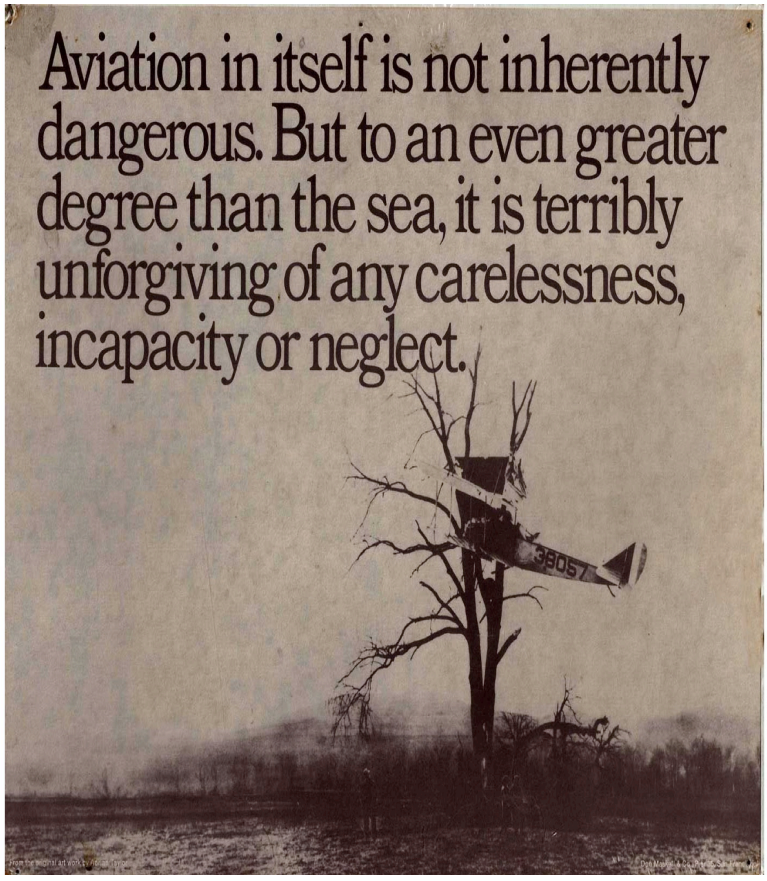
The Enigma of Safety



Digging into the history of aviation development in Australia the question of 'Safety' is at the forefront of just about every document written about aviation.

Indeed, over the past decade or so, safety has grown into an industry of itself and now absorbs considerable resources across every industry. Occupational health and safety is the new mantra in academia. Tens of thousands of pages of esoteric dissertation and philosophical debate fills the Internet, safety has become de rigueur de jour.

But what is Safety? How is it measured?

Wikipedia defines 'Safety' as:

"**Safety** is the state of being "**safe**" (from French sauf), the condition of being protected from harm or other non-desirable outcomes. **Safety** can also refer to the control of recognized hazards in order to achieve an ***acceptable level of risk."***

It is important to realize that safety is relative. Eliminating all risk is not possible, endeavouring to do so would be extremely difficult and exponentially expensive.

A safe situation is one where risks of injury or property damage are low and manageable.

When something is called safe, this usually means that it is safe within certain reasonable limits and parameters. Conversely a choice motivated purely by safety may have other consequences. Australia is a classic example where prescriptive over regulation is driving up compliance costs to the extent where Parts of its industry are becoming unviable and in some instances less safe.

Normative safety is achieved when a product or design meets applicable standards and practices for design and construction or manufacture, regardless of the product's actual safety history.

Objective safety occurs when the real world safety history is favourable, even if standards are not met.

It has always puzzled me that the general public tolerates the yearly death toll on our roads and highways, yet reacts with horror to very rare aviation accident.

But do they really?

How often do we hear our political masters state "The public expects us to impose these restrictions" is this perception really the public's or is it the politicians, or rather the bureaucrats that control them?

