takeoff safety statistics are not improving. These three events not only illustrate the vulnerabilities of how humans make decisions, but they also highlight the risk involved with having such subjective guidance about when it is appropriate to reject a takeoff beyond V_1.

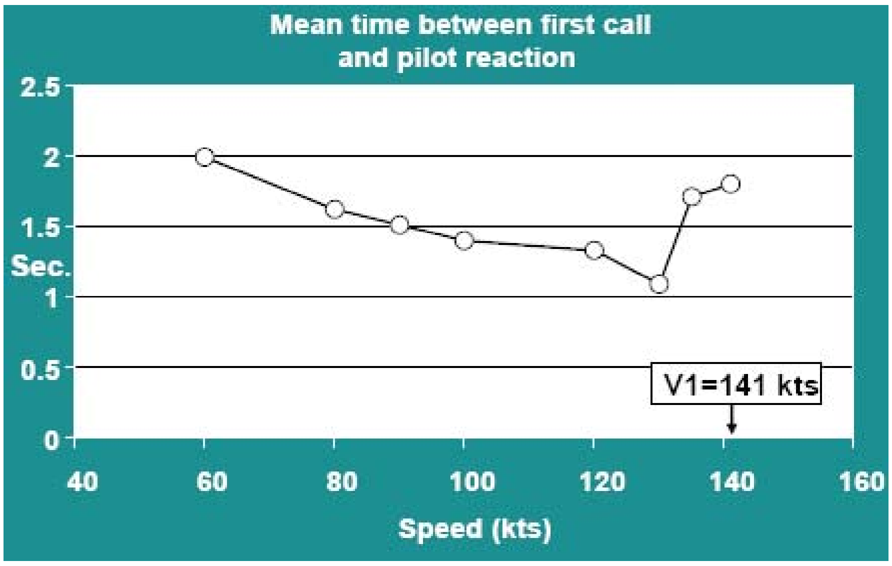


Figure 4. Reaction time to reject a takeoff as a function of ground speed. Within about 10kts of V_1, pilot reaction time increases.

Human Information Processing and Decision Making

There is debate regarding the level of information processing which takes place in such critical situations as this. Some pilots may instinctively react to a sensory input such as an aural alarm or the feel of a stick shaker with an almost automatic response. Others may take more time to decide, such as the captain of the Learjet who was killed following an overrun on takeoff in Southern Carolina in 2008. The CVR transcript details are summarised[2] here:

At 2355:10.5, the first officer reported, "V-one." About 1.5 seconds later, the CVR captured the beginning of a loud rumbling sound. Four-tenths of a second after the beginning of the loud rumbling sound, the first officer stated, "go," the captain stated something unintelligible, and, at 2355:13.0, the first officer stated, "go go go." The CVR recorded a sound similar to a metallic click, and, at 2355:14.0, the captain stated, "go?" The first officer then stated, "no? ar- alright. Get ah what the [expletive] was that?" The CVR recorded another metallic click sound, and, at 2355:17.0, the captain stated, "I don't know. We're not goin' though."

Regardless of the time it takes, the pitfalls of information processing and decision making are apparent. With an engine failure/fire condition, the crew has a set of pre-defined rules and, so long as there are reasonable cues, a comparative process using 'rule-based' decision-making can be completed e.g. fire/no fire and before V_1 / after V_1. Obviously some engine-related events are not as simple to diagnose particularly when accompanied with unusual cues that crews may not have experienced before. The Kalitta B747 captain obviously compared and contrasted the situation he was in to a previous engine failure he had experienced in the same aircraft. Its difficult to be critical of this intuitive form of diagnosis when we know that it is precisely this decision-making style that professional experts use in situations where there is immense time stress. The B737 captain at Birmingham had a heightened awareness of his aircraft's hold-over time when the first officer made a statement about not being able to rotate – can we blame him for being subject to confirmation bias when he suspected icing? What about the DC-10 captain? Psychologists[3] suggest that people typically entertain the most 'available' hypothesis and the captain's memory of the takeoff accident he witnessed was probably why structural failure came to mind first (particularly given that the compressor stall was not representative of what the captain had experienced in the simulator).

Unsafe to fly? The captain of Air Liberté Flight 8807 thought so when he saw another aircraft taxi out in front of him at Charles de Gaulle airport in 2000. The collision which occurred three seconds after V1, killed the first officer of the other aircraft, a Shorts 330.

Another difficulty which is highlighted in the NRL-Air Transport Safety Institute paper is that often the decision to reject is made prior to V_1, however, initiation of the abort manoeuvre doesn't take place until after V_1. Figure 4 depicts the results from a simulator study[4] conducted by Cranfield University which demonstrates an interesting phenomenon with regard to pilot reaction times in rejecting a takeoff. As ground speed increases, the reaction time (to an instruction to reject) reduces, however, within about 10kts of V_1, this trend reverses sharply and the time taken for pilots to react actually increases. It would appear that pilots have increased difficulty in making a decision the closer they get to that magic number.

Perceptions of Risk

When information is vague, people begin to form their own mental model of reality based on the information they do have – be it correct or incorrect, complete or incomplete. A pilot's mental model on what makes an aircraft unsafe to fly may be influenced if they have witnessed or heard about accidents where the takeoff was unsuccessful. The DC-10 event discussed above is an example of this where the captain obviously held strong views about the potentially catastrophic results of taking an 'unsafe aircraft' into the air. Which fatal DC-8 accident the captain had witnessed was not specified by the TSB in their report. However, given his age, there were potentially six DC-8 takeoff accidents he could have been witness to, one of those being the now infamous and controversial Arrow Air crash at Gander[5].

Humans tend to be subjected to bias when making decisions particularly when an element of risk is involved. For example, our perception of the severity of a hazard (e.g. taking an 'unsafe' aircraft into the air) appears to have a greater impact than the probability of a hazard (e.g. overrun events) when we estimate risk. Additionally, when we perceive the frequency of different consequences of risky behaviour, our perceptions are not based on actual frequencies (which would be objective risk), but on their salience in our memory. There is also evidence that peoples perception of risk is driven upward by something termed 'dread factor' meaning uncontrollable, catastrophic consequences. The DC-10 captain's decision to reject his takeoff now becomes more understandable. And obviously, while pilots won't be processing these risk assessments on any meaningful level when the decision to take action is made, we might wonder to what degree any pre-formed opinions could be an influence.

Lack of Objective Guidance

Is it little wonder that with the degree of subjectivity surrounding the V_1 guidance, we continue to see pilots rejecting the takeoff above V_1? The captain of Kailtta Air did *judge* the aircraft incapable of flight, the captain of the Canadian Airlines DC-10 *did have* serious doubt that the aircraft was safe to fly. The accident report comments on this: "When the captain heard the loud bang, he immediately thought of a bomb. The only procedural guidance available for this circumstance was that a rejected takeoff after V_1 could be initiated when the captain believes that the aircraft has suffered catastrophic failure and will not fly". With no objective guidelines or advice on offer, is it fair to blame a pilot for making an incorrect decision, particularly when that decision is highly complex and has to be made in a split second? Adding to the problem is that while there are plenty of statistics around about 'incorrect' decisions to reject, there are very few examples available when aborting the takeoff above V_1 was the correct decision. So what can be done? Given that liability issues would prevent the removal of the 'unsafe/unable' statement – would anybody want to say an aircraft is flyable under any circumstances? - perhaps the most objective guidance we have regarding the decision is that beyond V_1 the captain must acknowledge that they are gambling the unknown of the takeoff, against a known choice of an overrun. We have to be go-minded because, statistically, it is more likely to result in a successful outcome.

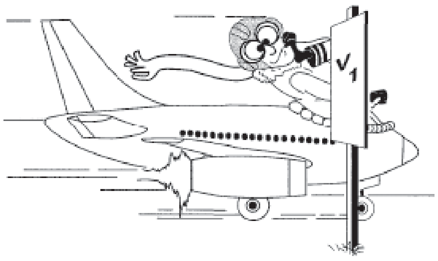
That particular gamble was one the captain of Air Liberté Flight 8807 made on the night of 25th May, 2000. The MD-83 was cleared to takeoff from runway 27 at Charles de Gaulle airport. Unbeknownst to the crew, a Shorts 330, operated by Streamline Aviation was then cleared to line-up and to wait as "number two". The tower controller believed that both the MD-83 and the Shorts were at the threshold of runway 27, but the Shorts had actually been cleared by the ground controller to use an intermediate taxiway. The Shorts then entered the runway at the moment the MD-83 was reaching its rotation speed. So what did the captain of the MD-83 do? Go or No-Go? The V_1 announcement had already been made by the first officer, then, three to four seconds before the impact, the Captain saw an aircraft stopped on a taxiway near the runway, approximately 200-300 metres ahead of them. Immediately after, since the aircraft appeared to be moving, he prepared to abort the take off in case of contact. Then just as V_R was called, the Captain saw the Shorts move forward from the left and heard the noise of its engines. Bearing in mind the risk of collision, the rotation was not performed. The impact occurred instantaneously, with the wing of the jet slicing through the cockpit of the Shorts, killing the first officer instantly.

