Administration of a safety system: further lessons from Mt Erebus?

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In any modern, high technology system, assuring its safety (i.e., an acceptably low risk of injury or death of users) itself constitutes a system, albeit with many elements less palpable than the technology itself. Developing such safety systems was first found to be necessary with the railways, and the necessity is even greater for aviation. Such a system must necessarily be administered, allowing human weakness to adversely influence its efficacity.

1. INTRODUCTION

In 1979, an explosion was heard in the icy wastes of Antarctica. Its echoes were heard in law courts in New Zealand and around the world; the ensuing scientific investigation, including at least one doctoral thesis, improved aviation safety; I shall argue that such science, with its clear methods and transparency, is even more needed today.

Declarations of "interest" are now commonplace in published research papers; if there are none, many journals demand an explicit statement to that effect. Presently, aviation is bedevilled with the preponderance of commercial interests over those of safety, replete with informal "risk assessments" from unqualified managers and from accountants whose expertise lies in a very different area. In aviation circles this is termed "profits over safety".

Using the topic of cabin air, the question is asked, "How are the safety issues learned after Erebus re-emerging?" Using the philosophies of Hannah Arendt and Michael Polanyi and the more recent experiences of James Robert Brown and David Healy, I pose the question, "What administrative mechanisms may allow potential mistakes (latent conditions) to remain unrecognized within the aviation safety system?"

2. THE THINKING BEHIND ADMINISTRATIVE STRUCTURES

2.1 Administration often based on science

Philosophy has given rigour to the thinking behind many human activities. Here, it will be applied to the administration of aviation safety systems, which are based on the premiss that objective science lies behind decision-making. Observation and measurement are central tenets of objective science, albeit that even early scientific endeavour recognized that unmeasurable features could also be important [1].

Political theorist Hannah Arendt (1906–1975) is possibly best known for her comments on the trial of Adolf Eichmann, a Nazi war criminal. Nazi crimes could not have succeeded on the scale they did without a complex system of scientific administration. Regarding science, Arendt notes [2]:

> The action of the scientists, since it acts into nature from the standpoint of the universe and not into the web of human relationships, lacks the revelatory character of action as well as the ability to produce stories and become historical, which together form the very source from which meaningfulness springs into and illuminates human existence.

In other words, science may be objective and sound, yet its application may be meaningless (or worse) unless the sanctity of life is held at its centre.[1] She had expected to observe a tyrant, a malevolent being. Instead, Eichmann appeared as "a dapper little man with clean fingernails". She thought him rather banal [3]. Indeed, one deposition at his trial was from Otto Winkelmann, a former senior SS police leader in Budapest in 1944. He stated that "[Eichmann] had the nature of a subaltern, which means a fellow who uses his power recklessly, without moral restraints. He would certainly overstep his authority if he thought he was acting in the spirit of his commander [Adolf Hitler]" [4]. Eichmann was not on trial for the personal assassination of millions of Jews. Rather, his crimes were those of a bureaucrat—an administrator. Arendt was forced to challenge the common view that criminals must in some way look evil. She coined the term "the banality of evil" to describe the administrator's being and activities. Incidentally, Eichmann was said to be,

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[1] A personal anecdote may suffice to illustrate this point. This is regarding a conversation with the Civil Aviation Authority (CAA) regarding my late husband's premature death from a heart attack after a particularly stressful flight. He was the Captain of a Boeing 747 and the events on the aircraft had distressed him so significantly—the police called it "an altercation"—that he went white. I added, in exasperation, "what if the heart attack had happened during landing?"—I had the crash at Staines in mind. The answer was, "the First Officer would have taken over." While from a safety systems standpoint this is correct, the man forgot that he was talking to a new widow and a more appropriate answer would not have sounded quite so coldly psychopathic. What is the point of a safety system unless it takes into account human values?

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initially, physically sickened by the sight of concentration camps. One might say that he became culpable the moment he overcame this revulsion. In any case, as Arendt has noted, it is easier to act than to think.

