



# **Re-inventing (with wheels, wings and sails) - A New Look at Transport Accident Investigator Training**

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## **Author Biography:**

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***Abstract***

Since 1977, Cranfield University has run air accident investigator training in collaboration with the Air Accidents Investigation Branch. In 2003, following an approach by the Marine Accident Investigation Branch and with the imminent establishment of the Rail Accident Investigation Branch, an opportunity arose to redefine accident investigation training. Recognising that training investigators from different modes was a significant change to an established programme, the fundamentals of investigation were researched and a syllabus put together that drew upon the key strengths and experiences of the three domains. Investigators were challenged to go beyond their comfort zone and consider the science of investigation from a number of different perspectives. Strong consideration was given to how investigator competencies could be assessed and a research programme was initiated to verify this. This was particularly important, as the Rail Accident Investigation Branch was to go from zero to full capacity without the opportunity for on-the-job training that other established agencies enjoy.

This paper describes the process of syllabus development and training design, along with the lessons learned in running the first programme in May 2004. It considers the advantages and disadvantages of training investigators from different modes together.

***Introduction***

Cranfield University first ran an accident investigation course in 1977 and since then, has trained hundreds of investigators from around the world. Its founding course director, Frank Taylor was awarded the Jerome Lederer Award for his contribution to aviation safety in 1998. With Frank's retirement and the appointment of the author in 2003, Cranfield was presented with an opportunity to take a fresh look at its accident investigation activities. This paper outlines the new developments and the lessons learned in training accident investigators.

***Sharing the lessons***

Popular wisdom suggests that we learn from our mistakes, yet the wisest amongst us learn from other people's mistakes. As safety professionals, we have become increasingly made aware of the lessons that can be learned from other industries or modes of transport. The work of system safety gurus such as Perrow (1984) and Reason (1990, 1996 etc.) have highlighted the common failures to be found across a range of complex sociotechnical systems including power generation, rail, marine, air and space transport, medicine and even banking. As improvements in safety move industries increasingly towards what Amalberti (2001) refers to as "ultra-safe systems", the need to learn lessons across modes is heightened.

In transport accident investigation that has led to the formation of multimodal investigation agencies such as the US National Transportation Safety Board (NTSB), Transportation Safety Board of Canada (TSB) and the Australian Transport Safety Bureau (ATSB). Such models have not been without criticism, but have brought a number of advances in the sharing of resources.

In the UK, the Air Accidents Investigation Branch (AAIB) provided a framework for the formation of the Marine Accident Investigation Branch (MAIB) in 1989. Both branches have operated successfully since with a limited amount of collaboration. Following a number of high-profile, rail accidents and in particular the recommendations of Lord Cullen after the 1999 Ladbroke Grove accident, the UK Government announced the formation of the Rail Accident Investigation Branch (RAIB). The choice of title was no coincidence reflecting the successes achieved by the MAIB and AAIB.

In discussing the formation of a new investigation agency, Cullen (2000) noted "...the evidence before the Inquiry plainly supported the view that inquiries by and under the RAIB should concentrate on the search for root causes rather than to ascribe fault, and the investigation process should not be distorted by questions of civil liability or criminal responsibility. This is, of course, the general approach taken by the AAIB [Air Accidents Investigation Branch] and the MAIB [Marine Accident Investigation Branch]. Regulation 4 of The Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996 states:

*The sole objective of the investigation of an accident or incident shall be the prevention of accidents and incidents. It will not be the purpose of such investigation to apportion blame or liability."*

It was logical then that the RAIB's Chief Inspector, Carolyn Griffiths (2003) described the Branch's purpose as being to "...undertake investigations into accident and incidents with the aim of enabling lessons to be learned and making recommendations to improve safety on railways and preventing railway accidents and railway incidents. Its task is to try to determine what caused an accident, not to consider or determine blame or liability in the context of either criminal or civil proceedings."

The decision to create three parallel organisations, rather than a single agency was not taken lightly. The Branches were careful to preserve their mode speciality, but noted several key areas for potential resource sharing (Smart, 2004). Some are very practical, such as the sharing of publishing and website functions: Others more technical, such as developments in data recorder analysis, legal services and investigator training.

RAIB faces a specific challenge that, having reached a stage of maturity, AAIB and MAIB do not. That is, of 'going live' on a particular day. In other words, railway accidents which occur between now and the end of February 2005 will be investigated by the Health and Safety Executive or Formal Inquiry. From 1<sup>st</sup> March 2005, the RAIB will become the designated agency with a staff of some 25 investigators. There is no opportunity for new investigators to shadow existing ones, so how can they be sure that investigators are competent?

