Doug Edwards

11 Oct 2010

Committee Secretary

Senate Standing Committee on Rural Affairs and Transport
Parliament House, Canberra

Inquiry into pilot training and airline safety

Good Morning

I wish to tender the attached document as a submission to the Committee. It focusses on pilot training, and is thus only tightly relevant to the first three Terms of Reference.

My paper is a draft, being prepared under supervision for the academic purpose of a Masters Degree by research (which is intended to segue into a PhD after one year). It is the culmination of over 30 years interest and work in the area of pilot training and its safety implications. The attached cv tells of my long association with – and pro-safety activism in – flying and aviation safety; military and civilian.

The theme of my submission is that the RAAF has achieved a major safety result – a zero aircraft-loss accident rate – that can emulated in civil aviation, if know what to do. When Air Force Training Director, I undertook research and management action that sought the very result the RAAF has achieved. While making no claim for responsibility for a signal accomplishment, that experience base, and knowledge gained since, enable identification of best-fit arguments as to how the safety result was obtained.

In turn, that supplies the basis for design of emulation schemes and methods. Given the lack of cause-effect certainty on the RAAF experience, I propose to proceed within a research and development framework at a university.

The arguments for emulation are set out in my papers. They support the following comments on Terms of Reference a to c:

(a & b) pilot experience requirements

Pilot experience requirements implicitly acknowledge that civilian pilot training is not delivering. However, the view that experience will remedy defects relies entirely on chance – and is thus no planning basis for safety defences and/or competencies.

Modern pedagogy and training systems are capable of graduating pilots whose overall competencies fully equip them as proficient for flight operations. Their development of the appropriate skills and attributes within a controlled environment is not only more reliable and certain, it is the only way authentication of "safety fitness" is possible

Military pilots with 250 hours get certified as operational crew in combat aircraft. The same robust levels of piloting capability can be gained within current civil aviation training structures without additional cost to the student. The technology exists

(simulation and other devices) as does the pedagogy. Few in the industry, however, seem equipped to deliver such "High Effect" training. There's no criticism here – the means to do it have not been deployed. Accordingly, it seems to be a case for CASA to develop the guidelines and references and make them available to the industry. It's not a huge task.

A relevant comment is that CASA is embarked on a project to improve flight training standards. To the outsider, it seems to place more reliance on assessment and not enough on better training. The assessment strategy, in effect, says that if more pilots fail a review the training will ramp up to higher levels of effect to prevent further failures. True enough, but crude. You can improve the training quality through education and demonstration of effect. That's the positive approach. And it's more scientific.

In my experience, overseas models are not superior to Australia's. They possess the same shortfalls (eg, "lite" training courses) and do not invite emulation. They are definitely not interested in the High Effect training doctrine.

(c) current industry practice – effect on safety

A pilot's safety attributes are learned – or from a training system viewpoint, imbued – so there will be no affect from any other influence if the training is effective. As above, it can be that without additional cost burden to the student. The training system would need to be doctrinally enriched and rendered more efficient, but all that is possible.

Conclusions

My comments have been brief as there is abundant support for them in the attachment. To the extent that the Inquiry reveals deficiencies in the civil aviation system, many of them will prove susceptible to training solutions (eg, the "experience" argument). I would be pleased to contribute to definition of "catalytic" options.

I should say I have not withheld these views from CASA. Each Director of Aviation Safety since Leroy Keith has been advised on what is on offer. In 2007 I completed a CASA-funded research exercise – to develop High Effect training guidelines. My report is on the CASA website: HTTP://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_92958

I would be happy to elaborate on any matter within my field of expertise.

My best wishes for the Inquiry. I do not believe there is a safety crisis to hand. However, there is plenty of scope for more efficiency and effectiveness in fostering a vital National transport resource.

Regards

Doug Edwards

John Douglas (Doug) Edwards

1962-1987	RAAF	Fighter pilot, base safety officer, accident investigator, flying instructor, fighter tactics instructor, squadron executive, staff officer, diplomat (USA), major unit CO, RAAF Director of Training, base OC.