2.2 Science can be subordinated to authority

Michael Polanyi (1891–1976) was a physical chemist, economist and also concerned about administration. His thinking was that no matter how valid the science, it was the context of the science and how it was administered that either achieved results or failed; he had occasion to note, "Far from teaching that science is practised by a strict code of impartiality and openness, the episode discloses the rôle of authority in the work of science" [5], which was also investigated by Milgram [6]:

> The purpose of the inquiry described here was to study obedience and disobedience to authority under conditions that permitted careful scrutiny of the phenomenon. A person was told by an experimenter to obey a set of increasingly callous orders, and our interest was to see when he would stop obeying.

This study revealed that it is surprisingly easy to make ordinary people obey callous orders. The proximity of the victim was found to influence behaviour; "possibly, it is easier to harm a person when he is unable to observe our actions" [6]. Polanyi was disappointed with a system that tacitly ignored the science (i.e., the observation and the experience) yet supported personalities with temporal power. Here we see a clue how administration may distort espoused safety aims.

2.3 Even "objective" observation can be theory-laden

A look at the principles behind administrative practice reveals the association between objectivity and the socialization of research. Brown has asserted that [7]:

> One of the great lessons of philosophy of science during the second half of the twentieth century is that observation can be theory-laden. Our prior beliefs, hopes, and expectations can significantly condition our cognitive faculties in such a way that we see what we expect to see.

He recognizes that prior belief influences outcome. For example, you may believe that you observe a mountain in the distance because it is on a map in that position; however, might it simply be cloud cover? The answer is an interpretation of what is seen. An administrator may, in obedience to authority, truly believe that Jews were responsible for his country's poverty. Only the banal administrator would accept that (or, indeed, anything) at face value. And, as we shall see, pilots who are at the controls of an aircraft when it crashes may have had reason to interpret what they saw as something different from reality.

2.4 Conflict of interest distorts "results"

A situation in which prior belief can influence outcomes is where latent conflicts of interest exist. Healy has called attention to such conflicts in the relationship between academia and industry, which can engender a violation of academic freedom [8]. He has brought the problems to the attention of American and British regulators and has raised awareness of "how pharmaceutical companies market drugs by marketing diseases and co-opt academic opinion-leaders by ghost-writing their articles" [9]. Those who administer this system bear some of the responsibility for the outcomes, which might be death by suicide of patients who are administered certain drugs. Healy describes two cases, that of Olivieri and his own, where the official response to attempts to uphold academic freedom in their respective universities was the termination of their contracts [8]:

> The e-mail message from the University of Toronto rescinded the contract I had with the university, stating that "Essentially, we believe that there is not a good fit between you and the role as leader of an academic program in mood and anxiety disorders at the Center. While you are held in high regard as a scholar of the history of modern psychiatry, we do not feel your approach is compatible with the goals for development of the academic and clinical resources that we have. This view was solidified by your recent appearance at the Center in the context of an academic lecture."

The University of Toronto compared Healy's "speaking out about the hazard of drugs to someone screaming 'fire!' in a crowded theatre. The implication is that some people may be hurt in the stampede to the exit" [8]. But, as Healy asks, "what if there *is* a fire in the theatre?" Similar dynamics are seen in the aviation world where those who call "fumes!" are deemed to be putting the industry at risk. This is ironical from the standpoint of crews and passengers who have been injured. Healy goes on to state that [8]:

> In both the Olivieri and Healy cases what is involved is a contrast between the values of science and the values of business. The clinical trial data that results from pharmaceutical company trials today is proprietary data. As long as this data remains unavailable to public scrutiny, it cannot be called scientific.

With that, Healy exposes the lie of an "objective" science that purports to substantiate the industry's decision-making. This is no unconscious action but one based on considered thought.

2.5 Funding can distort "results"

A change has occurred in methods of funding research. This has altered the dynamics of the system and Brown notes how unsafe distortions are now appearing [7]. They occur through suppression of information, nondisclosure of conflicting interests, skewing research toward the patentable, and deliberate ignorance [7]:

> Refusing to take action on the grounds that there is nothing but "anecdotal evidence" is not only bad philosophy of science; it borders on the criminal. Even the Nazis established the smoking–lung cancer link in the 1930s. Commercial interests elsewhere stood in the way for decades, during which millions died.

