

‘Free Lessons’ in Aviation Safety

Abstract

The aviation industry has traditionally been good at learning from its accidents: a global network of government run accident investigation organisations and the high media profile given to any major aviation disaster helps to ensure this. It is however not always so good at learning from near disasters or incidents that carry many of the key ingredients of an accident. As commercial aviation successfully reduces its accident rate the opportunity for learning from accidents diminishes and learning from potential accidents becomes more important. Ironically however, this success can generate a culture that minimises the perceived potential of incidents and becomes less likely to learn from them. The key to overcoming this is in generating a culture that has the desire to maximize the lessons for safety from any opportunity and openly share that learning. To succeed, this culture has to overcome the human and organizational desire to find a single cause and attribute blame. Invariably any accident is a chain of events and occurrences that come together in a tragic way and there are often many solutions to even the simplest incident. An incident that doesn't lead to a loss of life or significant financial burden should be seen as a 'free lesson', simply an opportunity to see how the system and its components broke down to allow the event, or more importantly one worse, to happen. Any system and ultimately any person is prone to failure and hence blame is of no value, what is important is in understanding where the failures are likely to occur and how to minimise their potential.

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Learning from accidents

Despite the statistics that support the safety of air travel, major aviation disasters generate big headlines and draw significant public interest, often disproportionately to their effect on population survival. Such attention has however helped to drive the aviation industry to the great success of the low accident rates that it enjoys today (Flight International¹). Major aviation nations take such accidents very seriously at a state level with most having a government lead accident investigation organisation that conduct investigations into air disasters.

These organisations are usually well resourced to conduct large and complex investigations into aviation disasters, hence these investigations are invariably very thorough in their approach, focusing on the detailed technical and human failings that allowed the accident to happen. This approach is most likely driven historically by the technical failures that caused so many accidents in the past and more recently by the litigious nature of personal injury. By nature of this detail and thoroughness the investigation may take many months or years to complete, however it ensures that little is open to challenge once they are complete and recommendations made.

The high public profile of the accident and the thoroughness of these investigations ensure that the recommendations from them are generally well accepted and adopted by the industry as a whole.

Missed opportunities for learning

As the accident rate reduces the opportunity to develop effective accident investigation recommendations for the industry is also reduced. To overcome this, and to ensure a continued downward pressure on accident rates, a shift is needed into the investigation of incidents that have the potential to lead to an accident. Many state investigation organisations have embraced this need and, within the terms of ICAO Annex 13 (ICAO²), are actively seeking to investigate these incidents. These state investigations however are often run along the same lines as accident investigations which may not necessarily be the best approach to ensuring maximum value in the circumstances that surround them.

In addition to the state investigators many large organisations have their own safety and quality departments that carry out internal investigations to significant incidents. These departments are better placed to ensure an appropriate level of investigation, as they are not subject to public scrutiny or the same legal burdens. However they still face the same cultural organisational barriers to learning from incidents.

As the industry accident rate has reduced and airlines have seen long periods without significant accidents, so the culture within them has tended to change. Whilst accidents are seen as a real threat there is a desire to learn from accidents and incidents to avoid their re-occurrence. In the absence of accidents the culture shifts towards a view that accidents happen to someone else and therefore incidents cease to become precursors to accidents, rather irritants on the running of the organisation. In effect the organisation 'forgets to be afraid' of the hazards that confront it (Reason³).

The culture shift is undoubtedly a subtle process that progresses as the corporate memory of serious accidents fades. Perhaps the most visible sign is the way the risks associated with incidents start to be minimised in the organisations' mind. Events are seen as isolated occurrences and their potential effects are reduced to the perhaps lucky outcome of the incident, which raised them into view. This process of minimizing the perceived potential of incidents reduces the need to learn from them, as the end result would never be worse. Even where an incident has a relatively significant outcome this may be minimised further by pointing out how other parts of the system let them down and hence it was just unlucky. Ultimately accidents invariably are the unlucky co-incidents of several failures but the culture views it as unlucky to get some of the failures rather than lucky not to get them all. It becomes a judgement over 'whether the current safety glass is half empty or half full' (Pidgeon⁴).

The tragic loss of the Space Shuttle Columbia and its ensuing investigation (CAIB⁵) showed how an organisation can come to normalise what are abnormal events. Over time the perceived risks associated with the loss of foam reduced and as more events occurred the luck of surviving them became a justification not to be concerned about them.

Associated with the shift to minimise the perceived potential of incidents is one of defence and avoidance of blame within the organisation. As the incidents are no longer seen as being of value in learning they become seen as a criticism of the failure of the organisation. The natural reaction of the organisation is then to avoid blame a pass responsibility of the failings down the chain. This leads to a culture of discipline and a failure to recognize the human factors surrounding any error or omission. The individual failures of people in the error chain become viewed in isolation and punished as such rather than as a lesson on how the system can fail and what can be done to minimise the effects of such failures. Individual punishment and discipline then further reduces the potential for learning, as confidentiality needs to be maintained and the 'guilty' are embarrassed to share their experience and education with other people.

