

22 November 2016

How to Investigate an Aircraft Accident
Prof Graham Braithwaite, Cranfield University

There are few areas of aircraft operations where there is more at stake, in terms of learning from mistakes, than in accident investigation. As confidentiality, even reputations, can be at stake, investigation procedures are constrained by strict protocols, but throughout they have to remain sufficiently flexible to allow shifts in the scope and depth of their deliberations. Prof. Braithwaite's presentation was a close parallel, with only the most essential elements of formality and yet a well-measured pace to his presentation, that took attention far and wide, and in a comfortable manner that is a challenge to describe in words alone.

His initial focus was on safety philosophy, where aviation has embraced a "not for blame" culture from its earliest days. Investigation has been regarded as a means to find mistakes, and equivalently to find what caused any failure and to quantify the source and severity of any matters that influenced the event. Desired outcomes are the promulgation of best practice, in procedures or legislation, irrespective of whether referring to operations or design. He commented on the wider acceptance of similar codes of conduct in recent decades, initially in the maritime then the rail transportation sectors, and now increasingly in the health/care sectors, and commented on the complexity of legal and moral obligations that can be attached to the considerations of causes and effects in any accident scenario.

He took the audience into the scene by showing photographs of 'staged' crash sites used for investigator training. These allowed him to introduce elements of the learning process, stressing how important it was to not carry pre-conceptions. He encouraged the visualisation and deduction of factors that could have contributed to an accident, the preservation of evidence on and around the site, and identification of any aspect of the surrounding environment that might seem un-associated at first, as they must be eliminated through study rather than intuition. All this comes with timescales attached, and his examples of essential evidence being destroyed included novice investigators walking over evidence in the crash zone, and when cabin cleaners on one occasion entered a disabled airliner and 'cleared the mess' were as humorous as they were serious. One simple message was 'not to touch' evidence until after it was appropriately recorded, and there was a clear warning that any dangerous 'objects' had to be identified and treated with appropriate respect.

Analysis was illustrated by a simple analogy. He compared how one constructs a jigsaw from its pieces, where it is traditional to start with recognisable elements (corners and edges, then pieces that can be related to one another through shape, pattern, colour, etc.) to the investigator's job of relating evidence from various sources. However the task is all the more difficult as the situation is likely to be more than two-dimensional, and to be multi-disciplinary.

He stressed that the classic investigation breakthrough with the 'Golden Rivet' was a rare event, and that while it is often the climatic point in detective novels and TV shows, the likelihood of a singular event with such impact is best regarded as never to be expected. This was the case too with Flight Data Recorders (FDR) which are always likely to be of

great assistance in unravelling a complex investigation, but it must be recognised that the recorder can only convey what information sensors give to it, and that these might be wrong: although that itself could be valuable evidence.

He provided some insight into actual accidents to illustrate issues that prevail. Amongst them were:

- The BA 777 undershoot at Heathrow in January 2008 which was also filmed by many bystanders, and which TV news programmes were trying to analyse immediately. He described the complexity of proving the cause, describing a complete full-scale replica of the vital fuel system parts that was necessary to examine the impact of low-temperature situations that could cause fuel to thicken, and lead to filters and pumps being clogged.
- The Air France A330 accident over the South Atlantic in June 2009: FDR evidence was not uncovered until almost two years later. Sensor (pitot) failures on that flight led to the FDR instrumentation data seeming unusable (but it did confirm that erroneous attitude and flight-path data was reaching the pilots) and yet it also recorded accurate aircraft flight-path data from navigation sensors. In this case the FDR confirmed what had hitherto been assumed, and also provided an accurate time-line of serious events.
- The Qantas A380 engine disintegration after take-off from Singapore in Nov 2010 was a worldwide news story, and the speaker cited that the chance of a captain experiencing such a severe combination of failures was so low as to be equivalent to winning the Lottery three times. Methodical analysis by investigators led to a clear cause being identified and confirmed that, severe as damage was, many potential consequences had also been alleviated by good safety design. Even so, recommendations from the investigation were numerous too.
- The collision of a helicopter with a high-rise construction site at Vauxhall in central London on a foggy morning in 2013. The wreckage, still burning, was photographed by a bystander and the images were shown in TV news programmes before emergency services had responded. The spread of portable recording capability, and the ease with which any member of the public can access social media, is already contributing to news media having first access to accident data and professing to have 'expert' advice that is not necessarily associated to the investigation team's views.

The presentation generated questions and comments from young and old alike amongst attendees. It stimulated debate on issues of liability and procedures, and reflections on the qualities of safety-related elements in civil aviation. It left a message that there is no reason to believe there will be a reduction in the work for accident investigators in the future, but there is every reason to believe that in terms of accident statistics the safety levels in civil aviation will continue to improve. The audience of 130 heartily supported the vote of thanks.

Presentation notes by Mike Hirst



The BA Boeing 777 which suffered fuel starvation at London Heathrow (January 2008)



Salvaging wreckage from the Air France A330 lost over the South Atlantic (June 2009)



The Rolls-Royce Trent which disintegrated on a Qantas A380 and led to an emergency landing at Singapore (November 2010)