

Runway Safety

**Runway Safety at
Amsterdam Schiphol**
by Job Brügger and Jan Smeitink

The construction of runway safety
by Professor Sidney Dekker

**Tearing down barriers –
building up relationships**
by Jim Krieger, O'Hare Tower



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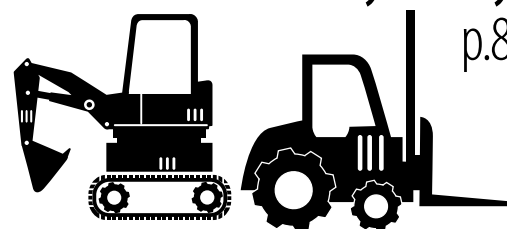
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CONTACT US

The success of this publication depends very much on you. We need to know what you think of HindSight.

Do you find the contents interesting or boring?

Are the incident descriptions easy to follow or hard to understand?

Did they make you think about something you hadn't thought of before?

Are you looking forward to the next edition?

Are there some improvements you would like to see in its content or layout?

Please tell us what you think – and even more important, please share your difficult experiences with us!

We hope that you will join us in making this publication a success.

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Frank Brenner has worked in Air Traffic Management for his entire career. He has been Director General of EUROCONTROL since 1 January 2013.

Since taking up his functions at EUROCONTROL, he has initiated the development of a Vision and Strategy, including the development of Centralised Services as part of the SESAR deployment concentrating on how to support controllers with new technology increasing safety.

Before joining EUROCONTROL, Frank Brenner was General Manager Operations for FABEC, Vice Chairman of EUROCONTROL's Performance Review Commission and a member of the Performance Review Body. Trained as an air traffic controller, he has held a number of posts at DFS including Head of ATM Operations, Director of Operations at the Business Unit for Aeronautical Data Management and Director of DFS's Control Centre Business Unit.

Dear Reader,


Traffic in Europe is starting to grow again. 2014 is showing a clear increase in aircraft movements and the latest forecasts are for growth of about 2.5% per annum over the next seven years. This trend is forecast to continue over the longer term, even if growth will be at a slower rate than we saw before the economic crisis.

However, a major constraining factor is the availability of airports and, in particular, runways. The planning and financing issues are well known; the result is that, by 2035, we can expect to see about a dozen airports running at or close to capacity for much of the day, something we only really experience today at Heathrow. This has many implications but an important one is that it has provided a real impetus to all the work on how to make best use of the existing infrastructure – on how to improve runway throughput.

Arrivals management has been a topic for many years but we are now also looking at performance based navigation (PBN), Point Merge and more accurate wake vortex separation. This comes at the same time as a much greater focus on performance, in particular on cost-efficiency. This focus is certainly needed for ATM and of course it has been a constant factor for both airlines and airports for several years.

However, what all this means is that there is real pressure on the airports and on ATM to improve performance and, in particular, to maximise runway throughput. That is why runway safety is so important and is likely to become even more critical.

EUROCONTROL is in a unique position. We do not regulate but rather we work with all the players in European aviation to help improve performance including, of course, safety. A major part of this is our role as Network Manager – a role in which we are working ever more closely with airports. Perhaps less well known is our work on coordinating Europe's input into ICAO and the Global Air Navigation Plan, our work on developing continuous descent operations and our work on the re-categorisation of aircraft for the purpose of wake vortex separation.

All this is extremely useful when considering runway safety – something we see as a very clear priority on which action needs to be taken. That is why we have developed, with our partners, the runway excursions and runway incursions action plans. That is why we provide training on safety management at airports. That is why we have organised seminars and workshops on runway safety. That is why we have provided input into ICAO's work on this topic. That is also why we are dedicating this issue of HindSight to this topic. 





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If you are healthy, do you stop taking care

On 5 May 2014, a colleague of mine contacted me and asked if we, in the Safety Unit of EUROCONTROL Network Manager, are those promoting the “One Runway, One frequency” campaign. He wanted to know more about it because he had received questions from frequency managers in some of the EUROCONTROL member States.

Apparently, according to the International Telecommunications Union (ITU), a specialised agency of the United Nations that coordinates the shared global use of the radio spectrum, VHF frequencies in the aeronautical mobile service may not be used for ground-ground communications. What this means in our specific runway case is that a vehicle should not use the TWR frequency to communicate with the Tower.

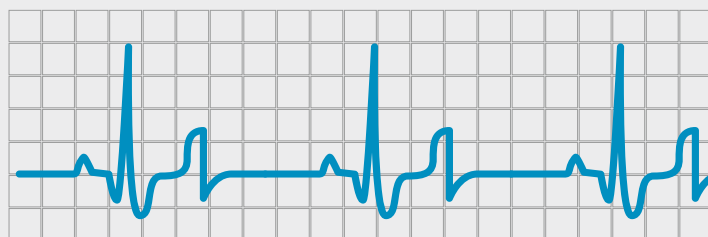
Can you stop it, if you cannot spot it?



Tzvetomir Blajev

Editor in Chief of Hindsight

Now, imagine that a vehicle driver is, for whatever reason, confused and the prevailing visibility prevents visual identification of a potential conflict. This may happen at one of the many airports in Europe that are not equipped with ground surveillance or Advanced Surface Movement Guidance and Control System (A-SMGCS). It is a fact that there are many airports that cannot afford to buy expensive systems like these. It is another question why we, as an aviation industry, do not have a “low-cost” runway safety net – but I will leave this subject for one of the future issues of Hindsight. In this situation of a vehicle straying onto an active runway just in front of an aircraft taking off in marginal visibility conditions, there are not many barriers that can help preventing an accident. Especially, if the crossing is at the “high energy” part of the runway – at a place where the speed of the aircraft will be too high to safely reject the take-off. One of the few barriers, maybe sometimes the only



one, is for the vehicle to be on the same frequency as all the aircraft so that the driver can monitor communications and is able to identify the busy status of the runway before entering.

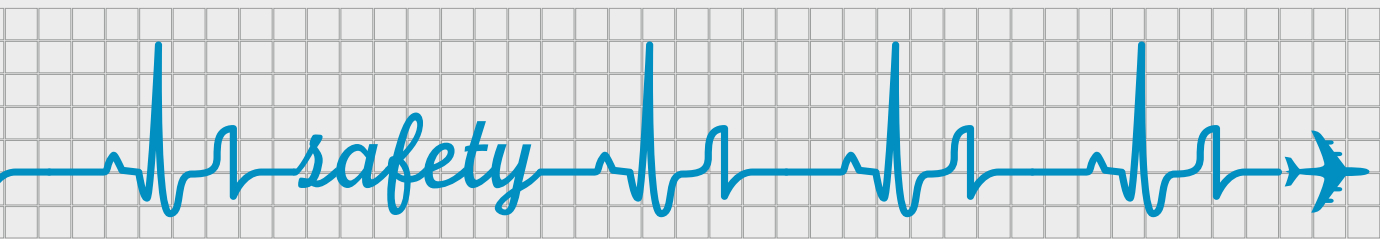
But is there a problem at all? One can argue that vehicles operate every day, in all meteorological conditions, sometimes on different frequencies and even talking different languages and still we do not hear of these causing accidents in Europe. What is even more compelling is that over the last few years, different global summaries of aviation safety have shown record levels of safety. There are calls to reduce the investment in aviation safety because we have achieved our goals. Indeed, why pour money and effort in something when there will be no obvious improvement. If you have no accidents you cannot improve anymore, can you?

This is difficult to argue against and the only analogy that comes to my mind is human health. If you invested in your health, if you were careful what you ate, exercised regularly and had a healthy style of live and as a result you did not have any health problems then would you stop taking care of your health?

But are we really that “healthy” in aviation safety terms?

Let us look at runway incursion incidents that happen in Europe. Each year I work with the European Air Navigation Service Providers, analyse incidents and prioritise the Top 5 safety issues to be taken care of at the EUROCONTROL level. For the year 2013, 92 Runway Incursion incidents classified as severity A or B were reported by EUROCONTROL member states. Severity A and B are the highest on the severity scale - the incidents which are assigned these severities are the most serious ones. I analysed a sample of 44 incidents out of these 92 incidents. The analysis was always done in the form of a discussion with

of your health?



the investigators that investigated the events. This disclosed a lot of interesting information and explanations that were not easy to grasp by simply reading the investigation reports.

My sample included four cases where an accident was only prevented by "providence". In other words, pure chance was the only barrier that "saved the day". What could be more serious incidents than these?

All four of these cases were scenarios in which other traffic entered a runway on which an aircraft had begun take-off. Vehicles were involved in three of those cases. In three of the cases the Air Traffic Controller in charge of the runway recognised the conflict but there was insufficient time for an effective reaction. In two of the cases, the controller was alerted by the A-SMGCS and in one case by the activation of a stop bar crossing alert. My conclusion is simple – our system is very vulnerable to situations involving vehicles and an ATC resolution in these cases is not always assured.

Is this only a European "problem"?

It is not. Let me draw your attention to two events that happened elsewhere.

The first one¹ took place on 21 April 2006 at Brisbane Airport, Australia. The surface movement controller issued a clearance for the driver of an aircraft tow vehicle to cross an active runway in front of an aircraft taking-off which had been issued with a take-off clearance by the runway controller. The surface movement controller and runway controller were using separate radio frequencies. The flight crew of the 737 saw

the tow vehicle crossing the runway ahead, but as they judged it would be clear before they reached that point, they elected to continue the take-off. In the investigation report it was reported that as a result of this occurrence, Airservices Australia would be actively considering a requirement that all runway crossing traffic should work the runway frequency as recommended by the International Civil Aviation Organisation.

The second event² happened on 29 July 2008 at Toronto International Airport, Canada. Three emergency vehicles were cleared by the ground controller to enter Runway 15R/33L on their way to the fire training area. Shortly afterwards, the runway controller cleared an aircraft to take-off from RWY 33L. An aural alert was generated that prompted the runway controller to instruct the aircraft to reject its take off but this was (understandably) ignored by the crew because the aircraft was about to rotate and was still approximately 750 metres from the vehicles.

It is not surprising that, when drafting the European Action Plan for the Prevention of Runway Incursions³, the wise representatives from various sectors of the aviation industry included Recommendation 1.3.5 "Improve situational awareness..... by conducting all communications associated with runway operations on a common frequency".

After examining the facts, it seems to me that we have a problem. It is rather similar to the case of human health - to quote the philosopher Bertrand Russell:

"Diagnosis proves that there are no healthy people".

Enjoy reading HindSight! 5

1- [http://www.skybrary.aero/index.php/Vehicle/B738,_Brisbane_Australia,_2006_\(RI_HF\)](http://www.skybrary.aero/index.php/Vehicle/B738,_Brisbane_Australia,_2006_(RI_HF))

2- [http://www.skybrary.aero/index.php/Vehicles/B737,_Toronto_Canada,_2008_\(RI_HF\)](http://www.skybrary.aero/index.php/Vehicles/B737,_Toronto_Canada,_2008_(RI_HF))

3- [http://www.skybrary.aero/index.php/European_Action_Plan_for_the_Prevention_of_Runway_Incursions_\(EAPPRI\)](http://www.skybrary.aero/index.php/European_Action_Plan_for_the_Prevention_of_Runway_Incursions_(EAPPRI))

The construction of runway safety

by **Professor Sidney Dekker**

A few years ago, my airline used to fly to Rome (FCO/LIRF) a couple of times a day. At that time, Rome Fiumicino seemed to be one of the world's construction sites with its own airport. Things would look different every week, sometimes only subtly so. A new terminal (5) was to open in 2008 and runway 16R/34L was being improved to allow the operation of larger aircraft such as the A380. This involved the renovation of the asphalt layer and construction of new taxiways, as well as the installation of Cat III runway lighting.

This was a pre-Electronic Flight Bag era and the Jeppesen charts we carried in the cockpit seemed to procreate on their own accord. The packs for LIRF were unapologetically thick, full of revisions and temporary maps and directions. I remember the fear of holding the stack of fresh plates between thumb and a few fingers - ready to put each new page in the binder in the right place. The middle chunk of pages would sometimes slide out, like a slick hamburger from a bun. The result would be a disordered mess of Jeppesen plates fanning out all across the floor.

Jepp plates and charts resemble inscrutable pieces of brittle, sticky foil at the best of times. But now they seemed to have sprouted a whole new lexicon of signs and markers and codes and barber poles associated with the changes and temporary conditions.



Still, there was always the question whether the airport actually put things in the places the temporary plates said. With construction going on, you never know. And in the dark, it was always harder to find out for real.

Not long before, I'd had a student who was involved in the investigation of a runway accident. The accident had taken the lives of 49 people. The airport had been un-



dergoing construction. "Lights are out all over the place," one pilot had remarked to the other. Indeed, they were. Also, the plates the pilots had were not consistent with the taxiway layout at the time. Taxiway signage in the constantly shifting topography of the airport had been misleading and depictions of taxiways on the charts available in the cockpit was simply wrong. In the darkness of early morning, the two pilots started their take-off roll from a runway that was close to their intended one. But the runway they'd ended up on was too short.

Professor Sidney Dekker

is Professor and Director of the Key Centre for Ethics, Law, Justice and Governance at Griffith University, Brisbane, Australia.

Author of best-selling books on human factors and safety, he has had experience as an airline pilot on the Boeing 737.

Taking the easy way out, investigators blamed the pilots – they had lost “positional awareness.” Investigators also blamed the controller on duty for not paying enough attention. Such a response is, unfortunately, all too typical. And it leads to the well-known, but incomplete, countermeasures against what we are made to believe is a “human error.” It has led us to focusing on restricting that unreliable frontline human operator.

In case of the pilots: stopping them, limiting them, restricting them – with stop bars, for instance. And by on-the-spot fines if they cross those bars without a clearance. A few weeks ago I was talking to the CEO of a company whose pilot had just been fined thousands of Euros for crossing a lit stopbar. The CEO had offered to pay, for which I commended him.

And in case of the controllers: we seem to want to manage the risk of human error by putting in more technology, more procedures, and prosecuting ATCO’s criminally if things still go wrong. Some people apparently still think we can improve safety just by preventing those fallible operators from doing the wrong thing.

Runaway safety?

But what about starting at the other end? What about looking first at the error traps that are built into our airports? Human error, after all, is not random, but systematically connected to features of people’s working environment. What about trying to anticipate and forestall the many error traps that emerge, unintentionally, when we start shifting things around during construction activities at our airports?

The story of the runway accident above seems to have had a long tail, and has recently harvested an additional victim. An state audit report that covers the year during which the accident occurred showed more than half a million dollars of questionable or unsupported expenses by airport managers. This included gym equipment, artwork that subsequently went missing, a hefty tab of a strip club, DVD’s, video games and reimbursements for expenses that managers had already got paid for.

This was not runway safety, but runaway safety.

When you are rebuilding your airport, half a million dollars may not seem like much. But it might have provided a few new taxi light bulbs and signs to guide crews to the correct runway.



My proposal is to remove the last item so we will have a nice round number and anyway, who wants... to spend money on something “temporary”?

Of course, none of this ever showed up in the conclusions of the accident investigation. After all, the “guilty” had already been found (the flight crew and the controller). Nonetheless, the airport’s director lost his job two years after the accident, and received a suspended prison sentence of five years.

Last year, he was found dead in his apartment. He was fifty years old.

A MEL for airports under construction

If it hasn’t been created already, it seems to be high time for a MEL, or Minimum Equipment List, for airports under construction. What are the things that we can or should absolutely not do without? What should we reserve money for? Taxiway and runway lights would seem a good candidate to go onto the MEL, as would plates that are accurate, and signage along taxiways. Surface movement radar? Lit barriers?

These seem like simple, even completely obvious things.

But apparently they are not, or have not been, as they (or their lack) are contributing factors in runway accidents from the past decades around the world. Think about what you would put on that MEL. And ask the pilots who frequent your airport would they want to have on it as well. Then take it to your airport’s director. **S**

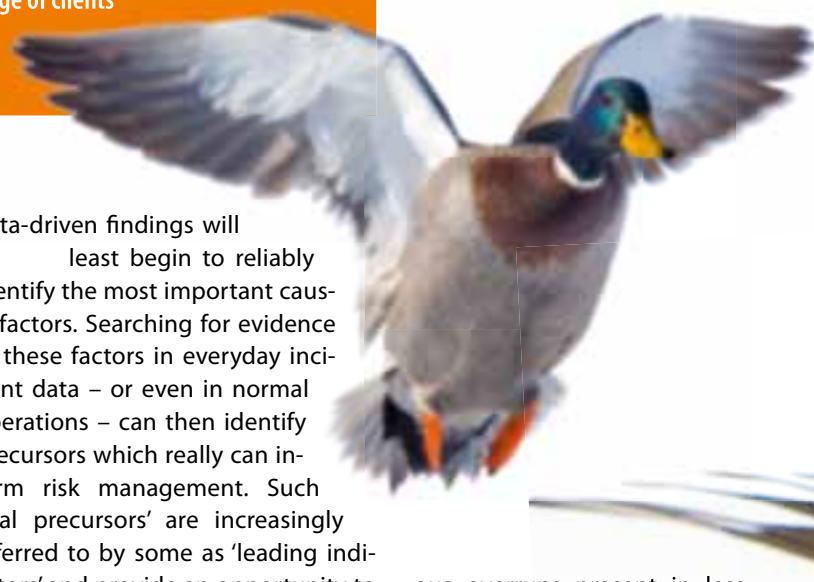
Hazardous runway overruns and their precursors

By Captain Ed Pooley

Runway Excursions are the only accident category which for the worldwide commercial jet fleet, has consistently shown an upward trend in fatalities. There were nearly 1000 of them in the ten year period ending in 2011, not too far from three times the number in the previous ten year period¹.



Captain Ed Pooley is an experienced airline pilot who for many years also held the post of Head of Safety for a large short haul airline operation. He now works with a wide range of clients as a Consultant and also acts as Chief Validation Adviser for SKYbrary.



Most of these are overruns on landing, but even if the description 'hazardous' is substituted for 'fatal', runway overruns by commercial aircraft are such a rarity that most airports will never see one. The runway safety challenge therefore becomes a matter not only of proactively having a risk management strategy in place but of making sure that any relevant evidence from the less serious overruns or near overruns that do occur is used to improve it. But the word 'relevant' is important! Despite the regularly-promoted implication that all incident data can ultimately be meaningfully related to one of a number of ultimate fatal accident outcomes each visualised as at the apex of a triangle or pyramid of occurrences, this is too simple. Precursors must be understood not assumed – and the occurrence data which can enable connections between the everyday and the potential catastrophe must be available.

data-driven findings will at least begin to reliably identify the most important causal factors. Searching for evidence of these factors in everyday incident data – or even in normal operations – can then identify precursors which really can inform risk management. Such 'real precursors' are increasingly referred to by some as 'leading indicators' and provide an opportunity to be genuinely proactive.

A lot of assumptions are regularly aired about landing overruns. For example that there are indisputably important connections between landing overruns and unstabilised approaches, high tailwind components and wet/slippery runways. But can these perceptions be validated by looking at the data we have for overruns? And to the extent that they can, are the precursors to the most seri-

ous overruns present in less serious outcomes such as 'almost' went off the end? Of course, there are always fatal accidents of any type which stick in the memory. In recent years, we have seen the dramatically unstabilised ILS approach on a false glide slope upper lobe that led to the catastrophic Boeing 737 overrun at Mangalore India in 2010² and another Boeing 737 overrun, this time without fatalities but still a dramatic hull loss, at Kingston Jamaica the previous year³. Do these headline events en-

Taking a careful look at the circumstances which led to major overrun accidents and coming up with some

1- http://www.skybrary.aero/index.php/Boeing_Annual_Summary_of_Commercial_Jet_Airplane_Accidents
2- [http://www.skybrary.aero/index.php/B738,_Mangalore_India,_2010_\(RE_HF_FIRE\)](http://www.skybrary.aero/index.php/B738,_Mangalore_India,_2010_(RE_HF_FIRE))
3- [http://www.skybrary.aero/index.php/B738,_Kingston_Jamaica,_2009_\(RE_HF\)](http://www.skybrary.aero/index.php/B738,_Kingston_Jamaica,_2009_(RE_HF))

A lot of assumptions are regularly aired about landing overruns. For example that there are indisputably important connections between landing overruns and unstabilised approaches, high tailwind components and wet/slippery runways.

courage the right risk management focus?

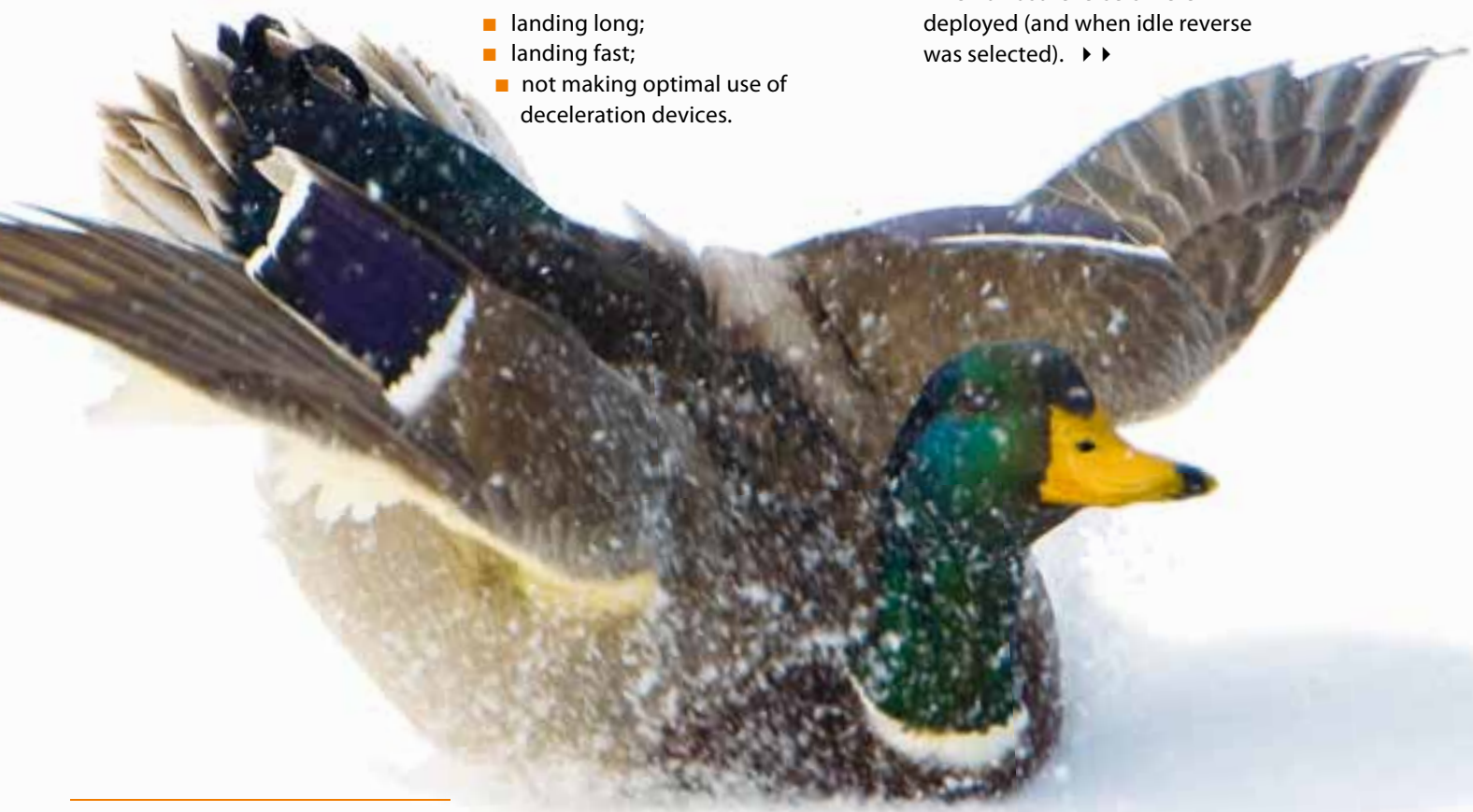
A recent careful look by Boeing at the facts in around 40 landing overrun events of various degrees of sever-

ity which involved their aircraft types over the last 10 years⁴ came up with some interesting findings in terms of which precursors are really associated with the most hazardous outcomes. This work distinguished three primary causal factors in these events:

- landing long;
- landing fast;
- not making optimal use of deceleration devices.

Recorded flight data and supporting information for each event was related to the ground speed as the aircraft departed the end of the runway and the extent of aircraft damage sustained. The following were determined for each:

- whether the approach had been stabilised;
- the touchdown speed relative to V_{ref} ;
- the proportion of runway left at touchdown;
- the tailwind component at touchdown;
- when speed brakes / ground spoilers were deployed;
- when thrust reversers were deployed (and when idle reverse was selected). ▶ ▶



4- As far as I know this work is unpublished at present

Hazardous runway overruns and their precursors (cont'd)

Some of the findings were:

- **all the most hazardous overruns followed long landings**
- the majority of overruns which followed an unstabilised approach were **long landings**
- long landing overruns were **equally split** between those where the runway threshold was crossed high with thrust at idle and those where it was crossed at the correct height but excessive thrust was then maintained
- **all** overruns which followed a touchdown in the TDZ were fast and also occurred in the presence of a tail wind component
- most overruns following inadequate deceleration after touchdown at the correct speed and position involved multiple issues and about 90% of them occurred on **dry runways**

- the chances of an overrun did not differ between day and night – although a rate calculation might indicate that night was more likely
- the chances of an overrun were generally similar after both an ILS approach and a non-precision approach
- the PIC was much more likely to be the PF in the case of long landing overruns (the most hazardous outcomes) but more likely to be the PM in overruns which were the result of a failure to decelerate after a normal touchdown

Some of the above were more 'obvious' than others! But I can't think of any good reason why the observations made should not apply to Airbus types too and possibly to regional jets and turboprops. But a lot of this is down to piloting where many of the solutions also lie, so do the quoted findings suggest that controllers could help?