The investigation report, which was produced by the Bureau Enquêtes-Accidents (BEA), makes no comment as to whether the decision the captain of the MD-83 was the correct one. There is no criticism that the captain rejected a takeoff beyond V_1, nor any speculation as to what would have happened had he chosen to continue. Other accident investigation reports have not been so reserved. In September 1970, a Trans International Airlines DC-8 crashed after takeoff at JFK. At some point prior to takeoff, a foreign object (most likely a piece of asphalt) became lodged between the leading edge of the right-hand elevator and the horizontal spar access door in the aft part of the stabilizer. The loss of elevator control meant that the aircraft stalled on takeoff (witness reports indicate the aircraft reached a nose-up attitude of between 60-90° at an altitude of around 300 to 500ft). The National Transport Safety Board concluded *"An apparent lack of crew responsiveness to a highly unusual emergency situation, coupled with the captain's failure to monitor adequately the takeoff, contributed to the failure to reject the takeoff"*. The more cynical amongst us by now might be thinking 'damned if you do, damned if you don't'!

Summary

So where does that leave pilots? As an industry we know that rejecting beyond V_1 is the leading cause of runway overruns on takeoff. We know that there are plenty of examples around where, in hindsight, investigators have determined that the decision to reject was 'incorrect'. We know that the only information given to pilots on the subject is, at best vague, at worst contradictory. We acknowledge that this is complex topic, fraught with contentions and that many prefer not to comment on the issue. Others give more careful commentary, such as this from the TSTA:

"The statistics of the past three decades show that a number of jet transports have experienced circumstances near V_1 that rendered the airplane incapable of being stopped on the runway remaining. It also must be recognised that catastrophic situations could occur which render the airplane incapable of flight. It is recognised that the kinds of situations that occur in line operations are not always the simple problems that the pilot was exposed to in training. Inevitably, the resolution of some situations will only be possible through the good judgement and discretion of the pilot."



Beyond V_1 pilots must recognise that they are gambling the unknown of the takeoff, against a known choice of an overrun.

Assessing such complex situations is difficult and often not well trained. There are often no references to what might make the aircraft unsafe to fly, making it difficult for the crew in recognizing such a condition. The reliance on perception then provides the opportunity for errors in decision making.

3 January, 2010: Air Berlin lies 83m past the end of runway 06 at Dortmund Airport after rejecting the takeoff from a ground speed of 125kts. When the first officer called "V?" at 127 KIAS, the captain noted his ASI was under-reading and the IAS disagree light had illuminated.

But, the question remains – what should industry be doing? We seem to have come up against a barrier with regard to our takeoff safety statistics. I wonder if we should ask ourselves whether we are providing the best support and tools for our flight crews when it comes to this issue? There's no doubt that excellent work has been done over the years to improve takeoff safety, particularly with regard to the clarification of what V_1 actually means. This article is not written to undermine any of the safety achievements which have been made to date. Rather its purpose is to query whether industry now needs to direct its focus to what has, for many years now, been seen as a somewhat 'taboo' subject. Should we be resting comfortably whilst in the knowledge that we've turned our flight crews out to wander this particular wasteland alone? After all, you can ask any pilot these days and they'll tell you the following: if you haven't initiated your rejected takeoff by V_1, you're going. V_1 is go-speed. At V_1 you're committed. At V_1 you must continue the takeoff. That is...unless you're the captain. Unless you're the captain and you have reason to believe that your aircraft is 'unsafe' to fly.

Welcome to the Wilderness...

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1 G.W.H.Van Es (2010). Report Number NRL-TP-2010-177.

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3 As described in Wickens, C. D. & Hollands, J. G. (2000). Engineering Psychology and Human Performance. New Jersey: Prentice Hall

4 Harris, D. and Khan, H. Response time to reject a takeoff. Human Factors and Aerospace Safety 3(2), 163-173, 2003.

5 The official accident report determined the probable cause of the crash was the "aircraft's unexpectedly high drag and reduced lift condition, which most likely was due to ice contamination on the wings, leading edges and upper surfaces". A minority report was filed by four members of the investigation team arguing that the cause could have been an onboard explosion of unknown origin.

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UK FLIGHT SAFETY COMMITTEE OBJECTIVES

- **To pursue the highest standards of aviation safety.**
- **To constitute a body of experienced aviation flight safety personnel available for consultation.**
- **To facilitate the free exchange of aviation safety data.**
- **To maintain an appropriate liaison with other bodies concerned with aviation safety.**
- **To provide assistance to operators establishing and maintaining a flight safety organisation.**

Call Sign Similarity and Confusion - EUROCONTROL Solutions to an Age Old Problem

by Sid Lawrence – EUROCONTROL Call Sign Similarity Project Manager

I suspect that most controllers and any pilots reading this will have at sometime or another been involved in a case of call sign similarity. If you're lucky, the worst that happened was distraction and a temporary (but unwelcome) increase in your workload; however, if things conspired against you then things may have escalated to a point where confusion reigned on the air waves resulting in a pilot acting on a clearance or instruction meant for another aircraft with all the attendant potential for level bust, runway incursion etc.

Of course controllers are also fallible(!) and it may be them and not the pilot who is confused. Moreover, controllers may have the added distraction of similar looking call signs on radar labels, flight strips etc to contend with. We know that ICAO PANS ATM provides a short term palliative – you can ask pilots to adopt a different call sign for a specified period until the threat has passed. But how realistic is this on a busy Approach frequency when you barely have time to get the normal flow of words out? Would it not be better all round if a more systematic view was taken of this long standing problem?

Well the EUROCONTROL response to this question is, yes. The Agency's efforts to provide solutions to call sign similarities (CSS) started back in 2004 as part of an Air Ground Communication (AGC) Safety Initiative.

We first of all picked up on previous research such as the UK CAA's ACCESS study (Aircraft Call Sign Confusion Evaluation Safety Study - published as CAP 704 in 2000) and other similar work by, the National Aerospace Laboratory of the Netherlands (NLR) and the France ANSP – direction des services de la navigation aérienne (DSNA).

The culmination of this research was the inclusion of a recommendation in the EUROCONTROL AGC Safety Initiative which stated that:

"EUROCONTROL should investigate the feasibility of using the flight planning process for the systemic analysis, detection and deconfliction of similar call signs"

In turn this recommendation found its way into the European Action Plan for Air Ground Communication Safety released in 2006. It is from here that the EUROCONTROL, Call Sign Similarity Project was launched in 2008 with the intent to provide pan-European solutions to what is an age old problem. The kick-off event was attended by 60+ aircraft operators (AO) and numerous ANSPs; IATA, the EC, and ICAO representatives were also present. Many of the attendees form the nucleus of the EUROCONTROL Call Sign Similarity User Group (CSS UG).

The aim of the CSS Project is simple - to reduce the operational safety risk associated with call sign similarity/confusion and enhance flight safety. It's not possible to eliminate the risk completely but the proposed EUROCONTROL solutions can make significant inroads depending on the actions of aircraft operators and, to a lesser extent, ANSPs.

The CSS Project Strategy is following a stepped-approach based around 3 Service Levels:

Service Level 0

- Establishment of a **Call Sign Management Cell (CSMC)** in the former CFMU (now Network Manager Operations Centre (NMOC)) to provide expertise and facilitation of the CSS solutions.
- The formation of a **CSS UG** (as mentioned previously) - co-Chaired by the Agency and an airline representative - to provide essential stakeholder input and experience into the development of the solutions.
- The development of a **Call Sign Similarity Tool (CSST)** to detect and deconflict call sign similarities embedded in aircraft operators' flight schedules. More on this later.
- Agreement on, and publication of, **Call Sign Similarity 'Rules'**. 'Similarity' is a relative term and means different things to different people. Agreeing on what makes one call sign 'similar' with another one is not an exact science.

Note: The CSS Project scope only covers the suffix part of the call sign and not the prefix (i.e. it's looking at similarities between the flight numbers (and letters) and not the ICAO aircraft operator designators and R/T designators). See 'What's in a Name?- Similarity Rules Explained' for more details.

Service Level 0 is largely complete. Any remaining work is associated with the upgrading of the CSST and improving the *modus operandi* of the CSMC.

What's in a name? – Call Sign Similarity 'Rules' Explained (in a separate panel/section)

So what makes one call sign 'similar' to another one? For example, the suffixes in ABC 1234 and DEF 1234 are not just similar but the same – an easy one to spot! But what about between ABC 5678 vs ABC 5687, or ABC 5678 vs ABC 6587, or ABC 5678 vs ABC 5682 or ABC 5678 vs ABC 5623? My guess is that most people would consider the first 3 examples to be 'similar' to some extent or another but perhaps would not regard the last one as a 'similarity' – some people do though!

After much debate, the CSS UG agreed a set of CSS 'Rules' which were published by EUROCONTROL in April 2010. Some examples of the most common 'rules' follow, the full list can be found at: http://www.eurocontrol.int/sites/default/files/content/documents/nm/safety/css-rules.pdf.

General Rules: Identical Final Digit (ABC 234 vs ABC 534); Identical Bigrams (ABC 32DF vs ABC 68DF); Anagrams (ABC 1636 vs ABC 1663); Parallel Characters (ABC 41 vs ABC 401 vs ABC 4351); Identical Final Letter (ABC 23L vs ABC 357L).

Local Rules: ICAO Designator Destination Codes (e.g. in UK AUAs do not use LL, KK, HH, SS etc). Note: This local rule conforms to recent IFATCA policy on call sign confusion.

Flight Entities: Headings and Flight Levels (ABC 170 vs Heading 170 vs FL 170); Runway Designators (ABC 23R vs Runway 23R); Note: These types of 'similarities' are more theoretical than practical. Not many AOs apply them and over use can severely constrain the 'solution space'.