Significant achievements

Promoted to Group Captain at age 37.

As Training Director, headed project to streamline RAAF training to save 300 man years of 'lost' time. Parallel study of pilot training secured lower failure rate on courses.

As Training Director led RAAF development of tests that reveal "error-prone" attributes in pilots; accident rate lowered subsequently to zero.

As Base Commander, RAAF East Sale, achieved 15% annual increase in productivity over 2 years (measured as student output, from 6 schools, with no additional staff).

1987-1989	Queensland Law Society	Continuing Legal Education (CLE)

Significant achievements

Introduced competency-based training design to CLE activities. Assisted CLE Director to arrange and deliver full range of CPD activities.

Designed and implemented management training for solicitors – The Practice Management Course. Its intent was to reduce "accidents" in solicitor work. Insurer froze PI insurance premiums as result.

1989-1990	Law firm consultant	Designed and conducted management & Risk Management training.

Significant achievements

Provided in-house courses in management systems and error prevention techniques.

1990-1996	Family Court Australia	Regional Manager, Northern Region (Coffs Harbour to Darwin, incl Alice Springs) 15 units, 110 staff.

Significant achievements

Implemented staff training and leadership programs resulting in highest 'production' statistics (eg, numbers of files-opened-per-staff-member). Region was most cost-effective (of five) in Court.

***Throughout 1987-1996**, remained active on RAAF Reserve, developing and teaching International Humanitarian Law (IHL). Originated the concept of IHL as the "Code of Ethics for the Profession of Arms". Taught doctrine to lawyers and combatants of all three Services, Australia-*

wide. Wrote Law of Armed Conflict chapters for RAAF Manual of Air Power, designed war games for training workshops, led related management-of-training activities.

***Throughout 1996-2002**, Aviation safety training developer, Initially through Aviation Australia, Eagle Farm, then independently, developed and delivered Safety Management System training and allied modules such as Risk Management and Mishap Investigation.*

***Since 2002,** aviation safety consultant and aviation adviser to university.*

Significant achievements past 20 years:

Co-owned C310 and charter company; remained active in aviation and aviation safety. Safety interest was motivated by learning from investigations and sustained by later personal experience (ie, colleagues' accidents). Sought to promote accident avoidance through "personal safety fitness" training. (85% of accidents are preventable. Targetted training reduces risk.)

*Wrote well-regarded book **Fit to Fly**. Have published many articles and papers, with domestic and international recognition as result. Large amount of information at:*

http://www.linklearn.com.au/redflag/home.htm

Recent training products are courses for pilots, maintenance engineers, aviation managers and emergency service managers and crews, such as:

- ***Human Factors** (judgement and decision + 50% of larger **HF Manual**).*
- *The **Red Flag** system – practical Risk Management (RM kit & course).*
- *Experiential learning **Threat & Error Management** (TEM) seminars.*
- ***Safety Management Systems** (based on ICAO/CASA guidelines).*
- ***Competency Management** (ie, positive control of operational functions).*
- *Accident Investigator.*
- ***Decision-Making under Stress,** inter alia, for Qld Emergency Services.*

*Actively participated in start-up of Aviation Safety Foundation Australasia (ASFA) as original Executive Committee member. Wrote ASFA **Code of Practice** as well as **training**, **professionalism** and **accreditation** policies.*

More recent publications include:

- *On Human Error.*
- *Performance Under Stress.*
- ***The Tools** – a practical guide to HF "operational components".*
- *Learning in Aviation.*
- *Guidelines for design of Part-Task Training devices and **Threat & Error Management (TEM)** skill testing and enhancement routines.*
- *Design of handheld-PC-based **fatigue management** program.*
- *Design TEM skill "fitness" appraisal paradigms and devices.*

Maintain contact with clients in aviation community.