The problem with perception is its emotive, public perception can be driven by a sensationist press, or subverted by other agencies and promoted in pursuit of other agendas unrelated to safety. For example our own regulator often promotes itself as the guardians of safety as an excuse for more draconian regulation and as a tool to intimidate politicians to acquiesce to agree to them. Unions use OH&S to drive industrial agenda's unrelated to actual safety.

The perception of safety can be at times quite divorced from reality.

So how safe is aviation?

A little bit of history related to Commercial Air Transport.

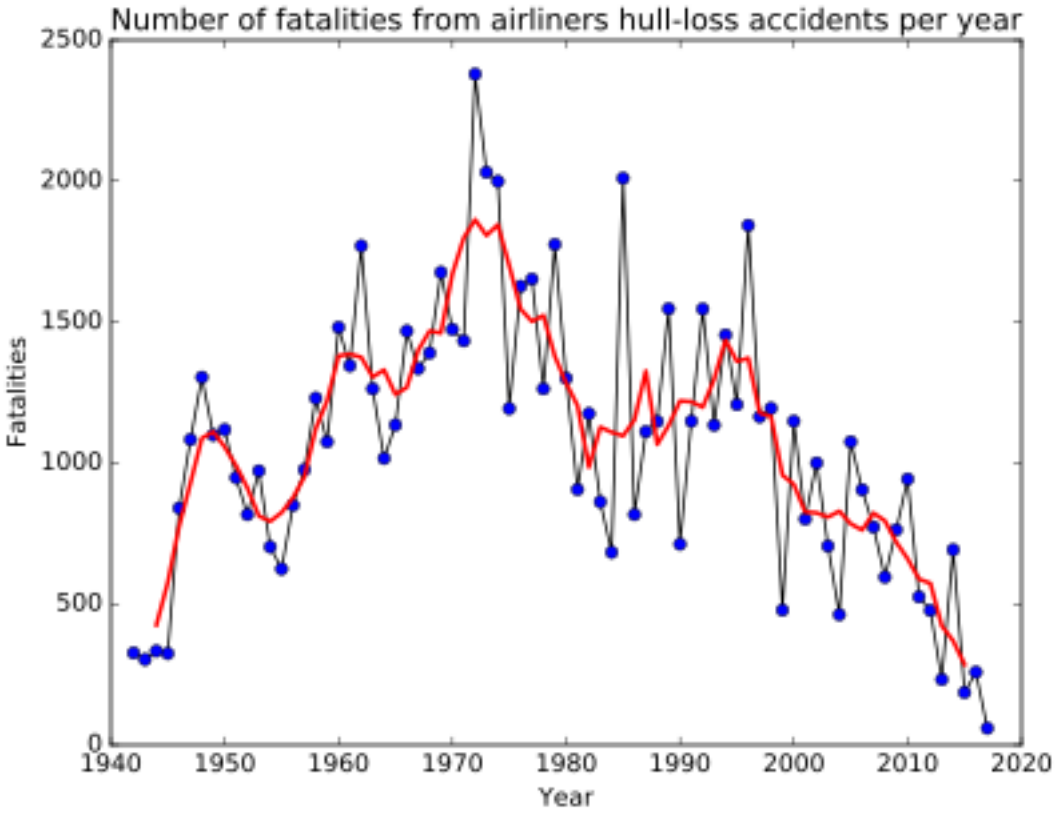
In 1926 and 1927 there were a total of 24 fatal commercial airline crashes, a further 16 in 1928, and 51 in 1929 (killing 61 people), which remains the worst year on record at an accident rate of about 1 for every 1,000,000 miles (1,600,000 km) flown.
Based on the current numbers flying, this would equate to 7,000 fatal incidents per year.

For the ten-year period 2002 to 2011, 0.6 fatal accidents happened per one million flights globally, 0.4 per million hours flown, 22.0 fatalities per one million flights or 12.7 per million hours flown.