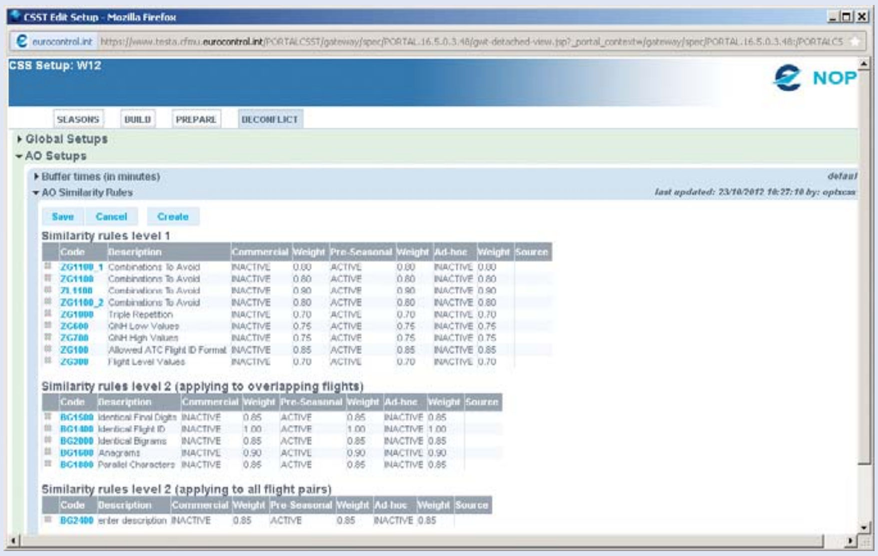
Formats All numeric (n, nn, nnn, nnnn); alphanumeric (nA, nAA, nnA, nnAA) and letters to avoid (e.g. I vs 1 and, O vs 0). Note: The suffix should never begin with a letter, e.g. Ann as a format is not permitted; in addition combinations such as nAnA and nAAn can be difficult to pronounce and should not be used.

Alphanumeric Call Sign

In an effort to provide more call sign 'solutions' some airlines have been adding letters to the suffixes to form so-called alphanumeric call signs. Whilst this can be a useful way to deconflict a flight schedule, alphanumerics are not without their problems and should be used judiciously. Both the NATS AIC: P 054/2009 "RTF Call Sign Confusion" and the Air Ground Communication Briefing Note on SKYbrary:http://www.skybrary.aero/bookshelf/books/110.pdf) recommend that AOs should try to use numeric solutions first before embarking on the use of alphanumerics. Furthermore, in certain circumstances (e.g. long-haul flights) it may not be possible to use a alphanumeric call signs because of overflight permissions by some States which insist that the numeric call sign associated with the Commercial Flight Number (CFN) - i.e. the flight number you see on your ticket - is used for ATC communications. Similar constraints are applied by some airport operators concerning the use of aerodrome 'slots'. In addition, some ANSP systems don't recognise alphanumeric call signs either - so they are not necessarily a panacea for success.

Rules and the CSST The CSS 'Rules' and their application in the CSST are at the heart of the detection and deconfliction process, so it's important that they are meaningful. Apply too many 'rules' and too many 'similarities' are detected, too few and more obvious 'similarities' are left inside the flight schedule. It's a balancing act. In addition, the more 'rules' that are applied by default – as well as any additional constraints that an AO chooses to apply - reduces the size of the 'solution space' to generate an acceptable conflict free call sign.

Screenshot of CSST Similarity 'Rules'

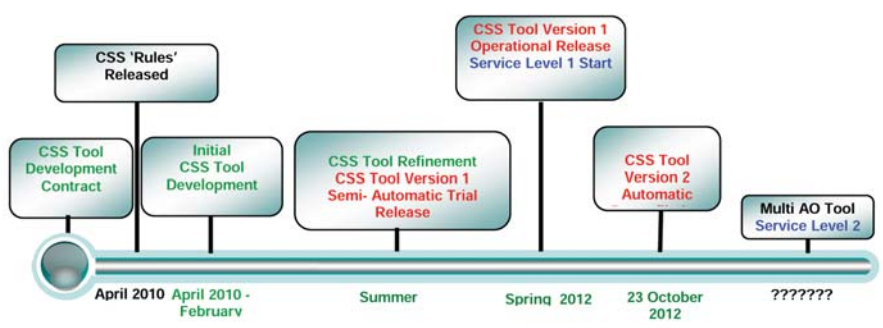


Service Level 1 is the detection and deconfliction of similar callsigns within a **single aircraft operator's** flight schedule. Records and safety data show that approximately 75% of reported similarities occur between two (or more) aircraft from the same airline. Hence, the approach adopted is to try to get each individual operator to put its own house in order before tackling the problem of 'similarities' between different AOs - see Service Level 2.

Service Level 1 operations formally commenced in March 2012 – see later.

Service Level 2 foresees the **deconfliction of multiple aircraft operators'** schedules by the CSMC. This is a more complex operation and there are a number of challenges that would need to be overcome before centrally coordinated solutions could be introduced. It would certainly need participating AOs to take a 'leap of faith' and hand over some responsibility for their CSS activities to the CSMC to have any chance of success. Much will depend on the results from Service Level 1 operations and the technological implications will need to be fully understood and subject to CBA before embarking down this route. Despite these challenges, Service level 2 remains firmly on the agenda for future consideration and attention.

CSS Project Timeline



Service Level 1 - Operational Concept
The Operational Concept for Service Level 1 – supported by the EUROCONTROL CSST – is to be proactive and preventative. Four Operational 'Use Cases' are defined:

Use Case 1 is the so-called commercial deconfliction use case and is provided to encourage airlines to begin the similarity deconfliction process as early as possible in the schedule production cycle. If the AO works with CFN as their ATC call signs then use of the CSST can highlight the similarities at the outset and assist airlines in reducing their number. This activity could typically be performed by the airline's scheduling department several months before the start of the next IATA season.

Use Case 2 is the main pre-seasonal use case. This is usually undertaken by the AO's operations division several weeks before the start of the IATA season and involves the deconfliction of the ATC call signs – which may, or may not, be the same as the scheduled CFNs depending on the AO's policy.

Use Case 3 is the ad hoc deconfliction of a schedule during the IATA season following the introduction of a new route/city pairing or as the result of a reported similarity/confusion event. It is normally preformed by the airline but it can also be done by the CSMC if necessary.

Use Case 4 has been dubbed the 'sanity check' use case. The idea is that the CSMC will conduct a screening of the deconflicted schedules for all the AOs that are using the CSST to check that use of the Tool is not creating an excessive number of multi AO similarities. It is inevitable that some inter AO similarities might occur; however, the large scale reductions (normally more than 75%) of embedded similarities within each operator's own schedule greatly outweighs any potential negative effects. Moreover, the CSST has been programmed to generate 'random' solutions as part of the deconfliction process rather than proposing the same default ordered list of sequential solutions to each AO.

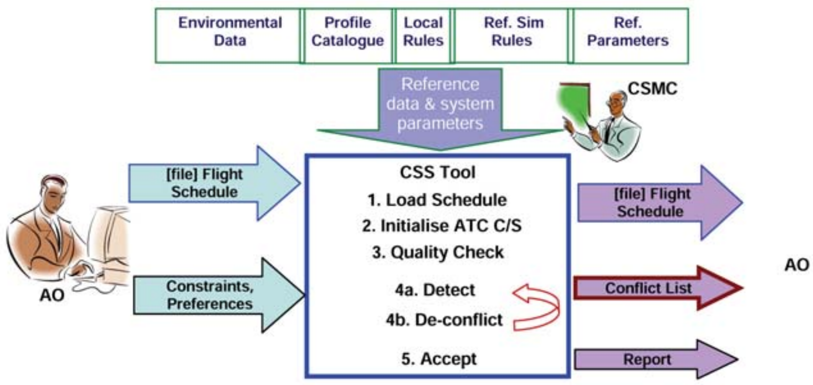
Call Sign Similarity Tool

The EUROCONTROL Call Sign Similarity Tool (CSST) is central to Service Level 1 operations. Following detailed inputs from the CSS UG, the release of a prototype version of CSST in autumn 2011 was tested by a small number of AOs to deconflict their 2011/12 winter season schedules. The prototype featured automatic detection of similarities but was limited to a manual or semi-manual deconfliction process. Notwithstanding some 'performance' issues, the AOs were more than satisfied with the results – the deconfliction rate was high (in excess of 90%) - and for them it was a much more efficient process. Further refinements were made during the winter and a first operational version of CSST was released on 20 March 2012 - this marked the formal start of Service Level 1 operations.

Fully Automatic CSST The big breakthrough, though, occurred in autumn 2012 with the release of a completely reworked CSST on 23 October. This version features much improved performance ('detection' speed is down to a matter of seconds in most cases) and most importantly the introduction of **fully automatic deconfliction**. What can currently take AOs 2 to 3 man days of effort can now be reduced to a matter of hours, depending on the size and complexity of the flight schedule.