*Serve on CASA **Standards Consultative Committee**, Airspace Working Group (as co-Chair) and Part 119 Working Group.*

*Through assisting stroke victim in rehabilitation, noted Neuroscience issues linked to human performance and learning. Realised consequent potential to enhance training guidelines and prescriptions in every field – now applied in **TEM training** courses for aviation and other **professionals**.*

*Member of "aviation wing" of **Safety Institute of Australia** (SIA) tasked by the SIA to develop **accreditation** programs for aviation safety professionals.*

Most recently (Oct 2010), invited by university to enter a Masters Degree by research program, with a view to transferring, after one year, to a PhD.

Safer Pilots Research and Development Project

Research will be conducted to establish the proposition that civilian pilot training can be augmented to produce graduates with the same safety capabilities as RAAF pilots of the cohort that achieved today's safety record. The attached paper discusses the Air Force accomplishment and speculates on causes. The Project will remove doubt as to origins of the safety result.

The Project will trial "catalysts" that enrich learning experience to more deeply embed essential competencies. It will be known as "High Effect" training. The development aim will be realised through initial and continuing production of relevant learning activity guidelines and training references (whose collective effect activates and sustains the catalytic function).

Volunteer intending pilot trainees will be enlisted and briefed on the Project. Before starting flying training, they will complete personality profiling to enable choice of optimum personal learning style, and cognitive fitness appraisal.

Subsequently, volunteers will attend a one-day preparation course (PrepFly). Online led, self-administered, maintenance training will follow. Participants will be encouraged to adopt post-graduate continuation training as a whole-of-career practice.

Before Project start, flying course plans will have been revised to accommodate the catalysts. No change to syllabus or underlying training structure is involved.

Instructors will be prepared to: accommodate students with expectations of learning styles they (the trainees) expect; and, be able to operate the active components of the training catalysts. Instructor training is by attendance, over two consecutive half-days. The same continuation program is encouraged.

The proposition relies on the hypothesis that cognitive fitness is the ingredient that delivered the RAAF's zero accident rate. Arguably, peak cognitive fitness enables the most reliable situation awareness – and thus decision-making – under the pressure characteristic of the pre-mishap phase of an accident … or avoided accident.

Review of 54 Australian GA fatal accidents, selected at random, reveals that all but 3 support the hypothesis. A study of passenger carrying aircraft accidents is underway.

Assessment of Project outcomes presents difficulties – awaiting evidence of change in safety patterns will test patience. Accordingly, Project results will initially be through comparison between pre-course and post-course cognitive fitness appraisals.

The Project is expected to achieve research aims in three years. By then, hard evidence should have accumulated to clarify the safety/cognitive fitness relationship. Regardless, at that point trial activities should segue into standard operation procedure.

A Project timeline and list of tasks will be attached in a later planning stage.

Doug Edwards

Notes on the Project

Main Ideas

This is clearly a Project of National importance. Furthermore, it lies squarely within the boundaries of the Civil Aviation Safety Authority's legislated "zone of interest". CASA has been advised of the initiative and invited to take an interest.

The key proposition is that civilian pilots can be trained to be as capable and safe as RAAF pilots.

- And thus deliver a major improvement in pilot graduate standards from present levels.

The instrument for realising that promise is higher potency training, as enabled by modern pedagogy. Confirmation of these propositions is expected.

- Graduates of "High Effect" courses will possess more robust flying skills.
- Pilots so trained will have stronger personal safety attributes.
- High Effect course graduates will retain their piloting and safety skills for so long as they properly engage in continuation training.
- All benefits can be achieved without additional cost to student or school.

A "training catalyst" enables these dividends. It takes augmenting effect when blended into existing training practice. No change in syllabus or other structural adjustment is needed. There is, therefore, no or minimal additional cost to student or flight school.

The research will be based on High Effect training and assessment. No control group is envisaged: The ultimate benchmark of success will be the cognitive fitness factor. Flight simulator exercises will be flown to confirm the safety effects of cognitive competency.