Thus, banal administrator can forego the precautionary principle, so needed in aviation, in favour of commercial gain. Where there are disputes, the banal administrator will demand 100% proof (whatever that means) because s/he hasn't the capacity, the authority or the imagination to consider the alternative.

2.6 The nature of evidence

Historians have pointed out that witness-testimonies are of foremost importance, as they assist in closing gaps left by documents, but may be used as equals to documents and appraised with valid results only if certain principles are obeyed, above all the basic one requiring that the link between testimony and critically validated documents shouldn't be abandoned whenever possible; that is, the most probable fact must be linked to the certified fact [10].

Doubts were voiced in 1955 regarding the safety of engineering bleed air into the air-conditioning systems of aircraft. Anecdotally, those who raised concerns were subjected to *ad hoc* marginalization by the subalterns of companies. However, Milgram's notion of proximity can break down in some circumstances.[2]

With all these potentially distorting factors can contemporary private research be trusted? Academic research is traditionally subjected to checks and balances in the form of peer reviews [11]. For those unfamiliar with the process, when a report submitted for publication arrives at the editorial office of a journal, it is first vetted by the editor, who may reject it out of hand—either because it is "out of scope" (not dealing with the right subject matter for that journal) or because it is manifestly of such low quality that it cannot be considered at all. Papers that pass this first hurdle are then sent to experts ("referees") in the field of the paper—at least one, usually two—who are asked to classify the paper as immediately publishable, publishable with amendments, or not publishable. The middle decision is the commonest and in that case the referees suggest the nature of the improvements that they consider are required. It is widely agreed that this process maintains the overall quality of the scholarly literature; as many as 80% of published papers receive some revision. If two referees disagree, the paper may be sent to a third, or the editor may adjudicate between them. The referees may be members of the journal's editorial board, if they have sufficiently specialized knowledge of the paper's field, or may be others chosen from a list of experts known to the editor. Privately undertaken research, whether carried out in a company or in an academic laboratory, may be subjected to no such checks and balances before publication—if it is published at all. Brown points out that "whether we attribute [distortion] to the theory-ladenness of observation, or to outright fraud, or to some more subtle form of corruption doesn't really matter." Reliable research requires full public funding with no profits, no patents and no strings attached [7].

2.7 Recapitulation

So far, philosophy offers us these thoughts:

- It is easier to act than to think
- Science may be "objective" and "sound", yet its application is open to meaningless reinterpretation unless the sanctity of life is held at its centre
- No matter how valid the science, it is the structures—the context of the science and how it is administered—that determine what action ensues
- The values of science and the values of business differ
- Organizations can espouse faulty prior beliefs that influence outcomes because there are few safeguards.

[2] I am in communication with a pilot who, while still employed by his company, is neurologically damaged; he cannot fly. His airline doctor has been "treating" him without recourse to a toxicologist; his health remains poor. Since visiting the Aerotoxic Association website he began to understand that he had been misdiagnosed. On broaching this with his physician, the latter agreed with him but said that he was afraid of losing his job if he acknowledged aerotoxic syndrome. This conflict of interest is probably replicated by good doctors across the globe. I say, "good doctors" without irony. Presumably they did not enter the medical profession in order to set about misleading their patients. They have the dilemma of needing to serve two masters, their own integrity versus the airline's business integrity. A conflict of interest lives within them.

Furthermore, there are, or we have:

- Latent conflicts of interest in the relationship between academia and industry
- Increasingly, "science" without a strict code of impartiality and openness
- Data remaining unavailable to public scrutiny
- Distortions appearing through the rôle of authority in the work of science
- Violations of academic freedom.

The individuals who administer such a system may:

- Use power recklessly, without moral restraints
- Lack proximity (protects the conscience)
- Ignore anecdotal evidence
- Reinterpret (influencing outcome).