Perhaps it would be a good idea if controllers were 'empowered' to instruct an aircraft which is clearly too fast or too high as it crosses the threshold (or which is neither but is clearly about to demonstrate a long landing anyway) to go around? Airport operators should note that it is pretty clear use of landing runways with a tail wind component needs to be minimised, if necessary at the expense of any conflicting noise abatement preferences.

Of course at a particular aerodrome, the approach to risk management should also be related to how

quickly the consequences of an overrun become really hazardous, especially if that hazard may not be known to an arriving pilot who is unfamiliar with the airport⁵. However, the only way to completely eliminate the most prevalent overtone to a hazardous overrun – long landings – is for an airport operator to establish and notify a requirement for a mandatory go around to be flown if touchdown has not been achieved by an (additionally indicated) point on the runway. For a short runway, this would be the end of the TDZ, for a longer one, maybe a third of the way along it. One place that does this with pretty well 100% pilot compliance is London City where the consequences of a significant overrun are distinctly hazardous and obvious to the pilots who (with special authorisation mandatory) use it.

Finally, let's return to the identification of precursors to something worse in everyday occurrence data. Clearly, aircraft operators need effective systems to get the most out of their routine monitoring of recorded flight data. But what about ATC and airport operators? Self evidently, you have to actually capture data on minor but relevant safety related observations first. A log kept by either airport operations or ATC of long landings (or of aircraft about to make one but then sent around because of this) would be useful if it included the aircraft type and flight identification plus the corresponding METAR and any runway braking action report given pre-landing. And even better would be liaison with the aircraft operator in each of these cases so that the 'big picture' is shared – and the way the risk arose is understood. **5**



5- Awareness of a particularly undesirable consequence of misjudgement or mismanagement usually leads to heightened pilot focus!

Runway safety – Concerto for ATCO and orchestra

By Maciej Szczukowski

Ever since I remember, classical music has accompanied me in my life. Apart from listening to it, I keep on trying to understand it better, on different levels. What I find fascinating is the act of conducting. One day I saw a movie of Maestro Riccardo Muti's master class. As he was conducting Dvorak's Symphony No. 5, he suddenly stopped and said, in his adorable Italian English and in the exact, following words: "more and more I believe less in what conductors can do". That is how I feel about ATCOs sometimes.

►►



Maciej Szczukowski

has been an Air Traffic Controller, for over 10 years, at Warsaw Okęcie Airport, Warsaw, Poland. He also holds a PPL.

Environmental performance: a necessity (cont'd)

When a conductor begins to work with a new orchestra, he does not know the musical background of each and every musician. Musicians' 'form' and mood are also unknown. Therefore the conductor assumes that all artists are well trained, that they are able to play in the right key and at the required tempo and that they have the technique and empathy to perform a piece of music in exactly the way the conductor would like them to. And, that together, all of them will be able to share the same vision of the music. The problem arises when the conductor assumes wrongly.

A few months ago an air traffic conductor (let's call him that way for a change) had a tough hour on TWR position. It was snowing, the visibility was limited, the wind was strong and gusty, limiting the number of available runway configurations. There were a significant number of inbound, all looking for a good landing on a clean runway. The snow removal vehicles were waiting for clearance to enter the runway but the traffic load impelled the "conductor" to make them wait. Other vehicles were clearing the rapid exit taxiways of the other, crossing runway to prevent them from icing. They were in different spots (some of them close to runways intersection) and the "conductor" was not able to check on them constantly. The supervisor was coordinating delays with approach controller, asking the "conductor" for his opinion from time to time. The quality of radio communication with the vehicle drivers was poor and so was their phraseology. Trying to work in these difficult circumstances, the "conductor" assumed that one of the vehicles would clear the last rapid exit taxiways in exactly the same manner as all the previous ones. There-

fore hearing the driver asking for the clearance he just said "approved" to the assistant (who was operating the communication system), happy to get some extra seconds for another coordination waiting in line. Two minutes later he realised that the vehicle had crossed the stop bar and the runway without a clearance. A few hours later he found out that the driver had also assumed something – he had thought that if he had no problem getting clearance to enter the runway from all the previous taxiways (which were not equipped with stop bars) then there was no reason to believe that it would be different in the case of the last one.

Some time ago I had an opportunity to read a whole lot of runway incursion reports. All of them contained a number of recommendations. How many of them (and how quickly) were implemented? That I don't know.

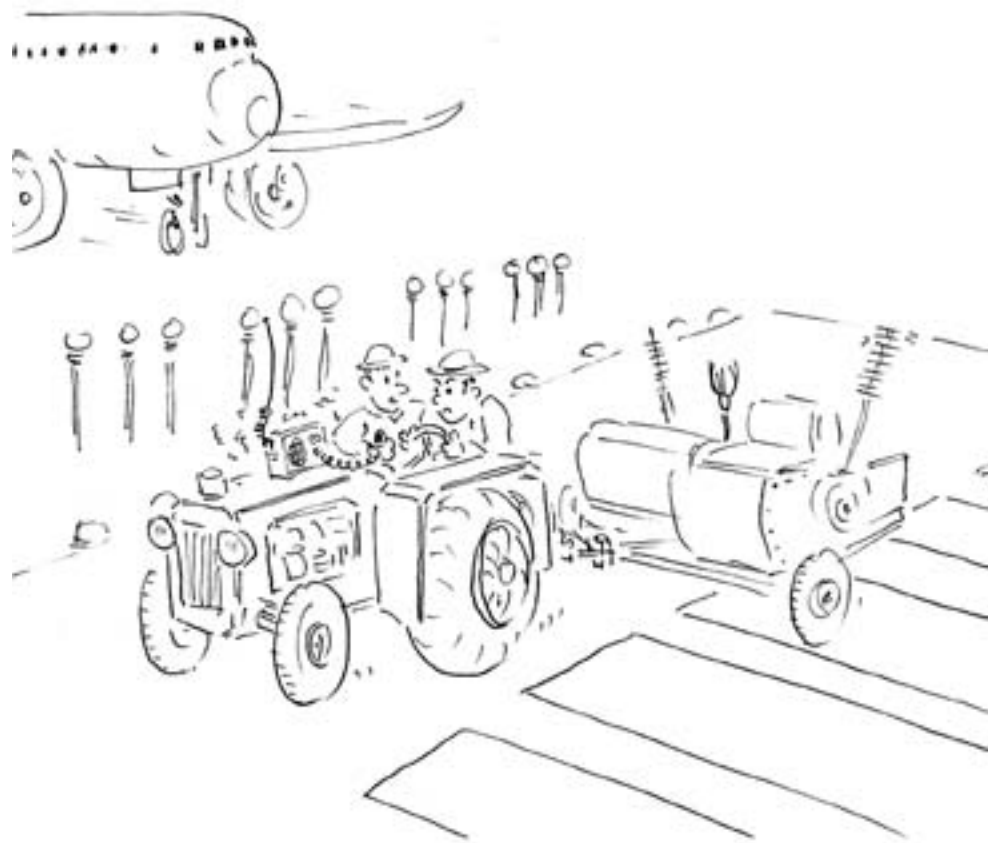
What makes this particular case a special one for me, is the fact that ... I was the "conductor". I did a lot of thinking about this incursion. I thought about available equipment, team resource management, human factors, training quality, my fatigue. And then I thought that maybe we, air traffic controllers, represent an incorrect approach to the whole problem of runway incursions?

For many years now we have had a basic standardised system. Airport maps, runway, taxiway and holding point markings and lights, stop bars etc. Yet runway incursions still occur. Just like in music, where a score printed in the same way will almost invariably lead to almost every performance being different. Because of such uncertainty it is the very basic task of the conductor and the musicians to establish the most mutually satisfying vision of their common performance. And so it is the role of ATC to understand the needs and draw the right conclusions. How?

Some time ago I had an opportunity to read a whole lot of runway incursion reports. All of them contained a number of recommendations. How many of them (and how quickly) were implemented? That I don't know. Many required investments (A-SMGCS or stop bar installation), creation of new procedures (some of which would probably lead to an increased number of actions or rules an ATCO would have to follow) or even serious changes in airport design. Some ideas were expensive. I am not sure how many were practical. One could introduce a double read-back before entering any runway – just like conductors, who make an extra hand move to indicate the exact moment a musician should start playing, just to be sure that there will be no mistake. Or one could designate airport hot spots on every intersection or publish NOTAMs about any known risk at the airport – just like conductors who make notes in their scores and in places which their orchestra seems to find difficult or demanding. One may try to accommodate at least part of such information in ATIS. But it is very likely that doing this would quickly lead to exceeding the recommended duration of 30 seconds¹.

1- ICAO Annex 11, Chapter 4.

So I decided to take a quick look at runway safety-related NOTAMs². A few days ago I checked the total number along with number and contents of such NOTAMs for 33 different European airports. The percentage of runway safety-related NOTAMs, out of the total number of NOTAMs for these airports, varied between zero and almost 40 %. Among airports with more than 15 NOTAMs active, two of them had 7 and 9 runway safety-related NOTAMs active out of, respectively, 47 and 69 (!) in total. Two thoughts came to my mind after these findings. First – if 40 % of NOTAMs were runway safety related then ATCOs might expect crews to remember them all. Second, and more important – it would be easy to overlook a single, runway safety-related NOTAM, "hidden" among over 60 other messages also required to be reviewed during preflight briefing and if appropriate reviewed during a departure or approach briefing. So I checked the average and maximum number of words in those NOTAMs. The numbers were 20 and 75 respectively. Bearing in mind that the average reading rate, for comprehension, can be 200 words per minute³, over 22 seconds would be required just to read the longest one. Time to discuss significant NOTAMs with the other pilot is not included here. My conclusion? Wise are the words of Ludwig Wittgenstein, a philosopher who opined that "what can be said at all can be said clearly, and what we cannot talk about we must pass over in silence". Airport authorities or ANSPs/ATCOs should ensure that they create NOTAMs only when they have a real relevance to the "Airmen" they are supposed to help and that they create them only with maximum clarity and brevity. And they should remember,




He was babbling something about "vacating" and "07:58"....
It is just few minutes past eight and we have finished our work
so I don't understand the fuss...

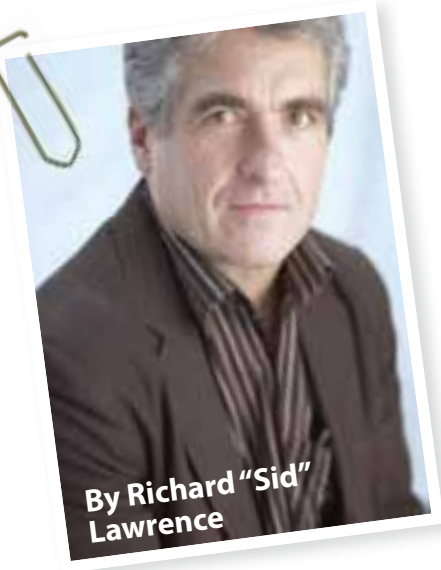
in this connection, that a picture can save a lot of words.

I believe that runway safety is actually about the proactive flow of information whether in the form of an internal note, a NOTAM or through radio communication. At the operational level, when ATCOs decide to clear a vehicle onto the runway, even though they can't see it, its radio seems to be broken and its driver demonstrates lack of familiarity with the taxiway and runway layout, then it may be too late. I think that nobody should demand more than an ATCO can handle so I see no reason not to openly restrict such driver from entering the area. Still I believe that it is crucial to express, afterwards, the reasons for such decision. Otherwise certain external pressures may arise,

the driver (if, however, cleared to enter the area and focused to do the job by all means) may "hear" a clearance an ATCO has never actually articulated.

Cross training, efficient data exchange, coordinated manuals are, in some places, still ideas far too complex or expensive to invest in. Verification of the quality of airport's ground personnel training is limited, especially in places where it's outsourced. But assertiveness along with understanding is available at all times. Maestro Muti said: "more and more I conduct, more I try to understand music and less I understand the act of waving my baton". I say: look at Your airport, talk, watch and listen. Try to learn and understand Your orchestra. Tell them more about Yourself. Then decide wisely and conduct the concert at Your best and with an understanding of Your 'audience'. 

2- Via FAA NOTAM Retrieval, see <https://pilotweb.nas.faa.gov/PilotWeb/>
3- [http://en.wikipedia.org/wiki/Reading_\(activity\)](http://en.wikipedia.org/wiki/Reading_(activity))



By Richard "Sid" Lawrence

“

Dear Readers,

The keen-eyed amongst you will have noticed the Safety Alerts section was missing from the previous edition of your favourite ATC magazine. This was due to the abundance of articles submitted on the theme of Hindsight 18, Justice versus Safety. I was due to post the outcome from the Request for Support message, Runway Incursion Prevention - Aerodrome Stop Bar Operating Policy but it was felt that this should be held over to this edition of Hindsight as it would complement this issue's Runway Safety theme.

So I'm pleased to say that the Safety Alert section is back and we can now take an in-depth look at the above mentioned RFS message released in March 2013. As usual, my intention is to try and bring new information to the table. You will see a digest of the feedback and responses received as well as comment, analysis and news of recent changes to stop bar specifications.

Without further ado, let's have a look at the Request for Support Message, Runway Incursion Prevention - Aerodrome Stop Bar Operating Policy

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REQUEST FOR SUPPORT MESSAGE

Runway Incursion Prevention Aerodrome Stop Bar Operating Policy

Synopsis

Released on 14 March 2013

Following a serious runway incursion incident, a European aerodrome operator was requesting support from the aviation community to inform the installation of a new aerodrome stop bar system and reviews of its stop bar operating policy and stop bar HMI design specifications.

The aerodrome has multiple, interconnecting runways and currently stop bars are operated H24/7 for the 'active' runway in use only.

ICAO references

ICAO Definition of Runway Incursion (ICAO Doc 9870) "Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft."

ICAO Annex 14, Volume I - 5.3.19

Note 1. "The provision of stop bars requires their control either manually or automatically by air traffic services."

Note 2. "Runway incursions may take place in all visibility or weather conditions. The provision of stop bars at runway holding positions and their use at night and in visibility conditions greater than 550 m runway visual range can form part of effective runway incursion prevention measures."

EUROPEAN ACTION PLAN FOR THE PREVENTION OF RUNWAY INCURSIONS (EAPPRI) Edition 2.0

EAPPRI Rec 1.2.15 (Aerodrome Operator): "Regularly review the operational use of aeronautical ground lighting e.g. stop bars, to ensure a robust policy to protect the runway."

EAPPRI Rec 1.4.3 (Aircraft Operator): "Ensure that flight deck procedures contain a requirement for specific clearances to cross any runway. **Includes non-active runways.**"

EAPPRI Rec 1.5.8 (ANSP): "Ensure that air traffic control procedures contain a requirement to issue a specific clearance to cross any runway. **Includes non-active runways.**"

Note: These EAPPRI recommendations are included in ICAO Doc 9870, *Manual for the Prevention of Runway Incursions*.

- ICAO Doc 9870 – Manual for the Prevention of Runway Incursions.
- European Action Plan for the Prevention of Runway Incursions (EAPRI) Ed 2.0.
- SKYbrary Articles/Documents:
 - http://www.skybrary.aero/index.php/Runway_Incursion_Prevention_-_Runway-holding_Position,_Stop_Bars_and_ATC_Clearance
 - http://www.skybrary.aero/index.php/Runway_Guard_and_Status_Lights
 - http://www.skybrary.aero/index.php/Taxiway_Lighting
 - IFATCA Stop Bar Survey Report (2008) <http://www.skybrary.aero/bookshelf/books/602.pdf>

Analysis

Stop bars were originally conceived for use during low visibility conditions. However, some aerodromes operate their stop bars permanently as an additional 'safety net' to help prevent runway incursions. Although the Annex 14, Volume I - 5.3.19 Note 2 above supports this general notion, not all aerodromes/ANSPs have adopted this stance and stop bar operating policies vary considerably and are inconsistent. For instance, at some aerodromes with multiple runways, during periods when stop bars are in operation, they are used only for the 'active' runway(s) and not for the other 'inactive' runway(s) whilst at other aerodromes they are operated for all runways irrespective of operational status.

Support requested

Aerodrome operators and air navigation service providers at aerodromes with multiple runways were invited to provide the following details concerning their stop bar operating policy:

- The periods of stop bar operation, e.g. H24/7, LVP only, night.
- Whether stop bars are used only for the 'active' runway(s) in use and/or for other 'inactive' runways.
- ATC clearances relating to accessing/crossing 'inactive' runways – with and/or without the corresponding use of stop bars.
- Any other relevant information, e.g. operability/functionality of stop bar control panel, selectively switchable stop bars, workload issues (is there a dedicated aerodrome lighting controller or are stop bars operated by the Tower/Ground controller?), automation, Red stop bar crossing warnings, links to other runway protection systems etc.

Aircraft operators and national aviation authorities were also kindly invited to share their experiences and preferences related to stop bar operating policy.

Feedback received

SA total of 10 responses were received: 6 from Aerodrome Operators, one ANSP, one National Authority and 2 Associations.

General: There is no consistency concerning aerodrome stop bar operating policy across Europe (indeed the World). Consequently, there is no consistency of actual stop bar operations at aerodromes. This causes problems to pilots, in particular those who fly to multiple locations in different parts/regions of the world.

Periods/Timing: As anticipated, the periods/timings of stop bar operation is mixed. Some aerodromes only operate stop bars during LVP (e.g. Cat III conditions) whereas others use them H24/7 or during aerodrome operating hours regardless of the weather. Some aerodromes have mixed use, e.g. not in use during Cat I conditions but in use H24/7 around dedicated 'Hot Spot' areas irrespective of conditions.

Other views include the IFALPA policy which states that stop bars shall be used 24 hours irrespective of the weather conditions, and irrespective of the status of the runway, be it active or not.

In addition, following extensive trials, the UK CAA encourages H24/7 use (see CAP 168). To date, approximately 9 UK aerodromes have adopted this practice.

There are arguments for and against the use of H24/7 stop bars. On the plus side, H24/7 operation provides a permanent 'ring of red' to protect the runway(s) regardless of other operational factors. Moreover, at the behavioural level, H24/7 use 'simplifies' matters for the pilots (and controllers) and helps to ingrain 'good' habits. On the negative side, H24/7 use can increase ATCO workload (to the possible detriment of other activities, such as looking out of the window!) but this largely depends on the ergonomic configuration and switchability/controllability of the stop bars. In a few places, dedicated aerodrome lighting controllers are established to alleviate some of the workload on the Tower controller and thus permit a much more flexible use of the stop bars.

Note: In 2011, the EUROCONTROL Safety Improvement Sub Group (SIG) conducted an ad hoc survey of ANSPs to determine automatic stop bar re-light intervals where this functionality exists. The timing value varied depending on the means of stop bar operation i.e. whether automatic or automatic + sensor but was typically within the range of 30-45 seconds, although at one aerodrome it was only 20 seconds whilst at another it was as long as 90 seconds.

REQUEST FOR SUPPORT MESSAGE (cont'd)

Locations - Active/Inactive Runways: The use of stop bars on active and inactive runways was again mixed. Assuming that stop bars are on (e.g. during LVP) then some aerodromes operate them on all runways although on others they are used only for the 'active' runways.

ATC Clearance Inactive Runways: As per EAPPRI ANSP Recommendation 1.5.8, it is common practice that ATC issues specific clearances to cross all runways irrespective of status – i.e. active or inactive.

Discussion point: Notwithstanding the above, there is a view that focus on avoiding pilot RIs onto active runways is more effective if inactive runways do not have 'unnecessary' rules. Questions are raised about inactive runways which become vital taxiways and there is an opinion that the all runways in all states 'solution' to crossing clearances introduces entirely unnecessary rules as well as reducing focus on what matters, i.e. the 'ring of red' should be just that - protecting active runways. What do you think?

Functionality: It is preferable that stop bars are independently switchable. In addition, stop bars can be interlocked with a section of taxiway centreline 'lead-on' lights beyond the stop bar (i.e. stop bar switched off, 'lead-on' lights come on – sometimes referred to as the 'follow the greens' policy). However, it is important that failure of one element should not affect the operation of the other. One aerodrome reported that if for any reason the stop bars cannot be extinguished, then the holding points for runway access associated with those stop bars are not used during LVP.

Many stop bar systems are connected/linked to the A-SMGCS (where fitted) and to the other airfield lighting. When stop bars are operated as part RIMCAS-type system (Runway Incursion Monitoring and Conflict Alert System) visual and/or aural warnings can be generated to alert the controller that an aircraft/vehicle has crossed a lit stop bar.

Contingency: If, for any reason, the stop bars cannot be switched off then, exceptionally, many aerodromes use 'follow-me' vehicles to escort aircraft through the lit stop bar. Alternatively, if possible, some aerodromes re-route traffic to avoid the area(s) where the stop bars are inoperable (i.e. stuck on red) rather than issue a clearance to cross a red stop bar (even when accompanied by a 'follow me' vehicle) as this is less likely to induce unwanted negative behaviour.

General Compliance: The good news is that the mantras "**never cross a lit stop bar**" (even with an ATC clearance) and "**controllers should not issue instructions to cross a lit stop bar**" (other than exceptionally during contingency) are widely understood and there is a **high degree of compliance from both the pilot and ATCO sides.**



Changes to Stop Bar Specifications: Since the publication of the RFS message, changes to ICAO Annex 14 (effective November 2013) has provided some flexibility concerning the distance between the filaments of the stop bars. The annex now states that, "stop bars shall consist of lights spaced at uniform intervals of no more than 3 m across the taxiway". In conjunction with the increasing use of LED filaments, a distance of 1.5m has been shown to greatly increase the visibility of the stop bars in all light conditions. **S**



REQUEST FOR SUPPORT MESSAGE


Passing of 'level' information when providing Traffic Information



**1000 feet
above, ...
below, ...
ABOVE or BELOW??**

As reported in the Hindsight 17 (June 2013), the overriding opinion of the EUROCONTROL Safety Improvement Sub Group (SISG) members and the majority of respondents to the RFS is that use of phraseology such as "1000 FEET ABOVE/BELOW" when providing traffic information in certain situations, as opposed to stating the actual flight level, height or altitude of the other traffic, would improve operational flight safety and regularise what is already a common practice in many ANSPs.

Consequently, the SISG has now approached the EUROCONTROL ATM Procedures Development Sub Group (APDSG) to gain its support to progress a change to PANS ATM phraseology. The APDSG is now in the process of gathering additional supporting information so that it can consider how the issue might best be taken forward including wider industry consultation with the relevant controller and pilot groups. The intent would be to propose phraseology that would complement rather than the replace the existing PANS ATM phraseology, which while safe is sub-optimal in the view of many controllers and pilots.

Assuming that a consensus on proposed additions to R/T phraseology can be reached then APDSG has the means to make a formal approach to ICAO. 

A day in the life

by Bengt Collin

05.11

Drinking his first black coffee in his hotel room, he started singing on the song "Samba Sambero". He stopped immediately when he came aware of it. Why did he remember songs like that? Irritating songs with irritating lyrics, performed by artists that were, to say the least, different. Nine times out of ten the songs been broadcast on TV, somehow they stayed in his mind forever. How ever hard he tried, it was impossible to forget these songs, in fact the more he tried to forget, the more he remembered them. Like this morning. He started singing Samba Sambero again.

05.45

The crew transport was waiting for them outside the hotel, to take them to the small airport a few kilometres away. The darkness was thick, the streets empty. The clear crispy air woke him up in seconds. It was his first year with the airline, before he had worked abroad for six years for another low cost carrier. The opportunity to move back home arose when this airline, continuously expanding their route network, invested in new aircraft. They had a need for more pilots with experience.

They worked hard, today being no exception. An eleven hour flying duty period was

scheduled, with six flights. The first flight was south returning back to their home base, followed by a return flight up to the very north, then two more legs out from and back to where they started this morning. At least it was not snowing, but the planning was very tight to say the least, with 25 minutes scheduled turn around times.

09.10

Three of the walls in the meeting room were in a dark green colour, a colour that reminded her on the big forest where she grew up. The fourth wall was brown, luckily it didn't give her any flash backs at all.

The big organisation was visiting to do a study on safety culture. Prior to the scheduled visit, everybody had had the chance to answer a questionnaire. Now they were discussing and explaining what the written answers indicated. This particular session included the airport people; airside workers as well as ATC. In the corner of the room was a big plant, well it was, obviously no one had watered it for months.

Liza, a controller from the Tower, was a bit surprised that some of the meeting participants were unaware of the existence of the Local Runway Safety Team. Being a member of the team herself, she assumed everybody knew about it. They were actually having a Team meeting this afternoon, the first for ten months.

11.30

The safety culture visitors continued with a meeting with the airport management. "We have a good safety culture, in fact this is our top priority" Steve, one of the management representatives, explained. The other participants nodded and looked very serious. "If our workforce have other

opinions, then we have no idea why", he added.

"We haven't said that, we just wanted your opinions" a representative from the big organisation responded, "it's important to have an open discussion about everything".

"Well, our budget is under pressure, but we know what to do, no problem, we will look after all the issues. Next year we will have more resources and everything will be just fine". The airport representative looked confident. The ATC representative agreed, "we will have a really in-depth look at the increasing number of runway incursions next year too, but we know nothing has really changed".

11.42

They arrived 30 minutes late at the airport in the north. Considering the tight turn around time, plus the expectation of a strong head wind on their return flight, the Captain decided to contact crew planning at their home base. It was clearly impossible to complete the planned sectors inside the rostered eleven hour duty time, the maximum allowed. He did not want to file another Captain's Discretion Report, a must if you exceeded the permitted maximum hours. The last time he had had to do so was some three weeks ago, he knew from colleagues that this happened in the company far too often. More important was that they would certainly not be fit to fly towards the end of the day. The report was one thing, the reason behind it much more important.