The "true safety picture" will only emerge over years – or even decades. Training effect will be immediately measurable. Objective tests of cognitive fitness will provide hard data as evidence of achievement of research objectives.

Cognitive fitness, enhanced by the pilot training course, is the best-fit explanation for the Air Force safety dividend. Incorporating equivalent learning in the civilian course should deliver the same benefits.

RAAF experience suggests that individuals with peak levels of cognitive fitness learn complex skills such as flying an aeroplane more readily and enduringly. And, as pilots, they are unlikely to have a human error mishap. Modern pedagogy enables the civilian training course to emulate its military counterpart in safety effect.

Innate cognitive fitness is acquired from earliest childhood. It develops autonomously through chance encounters with stimuli that prompt exercise of identifiable cognitive skills. As with physical skills, supplemental exercise strengthens fitness. However, the safety factor for the latter suggests – indeed, demands – that development of such vital attributes should not be left to chance.

Learning System Structure

At the outset, a "Lead School" for the Project will be selected as the "operational base" for the Project. Its staff will be trained to administer PrepFly and High Effect training for its own students, to train instructors from other schools, to maintain surveillance over partner schools, and to pursue the relevant research.

Project Training References

Training materials include:

1) Student Study Guide for PrepFly. (Includes "reading" the psychological profile.)
2) Booklet on Learning (supplementary to the FAA Instructor Handbook).
3) Guidelines for High Effect training, through the pilots course syllabus & beyond.
4) Instructor training notes and guidelines for High Effect exercises, with samples.
5) Manual for self-training for cognitive fitness.
6) Booklet on the relevant cognitive competencies.
7) Guidelines for continuation program.

Safer Pilots Project

The attached briefing paper introduces a safety concept that transforms our ideas on irreducible limits for safe operation in any domain of human activity. Given the right sort of lift-off platform, it will deliver an unprecedented decline in accidents.

A spectacular example craves emulation – zero losses in the inherently and necessarily high-risk business of flying fighter aircraft. Although the origins of the achievement may be lost in the mists of time, its significance is prodigious.

A 30-minute briefing explains how it was achieved and why it can be reproduced.

A Project for delivering the safety benefit in civil aviation is ready. It is:

- A training course for candidates for pilot training, before they commence training.
- Training for flying instructors who will encounter students so trained.
- A course for graduate pilots of any experience level and employment.
- Guidelines and materials for self-administered continuation training for all who have completed the initial course.
    - An online reporting system will support Continuation Training.

Volunteers for such training will be sought.

Essential to effectiveness – that is, sustaining the training's ability to deliver the safety dividend initially and continuously – is a system of accreditation and supervision. The "Professional Association" model is ideal for this, and several options are under review.

Equally important is revisiting the origins of the RAAF safety achievement.

The concepts outlined in the briefing paper are unique. Their "disappearance" is due, in the main, to the military's rotational postings – move on after 2-3 years, typically. To re-build the "intellectual capital base", research is essential to the Project. It will include:

- Accident analysis to establish the prevalence of mishaps attributable to the factors for which the proposed training regime is an antidote.
    - In a preliminary review, I selected 300 accidents at random from the ATSB database and analysed the 54 fatal events. All but 2 were characteristic.
        - See: https://public.me.com/dougwds – "Brief Accident Summaries"
- Collecting safety-related performance data during pilots' courses.
- Tracking data from Continuation Training, as reported via the online facility.

Another unique aspect of the "conceptual package" is reliance on high potency training paradigms. Quite simply, no other form of pedagogy will work. Access to these methods came through an encounter with Neuroscience. A colleague – a former Mirage student – was disabled by a stroke. I could get him to engage in rehabilitation exercising when the therapists could not. The insights enabled me to add significantly to learning doctrine.

Neuroscientists know about this – but they tend to focus on the ill. They don't seem to realise the enormous potential for good their knowledge has for the fit and healthy.

These and other "headline" issues are described in the briefing session.