Any decison-making that flows from business-led assertions move outside the validated zone of a scientifically-led safety system.

For Arendt, what determines the administrator's interpretation of data and subsequent actions is a matter of strength of character. In the case of Eichmann, his character was banal and the results were horrific. For Brown, organizations are able to maintain faulty prior beliefs that result in bad outcomes because there are few safeguards. Sagan adds, because there are few discoverable safeguards (ref. 12, pp. 207–211). Here we are dealing with the anonymous face of the bureaucrat whose proximity to the victim is remote. For Healy, scientific values and business values are contrasted. While data remains unavailable to public scrutiny it is not scientific and any decison-making that flows from such data remains outside a safety system.

3. EARLY LESSONS FROM MT EREBUS: AN ACCIDENT, A REPORT AND A COMMISSION OF INQUIRY

"On 28 November 1979, an Air New Zealand DC10 airliner crashed into the northern flanks of Mt Erebus while on a tourist flight over Antarctica. All 257 people aboard died instantly" (ref. 13, p. 22). At that time the system of investigation was littered with conflicting interests and the crew took the blame. Initially, the notion of ethical treatment of the dead crew and their families was not considered. Captain Gordon Vette, a pilot with Air New Zealand, alludes to colleagues "within the airline whose views I had to strongly oppose" (ref. 13, p. 12), the purpose of which may have been more to do with distancing themselves psychologically rather than informing the safety system. Initially, no safety lessons were learned; a culture of blame reigned. A report and an inquiry examined the dynamics of apportioning blame; the latter began to introduce meaning, in Arendt's sense, into the argument.

3.1 The Chippingdale Report (30 May 1980)

Capt. Vette's critique of this report (ref. 13, pp. 300–326) is as follows: Ron Chippingdale was New Zealand's Chief Inspector of Accidents. He "had no expertise in the piloting or navigation of sophisticated airliners ... [and relied] on verbal hearsay" (ref. 13, p. 9). He asserted that the DC10 Captain, Jim Collins "had erred by continuing the flight at low level" and First Officer Greg Cassin was "criticized for failing to adequately monitor the flight because he was engrossed in trying to establish radio contact" (ref. 13, p. 22). Further, "the report blamed the pilots and exonerated the administration of the airline" (ref. 13, p. 325), whose management had been confident that the subsequent commission would endorse the Chippingdale Report. This was the context for the subsequent inquiry headed by Justice Mahon together with two barristers, David Baragwanath and Gary Harrison.

Vette put to one side the Chief Inspector's views. As Justice Mahon was to say later, "This was a prophetic act, because during my enquiry the Chief Inspector's views gradually came to be discarded by everyone except Air New Zealand and his own employers ... [which made] him so unpopular with the Chief Inspector and with the company management" (ref. 13, p. 10).

3.2 The Royal Commission (The Mahon Report, 1980–81)

Evidence came to light that demonstrated that such accidents as that on Mt Erebus have their source in decisions made very many miles away from the accident site. "The navigation staff of the Company, on the eve of the flight, had altered the computer track 27 miles to the east, without informing the crew" (ref. 13, p. 8). In consequence, the aircraft was programmed to fly on a collision course with Mt Erebus. Unluckily there was a whiteout around the mountain at the time of flight. The combination of these two factors made the accident all but inevitable.

The Mahon Report (ref. 13, pp. 217–276) put the blame squarely on the airline; the original notions of blame were thwarted and the pilots were posthumously exonerated. In the chapter called *The Stance Adopted by the Airline Before the Commission of Inquiry,* Justice Mahon further stated:

> "in this case the palpably false sections of evidence which I heard could not be the result of mistake, or faulty recollection. They originated, I am compelled to say, in a predetermined plan of deception. They were clearly part of an attempt to conceal a series of disastrous administrative blunders and so, in regard to particular items of evidence to which I have referred, I am forced reluctantly to say that I had to listen to an orchestrated litany of lies."