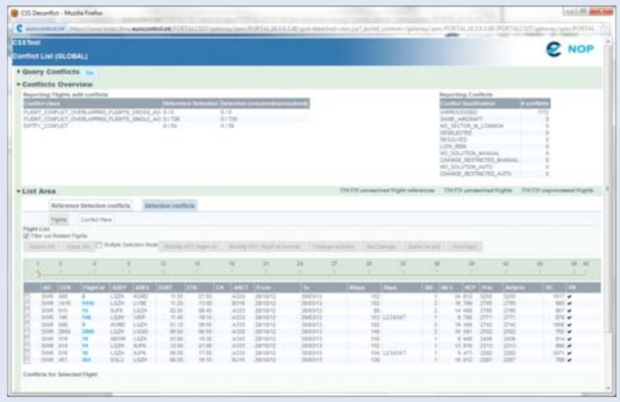
CSST is web-based and available to all AOs through the EUROCONTROL Network Operations Portal (NOP).

How CSST Works - Call Sign Similarity Tool Explained (in a separate panel/section) with a graphic and CSST screen shot.



CSST Process
The basics mechanics of CSST, shown on the graphic, are as follows:

- Prior to each season the CSMC inputs the reference data and parameter settings, including:
  - The default 'Rules' settings - currently 10. Later in the process, AOs can add others as they see fit.
  - A 'city pairs' profile catalogue from the Network Manager (NM) data warehouse - currently 140,000+.
  - ATC Unit of Airspace (AUA) volumes - as used by the NM for ATFCM functions - these roughly equate to FIR boundaries but some are smaller.
  - Buffer Times – standard is ETA/ETD -15 mins to +30 mins to allow some room for early arrivals/departures or delays.
- AO creates a work area in CSST and uploads their schedule.
- AO initiates, and CSST assigns, an ATC call sign to each flight – usually the CFN in the schedule.
- CSST carries out a quality check to ensure that all flights in the schedule have a 'city pair' and assigns a 'profile' based on the most commonly flown 'city pair' routing.
- AO can then add any further constraints or preferences (e.g. additional 'rules' or preferred formats for call sign solutions)
- CSST then 'detects' similarities firstly by comparing all the flights in the schedule to see whether they will overlap in time and space (e.g. at departure or destination aerodrome or somewhere en route (using the AUAs).
- CSST then applies the similarity 'rules' to the overlapping pairs of flights to see which of them have 'similar' call signs. This action generates a 'conflict list' of flights that need to be deconflicted.
- AO can then use CSST to carry out the deconfliction either manually, semi-manually or fully automatically as they prefer.
- CSST proposes a deconflicted flight schedule which may also contain any 'unresolved' conflicts because:
  - The CSST has run out of 'solutions'; or
  - The AO has decided not to change a CFN/call sign due to overflight permissions etc.
- AO can then 'accept' the outcome and apply the deconflicted ATC callsigns during the forthcoming season.



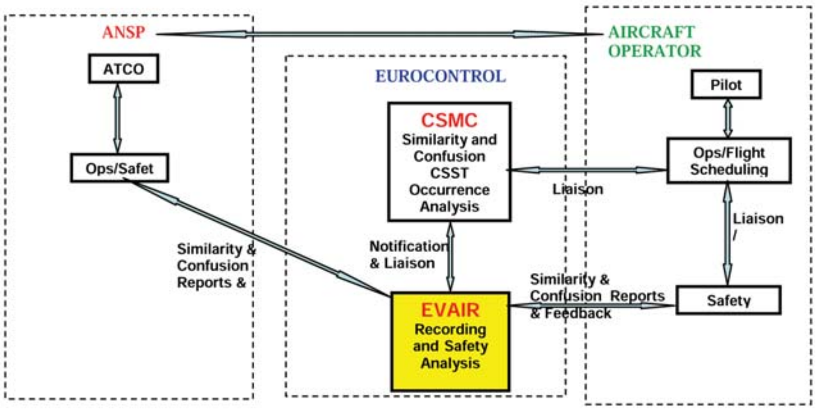
Screenshot of typical CSST Conflict List

The AO remains firmly in control at all times. CSST is versatile and flexible enough to accommodate most AO preferences and constraints whilst still providing a very good level of deconfliction. The CSMC helps to facilitate the whole process and a CSST User Guide and CSST NOP Help is available to Users. On-site familiarisation training is available at the CSMC or AO premises.

Performance Monitoring

To help us gauge the operational effectiveness of CSST a performance monitoring regime has been agreed with AOs and ANSPs centred on the EUROCONTROL Voluntary ATM Incident Reporting (EVAIR) scheme: http://www.eurocontrol.int/services/eurocontrol-voluntary-atm-incident-reporting Essentially, AOs and ANSPs are encouraged to send their similarity and confusion reports to EVAIR who record them and forward them to the CSMC for potential evaluation.

CSS Performance Monitoring



EVAIR – EUROCONTROL Voluntary ATM Incident Reporting

We welcome reports from all quarters but are especially interested in those that involve CSST Users so that CSMC can see if any of the Tool's parameters or reference settings need changing. For instance, based on the information already provided by ANSPs, we were able to refine the application of some of the 'rules' so that they more accurately capture the 'similarities' reported by controllers and pilots rather than some of the more obscure 'similarities' they were detecting inside AOs' schedules.

Currently, 12 ANSPs - including NATS - provide us with regular CSS data. In addition, if requested, we use the information to put AOs in touch with each other if they are involved in a multi AO conflict. The airlines generally react well to these prompts and many ad hoc changes to call signs are made to reduce the risk of re-occurrence during the remainder of the season. The performance monitoring regime is also a useful means of recruiting new AOs to the CSS Service and CSST.

CSST Performance – AO and ANSP feedback

CSST offers AOs the potential for significant savings in time and effort to deconflict their flight schedules. More importantly though, notwithstanding known AO limitations such as not changing the call signs of some long haul flights subject to overflight permissions etc, CSST users report a high rate of deconfliction – some can remove all embedded similarities. This translates into considerable reductions in the number of single AO similarities and confusions being reported involving these airlines. Flybe UK is an excellent example. The company has been involved in the CSS Project from the outset and has fully embraced the CSST to extent that it has virtually eliminated all intra AO similarities during the past 2 seasons. This is good news for all parties. Risk is reducing and flight safety is enhanced - the ultimate operational aim of the CSS Project.

AO Participation

The CSS UG membership includes more than 60 airlines and many ANSPs who all follow the programme closely. Some AOs who were previously doing nothing have decided to go off and do their own thing - which is perfectly acceptable – but conversely some others have come the other way and embraced the EUROCONTROL concept. Approximately 40 AOs have signed up to access the CSST and about a third of them have taken positive action to use the Tool in earnest. The major challenge to us now is to get the remainder to convert their initial interest into practical application as well as to attract more clients to CSST. In this sense, there is world wide interest in the CSS Project. We have contacts in the US, Australia, the Far and Middle East as well as South America and Africa. Indeed, because CSST can detect similarities based on ICAO departure and destination location codes, its benefits can be applied globally even though it is optimised for European-based operations.

What's Next?

After a hectic couple of years developing the CSST, it's now time for a period of consolidation. We need more AOs to use the Tool and more ANSPs to join the performance monitoring regime. In addition, the CSMC needs to gain more experience before taking any steps towards Service Level 2 operations. The Use Case 4 'sanity check' work should help us better understand some of the complexities of multi AO deconfliction and help us assess the feasibility and practicality of moving to the next level. However, it's clear already that if we want CSS solutions to truly work on a pan-European dimension then there will need to be some form of central 'control' and/or coordination by the CSMC (or perhaps another body?). We will need complete buy-in for the operational concept from the airlines who may have to cede some of their current powers regarding their ATC call sign policy.

Conclusion

At face value, resolving call sign similarity looks quite simple. However, you only need to scratch under the surface and there are many nuances and intricacies that need to be considered. The ATC call sign especially where it is also the CFN, is part of an AO's identity and as such airlines care about it and sometimes guard it jealously. The call sign is also an integral part of the controller-pilot communication loop and so there should be no room for confusion either on the ground or in the air. Finally, despite the introduction of new technologies such as CPDLC, which may reduce exposure to the risk, the threat of call sign similarity/confusion is, and will remain, something which we need to guard against. Through the proposed EUROCONTROL solutions we are doing just that.

Additional Information/Contact Us

- EUROCONTROL website contains more information about the CSS Project: http://www.eurocontrol.int/services/call-sign-similarity.
- SKYbrary - Air Ground Communication (www.skybrary.aero)
- SKYbrary Bookshelf http://www.skybrary.aero/bookshelf/content/index.php.
- Call Sign Management Cell at nm.csmc@eurocontrol.int

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focus ON COMMERCIAL AVIATION SAFETY

"The Curse of the Silo Mentality"

by Martin Barrow

Martin Barrow is an aviation safety and security consultant with extensive experience in Asia, including as a member of the Hong Kong Aviation Advisory Board and Steering Group for the new Hong Kong Airport and as a Director of Malaysia Airlines. Mr Barrow is writing in a private capacity and his views may not necessarily be the same as those of any organization with which he is associated!

What is Silo Mentality?

Organisations of all sizes suffer from the consequences of internal functional barriers. As well as Silo Mentality this is sometimes described as Silo Thinking, Silo Vision, Silo Effect or Stovepipe mentality. I am sure all will be familiar with the challenge of improving internal communication, both within Government and with the private sector. The inquest into the 7/7 events heard reports of poor coordination across many entities although much will have been done already to make improvements.

I seem to spend a lot of time talking in many organizations across the world about the need to close down the SMD, **the silo mentality department**, as well as other related departments such as the BCD **(blame culture dept)** and BRTD **(bureaucracy and red tape dept)**, all of which are a hindrance to better communication in issues related to security and crisis management.