Doug Edwards

Safer Pilots

When the last RAAF fighter crashed no one knew it was the last.[1] The truth eventually dawned … but by then no one knew why. Good luck? The few who could throw light on the story had moved on; that part of corporate memory was blank.

The zero accident rate was intended. A 1977 Mirage accident evoked interest in a certain personality trait.[2] In the 80s, research was commissioned to check it out. It aimed to see if folk with the attribute could be excluded from selection as candidates for pilot training. The safety potential was for reduction in human error accidents.

The research project investigated these questions over two years:

- Why the personality type features prominently in human error accidents?
- Could such people be identified?

Neumann's DMT was used.[3] Results affirmed that the suspect trait could be detected. Pilot selection processes were adjusted. Candidates with the attribute would not be recruited. (Discriminatory selection is known as *screening*.)

DMT was not a part of the new screening regime. Instead, its forensic smarts were emulated. In interview, psychologists asked carefully framed probing questions and "read" personality indicators in responses.

The idea that some people are accident-prone makes sense, but it's not popular. Even high-risk organisations seem to avoid confronting it. For example, there was unease in the RAAF over the DMT's *accident-prone-type* theory. As a result, the interview strategy was soon neutralised. (Non-psychologists took over the task.)

So what stopped the accidents?

The *pilots' course* did it, by acting as an extension of screening. It always had. However, when the PC-9 replaced the Macchi, the effect became pronounced. The active agent is *information rate demand*. Late in the syllabus, complex instrument flying (IF) exercises are hand-flown. There is a spike in failures at this point. It's the final screening hurdle.

Investigators of the Mirage accident had pondered this very phenomenon: *information overload.* They could only speculate – but they did identify a serious hazard – *loss of Situation Awareness (SA) under pressure*. This is not the attribute the DMT reads – that's "denial" – but it is one of the trait's practical manifestations.

By then the link between the DMT trial finding *(accident-prone type can be detected)* and zero loss rate *(accident-prone type eliminated)* was broken. Selection wasn't screening anymore, but the aim was achieved. Pilots' course was applying the ultimate test.

The accident record confirms that Situation Awareness failure is a hazard. Good SA is "The Picture". It is delivered by neural operations – cognitive competencies. The RAAF experience is that when they are at peak, you *most readily learn complex tasks* – and *you will be a safer person*. The Project will develop the means to enable all pilots to be so fit.

Cognitive fitness is like its physical counterpart – improved and maintained by exercise, mostly self-managed. A training course that describes SA cognitive skills enables self-diagnosis and design of personal workouts. Fitness checks augment training effects.

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1 … the last for at least 18 years, that is.

2 My book, *Fit to Fly*, describes the accident, the thinking that prompted the research, and the aim of testing.

3 Defence Mechanism Test. For a description, see: http://tmdoctors.info/dmtdescr.htm

Safer Pilots R&D

The R&D Project will prove the roles of cognitive fitness in learning and safety.

While safety gains comparable to the RAAF zero accident rate are realisable in many domains, the Project will focus on civil aviation and candidates for pilot training.[i]

Objectives

The Project aims to demonstrate that cognitive training preparatory to a pilot's course will render the learning-to-fly process more efficient and effective – while producing safer graduates.

As attainment of the latter objective will not be quickly discernible, *learning facility* is the initial aim point for research.

Execution

Volunteer participants will receive a 6-hour course in SA cognitive skills. They will learn to define the competencies and how to exercise them. Continuation training will be self-supervised via diary or online log. Routine fitness tests will be encouraged.[ii]

The course will be known as Preparation for Flight Training, or ***PrepFly***.[iii] It will be delivered in person initially. An online variant will follow.

The *research* component will be achieved by assessing performance on the standard pilots' course against existing "norms".

The *development* aspect covers production and proof testing of the training course, its supervisory component, and a reference manual.

Project Considerations

This document provides a broad outline of the Project and its rationale

As statements of intention are brief, endnotes supplement them. If you have a query on an issue, the endnote will hopefully provide an answer.