However, Mahon was considered to be going beyond the Commission's scope in making these remarks. The statement had not been put to the defendants and was therefore not defended. Because of the magnitude of the disaster a judicial review followed and gave redress to these comments because they were "contrary to law, in excess of jurisdiction and in breach of natural justice" [14].

4. A FURTHER LESSON FROM MT EREBUS

A further systemic failure only become apparent much later. Justice Mahon was asked:

> One of the confusing things about the Erebus case was that involved in it was the Government, one of its Departments, a major state enterprise run by Government appointees, all of them under scrutiny all of them with something to say, did that make it more complex for you?

to which he responded [15]:

> "That type of situation always makes an enquiry complex where some disaster or scandal involving some Government agency and the procedure adopted by some Governments, the United Kingdom in particular, is to set up such an enquiry, then wait to see what the findings are. If the findings are in favour of the Government it warmly supports the report ... on the other hand if the findings implicate ... some Government agency, then the tendency is for the Government of the day to reject the report and they will say that it is wrong. This does not happen in Australia of course, but ... in England and New Zealand, such an approach is in accordance with the hallowed traditions of the Westminster style of government."

Thus, a senior judge uttered an indictment of the use of administrative structures where a developed safety system was lacking. This historical context is important. Now, should a Government minister attempt to act in a way that overrides the science, there is redress. Checks and balances are still available in the form of a judicial review.

The purpose of including management factors in the aviation safety system is to obviate future accidents and incidents. The context within which a pilot works, whether s/he is being bullied or not, supported or not, may introduce unnecessary stressors [16]. In the next section, a physical stressor, the inhalation of noxious fumes, is outlined.

5. A CONTEMPORARY AIR SAFETY ISSUE

We are committed to "learning by trial and terror", as Scott Sagan observes, even though "solutions to most organizational problems are known somewhere in the organization" (ref. 12, p. 210). In the age of the Internet, the terror experienced by two pilots paralysed by noxious fumes in the cabin air is publicly accessible [17]:

> Flight BU925 between Stockholm and Malmö was saved by the fact that it was still a few thousand feet above ground when Captain Niels Gomer and his co-pilot were completely incapacitated by a mysterious toxic gas. Otherwise the aircraft would probably have crashed with 73 people on board.
>
> "There's no doubt that this was the worst thing I've experienced in my whole life. Once I began to feel ill, things happened extremely quickly. If I hadn't managed to get my oxygen mask on in 15 seconds, I would never have succeeded in getting it on. I was so ill that I couldn't even lift an arm".

Accident investigator Olle Lundström found that "According to the crew, several of the passengers were in a zombie-like condition"; the Swedish accident investigation board concluded that "contaminated cabin air was probably the cause of the near-accident."

The 2011 Cranfield Report [18]. This report, of a study commissioned by the UK Department for Transport, purported to demonstrate that the concentrations of neurotoxins and other noxious substances in aircraft cabin air were below the danger thresholds.[3] In his peer review of the work, Prof. Roy Harrison, of the Division of Environmental Health and Risk Management, University of Birmingham, states [19]:

> There is ... one issue which appears highly unsatisfactory. The method for sampling both volatile organic compounds and semivolatile organic compounds (the organophosphate esters) involves pumping air through stainless steel sorbent tubes packed with quartz wool and Tenax TA. This is a fairly standard tube for sampling volatile organic compounds and is likely to have proved reliable for this purpose. It is, however, wholly untested for the sampling of organophosphate esters, and for semivolatile compounds more generally. There are two problems associated with its use for organophosphate (OP) esters. Firstly, the OP esters have rather high boiling points and are hence likely to be partitioned mainly onto airborne particles. The Tenax traps will not be efficient collectors of airborne particles and the residence time is likely to be insufficient to ensure desorption to the Tenax. Secondly, the OP esters are rather polar compounds, in comparison to the hydrocarbons which are of low polarity. Consequently, for this

[3] See the paper by Murawski and Michaelis, this issue, pp. 147–151, for a critique of the Report.