I have been teased by staff that I am manager of the CQTND, **the challenge**, **question**, **trouble and nuisance dept**, as I challenge and ask a lot of questions as a non-executive director of various entities. That is of course the job of a non-executive director but overall we all work together very well. Problems of poor communication across organizations are not just in the fields of security and ERP: better "joined up Government" must be a target everywhere, as must be better links with the private sector.

I was speaking at a risk conference recently and afterwards a US lawyer asked me to explain about silo mentalities as he had not heard the expression before. I was able to give him a sombre but real example: if the White House, the State Department, the FBI, and CIA had communicated more effectively, they would have been much more aware prior to 9/11 of the determined intention to attack the USA. Of course, the US has taken a lot of action since with the homeland security set up but as demonstrated by Katrina, there are still plenty of silo problems. We should also remember the overriding conclusion of the 9/11 Senate Commission: **"There was a collective failure of imagination and that failing to prepare for a range of totally imaginable occurrences is unforgivable"**.

This is a global issue, but is perhaps exacerbated in Asia where there is a stronger hierarchical culture, a systemic failure to speak up and contradict one's boss and inherent secret-ness.

The problem is that the silo mentality is so widespread that it is too easy to assume that it is an inevitable problem within organisations. In fact, it is only inevitable in those that choose not to eliminate it. This can be a costly mistake as the silo mentality can have major consequences:

1. It is a major factor in creating resistance to change. When people or groups are only focussed on their own activities, they see change only in terms of the problems it will create for them.

2. The SM has a major effect on the effectiveness of an organisation. Ask yourselves the simple question: if everyone focussed on working to assist the organisation achieve its goals, how much more effective would it be. The usual answer is between 20 and 40%.

3. The SM ensures that an organisation does not change until after a crisis which may prove a fatal weakness.

4. The SM helps create internal conflict and misalignment that can make many organisations unpleasant and stressful places at which to work.

5. A SM stops different organisations and groups from working together effectively, even when working together could be highly beneficial to all concerned.

6. Organisations must discuss internally as to why they have silo issues: ie is it because individuals lack self-confidence, is it due to fear of interference, is it a concern that too much communication will create a bureaucracy and delays in decision making. All of these can be easily overcome with teamwork!

A risk management report published in Sept 2010 by the Chartered Institute of Management Accountants **warns against the silo mentality and the compartmentalisation of risk management (full report available on their website)**. Risk management is no longer the exclusive domain of the finance function. The report reveals that the effective management of risk can only be achieved if it is clearly linked to operational performance and communication across organisations. To ensure a business is sustainable, risk management must be embedded in the overall organisational culture. The link between risk and management and performance must also be clearly laid out.

Silos in the world of aviation security and safety

The heightened security since 2001 has cost the industry $30b and the silo mentality in security is often an issue. Historically, security departments have existed but they have been tucked away behind an unmarked door and not talked about! Of course there are some aspects related to intelligence which must be kept totally confidential but the move to more open dialogue on security is welcomed. 20 years ago the Government line was to neither confirm nor deny the existence of the Government's security-related organizations. That has changed dramatically, with web sites and on line recruitment! Readers will be familiar with CPNI, the Security Service's Centre for the Protection of the National Infrastructure which works closely with critical national businesses. The speech on 12th October 2010 by the head of GCHQ on cyber attacks highlights the need for Government/Business collaboration on that issue.

In the airline business, there is a strong culture of promoting openness under the safety management system. An open non-punitive culture is an essential tool in promoting safety and security: we must all learn from mistakes and encourage openness.

Luckily in aviation whilst we must never discuss commercial matters due to anti-trust laws, when it comes to safety and security we are all on the same side of the table and there is constant dialogue across the industry. The industry is full of acronyms, but I have introduced another! **LLATOC** is **Lessons Learnt Action Taken Outcome Closure**. ie Ensure there is follow up action on everything.

Blame, except in cases of gross negligence, must be avoided but should of course be apportioned if there is a cover up of an incident and the airline industry has moved towards a "Just Culture" distinguishing between mistakes and gross negligence or covers-ups.

The greatest cover up in history was probably Watergate in the early 1970s: if President Nixon had owned up right at the beginning he could probably have survived as President!

Open Commonication: Suggested Actions

Across all threats, it is better for Governments to be open with the public as a whole and with business, to ensure maximum support and understanding from all concerned. I would suggest 7 actions under promoting openness:

1. Business organizations must become partners with state and local governments to identify gaps in regional preparedness and response capability, and then work together to close the gaps.

2. Regional public/private partners should identify in advance their unique resources and personnel that can be made available to state and local first responders, and ensure that the business organizations are also integral parts of public emergency planning and exercises.

3. State and local officials together with multinational corporations should form ongoing, working partnerships and relationships at the regional level that transcend government, industry sectors, and political boundaries. The government as well as the private sectors should recognize that business-government partnerships require a level of trust and it is easily created and developed at the regional level.

4. Businesses themselves should work more closely together. We encourage this in the Association of Asia Pacific Airlines where there are sub-groups for both security and emergency response planning. Here in the UK, the UKAEPG (UK Airline Emergency Planning Group) does an excellent job in ensuring coordination among UK and overseas airlines.

5. Security professionals provide great opportunities to ensure a coordinated response. In East Asia the Asia Crisis and Security Group (ACS), was set up after the Tsunami to enhance cooperation through more effective security and crisis management. Membership is free and please visit www.acsgroup.org for details as it may be relevant to some readers with links in Asia.

6. Leaders and managers in both government and business should step up their MBWA, **management by wandering about**. This is not about by-passing normal decision making through line management but is about **looking, learning, listening and encouraging**. It is an important KPI in some multinationals and across all organisations, there should be more people getting away from their own desks and in trays! British Airways set up a "A Day in the Life of" programme a few years ago, with staff from one department spending a day in another department eg Someone from Flight Operations spending a day at Engineering. Hugely valuable in overcoming silos!

7. The dangers of superficial reporting through the over reliance on power point is being increasingly highlighted in the private and public sectors. Coloured graphics and contrived charts substitute for thought and logic, yet create a façade of analytical credibility. Quick flashes of powerpoint will not eliminate silos; real face to face communication and discussion is needed!

Learning from the United Kingdom

It is only in 2001 that a central organization was set up in the Cabinet Office,the Civil Contingencies Secretariat, which has done good work ever since. This was because of two crises in the UK: foot and mouth disease and oil supply/transportation issues (i.e. not because of the events of 9-11), as the Prime Minister found that there was little coordination across Government in dealing with a crisis. There is an excellent website (www.ukresilience.info/)

In 2006, the CCS started a new initiative, the Business Advisory Group on Civil Protection, the aim of which was to improve coordination between Government and Business. I was invited to join that group which included representatives from all relevant Government departments and individuals from businesses and associations covering fields such as banking, insurance, retail, power companies, telecommunications, aviation, hotels and tourism, and manufacturing.

Countries across Asia would benefit from much more openness and better collaboration, perhaps through a similar coordination group or committee between Government and the Private Sector. I am sure the UK's Civil Contingencies Secretariat would be happy to meet with representatives from Asia to demonstrate how it works.

The handling by China of the tragic Sichuan earthquake 2 years ago is an example of an encouraging trend towards openness and better coordination, Delegations from China have met the Cabinet Office.

Japan

An interesting example in Asia on growing openness is Japan (where I lived for many years), which also did not have a central unit until after the tragic Kobe earthquake of 1995. Apparently the Prime Minister heard about the earthquake on television!

Based on the lessons from that earthquake, a post of Chief Cabinet Secretary for Crisis Management was set up to effectively fill the role of crisis management as a "control tower" for Government as a whole. The team acts as a catalyst to improve crisis management for Government as a whole through advancing the development of response plans to various types of crises and encouraging the implementation of practical training based upon them. They have also just contributed an article to the next edition of CBRNe World on lessons learnt from the subway sarin attack in Tokyo 15 years ago.

Japan also should be applauded for taking the initiative to set up the Asian Disaster Reduction Centre, and I hope that the UK has links with it.

Another sign of openness is the decision of JAL and ANA to open safety training centres , with access for the public and other airlines. The JAL one features some of the wreckage of JAL123 the worlds worst single aircraft accident and both list lessons learnt from their and other operators accidents.

Conclusion:

In addition to the focus on eliminating the silo mentality, there are a number of other parallel initiatives that need to be undertaken:

1. **Recognition of the range of threats: "Think the unthinkable"** There is a serious and sustained range of threat against global interests at home and abroad, which does not exclude either Governments or the private sector and covers both malicious and non-malicious threats.

2. **Avoid Complacency** Progress has been made across the world in reducing national vulnerabilities. There have been definite improvements, but we risk becoming complacent, taking for granted that "it may not happen here" Hence my suggestion that Governments and Business should work more closely together in an open environment. For example, I have been encouraging Governments in South East Asia to learn lessons from the April volcanic ash crisis as it could happen there.

3. **Understand your vulnerabilities** Do we really all know our weak points? Do we appreciate every end-to-end critical process in our organisation or business? How are any of these vulnerabilities escalated to senior decision makers in the organisation? I suggest that threats are difficult to influence because those who create threats operate their own agenda. But vulnerabilities are our responsibility. We can do something about them and we can reduce them once we have taken time to understand them.

5. **The importance of Business Continuity Management** I am often asked what single piece of advice I can recommend that would be most helpful to the business community. My answer is a simple, but effective, business continuity plan that is regularly reviewed and tested. But I urge you to avoid producing long and complicated plans: there is a tendency to produce detailed papers and then tick the box that BCM is in place, leaving the document unread and not understood, gathering dust on an upper shelf before it has to be renewed.