> *Significant* notes are inserted in the text.

This version is a draft. It will be progressively updated. (5 Oct 10)

> The term "safety catalyst" describes the stimulant delivering the safety dividend. That's as it can be seen as an "augmenting additive" to normal human cognition. The end product is *ability to maintain Situation Awareness (SA) under stress.* Cognitive fitness enhancement is achieved through precision-targetted exercise.

Links to Past

The Research essentially takes up where the RAAF DMT trial left off.[iv]

Information Session

For decision-makers, a 15-minute Briefing is available on:

- Situation Awareness, (the William T Powers Model, according to Hendy)
- Decision,[v]
- The Cognitive Competencies they (SA & D) rely on, and,
- Project outline.

Project Location

Project activities will take place at partner flight schools.

Test/Train Strategy

The principal trial activity involves volunteer participants engaging in a personal *test-train-test* cycle. The ***PrepFly*** course will ready them for these activities:

- Self-assessment for "innate" cognitive fitness.[vi]
- Designing self-administered cognitive fitness "top up" training.
- Continuation-training (as a start to whole-of-professional life practice).

> A *training* strategy may seem to be at odds with RAAF *screening* experience. It isn't. The cognitive skills involved are common to learning *and* safety performance.

Timing

Planning and preparation with a "Lead School" partner will take place in late 2010. It will include trials of courseware and testing of paradigms and technology.[vii]

The trial proper is planned to run from January 2011 for 3 years. The partner school base will progressively expand during that time.

A detailed action plan will cover the first 9 months, from 1 Nov 10.

Safety Strategy

As before, differently from the RAAF, a *training solution* will be applied vice *screening*.

The training course will enable candidates to learn to fly with maximum efficiency.[viii]

The cognitive attributes that support efficient learning of complex competencies also produce safety benefits.

Training & Assessment

The training design challenge is considerable. Normal pedagogic paradigms will simply not work.

A vital element of the Project is to apply high-potency training doctrine and methods in the training. This is derived from a blend of venerable pedagogic theory (as in the FAA Instructor Handbook) with insights from Neuroscience.[ix]

Candidates for civilian pilot training will be the first involved. Volunteers will be called for from partner flight schools.

Before a volunteer begins pilot's course, he or she will engage in ***PrepFly*** – training that permits him or her to – or confirms they already can – achieve high rates of Information Processing, as characterised by demand in the RAAF syllabus's advanced IF phase.

Partner school flight instructors will be trained in ***PrepFly*** roles, including assessment.

Project Tasks and Activities, Deliverables

This section will be augmented as the detailed plan is written. A few certainties are:

- Confirm the need, affirm strategic direction:
  - A sufficient search of the Australian Transport Safety Bureau (ATSB) incident and accident database (and overseas equivalents) to confirm that loss of SA events feature highly in mishaps.
    - Or, in other words, significant reduction in SA failures will enhance safety disproportionately.
  - Safety analysis to accord to the SERA model.[x]
- Candidate guidance materials for a student undergoing the prior preparation Situation Awareness (SA) training (before starting the pilot's course).

- Training guidelines for students on the pilots' course.
- Guidelines for instructors participating in either the ***PrepFly*** course or ***High Impact*** pilot training – supplementary to the FAA Instructor Handbook.
- Courseware for ***PrepFly*** course training.
- An operating framework for a professional association hosting the Continuation Training Program.

Summary

Project *research* aims to confirm these propositions:

- The ability to maintain Situation Awareness under stress (or "operate at the maximum human limit in information processing") is a potent safety catalyst.
- The cognitive competencies that deliver Situation Awareness improve with training, and can be strengthened to the fullest extent possible.
- When SA's Cognitive Competencies are "fully fit", that person will find learning to fly easier – within a training milieu characterised by disciplined adherence to High Impact doctrine and procedures.
- Graduates of a High Impact learning regime – ie, the prior cognitive fitness exercise together with the pilots' course – will possess the highest safety skills for as long as effective exercise is continued.