> reason also, the Tenax may not be an efficient collector of OP esters. In this context, it is surprising that the report gives no justification of the selection of this sampling method and more seriously gives no evidence of its efficiency for the collection of OP esters ... Consequently, there is every reason to believe that the Tenax tubes are likely to be markedly inefficient for the sampling of OP esters and consequently the lack of sampling efficiency studies conducted on airborne samples is a very serious deficiency. This is particularly so as some of the major concerns surrounding fume events in aircraft cabins focus upon the possible adverse effects of exposure to OP esters.

In his conclusion, Harrison states: "there are serious weaknesses both in the sampling of OP esters and in the analysis of continuous measurement data which substantially weaken the overall impact of the report. Otherwise, the points raised are relatively minor, but nonetheless should be given attention in drawing up the final version of this report."

Peter R Jackson, Consultant in Clinical Pharmacology and Therapeutics and a member of the UK Committee on Toxicity (COT), states in his peer review [19]:

> It is important to stress that its results have little bearing on the exposure to volatile organic compounds and semivolatile organic compounds in reportable fume events, the basis of the suggested second component. The absence of any such reportable events in the 100 flights investigated may tell us something about the frequency of such events but with the small number of flights sampled and the lack of information about the selection of the flights used for investigation and whether this is representative of the airline industry as a whole the interpretation of this is difficult.

Plainly, these are not impressive endorsements of the Cranfield Report. Despite these comments, and the fact that they appear to apply to the final, published version of the report as much as to the draft that was reviewed, the Cranfield Report has been widely interpreted as providing evidence that "no pollutants such as tricresyl phosphate (TCP) were found in cabin air at levels exceeding health and safety guidelines" and is cited as giving reason to denying the existence of aerotoxic syndrome, even though, within the industry, there is awareness of a potential health and safety problem; in the Terry Williams case, bleed air was mentioned as a contributory factor to her illness [20, 21]. As the case developed, Boeing turned over 250,000 pages of documents dating to 1954 and 1955 that showed the company was aware of cabin air contamination and had sought detection and filtration systems to combat the problem; concern among executives that there could be health hazards related to exposure to toxic fumes when oil leaks into bleed-air systems was also documented.

6. WHITHER HENCE?

It is unfortunate that much apparently relevant data is not available for scrutiny. Michaelis notes [22]:

> Over the years, the highly regulated aviation industry has developed a very sophisticated documentation process that is used in order to record activities and ultimately ensure aircraft are operated in a safe or airworthy manner. Some of this information relates to problems the industry has with oil leaks and contaminated air events and the consequences of such exposures. Much of these data are inaccessible and commercially confidential.

As pointed out in §2.4, scientific reasoning relies on publicly accessible data and generally accepted rules of reasoning. If these conditions are not fulfilled, inference is unreliable and may be downright misleading. Unless he or she has had same scientific training, a politician may not realize the importance of such stipulations. The UK Minister of State for Transport, Theresa Villiers, has asserted that "the Department will always take the health of persons on board aircraft very seriously and I hope the publication of this thorough and independent analysis by Cranfield University will provide reassurance on this issue" [23].

Administrative mistakes do not cause deaths in the office; office managers usually do not see the death and destruction they cause, they are distanced from the downstream effects. Here, Milgram's proximity theory is seen in action. Yet, currently, pilots are being denied the necessary tools to inform their decision-making. Rather, their incapacitation is addressed thus: "Symptoms reported by some crew members who have been exposed to fumes in the cabin are similar to those seen in chronic hyperventilation" [24]. Was this a fully-researched, transparent, scientific conclusion or an *ad hoc* utterance? Now, neurotoxins have been found in the blood of injured pilots.[4]

The question is how our administrative systems—including regulators, governments and commercial interests—manage to propagate denials. Like the case of the holocaust deniers in Germany, administrative deniers should be made accountable. Delays in solving this problem add to the numbers of injured crew and passengers every day.