6. **The need for frequent rehearsals and testing** It is essential that all organisations, in and out of Government, should conduct frequent worst-case rehearsals. Sadly, not enough is done on this. Yes, it takes some resources and time but not a great deal of direct cost and it must be an integral part of the BCM.

7. **Humanitarian issues** Finally and, most importantly, all organisations need to do more in considering human issues. Let me give one simple example: most companies have off-site financial records, but few have human and next of kin records off-site. There is more and more legislation on family protection and all organisations need to ensure they have all forms of back up and volunteers to help families in a crisis situation. Family Assistance and Support Groups are now becoming a legal requirement in some jurisdictions and this will no doubt spread across to Asia, where we need to understand the needs in different cultures and religions.

These points are summarised in 10 Key Actions overleaf:

The Top Ten Priorities

EMERGENCY RESPONSE & CRISIS MANAGEMENT PLANS. ALL UNITS TO CONFIRM THAT THE BASICS ARE IN PLACE:

BASICS & CORE ACTIONS	STATUS At....................
1 **ASSESSMENT: Think The Unthinkable EG Technical:** breakdowns & malfunctions **Man-made:** criminal acts/workplace violence/accidents/suicide/fire/structural collapse/ bomb threats/terrorism **Natural:** Pandemics/ Earthquakes/ Floods/ Typhoons/ Tsunami	
2 **ORGANISATION: CASCADES/BACK-UPS/ROLES/GO TEAM:** There must be a cascade chart showing who tells who and who are the 2 levels of back-ups and spokesperson, GO TEAM planning etc	
3 **FAMILY ASSISTANCE: EXTERNAL & STAFF:** Volunteers to be in place and family assistance programme	
4a **INTERNAL CONTACTS:** All concerned to have tel lists of all relevant people: office/mobile/home (NB Home numbers must be included as mobile communication fails at a time of grave crisis). Lists to be in laminated pocket cards and copies should be at office/ home/ car etc	
4b **EXTERNAL CONTACTS:** List all external emergency contacts at Emergency Services/ Government/lawyers/accountants/PR consultants/other service providers/ partners etc (office/ mobile/ home of key people, in laminated cards)	
5 **REHEARSALS & TRAINING:** All units should have rehearsals at regular intervals with updates as new threats emerge	
6 **ALTERNATIVES: OFFICE BASE OR HOME:** Plan to be in-place if office or home uninhabitable/destroyed	
7 **OFFSITE RECORDS** Offsite records of staff/next of kin contacts/financial records etc to be maintained, Also, offsite CAD (computer aided design) of building layout will help rescue services find victims	
8 **COMMUNICATION: CORE MEDIA MESSAGES:** Ensure in place/train all in basics of 5 Cs: (i)Confirm (ii) Condolences (iii) Cooperate (iv) Communicate (v) Conclude (Remember all can be ambushed by the media: "sorry, refer to PR Dept" will not be acceptable. Minimum message needed.)	
9 **INTERFACE WITH OTHERS** Ensure interface with others depts./entities/companies and exchange best practices at appropriate meetings eg at Industry forum/Chamber of Commerce etc.	
10 **MANUALS AND CHECKLISTS** Ensure manuals are kept up-to-date but critical to make them short and sharp. Avoid long prose and use checklists rather than manuals whenever possible.	

Airprox Analysis

by Peter Reading

The UK Airprox Board (UKAB) reviews reported air proximity events and determines cause and risk, and where appropriate makes safety recommendations. It covers all areas of aerial activity, commercial air transport, military, general aviation, air traffic and regulation.

Pilots or controllers can report Airprox. The investigation is based on statements, radio transcripts, radar recordings, and TCAS simulations. CAA Air Traffic Standards or the military equivalent make the investigation, and report to UKAB. UKAB has a small secretariat who consolidate the data, prepare for discussion at the meetings, arrange and chair the meetings and finalise the reports. UKAB consists of representatives of each branch of activity with observers providing specific areas of knowledge, CAA, Military Aviation Authority (MAA), NATS, are examples.

The output from these meetings can be found at www.airproxboard.co.uk. Just a casual look will see how detailed and thorough the investigations are, but they are not bedtime reading! For this article, I have extracted some data, but included the reference if you wish to research more.

The objective is to understand why the reported event happened from all perspectives, and the board works together as a team to achieve this. It is not adversarial with each activity defending its own corner. I have learnt a great deal by listening to these inputs, both the procedures and human factors involved. We all operate in our own bubble and are masters of the bubble. We all know that we have to interact with other bubbles, but we generally don't know the details of how they function. I hope to pass on the insights that I have learnt from the other bubbles.

So, I am going to focus on commercial air transport (CAT) events: the threats to our operation and illustrate the common themes that have emerged.

Safety events, of which Airprox events are only one example, are like icebergs. For every mid-air collision, there are many more airprox's beneath the surface, if we can identify the root causes, then we can prevent repetition.

Analysis

First, a thought experiment. Before reading on, what do you think is the threat? Type of threat: military, GA, or other commercial air transport? Caused by error of pilots, or air traffic controllers, or of procedure? Where is the threat most likely i.e. in what type of airspace? What is the level of risk?

Our perception of the threat will determine how good our mitigation will be. If we don't regard a certain activity as a risk, we will not be prepared.

So, now for the analysis. I would be interested in your feedback as to whether your perception of threats before reading this is the same as the analysis...

The analysis is based on the 2-year period from November 09 to October 11. There have been a total of 341 reported airprox. Of these 49 involved CAT, excluding helicopters. (Some helicopter events are classified as CAT, but these have been removed from the analysis, as the nature of the operation is quite different from our own). Of these 49 events, 12 were sighting reports or controller perceived conflicts with no loss of separation, leaving 37 'real' events. I say real in inverted commas, as even the sighting reports were real to the reporters.

Where do the threats occur?

Airspace Class	Number of events
A	15
C	3
D	7
E	1
F	1
G	9
D/G	1
A/G	1
F/G	1

So 36 of the 49 events are in controlled airspace (Classes A-E) and 11 are in uncontrolled airspace (F&G), and 2 are on transition. Did you find it surprising that such a high proportion is within controlled airspace? There is a theme here, which I will expand on further, when we look at the underlying common themes.

What aircraft type causes the threat to CAT?

Aircraft Classification	Number of events
Other CAT	12
Civilian GA	24
Military	11
Not Known	2

What were the causes?

Cause of Error	Number of events
Did not comply with clearance	7
Clearance misunderstood or copied incorrectly, incorrect read back was not detected	2
Aircraft entered controlled airspace without clearance	4
Conflict in Class E	1
Conflict in Class G	4
Flew too close	1
ATC error	17
Sightings	8
Perceived Conflicts	4
Not determined	4

What were the risks?
The risks are defined as below:

A Risk of Collision: An actual risk of collision existed.
B Safety not assured: The safety of the aircraft was compromised.
C No risk of collision: No risk of collision existed.
D Risk not determined: Insufficient information was available to determine the risk involved, or inconclusive or conflicting evidence precluded such determination.
E Non-Event. Met the criteria for reporting but, by analysis, it was determined that the occurrence was so benign that it would be misleading to consider it an Airprox occurrence. Normal procedures, safety standards and parameters pertained.

Risk	Number of events
A	0
B	1
C	43
D	3
E	2

Risk class E was introduced during the period to take into account the growing number of

TCAS reports where there had been no loss of separation. All of the sightings and perceived conflicts would now be classified as E, and this would reduce the number of C risk events to 31.

The B risk was a conflict between IFR and VFR traffic in Class E airspace, resolved by the B757 crew, which we will come back to shortly.

So why bother with all of the C events when there was no risk of collision? On these occasions, there was no risk of collision because either the crews saw the conflicting aircraft or other mitigation took place such as TCAS. But there was the potential for a mid air collision, it is just that the holes in the cheese did not quite line up on this occasion. But we can still learn from these events.

What can we learn?

Departure Clearances and Read back

Airprox 2009-079 involved a C525 aircraft departing London City who incorrectly read back a departure stop altitude of 4000'; it should have been 3000'. The mistaken read back was not picked up by ATC. The aircraft departed and came into conflict with London Heathrow traffic at 4000' over central London. The C525 was visual throughout and the crew visually manoeuvred. The B777 crew was alerted by TCAS. The root cause was incorrect read back. If clearances are heard by both crew members, there is an opportunity to trap such errors.

Airspace Classification

You are departing a UK regional airport, say LBA, and you are given Traffic Information on an aircraft. Who is responsible for separation from that aircraft?

It is clear from Airprox statements, and from a sample that I have done, that this is commonly misunderstood. Many UK airports are within Class D airspace. ATC will provide separation from IFR and special VFR traffic. They can only provide Traffic Information on VFR traffic and YOU are responsible for separation.

Airprox 2011-085 was a conflict in Class E airspace assessed as Risk B at 10 nm East of GLA. Is ATC required to give you Traffic Information on aircraft in Class E airspace?

ATC will only provide Traffic Information on participating traffic. There is no requirement to get a clearance to enter Class E airspace. Do you know you are in Class E airspace? Did the crew in this airprox know that they were in Class E airspace, and there may be traffic that they have not been told about?