Project *development* will deliver:

- A reference manual covering the above training and doctrinal guidelines.
- Instructor guidelines.
- A complete package of courseware for ***PrepFly***.

Endnotes

i The need in civil aviation is immediate and pressing

Australian Transport Safety Bureau (ATSB) safety report: **Improving the odds: Trends in fatal/non-fatal accidents in private flying** – released in June 2010 – states that:

> Three occurrence types accounted for the majority of fatal accidents: collision with terrain (90%); loss of control (44%); and wire strikes (12%).

Each occurrence type clearly involves failure in Situation Awareness, either total or partial.

> The accident classification system used by the ATSB does not contain a "loss of Situation Awareness" category. Nonetheless, the Report's text, and facts cited in the Report, support the conclusion that most human error fatal accident were SA-related.

The ATSB Report also recommends:

> Pilots are encouraged to make decisions before the flight, continually assess the flight conditions (particularly weather conditions), evaluate the effectiveness of their plans, set personal minimums, assess their fitness to fly, set passenger expectations by making safety the primary goal, and to seek local knowledge of the route and destination as part of their pre-flight planning.

In other words, *"do all in your power to acquire and maintain Situation Awareness."*

My own earlier research involved taking 300 ATSB accident reports at random and examining the 54 that were fatal events. All but 2 featured SA failure.

See: https://public.me.com/dougwds – "7. Brief Accident Summaries"

ii Training vs Testing

When the cognitive competencies that provide SA are at peak fitness, the safety catalyst is of most effect. When those competencies are so fit, the challenges involved in learning to fly are more readily managed. You learn to fly more efficiently, and, while learning, you reinforce the safety advantage of the catalyst.

The DMT is a useful start point for argument. It originated in Sweden, and aimed to *minimise failure on military pilots' courses*. Typically, over 40% of candidates – who'd been selected only after *gruelling* aptitude testing – fail a course. It's hideously costly.

A *low DMT score* was held to be a poor indicator of success in learning to fly.

The RAAF DMT trial was meant to resolve the safety question from the Mirage accident. The underlying purpose was *to not recruit candidates for pilots' course who would be unable to maintain Situation Awareness under stress* (and thus be more likely to have an accident).

A poor score was the "hazard" indicator.

The Air Force hierarchy was sceptical of the safety thesis. But they were worried about high pilots' course failures. So the trial was authorised with cost-saving aspirations.

Training results were in first. Correlation was strong (but not 100%). Twice as many in the low score group failed pilots' course.

As to the safety factor, there's been no formal follow-up of trial personnel that I know of. Anecdotal evidence suggests that correlation is much the same as for training.

iii Learning Methods to be applied

The term "*intensive*" applies to this short training course.

It ***must*** be experiential, and rigorously so (for learning impact). A key element of the intended "Safer Pilots regime" is in the training methods to be used. They may not be diluted without effects waning.

> This is too large a subject for this document – indeed, amongst the Project's proposed deliverables is production of a reference text on "High Impact" Training.
>
> Suffice to say for now, experiential training is the only way that intended effects will be realised. And it will have to be designed from a strong knowledge base and with precise focus on objectives and valid means for their attainment.
>
> Complete confidence in the potency – and hence effectiveness – of my training prescriptions is reflected in the fact that a six-hour course will deliver.

iv More on the DMT Trial

The DMT trial identified several pilots as "very high risk". As the trial was an academic exercise, the DMT results did not influence the selection processes. Most of the high-risk candidates did begin flight training, and some graduated.

One of them was discharged from the course and the RAAF just days before graduation for a gross breach of discipline. He, along with his passenger, died several years later in a pilot error accident.

The crash followed his deliberate decision to violate Regulations and attempt an illegal manoeuvre – to show off. The aircraft was capable of the manoeuvre. He was not trained for it, nor licensed as required by Regulations. The manoeuvre proved to be beyond his piloting skills.