13.35

"I'll hope you understand the cost for our company if you don't fly your rostered flights. Being a company highly appreciated by our customers we ex-



Bengt Collin

worked at EUROCONTROL HQ as a Senior Expert

involved in operational ATC safety activities. Bengt has a long background as Tower and Approach controller at Stockholm-Arlanda Airport, Sweden

pect you to meet their expectations. No one ever expected us to depart on time, but our passengers at least expect to arrive at their destination the same evening”.

The message from the crew base supervisor was crystal clear. He felt the pressure - refusing to fly the last two flights may end up in increased pressure at the next six month proficiency check, it had happened before to pilots who had complained.

14.55

The Local Runway Safety Team meeting started five minutes early, everybody was there on time - unbelievable. Chris, the secretary, went quickly through the actions from the previous meeting. “The runway safety awareness campaign is still on hold. The airport thought it was not necessary, we had one five years ago and without their support we can’t proceed. Let’s look at the problem from a positive side, less work for us”.

Liza couldn’t stay silent, she almost never could. “We need to do this campaign, we have a lot of new people in various airside jobs and besides that, the number of reported runway incursions has increased. Earlier today I was in a safety culture meeting, some participants were completely unaware of our Team and our safety work”. “Brent, you are representing the airport, can’t you do something”? Brent looked uncomfortable. “I’ve tried to explain this to the management but the standard answer is that we need to save money. We don’t even have enough money to update the signs that we suggested at the last meeting although it is urgent”.

“That was the next item on the list of action, I suppose we need to keep it for the next meeting then” Chris replied. “What about the proposal for the vehicle driver training Alan? As you explained to us, that was also urgent” Sid, the Chairman seated at the far end of the table, asked Alan.

“Same thing I’m afraid, no money” Alan replied. “We still have the old training method from the days before the re-modelling of the airport”, he continued. I’ve read in an article about the new simulator for vehicle drivers at Brussels. They can train their drivers for difficult situations in various scenarios which are impossible to train live. It would be perfect for us, but no”.

A distinct aroma of coffee spread around the room. This will be a short meeting Liza thought as she suppressed a gasp. It’s been a long day, but it still wasn’t over, she had to return to the Tower for duty for at least four more hours.

15.28

Liza, being in charge of the runway, was sitting in front of three relatively large screens. The electronic strip system was very new, they had started using it operationally two weeks ago. Like all the other systems it was a stand-alone system. Originally it was planned to be integrated with the airport surveillance system, but due to technical problems this had been delayed for at least a

» »

Case Study A day in the life (cont'd)

year. She had to work with different inputs for everything and not working every day, she found it not exactly difficult but certainly a bit complicated. I wonder if it'll ever get integrated Liza thought, looking down on one of the screens and the taxiways in front of her. At the other end of the cabin she could hear the conversation of two colleagues about the television program they had both watched. "This song is really annoying" one of them said, starting to sing, completely out of tune, "Samba Sambero, Samba Samberio, mitt hjärta dansar, kärleken i mitt blod". For a second Liza thought of asking them to leave, they really disturbed her and besides that they couldn't sing. But better wait until the Supervisor returned from his meal break, he'd been away for an hour, maybe more. She continued her work by giving an aircraft a departure clearance.

16.01

Their last turn around lasted thirty five minutes, adding another ten minutes to their total delay. The head wind on their last flight of the day made it impossible to claw any time back. His First Officer asked for descent. It was quiet in the flight deck, neither of them was in the mood for a chat. He tried to stay focused on what to do. He was tired.

16.16

The assistant controller replied to the vehicle driver calling. The driver had phoned ten minutes earlier, explaining the urgent need to replace some centre line lights. They had a small gap in both the inbound and outbound traffic, better to fix the problem immediately rather than waiting till later. He coordinated with Liza, but the vehicle driver used a completely dif-

ferent intersection to the one cleared and coordinated. He chose not to correct him, after all no one else was around and anyway, he knew about the incorrect signs. He returned to his coffee and newspaper, hoping no one would disturb him in the near future - he wanted to check the results for his favourite team Wolves.

16.17

Liza had problems with the electronic strip system. How did you mark the runway as occupied? She had done it in the training but that was a long time ago, at least four months earlier. Due to their roster, the training could not be delayed when the system was. She would ask Peter when he returned from his break, he would certainly know how to do it.

16.26

On four mile final they were instructed to contact the Tower. An alert sounded. Both pilots looked at the accompanying flashing amber light, the sound was irritating. It took a few seconds before they realised where the problem was and neither of them knew exactly what to do. "Check the Manual please" he said to his First Officer, I'll continue flying.

16.28


"Peter, how do you show that there is a vehicle on the runway", Liza asked? Peter walked up to her, they both looked down on the electronic strips, Peter started to explain, pointing on the strips. An aircraft landed on the runway, missing the vehicle by two metres.

16.29

We got the landing clearance didn't we? I'm sure we did, the First Officer replied. I was busy looking up the drill,

it's something to do with the flap setting, so it's good we didn't overrun the end of the runway - there was a risk we might given that the braking action was far below what reported. It was rather slippery and certainly not the reported "good" braking action. "We should report this", his First Officer commented in a concerned voice! Forget it, the Captain replied. After a day like that, the last thing I want to do is write a report on the braking action, I want to get home as soon as possible. I have an early start tomorrow.

18.24

The head lights from his car were a sharp contrast to the dark area around his dark house and the dark road in front of it. He didn't think about it though, he opened his front door. He was so tired, he went in to the dark empty house and cuddled his Persian cat. Finally back home after a long LONG day. Samba Sambero, he started singing... 



Case Study Comment 1

by Jim Krieger

What is the moral of this story? For me, it is that there are dangers associated with merely paying lip service to safety. There can be no rationalisations to support doing less or taking shortcuts. When we embark on the road to runway safety, we have to be ready to go all the way or be willing to accept the consequences of falling short. Those consequences, like those seen here, will not always be easy to predict.

With that said, let's have a closer look at what happened.

First, we have a flight crew compelled to execute a schedule that is impossible to complete within reasonable duty limits. I have no airline operations or crew scheduling experience, but this situation sounds like a formula for hasty decision making, increased stress, and motivation to take shortcuts to get the job done. All of those items appeared here, and I am sure that none of us would want our

flight crew to be subjected to such things. Haste makes waste in many circumstances but certainly none more potentially devastating than in our business.

Was fatigue also a by-product of this practice? Yes, and at the worst possible time – just when the crew needed all of their vigilance to respond to an alert on the flight deck and detect vehicular traffic on their runway. The resultant vehicular runway incursion occurred more than eleven hours after



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numerous air traffic control and leadership positions at Chicago-O'Hare International Airport and he currently works as the Air Traffic Manager at O'Hare Tower.

their day had begun and that is a long time by any measure.

Second, admonishments from leadership about the perils of increased costs are rarely justified in discussions even remotely related to safety. The potential for sending the wrong message is simply too great. In this case, however, the message came through loud and clear and exactly as it was intended: "finish your trips or else." The "or else" was the prospect of increased scrutiny during the proficiency check process. Add it all up and you have an environment in this airline that encourages pilots to bend the rules and to bend safety in the process. Is this a "safety" culture? It's not even close. Does it probably work most of the time? Probably, and that is very unfortunate.

On the other side of the mic we have the air traffic controller. Her day starts coincidentally enough with a visit from an organisation conducting a safety culture study. Troubling to her and to me is the fact that some of the meeting participants were not even aware of the existence of the Local Runway Safety Team. That seems to say a lot about the lack of a safety culture already.

►►



Case Study Comment 1 by Jim Krieger (cont'd)

While we all know what it is like to face budget and resource challenges, putting runway safety on hold simply cannot be an option. It is too important.

There was also an unsolicited statement from one of the airport management officials about how they have “a good safety culture” and that it is “a top priority.” He went on to say that “if the workforce has other opinions, we have no idea why.”

I wondered what was truly at the source of such a defensive statement and it soon became clear. The airport management team, like many organisations, has been experiencing budget and resource challenges that have caused them to put their runway safety efforts on hold in the hopes that next year will be better. That sentiment is echoed by the ATC representative as well. Together, they rationalised that “they know nothing has changed” concerning local runway incursions and that “a runway safety awareness campaign is not necessary.” While we all know what it is like to face budget and resource challenges, putting runway safety on hold simply cannot be an option. It is too important. Instead of waiting for better times, the Local Runway Safety Team has to figure out new ways to accomplish their safety initiatives. They must innovate and perhaps produce even better solutions in the process.

Finally there were problems with the new electronic strip equipment in the

tower. It apparently was complicated to use and the training for it occurred many months before the delayed implementation of the system. Those issues are not uncommon, as new, stand-alone systems are sometimes hastily adopted with good intentions and then the complexities of the real world intervene. Unfortunately, the consequences of installing complicated equipment four months after training the personnel who will use it are sometimes difficult if not impossible to foresee.

If you consider all the issues confronting all the characters, you realize that you have an environment capable of producing the runway incursion we saw here, or perhaps an even worse incursion next time around. Did any one of our characters really intend for that to happen? I do not think so but it happened nonetheless.

“A Day in the Life” shows us that our efforts to address runway safety cannot wait until next year, cannot be rationalized away as unnecessary, cannot be partially addressed, and cannot be compromised by scheduling practices and ineffective training. It also tells us that to keep our runways safe, we all have to follow a consistent, unyielding course that can’t be significantly altered by anything despite our ever changing environment. No shortcuts are allowed!

This “A Day in the Life” scenario makes me think of yet another Beatles hit, “The Long and Winding Road.” It is an apt description of the path that we will all need to stay on to ensure consistent runway safety in our not so consistent world. ☺



Case Study Comment 2

by Captain Ed Pooley

Plenty of holes in those defensive slices of cheese –
and all nicely lined up with only providence to save the day.

Not necessarily in any significant order, we have:

- Management who have no idea how to engender a safety culture in the airport workforce.
- An LRST which has representation which appears to be without sufficient delegated authority to be able to engage in effectively prioritising issues in a climate of 'scarce resources'.
- An LRST which on the face of it - for example driver training for a new airside layout - seems to accept that there is only one fixed price solution to the training need. Flexible thinking is a necessary part of risk

management given that the 'gold-plated' solution may not be achievable.

- One frequency and one controller for all runway occupancy is a pretty obvious way to raise controller awareness whatever supporting aids are available - but not in use at this airport.
- New equipment needs adequate training and ATC management were foolish to accept its use without finding a way to deliver this beforehand.
- No mention of the circumstances that led to the incorrect braking action being passed - or of any visual or other evidence that weather at the aerodrome had changed in a way that might render the one given no longer valid - but something is wrong somewhere.
- A pilot in command who allowed a typical short haul day to create a situation where a cautionary alert became a distraction sufficient to fail to check in on TWR
- The landing does not appear to have been carried out in RVR conditions so the runway must have been visible before the landing occurred. But there was no mention of a visual check being made of the runway ahead clear by the pilots - or of the conspicuousness of the vehicle on the runway when viewed from short final against whatever colour the visible surface of the runway

Captain Ed Pooley

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

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



was. Was it easily seen? If so why no go around?

- And finally, we have a TWR controller who allowed themselves to be distracted from normal situational awareness when (it seems fair to assume) that they must have been expecting a call from the inbound aircraft after APP had handed off to them.

Being asked to offer just one recommendation with all the above to sort out is a bit of a challenge! And there is absolutely no single cure for the risk of collision created which was the primary concern. But the most vulnerable person in the 'error chain' is the runway controller working alone. So....

RECOMMENDATION:

A controller should only be required to attend meetings on behalf of ATC when they have completed their controlling duties in the shift concerned. This may not eliminate the propensity to be distracted but it might well help. 5



Case Study Comment 3

by Mike Edwards

What happened next...

Mike Edwards

was until recently Head of Safety Investigation at NATS (the UK Air Navigation Service Provider). He held this role for 7 years and prior to that he was Head of Investigation at London ACC. He had been an ATCO at Edinburgh and Heathrow before becoming the manager of all student controllers and then a Supervisor at London Terminal Control. He holds a PPL with Group B rating.

18:29

His phone rang just as he was putting his usual microwave ready meal on to a plate. How he hated these tasteless things that were always either cold or too hot. It was the airline Fleet Captain. "Yes, that's right...What vehicle?... How close?Never, we would have seen it....anyway it's not our fault, we had landing clearance, so no problemo.... What do you mean, we didn't have landing clearance? but..but..yeah okay..9 o'clock tomorrow, good bye". He was stunned, he sat down with a beer and his ready meal - it was cold. He offered it to the cat, who sniffed it disdainfully, gave him a look and walked off.

18:30

Liza was still at the Tower. The incident had happened two hours ago, she had been there since nine o'clock this morning and now she just wanted to go home. "This is ridiculous, I have written my report, I don't know what happened. It's not my fault that you can't get the recorders to playback. I have been sat here for two hours tearing my hair out and I want to go home!"

Peter said sorry again but explained again that the Chief wanted to speak to her and he was still in his car... somewhere.

18:45

The electrician, known affectionately as Sparky by his friends, finally got home. He kept reliving the moment when he turned round and saw that aeroplane on top of him. How it missed he will never know. Being a devout man, he had gone straight away to thank his God. "I am sorry, I swear that I will never do it again" he had said and he really meant it this time. He hated having to go out on the airfield by himself. He was an electrician not an airport person. He had told them, but they had just sat him and some others in a classroom for a couple of hours, took them on a tour around the airport tarmac and gave him a map and a crib sheet of what to say to the people in the Control Tower. They crossed a runway a couple of times, but he didn't get a go on the radio. He didn't understand most of it, but he hadn't said anything.

18:50

The Chief phoned in. He asked Peter where he was when it happened. Peter was afraid he would be asked that question. He was feeling very guilty that he had stayed in the Rest Room watching his team. He knew that he should have gone back upstairs but Liza was on and she was solid, she would cope and not complain and it was 1 – 1 and going into extra time. Peter told the Chief that Liza was waiting to see him. The Chief said to

tell Liza that it didn't matter and to go home. Peter wasn't looking forwards to telling Liza.

18:55

The Captain picked up the phone, it was the First Officer ringing. "Yes they have, 9 o'clock tomorrow morning.... you too.... right well we had better get our story straight then. Okay, so you switched to the Tower and got the landing clearance....What do you mean?....So, we were still on the Radar frequency then...so how did we?..... why didn't you?.....what?.... well I would have expected.....forget it". He put the phone down and tried to calm himself by singing Samba Samba, but he could not remember the words anymore.

THE NEXT DAY

09:00

He was sitting in the Fleet Captain's office along with the First Officer. Last night had not gone well, as they had ended up blaming each other and were barely on speaking terms. The Fleet Captain had glossed over the issue about flying duty times and asked him the one difficult question.

"So, when you had alarm bells ringing and lights flashing at 4 miles, why didn't you just go around?" He was ready for this one. "I knew we were running late. I didn't want to inconvenience our customers any further".

10:00

Liza and Peter were sat in The Chief's office, drinking something brown and lukewarm. It was probably called "A

Suggestion of Coffee" or something equally stupid. The walls were painted in a sky blue colour. Liza thought of her boss's favourite phrase about "Blue Sky Thinking". "No clouds, no problems, it's the big picture that matters, nothing is impossible". The Chief wondered why he was still here.

The Chief was not a happy man. He was incredulous. "How could an Airbus land when the runway was blocked and without any of you knowing anything about it? You are both suspended until we sort this mess out"

Liza thought that this might be the result, but did at least expect a chance to tell her side of it.

"Look boss, I am really sorry but Peter and I were concentrating on the new strip display because the training was so long ago and just I didn't see it coming on the ATM. If we still did the warning in of the order from Approach to Tower, like we used to do, I would have known to expect it and if we had got the integrated system with the Runway Incursion Monitor, I would have been warned about it. Yes, and another thing, the Local Runway Safety Team has been saying for ages that vehicles on the runway should be on the Tower frequency not with some dozy assistant who isn't looking out of the window – and anyway, what was the crew doing landing on a runway without a clearance? They weren't even on the right frequency!"

The Chief suddenly looked very pleased. "Thank you Liza, I had already thought of those last two points of course and I will certainly be discussing them with the airline. You two go and help out in the Training department or something. I will try my best to get you back in position as soon as possible".

10:20

Just as The Chief was about to dial the number for the airline, his other phone rang. It was Steve from the Airport. "Hello Steve a special runway safety action meeting...yes, an excellent idea, funnily enough I was about to phone you".

RECOMMENDATION

This tale revolves around money and the philosophy of "it hasn't gone wrong yet, so why waste money on it". The rising number of Runway Incursion reports and the number of Captain's Discretion reports are indicators that it was going wrong. Where is the Regulator in this story?

It is recommended that the Airport Director in conjunction with the Air Navigation Service Provider and other airport operators agrees upon a program of runway safety actions, focussed on addressing the factors associated with reported runway incursions, as prioritised by the Local Runway Safety Team (LRST).

The LRST should grade actions as Urgent – Required – Desirable. The program of action to be agreed within two months and a project delivery plan agreed within one month thereafter. 5





“Your safety is our mission”

How Europe is enabling airport operators to tackle runway safety with a harmonised approach

by Sarah Poralla

On Thursday, 25 February 2010 at 3.19pm in the afternoon, a serious aircraft incident took place at Oslo's Gardermoen airport. An Airbus A320 aircraft of Aeroflot (AFL212) made a taxiing mistake and took off from taxiway M instead of runway 01L. There were three pilots, four cabin crew members and sixty passengers on-board...

The three pilots had not been aware that they had taken off from the taxiway until informed of this by the air traffic controller after take-off. The flight continued as planned to Moscow after the incident. Some serendipitous circumstances had prevented a more serious outcome of this serious incident. Under the prevailing conditions, taxiway M was by chance long enough for the aircraft to take off. The taxiway was at the time of the incident also free of other traffic and obstacles.

The Oslo incident serves as a case-study to illustrate that runway safety must be at the forefront of all actors in the system. The fact that such incidents still happen in this day and age underscores the importance to harmonise the appearance and

management of manoeuvring areas. This is, because aerodromes are not (just) an assembly of static infrastructure and equipment permitting flight crews to collect and deliver passengers, but are dynamic systems themselves where different actors interface to deliver a safe service under varying environmental (visual and weather) conditions.

In 2005 the European Commission announced the inclusion of the safety of aerodromes and ATM/ ANS into the remit of the European aviation system and in 2009 the EASA Basic Regulation was changed to mandate EASA

to develop the detailed rules and certification specifications for these areas. From 2010 to 2013 the Agency, together with NAAs and industry did just that. In formulating its safety regulations for aerodromes, Europe has adopted material from a number of ICAO source documents and Annexes in order to define aerodrome design and operating requirements. Additional material – best practice – from a wide range of global national aviation authorities has also been assessed and, where



applicable absorbed into the EASA rules. Care was taken in that process to not exceed or dilute the overarching ICAO material.

The resulting Regulation 139/2014 containing the Implementing Rules, the accompanying acceptable means of compliance and material, as well as the certification specifications for aerodrome design, came into effect this March. The rules contain a wide range of regulatory requirements, but for the purposes of this article I will focus on the fairly narrow element of those requirements under the generic term "runway safety". This in itself opens the door on a wide range of activities – aerodrome design, implementation and operations – which affect and require input from ANSPs, aircraft operators and operators (use of vehicles, etc). To add some spice to this melange, there are rules specifically aimed at the prevention of runway incursions and excursions taken from the best practices in the known European Plans. Additionally, the Agency is undertaking studies for runway friction measuring and reporting and future use of novel runway surfacing materials which will be included into the European rules in the future.

But for now, back to the basic scenario, our *raison d'être*, to ensure safe operation of aircraft and aerodromes. In simple terms the objective is to prevent (or minimise the possibility) of aircraft inadvertently leaving the paved surface of the runway or taxiway, to prevent aircraft or vehicles inadvertently entering a runway or taxiway occupied by other aircraft or vehicles including aircraft making an approach to land or take off. It should be evident that the ANSP plays a major part in this process, and equally evident that aerodrome design – the visual cues given to pilots and drivers – should complement instructions from air traffic controllers.

It would be accurate to say that the latter case, involving universally recognised markings, lights and signs (that's the ICAO part of the equation), has a significant input in maintaining aerodrome users' situational awareness, particularly in poor weather when LVPs are activated. Moreover, and this demonstrates the holistic approach to safety, the visual elements should not only be standardised (in compliance with the ICAO SARPs), but well maintained, visible in all meteorological conditions, functioning (lit signs, serviceable AGL) and above all appropriate to the needs of aerodrome operations. At the same time it is equally important that the aerodrome operator publishes runway safety information to aerodrome users (AIP, NOTAM, hotspot charts, safety bulletins etc.) in a timely and reliable manner and that the



Sarah Poralla

is a German national and has worked for an airport management company and the European Commission (DG MOVE), where she worked on airport charges,

airport capacity and infrastructure, air-rail intermodality and slot rules. Since 2007 she has been a rulemaking officer at the European Aviation Safety Agency (EASA) and part of the team that prepared the new Commission Regulation 139/2014. Sarah holds degrees from London School of Economics and the University of Oxford.

aerodrome operator leads safety programmes and committees to continually improve the safety performance of the aerodrome.

So for EASA's part, the rules are intended to ensure standardisation of aerodrome design and operations across the EU, while at the same time recognising that there may be unavoidable local variations, and accommodating those deviations by a variety of mechanisms, such as: demonstrating an equivalent level of safety (ELOS); producing a deviation acceptance and action document (DAAD) which could recognise that a future action plan is needed to address the deviation; introducing a special condition (SC) to ameliorate by procedural means an immutable scenario, for example where local topography prevents application of a regulatory requirement. The aim of safe operations can be maintained even when this fairly wide range of flexible options is proportionately applied. ▶▶



Runway with yellow markings in Norway. The Norwegian CAA have decided to ask Avinor to phase these markings out and to mark the runways white by 2017 at the latest² (Photo by Avinor)

Using the Oslo incident as an example we can illustrate how EASA rules are being applied to achieve a standard measure of safety:

The investigation by the Norwegian AIB¹ revealed several causes for the crew's taxiing mistake and take-off from the taxiway. The factors which contributed to the event can be found with the all the parties involved, i.e. the airline, the control tower and the airport.

However, among the contributory airport-related factors uncovered were the unusual runway marking colour in Norway - yellow instead of white - which were not compliant with ICAO (and EASA) standards but before the incident were believed to be more appropriate in winter conditions.

Furthermore, the relevant part of the manoeuvring area where the confusion took place had not yet been published as a "hot spot" in the AIP charts (although it would have been imminent in the AIRAC cycle) and that the runway Safety Team (LRST)

had not foreseen this incident scenario of an aircraft taxiing to an intersection take-off point on the runway and that therefore there was inadequate signage.

This incident therefore demonstrates a need for the commonality and standardisation of runway safety management for which EASA's rule structure has created.

- In the EASA Aerodrome Design Certification Specifications there are many --specifications that

are intended to minimise the risk of runway incursions in terms of marking and lighting of hot spot areas, requiring stop bars, runway guard lights, taxiway centreline and lead on lights.

- In terms of aerodrome operations, the European implementing rules require Aerodrome's Safety Programmes which include the establishment of Local Runway Safety Teams (LRST) as an appropriate means to bring together the operator, aerodrome users, vehicle drivers and the ANSP to study the aerodrome from different vantage points and to improve it jointly.

In the coming years the aerodrome section at EASA will update and improve its rules for aerodrome safety mirroring the ICAO requirements, but also enhancing them with the best practices from around the world, while also giving guidance on the standardised introduction of new technologies. **S**



Taxiway M at Oslo's Gardermoen airport from which an Aeroflot Airbus A320 aircraft took off from instead of runway 01L (reproduced from the AIBN Investigation Report)

The aerodrome safety rules can be accessed via the EASA website:

<http://www.easa.europa.eu/easa-and-you/aviation-domain/aerodromes?page=relevant-legislation-for-aerodromes>

The team at EASA can be contacted by email using: aerodromes@easa.europa.eu

1- [http://www.skybrary.aero/index.php/A322,_Oslo_Norway,_2010_\(RE_HF\)](http://www.skybrary.aero/index.php/A322,_Oslo_Norway,_2010_(RE_HF))

2- The next issue of the Norwegian AIP will say the following: 5.2.1.4: Norway is changing the colour of runway markings from yellow to white. In a transition period until 31.12.2017 some runways will still have yellow markings.

Tearing down barriers – building up relationships

by Jim Krieger

What's on your runway?

In 2009, I was employed by the FAA as the Quality Control Manager at O'Hare Tower. From May until October of that year, O'Hare Airport had a construction project in which runway 10-28 was shortened by approximately 1000 meters and a frangible barrier was placed on the closed portion of the runway to protect a localiser antenna array (pictured).

Despite what we considered to be careful planning on our part, we had five very serious safety events occur on that runway during this construction. There were two instances of aircraft overrunning into the closed portion of the runway, one aircraft touching down and then going around after seeing chevrons in the same area, and two cases of heavy aircraft departing towards the barrier with erroneous knowledge of the actual distance of runway available. One of the heavy jets destroyed the barrier with jet blast after departing towards it with just over 1800 metres available. What is truly remarkable about that is that the

crew had just refused to depart on a 2400 metre runway because they were too heavy for it!

Time to take action

These events and others from around the world were the impetus for the Federal Aviation Administration to take action. Recognising that airport construction introduces additional risk to air traffic operations, the Federal Aviation Administration (FAA) Air Traffic Organisation (ATO) created the Airport Construction Advisory Council (ACAC) in April 2010. The ACAC was tasked with ensuring safety during airport construction activities.

The ACAC consists of FAA and US Aviation Industry professionals with diverse backgrounds and experience and they are strategically positioned across the United States. Their theme is "managers working with managers", a concept that accentuates their credibility and facilitates their reception at air traffic facilities and airport offices across the United States.