A partial answer lay in sharing some of the selection and training methods successfully employed by the other two branches. This is an area in which Cranfield recognised the opportunity to share some of the experience it had in the training of aircraft accident

investigation. Hence, in 2003, the University commenced a project to examine the possible benefits of offering training for investigators from the air, marine and rail domains.

### ***From the ivory tower...***

Although Cranfield has always enjoyed a close relationship with industry, it was felt that we could do more to ensure our courses and research remained relevant and up-to-date. An Industry Advisory Board was formed in September 2003, Chaired by Ken Smart – Head of the UK Air Accidents Investigation Branch and President of the European Chapter of ISASI. In keeping with our main area of expertise, membership was drawn predominantly from the aviation industry. However, in anticipation of future growth two key representatives from the UK rail and marine investigation agencies were invited to join. The full membership of the Board in June 2004 was:

Ken Smart	Chief Inspector, UK Air Accidents Investigation Branch
Carolyn Griffiths	Chief Inspector, UK Rail Accident Investigation Branch
Stuart Withington	Principal Inspector, UK Marine Accident Investigation Branch
Peter Wigens	Head of Safety, Cathay Pacific Airways
Roger Whitefield	Head of Safety, British Airways
Mick Quinn	Senior Vice President - Safety, Emirates
Kwok Chan	Head of Safety and Accident Investigations, Airbus
David Burgess	Senior Advisor, Royal Navy Flight Safety & Accident Investigation Centre

The aim of the Advisory Board is to provide guidance on the strategic direction for the centre in its teaching, research and other development areas. Its first meeting was held in October 2003 and made a significant contribution to the progress that has been made over the last year. Two key areas were the subject of prolonged discussion: The first was that of whether it was possible to include a multi-modal element of investigator training without diluting the existing Aircraft Accident Investigation course. The second was on the subject of assessment and accreditation of investigator training.

### ***Similarities***

In developing a possible ‘multimodal’ course, it was decided to start by highlighting the fundamental skills that are required of a transport accident investigator. Whilst it was always acknowledged that there was to be a lot of specific content for each mode of transport, the criteria for what was considered as ‘fundamentals’ was always to be those things that would be needed of any accident investigator. The length of the course was to be driven by the content and not the other way around.

Thankfully, major transport accidents are relatively rare events. Within aircraft accident investigation, this can mean that certain states have little hands-on experience in dealing with large accidents. Cooperation between agencies has often provided the opportunity for states to second investigators to major investigations in order to gain experience. It is this transmission of best practice that can be enhanced by opening up the boundaries between modes.

For example, it is the railways in the UK that have seemed to have attracted the most attention in recent years following a string of fatal accidents at Southall, Ladbroke Grove, Hatfield, Potters Bar and Great Heck. The public and political interest in these accidents has been

intense and therefore, these accidents provide some of the best case studies to draw on. One example relates to the role and demands of the news media. The BBC were kind enough to facilitate a visit to their news headquarters in London. Whilst all of those involved in investigation would be well aware of ‘horror stories’ involving the media, it was felt that one way of understanding what the media would be likely to do was to see exactly what they were trying to achieve. Even in the last five years, the way in which the media work has changed beyond recognition. Major news provider such as the BBC no longer work to the timetable of two or three major broadcasts per day, or even hourly bulletins, but rather are delivering content via 24 hour streams on TV, radio and the world wide web. The case study of the news media response to the 2002 Potters Bar rail crash in which seven died illustrated the point clearly. Posed with the news editor’s dilemma of whether to move the only satellite truck within the cordon to a better shot than the rival network, investigators were asked to consider what they would do. The aim is not to create apologists for the media, but at least an understanding of what the different motives are.

Other experiences are of particular value to at least one other mode. For example, marine salvage is an important area for marine and aircraft accident investigators, but it is rare (though not unheard of) for railway vehicles to need recovery from water. In the case of surveying land based accident sites, the main techniques are less relevant to the marine investigators, but the basics of how to approach an evidence collection have relevance.

The first run-through of the ‘fundamentals’ course commenced in mid-May 2004. At the start of the course, delegates were asked to define what makes a good investigator.

