

## Investing in the Future - the Development of Air Safety Investigator Training

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### Abstract

In 2000, the University of New South Wales embarked upon a program to establish a tertiary-level investigation program to serve the Asia Pacific aviation market. The aim was to create courses that reflected the changing needs of the aviation industry and a shift in emphasis in investigation. This paper details how the syllabuses were created, the teaching methods used and the evolution of these courses to include rail safety investigations. The development of courses has revealed new opportunities to investigate 'normal' incidents and accidents as part of a safety management system and the benefits of allowing greater access to investigator training. Challenges have included the need to provide a sound theoretical background and yet capture the sort of practical skills that investigators may need.

### What makes a good investigator?

William Tench, former head of the UK Accident Investigation Board described the job of the investigator as "...a fascinating challenge, occasionally exciting but always involving patient, even monotonous examination of every aspect of the accident - the tedium of which may erode those qualities of tenacity, imagination and perseverance which are fundamental to the effective investigator. Very important, too, is the need for a sympathetic appreciation of human behaviour under conditions of stress." (Tench, 1985)

Richard Wood and Robert Sweginnis (1995) of the Southern California Safety Institute suggest that there are three basic attributes that describe all good investigators:

1. They are not afraid to be wrong. They will accept facts that are contrary to their present theory.
2. They readily admit that they don't know everything. When they need help, they seek help.
3. They listen to other investigators. They don't necessarily believe them, but they do listen to them.

What is clear is that good investigators do not come about by chance or simply the ownership of a fluorescent jacket. The ISASI factory is yet to ramp up production and the Ken Lewis cloning program is still in its infancy. Tomorrow's investigators need the support of training and research, and also deserve recognition of their efforts along the way. This paper details the ways in which the Department of Aviation at UNSW is attempting to enhance safety through the provision of undergraduate teaching, investigator training and related research.

### From the mouths of babes...

UNSW Aviation teaches a group of some 180 undergraduates who are studying in the management (60%) or flying (40%) stream of the Bachelor of Aviation. In an industry where such vocational degree programs are still relatively new, there are a number of opportunities to invest in the future. How many CRM or other training programs solicit the question "...has our management ever done this course?" The fact is that tomorrow's managers may well be blessed with a far more balanced view of aviation safety and human factors than the average Commerce or Economics graduate that is the current staple of airline graduate recruitment schemes. With graduates heading for careers ranging from pilots and air traffic controllers to fleet planners and crew schedulers, it may be reassuring to know that students are exposed to the following:

- 56 contact hours of aviation human factors;
- 56 contact hours of risk management; and
- 84 contact hours of aviation safety management.

Graduates of the program, who may be as young as 21, will not have all the answers and certainly will not have the experience. However, safety management requires a range of short and longer-term strategies and the industry may never get such a captive audience to teach safety or human factors to again.

Undergraduates are a special breed of person, about whom many theses and best selling books could be written. However, there are a couple of observations from teaching safety management that are worth noting at this stage. Firstly, experience at UNSW has demonstrated a danger of using major accidents as case studies to try and teach students transferable skills. Whilst there is much written and many videos made of accidents such as Tenerife and Manchester, there is a risk that students perceive such events to be of such magnitude that they cannot relate to them. Like many 18-20 year olds, students can have an overly-inflated opinion of their own greatness and can often dismiss actions of those involved in accidents as stupidity. Similarly, there is also a tendency to make a great deal of assumptions about the act of investigation. The skills of investigators and the clarity with which many case studies have been put together can encourage a dangerous hindsight bias. Teaching the black and white issues of safety could be done in a few weeks, but the shades of grey take very much longer!

Conceptual models such as Reason's Organisational Accident model (Reason, 1997) have helped assist in the understanding of the events and failures that may lead up to an accident. However, there is also a risk that such models can leave an oversimplified view of the dynamics involved. Whilst we may now be more confident that readers understand what happened, and may be also why, can we be sure that they also understand how to recognise a similar situation as it starts to unfold in the future? As most people are unaware that they are about to be involved in an accident until immediately before, prevention can be rather harder than case studies may suggest.

Students are challenged to investigate multi-modal accidents to try and understand not just causal factors, but also the limitations that are on investigators and other safety professionals. The mistakes made are generally no better, or worse, than those made by many of those running the aviation industry. A desire to blame individuals, or to bastardise the teachings of Reason and blame the CEO instead are

hazards to avoid. The advantage is to get to students early and establish concepts as 'common sense' before it gets to the stage of needing a band-aid solution.

