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 period[1].

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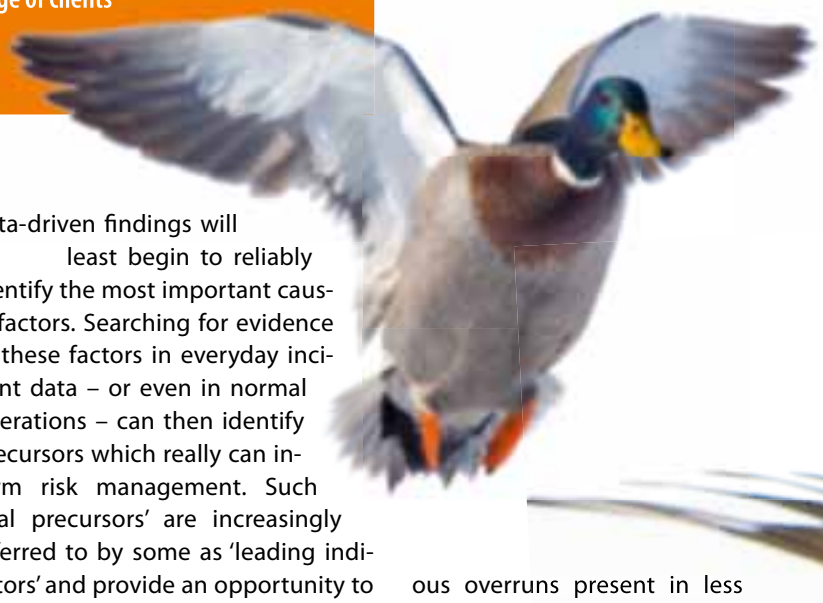

Most of these are overruns on landing, but even if the description 'hazardous' is substituted for 'fatal', runway overruns by commercial aircraft are such a rarity that most airports will never see one. The runway safety challenge therefore becomes a matter not only of proactively having a risk management 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.

Taking a careful look at the circumstances which led to major overrun accidents and coming up with some 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 serious 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 2010[2] and another Boeing 737 overrun, this time without fatalities but still a dramatic hull loss, at Kingston Jamaica the previous year[3]. Do these headline events en-

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)
3- http://www.skybrary.aero/index.php/B738,_Kingston_Jamaica,_2009_(RE_HF)

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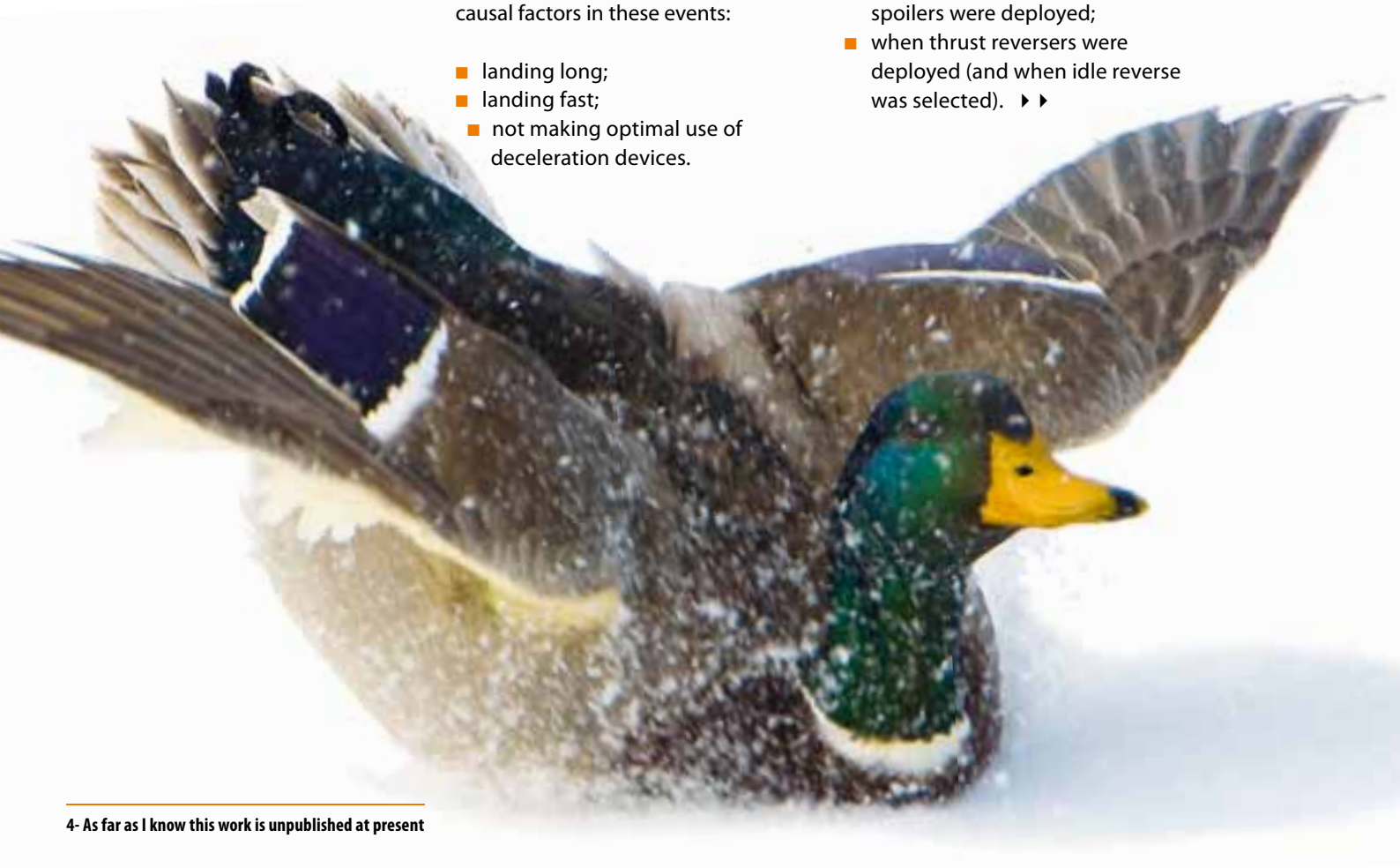
courage the right risk management focus?