The ACAC has taken a multifaceted approach to mitigating the hazards associated with airport construction. Initial efforts targeted operations on runways shortened due to construction as this situation has the most risk associated with it as aircraft, vehicles, pedestrians, broken pavement, and sometimes other substantial objects are all present on the same connected surface at the same time. Working with subject matter experts in the US aviation industry, the International Civil Aviation Organization (ICAO), domestic and international aviation labor and professional organizations, and ▶▶



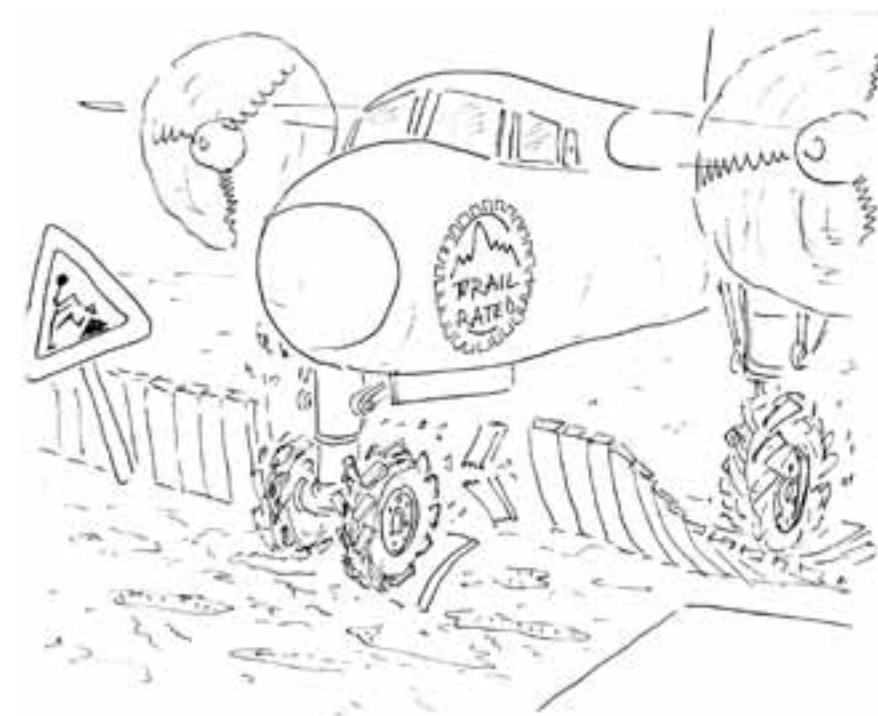


Tearing down barriers - building up relationships (cont'd)

EUROCONTROL, the ACAC has developed a portfolio of initiatives designed to ensure that safety is maintained during airport construction. While I will not go into detail about all of the initiatives at this time, many were designed to address a common factor found in numerous construction-related safety events: missed or forgotten Notices to Airmen (NOTAMs).

For perhaps an unknowable number of reasons, the ACAC found that pilots, controllers and airfield personnel oftentimes were just not aware of construction NOTAMs or did not fully comprehend the effect that they would have on their operations. Sometimes people knew about a critical NOTAM at one point and later forgot about it. On other occasions, they simply never knew about the construction NOTAM at all.

While this problem is not new, the consequences of missing such information at the times that operators need it most, like during the takeoff or landing phases of flight, cannot be overlooked. Why do people miss such important information? As we all know there are many NOTAMs out there, particularly at the larger airports, and sometimes it is difficult for people to comprehend and assimilate all of them. For ex-



TWR, taxiway works are no longer an issue for our new tyres and oleos...

ample, while investigating the event I described earlier in which the blast fence was destroyed, we found that there were over 70 NOTAMs in effect at the time of the incident and that the NOTAM that made all the difference in the world to that flight crew was number 56 on the list! The number one NOTAM that night described that the runway 22L windsock was unlit, which relatively speaking, was not very important in the grand scheme of things. That occurred because US NOTAMs at that time were prioritised by effective date, with the most recent and not necessarily the most critical ones, rising to the top.

To address the NOTAM and other issues, the ACAC developed a portfolio of mitigations:

- Changes to controller takeoff and landing clearance phraseology during construction.
- Changes to Automatic Terminal Information Service (ATIS) procedures.
- Hand-made graphic NOTAMs called Construction Notices.
- New signage for airport construction, especially on reduced length runways.
- A test of the color orange for airport construction signage to alert pilots to construction-related critical information.



- Development of a compilation of best practices that is required reading for Air Traffic Managers (ATMs) before construction begins on their airport.
- Development of a construction checklist that is also mandatory for Air Traffic Managers.

The ACAC also provides onsite support upon request, something that many ATMs have reported to be very helpful. Sometimes a different and perhaps more experienced perspective can provide insights that were not previously considered. Even more beneficial, we have found that we always learn something from the airport operators and ATMs during these visits as well. We then add their information to our Best Practices document and our construction checklists.

This type of information sharing should not be hindered by national boundaries as I discovered during a site visit to Paris in 2012. This trip was made after we had heard about construction safety events at Charles de Gaulle Airport in 2008 that were eerily similar to those experienced at O'Hare Airport in 2009. My meeting with Jean-Marc Flon, the General Manager, ATS CDG, Gaël Le Bris, Airside Development Manager at Aéroports de Paris, and many others

yielded 10 best practices that I took back to the United States and are now being used by our ATMs. A worthwhile trip for me indeed! Had we been more actively seeking this type of sharing earlier, perhaps we could have avoided the O'Hare events altogether.

The productive relationships developed as a result of this trip continue today. In January for example, Gaël came to O'Hare Airport to continue this exchange of technical information with us and the City of Chicago Department of Aviation.

Next steps: **Removing barriers and building relationships**

Airport construction has been proven to add risk to air traffic operations, everywhere. Since construction safety is therefore a global issue, it makes sense to me that it deserves a global, unified and coordinated response. Without such a response, pilots worldwide will continue to be exposed to methods and strategies that sometimes vary greatly by region. In addition, pilots, air traffic controllers, and airport operators may needlessly endure safety events that could have been prevented were it not for some deliberate action from all of us.

What kind of action? Collaborative action. For starters I think that the ACAC initiatives and concepts can be used by any organization responsible for aviation safety. I recommend that you consider a similar approach to airport construction safety in your organization and that you then share your findings and techniques worldwide. Airport construction safety will only be truly enhanced by the widespread and consistent development and implementation of airport construction safety solutions that we regularly share with each other. As I learned from my experience in Paris, working together, we can significantly enhance safety for all citizens and develop great relationships at the same time. ✍



Jim Krieger is an experienced Air Traffic professional who recently served as the FAA's Group Manager for Runway Safety in the United States. He has held numerous air traffic control and leadership positions at Chicago-O'Hare International Airport and he currently works as the Air Traffic Manager at O'Hare Tower.





Brussels airport continuously improves its runway safety concept

by Jan Loncke and Davy Van Hyfte

At Brussels Airport, “runway incursions” is the number one safety key performance indicator. The European Action Plan for the Prevention of Runway Incursions (EAPPRI) has been fully implemented by the Airport Authority with the full support of the Belgian CAA who have included the application of EAPPRI recommendations as a key performance indicator in the State Safety Plan (SSP).

It is well known that most runway incursions have a typical set of causes and this article will not elaborate on all of these but instead focus on some specific issues identified. Few of those working at the airport are native English speakers – the mother tongue of the majority is either French or Dutch (Flemish).

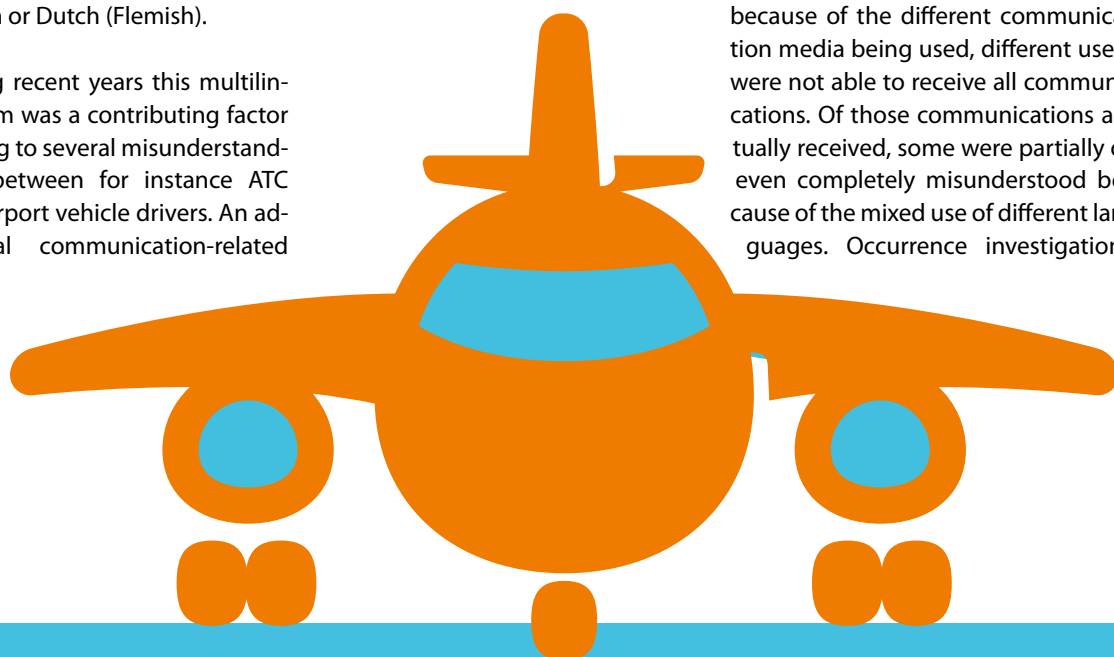
During recent years this multilingualism was a contributing factor leading to several misunderstandings between for instance ATC and airport vehicle drivers. An additional communication-related

contributing factor to some runway incursions was the combined use of VHF-sets and trunked radio systems.

An atmosphere existed where ground operations personnel, air traffic controllers and pilots were speaking to each other using different communication means and

often using different languages whilst seeking to achieve expeditious and safe movements within an area including two parallel runways and one crossing runway.

We all advocate the importance of situational awareness for users of the manoeuvring area and on the importance of developing mental maps to help prevent runway incursions, but because of the different communication media being used, different users were not able to receive all communications. Of those communications actually received, some were partially or even completely misunderstood because of the mixed use of different languages. Occurrence investigations





showed that situational awareness, especially for vehicle drivers, was often minimal and pilots were unable to appreciate what was happening around them.

After consulting the Local Runway Safety Team, Brussels Airport decided to implement the “triple one principle” of “one runway – one frequency – one language”. This means that all people working on or around the same runway in use, whether being a pilot, an air traffic controller, an airport lighting technician or anyone else would speak the same language, using the same VHF radio frequency.

As a direct consequence, the need to retrain all those working on the manoeuvring area became apparent. A new curriculum and training program was developed and began by focusing on driving on the manoeuvring area safely according to standardised procedures. A compulsory and important part of this training is about the use of standard ICAO phraseology by all vehicle drivers. This training program was developed and managed by the Brussels Airport Safety Management Unit (SMU).

The curriculum consists of a theoretical part focusing on general airside safety and specifics such as runway incursion awareness, markings and signage, local airside traffic rules, radio communication and stop bar procedures.

General airside safety deals with the hazards that can exist airside such as FOD, adverse weather (winter conditions, low visibility, thunderstorms, high winds), and jet blast. The radio communication procedures element contains quite a bit of standard phraseology and aviation vocabulary in line with the relevant ICAO Annexes and Documents and was developed by Brussels Airport’s SMU in close collaboration with ANSP Belgocontrol.

Phraseology and how it should be used in a standard way is covered on a theoretical basis and when the vehicle driver trainees seem comfortable using the vocabulary, exercises were conducted using role play scenarios. As they became more familiar with the procedures, scenarios on the manoeuvring area were simulated by making use of a large airport chart, a slide show and by projecting airside images relevant to routes virtually driven. When trainees achieved an adequate proficiency, they were taken outside to do live on-the-job exercises. After completion of the course, trainees had to successfully pass a theoretical test but for the practical part trainees were assessed on-the-job.

Initial training is followed by recurrent training at two year intervals. This covers the same topics but also includes case studies and lessons learnt from incidents that have happened during the period between their initial and recurrent training.



Jan Loncke is an industrial engineer with over 20 years in aviation. At Brussels Airport, he has been involved in infrastructure projects, maintenance, airside operations and, for the past three years, the activities of the safety management unit, mainly in auditing and training. He is also a helicopter pilot with 12 years experience on a wide variety of commercial flying duties.



Davy Van Hyfte started his aviation career as a military air traffic controller. He gained experience as a Tower, Approach and Area controller and participated in overseas missions too. For the past six years, he has been Safety Development Manager at the Brussels Airport Safety Management Unit and is involved in auditing, incident investigation and human factors.

After following this regime for some years we concluded that the effectiveness of the practical training part was rather limited. Navigating virtually on a map and using only some background pictures in a classroom was still rather distant from the real thing. It was also not feasible to undertake practical training at night, during low visibility operations and general airside driving practice at busy times was rarely permitted by the tower controllers for obvious reasons.



Brussels airport continuously improves its runway safety concept (cont'd)

So, at the end of 2013, an airside driver training simulator was acquired to provide better practical training in a controlled environment without unnecessary disrupting normal airside operations. This simulator is now being used for both initial and recurrent practical training.

Different scenarios may be presented during the training sessions, customising them to the trainees' specific training needs, their acquired level of proficiency and the professional context. For instance, response by ARFF personnel to aircraft emergencies, picking up FOD from the runway, checking for obstacles on the aerodrome and performing general airside inspections can all be covered.

Brussels Airport SMU instructors are able to pre-program any possible scenario and control traffic density, time of the day and all kinds of (adverse) weather conditions. This makes it possible to effectively train airside drivers under simulated stressful conditions and to help them cope with harsh situations when driving airside for real.

The system is not only used for personalised training with the capability to track

the progress made by individual trainees for feedback purposes, but also for driver practical testing. By means of this training tool, the Brussels Airport SMU goes way beyond to what is practically possible on an operational international airport in real life.

In anticipation of the forthcoming EASA regulations for aerodromes, the system is also configured not only to provide initial and recurrent training, follow-up of trainees and testing but is also ready to be used as a proficiency check platform. In addition, training can be programmed for all kind of airside tasks, such as aircraft push-back and towing operations, marshalling, winter operations, follow-me, ARFF, aircraft servicing, and all other activities with specialised equipment for that matter.

Actual occurrences and incidents can be replicated too. We also believe that by examining actual incidents from a different point of view, we might discern additional contributing factors and perhaps lessons to be learnt – the latter being able to add value to training by demonstrating to trainees the reasons why occurrences happened in a just way.

Potential changes to Standard Operating Procedures may also be tested to find out if they are practical or not. Of course some of these are relatively 'high level' possibilities of the system and clearly, it is the more basic features which will be most used, namely phraseology training

and airside familiarisation. Such training is not only available for drivers who need to drive on the manoeuvring area but also for those who drive on other parts of the movement area. The overriding aim of all familiarisation is to improve situational awareness in a range of different circumstances.

In all these ways, we are sure that the use of the driving simulator will make a positive contribution to practical training, improve situational awareness and thus enhance airside safety.

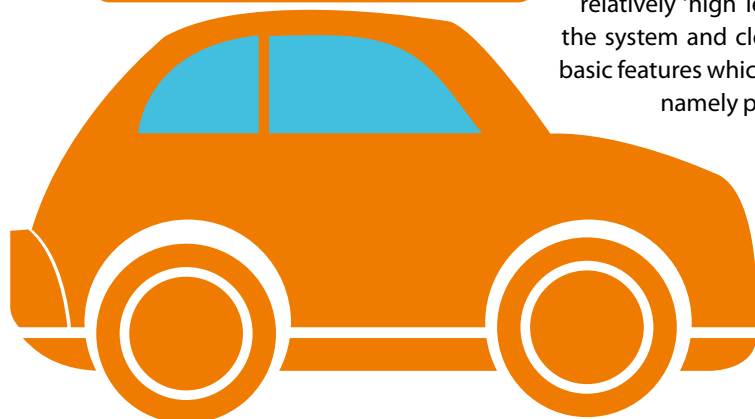
Case Study One: RWY 25L in use for arrivals only. Intersecting RWY 01 was not in use.

A crash tender, entering the manoeuvring area, requested to cross RWY 25L via (TWY) C5, the way the fire fighters were used (and trained) to do, using ICAO phraseology. ATC gave them an instruction (also using ICAO phraseology) to proceed instead to C6, because it was necessary to keep C5 free as a high speed exit for runway 25L. (C6 is not a high speed exit)

Since the driver & co-driver were mentally prepared to cross at C5, they were not ready for another instruction. In the crash tender a discussion started, in a mixture of Dutch & French, about the contents of the instruction while it was still being issued by the ATCO, so that they didn't copy the complete message, which was : "Proceed to C6, hold short of RWY 25L, landing traffic." The part that was not copied by the crash tender was: "hold short of RWY 25L, landing traffic".

The result was that the crash tender crossed RWY 25L at C6 while an aircraft, which had been cleared to land, was crossing the threshold of 25L.


FOLLOW ME

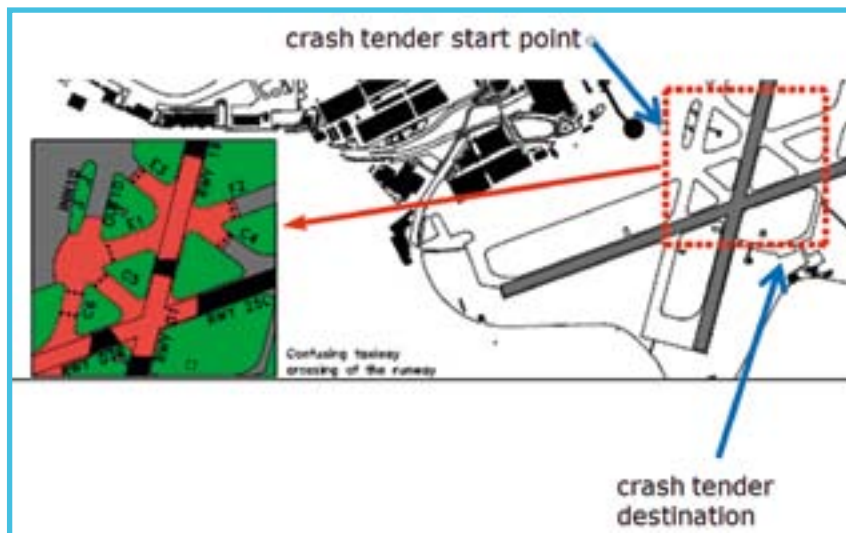


Here is part of the hot spots chart which shows the location:

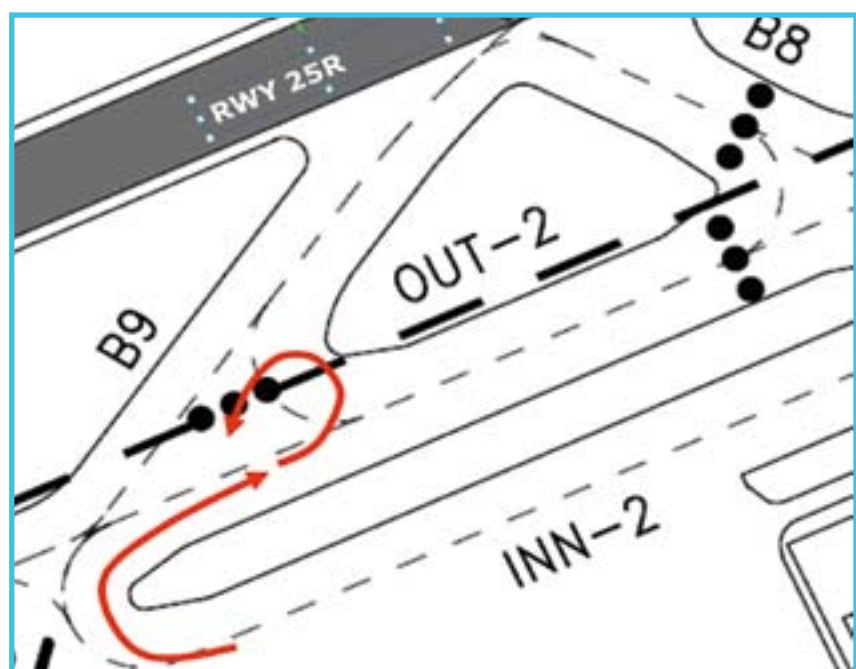
A Follow-Me vehicle was escorting seven dumper trucks for the removal of snow from OUT-2. The drivers of these sub-contractor operated vehicles, were neither used to nor trained to drive on the manoeuvring area, but they had been briefed by the Follow-

Upon arrival at OUT-2, the Follow-Me vehicle pulled out of the way of the trucks, making a 180° turn - to the north - but in doing so crossed the stop bar on B9.

The Follow-Me vehicle vacated the protected area and stopped at the safe side of the stop bar. But instead of remaining on OUT-2, the escorted drivers (who had been briefed to stay behind the Follow-Me), all lined up behind the Follow-Me vehicle, ending up in a single file on TWY B9, thus, all entering the protected area of RWY 25R and creating a 'combined' runway incursion. 



Brussels Airport SMU instructors are able to pre-program any possible scenario and control traffic density, time of the day and all kinds of (adverse) weather conditions. This makes it possible to effectively train airside drivers under simulated stressful conditions and to help them cope with harsh situations when driving airside for real.





Runway safety at Amsterdam Schiphol

by Job Brüggem and Jan Smeitink

"Mind your step!"

This is repeated a zillion times a day by a friendly electronic female voice at the end of the moving walkways at Amsterdam Schiphol Airport. Surely you must have heard it. But stepping off the walkway seems simple enough, doesn't it? Should we be warned for this? Let's find out.

10 Dec 1998

On a grim day, with reduced visibility and during a traffic peak, LVNL controllers cleared a Boeing 767 for take-off on runway 24. Simultaneously, a tow with a Boeing 747 behind it was crossing this runway at the midpoint. It is a classic trap. But it happened. The co-pilot of the B767 spotted the towed aircraft across the runway ahead in time and aborted the take-off. No one was hurt. The 767 taxied back, cooled its brakes and took off normally.

Amongst the many reasons why this had gone seriously wrong (runway layout, reduced visibility, high traffic peak, non-adherence to procedures, runway stop bar lighting panel design flaws etc.) one particular issue stood out: the fact that the runway controller was on the same frequency and using the same language as the crew of the departing B767, but that the assistant controller was speaking with the driver of the tow truck on a different frequency, in the local language. It wasn't the party-line effect that saved the day here.

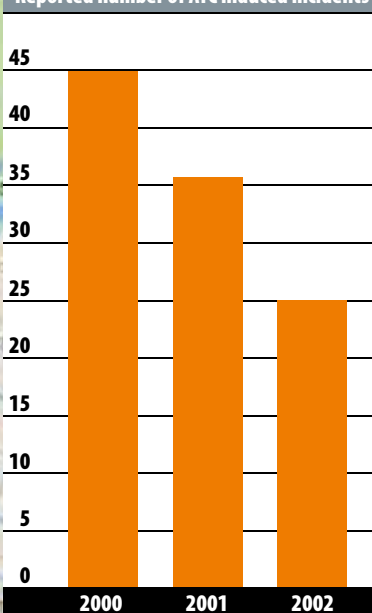
You may have heard of this incident before. There are good reasons for that. The Captain of the B767, obviously not amused, reported this to

the aviation police. A criminal trial in 2000 against three controllers followed and eventually, in 2002, an Appeal Court convicted all three as charged, although it did not hand down a sentence. This resulted in a significant drop in the reporting of serious incidents where LVNL itself was involved. After about five years, the reporting rate had recovered but the legacy effect of the so called 'Delta Case' remains and it will take a generation of controllers to fade out the prosecution anxieties from the emotional palate.

Layout of Schiphol airport

Please have a look at the layout of the airport. There are six runways. Infrastructure is all high-tech, modern, with good signage, lighting, stop bars, the works. Back in the sixties when the airport was designed, arguably good reasons existed to have a tangential system with converging runways. Always a runway with headwind! But now the terminal is in the arm-pit of those runways and does not leave room for expansion. The freight area is on the South-East part and aircraft must cross runway 06-24 for entering or departing. Towing movements to and from the maintenance facilities at the eastern part of the airport require the crossing of two runways. General aviation has a platform close to runway 04-22. We count 54 (fifty-four!) entries and exits to runways. Who designed this, you ask? Hey wait, there is more. Due to a strict noise regime around the airport, it is necessary to frequently change runway combinations to make sure everyone receives their fair share of aircraft noise, a policy necessitating frequent taxi route changes and changes to departure routes. Are we surprised that the airport is particularly vulnerable for runway incursions? No we are not.

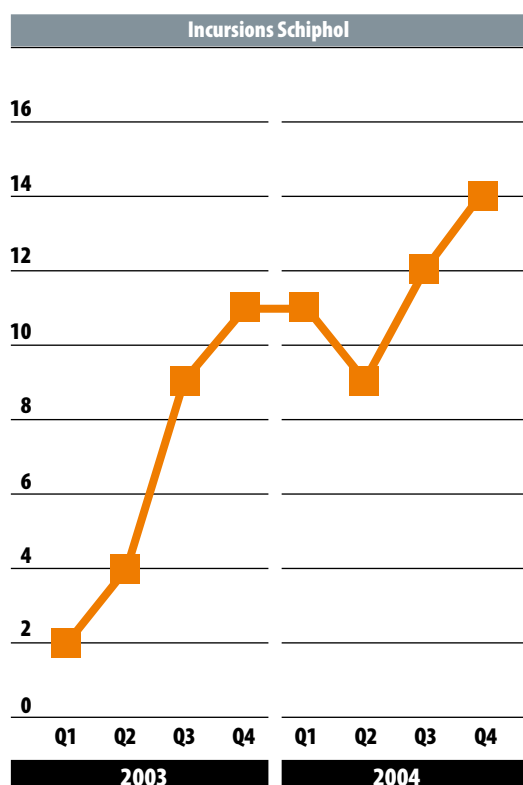
Reported number of ATC induced incidents



Runway safety at Amsterdam Schiphol (cont'd)

Runway Incursions

And so we started tracking runway incursions. At first we needed to advertise that we wanted them to be reported, so we spread the word and asked controllers to report incursions, based on the well-known definitions / descriptions from ICAO. We had many discussions on what precisely was an incursion and what was not. Besides that, we created a new problem: the amount of reported incursions for Schiphol airport increased and the executives were not pleased. We were going the wrong way! What did we think we were doing? Actually, we thought we finally had some good data upon which we could base solid arguments and actions. We did not really bother about statistics or benchmarking with other ANSPs which could show us as 'bad performer' and argued that we'd now better start taking action.