This desire to avoid corporate blame also puts pressure on the organisation to keep its incidents a secret to avoid public view. By doing so the potential for the wider industry, or even other parts of the same organisation to learn from incidents is greatly damaged.

An accident can't be hidden but an incident often can and even when not the public relations departments will push the perceived minimised risk, so increasing the downward spiral of minimization and denial.

Perhaps the most sinister side to this culture slip is that as it pervades an organisation it can start to devalue the incident reporting culture within it. As employees start to see incidents minimised they may either join in with that view and not report things or believe that even if they do they will not be considered for the risks they represent. Where measures of risk are applied to incident reports this will also likely be used to minimise the perception of risk and criticism within the organisation.

Once such a culture of perceived risk minimisation and blame avoidance becomes established in an organisation the desire to learn from incidents is greatly diminished. It is against this background that investigations into incidents have to be approached and is where the traditional detailed and drawn-out state investigation processes may struggle.

The traditional focus on the detailed technical and human failings that lead to a particular accident, although clearly stated not to be to casting blame, do ultimately identify individual failings and provide a path to pass the blame down the organisation. The solutions become individual both at a personal and a technical level, which suits the culture of isolated failings and the business too. 'Fixing' individual people and replacing isolated components provides an apparent low cost solution to provide safety rather than addressing the issues that really need to be addressed. Ultimately it is a false economy as the solutions do little or nothing to avoid the next incident or accident.

The thoroughness of traditional state investigations leads to timescales, which do little to drive the organisation in the real changes it needs to make. In a dynamic business such as aviation the structure and processes may significantly change between an incident and the publication of a major investigation report. Finally the cost of such detailed investigations may not be justified against what may seem like minor incidents and where quantity may actually count well when measured against quality.

Sadly this shift, once well established, will also have a knock on effect in the event of an accident and its ensuing investigation. The desire to avoid organisational blame will be stronger and the self-denial of the true outcome greater. Ultimately accidents may just be seen as bad luck rather than something that can be avoided.

What needs to change?

Maintaining the drive to reduce aviation accident rates requires the industry to learn collectively from its incidents and in doing so recognise that incidents are the precursors to accidents. To do this requires a culture shift away from seeing incidents as a criticism

of the organisation to treating them as an opportunity for learning, a 'free lesson' (Reason³).

The term 'free lesson' is an excellent description for an incident that hasn't involved tragic loss of life or massive financial burden. The costs in accident terms are therefore very low but the opportunity for learning may be no less than in a full blown accident. Arguably the potential for learning is much greater as you have the people involved still available to learn from.

To achieve this learning the organisation has to welcome incidents and, more importantly, incident reporting as an opportunity to see how the system broke down to allow something to happen. It must also be willing, and able, to appreciate how it could breakdown further to allow an accident to occur. History has demonstrated that, with the benefit of hindsight, many accidents could be predicted from the incidents that have gone before them. A prime example is the Concorde tragedy at Gonesse (BEA⁶) where multiple events of fuel tank rupturing due to tyre bursts clearly demonstrated the potential for the disaster that unfolded that day. Disasters are logically not the only examples of where lessons were not learnt but inevitably they are the ones that are in the public domain. Examples where luck became the protection against a foreseeable accident will no doubt remain as 'skeletons in the cupboards' of the organisations in which they occurred.

Ultimately the measure of success of any incident reporting and investigation system needs to be the lessons that have been learned rather than purely the number of incidents reported. It is accepted that as success comes from this learning the number of incidents should reduce but this should not become the goal. Every report should be viewed from what has been learnt from it and the corporate safety measures driven from those lessons learned.

Learning from incidents clearly requires sharing of the knowledge gained from them and their investigation. To be effective for the whole industry this sharing must be done both throughout the organisation and across the industry. Such sharing requires a mature attitude from the organisation and ultimately from the public that will inevitably become exposed to this knowledge. Although it may be debateable that all publicity is good publicity, in this case the learning approach should ensure that it is good publicity. The organisations and industry need to show how they are reacting and learning from these incidents and how their likelihood of re-occurrence is being reduced by the actions that are being undertaken.

The avoidance of individual blame is also a key enabler to a culture that is willing and able to learn from its incidents. It has to be accepted that the system and people within it

will fail; it is perhaps the only thing that is guaranteed about human beings. By treating incidents as an opportunity to see how the system fails it allows real-time testing of the system in much the same way as software might be tested. In aviation, as software cannot be exhaustively tested before use, it is assumed that it will fail and therefore the necessary barriers and redundancy needs to be put in place to protect against this failure. The organisation, its systems and the humans within it should be treated in a similar way, accepting that individually parts will fail but in ensuring that as a whole it does not break down. It is only through experiencing those failures that you can ensure that the appropriate barriers are in place to avoid a complete break down.