[4] This was following the co-pilot's collapse with nausea from oil fumes in the cockpit air on an Air Berlin flight from Milan Malpensa to Düsseldorf in November 2011. The German accident investigator (BFU) took the unprecedented step of sending a blood sample from the co-pilot for analysis at the University of Nebraska, where TCP was found. See http://www.flightglobal.com/blogs/learmount/

7. CONCLUDING REMARKS

In the business model of thinking the bottom line is seen thus [25]:

> Profit is the amount of money a company earns during a given fiscal period. It is calculated by subtracting from revenue all of the costs incurred during the fiscal year. For example, if a lemonade stand sold their product for $0.10 per cup, it cost $0.05 to manufacture, $0.01 to pay the employee who is running the stand, and $0.01 to pay taxes, the profit is $0.03. It is what is left over after all of the expenses have been paid. This is the measure of true success, how much money a business generates for the owners. Profitability is measured by return on equity and return on assets.

Where an airline owner follows the business model in preference to the safety model we see the conflict described in §2 in action. This preference was seen early in the history of aviation. As a result of increasing accidents, the regulation of safety was becoming an increasingly urgent need on both sides of the Atlantic. In 1926 the aviation industry in the USA pressed Congress to set safety standards. The Federal Aviation Administration (FAA) and its counterpart in the UK, the Civil Aviation Administration (CAA), grew from this need.

Attorney and former Inspector General of the US Department of Transportation (and herself a pilot) Mary Schiavo admitted that when safety was first addressed, (through the introduction of the FAA and CAA) no-one could see the oddity of the airline business regulating itself. She states that this "dual mission did not leap out at anyone in 1958 ... as a glaring paradox" because "at its core safety isn't cost effective." With deregulation the industry thrived but no one person monitored the downside—what Schiavo calls "destructive competition" [26]. The term "Economic Regulation" (the CAA's remit) is, therefore, an oxymoron.

The airline manager is in a double bind. "Effective accident prevention can be linked inalterably to effective management" [27]. Observations reveal that, organizationally, "accident prevention" (the safety system) and "commercial management" (the business model) are two polarized aspects of airlines. In practical terms the former is mainly the remit of aircrew and the latter is mainly the remit of managers. Psychologically this is an unhealthy split—like the psychological concept of splitting in the individual, this organizational split is a process by which a structure loses its integrity and becomes replaced by two or more part-structures. That is, it becomes fragmented. The business aspect may not comprehend the importance of pilots who are now reporting that they are being overcome with fumes in aircraft cabins, increasing the risk to aircraft; and may therefore resist making it public.

One of the factors in the Dryden crash was that the president and chief executive officer operated in "the entrepreneurial management style of a man who has built his company from a small family business." This style weakened the safety system. When questioned, an Air Canada representative explained a significant difference [28]:

> I would define it basically as being able to make a lot of decisions often by oneself very quickly as opposed to, in our corporation [with which they had merged], where most decisions were run through various committees with a lot of studies to back them up and that type of thing, often a gut-feel-type decision-making as opposed to one backed up by extensive study—and vetting—at various levels by various experts, because there simply weren't the experts around and the experts weren't needed in that environment.

The representative himself [28]:

> on the other hand, came from an organization where consensus, extensive study, various levels of approval, checks and balances existed, and that was simply not necessarily the style in an entrepreneurial environment ... I spent some considerable time within our corporation counselling our senior management members on why decisions were taken and what was behind them ... there was a dichotomy back and forth, and that took place over a period of several years.

Pilots have continuous training in safety. Their proximity to accidents is closest. However, aviation history demonstrates that pilots' concerns (whistleblowing) are often not welcome. The history of aviation is replete with such examples; airline managers are not examined or trained in the history of aviation safety as pilots are. They may still consider that finances, rather than safety, are the bottom line.

The point is that commercial risk, part of the business model of running a company, becomes operational risk, where unintentional safety deficits enter the system. "From a corporate perspective, the commitment to safety management was, in the years preceding the Dryden accident, largely cosmetic" (ref. 28, p. 1135). For business managers, the bottom line is profits; for crews, the bottom line is injury or death.

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