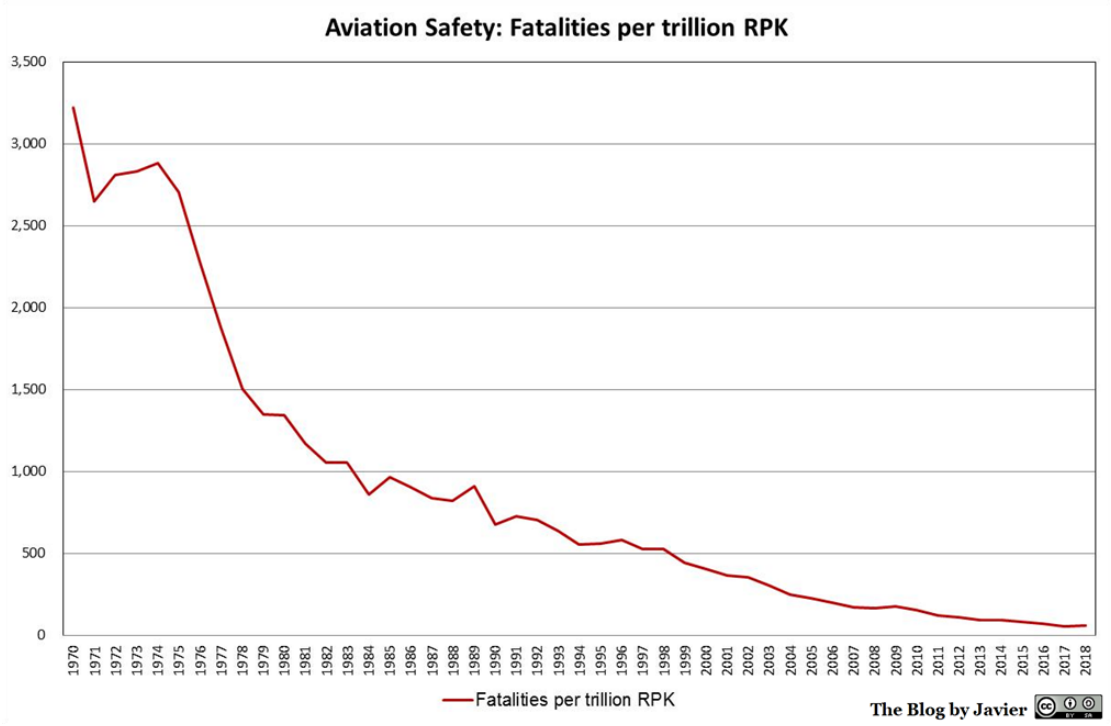
From 310 million passengers in 1970, air transport had grown to 3,696 million in 2016, led by 823 million in the United States then 488 million in China.

In 2016, there were 19 fatal accidents of civil airliners of more than 14 passengers, resulting in 325 fatalities: the second safest year ever after 2015 with 16 accidents and 2013 with 265 fatalities.

For planes heavier than 5.7 t, there were 34.9 million departures and 75 accidents worldwide with 7 of these fatal for 182 fatalities, the lowest since 2013: 5.21 fatalities per million departures.



Yearly fatalities since 1942, 5-year average in red: fatalities peaked in 1972.



Fatalities per trillion revenue passenger kilometers, 1970-2018 (five-year moving average for fatalities)

From UK statistics some interesting transport comparisons.

There are three main ways in which risk of fatality of a certain mode of travel can be measured:

Deaths per billion typical *journeys* taken, deaths per billion *hours* travelled, or deaths per billion *kilometres* travelled.

The following table displays these statistics for the United Kingdom 1990–2000.
Note: that aviation safety does not include the transportation to the airport.

DEATHS PER BILLION			
Type	Journeys	Hours	km
Bus	4.3	11.1	0.4
Rail	20	30	0.6
Car	40	130	3.1
Foot	40	220	54.2
Water	90	50	2.6
Air	117	30.8	0.05
Cycle	170	550	44.6

The first two statistics are computed for typical travels for respective forms of transport, so they cannot be used directly to compare risks related to different forms of transport in a particular travel "from A to B". For example: according to statistics, a typical flight from Los Angeles to New York will carry a larger risk factor than a typical car travel from home to office. But a car travel from Los Angeles to New York would not be typical. It would be as large as several dozens of typical car travels, and associated risk will be larger as well. Because the journey would take a much longer time, the overall risk associated by making this journey by car will be higher than making the same journey by air, even if each individual hour of car travel can be less risky than an hour of flight.