Class E airspace is more common in Europe than UK, and the class of airspace is not shown on Approach Charts, although it is shown on en-route charts. For example Fig 1 shows the Class E airspace around La Rochelle CTA, Aquitaine TMA, and Toulouse TMA on the en-route chart. Fig2 shows the same area with the Class E shaded in yellow.

So you need to know the classification of the airspace that you are in, and understand the service that it provides.

When is a clearance not a clearance?

It is commonplace when flying into SOU to hear London saying 'Farnborough will accept you descending 4000' QNH abcd, you are cleared to leave controlled airspace by descent'. This is read back 'Descend altitude 4000', and this is rarely corrected.

Fig 1. Enroute Chart for La Rochelle, Bergerac, Toulouse area

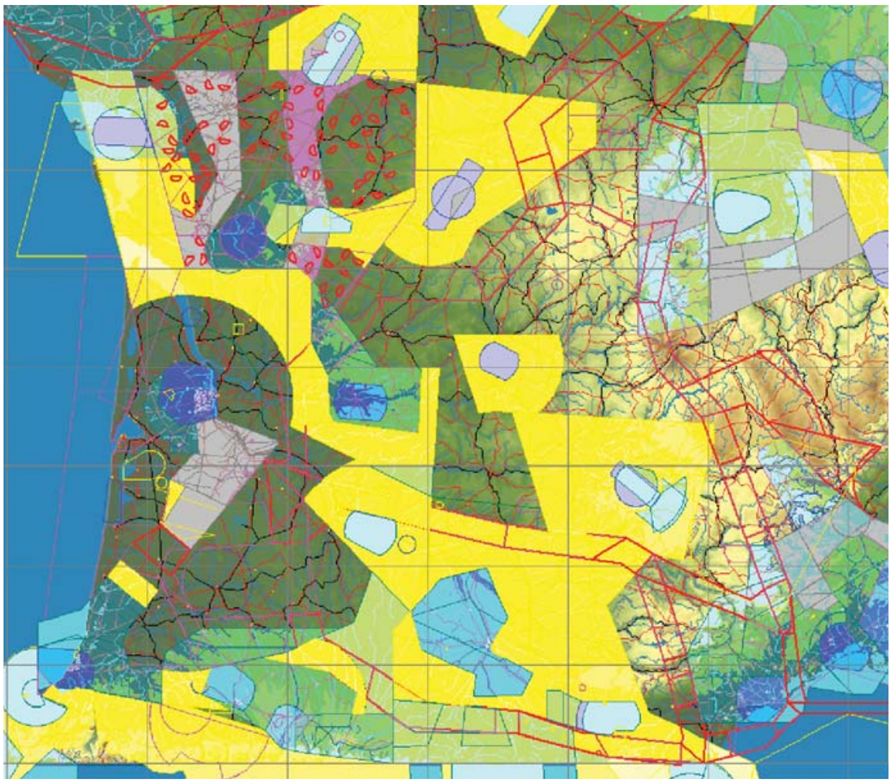


Fig 2. Shown in Yellow - Class E Airspace around : La Rochelle CTA, Bordeaux CTA, Acquitaine TMA, Toulouse TMA

The clearance is to leave controlled airspace, once you are clear of controlled airspace, you may be 'coordinated' which is dependent on the service that you agreed with ATS unit. You should not deviate from this agreement without telling ATC, but ATC instructions are NOT clearances, and you are responsible for separation from all other traffic and terrain clearance. Unfortunately the phraseology used by Air Traffic Service Units outside of controlled airspace is identical to the phraseology within controlled airspace, and this has led a number of aircraft to believe that they were still receiving a radar control service, when they were not.

Airprox 2011-113 describes how a military transport aircraft accepted a 'clearance' in Class G airspace into conflict with another aircraft.

Always agree the service level: Ask for deconfliction, but the service unit may offer a lower service due to technical defects (e.g. no primary radar), environmental (e.g. weather returns), or high traffic density. The deconfliction minima from unknown traffic is very large 5 NM laterally and 3000' vertically (unverified Mode C), and so sometimes it will be difficult to offer the service and get you to your destination!

This may have been a contributory factor to **Airprox 2009-075**. This aircraft was flying from BFS to NEW and left controlled airspace, but they were not told that they had left controlled airspace. They had traffic showing on TCAS, and on first contact with NEW, they were given an avoidance heading. The traffic was a Typhoon carrying out high-energy manoeuvres within its designated airspace. There was no loss of separation, but it is understandable why the crew filed a report, especially as they had not been told they were leaving controlled airspace.

TCAS Phraseology

You are probably aware that once you say the words: 'TCAS RA', ATC cannot give you any further instructions until you say 'Clear of Conflict'. It is clearly important to make both of these transmissions promptly.

There have been two airprox when ATC thought incorrectly the aircraft was acting under a TCAS RA.

Airprox 2010-018 describes how a B737 was inbound to Bristol from the North receiving a radar control service from Cardiff. An F15E entered controlled airspace without clearance. The controller gave an avoidance turn from the traffic. The F15E then turned towards the B737 and started climbing. The controller heard the B737 say ' TCAS traffic range 5 miles... unintelligible ... avoiding'. The controller believed that aircraft was operating under a TCAS RA and so stopped providing appropriate avoiding action. The B737 had never received a TCAS RA.

Airprox 2011-025 was between a SF340 and a Tornado GR4 on an advisory route (Class F). The Tornado had been undertaking a low level exercise but broke off due to weather and conducted an emergency abort from low level, which caused a conflict with the SF340.

Abstract from report;
At 1236:00 the Moray sector controller (MOR) requested the SF 340's flight conditions and the pilot replied, *"between layers, VMC at the moment"*. By 1236:04 the Tornado had commenced a right turn and was tracking perpendicular to the ADR at FL080. Short Term Conflict Alert (STCA) activated at 1236:23 at which time the MOR provided TI as, *"pop-up traffic in your ten o'clock at a range of 5 miles"*, followed by the instruction, *"turn right immediately heading 090 degrees"*. The pilot read back the instruction and, at 1236:35, the controller upgraded this to, *"avoiding action turn right immediately onto a heading of 120 degrees"* and updated TI was provided.

At 1236:49 a high-level short-term conflict alert (STCA) activated when the ac were 5nm apart on converging tracks, the SF 340 descending through FL082 and the Tornado maintaining FL082.

The SF 340 pilot then informed the controller, *"and have TCAS contact erm visual now"*.

The controller then stopped giving avoiding action because he believed that the aircraft was manoeuvring under a TCAS RA.

So the lesson of the above is don't say the words TCAS on the RT, unless you are manoeuvring in accordance with and RA

TCAS Response

The correct procedure is to always follow a TCAS RA, even when visual with other aircraft. There are examples when the visual clues are misleading. An example of this is Airprox 2009-044.

A Glasair pilot was flying at FL45 transiting across the top of Brize Norton CTA/CTR. He was equipped with Mode C/S, but no TCAS. There was a C17 in the hold also above the Brize Norton CTA/CTR at FL40, who was TCAS equipped. The Glasair pilot believed he was below the C17 so started to descend. Why did he believe that he was below the C17? The C17 is a large aircraft flying in the hold, possibly belly up to the Glasair, could this have created an illusion for the Glasair pilot that he was below the C17? Whatever the reason, the Mk 1 eyeball did not work.

The Glasair was not 'contracting in' to the TCAS collision avoidance system, and this created a set of rapid and contradictory messages for the C17.

Alert Time	Alert Description	Altitude (FL)	Intruder Range (Nm)	Vertical Sep. (ft)
09:40:27	TRAFFIC ALERT	40	3.14	489
09:40:37	MONITOR V/S	40	2.10	507
09:40:41	DESCEND	40	1.70	374
09:40:44	INCREASE DESCENT	39	1.40	264
09:40:46	CLIMB NOW (RCL)	39	1.20	202
09:41:01	CLEAR OF CONFLICT	36	0.24	7

All in the space of 34 seconds!

You may wonder how they both came to be in the same bit of sky. Therein is another story! I recommend going to the Airprox website for the full report.

Where was that he said?

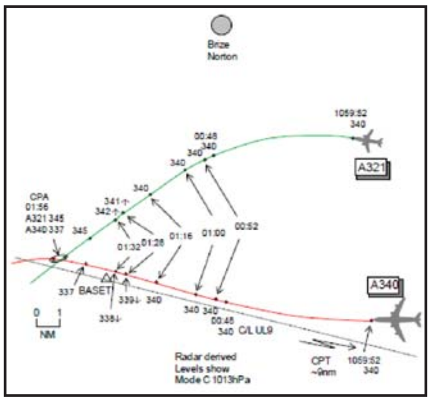
Have you ever had the experience of being cleared direct to a point, on an unfamiliar route, may be rattled off at high speed, and you did not quite catch the point. You ask your colleague: 'where was that', and you conclude that neither of you know, and so, you ask again. Or even to spell the point. Maybe you look down at the FMS flight plan list and you look for a point that sounds similar to what you have been told. The following airprox illustrates the dangers of guessing or assuming.