A recent careful look by Boeing at the facts in around 40 landing overrun events of various degrees of severity which involved their aircraft types over the last 10 years[4] 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 Vref;
- 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:

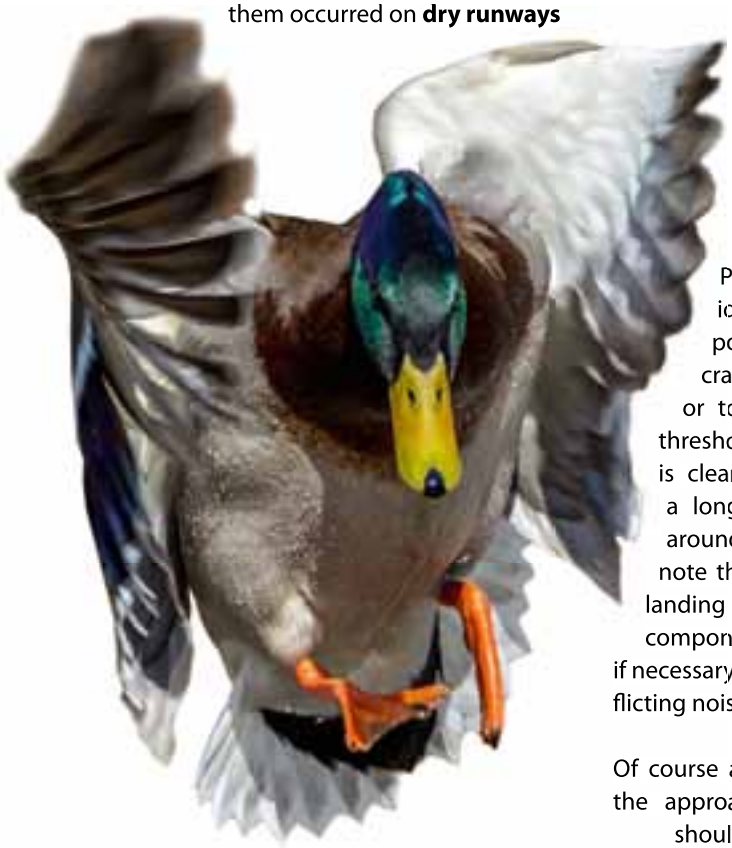
- **all the most hazardous overruns followed long landings**
- the majority of overruns which followed an unstabilised approach were **long landings**
- long landing overruns were **equally split** between those where the runway threshold was crossed high with thrust at idle and those where it was crossed 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 airport[5]. However, the only way to completely eliminate the most prevalent overture 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- Awareness of a particularly undesirable consequence of misjudgement or mismanagement usually leads to heightened pilot focus!