

# Does what happened in the aircraft matter anymore?

Paper for ISASI 2019 Seminar

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## Abstract

Although investigations are conducted with continually increasing rigour, we continue to see similar accidents occur. The identification of occurrence factors and in-flight human factors remain integral to our investigations, but we need to do more if we want to move our investigation findings from reactive to preventive.

The investigation of organisational issues is common practice. However organisational factors traditionally have been explored only where they were a direct contributor to a factor in the accident sequence. The aim of this paper is to show some of the challenges to this methodology. Sometimes, what occurs inside the aircraft fundamentally may not be the whole story. The big lessons, and those with wider-reaching preventive benefits for the aviation industry, might come from exploration of matters beyond the accident itself.

## The purpose of accident investigation

At the back of each Australian Transport Safety Bureau (ATSB) report there is the following statement:

“The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings.”

The intended purpose of investigating transport accidents and incidents in order to prevent future accidents and incidents is not new to the ISASI community. However, when a report is released -

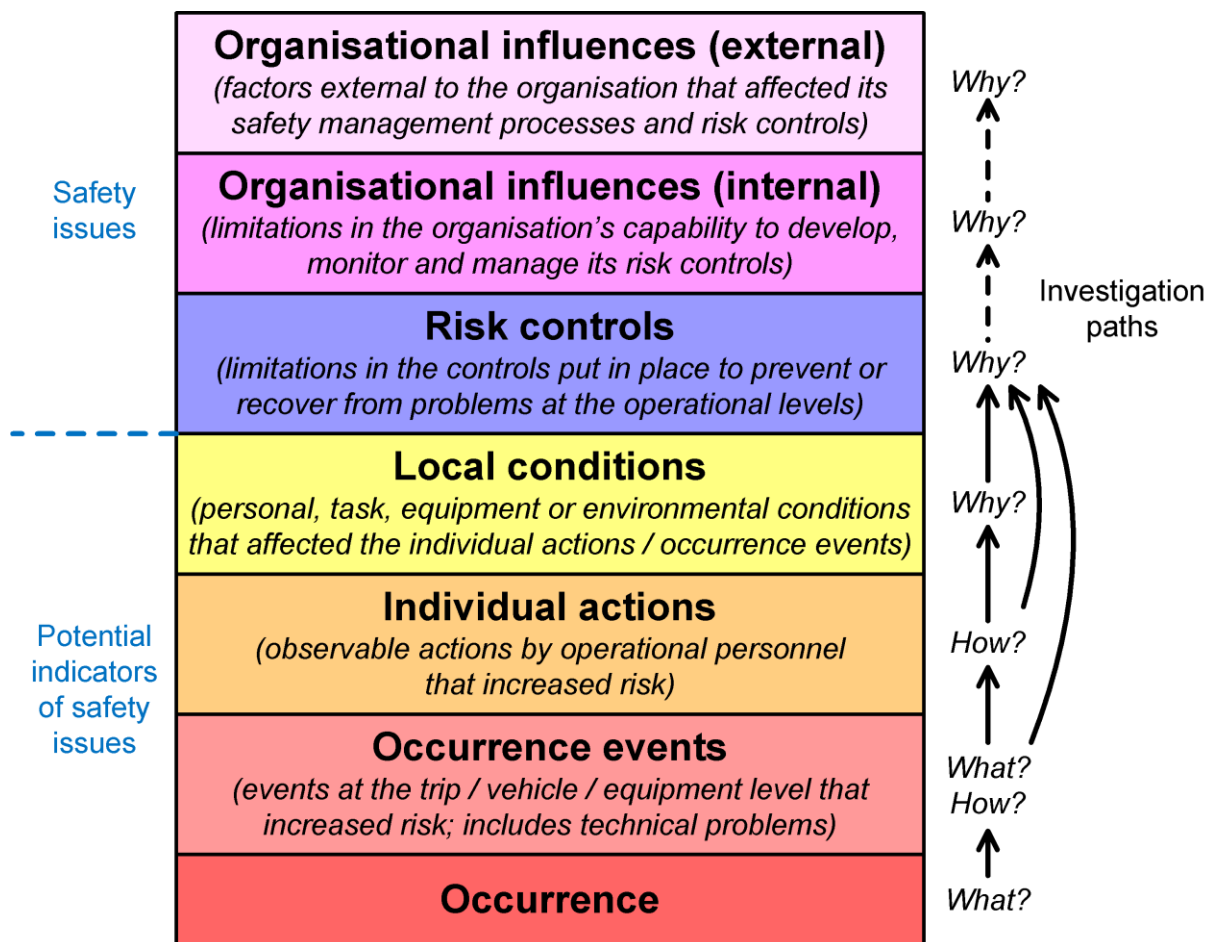
following months or years of investigative work - the communicated message often risks becoming over simplified in the public domain, with a focus on reactive questions of “what went wrong” or “how it happened”, rather than the preventive question of “why it happened” and how the risk of re-occurrence can be reduced. When this is the case, it diminishes the role of the investigation report in communicating the safety-related risks that the investigation has revealed.