It is therefore important to use each statistic in a proper context. When it comes to a question about risks associated with a particular long-range travel from one city to another, the most suitable statistic is the third one, thus giving a reason to name air travel as the safest form of transportation.

How safe is Safe?

Air travel is the safest mode of mass transportation; your odds of dying in a plane crash are about one in 11,000,000. That's an average of about 110 people per year, and those numbers include private planes and non-crash related accidents in addition to commercial travel. In fact, you're more likely to be struck by lightning, with a one in 13,000 chance for your lifetime.

Fatal accidents do occur, of course, but media outlets give them so much attention you begin to think they happen all the time. Between 1982 and 2010, 3288 people in the US died from aeroplane related causes.

That's an average of about 110 people per year, and those numbers include private planes and non-crash related accidents in addition to commercial travel.

In Australia, 42 people died in air transport related incidents in 2008 and 27 in 2009 and flying is only getting safer. Julie O'Donnell, a spokeswoman for Boeing, explains that fatal accidents occurred once every 200,000 flights in the '50s and '60s. Now, fatal accidents only occur once every two million flights.

It's also important to realise that most aviation incidents are not fatal. Planes lose altitude, slide off the runway and hit extreme turbulence without any injuries. Even if your plane is involved in some type of accident, there's a good chance you'll survive.

The US National Transportation Safety Board estimates there's a 95 per cent chance of survival based on their studies of past commercial aircraft accidents.

Regulation and Safety

Aviation Safety continues to improve as new technology is introduced and initiatives lead by aviation safety partnerships between some regulators, manufacturers, operators, professional unions, research organisations, and international aviation organisations, which further enhance safety

Regulation alone plays only a small part in overall safety.

What is the purpose of regulation? What are we really trying to achieve?

What should the world look like after it has been regulated?

Many "stakeholders" assent to the concept of regulation as a tool to fix a problem, but is there any clear idea about what the outcomes should be?

It is very easy to become enmeshed in the mechanisms and processes of compliance without developing a grasp of the principles underlying regulation, a trap our regulator has fallen into.

With no incentive to examine cause and effect, or unintended consequence they churn out vast volumes of extremely complicated regulation that have no practical purpose, defy common sense and diminish real safety.

I believe regulation should be based on ethical drivers that, if we understand them better, will help direct us towards a more effective, safe and efficient system.

DO MORE REGULATIONS EQUAL LESS SAFETY?

Aviation Business in Australia must comply with a lot of rules. Tens of thousands of pages with more added each year. The chief rationale for these regulations is safety, the only mandate CASA are required to consider.

The underlying principle however is not safety; it is to relieve themselves and the government of liability. As a result they concentrate on writing highly detailed and prescriptive rules in an endeavour to quantify common sense.

There is a phrase used often in the aviation world, "Regulatory Capture".

Generally applied to a regulator being captured by industry. Politically, due to the highly technical nature of aviation the reverse has occurred in Australia with politicians captured by the regulator leading to a failure of oversight. This allows the regulator free reign to impose poorly drafted and ineffective rules that diminish safety rather than enhance it.

The significant drag regulatory compliance puts on the industry and the Australian economy and the burden it places on all businesses, but especially small ones is ignored.

Many, and too detailed, regulations swamp business in unnecessary financial and logistical burdens, resulting in reduced compliance, discourages innovation, and fuels uncertainty which diminishes participation and investment, ultimately making Australians less safe.

REGULATORY OVERLOAD

Psychology, economics, and organizational science, suggest that too many regulations—particularly highly detailed regulations—may make society less, rather than more, safe.