This man had left the RAAF and joined an airline, where he was highly regarded. The accident flight was in General Aviation, but in his day job he flew passenger routes. His brother was the pilot whose fatal accident, a decade earlier, is explored in ***Fit to Fly***.

The DMT was meant to "pick" individuals such as this. It seems to have done the job very well. DMT design intent – identify folk who'll make this class of decision – and the *cognitive-fitness-training-will-make-a-pilot-safer* hypothesis, may thus be seen to be at odds. They are not.

One manifestation of the personality trait is the urge to demonstrate, to put on a show. Another is to not recognise the presence of hazard. (That's DMT's forensic focus.) Both were involved in his accident. Less obviously, such people are also *quick learners*. They pick up complex skills easily and quickly and impress their teachers enormously.

This facility for learning seems paradoxical alongside their SA collapse vulnerability.

Those of us who have to labour at learning might well envy pedagogic ease. We have to struggle through the stress and discomfort associated with trying, again and again, to become even half way capable of the skill we want to learn. Sport (golf?) is an obvious

analogy, but it could be anything – take up chess, learn to fly. And the older you are, the more difficult skill acquisition is (and the more stress accompanies the lessons).

The downside of easy and rapid skill acquisition, for those "lucky" enough, is that they *do not gain experience in performing under stress*. Through their life, they bypass the "intense sweaty saunas" other ordinary mortals must work though as they learn. So when the lucky folk do encounter a stress peak – say something badly amiss with the aeroplane – *can't be sure what, but enough to prompt serious anxiety* – they prove unable to perform under the (unaccustomed) stress load.

For such folk, SA collapse if the first casualty of stress.

> The "riddle" of the candidates who DMT marked as likely to fail the pilots' course, but who passed, is easily solved. They learned their way through the information demand "humps" – and thus gave full freedom of manoeuvre to their considerable talents.

v DMT Trial & Decision

DMT tests for denial. Its malignant potential is activated by *decision*. Typically, a hazard alert is ignored; the situation is not read as dangerous. That's SA failure. The DMT identifies the type for whom that cognitive trait can manifest as an accident cause. The accident record provides plenty of evidence of the pathogen at work.

vi Testing

Tests will be carried out in a simple flight simulator. They will not necessarily involve hand flying (eg, for candidates yet to start flight training), but a series of patterns controlled through the autopilot. Other challenges will be introduced. In the early stages, assessment will be subjective, though guided by biofeedback (heart rate).

Existing tests such as Cogstate and Wombat may be used in supplementary roles.

For the young adults typical of candidates for pilot training, the innate fitness state of the SA competencies will have been affected by lifestyle and opportunities for exercise. Testing will set a start point benchmark for each participant. For those who test "low", the training will make up for what they missed in life experience.

vii Trial Technology

The main instrument intended for both testing and training is a flight simulator. As cognitive skills are the focus of interest, there is no need for sophistication. Indeed, even a desktop model will suffice.

In addition, as noted, biofeedback for stress level indication will be employed.

viii Enabling High Impact Training

Flying school preparation, including instructor preparation, are vital pre-requisites.

ix Neuroscience and Learning

The insights into Neuroscience's links to pedagogy are unique. They originate in my experience taking the lead role in the rehabilitation of a pilot colleague after a severe stroke. He'd been a student of mine, and, while he would not cooperate with therapists, he was responsive to my input. I was thus able to direct his rehab exercising.

In doing that, I re-visited my flying instructor references and experience, and began to research Neuroscience, as it relates to stroke victims. For example, stroke victims manifest the same difficulties with decision-making as all humans under intense stress. Further, rehab is about new learning. It has much to tell us about ordinary learning.

> There is too much involved to outline in this planning document. Suffice to say that a booklet, derived from the admixture of Neuroscience and Pedagogy, will be used to guide training design for PrepFly – and to be used to enhance training effects through the pilots' course itself.

x Keith Hendy's SERA

See paper at: https://public.me.com/dougwds