Indeed, too often, a new investigation reveals contributory factors that are similar to those we have seen in previous investigations. In these cases, the question raised is why did these further accidents occur, when we identified the risks previously? Further, there is the continued challenge of accidents where we cannot uncover the full details of what occurred.

In addressing the ISASI 2019 seminar topic: “Future Safety: Has the past become irrelevant?”, this paper puts forward the position that although the past has not become irrelevant, the lessons of the past might be insufficient for the purpose of further mitigating risk. They must be challenged and re-examined if we are to make improvements in the future.

### Quality assurance in ATSB investigations

In fulfilling the requirement to “include factual material of sufficient weight to support the analysis and findings”, ATSB investigators follow a published methodology, the fundamental concepts of which have been presented at previous ISASI seminars. This methodology requires us to take a link-by-link approach building up through levels of safety factors (Figure 1): from occurrence events (including technical failures), to individual actions and local conditions, then up to risk controls and organisational influences.



## Figure 1: Levels of safety factors

In identifying the various safety indicators and safety issues that contribute to an accident, we consider all available evidence, in order to test the existence of each reasonable hypothesis (*'Did the potential safety factor exist?'*). If the factor is shown to exist at the time of the accident, then the next step is to test for influence (*'Did the proposed safety factors have an influence on the occurrence or a known contributing factor?'*). If the hypothesis passes both these tests it is generally considered to be a 'contributing factor'.

If a hypothesis passes the test for existence at the time of the accident, but a direct influence on the occurrence or on another safety factor cannot be demonstrated, then it will undergo a test for importance (asking *'Is the proposed factor worth including in the final report's findings, even though it cannot be demonstrated to have had a influence this time?'*). Any hypotheses that pass a test for importance despite not passing a test for influence are included in the findings as 'other factors that increased risk'.

The investigation of risk controls and organisational influences is not a new concept, but, like all safety factors, it requires demonstration of the link between how a risk control may have influenced the operation, or how the organisation influenced the risk controls or the operation. For example, an investigator might review an operator's flight crew rostering practices only after first identifying that a pilot was fatigued, and thus made an error that contributed to an accident or incident. Demonstrating these links clearly in our reports has been a way we have validated and documented the factual contribution of organisational factors to an accident.

This investigation process has been in place at the ATSB for many years. The 2014 independent review of our methodology by the Transport Safety Bureau of Canada concluded that the approach represented best practice, and produced sound results when applied consistently.

## Challenges to the methodology

Two of the challenges we face in applying the published methodology to reach the declared objectives of our investigation reports are when we cannot identify the exact occurrence events of the accident, and when we keep seeing the same kind of accident re-occurring.

First, in the current world of advancing technology and constant monitoring of processes and events, there is an expectation that the sequence of events of any accident or incident should not be difficult to establish. This supposition is indeed true for the majority of accidents, where we typically have multiple sources of available data such as flight data recorder or cockpit voice recorder information, other recorded data (from radar, GPS or other sources), video recordings or witness interviews to piece together and validate other sources.