EAPPRI

Along came the first release of the EAPPRI (European Action Plan for the Prevention of Runway Incursions¹) document in 2003. It looked like a solid masterpiece and immediately the recommendations were distributed to various people to check. We found we were not as good as we had hoped. Perhaps that was the reason that we only partly followed the recommendations. After all, it wasn't a formal document with regulatory powers, was it? It still isn't. But we found out that you need a pretty convincing argument why you weren't following the EAPPRI recommendations when things went wrong. So when the second version appeared in 2011, we took it much more seriously and produced a gap analysis and cross-referenced our practices against all the recommendations, for the ANSP, airport, airline and oversight authorities. Much better now. We "minded our steps"!

The Schiphol Runway Safety Team (RST)

To build up the operations of the runway safety team, we considered we needed the best operational brains in this industry. From the start that required the inclusion of operational people: pilots from airlines, air traffic controllers from ANSP, including representatives from Dutch ALPA and the Dutch ATC Guild, and airport operation managers. The team was supported by representatives from the back office including infrastructure planning, safety management & incident investigation, procedural design etc. And an observer from the Regulator attends the runway safety meetings on a regular basis which we found to be particularly useful.

The mandate of the RST has always been to provide top quality safety advice. The team did this and over the years several actions have been taken that are worth listing here:

- end-around taxiways
- harmonising stop bar functionality
- improving signage
- identifying and eliminating hotspots
- improving communication procedures
- training and campaigning

Having a lot of data, covering more than ten years, gives us the luxury of simple but effective analysis. What are the main factors that contribute to an incursion? What are the vulnerable places at the airport (the hot spots)? Who from the flying operators are the likely candidates for an incursion? The runway safety team actively seeks information from the safety department of airlines that have been involved in an incursion event. The feedback from airlines that operate only infrequently to Schiphol, and may thus be most affected by its complicated layout, has proven to be especially useful in terms of increased awareness and pointers for improvements. Together with the much improved rate of reporting from staff of both the airport authority and the ANSP, it can now confidently be said that all runway incursions at Schiphol, however futile, are carefully noted and analysed. We feel nothing escapes our attention now!

You will recognise this of course. And obviously, it is all the usual stuff, no rocket science here. However, some

¹ - A Runway Incursion is any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft. [ICAO]

more interesting products emerged, of which we shall briefly discuss just three:

Runway incursion definition paper

This paper provides detailed guidance on the exact application of both the definition of a runway incursion and its severity classification. For this purpose, the paper contains not only risk assessment matrices but also background information and examples of occurrences to aid objective and uniform rating of events. The paper is drawn up in conformity with the ICAO definition as well as with the guidelines and recommendations in the current version of the European Action Plan and has, since its introduction in January 2012, proved to be a valuable tool. Our paper is a big help for us. Feel like you need a copy? Let us know and we will gladly send you one, free of charge.

Mapping and analysis of Incursion Events

On an annual basis all runway incursions are plotted in a map, showing the runway system at Schiphol. The use of such a map as part of a comprehensive annual report on runway safety, is a great help in objectively identifying hotspots and it provides a strangely powerful means to convince management of the need for necessary changes and their cost.

While the map itself depicts events in absolute numbers, more detailed analyses can relate the number of incursion events on each runway to the traffic density on the runway involved. Would you guess that the incursion rate of the most vulnerable runway 04-22 is about six times higher than the best performing runway 18R-36L? Given the geography and usage, perhaps this is not a big surprise, but clearly there is room for improvement.



Job Brüggemans is the safety manager of ATC The Netherlands (LVNL) and is particularly known for his activities in Just Culture developments. He was one of the first to demonstrate

the detrimental effect of prosecution of air traffic controllers on incident reporting. In 2003 he re-created the CANSO Safety Standing Committee and chaired it for six years. He is currently leading the effort for the FAB Europe Central safety management activities. He also advises in the health care industry on safety matters with a particular focus on Just Culture and safety leadership.



Jan Smeitink is currently Airport Manager for Amsterdam Airport Schiphol and chairman of the Schiphol Runway Safety Team. Previous assignments include flight engineer on the B747-200/300 series and Investigation Manager with the Dutch Safety Board.

Runway safety at Amsterdam Schiphol (cont'd)

Runway Incursion Alerting System Schiphol (RIASS)

An especially valuable addition was the introduction of an alerting tool to warn tower controllers verbally and visually of potential collision risks. The words "Incursion, zero six! Incursion, zero six!" are sure to get the controller's attention and swift action will follow to mitigate the severity. Have a look at the radar screen of the tower controller, showing an alert (the two white circles around the labels).



Introduction of the tool was only possible after the installation of a full multi-lateralisation system at the airport and the introduction of a requirement for all vehicles with access to the manoeuvring area to be equipped with a transponder. The system became fully operational for all six runways on 20 December 2010 and has become one of the best trusted friends in the tower

cab. It works day and night, independent of lighting, visibility, stop bar status or runway usage.

Results we can now be proud of!


Have a look at the chart below. The blue line shows the absolute numbers of runway incursions, including even the most futile incidents. You may notice that the severity of the incursions has dropped, which for us is far more important than their total number. Nevertheless, the total number is now also beginning to fall.

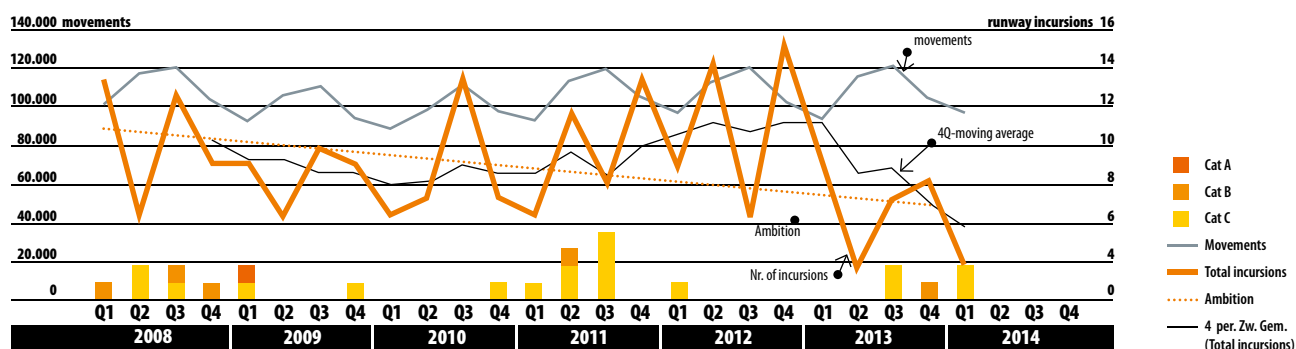
Recovery from the effects of unjust litigation through perseverance in attaining safety goals has paid off in the end. This achievement can be attributed to the increasing willingness to understand each other's position, seek synergies by learning from best practices of the various parties. Obviously cultural differences between the various members of the RST do exist and they can easily lead to misunderstandings, incomprehension and reproach. But if genuine striving for continuous dialogue can be upheld, the benefit for the airport's safety performance will sooner or later be reflected in tangible figures. Schiphol's significant positive safety trend in runway incursion related events, although of recent origin, is likely to prove robust if parties continue to seek each other's expertise, for example in joint incident investi-

gations, without prejudice. With basic conditions like that in EAPPRI being fulfilled, the next goal of an effective Runway Safety Team is to bridge differences in the organisational cultures of its stakeholders, showing respect for each other's background, policies and points of view as a prerequisite for sustainable safety performance.

In Closing

Back to the Delta Case and 1998. Fifteen years since the rejected take-off incident, what about R/T communication with vehicles on active runways? Well, it has not been fully solved yet. One can easily be cynical about the fact that it takes 15 years to adopt an EAPPRI recommendation that appears simple enough (all vehicles on one runway on the same frequency, in one language). But when implemented in 2003, despite a significant investment in training, radios etc, it threw up both new and unanticipated human factor issues and technical problems, and was altogether rejected by controllers. Considerably more time and careful analysis was obviously required. Only in 2014 we are now fully conversant with all the ins and outs of the situation. Well, at least we think we are. There is now a comprehensive proposal for a solution based on many design exercises, simulator tests and evaluation of potential scenarios. It wasn't as simple as it originally seemed.

Mind your step! 



Is automation of performance
calculations reducing flight crew
awareness of the reference performance values?

Runway safety - automation versus knowledge..

by Captain Dirk De Winter



Captain Dirk de Winter

has over 11,000 hours flying time over the last 22 years. He started as a cadet pilot with SABENA in 1987 flying Boeing and Airbus aircraft. Before starting his flying career Dirk obtained Masters degree in Electronic Engineering from the University of Brussels. Since January 2009 Dirk has been working part-time at EUROCONTROL.

Runway safety - automation versus knowledge cont'd)

After invading our daily lives tablets are emerging on the flight deck. While initially pilots were using smart phones and tablets on a personal basis, airlines have discovered their benefits and are introducing them rapidly on the flight deck as part of the aircraft operations.

The advantages of these tablets, more specifically electronic flight bags (EFB), are obvious and multiple. These little devices carry all the company and aircraft manuals making them great space and weight savers. The update function is also a great workload saver for the operations department and can even be automated through wireless technology.

Besides consultation of company documentation the EFB can offer loading and performance calculations. This puts the EFB in-between the paper loading forms and the FMC. The interaction between the paper loading form, the EFB and the FMC poses threats to flight safety and it requires robust standard operating procedures (SOP) to mitigate these threats. Recommendations and guidance material on this can be found in the European Action Plan for the Prevention of Runway Excursions (EAPPRE - REC 3.4.13).

3.4.13	CRUISE	The aircraft operator should publish and provide training on the company policy regarding in-flight assessment of landing performance. Flight crew must be advised whether company landing distance data relates to unfactored or operational distances. In the case of unfactored distances the company should provide the safety margin to be used in normal and abnormal conditions.	Aircraft Operator	31 May 2013	APPENDIX 2
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Here the EFB shows its greatest benefit. To calculate the IFLD the flight crew selects the landing airport and runway and inserts relevant parameters such as: the latest weather information; the appropriate runway condition code; the landing flap position and the level of auto brake. Hit the compute button and the module calculates the Operational Landing distance (OLD) and factored operational landing distance (FOLD). If the FOLD is displayed in green it's smaller than the landing distance available and we're good to land. No need to use graphs to calculate the headwind component, no need to interpolate between multiple columns in complex tables.

More benefits are encountered in abnormal conditions. Any MEL¹ item affecting the aircraft performance; select the item from the list. An aircraft failure or an ECAM² message; just select the corresponding ECAM message from the list. A change in runway dimensions?

But are these all benefits? The airline I work for uses an alternative training and qualification program (ATQP) for recurrent training on their Airbus fleet. On the line orientated evaluation (LOE) day in the simulator, the flight crew is tasked to fly a normal line flight, but during it, the instructor generates abnormal events without the prior knowledge of the crew in order to observe the crew response.

Last summer season one of my favourite combinations was a reduced runway length followed by an engine failure on approach. When the flight crew requested the latest weather information to facilitate the approach briefing I passed the information the available runway length was reduced to 1600m due to urgent maintenance works. This triggered a landing performance calculation from the crew resulting in a FOLD of 1250m thus a 350m buffer to the available landing distance. All crew managed this event very well and elected to continue to the destination. The descent continued uneventful and the flight established on the ILS with the runway in sight. Just after descend on the glideslope had begun, I introduced a 'converging birds' visual effect combined with an engine failure to simulate an engine bird strike. At this stage the autopilot was still engaged and the initial actions to 'secure' the engine could be completed well before the 1000ft

REF	FLIGHT PHASE	RECOMMENDATION	OWNER	IMPLEMENTATION DATE	GUIDANCE
3.4.13	TAKEOFF	The aircraft operator should ensure their standard operating procedure (SOP) requires the flight crew to perform independent determination of takeoff data and crosscheck the results. The aircraft operator should ensure their Standard Operating Procedures include flight crew cross-checking the 'load and trim sheet' and 'performance' data input into the Flight Management Computer (FMC).	Aircraft Operator	31 May 2013	APPENDIX 2

While the European regulator only makes a generic statement regarding the need to assess the in-flight landing performance most aircraft operators (AO) have SOP to clarify this assessment during the approach briefing (EAPPRE REC 3.4.15)

Make the correction in the runway tab and the performance module will calculate the approach speed and the FOLD instantly. This reduces the flight crew workload and reduces the possibility of an error especially compared to the manual calculation.

1- MEL: Minimum Equipment List. Lists the conditions under which an aircraft can still be dispatched with inoperative equipment
2- ECAM: Electronic Centralised Aircraft Monitor system. Displays system diagrams and parameters; generates alerts and displays abnormal procedures.

MENU ▾ **LDG PERF** **FUNCTIONS** ▾ 0 MSG + CLR **A330T**

CONDITIONS <F3>

COMPUTATION: IN-FLIGHT ▾

WIND: 14kt [---] [---]

OAT: 15 °C ISA -20

QNH: 1013 hPa

RWY COND: 4-Good to medium ▾

A-ICE: OFF ▾

LW: 190.0

AR COND: OFF ▾

APPR TYPE: Normal ▾

GA GRADIENT: 2.1

VPat: 0

LDG TECHNIQUE: Manual - AVTHR on ▾

BRK MODE: Manual ▾

ECAM ALERTS: ENG 1 SHUT DOWN

SINGLE RWY COMPUTATION <F2> **MULTIPLE RWY COMPUTATION <Ctrl F2>**

ERFURT: EDGE/ERF ▾ RWY: 10 ▾

CLCVN: 1800 ft SLOPE: 0.0%

LENGTH: 2000 m

FUNCTIONS ▾

NA

RESULTS

RWY: 10 LW: 190.0T MLW(perf): 238.1T

LIMITATION CODE: WGT

LD: 1853 m

FACTOR / INCREMENT: 1.15

FACTORED LD: 2131 m

STOP MARGIN: 469 m

FLAPS LVR POS: 3

VAPP: 149kt

ACFT STS <F5> COMPUTE <F8> CLEAR <F6> MORE <F10>

Fly Smart with Airbus - A330 example of in-flight landing performance calculation

stabilisation 'gate' leaving sufficient time to decide on the safest course of action.

Only one crew continued to a landing – about a dozen others elected to commence an immediate single engine go-around followed by a 20-minute diversion through the busiest European TMA to another single runway airport. When asked to explain their decision making during the debrief, most crews said that there was not enough time to re-assess the landing distance so a go-around was made. When asked if a continued approach and landing was also a safe option, the answers were not so swift! What is the difference between the landing distance required for a 2-engine landing and one for a single engine landing? And what distance does this represent on a dry runway?

After various regulatory and safety initiatives, this aircraft manufacturer changed the presentation of the landing performance data. One of the improvements was the change from actual landing distance (ALD) data to realistically achievable operational landing distance (OLD).

More importantly, the influence of the factors affecting the OLD were changed from relative (%) values to absolute values in meters. This was done to increase the flight crew awareness on the influence of these factors. Below is an in-flight landing distance table from the paper quick reference handbook (QRH) of an A320. It represents the OLD with full flaps on a dry runway with all the factors affecting the landing distance given in metres.

The table below indicates that the loss of an engine (and therefore the corresponding thrust reverser) represents only a 10 meter increase in landing distance on a dry runway. The knowledge that the effect of a thrust reverser on a dry runway is almost negligible could have avoided a diversion on one engine.

Calculating performance data using the EFB brings clear benefits for flight crew workload and reduces the possibility of calculation errors. The benefit is even more pronounced with complex or combined failures. Unfortunately though, this leaves the flight crew less and less involved in the calculation process and thus diminishes their insight in respect of the process and their knowledge of the effect of the correction factors on the landing distance.

Normal line operations never restrict the time needed to make landing performance calculations with the EFB. However in time-critical situations, knowledge of reference performance values increases flight crew awareness and delivers sound decision making in selecting the safest as well as the most cost effective course of action. **S**

CONF FULL

Corrections on Landing Distance (m)		WEIGHT		SPD	ALT	WIND	TEMP	SLOPE	REV
Braking Mode	REF DIST (m) for 63T	Per 1T BELOW 63T	Per 1T ABOVE 63T	Per 5kt	Per 1000ft above SL	Per 5kt TW	Per 10°C ABOVE ISA	Per 1% Down Slope	Per Thrust Reverser Operative
Maximum MANUAL	1 020	-10	+40	+70	+30	+110	+40	+20	-10
AUTOBRAKE MED	1 270	-10	+30	+90	+40	+130	+40	+10	0
AUTOBRAKE LOW	1 800	-20	+50	+130	+70	+200	+60	+30	-10

A320 in-flight landing distance on dry runway

Aerodrome layout and the potential for modifications to improve runway safety

by Captain André M. Skandsen

Pilots visit a considerable number of airports all over the world and observe and experience vastly different aerodrome layouts...

This unparalleled experience, gained through their day-to-day operations, justifies a place for them at the forefront of improving aerodrome design and ultimately – improving runway safety. Such stakeholder engagement, through pilot professionals and their associations, can be an important contribution to the continuous improvement of aviation safety in Europe and globally.

This article highlights joint Aerodrome design positions of two leading pilot associations' representatives – the European Cockpit Association (ECA) and the International Federation of Air Line Pilots' Associations (IFALPA).



Captain André M. Skandsen

is a captain on the Bombardier Q-400 flying for Widerøe, the largest regional airline in Scandinavia. André has previous experience as a chief pilot for Widerøe, but is currently

a member of the Flight Safety Committee in the Norwegian Pilots Association. He also participates actively in safety committees within ECA, IFALPA and EUROCONTROL. He is primarily focusing on runway safety, winter operations and aerodrome design.

New build airports should be designed in such a way that the runway incursion risk is minimised. Furthermore, at existing airports, the effect on runway incursions should be taken into account when runway and taxiway systems are altered.

ECA believes that pilot participation in the planning of new aerodromes and any expansion or redesign of existing ones is of upmost importance and will greatly benefit the planning process. Aerodrome design should be instinctive and logical to the pilot, let's face it: a pilot-friendly airport is likely to be a safe and efficient airport!

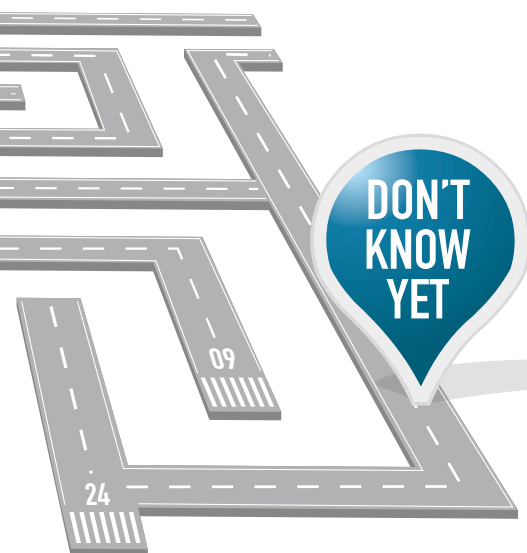
Taxiway crossings of runways should be avoided whenever possible. This may be achievable by the construction of "end-around" or "perimeter" taxiways. When a crossing is unavoidable, it should be done at a low energy point on the runway - at either runway end.

Obviously any aerodrome design should be such that runway crossings are not required by aircraft or vehicles transiting from one part of an airport to another. Whenever this unavoidable by design, the use of mitigation procedures like mandatory use of Stop Bars should be implemented.

Taxiway nomenclature

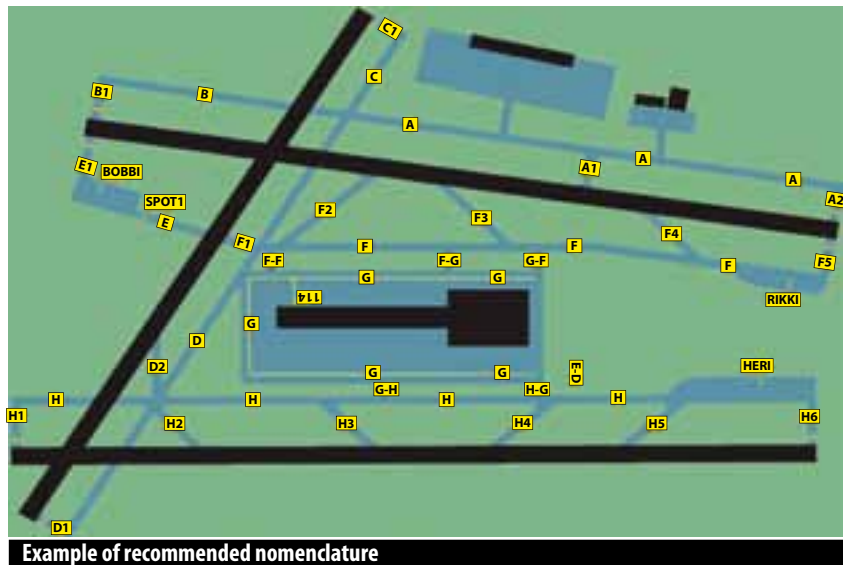
At present there is no worldwide standard for taxiway designation which leads to the potential for confusion. ICAO Annex 14 has only some vague recommendations of taxiway naming and offers no guidance to a systemic application of designations. A standardised nomenclature would obviously give pilots a higher situational awareness on ground, regardless of how frequently they visit the airport.

IFALPA has therefore developed and proposed the following taxiway designation system:



Rapid exit taxiways (RETs) shall be used for runway exit only and shall have "no entry" signage and illuminated stop-bars installed to prevent inadvertent use for entry.

RETs are not suitable for intersection take-offs or crossings due to the restricted view of runway from cockpit. Any intersection take-off or crossing should be done from taxiways that are perpendicular to the runway.



- Primary route taxiways should be designated using only one letter (e.g. A, T, J).
- The allocation of letter should start at one end of the airport and continue sequentially to the opposite end (i.e. from east to west or north to south)
- The letters I, O, S, and Z should not be used to avoid confusion with the numbers 1, 0, 5 and 2 the letter X should not be used since there is a potential for confusion with a closed designation.
- Different taxiways shall not have the same or a similar designation.
- Taxiways that connect to the runway should have an alpha numeric designation (e.g. A1, A2, and A3...A12). The numbering should start at one end of the runway and follow a logical sequence to the other end, whilst not leaving out any numbers and maintaining a logical sequence.
- Taxiways crossing a runway should be avoided. Where this is not possible, the taxiways shall have different names on either side of the runway. For example taxiway K on the east side of a runway will become L on the Westside. In the event that it is a link taxiway, for example K5 on the east side, both letter and number should change on the west side retaining as closely as possible the designation logic (to L4 perhaps).
- Connecting taxiways (intersections, links between major traffic routes) shall be named in such a way that they cannot be mistaken as runway entrances/exit and are logically connected to the taxiways they serve (e.g. AC connects taxiways A and C).
- Different taxiways on the same aerodrome shall not have the same or similar designations.
- Holding Points shall have unique names, starting with the word "point" so that they cannot be mistaken for taxiways. They should be logically connected to the taxiway which they serve.
- Intermediate holding points shall be designated by the word "spot" and then the number (e.g. Spot 7)
- Apron stand designators shall use a discretely different naming convention and shall not conflict with any other taxiway designators at the airport. This can best be achieved by providing gates a three digit number (e.g. 203, 785 etc...)
- The use of standard taxi routes is recommended to reduce congestion on ground frequencies and to make taxi clearances predictable.

Aerodrome layout and the potential for modifications to improve runway safety (cont'd)

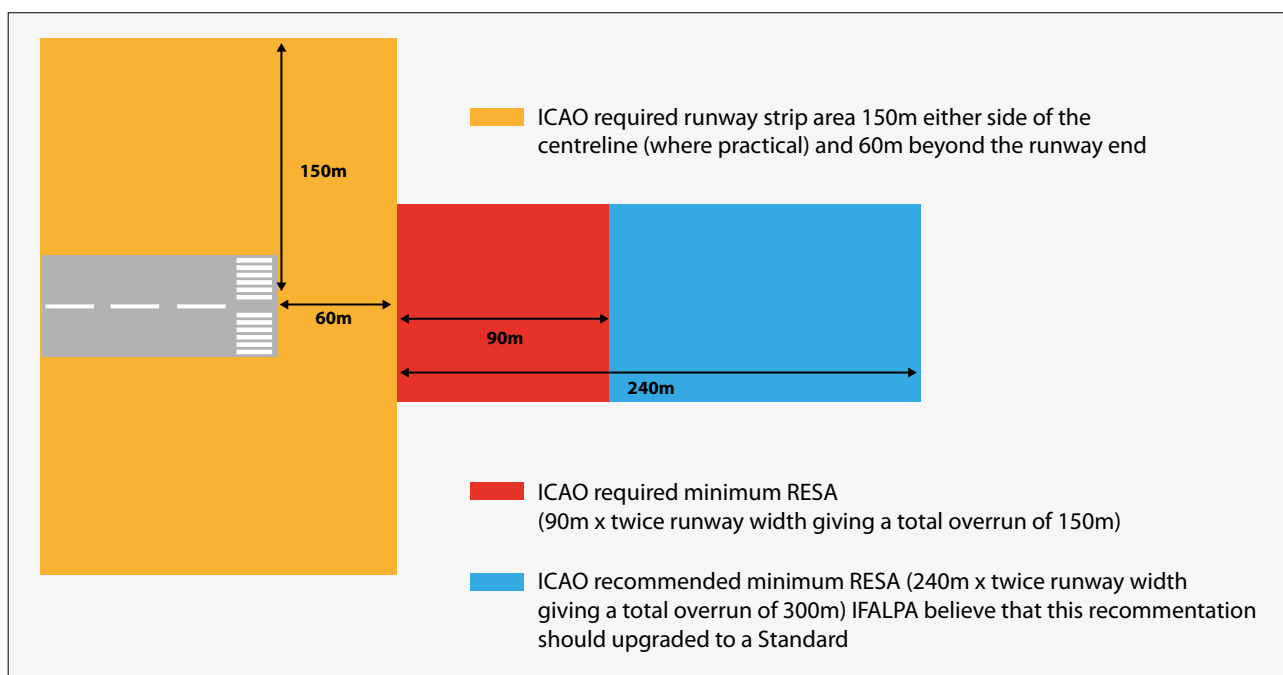
Runway End Safety Areas

ECA and IFALPA are of the opinion that the ICAO Annex 14 Recommendations for RESA dimensions should be adopted as a Standard. That means that the minimum requirement for a RESA would be that it would be 240 metres in length for code 3 & 4 runways and 90 metres in length for code 1 & 2 runways.