Open-minded	Empathetic
Able to focus on the big picture	Trustworthy / ethical
Starts at the beginning	Unbiased
Asks for help when needed	Plans ahead
Curious	Good communicator
Logical	Flexible
Cooperative	Confident in decisions
Thorough	Able to 'switch off'
Looks beyond the obvious	Care about welfare (self / others)
Good observational / analytical skills	Doesn't miss the obvious
An eye for detail	Resilient

The answers are very similar to those presented in Frank Taylor’s paper ‘The ideal air safety investigator?’ in ISASI Forum in July 1996 and were agreed upon by delegates from air, marine and rail transport. Upon completion of the three-week course, there was very positive feedback on the way in which the course had drawn upon the experiences of other modes. Having said that, there were some areas of clear difference too.

### ***Differences***

Perhaps one of the most valuable outcomes of bringing investigators from different modes together has been in revealing differences in approach. Some of these differences are entirely logical and are a function of the operating environments. However, some of the others do suggest an opportunity to question whether ‘the way we have always done it’ is necessarily still valid. A good example arose during the working group phase of the new course, whilst

visiting the data recorder facility at the MAIB. Presented with a near collision involving two ferries off the coast of Britain, the aviators were puzzled at being able to listen to the full audio from the voyage data recorder. The marine investigators were happy to point out that there was no problem at all in being able to share such information. Indeed the Unions positively supported it as a way of helping clear members who had genuinely done nothing wrong. The philosophical difference may be for some valid historical reasons, but there is considerable value in asking why we do certain things the way we do.

One of the biggest challenges for training is in deciding what sorts of exercises can be used to practice skills when delegates are drawn from a range of modes. One of the major components of Cranfield's success to date has been the inclusion of field exercises involving crashed aircraft on the University's own airport. The logistics and organisation of these exercises is complicated enough, but imagine what would be involved in putting together a rail accident. Tabletop exercises provide a good substitute for some of the elements, but also an opportunity to allow trainee investigators to push outside their comfort zone and surprise themselves. This year, four investigation teams looked at the early phases of a major rail accident site investigation. One of the teams was purposely made up exclusively of marine and air accident investigators whilst the others included rail specialists. The fact that it was all but impossible to pick out which team had no rail investigators acted as a powerful reminder that the key principles of investigation remain the same.

Getting the balance right in the first run through was always to be a tall order. Feedback at the end of the course suggested that where individuals had wanted something different from a particular session, this was not a view that was necessarily shared with others from the same mode. The fact that the rail investigators petitioned their Chief Inspector to be able to stay on through the 'air-only' weeks 4-6 of the course was perhaps the best recommendation.

### *Establishing competencies*

Returning to the issue of competencies, Cranfield have taken the opportunity to review both the objectives and assessment of the course and commence research to look deeper into the subject of investigator competencies. Within the air, rail and marine transport communities, there has been an increasing interest in recent years in the issue of establishing and measuring competencies in accident investigation.

The International Society of Air Safety Investigators is a well-recognised and respected body of professionals. Its code of ethics provide clear guidance as to the expect behaviour of its members, but does it have a role to play in defining competencies? Full membership of the society requires an investigator to have completed ten investigation, but does such a criteria define a level of competence? In simple terms, it may be argued that the completion of ten investigations equates to a certain level of experience and, indeed, the fact that an individual is still working in the field may suggest a certain level of competency. However, just as accident types can be very different, then so can the levels of experience gained.

It would be deeply challenging, if not impossible for ISASI to attempt to set measurable competencies for membership. Defining competencies would be a difficult enough task, but actually measuring them is a mammoth one. This does not mean that ISASI does not have a role here – quite the opposite in fact. By using the experience of its membership and the organisations that are involved in training and employing investigators, there is a major

opportunity to move the agenda forward. The continued professional development of the discipline is an important one.

### ***Accreditation***

What qualifies someone to be an aircraft accident investigator? In practical terms we may know that investigators are multi-skilled individuals who bring a wealth of experience and qualifications. However, experience and qualifications are generally earned in roles such as engineer, pilot or air traffic controller leading a persistent lawyer or Coroner to press ‘...but what is your qualification to be an accident investigator?’ There can be few professions requiring as much skill as accident investigation without a formal qualification to recognise this. In the past it seems to have been enough to have a *de facto* qualification of having attended a course at Cranfield, USC, SCSi and so on, but what does ‘attendance’ at a course really qualify someone to do – unless they are assessed? Increasingly, there has been a move towards assessed and certificated courses. For example, both SCSi and George Washington University offer Certificate programmes.

In Australia, the ATSB launched its own Diploma programme in Transport Safety Investigation with the Canberra Institute of Technology. The first staff completed the Diploma in 2002. The structure of the Diploma was the culmination of two years of development that included deciding between a University degree-style programme and a more vocational path. The Diploma allowed greater flexibility to assess the full range of investigator competencies through from basic office and work skills through to more complex investigation techniques. It also allowed the ATSB to establish its own competency measures, which could be assessed by its own staff as new investigators built up their experience levels.