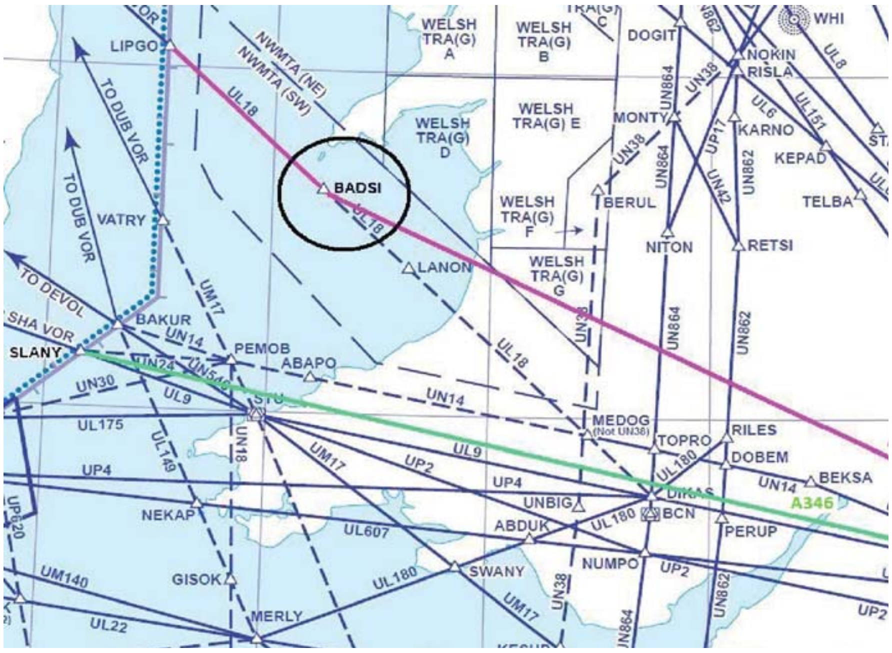
Airprox 2012-012. Two aircraft from the same airline were handed over to the controller on the same heading and at the same level. The A321 was then cleared BADSI LIPGO. This would have been a RIGHT turn.

The First Officer was off the flight deck at the time, but the aircraft commenced a LEFT turn towards BASET and also towards A340 (7.9 miles away). The Captain readback BASET LIPGO, but this was difficult to discern and was not picked up by the controller.

A short-term conflict alert was triggered and avoiding actions were given. The A321 mistakenly took the avoiding action for the A340 (same company callsign) which made the situation worse. TCAS RA's were triggered which then resolved the situation.

The Airprox board normally has to base the decisions on the statements of the crews and there is generally no opportunity to ask





supplementary questions to fully understand the human factors involved. But there are a number of possibilities. The Captain, on his own, may have misheard BASET, and as the FO was not present there was no opportunity to correct the misheard waypoint. Or, he may have been uncertain and looked at the FMS and 'saw' BASET as the next waypoint, which shared the same first syllable as BADSI. But what is certain is that he selected and readback BASET.

So the motto is, if uncertain, ask. There can be a reluctance to seek clarification, but this event demonstrates that this must be the best course of action.

Why do we state hectopascals for QNH settings below 1000?

You may wonder the reason for this apparently byzantine form of RT. My own mind set is that if I can attach a logical reason for doing something, it makes the action easier to complete and to remember. So I offer this airprox by way of explanation.

Airprox 2011-167

The SF340 was flying a procedural approach and established on the localiser at 2000' QNH 990.

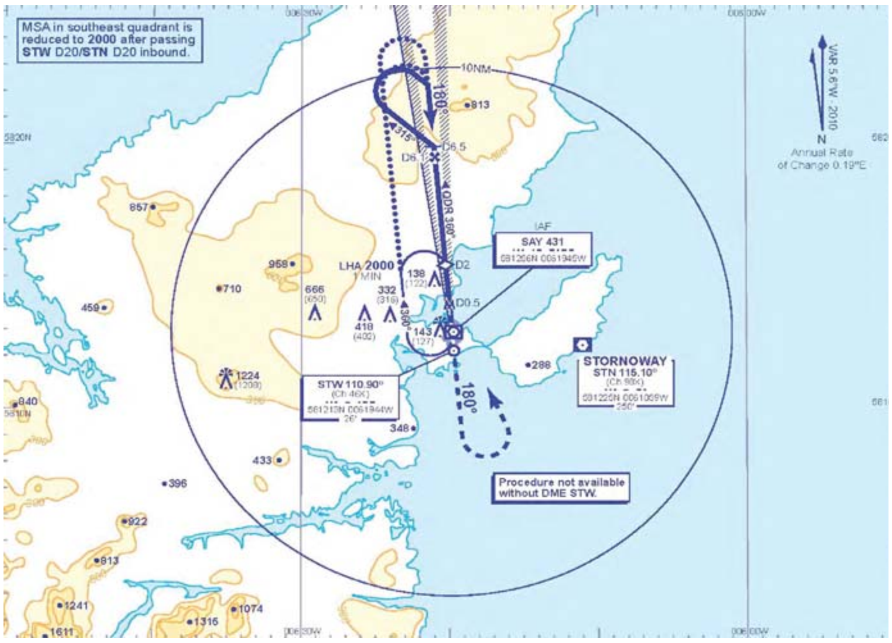
The following aircraft a BE200 (foreign military) was cleared to 3000' QNH 990, but was seen by the SF340 as descending through 3000' to 2300' on his TCAS display.

So the SF340 queried this with ATC.

The controller has no radar.

The most relevant part of the RT transcript is below:

SF340: "Er Stornoway confirm cleared altitude for the number two aircraft"
Controller: "(BE200c/s) [1144:10] you may descend to altitude three thousand feet but to continue not below three thousand feet until advised"
BE200: "(BE200 c/s) roger we are levelling at three thousand."
At 1144:20 the controller asked the BE200 pilot if he was familiar with the procedure for extending the holding pattern and then turning onto the localiser. The BE200 pilot responded, "(BE200 c/s) yes sir I'm completely er we're we're fighting this wind right now we're trying to get back over on that side." After this exchange the SF340 again enquired as to the altitude of the BE200:
SF340: "Can we just double check that aircraft's altitude we've got him as yeah he's about four miles about eight hundred above [1144:50]"
Controller: "That er that's er level at three thousand feet for the BE200 c/s (SF340c/s)" [1145:00]
Controller: "(BE200 c/s) just confirm that you're level at altitude three thousand feet on the QNH of niner niner zero hectopascals"
BE200: "Yes sir [1145:10] level three thousand two nine nine zero". Controller: "Roger."



The BE200 was actually flying at 3000' QNH 29.90" mercury rather than 3000' QNH 990 hectopascals, and so was flying 700' lower than his coordinated altitude. The leading two in 29.90 is routinely dropped which is the source of confusion. Although hectopascals had been stated several times by the controller during this process, it was not set nor readback.

Air Traffic Control

17 of the 49 events have been due to ATC. It is just as easy to issue a clearance in error, or in part, as it is for us to not comply with a clearance. Some of these were mitigated by other systems such as TCAS and STCA, and sometimes the situational awareness of the flight crew.

Airprox 2010-028 is an example of how easily an event can occur by a simple omission. A DHC8 was inbound to London Gatwick from the North and had been cleared to descend to FL150, and was descending at 500 fpm. A C17 was routing along L9 at FL160. There was a loss of separation between the two aircraft. The controller had intended the clearance to be 'Descend FL150 to be level by KIDLI', but he did not give the descent restriction and did not notice the slow rate of descent. 6 minutes after issuing the clearance there was a handover of controllers and the incoming controller also did not assimilate that the DHC8 was high in relation to KIDLI.

There was a learning point here for ATC that if no descent constraint is given, and if the aircraft is being descended before the optimal descent point, then aircraft will descend slowly to save fuel.

There is also an issue on the way in which these Standard Level Agreements are shown on STAR charts. The FL150 at KIDLI is not shown on the STAR plate for Gatwick, but the equivalent Standard Level Agreements are shown for Southampton. There is no consensus on showing descent planning on the STARs. Some feel it is useful for programming FMS, some feel that it clutters up the chart and there is evidence that US crews take this as a clearance to descend once cleared for the STAR. In the US, if you are cleared to descend via a STAR it is both laterally and vertically.

The Future

The surveillance system in Europe and anti-collision systems on CAT predates the advent of GPS. But there are systems available, which make use of GPS. ADSB (Automatic Dependent Surveillance -Broadcast) transmits the GPS data of the aircraft and is used to create a radar like display. This is already in use for surveillance of upper airspace in Australia and Canada, which previously was served by a procedural service, as there was only limited radar cover. It is proposed to Implement ADS-B in the US by 2020. It is more accurate than radar and it is cheaper, (the cost of implementation of the entire system in Australia was the same as one secondary radar head), allowing it to be used in areas not currently covered by radar. All Boeing and Airbus products come off the production line with ADS-B fitted, but not so for regional aircraft.

Also, there are examples of anti collision systems using GPS within the GA community. They transmit GPS position and 'listen out' for other aircraft transmissions, and then calculate whether there is a risk of collision, providing both azimuth and vertical information on a potential threat. But at the moment, no resolution is provided, and this will only work between aircraft that are similarly fitted.

It is possible that these systems will converge over time and provide both surveillance and anti-collision for all aircraft, so avoiding the problems described between the Glasair and the C17 when only one party was 'contracting in'. But, how long will this take? The organisation, which is taking the lead in this, is SESAR (Single European Sky ATM Research). Further information on their website: http://ec.europa.eu/transport/air/sesar/sesar_en.htm

Summary Points

Both crew should be present when receiving departure clearance to cross check.

Know the airspace class that you are flying in and the associated rules.

Avoid using the word TCAS on RT unless you are complying with a TCAS RA.

Always follow TCAS, even when visual.

If the clearance is unclear, check rather than guess or assume.

Use standard RT phraseology.

To err is human, we can all make mistakes, don't assume perfection.

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