Investigators generally do not go straight into the job out of University and there is certainly no attempt to change this. Experience is vital for credibility, but sometimes can be considered a luxury. Those students who go out to fly in General Aviation can add perspectives that were previously lacking whilst others can find themselves working in safety very quickly. Some of the benefits are subtle; imagine those working in crew scheduling understanding all about the effects of fatigue on performance!

### **The art of investigation**

The act of investigation - whether it is a science or an artform, has evolved continuously. Advances in technology and methodologies have led the aviation industry to a position where few accidents are unsolvable. The achievements of investigation in recommending change are numerous and have been a major factor in creating aviation's enviable record for safety. Australia's BASI (and now, ATSB) played a major role in shifting the emphasis towards a more systemic, human factors approach. However, such innovation also needs to be supported by other changes in the system, such as in the training of investigators.

A greater emphasis on safety management systems by airlines, and now by regulators such as CASA has highlighted a need for investigation training to be available to those outside government agencies such as the ATSB and TAIC. Whilst there will always be a need for such agencies to investigate major incidents and accidents, there is also an increasing opportunity for operators to investigate the sort of 'normal accidents' that occur on a regular basis. Major investigator training courses such as the 6 week Cranfield course are likely to over-equip the sort of employee that could be carrying out such investigations, yet without appropriate training, investigators may end up being no more than enthusiastic amateurs.

Courses such as the BASI / ATSB *Human Factors for Investigation* and the CASA *Human Factors for Regulators* course have helped address deficiencies in specific areas. However, the UNSW team believed that there was a clear need for a more encompassing investigator course that was human-factors oriented, yet also included a full range of investigator skills. This view was shared by Qantas Airways and the Australasian Ground Safety Council who supported the development of new courses in this area. Human factors has become a major part of investigation, but still remains only one part of the cross-disciplinary field. Arguably, there have been examples of the investigation pendulum swinging too far towards human factors and forgetting the other elements. Expertise in human factors does not necessarily equate to expertise in investigation.

It was clear that a new course could add considerable value to the art of investigation and with the support of Qantas as launch customer, the UNSW team set about fulfilling the need. Our aim was to achieve a balance that allowed occurrences to be investigated properly with due regard, not over-emphasis, on human factors. At the same time, we were also aware that whilst in-flight break-up properties of F/A-18's and so on may be of interest, it was not something that most operators experienced very often. The UNSW team also considered that in the event of a major accident, it was unlikely that the sort of investigators we were training would be directly involved. As in many disciplines, 'golden bullets' fly

around from time to time claiming to solve all problems in isolation. The reality is that safety professionals need a broad knowledge base to be able to apply appropriate solutions.

Qantas Airways believed that there was considerable merit in training seconded line staff and middle managers to conduct low to medium level investigations. This would free up precious safety department resources to investigate larger scale events and generally manage safety, whilst increasing the number of investigations that could be conducted. This would also increase the amount of safety data that was available for trend analysis etc. Longer term, this means that safety and human factors aware staff can take what they have learned as an investigator back to the line and influence operations from the inside. As a publicly available course, there is also now an avenue whereby an employee can attend the course prior to applying for a new job, rather than relying on on-the-job training if and after they are appointed. With syllabus development commencing early in 2000, the first short course was scheduled to run mid year 2001 and 6 monthly thereafter. For such a course to be of maximum value, it needed to run regularly.

The Australasian Ground Safety Council also believed that there was a need for its members to be able to access investigator training. As the late George Oldfield reminded this meeting in 1999, ground accidents represent a chronic cost to the aviation industry. Ramp rash affects all of us, yet many events are not fully investigated - mainly because of a lack of resources or investigative skills. Whilst a short course was an option to address this need, an alternative approach was to make a distance-learning course available. For a country such as Australia, this has a couple of benefits. Firstly, those involved in investigating ramp accidents tend to have a number of roles and cannot easily spend a week away from the office attending a course. Secondly, many airports are in remote areas and would need to incur considerable cost to send an employee on a course in Sydney. The course was launched in September 2001 and has already seen students enrolled from as far afield as Canada.

### **Why go to back to school?**

In establishing such a program in a University, there are a number of benefits to both the students and the discipline at large. Firstly, although a one week short course or six week distance learning course is not going to equate to a qualification in its own right, the design of the course, and the use of assessment allows a student to use it as credit either towards a university certificate, degree or diploma or as recognition of prior learning (RPL) towards a vocational training qualification. To have *passed* a course with a structured assessment, rather than just *attended* it provides increased credibility for someone who may find themselves in front of a Coroner at a later date.