To maximise the learning from these incidents requires a level of investigation that is proportionate to the effort required to put corrective actions in place. The conflicting legal interests of personal injury and financial loss should much less influence the incident than they would and accident, so the burden of proof on the investigation would be reduced. Ultimately the most important thing to come from the investigation is the identity of the issues and causal factors that are worth fixing, rather than detailed cause of the incident. The reduction of this investigative burden will bring efficiencies in both manpower and time. The manpower benefits potentially either lower the costs or, perhaps more acceptably, allow a wider range of incidents to be investigated and addressed. The benefit on timescales will enable recommendations to be issued and acted upon in a timely fashion to ensure the organisation evolves based on the learning from how it actually performs with regards to aviation safety.

A healthy safety culture should address the key aspects of reporting, justice, flexibility and learning (Reason³). That safety culture needs to constantly work against the pressures of isolating and minimising incidents and allow them to be accepted as lessons on how the system fails. Where an organisation can foster such a culture it will be able to welcome incident reports, accept that blame is not a solution, recognise the right people in the organisation to make the decisions on risk and finally to actively learn from these incidents. Ultimately, if successful, it becomes a self-promoting circle where its success encourages more reporting and therefore more opportunities for learning (figure 1).

Benefits of change

Clearly the greatest benefit of this culture shift is in the improved learning from incidents and ultimately the further reduction in aviation accidents. There is however a number of other benefits that could be realised from it.

After a major accident the investigation, both the genuine investigation and also that conducted through the media, will 'turn over many stones' of the organisation and the industry. The shortcomings and failings that are exposed in that process will be publicly scrutinised and often used for legal gain. Major accident investigations, such as those

into the Space Shuttle disasters, are sometimes criticised for the way they expose shortcomings that would be evident in many organisations and are not necessarily material to the incident in question. Regardless of this criticism the fact has to be accepted that such scrutiny will occur in the aftermath of an accident. Where an organisation has embraced true learning from incidents these ‘stones’ can be turned over carefully and the issues thoroughly addressed or understood and accepted without great public interest. In the event of a tragic accident the organisation will know what is likely to be exposed and be well placed to publicly demonstrate why it is acceptable.

The mature organisational attitude to incidents, and the way they are treated with regards to public affairs, will ultimately have an effect on the way a major accident is handled. Where an organisation is not experienced at genuinely learning from incidents its reaction to an accident will likely be disproportionate and misguided. The learning process becomes one of continuous improvement regardless of the outcome. A near miss by luck is no different to a midair collision from an organisational failure viewpoint and hence the reaction to the two should be identical.

By learning to share incidents and their corrective actions with the public at large, the industry can open a mature public debate over the safety of aviation. The demonstration of how the industry can learn by its failures allows it to raise its profile and ensure a more balanced view on the risk it poses.

Conclusion

As accident rates decline the opportunities to learn from them also diminish. By accepting that incidents are the precursors to accidents the industry can use them to continue the downward pressure on global aviation accident rates. The reduction of accidents however creates an impression of corporate immunity and organisations forget to be afraid of the hazards they are exposed to. In effect organisations begin to treat incidents as isolated occurrences and minimise the perceived potential risk that they bring.

To overcome this attitude requires a culture shift into an openness and willingness to learn as much as possible from these incidents, accepting that they are an inevitable part of any complex system involving humans. Incidents need to be treated as ‘free lessons’ and success should be measured on what you learn from them. This learning process involves the open sharing of the lessons from incidents and hence a maturity to share that knowledge in the public eye.

A key part of learning from incidents is avoiding individual or organisational blame for the errors and failures that lead to them occurring. It has to be accepted that people and

processes will fail and the incidents are the opportunity to see how they fail and ensure the barriers and redundancy are effective in minimising the likelihood of an accident.

This change of culture, if successful, becomes self-promoting: as staff recognise the value of, and are not fearful of, reporting so reporting increases and the opportunities for learning increase. These increased opportunities help the organisation become more flexible and open as it learns to make the right risk decisions and take appropriate mitigating actions.

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Andrew Rose is an Air Safety Investigator for a UK airline part time and outside runs Llanbury Consulting, an aviation consultancy business specializing in surveillance and communication. Andrew has worked for the airline for 17 years, starting as an Engineering apprentice before gaining a Masters Degree in Control, Instrumentation and Systems Engineering from City University, London.

From 1992 to 2001 he worked in various roles within the Avionic Standards and Design areas, where he was responsible for Air Traffic Surveillance and Airborne Collision Avoidance Systems (ACAS). Whilst in the Standards Department Andrew held UK

CAA delegated Design Authority for the approval of aircraft modifications and for a number of years chaired the Airlines Electronic Engineering Committee - Airborne Separation Assurance Systems Subcommittee. During that time he carried out a number of investigations into system failures including a significant investigation into an ACAS induced near-miss that resulted in Airworthiness Directives being issued in a number of countries.

Since joining the Airline Safety Department in 2001, Andrew has undertaken a number of investigations into significant incidents both internally and through close liaison with state investigators.

Figure 1 – Learning from Incidents