A Behavioural Analysis of Regulatory Compliance, occupational psychologists and economists look at the behavioural effects of regulatory overload on businesses.

They find that incoherent and excessive regulation can diminish individuals and businesses ability to comprehend basic principles and apply them in everyday judgments. A culture of dependency can result. Increased regulation of an undirected kind does indeed make matters worse.

Reduced Compliance. Workers subjected to too many rules—some of which are overly complex, contradictory, out-dated, or inapplicable to their specific jobs—often forget, cannot prioritize, or simply ignore many of them.

Helpful rules become harmful if they obscure more important rules. For example, road signs announcing important, but relatively minor risks can distract a driver long enough to miss the stoplight.

The Australian Regulator often try to address a wide range of situations by writing very detailed "command- and-control," or prescriptive, rules.

The length and legalistic language of the regulations make it hard for businesses to decipher if, or how, these rules apply to them.

The rules that do apply directly often fail to capture the complexity of the problems businesses face.

Even if there has been full regulatory compliance, if something bad happening in the industry or a specific business it often spurs even more rules and exceptions, further increasing the complexity of, and difficulty of complying with, the parts of the regulatory code applicable to each situation.

When workers no longer see regulations as a means of promoting safety, they are less likely to comply; when they do comply, they often focus on passing audits, rather than improving safety.

Workers who see an increasing number of regulations as irrelevant to their jobs become less motivated to comply with any of the rules.

Less Innovation.

When there are too many rules, particularly command-and-control rules, businesses may respond by becoming rigid and reactive.

Instead of anticipating and addressing safety concerns, businesses become so preoccupied with following the rules that they fail to pursue innovative solutions to improve safety. The failure to innovate leads to more mistakes, which spurs more regulations, less innovation, less safety, more mistakes, another round of rules, and so on. In addition:

- When something unexpected happens, reactive businesses are less capable of solving problems. Instead, they simply wait for officials to tell them what to do.
- Financially, it often is more cost-effective for firms to invest in legal experts, to ensure regulatory compliance at the lowest possible cost, than in experts who can find the best solutions to the business' specific challenges.
- Attempting to comply with too many rules is harder for small businesses. Large businesses manage by complex internal procedures and can dedicate resources to compliance. Small businesses without internal bureaucracies must be as flexible as possible and cannot arrange their business around rigid external rules.
- When large businesses lobby to have their procedures adopted as rules, small businesses bear a disproportionate compliance cost—at least 30% higher per employee—and may be priced out of the market. This reduces competition and innovation, both in general and in the realm of safety.

Increased Uncertainty.

Businesses face an on-going climate of uncertainty fuelled by too many vague, broad, and overly complex rules. This uncertainty suppresses investment and growth across the economy, and is particularly harmful for small businesses.

- The sheer volume of rules on the books today creates uncertainty; but the situation is made much worse by the fact that no rule ever is "final." Particularly when regulators use command-and-control techniques, there will be more rules that change more often.

Uncertainty often leads to paralysis. Businesses delay investments, even in safety improvements, so as to see what regulators will do next. For example, a business might not install new equipment because regulators might later specify a different, though not necessarily better, technical standard.

A better way

- "Goal-based regulation" does not specify the means of achieving compliance but sets goals that allow alternative ways of achieving compliance, e.g. "People shall be prevented from falling over the edge of the cliff". In "prescriptive regulation" the specific means of achieving compliance is mandated, e.g. "You shall install a 1 meter high fence at the edge of the cliff".
- There is an increasing tendency in the real world to adopt a goal-based approach to safety regulation, and there are good technical and

commercial reasons for believing this approach is preferable to more prescriptive regulation. It is however important to address the practical problems associated with goal-based regulation in order for it to be applied effectively.