Faced with increasing scrutiny from the legal and coronial processes, the UK investigation branches are faced with deciding on whether an academic or more vocational path is the right one to follow. The reality is that a combination of both is probably the sensible way forward. Whilst the industry would benefit from standards that are accessible to many agencies eg. through a degree programme, each individual investigation agency must satisfy itself that its own staff are competent to do the task.

At Cranfield, we are well aware that six weeks of accident investigator training was a long time to work without recognition towards a qualification. However, it was also clear that an appropriate level and style of assessment was required in order to make it accreditable. Having said that, Cranfield did not have a fixed view that the only accreditation path was through a formal degree programme. After long discussions with industry partners, it was agreed that we would establish a degree programme in safety and accident investigation that would provide one element of an investigator’s qualification path.

As many investigators join the profession with a first degree or equivalent vocational training, it was clear that a degree programme would need to be at the postgraduate level. In the UK, a Masters degree generally requires the equivalent of a minimum of 45 weeks of full time study. (Masters degrees recognise that attendance at short courses is supplemented by a considerable amount of self-study time so a student would not be expected to attend campus for 45 weeks!)

From September 2004, Cranfield will offer the new part-time programme in Safety and Accident Investigation with streams for Air Transport and, subsequently, Marine and Rail Transport. It will be offered at three levels: Postgraduate Certificate, Postgraduate Diploma and Masters (MSc). The structure is as follows:

#### *Postgraduate Certificate*

- Fundamentals of Accident Investigation (3 weeks)
- Advanced Aircraft Accident Investigation Techniques (3 weeks)

#### *Postgraduate Diploma*

The two modules from the Postgraduate Certificate course, a small research project plus any four one-week short courses from:

- Introduction to Human Factors
- Human Performance and Error
- Research Methods and Statistics
- Safety Culture and Risk Management
- Forensic Science – Investigation and Evidence Collection
- Fire and Explosion Investigations
- Engineering Failures and Accidents
- Analytical Techniques in Forensic Science
- Courtroom skills and the Legal Responsibilities of the Forensic Scientist
- Forensic Aspects of the Effects of Explosions on Materials
- Underwater Vehicles and their Application
- Corrosion in the Offshore Environment
- Design for Operation and Aircraft Crashworthiness

#### *Masters (MSc)*

As Postgraduate Diploma except the small research project is replaced with a major research thesis equivalent to 22.5 weeks of full-time study.

Does the programme cover everything an investigator needs to know? Of course not, but it does offer a wide choice of specialist subjects for an investigator to pursue their specialism. Additional modules will be added as Cranfield expands its offerings through its new Institute for Safety, Risk and Reliability. The critical question is what such a programme can add to the discipline of aircraft accident investigation?

Investigation is a discipline in evolution and as technologies and techniques become more advanced, so too the demands on the investigator will increase. A structured qualification programme is one way of developing and recognising the role of the investigator and in clearly demonstrating this for external scrutiny. It is certainly not the complete solution which is why Cranfield have embarked upon a research project in collaboration with the UK Marine, Rail and Air Accident Investigation Branches to explore how investigator competencies can be assessed through recruitment and training.

The recruitment of new investigators has provided a challenge for many years and certain developments have only made that more difficult. Well-intentioned policies designed to prevent stereotyping and discrimination can make recruitment processes rigid in their structure. Anecdotal evidence suggests that good potential candidates may be missed out if their profile does not match that which was predicted at the start of recruitment. With investigators being drawn from a pool of people with many talents and skills, it is difficult to avoid being caught out in this way. With investigator training having been largely unassessed until now, the opportunity to be able to demonstrate that an individual is competent to work in a particular role has been limited.

The research project aims to establish the competencies required of a transport accident investigator and evaluate what sorts of assessment techniques may be used to measure them. It may sound a relatively simple task, but previous attempts have demonstrated that it is not. We would welcome the participation of ISASI members in the research study and look forward to sharing results over the next few years.

### ***Summary***

The training of accident investigators is an important function and one which needs to keep developing if it is to continue to meet the industry's needs. Cranfield University, an important experience in the careers of many aircraft accident investigators working around the world has recognised the need to facilitate the sharing of investigator experience, not just within the aviation community, but also with those in rail and marine transport. It has also recognised the need for structured assessment and therefore accreditation of investigator training and is working hard towards the development of objective measures of competency. The future of accident investigation is exciting and we look forward to continuing to play our role.

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