Nevertheless, in one recent ATSB investigation, the lack of available data presented a significant challenge to investigators. This was a fatal accident with no survivors, in a remote area of Australia outside radar coverage. There were no recording devices fitted to the aircraft, and much of the aircraft was unrecoverable or unexaminable post-impact. There were no witnesses to the accident.

In another accident, the flight was captured on radar, and there were many witnesses, but there was no evidence from inside the aircraft to account for the fact that it deviated from its intended flight path before impact. In a third investigation, survivors presented with different and conflicting recollections, but there was no source of on-board data to validate any of their accounts. There is a long list of such challenges, including investigations into missing aircraft. While we might be able to piece together the flight path of an aircraft from available evidence, it is often difficult to identify the specific events and conditions (let alone the particular in-flight human factors) that may have contributed to an accident.

Clearly however, lessons can be learned. It would not be appropriate or acceptable for such investigations to conclude with no findings because of our inability to identify any directly contributing events from the accident sequence. While our methodology sets us up to build up hypotheses from these events, the development needed for future safety lies in how to factually demonstrate an influence without the occurrence factors being available to direct us.

The second challenge is that, despite conducting investigations with continuously increasing rigour, we continue to see similar accidents re-occur. Some examples of these include:

- flights from visual flight rules into instrument meteorological conditions leading to a loss of control
- stall training accidents
- simulated engine failure training accidents
- descents below minimum safe altitude.

Accidents resulting from these types of occurrence have been investigated many times, including current active investigations. In addition, there is repetition in investigations involving particular operators, particular areas of the aviation industry or particular aircraft types.

All these investigations have been conducted in accordance with the ATSB investigation methodology, and ideally should have identified all the findings and reduced the safety-related risk. But when similar outcomes to similar risk happen repeatedly, we are forced to reconsider both the scope with which we have explored potential safety issues to do with risk controls and organisational issues; and the way the safety issues identified in our reports are being communicated, and addressed by those most exposed to the safety-related risk.

In responding to both these challenges, where we have limited knowledge about an accident sequence, or have seen the accident sequence occur before, we need to systematically sharpen our focus on organisational and other factors outside the aircraft, while also staying within scope and evidence based, to maximise the benefit of our work.

## The future

The fundamental purpose of a safety investigation is preventive, not reactive. There is challenge in setting the scope of an investigation: it cannot be limitless, yet it must be broad enough to reveal all lessons that might need to be learned. It is our responsibility as an investigation agency to communicate the results of the investigation to those bodies and organisations that have the capacity to reduce the risk of the accident or incident occurring again; it is then their responsibility to take such action as is necessary to improve transport safety as a result.

At the ISASI 2018 Seminar, the ATSB Executive Director, Nat Nagy, outlined the vision 2025 plan for the ATSB, and made the point that we focus on investigating and researching the safety issues that others do not. Our 2018-19 corporate plan develops this further:

“As the independent safety investigator, the ATSB is in a position to provide information on safety issues, particularly broader systemic ones, which may not otherwise be apparent to operators and other organisations who have done their own internal investigations”

Conducting more safety studies will enable us to work beyond a single investigation, and to compare the evidence about organisational and risk factors identified across a range of investigations, that may not be directly linked to one occurrence, but to a range of different occurrences. Safety studies published this year include the “Analysis of wake turbulence occurrences at Sydney Airport 2012-2016” and the “Exploration of change in aviation gasoline lead content in northern Australia on reported engine-related occurrences”. There are more similar investigations underway.

Such safety study reports and investigations where the sequence of events and safety-related risks leading to these are not obvious are our challenges for the future. The big lessons for future safety might not lie in the precise story of what occurred inside the aircraft, but in the wider-reaching preventive benefits for the aviation industry that come from exploration of topics outside the scope of the accident itself.

## References

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