Secondly, the University provides an opportunity to bring academics and industry practitioners together. The UNSW program has been developed by Bryan Stott, John Guselli, John Faulkner, Barry Sargeant, Mike Innes and Graham Braithwaite. In addition, there is also the opportunity to develop associated research. Postgraduate researchers within the department are currently conducting a range of projects that support the investigation program;

- Behavioural markers for cabin crew safety performance;
- The importance of risk homeostasis for the aviation industry;

- Safety culture within Australian Defence Force aviation;
- The role of panic in aircraft accidents;
- Inter-cultural communication within the aviation industry;
- Assessing clinical outcomes of in-flight medical events;
- Validating the 1:36 rule for cabin crew.

In addition to the projects already underway, the University will support new PhD and Postdoctoral fellowships for 2003 and is seeking to employ an additional lecturer in safety, human factors or investigation.

In addition to the Department of Aviation, the University also includes researchers in aeronautical engineering, safety science and even food safety, in addition to being home to the NSW Injury Risk Management Centre and running University College of the Australian Defence Force Academy, Canberra. It is a resource that the aviation industry already uses, but one that can be utilised so much more in the future.

### **Our friends without wings**

Following the high profile, fatal rail accident that occurred at Glenbrook, NSW on 2<sup>nd</sup> December 1999, there was a considered move towards embracing a more human factors aware approach to safety in the rail industry. In 2001, the Department of Aviation was approached by an employee of the NSW Rail Infrastructure Corporation, who was seeking investigator training for his colleagues. His research had led him to the aviation industry and in particular to the likes of Cranfield, USC and SCSi. The simple fact was that the rail industry needed investigator training and aviation was the closest that they seemed to be able to get. Having heard that UNSW was developing a new course for the aviation industry, a request was made for a rail specific version.

Following the successful launch of the airline and ground safety courses in 2001, a new course was tailored for the rail environment. With an emphasis on training current investigators, the course was designed to focus on human factors, organisational and systemic issues. However, as the syllabus evolved, a need to revisit many of the basic concepts of investigation was highlighted. As Wood and Sweginnis observed, investigators "...readily admit that they don't know everything." Some investigators admit more readily than others. The fact that an investigator with 37 years experience, mainly in the safety area was able to walk away at the end having learnt something says something about the course, but probably says more about what made him a good investigator.

The rail participants saw considerable value in exploring experience from outside their core discipline. This can be a great leveller and can also increase the available knowledge base. However, the course facilitators have to be careful not to revert to *Boys Own* teaching and tell lots of interesting, exciting, but irrelevant stories from aviation. The overall aim is to provide useful skills rather than just an 'enjoyable' or 'entertaining' course. Two particular successes are highlight below.

### **In pursuit of the organization accident**

The case study of the Herald of Free Enterprise, a roll-on roll-off ferry that sank near Zeebrugge harbour in 1987 with the loss of 192 souls, is used to explore the

concept of organisational accidents. Even for those unfamiliar with the work of Reason are generally able to accept the concept through such a case study, even if a 'hang the guilty bastard' attitude can take a while to dissipate. What tends to completely throw the investigators is the opportunity to interview the Chairman of the Board of the ship's operator.

As company investigators and with time allocated to prepare an interview strategy, participants are able to interview 'Sir Jeffrey Sterling' - a formidable director with an uncanny resemblance to Capt. John Faulkner. Having been both an investigator and a board member, John is able to answer questions in the sort of way that unprepared investigators may find a director might. The effect is dramatic and can frustrate investigators no end. As a recent participant observed, "...in the real thing, I would be more prepared". If that lesson alone were learnt, it would be considered a success. If investigators don't realise at that point that not all witnesses are likely to be keen to cooperate, the session held in the witness box of the Coroner's Court is generally enough to focus the mind...

### Simulating the real world

The 'real world' is a place that those working in academia are often told about. Unlike academia, it is a place free of deadlines, dead wood and paperwork. There is no bureaucracy, no office politics and no pressure...

The need for investigators to be trained for the real world is something that prompted the UNSW team to think differently about the way participants consolidate the skills they learn on the investigator course. Whilst accident case studies can be used to great effect to train investigators, especially when facilitated by experienced investigators, they are not perfect. The aim was therefore to build a one-day simulation that exposed investigators to the sort of challenges they may face in a real investigation. Unlike a case study, the simulation does not supply investigators with an ordered synopsis for them to explore possible causes. Rather, the simulation begins with a simple notification that an accident has occurred resulting in damage to two vehicles and no serious injuries. Investigation teams are selected and the team sets off to the scene. The 30-minute 'journey' allows investigators to plan how they will work and start to think about what sort of evidence they will be looking to collect.