Since at some existing airports it would be impossible to establish such a RESA due to topography or other constraints, an arresting system like EMAS¹ should then be installed at the runway end to create an equivalent stopping opportunity. In Europe EMAS has already been installed at both Madrid-Barajas airport in Spain and at Kristiansand-Kjevik airport in Norway.



EMAS installation at end of RWY 22 at Kristiansand-Kjevik Airport in Norway



RESA Dimensions Code 3 and 4 Runways

1- See [http://www.skybrary.aero/index.php/Engineered_Materials_Arresting_System_\(EMAS\)](http://www.skybrary.aero/index.php/Engineered_Materials_Arresting_System_(EMAS))



TWR, Big Bird calling... We've checked the RWY is clear!

Stop Bars

One of the most effective means of reducing the risk of runway incursions is the use of lit Stop Bars. A large number of major airports already have Stop Bars installed, but the policy for their use varies from airport to airport.

ECA and IFALPA believe that the Stop Bars should be installed at all taxiway/runway intersections and used at all times an aerodrome is in operation, regardless of weather conditions.

For Stop bar systems to be truly effective they must have the following elements:

- Stop bars shall be selectively switch-able by the appropriate air traffic controller.

- Stop bars shall be installed at all aerodromes where a runway crossing is possible and provided at every runway holding position serving a runway whether or not that runway is active.

- Aircraft shall never be expected to cross red stop bars unless contingency measures are in force. Contingency measures should cover all cases where the stop bars or their controls are unserviceable.

Summary

To sum up I would like to invite all AN-SPs, regulators and Aerodromes to actively involve pilots in their relevant future work and projects. Pilots are able to observe and experience different airports and Air Traffic Control (ATC) systems and are able to compare their

relative effectiveness – what works and what doesn't. This experience can be of great benefit in determining not only where safety can be improved but also how capacity can be safely boosted.

ECA and IFALPA are actively working for greater pilot representation in LRSTs and on other safety related teams and committees in Europe and the rest of the world. We are also training selected pilots to become members of LRSTs and are able to participate in larger committees with highly qualified Airport Liaison Representatives.

"A pilot-friendly airport is by nature a safe and efficient airport! ✈️"

Reference: IFALPA Runway Safety Manual



The runway collision risk how do we know?

by **Captain Bertrand de Courville**

I remember a meeting dedicated to the choice of European safety priorities. This was some 15 years ago. The question of a focused effort to address the runway collision risk was discussed...



Captain Bertrand de Courville

Recently retired as a Captain on the Airbus A330/A340 and Corporate Safety Manager at Air France and now a Consultant.

Presently co-chair of the European Commercial Aviation Safety Team (ECAST) and involved in industry programs with IATA, Eurocontrol, ICAO, Flight Safety Foundation and EASA. Member of the Air and Space Academy of France, Fellow of the Royal Aeronautical Society, Flight Safety Foundation's Laura Taber Barbour Air Safety award. Qualified on A330/340, Boeing B737, B747, Airbus A320 and other types from gliders to float planes.

Some participants observed the clear absence of accidents of this type. Some others, referring to the importance of being "data driven", insisted on the absence of significant runway incursions to question the interest of such an initiative. The group finally considered that this should not be part of the safety priority list of actions. When asked how they knew there were "no runway incursions", the answer was: "We have no significant reports in Europe". For different reasons at this time, the runway incursion issue was implicitly perceived as a threat only on airports with higher traffic levels and complex runway patterns such as US airports.

I was surprised at this and whilst new in the group, I expressed my disagreement suggesting that a re-examination of this apparent absence of runway incursions should be undertaken. This was not because of any better knowledge regarding the runway incursion threat in Europe but because the same observation in my own airline led us to the opposite conclusion. This was in 1996. We were assessing our exposure to the main generic accident risks (Controlled flight into terrain, Mid-air collision, Runway collisions, Loss of control in flight, Runway excursion and a few less catastrophic ones). During these reviews, the question of precursor visibility was systematically brought up as a key vulnerability factor. Regarding the runway collision accident risk, the most obvious precursor was runway incursions and, despite the almost certain existence of events of this type, we had no reports of it at all. In other domains we had a rather good level of reporting. We concluded that the greatest risk for our airline at the time was systemic and that the answer lay in the absence of reporting, not in the occurrences themselves. The risk was to be blind without even being aware of it.

In order to clarify, we launched an internal questionnaire sent to all pilots including the following very broad and simple questions:

- *"During your career have you ever crossed an active runway, lined up on a runway or taken off from a runway while convinced you were cleared to do so and discovering shortly after you were not."*
- *If your answer is "Yes" could you describe the circumstances?*
- *If the answer is "No", do you think it could happen to you?*



This questionnaire response provided powerful leverage in many respects. Its initial dissemination, the usual message to encourage the pilots to answer and the publications of the results captured pilots and flight instructors' attention on the subject for a significant period of time. Runway

incursions, which had not been seen as a direct safety concern by most of the pilots, began to be more familiar. The risk awareness regarding runway collisions started to improve.

The absence of reports was also explained. After a runway incursion, pilots and air traffic controllers spontaneously debriefed the incident directly on the frequency or on the phone later in the day. By doing this, each party felt that they had learnt enough together from the event they had just experienced without realizing that this was just a "local learning". Their perception was also that their incident was unique and of no value for

others. They were not covering up the event, but simply did not feel the need to report it. Again, this was in the 90s at a time when reporting programs were not what they are today.

By demonstrating formally that runway incursions did exist in our airline, the answers to the questionnaire provided the documented proof we needed. No surprise. We were not different from other airlines, not different from US where the runway incursions risk was already recognised as critical and therefore closely monitored.

We were also able to understand through the questionnaire answers that a majority of events was related to a limited number of error mechanisms. This was enough to take action. Various articles and extracts from runway incursion investigation reports from all around the world were systematically introduced in our Safety Magazine over a period of several consecutive years. The objective was to raise risk awareness and change pilot attitude regarding this risk. Different tasks usually performed during taxi were reconsidered. The departure briefing as well as the Public Address welcome announcement to the passengers were removed from the taxi phase and placed at the gate. The before take-off check list was simplified. And the taxi phase itself became a "critical phase of flight". This was done between 1996 and 2000.

At this time, during the years 90s, very few airports and civil aviation administrations in Europe were monitoring and publishing ▶▶



The runway collision risk: how do we know? (cont'd)

data about runway incursions. Rejected take-offs or go around caused by such an event were hardly ever investigated and reporting programs were not as mature as they are today.

Then, in May 2000, at night, an MD83 on take-off collided with a small Short 330 cargo plane lining up from an intermediate taxiway at Paris CDG¹. In October 2001, a Cessna Citation taxiing in fog entered the active runway just ahead of a MD87 taking off from Milano Linate². The runway incursion issue became a European priority and the first European Action Plan for the Prevention of Runway Incursion (EAP-PR1) was launched. Since this date, a considerable effort has been made and the second edition of the EAPPRE³ has now been published.

Runway incursions incidents are much better reported and monitored but the risk is still there, and everybody knows it.

Today, it is very encouraging to see that nobody dares to consider the problem completely solved. Runway incursions incidents are much better reported and monitored but the risk is still there, and everybody knows it. If we wished to be optimistic, then we could conclude this story here but safety always needs to be challenged. As James Reason said, we always need the “dash of paranoia” to maintain our chronic unease.


So let's try to do the exercise. What could go wrong now? Are we doing enough? I will propose the answer below.

In September 2009, the crew of a B777 operated by a major European airline failed to identify their take-off position correctly and lined up at the wrong runway intersection in good daylight visibility at a Caribbean airport. As a consequence, the take-off was initiated with only 1200 metres ahead of them. A lift off before the end of the runway was only achieved because of the unusually light weight of the aircraft. In February 2010 the pilots taxiing a B737 at Amsterdam failed to identify their correct take-off position in good visibility at night and took off from the parallel taxiway.

The same month, at Oslo, the pilots of an A320 did the same thing in similarly good visibility by day. In November 2010, the crew of an A340 operated by a major European airline failed to correctly identify their take off position at Hong Kong in good visibility at night and began take-off on a taxiway. This time it was noticed by the ATC which promptly alerted the pilots and the take-off was rejected.

These four events have all been independently investigated. Accounts of them and the corresponding Official Investigation Reports are all on SKYbrary⁴! But how far have they really been disseminated within the industry, beyond the airlines involved and beyond the borders of the country that investigated them.

How many airlines have taken advantage of these events to challenge their own procedures and practices? More standardised policies, procedures, practices and training around the world which now prevail make the operational failures identified in a single incident more predictable. Seeing the same error repeating itself in different airlines and different locations is very significant. Pilots are assumed to check their take off position very carefully. This safety assumption has not been met on several occasions. It is highly probable that other operators are exposed to the risk of similar errors without being aware.

On the basis of these incidents, the issues involved should be clarified through a focused monitoring program (data mining, survey, line observation). Airlines should use time and resources to achieve this and, whenever possible and relevant, share their findings. 

1- See: [http://www.skybrary.aero/index.php/SH33/_MD83,_Paris_CDG_France,_2000_\(RI_AG_C_HF\)](http://www.skybrary.aero/index.php/SH33/_MD83,_Paris_CDG_France,_2000_(RI_AG_C_HF))

2- See [http://www.skybrary.aero/index.php/MD87/_C525,_Milan_Linate,_2001_\(WX_RI_FIRE_HF\)](http://www.skybrary.aero/index.php/MD87/_C525,_Milan_Linate,_2001_(WX_RI_FIRE_HF))

3- See [http://www.skybrary.aero/index.php/European_Action_Plan_for_the_Prevention_of_Runway_Incursions_\(EAPPRI\)](http://www.skybrary.aero/index.php/European_Action_Plan_for_the_Prevention_of_Runway_Incursions_(EAPPRI))

4- See [http://www.skybrary.aero/index.php/B772,_St_Kitts_West_Indies,_2009_\(HF_RE\)](http://www.skybrary.aero/index.php/B772,_St_Kitts_West_Indies,_2009_(HF_RE))

[http://www.skybrary.aero/index.php/B733,_Amsterdam_Netherlands,_2010_\(RE_HF\)](http://www.skybrary.aero/index.php/B733,_Amsterdam_Netherlands,_2010_(RE_HF))

[http://www.skybrary.aero/index.php/A343,_Hong_Kong_China,_2010_\(RE_HF\)](http://www.skybrary.aero/index.php/A343,_Hong_Kong_China,_2010_(RE_HF))

[http://www.skybrary.aero/index.php/A322,_Oslo_Norway,_2010_\(RE_HF\)](http://www.skybrary.aero/index.php/A322,_Oslo_Norway,_2010_(RE_HF))

To land or not to land

Causal and contributory factors in landing without clearance events

by **Alfonso Barba**

Last year an Air India B737 was reported to have landed at Mumbai airport without an ATC clearance. Luckily, there was no other aircraft on the runway at the time, and the incident was acknowledged within the air safety community to illustrate yet again the need to focus on runway safety priorities, including runway incursion prevention strategies.

The landing of an aircraft on an active runway without a specific clearance from ATC is not such a rare event as would be expected in a professional environment where air traffic is under the control of a service provider which has as its major objective the safe and expeditious flow of traffic, including guidance and instructions to aircraft so they do not conflict with each other or any obstacle, including terrain.

Yet landings – as well as departures – without a clearance occur at most airports in the world some time or other, even in conditions of busy traffic, although fortunately only on very few occasions have such situations led to a collision between aircraft. This kind of event constitutes one of the most lethal potential risks in a runway environment at an airport and falls under the category of a runway incursion in most occasions, when the presence of the landing aircraft on the runway surface and its protection area is inadequate against all standards whether the aircraft experienced some kind of communications problem, assumed a clearance that was never given, or simply failed to comply with ATM procedures.

Scope

Last year, various circumstances triggered an interest at Aena in carrying out a more in depth study of the causes and factors behind landings and departures without a clearance, with a special focus on the former:

- Although both are a safety concern of sufficient magnitude, the higher proportion of landings without clearance (LwC) as compared to de-

partures without an ATC clearance (DwC), and the higher number of human performance and systemic – contextual, human performance, and even environmental – factors involved make landings a potentially a more critical occurrence. Aena's analyses of departure and landing events ranging from 2007 to 2012 show a global figure of around 126 events of which 83 were landings, i.e. a rough over 65% and an average of almost 12 per year. ▶▶



To land or not to land - Causal and contributory factors in landing without clearance events (cont'd)

■ The release of a report by the Spanish AIB (CIAIAC) on their investigation into a the landing without a clearance event at Alicante on 6th January 2011 which identified both flight crew and ATC action or inaction which led to it and made corresponding recommendations. Also, another CIAIAC report of a landing on a closed runway by another commercial aircraft at Mahon in 2011 drew the attention of the safety Division and regional departments to the need for a more comprehensive study of the possible causes for such events.

■ Data analyses from airports and the opinion of crews, the ATS network in Europe and the FAA indicated that the phenomenon is widely known and addressed, albeit there seems to be no common strategy specifically focused on the prevention or reduction of departures or landings where a clearance is missing.

■ The publication by EUROCONTROL earlier this year of two safety priorities related to runway safety – occupied runway detection and landing without clearance which arose from the development of the SISG SAFMAP technique to show the progression towards accident outcomes. Clearly enough, landings without clearance stand out as an important link in the chain of many runway accidents, with other familiar contributory factors such as unstable approaches, communications congestion, late clearances and runway incursions/excursions.

compliance with ATM procedures by both groups of professionals involved, where ATCOs are trained to expect that a pilot will go around rather than risk landing on a runway of which there is no last minute information about availability and conditions. Reality has proved this to be an overoptimistic assumption for which some providers have already created a safety barrier by inserting specific provisions for aircraft not to land unless previously authorized, except on emergency cases.

A recent survey by UK CAA for the years 2008-2012 shows 91 landings without clearance for that period, of which 43% were by commercial air transport aircraft and 54% by private, training or solo flights, demonstrating that this is a concern across the range of aircraft operations, even if most of the events were “no risk” occurrences. Identified in the Aena study are factors related to the use of the Tower frequency, where pilots did not call at all, or found the frequency busy with continuous RT, or simply mis-selected or selected a wrong frequency, high cabin workload (for any reason), forgetting to contact Tower, or the misunderstanding or misuse of phraseology, as shown on next page.



Alfonso Barba

has a 37-year career as an ATCO, with extensive experience in the fields of controller training and assessment, flow management and test development for the Eurocontrol ELPAC tests. He joined Safety management in the early 2000s helping to build up

Aena's SMS, with a special focus on human factors in ATM incident investigations. He is currently safety manager for the Balearic ATS Region and a member of the Safety Improvement and Safety Human Performance subgroups.

An earlier review by safety analyst Dr Sherry L. Chappell using the responses of pilots based on 37 NASA ASRS reports showed that the communications factor is a common cause of non-





Fig. 1 - Aena figures for landings and departures without an ATC clearance (end 2007-April 2014)





To land or not to land - Causal and contributory factors in landing without clearance events (cont'd)

Systemic Contributory Factors

Based on our preliminary analyses of recent cases in the commercial air transport industry (CAT), with special focus on Aena's airports network, it is not difficult to identify a commonality of contributing factors pertaining both to ATC and pilots under the direction of Final Approach or Aerodrome Control. Some detail on the factors addressed in the taxonomy used for our investigation as supplemented by consideration of crew-related tasks on the approach will allow focus on those factors which are relevant to LwC:

Usually, one or more factors will feature in particular LwC occurrences and investigators will try to find a connection which explains why a landing without "all" the formalities and the required ATC clearance took place. It is easier to make sense of an otherwise inexplicable decision by a crew to continue their approach and land if they are aware of not having received an authorisation if a sequence of events containing one or more of these factors is established. In the Alicante incident for instance, factors like expectation by both ATC and crew, inadequate management of frequency selection and the lack of supervision by Ap-

proach and Tower mixed with complacency and invalid assumptions by the crew resulted in a landing without clearance which neither Approach nor Tower were aware of until the aircraft called on the ground.

Some Findings: Systemic Contributory Factors for LWC Occurrences

[AENA, based on 83 Events from the end of 2007 to 31 March 2014]

Investigation of ATM incidents usually employs a standard taxonomy of causal and associated contributory factors de-

1. ORGANISATIONAL: BARRIERS & PROTECTION

- A. Procedures, including prompts or cues indicating crew/Tower that aircraft has been cleared to land (checklists).
- B. Awareness of factors contributing to Landings without a clearance (ASRs, Bulletins, training, other).
- C. Strip annotation.
- D. Go around/Unstable approaches awareness and management as part of training for ATCOs.
- E. Handover routines and procedures between Approach and Tower Control.
- F. Other SOPs
- G. Visual airport alerts of runway occupancy for pilots and ATC
- H. CRM and crew roles
- I. Flight crew checklists
- J. Electronic traffic information displays
- K. Use of radar
- L. Training

2. SITUATIONAL/ CONTEXTUAL FACTORS

- A. Communications load (too many instructions/too much information).
- B. Handover APP-TWR issues: shift within the unit, handover of traffic from APP to TWR.
- C. OJT (ATC) under supervision.
- D. Distractions: calls from another sector, unit, company Operations, etc.
- E. Configuration of working positions in Tower (e.g. Local ATCO managing both arrivals and departures).
- F. Flight deck task accumulation/workload (e.g. high energy states requiring the undivided attention of the crew).
- G. Late change of runway.
- H. Late clearance.
- I. Wake turbulence or weather issues requiring task prioritisation.
- J. Use of non-standard or ambiguous phraseology.
- K. Misunderstandings/False assumptions.
- L. Exceptional local procedures.
- M. Differences in national regulations (e.g. issuing landing clearances concurrently to several aircraft).
- N. Distractions of any kind.
- O. Use of checklists and items included (as a standard, the "Before landing" checklist does not include a bullet to verify if landing clearance has been obtained, as normally they need to be completed before a landing clearance is acknowledged).
- P. Radio silence during very low traffic load periods.
- Q. Unilateral anticipation of a clearance by flight crew.
- R. Technical issues with radio communications such as interference or range.
- S. Pressure on the crew derived from ATC airspace and aerodrome capacity-related issues.

rived from EUROCONTROL and CANSO plus an expanded sub-classification of factors developed by ANSPs to suit their own SMS needs. Typically, the LwC cases at Aena are categorised under the “runway incursion where no evasive action was necessary” label, as regardless of ATM contributory issues (e.g. lack of awareness of an approaching aircraft or crew assumptions) its presence on the runway constitutes an undesired state in safety terms when no authorisation has been given. A deeper analysis of factors following such events may help highlight new areas for improvement: (or aspects not explicitly identified previously), springing from the investigations

3. HUMAN PERFORMANCE FACTORS

- A. Slips, lapses.
- B. Forgetting to do an action.
- C. Divided attention.
- D. Lack of supervision (by Supervisor/OJTI).
- E. CRM-related factors.
- F. No action by ATC/Crew.
- G. Crew compliance.
- H. Failure to detect lack of clearance (ATC/Crew)
- I. Misinterpretation of instructions/clearance.
- J. Loss of mental picture by ATC.
- K. Wrong selection of Tower frequency.
- L. False expectations or assumptions.
- M. Deferred clearances.
- N. Memory and information processing factors.
- O. Mis-hearings/ misunderstandings.
- P. Incoming flight awareness (Visual detection.)
- Q. Complacency.

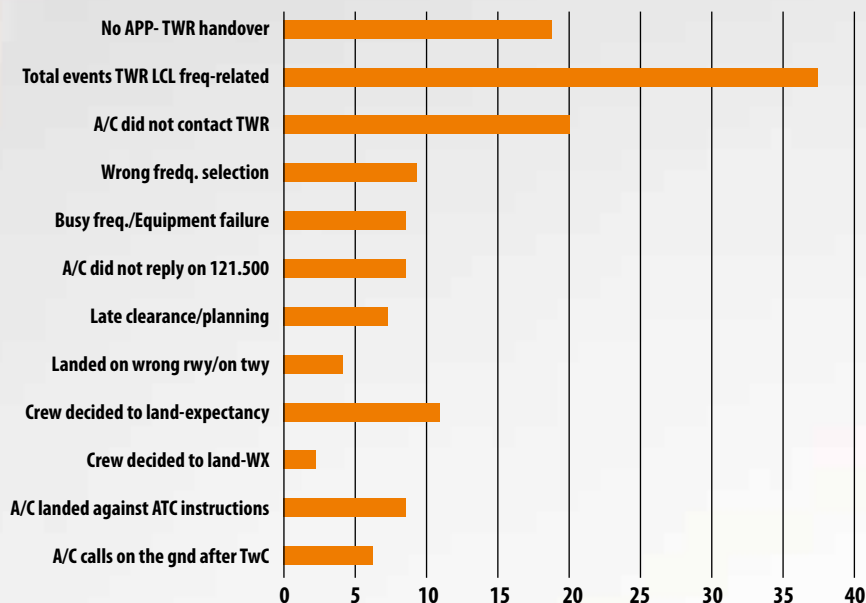


Fig. 2 - Aena study of 83 LwC events and resulting contributing factors

of 83 events at Aena airports during in the last six years:

The quality of investigations leading to the above results has improved over the years increasingly throughout the years, as SMS processes have matured and investigators have gained expertise. Correspondingly, a more thorough review of each ASR investigation and the use of more detailed factors fed into the SMS have identified several sources of concern which can inform strategies for LwC event reduction.

1. Failure to transfer an approaching aircraft from Approach Control to Aerodrome or Tower Control opens a too wide window of opportunity for other factors to intervene, with negative safety consequences (complacency, crew focus on other tasks, visual surveillance by Tower, etc.).
2. On too many occasions the aircraft did not call Tower, even if correctly instructed to do so. Attentional issues and crew task workload were mainly identified as well as the fact that there is often no specific “landing clearance confirmation” bullet on the pre-landing check list.
3. Visual surveillance by Tower controllers is possibly the one before the last safety barrier, second only to a go-around manoeuvre. With multiple runway operations, configuration of operational positions at the

CONTROL tower and extensive use of information displays, the “old” way of doing things in a Tower through your eyes only has changed radically, sometimes at the cost of matching the expected arrival with what you see is approaching the airfield.

4. But perhaps the most worrying of factors leading to LwC is the conscious act of volition, where the crew decides to land when fully aware that no landing clearance has been received. Expectation that the runway will be clear at touchdown, assumed RT failure with subtle application of ICAO procedures when in VMC and the visual ‘assurance’ that the runway is clear of obstacles (and will remain so) are all a major source of concern which we should endeavour to address through appropriate and common procedures.