- The Robens Report [Robens 1972] and the Cullen Enquiry [Cullen 1990] were major drivers behind the UK Regulatory agencies exploring the benefits of introducing goal-based regulations. The reports noted several shortcomings with prescriptive safety regulations.
- Firstly, with prescriptive regulations, the service provider is only required to carry out the mandated actions to discharge his legal responsibilities. If these actions then prove to be insufficient to prevent a subsequent accident, it is the regulations and those that set them that are seen to be deficient. Thus safety is viewed as the responsibility of the regulator and not the service provider whose responsibility, in law, it actually is.
- Secondly, prescriptive regulations tend to be a distillation of past experience and, as such, can prove at best to be inappropriate and at worst to create unnecessary dangers in industries that are technically innovative. It is the innovator that is best placed to ensure the safety of their design, not the regulator. Clearly prescriptive safety regulations are unable to cope with a diversity of design solutions.
- Thirdly, prescriptive regulations encode the best engineering practice at the time that they were written and rapidly become deficient where best practice is changing e.g. with evolving technologies. In fact it is quite probable that prescriptive regulations eventually prevent the service provider from adopting current best practice.
- Another driver for adopting goal-based regulation, from a legal viewpoint, is that overly restrictive regulation may be viewed as a barrier to open markets. Various international agreements, EC Directives and Regulations are intended to promote open markets and equivalent safety across nations. Whilst it is necessary to prescribe interoperability requirements and minimum levels of safety, prescription in other areas would defeat the aim of facilitating open markets and competition.
- Finally, from a commercial viewpoint, prescriptive regulations could affect the cost and technical quality of available solutions provided by commercial suppliers.
- So there are clear benefits in adopting a goal-based approach as it gives greater freedom in developing technical solutions and accommodating different standards. However, in order to adopt a goal-based approach, it is necessary to provide a coherent and convincing safety justification.

SOLUTIONS

In the attempt to better protect the government from liability CASA write ever more, and ever more prescriptive, rules. But evidence suggests that constantly expanding the regulatory burden has the opposite effect: the difficulty of complying with such complex regulations makes Australian aviation less safe.

Simplifying and clarifying the regulatory code would go a long way toward improving safety.

Specifically, CASA have proved themselves very inept at writing regulations, at the very least they could eliminate rules that are no longer needed, simplify the rules and write them in plain English with clear compliance priorities.

They also could focus on defining required outcomes, rather than detailing activities and focusing their priorities on limiting liability. This would return to businesses and workers the behavioural and financial incentives to find the best solutions for their specific, ever- evolving set of challenges to improve safety and the responsibility to do so.

Of course the logical thing they could do, is accept they have completely failed in the vision government set for them and do as New Zealand did.

If improvement in Safety outcomes is their primary goal, if a viable and growing industry is their objective;

Embrace the safest, simplest rule set in the world, the US FAR's.

The benefits of doing so;

- We would improve safety. The USA has far better safety outcomes than we do.
- We would align ourselves with our primary supplier and as New Zealand regulations have spread throughout our region, align ourselves with our neighbours instead of sticking out like a sore thumb as the odd man out.
- Compliance costs would be dramatically reduced without compromising on safety, enabling industry to invest in new equipment and training which would improve safety.
- Unshackling industry would dramatically lower costs, opening the way for greater participation and therefore growth, commensurate with a greater contribution to GDP.

CASA has already expended upwards of half a billion dollars and over thirty years on their regulatory reform program to achieve an industry in severe decline for no quantifiable improvement in safety.

New Zealand modelled their regulations on the US FAR's and took a couple million dollars and a couple of years to complete the transition. New Zealand's industry is vibrant and growing, Australia's is dying.

The Paradox in all this is, CASA says it regulates the way it does to keep the Australian public safe.

If that is their statutory responsibility, as they go to great pains to promote, and Australia is the safest, Why are "Less Safe" foreign operators allowed to fly into Australia? And why do so many Australians travel on foreign airlines?

Could it be that their perception of “Safety” is not quite as intolerant of risk as it is painted or somehow they are not aware.

Some years ago CASA were going to require General aviation operators to brief passengers that they were about to board a less safe aircraft.

Should therefore there be large signs posted in International terminals that flying on foreign carriers is less safe than Australian ones?