The simulation co-ordinator then 'calls' the investigation team to find out what they want once they arrive on-scene. The aim is to provide sources of evidence - whether physical or witnesses for the investigators to work with. What the investigators usually want is quite revealing and arguably demonstrates the value of a simulation better than any other one thing. The co-ordinator is usually bombarded with 'why' questions and requests for the final answers. For example,

*"Were there any witnesses?"*

*"Was the crew fatigued?"*

*"Did they see the other train?"*

*"Did they brake before they hit it?"*

The co-ordinator has no option other than to state that he does not know the answer and that the investigators must decide how they will find out the relevant information. Inevitably, this means that the investigators will need to conduct interviews and analyse a range of written material, which is available on request.

Put simply, the aim is to offer the haystack from which the investigators may find the necessary needles.

Although the course structure includes coverage on interview techniques, there seems to be a widely held belief that this is not something that most investigators (or would-be investigators) need much training in. The truth depends on perspective. Course participants tend to underestimate their weaknesses in investigative interviewing, until the point that they are faced with 'real' witnesses in the simulation. When witnesses are 'in-character', the investigators find them rather harder to extract the whole truth from. The availability of witnesses and other interviewees may be limited by their geographical location, leave or rest entitlements, or general attitude. The aim of the simulation is always to be realistic. Therefore the acting is neither hammed-up or overly-cooperative - if a real investigator discovers that the CEO is busy, then so should students of investigation.

At the end of a day of investigation, the teams have usually advanced their theories sufficiently to be able to write an investigation report. Whilst the glamour of investigation may be in uncovering what went wrong and why, the reality is that it must then be written up into a format that is clear, accurate and usable. The rail industry has started to adopt the report structure suggested by Australian Standard 5022 - Guidelines for railway safety investigation. Students are encouraged to use the format suggested by this document to put together their reports and stress the importance of human factors and organisational issues. In keeping with the 'real-world' theme, there is a deadline for submitting the report - which is then assessed by experienced investigators. In fact, the review is two-fold; a de-identified report is supplied to each participant for peer review and self-reflection.

Report writing outside the five days of the course is not always popular with many of the students at the time and requires commitment on the part of their management to support them. However, the aim of the training is to develop skills, not to just test short-term memory of facts and hence requires a suitable form of assessment. The real measure is now starting to come from the feedback of the manager who initiated the program. Of the fifteen investigators that participated in the first course, there has been a noticeable change in the way they investigate and write their reports. Even the class-cynic found himself explaining his discovery of organisational influences on a fatigue issue after originally claiming that he knew it all!

### **Building a career path**

There are few roles as specialised or as skilled as accident investigation that do not carry a specific professional qualification or accreditation. Whilst the recruitment criteria may be strict in requiring experience and technical qualifications (such as ATPL, LAME etc.), the training of investigators within their new role does not seem to be recognised with a particular, high-level qualification. Even though we may proudly display our memberships of ISASI, it remains a professional society and not a specific accreditation.

How many other professions draw upon the sort of skills that air safety investigation does? It is with awe that many of us look upon the achievement of investigations in hostile environments such as the Florida Everglades (Valujet DC-9), the Atlantic Ocean (Swissair MD-11, TWA 800, Birgenair B757 etc.) or indeed at

Mount Erebus; not to mention the metaphorically hostile media and political environments.

Building academically sound courses that allow career progression for people wishing to become investigators, as well as those who already are, brings investigation up to the standard that most disciplines have enjoyed for many years. The opportunities afforded by innovation such as undergraduate degrees in aviation and more accessible vocational courses for mature students also provides the opportunity to change the way the entire industry thinks about safety in the future. With the added benefit of research to both further science and pool expertise within the Asia Pacific region, the future is exciting.

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## About the author

Dr. Graham Braithwaite is a Lecturer in Aviation Safety and Human Factors with the Department of Aviation, University of New South Wales, Sydney. His research interests include culture and its effects on communication, risk perception and aviation safety; human factors and CRM development and evaluation; cabin safety and other systemic safety issues. Graham has recently published a book on Australian Aviation Safety 'Attitude or Latitude?' through Ashgate Publishing and is also the Chairman of the Asia Pacific Cabin Safety Working Group of the Australian Society of Air Safety Investigators.

## About the Department of Aviation

The Department of Aviation of the University of New South Wales was established in 1995. Since then it has grown rapidly and now is home to over 300 students from all over the world. With five aircraft and a flight-training centre at Bankstown airport, the Department offers on campus, distance learning and short courses and has students from as far a field as Canada, Ireland and Kazakhstan. The Department is proud to be a corporate member of the International Society of Air Safety Investigators.