Only recently, the Spanish Safety Agency launched a survey for ATCOs and pilots based on the EUROCONTROL September 2013 Operational Safety Study on Landings without ATC Clearance, taking on board in the corresponding questionnaire an extended version of the barriers which the aviation community may deem most effective in preventing an aircraft from landing when it has received no ATC clearance to do so. Hopefully, the results will help recommendations for better protections which we could try to put in place as service providers for the benefit of runway safety. **S**



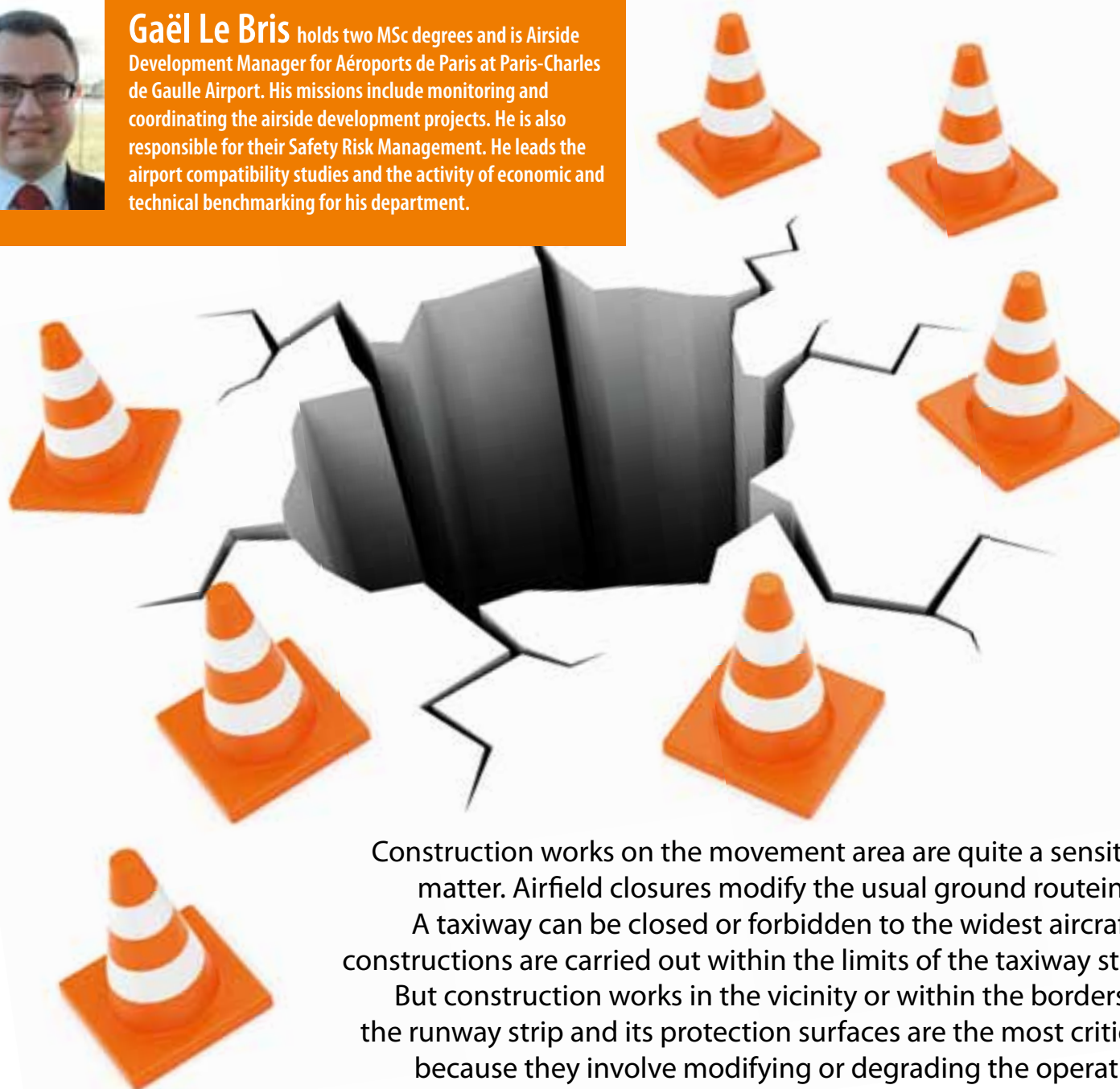
Mind the gap...

Keeping aircraft operations safe during runway construction works

by Gaël Le Bris



Gaël Le Bris holds two MSc degrees and is Airside Development Manager for Aéroports de Paris at Paris-Charles de Gaulle Airport. His missions include monitoring and coordinating the airside development projects. He is also responsible for their Safety Risk Management. He leads the airport compatibility studies and the activity of economic and technical benchmarking for his department.



Construction works on the movement area are quite a sensitive matter. Airfield closures modify the usual ground routings. A taxiway can be closed or forbidden to the widest aircraft if constructions are carried out within the limits of the taxiway strip. But construction works in the vicinity or within the borders of the runway strip and its protection surfaces are the most critical, because they involve modifying or degrading the operating conditions of an area where aircraft land and takeoff.

Temporarily shortened runways, especially if the threshold is displaced may avoid the closure of the runway. This concept is used at airports of all volumes of traffic, fleet mix, and location. They have been deployed equally at general aviation, civilian/military, and commercial airports.

However, accident and incident records show that events have happened on shortened runways, and sometimes even on closed runways. Consequently, the airport operators, in cooperation with the Air Navigation Service Provider (ANSP) and the airlines, must carefully prepare for the operation of runway restrictions or closures. To succeed in this, they should apply the techniques and tools of Safety Risk Management (SRM) as part of an Airport Safety Management System (A-SMS).

The right path

One of the main hazards during the temporary displacement of a runway threshold is an aircraft landing before the new threshold. In 1997 at Porto airport, a Saab 340 landed near the normal threshold then encountered a trench and lost its landing gear¹. In Perth, in 2005² and then again in 2008³, flights touched down or interrupted the final approach before the displaced threshold. When the lengths of a runway are reduced, the pilots usual environment may be significantly modified and become more com-

plex. Also, the level of service in terms of infrastructure (NAVAIDS, markings, etc.) may be reduced during construction works, when they might paradoxically be especially useful at their existing standard.

Displacing a threshold means that the Instrument Landing System (ILS) Glide Path (GP) is no longer available. Since the ILS localiser (LOC) is usually still operative, the LOC/DME is often the most popular alternative. A temporarily relocated PAPI can be an affordable means of providing a visual indication on aircraft position on the modified vertical profile. Finally, inapplicable markings must be properly removed or masked and it is vital that the new temporary markings are clear and comprehensive.

At Paris-CDG, such a configuration was used when the threshold of runway 08L was displaced for two months during the summer of 2012 with equivalent infrastructure, but with only a non-precision approach. All the runway threshold and related markings moved approximately 700 metres along the runway and the normal markings were fully masked and replaced with white crosses or displaced threshold arrows.

Caution: runway closed ahead

Hazards remain even if a runway is completely closed, especially when its threshold is near to that of another (parallel or crossing) runway. In ICAO Annex 14, the required marking for a closed runway⁴ is a 36 m-long white cross every 300 m. But again, being compliant is necessary but not always sufficient to avoid incidents. In 2011 in Menorca, Spain a CRJ200 landed on a runway (RWY01R) that was properly closed with ten painted crosses all along. The investigation⁵ found that despite requesting and flying a visual approach, the crew input the procedure for the closed parallel runway they were used to landing on (RWY01L) into their FMS and then proceeded to fly it.

When Paris CDG completed a Safety Risk Assessment for resurfacing RWY08R/26L (the preferential runway for landing on the southern runway pair) during summer 2014, it was decided to replace the normal white colour of three of the ten white crosses with a luminous orange. This trial was inspired by the standards in the United States, where the crosses for closed runways are yellow⁶.

►►

- 1- See the report in Portuguese language only via a link from: <http://www.gpcaa.gov.pt?cr=9600>
- 2- See: [http://www.skybrary.aero/index.php/A342,_Perth_Australia,_2005_\(RE_HF_GND\)](http://www.skybrary.aero/index.php/A342,_Perth_Australia,_2005_(RE_HF_GND))
- 3- See: [http://www.skybrary.aero/index.php/B738,_Perth_Australia,_2008_\(RE_HF\)](http://www.skybrary.aero/index.php/B738,_Perth_Australia,_2008_(RE_HF))
- 4- Annex 14, Aerodromes, Vol. I Aerodrome Design and Operations, 6th edition, ICAO, July 2013, p. 7-2.
- 5- [http://www.skybrary.aero/index.php/CRJ2,_Menorca_Spain,_2011_\(RE_HF\)](http://www.skybrary.aero/index.php/CRJ2,_Menorca_Spain,_2011_(RE_HF))
- 6- <http://www.skybrary.aero/bookshelf/books/2714.pdf>

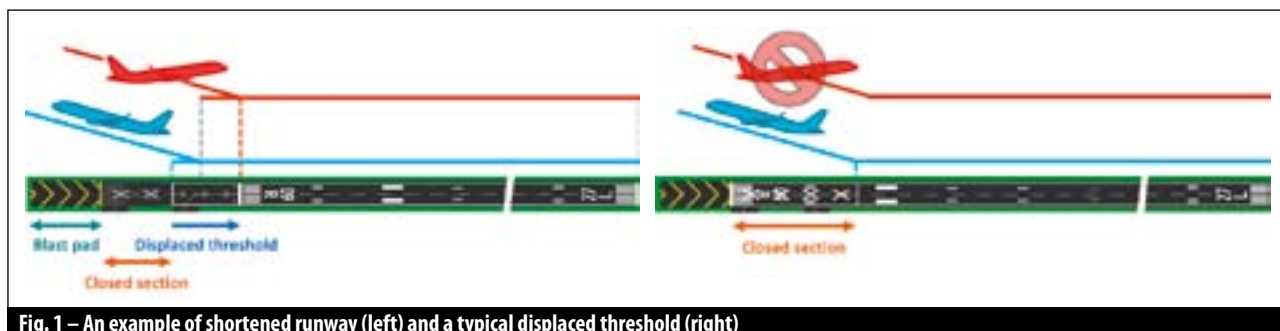


Fig. 1 – An example of shortened runway (left) and a typical displaced threshold (right)

Mind the gap...

Keeping aircraft operations safe during runway construction works (cont'd)

The main goal is highlighting the runway status by breaking the habit of pilots of seeing white markings on active runways. In addition, white crosses are readily visible on asphalt runway surfaces, but they stand out far less well on recent concrete runway surfaces. Since RWY08R/26L has a cement concrete construction which will be eventually be overlaid with an asphalt concrete layer, the use of the two colours ensures adequate visibility of the closure markings during interim state of the runway.

What is happening to my runway?

Providing crews with proper information is a key issue in the prevention of most accidents. For instance, in an undershoot at Porto Airport (1997) and

two near-collisions with construction works at Paris-CDG (2008)⁷ and at Prague (2012)⁸, lack of awareness and information on the part of the flight crew was considered to be the primary cause.

A reduction in the length of a runway is announced by a NOTAM or an AIP Supplement. They specify the reductions in the declared distances and changes to available NAVAIDS and procedures. A NOTAM can take a dozen lines to describe such modifications of the operating conditions. In a context where the number of NOTAMs can be significant, AIP Supplements represent a real value added for safety. Indeed, unlike NOTAMs, they provide accurate descriptions and charts on a separate document. A short simple Trigger NOTAM announces the publication of an AIP

Supplement.

Since missing the aeronautical information happens, it is important to reinforce it locally. Paris-CDG publishes a regular bulletin of airside works, displaying week-by-week the airside closures for the coming year. In Europe, the A-CDM (Airport Collaborative Decision Making) websites are a good medium to make these materials available on a large scale to the airside community. In the United States, the Federal Aviation Administration published illustrated construction works notices, available on the National Flight Data Center (NFDC) website⁹.

Ultimate safety nets

However, despite the efforts of the airport operators and the ANSP to communicate beyond the minimum mandatory actions, accidents due to lack of awareness in the flight deck still happen. In the 2008 incident at Paris-CDG, a Boeing 737 took off towards work in progress at the far end if the runway without taking into account the reduced declared distances. As a result, it subsequently crossed plastic barricades 100 m after the end of the reduced TORA and then flew low over blast fences. The investigation¹⁰ concluded the crew was not aware that the available distances were reduced. In the 2012 incident in Prague, the Captain determined the V-speeds based on the full runway lengths. The crew attributed their error to fatigue and low awareness.

Airport operators and ANSPs can work together to provide innovative solutions which will increase pilot awareness. At Mumbai in 2009, the temporarily reduced-length runway 27 was designated runway 27A. At Paris-CDG in 2012, the single access taxiway to the threshold of runway 26R during the works was temporarily named R1

LAL 11/035 LAL TWY A1, A2, A3, P1, P2, TWY A WEST OF TWY H, TWY P WEST OF TWY S CLSD 1311192028-1403282100
LAL 11/034 LAL RWY 27 DECLARED DISTANCES: TORA 4734 TODA 4734 ASDA 4734 LDA 4734. 1311192029-1403282100
LAL 11/033 LAL RWY 9 THR DISPLACED 3766FT NOT STD MARKING. DECLARED DISTANCES: TORA 5734 TODA 5734 ASDA 5734 LDA 4734. 1311192029-1403282100
LAL 11/021 LAL NAV ILS RWY 9 GP OUT OF SERVICE 1311181200-1403182359EST
LAL 11/020 LAL RWY 9 PAPI OUT OF SERVICE 1311181200-1403182359EST
LAL 11/019 LAL RWY 9 ALS OUT OF SERVICE 1311181200-1403182359
LAL 11/013 LAL RWY 27 ALL DISTANCE REMAINING SIGNS MISSING 1311082156-1403312200
LAL 11/012 LAL RWY 9 ALL DISTANCE REMAINING SIGNS MISSING 1311082154-1403312200

Fig. 3 – An example of a temporary DTHR described by NOTAMs

7- [http://www.skybrary.aero/index.php/B738,_Paris_CDG_France,_2008_\(RE_HF\)](http://www.skybrary.aero/index.php/B738,_Paris_CDG_France,_2008_(RE_HF))

8- http://www.aaib.gov.uk/cms_resources.cfm?file=/Airbus%20A319-111%20G-EZDN%2002-13.pdf

9- <https://nfdc.faa.gov/xwiki/bin/view/NFDC/Construction+Notices>

10- [http://www.skybrary.aero/index.php/B738,_Paris_CDG_France,_2008_\(RE_HF\)](http://www.skybrary.aero/index.php/B738,_Paris_CDG_France,_2008_(RE_HF))



Oh, him? He's part of the awareness campaign about the reduced RWY length...

"WORKS".

Landing and taking off towards or away from construction works requires quasi re-designing the runway. Facing this complexity, SRM is the "right stuff" and the only tool to address this challenge in a comprehensive and efficient way.

But the last barrier against an accident is the air traffic controller. Indeed, he is the only one able to prevent an accident in real time. In the accident at Perth in 2008, the air traffic controller played a key role in helping the crew for initiating a second go-around and for identifying the temporary thresh-

old¹¹. At Paris-CDG in 2012, three attempted incursions onto runway 26R using closed taxiways were stopped as a result of intervention by air traffic controllers. The controller is also the pilots' last source of information in case they are not aware of the aeronautical information and so the way in which phraseology is used can be critical (see HindSight 15 of May 2012¹²).

Working together to improve safety

Safety Risk Management (SRM) is a formal approach to assessing the impacts of any modification at an airport on aviation safety and to mitigating their effects by appropriate measures. It is part of the Airport Safety Management System (A-SMS) which is mandatory for certified airports in Europe under the provisions of Regu-

lation EC N°139/2014¹³. On the other side of the Atlantic, the FAA is in the process of adding provisions for such an A-SMS to its equivalent regulation (Part 139).

Landing and taking off towards or away from construction works requires quasi re-designing the runway. Facing this complexity, SRM is the "right stuff" and the only tool to address this challenge in a comprehensive and efficient way. In a SRM process, all airfield project and airside operations stakeholders must work together to deliver the appropriate level of safety under both the usual operation of an airport and temporary variations from it using their respective competencies and experiences.

Also, it is important to bear in mind past accidents when conducting a SRM process. But since no one airport can claim to have experienced the entire range of accidents and incidents possible, it is relevant to look for learning from events occurring at other airports. Although both the FAA and Transport Canada provide public online access to their safety occurrence databases (ASIAS¹⁴ and CADORS¹⁵). Such a systematic data sharing does not exist in Europe.

But the most direct information is always the most valuable, and so the best value comes from airports, ANSPs and airlines directly sharing their experience and best management practices in order to enhance the level of safety of the air transportation system, especially when it concerns runway construction works. **S**

11- [http://www.skybrary.aero/index.php/B738,_Perth_Australia,_2008_\(RE_HF\)](http://www.skybrary.aero/index.php/B738,_Perth_Australia,_2008_(RE_HF))

12- <http://www.skybrary.aero/bookshelf/books/1792.pdf>

13- <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2014:044:0001:0034:EN:PDF>

14- <http://www.asias.faa.gov>

15- <http://wwwapps.tc.gc.ca/saf-sec-sur/2/cadors-screaq/>

Sustaining an effective runway safety team

by Iain White

So, you've established a Runway Safety Team at your airport, but how do you sustain it once the lure of a free cup of tea for participants has lost its appeal? This is a question currently being asked by the Australian Runway Safety Program and it appears that some of the solutions are the same as when establishing the team.

Background – the Australian Runway Safety Program

The Australian Runway Safety Program was formally established in 2010 and incorporates a national Runway Safety Group (RSG) which includes representatives from Airservices Australia (the State ANSP), the Civil Aviation Safety Authority (the regulator), the Australian Transport Safety Bureau (the investigator), airport, pilot and ground safety organisations and Defence. In addition to the national group, Local Runway Safety Teams (or similar) have been established at 27 of Australia's 28 civilian-controlled airports.

Civilian-controlled airports across Australia range from major international airports to small airports operated by local government and six that are predominantly used for general aviation pilot training. The differences in air-

port size, operator, type of operations and culture (either safety culture, or urban/rural culture) are all considerations for the establishment and sustainability of an effective LRST.

Currently, Australia sees between 150 and 180 runway incursions reported each year – a figure which has reduced since the implementation of the program. Of these incursions, approximately 60% occur across three of the general aviation airports where low hour pilots operate. Fortunately, runway excursions are rare, with these generally comprising minor excursions by low hour pilots due to a minor mechanical malfunction or incorrect crosswind technique. These statistics are important when trying to maintain the enthusiasm of people to participate in (not just attend) a LRST.

Noting the significant differences that exist across the airports, let's have a look at some of them; how they influenced the implementation of the



LRSTs and how we are trying to use them to continue the forums as an effective enhancer of runway safety.

Our experience has shown that the best way to establish and maintain a successful LRST is to know the particular airport – its operations, organisational structure, number and types of occurrences and local culture – and then mould the LRST to that airport. While the guidance material¹ available is excellent, trying to force an airport to establish an LRST around a fixed methodology is likely to result in reduced or inappropriate participation. It is likely to be viewed as a compulsory forum rather than an opportunity to make a difference and, depending on competing priorities, organisations (particularly flying organisations) will either not attend, or send a junior representative in an effort to ‘tick the attendance box’.

For example, most of Australia’s major airports had enough local interest to establish a dedicated LRST with little support required from the national RSG. However, most smaller or regional airports expressed concern that establishing an LRST would be seen as simply creating another meeting for the same airport participants to attend (or not attend). After considering these airports individually, most had already established an Airside Safety Committee, Chief Flying Instructor/Chief Pilot (CFI/CP) meeting, or another forum where all, or most of the proposed LRST participants would engage. At these locations, the LRST was incorporated into existing forums by adding the LRST topics to the agenda. Interestingly, many of these groups were already including runway safety topics in their discussions. Personally, I

am a fan of this approach as there is always going to be an overlap between runway safety and other (operational) topics. Additionally, broadening the agenda increases the likelihood of encouraging the proposed participants away from their other duties.

Our experience has shown that the best way to establish and maintain a successful LRST is to know the particular airport – its operations, organisational structure, number and types of occurrences and local culture – and then mould the LRST to that airport.

This ‘integrated’ application of the LRST concept is now also being considered by one of our major airports to maintain its runway safety team. Initially, a dedicated LRST was successfully established, but with reported runway incursions at this airport extremely rare and runway excursions even more so, participation at recent meetings has been poor. It appears that some operators may perceive that the lack of recorded runway safety occurrences at the airport means that the LRST is no longer important. The airport operator is looking to subsume the LRST into



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the Airside Safety Committee which has a similar membership as the initial LRST but appears to be more successful maintaining participation due to its broader scope.

In addition to the tailored implementation of the LRST, there are a range of other lessons we have learnt which can help to maintain an effective focus on runway safety:

Expand and maintain the focus of the team. Following on from the scenario above, another consideration is to provide the team with information and/or examples of runway safety occurrences or information from other locations that may be relevant to them. For example, given our good fortune with runway excursions, many locations seem focussed primarily on runway incursions. By providing an example of a runway excursion from elsewhere and relating that to the local environment will keep the team focussed on how they can proactively prevent a similar occurrence. CANSO ▶▶

1- An example of the available LRST guidance material is the ICAO Runway Safety Team Handbook available at <http://www.skybrary.aero/bookshelf/books/2618.pdf>

Sustaining an effective runway safety team (cont'd)

recently released a range of information on unstable approaches, how they contribute to runway excursions and how pilots and controllers can prevent them. The program used statistics from a Flight Safety Foundation study showing that 3% of approaches are unstable and that 97% of these continued to landing (rather than going around). Ten percent of these resulted in abnormal landings. By using these figures and relating them to the number of aircraft movements at a particular airport (and therefore, the statistical likelihood of unstable approaches and abnormal landings) the team's focus and enthusiasm to prevent runway excursions has been enhanced.

In a similar vein, an ICAO Category 'A' runway incursion which occurred at Moorabbin was investigated by the Australian Transport Safety Bureau with the benefit of access to a video recording of the event provided by the passenger. The combination of the video and the investigation report², which highlighted distraction as a causal factor, was an excellent tool to encourage and focus many LRSTs and prospective participants across the country.

Facilitate and encourage. It should be noted that in Australia there is no regulatory requirement for airports to have runway safety teams and even if there is a team, there is no requirement for an aircraft operator, airport, ANSP or any other organisation to participate. This means that the backbone to successful implementation and sustainment of a LRST is the facili-



tation and encouragement by either the national Runway Safety Group or individual organisations. In Australia, Airservices has largely driven the LRSTs by having its Tower staff chair the Team during its establishment and by providing a link between the local and national programs. Some locations require little support: particularly where there is an enthusiastic individual to drive the process – we call these people 'local champions' and they are worth their weight in gold! At many other airports, ongoing support and encouragement is required to sustain the teams. A few tips that might assist are:

- **Recognition and reward for local efforts:** Even a small step forward is worth recognising to ensure that the local team is aware that their achievements are noticed. Don't forget to look after your local champions!
- **Transfer of information to/from the national group:** If your LRST is not part of a wider program, see if there is one which you can become involved with. A wider program will be able to provide relevant examples of occurrences,

data from other locations and support to your team. Lessons learnt from different locations that relate to your airport can be an excellent way to help teams address their own problems. For example, the Perth LRST identified an issue with airside drivers accidentally sitting on their radio handsets and 'jamming' the Ground frequency. The team developed a sticker for vehicle dashboards to remind drivers to check that they weren't accidentally transmitting. When the sticker was offered to other LRSTs, it became apparent that the same problem had been identified at approximately half of the airports across the country.

The Local Runway Safety Team is the cornerstone of an effective runway safety program. However, teams must be implemented and continually refined to consider the individual circumstances of each airport. Also, I can't over-emphasise the importance of having (and maintaining) a local champion to drive the importance of runway safety and the runway safety team. While the Australian Runway Safety Program is still quite embryonic (I am continually learning new ways to improve our systems), I hope that some of the lessons from our program may help others.

2- ATSB Investigation number: AO-2011-165 and passenger video are available at: http://www.atsb.gov.au/publications/investigation_reports/2011/aa/ao-2011-165.aspx

Adherence **makes the difference!**

by Captain Wolfgang Starke

Sometimes it is hard to understand. There are markings, lit stopbars, runway guard-lights and standard phraseology on the radio – but still we see runway incursions by modern multi-crew aircraft. Looking into the flight decks, we find highly professional and properly trained crews working according to standard operating procedures (SOPs). However, there is a major problem which leads to serious incidents: distraction!



**PLEASE
DO NOT
CALL ME,
I AM
WORKING!**

Looking back into the year 1981 the U.S. Federal Aviation Administration (FAA) introduced FAR 121.542 and 135.100. These regulations were supposed to prohibit flight crews from any non-essential task during critical phases of flight (the sterile flight deck concept), which included aircraft movements on the ground when under their own power. Several years later, Flight Safety Foundation published its Approach and Landing Accident Reduction Tool Kit where it was noted that 72% of 76 approach and landing accidents and serious incidents which occurred between 1984 and 1997¹ could be attributed to the lack of a sterile flight deck. Although this is by no means only a statistic about runway incursions, the basic problem still applies.

A little bit more than 30 years after the attempt to introduce the sterile flight deck concept by regulation

and following the widespread best practice adoption of the principle in Europe, EASA published its Opinion 05/2013 on Sterile flight deck procedures. This Opinion defines ground movements under own power as non-critical phases of flight but urges that this phase of flight should be treated like a critical one, effectively extending sterile flight deck procedures to ground operations. However, this Opinion is still not yet incorporated into national regulations and so there are still airlines that do not design their SOPs accordingly.

Looking at the taxi phase of a flight, there is one significant difference from all other phases of flight – during taxi, the aircraft can be nearly instantaneously stopped. ▶▶

Wolfgang Starke

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1- [http://www.skybrary.aero/index.php/Sterile_Flight_Deck_\(OGHFA_BN\)](http://www.skybrary.aero/index.php/Sterile_Flight_Deck_(OGHFA_BN))

Adherence makes the difference! (cont'd)

This fact is a good reason to not define the taxi-phase as a critical phase of flight. However, looking at the possible severity of accidents linked to the taxi phase of flights, which can be the result of runway incursions, this possible severity is one of the key reasons to treat the taxi-phase like a critical phase of flight, even though it is not included in the EASA definition. This is exactly mirrored in the above-mentioned Opinion of EASA.

In the light of the estimate of an average of two runway incursions per day within the European core area, EUROCONTROL published the European Action Plan for the Prevention of Runway Incursions (EAPPRI) which is available at Edition 2.0 (April 2011). To make this Action Plan an effective document, the stakeholders involved were invited to participate in the development of the Plan. As one of the stakeholders, the European Cockpit Association, representing about 38,000 European pilots, has contributed to the Plan with the expertise of pilots, gained in the course of their day-to-day operations and experience.

Taking a closer look at the recommendations for aircraft operators contained in the EAPPRI, it can be found that, for example, the sterile flight deck concept should be promoted². Further, paragraph 1.4.11 deals with position uncertainty on the ground and paragraph 1.4.12 recommends the avoidance of "head-down" time during taxi. Is this all implemented and adhered to by airlines and flight crews?

A Turkish Airlines Boeing 737-800 was taxiing out for departure at Dublin Air-

port in October 2010³. As the Turkish aircraft reached the active runway 28, a German Wings Airbus A319 was on short final to land. With the German A319 one mile from touchdown, the Turkish aircraft was seen by the A319 to go past the holding point of Runway 28 and the crew decided to go around. The A319 overflew the B738 at a height of about 500 feet about 30 seconds after the latter had crossed the runway holding point. The Investigation Report says that in a post-flight interview with the Irish Air Accident Investigation Unit (AAIU), the Captain of the Turkish Boeing 737 stated that he was occupied with head-down tasks for departure while taxiing. During a brief heads-up he had only seen the number 34 on the combined holding point signage of runways 34 and 28.

Another example of a similar occurrence, also at Dublin⁴ and similarly investigated by the Irish AAIU, happened when a Monarch Airbus A321 entered an active runway in May 2011 whilst a Ryanair Boeing 737-800 was taking off from it causing a high speed rejected take off to be made to avoid a collision. The AAIU Report cited a "possible distraction by cockpit tasks during a relatively short and busy taxi" as one of their findings.

What can be done to reduce these kinds of incidents and accidents?

First of all it is up to the airlines to provide standard operating procedures that mirror the recommendations from EAPPRI and take into account the information from FAA and EASA materials.



It must be the "sterile flight deck" procedure that heard of...

2- Section 1.4 Aircraft Operator Issues, paragraph 1.4.5 in the EUROCONTROL EAPPRI at: <http://www.skybrary.aero/bookshelf/books/151.pdf>

3- See [http://www.skybrary.aero/index.php/B738/_A319,_Dublin_Ireland,_2010_\(RI_HF\)](http://www.skybrary.aero/index.php/B738/_A319,_Dublin_Ireland,_2010_(RI_HF)) for a full summary and the Official Investigation Report

4- See [http://www.skybrary.aero/index.php/A321/_B738,_Dublin_Ireland,_2011_\(RI_HF\)](http://www.skybrary.aero/index.php/A321/_B738,_Dublin_Ireland,_2011_(RI_HF)) for a full summary and the Official Investigation Report

The sterile flight deck concept should be implemented as a standard during taxi. Simultaneously SOPs should require flight crews to perform all actions needed to be done prior take-off while standing still at the parking position.

But what should these procedures look like?

The sterile flight deck concept should be implemented as a standard during taxi. Simultaneously SOPs should require flight crews to perform all actions needed to be done prior take-off while standing still at the parking position. Actions such as switching or checking of Ice Protection systems, checking flight controls, completing mass & balance or performance calculations should not be done while taxiing. The same is certainly true for post-flight items like completion of the journey log or preparatory work for the onward flight. Yet there are numerous examples where exactly these actions are allocated to the taxi phase of a flight.

If you ask why procedures are designed like this, there is a simple answer. Every minute an aircraft is operating costs a certain amount of money. Multiplying a hypothetical two minutes additional preparatory work on the parking stand before commencement of taxi while the engines are already running with the number of flights of a major airline can easily add up to several hours of aircraft operating time each day. Depending on the aircraft type and its operating costs, this can be quite expensive.

But distraction sometimes has another origin. There are quite a few airports in

Europe where it is normal to issue the departure clearance to aircraft while they are taxiing out. This in turn can interfere with the pilots monitoring the progress of their aircraft.

Something like this happened to me at the beginning of 2013. I was approaching Warsaw's Chopin Airport in heavy snow and with a low cloud base. During flare I had to take over control and reject the landing after an unexpected gust. We went around after a brief touchdown on the left main gear. As I instructed the First Officer to raise the gear having achieved a positive climb, ATC asked the reason for the go-around. You can imagine that this was by some margin not my number one priority at that moment.

There is also another issue with the recommendations even if they are adopted as SOPs - the problem of non-adherence to them. Among the reasons for this might be inappropriate haste on the part of the pilots or their complacency.

The issue of haste or complacency of pilots is not an easy to deal with issue. With tight schedules, hub-operations that make delays very expensive and night curfews which can lead to diversions on delayed flights can all explain a push to hurry things up from time to time. Also personal rosters planned with little margin over minimum rest times can put pressure on crews.

But even in the absence of time pressure, pilots sometimes tend towards haste, especially if it is the final flight of their duty.

Complacency affects flight safety very similarly to haste, especially on short haul operations where pilots often know their procedures and the airports they go to very well from flying up to 80 flights per month. If the airports are the same every day and their flights are routinely uneventful, pilots sometimes disregard some of their professionalism in the face of monotony.

To conclude, there are three things to do:

- First, published recommendations have to be mirrored in airlines' SOPs. This might cost some money. But it is definitely needed for safety reasons.
- Second, Air Traffic Control should recognise the sterile flight deck concept and ATC-procedures should be designed in a way to distract pilots as little as possible.
- Third – and maybe this is the most important point on this little “do-list” – pilots and all other aviation professionals should not accept haste or complacency. Of course, chances of having an accident nowadays are relatively low. But the severity of accidents – especially landing and take-off accidents – is rather high. Therefore, ground movements of airplanes should be treated as a very critical phase of flight.

There is a huge opportunity to improve safety in aviation if everyone concerned accepts flight safety not just as a requirement but as a necessary professional attitude. **5**



Unexpected runway crossing



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

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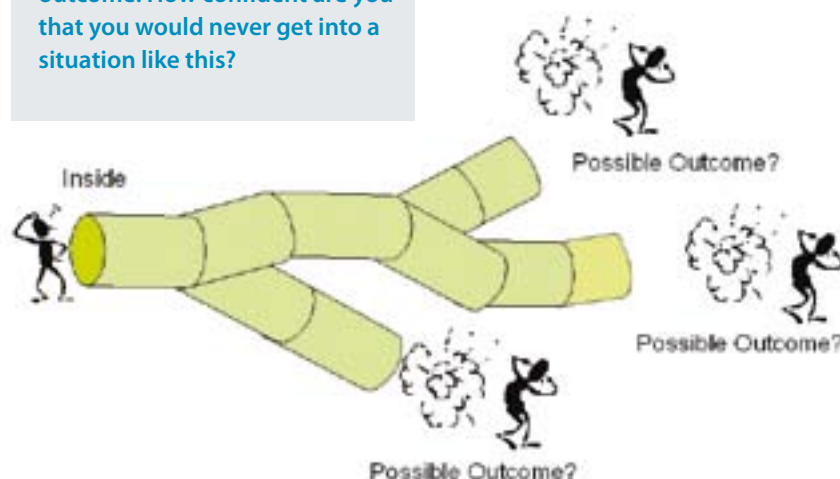




Unexpected runway crossing (cont'd)

THE FACTS

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



You're a controller in an Air Traffic Control tower at a busy regional airport. You're part of a three-person team, comprising a controller with responsibility for traffic taking off and landing on the runway, a controller (you) with responsibility for all ground traffic and an assistant controller in a supporting role to both controllers.

The airport where you work has one runway, one main terminal and several other aprons used for aircraft handling and parking. The view of the runway and the terminal area from the control tower is good. Also, most of the taxiways to and from the various aprons can be observed without difficulty.

The exception is taxiway Yankee, connecting one of the aprons with runway intersection Yankee and leading over a high point in the terrain and the part beyond the high

point is not visible from the tower. Traffic in either direction on taxiway Yankee is also unable to see the part of the taxiway on the other side of the high point. Because of this limitation there is a local procedure for all ground traffic, including vehicles, to first ask permission from ATC before using taxiway Yankee.

It's a fine morning and you're about halfway down your shift. The traffic is progressing nicely, with nothing more than the usual small issues that need to be resolved by a controller during a working day. The other controller is managing his runway traffic, including two training aircraft in the local traffic circuit, and you're feeding him with some departures while taking the arrivals from him after landing.

You receive a call from an airport vehicle (Airport Two), but the quality of the radio reception is not very good. This is a known feature of the radio system the airport operator uses.

What would you do?

You're pleased with yourself for being able to determine that the vehicle driver is asking permission to use taxiway Yankee, and since there is no other traffic on that taxiway you give the driver permission to use Yankee. Airport Two acknowledges this, but as the quality of the connection again is not very good you can't make out every word the driver says.

What would you do?

You don't ask Airport Two to repeat its transmission, because you're quite sure it was a correct acknowledgement of the permission to use taxiway Yankee.

A few seconds later you overhear the pilot of an aircraft that just became airborne commenting to the Tower controller about a vehicle that crossed the runway in front of the aircraft during their take off roll. The Tower controller is as surprised as you are, for you both are unaware of any vehicle intending to cross the runway.

What would you think?

After some discussion you arrive at the conclusion that the only vehicle it may have been is Airport Two. You contact the driver and ask him whether he has just crossed the runway, and to your surprise Airport Two confirms that he has done so. The driver adds that, while crossing the runway, he was a bit scared to see an aircraft in its take off roll on the runway coming at him.

You decide to stop discussing the matter via the R/T, and ask the driver of Airport Two to contact you by telephone at his first convenience in order to sort things out.

DATA, DISCUSSION AND HUMAN FACTORS

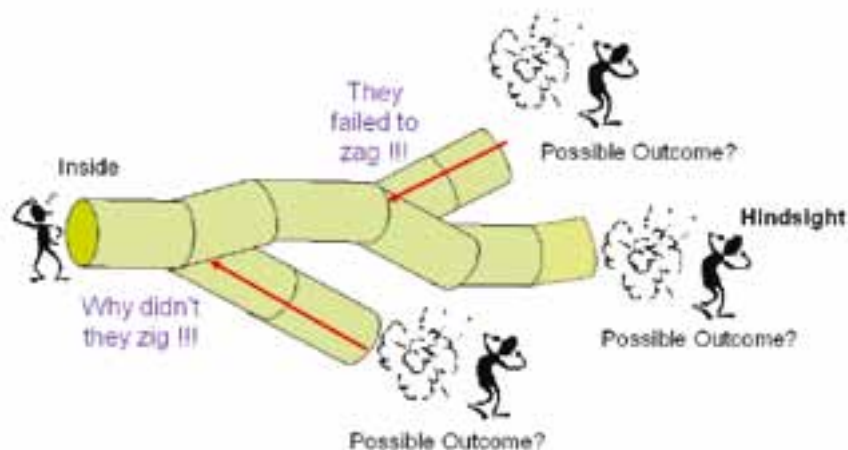
This section is based on factors that were identified in the investigation of this occurrence. Read the story knowing the actual outcome. Reflect on your own and others' thoughts about the case, and see how easily these might become judgmental with hindsight. Can you offer an alternative analysis?

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

Communication procedures. At this airport the R/T communication procedures for vehicle drivers were not adhered to very strictly. Drivers that wanted to use the Yankee taxiway would use phraseologies that varied from "request to use Yankee" to "for Yankee", and all possible variations in between. If a vehicle driver wanted to cross the runway at intersection Yankee, the phraseology usually was "request to cross at Yankee" although variations had begun to appear here as well.

The driver involved in the incident was in fact requesting permission from ATC to cross the runway at intersection Yankee. His words were "request to cross Yankee", to which he received the reply "Yankee approved".

Radio quality. Some time before the incident the airport operator had installed new radio equipment in their vehicles. Whilst meant as an improvement, the new equipment was found to have a number of "teething troubles" that affected the quality of the communications.



On the ATC side the controllers had quickly become accustomed to the deterioration in the quality of the communications from the airport vehicles. Where at first they often had to ask the drivers to repeat their transmissions ("say again"), they now usually were able to understand the content of the messages in the first call.

But even before the installation of the new radio equipment there had been issues with the quality of transmissions from vehicles that were located at the apron side of taxiway Yankee. A study had indicated that these problems could be resolved by installing an extra radio antenna in that part of the airport, but at the time of the incident this had not yet been done.

The controllers were aware of this problem, and had learned to expect a poorer quality in transmissions from vehicles located at the platform side of Yankee.

The combination of the poor quality of the received transmission and the reference to Yankee by the driver may have increased the controller's impression that the vehicle was asking permission to use taxiway Yankee from the apron side.

Visual confirmation of position. At the time of the incident the local ATC procedures did not have any provisions for visually confirming the position of a vehicle before issuing it with an approval to proceed.

The controller who was responsible for the ground traffic that day had made it a personal technique however to always try and verify the position of vehicles that he was communicating with.

In fact, he had looked at the visible part of taxiway Yankee when Airport Two called him, and when



Unexpected runway crossing (cont'd)

HUMAN PERFORMANCE - TEM ANALYSIS

he didn't see a vehicle there this confirmed his belief that the driver was asking permission to use the taxiway from the platform side (which he couldn't see from the control tower). He had not noticed the vehicle on the opposite side of the runway near Yankee intersection.

Naming of taxiways and intersections. The fact that at this airport the name Yankee was used for a taxiway as well as for a runway intersection played an important role in this incident. Without additional safeguards the potential for confusion was high.

The only way to distinguish between Yankee as a taxiway and Yankee as a runway intersection was by specifically adding the words "taxiway" or "intersection". This was not routinely done in vehicle R/T communications at the time of the incident.

When the driver of Airport Two phrased his request to cross the runway at intersection Yankee as "request to cross Yankee", the combination of the (known) poor radio quality and the absence of a vehicle at the visible side of taxiway Yankee made it plausible for the controller to believe that the request was from a vehicle at the apron side to use taxiway Yankee.

Note: This section is offered as an alternative way of analysing the occurrence. For more information about the Threat and Error Management (TEM) framework, see: [http://www.skybrary.aero/index.php/Threat_and_Error_Management_\(TEM\)](http://www.skybrary.aero/index.php/Threat_and_Error_Management_(TEM))

In the scenario the following **Threats** can be identified from the controller's perspective (in no particular order): poor quality of radio equipment in airport vehicles; taxiway partly obscured from view; ambiguous communication from the vehicle driver; same name used for different locations at the airport; poor radio signal near the apron at the end of taxiway Yankee. Those Threats were not all managed adequately by the controller.

The fact that the controller did not ask Airport Two to repeat its request after the first unclear transmission, but assumed that he understood what was being asked, can be regarded as an **Error**. Also the very short reply ("Yankee approved", rather than for example "using taxiway Yankee approved") given by the controller to the request from Airport Two can be seen as a procedural Error. Those Errors were not managed by the controller.

The unmanaged Threats and Errors are linked to an **Undesired State**, i.e. Airport Two crossing the runway rather than using taxiway Yankee as believed by the controller. The Undesired State was not managed by the controller, and thus resulted in a runway incursion as end-state.



Prevention Strategies and Lines of Defence

If the controller and the vehicle driver had applied more **formal and standardised communication procedures**, the incident may not have happened. Just by adding the words "the runway at..." the intention of the driver would have become less ambiguous (the request in that case would have read "request to cross the runway at Yankee"). And when the controller doubted even a part of the unclear transmission from the driver, he should have asked him to "say again" – if necessary multiple times, until all doubts were removed.

The **communication procedures** for vehicles could be improved by requiring drivers to always state their position and their intention as clearly as possible when making requests to ATC.

For vehicles requesting to use taxiway Yankee at this airport, the phraseology could become "at apron side, request use of taxiway Yankee towards the terminal side" (or words to that effect).



A request to cross the runway at intersection Yankee could be phrased as "south of the runway, request runway crossing at intersection Yankee towards the terminal".

By being this explicit the ambiguity is greatly reduced with little or no chance of misunderstanding.

An even better way to avoid potential misunderstandings would be to rename either the intersection or the taxiway, so that only one of the two is named Yankee. Obviously the new name chosen should not conflict with the name of another location at the airport, i.e. it should be a unique name.

When at an airport the name Yankee is only associated with a runway intersection, even in distorted communications this name will not easily lead to confusion with a taxiway that for example is named Foxtrot.

The name change combined with improved communication procedures would form a robust safety enhancement at this airport.

If over time the discipline in communications between vehicles and ATC were to become less, the difference in names for the intersection and the taxiway will still exist as a safety barrier.

In the scenario the controller had made it a personal technique to always try and visually confirm the position of a vehicle that contacted him with a request. This should be more than a personal technique: it should be standard practice for all controllers at the airport. Where visual confirmation is not possible and ground radar is not available, the installation of appropriately sited CCTV cameras should be considered. Controllers should be especially alert in situations where vehicles (and aircraft) may be at positions for which there is no direct view from the tower.

With respect to the problems with the quality of the radio equipment in the vehicles of the airport authority, it should be noted that user knowledge of the problem is no substitute for removing the problem.

The individual controllers at this airport probably can't change the situation during their shift, but ATC management may be in a position to demand that the airport authority fix the problem with some urgency.


If the airport authority had conducted a more thorough field acceptance test before starting to use the new radio equipment operationally, the poor quality might have been identified and remedied before causing a safety problem. Where the signal quality could be improved by placing an extra antenna, this should have been done.

Last but not least the controller in the scenario did well to ask the driver of Airport Two to contact him by phone in order to sort things out. The alternative would have been to continue discussing the incident via the R/T (which was of poor quality to begin with), which would potentially have caused a further disruption of operations at the airport. This is unwanted at any time, but in particular after an incident.

KEY POINTS

A combination of poor radio transmission quality, poor communication procedures and the use of similar names for a runway intersection and a taxiway resulted in a runway crossing by a vehicle while an aircraft was on its take off roll on that same runway. The crossing was not noticed from the tower but the pilots of the departing aircraft commented on it after they were airborne. It took the tower crew some time to understand what had taken place.

This scenario highlights the importance of:

- communication procedures for airport vehicles;
- R/T discipline for communications between ATC and vehicles;
- avoiding ambiguity when naming locations such as intersections and taxi tracks at airports;
- avoiding assumptions;
- visual or other confirmation of the position of aircraft and vehicles from the control tower. 

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

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SKYbrary is also the place where you can access:

- all the documents of the **Flight Safety Foundation Operator's Guide to Human Factors in Aviation**
- the largest collection of selected official **accident & serious incident reports** from around the world anywhere in one place online

An article taken from **SKYbrary** is reprinted in each **HINDSIGHT**. For this issue, we have chosen **"Runway End Safety Area "**

Definition

"An area symmetrical about the extended runway centre line and adjacent to the end of the strip primarily intended to reduce the risk of damage to an aeroplane undershooting or overrunning the runway" [ICAO Annex 14]

Description

Runway End Safety Areas (RESA) are a formal means to limit the consequences when aeroplanes overrun the end of a runway during a landing or a rejected take off, or undershoot the intended landing runway.

They are constructed to provide a cleared and graded area which is, as far as practicable, clear of all but frangible objects. It should have a surface which will enhance the deceleration of aircraft in the overrun case but should not be such as to hinder the movement of rescue and fire fighting vehicles or any other aspect of emergency response activity.

Minor aircraft runway overruns and undershoots are a relatively frequent occurrence. Most data sources point to significant occurrences on average once a week worldwide and suggest that runway excursions overall are the fourth largest cause of airline fatalities. It has been stated by the FAA Airport Design Division that approximately 90% of runway undershoot or overruns are contained within 300 metres of the runway end. The contribution which RESAs can make to a reduction in the consequences of such over-runs has frequently been demonstrated as has the avoidable hazardous outcomes where they have not been present.

ICAO Annex 14 SARPs

ICAO SARPs relating to Runways are determined according to runway length using the standard Runway Code categories. Code 1 runways are less than 800 metres long, Code 2 runways are 800-1199 metres long, Code 3 runways are 1200-1799 metres long and Code 4 Runways are 1800 metres or more in length.

In all cases, the dimensions of a 'Runway Strip' are first defined which must contain the dimensions of the designated runway surface and which should

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Runway End Safety Area

be flat, firm and free of non-frangible instructions. For Code 3 and 4 runways, runway strips must extend at least 150 metres either side of the runway centreline and at least 60 metres beyond the end of the runway including any stopway. For Code 1 and 2 runways, the width requirement is reduced to 75 metres and for non-instrument Code 1 Runways, the length requirement is reduced to 30 metres.

ICAO RESA specifications all begin at the limit of the 'Runway Strip' not at the limit of the Runway/Stopway surface.

RESA SARPs were revised in 1999 when the then Recommended Practice of a 90 metre RESA was converted into a Standard. The current Requirement is that Code 3 and 4 runways have a RESA which extends a minimum of 90 metres beyond the runway strip and be a minimum of twice the width of the defined runway width. The additional Recommended Practice for these runway codes is that the RESA length is 240 metres or as near to this length as is practicable at a width equal to that of the graded strip. For Code 1 and 2 Runways, the Recommended Practice is for a RESA length of 120 metres with a width equal to the graded strip.

RESA Implementation

Implementation of these SARPs by State Regulators is ongoing. Many have now prescribed a period within which the ICAO Standard must be adopted and the Recommended Practices carefully considered.

In the case of the USA, the FAA Airport Design requirements specify the minimum dimensions of a 'Runway Safety Area' which includes the Runway Strip defined by ICAO. Since 2002, these requirements have included a Runway Safety Area at each end of a runway which takes account of the direction of runway use when specifying the minimum length of the runway end element. The basic standard is defined for instrument runways used by transport aircraft and any such runway with an 'approach visibility minima' of less than 1200 metres and is 300 metres for the overrun case and 180 metres for the undershoot case. It is permissible to reduce the overrun case

to 180 metres if the runway has either instrument or visual vertical guidance aids and an Engineered Materials Arresting Systems (EMAS) which can stop an aircraft which leaves the end of the runway at up to 70 kts groundspeed is provided.

It can be seen that the FAA overrun requirement (300 metres) is equivalent to the ICAO RESA Recommended Practice plus the required Runway Strip (also totalling 300 metres) but that the FAA undershoot requirement (180 metres) is only slightly more than the ICAO RESA Standard plus the required runway strip (totalling 150 metres).

Related Articles

Runway Excursion

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

European Action Plan for the Prevention of Runway Excursions (EAPPRE) *Edition 1.0, January 2013.*

[http://www.skybrary.aero/index.php/European_Action_Plan_for_the_Prevention_of_Runway_Excursions_\(EAPPRE\)](http://www.skybrary.aero/index.php/European_Action_Plan_for_the_Prevention_of_Runway_Excursions_(EAPPRE))


Rejected Take Off

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

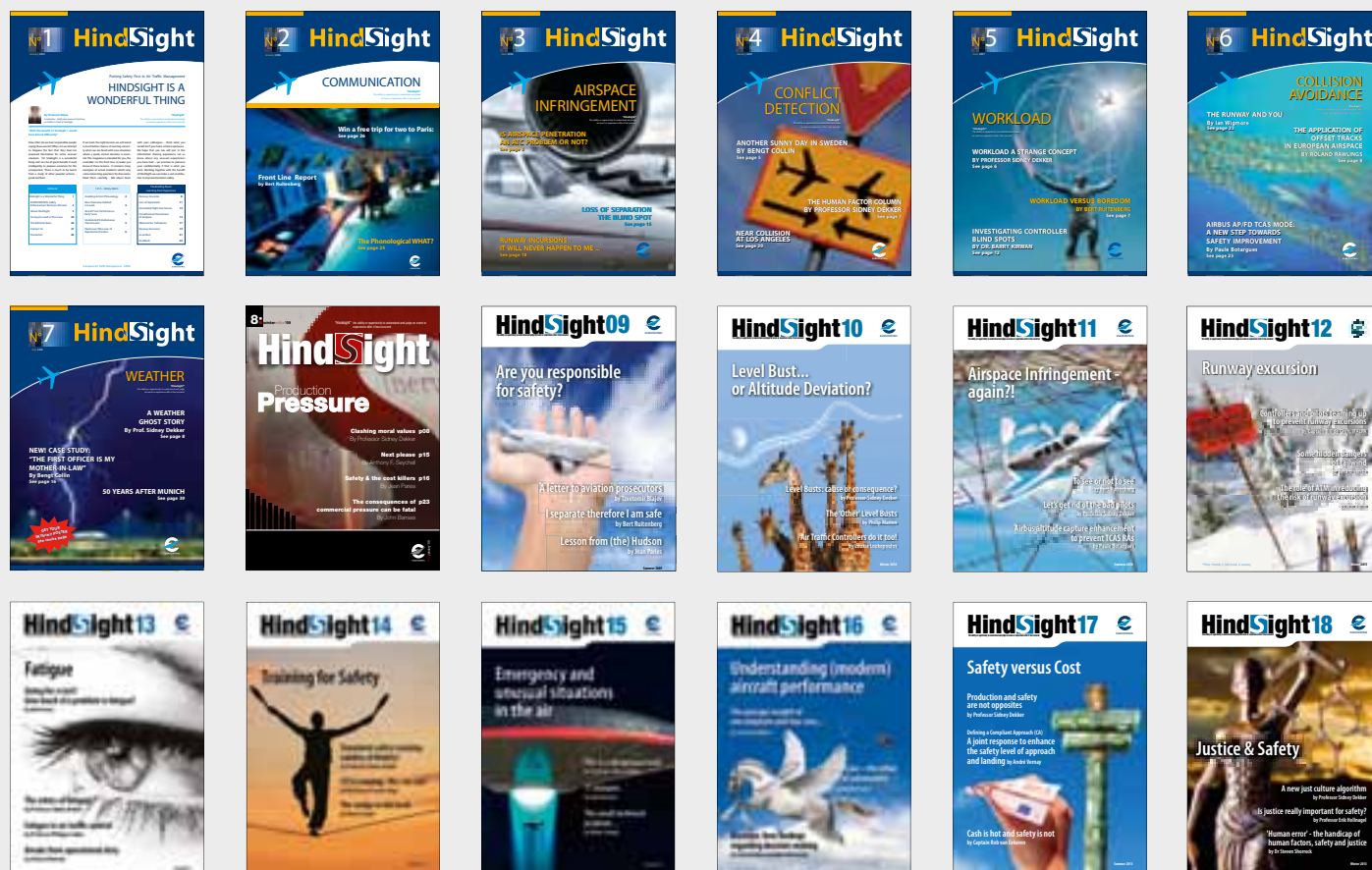
Accident and Serious Incident Reports: RE - *a list of all Accident and Serious Incidents within SKYbrary which involved a runway excursion.*

http://www.skybrary.aero/index.php/Accident_and_Serious_Incident_Reports:_RE

EASA Runway Excursion Statistics, August 2008

http://www.skybrary.aero/index.php/EASA_Runway_Excursion_Statistics,_August_2008 

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In the next issue of HindSight: Safety and Automation



Putting Safety First in Air Traffic Management

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