

Pilots, Controllers and Mechanics on Trial: Cases, Concerns and Countermeasures

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Abstract

This paper examines criminal prosecutions of pilots, air traffic controllers, and maintenance technicians in the wake of aviation incidents and accidents worldwide, which points to an accelerating criminalization trend over the past fifteen years. It examines the concerns surrounding criminalization by considering its wisdom, fairness, and utility, taking into account the consequences for both the affected individual and the aviation industry as a whole. It concludes by reviewing the diversity of countermeasures that are currently being developed in aviation and assesses the possibility of mitigating the criminalization trend.

Pilots, Controllers and Mechanics on Trial: Cases, Concerns, and Countermeasures

There is increasing concern about pilots, controllers, and mechanics facing trial in the wake of incidents and accidents (Esler, 2009; Michaels, 2008; North, 2002; Ter Kulle, 2004; Thomas, 2007). Even though criminal prosecution has followed aviation accidents in the past, it now has become an automatic response to accidental death (or even just risk of death) in many countries (ICAO, 2007). Prosecution is often seen by those inside a profession as unfair, unnecessary, intrusive and “heavy handed” (Moran, 2008) as well as detrimental for safety initiatives aimed at increasing honest disclosure and the free flow of safety information (FSF, 2006; GAIN, 2004; ICAO, 2007).

The basis for responding to, and learning from, accidents in aviation is provided by Annex 13 to the ICAO convention. This represents an international treaty of all UN member countries, which establishes the purpose of investigations and protects those safety investigations for learning and system improvement only. Co-mingling safety investigations with criminal prosecutions is something that Annex 13 explicitly guards against, and ICAO member states are in principle obliged to enact its standards through their own regulatory and legal systems. There is, however, growing evidence of cracks and holes in the wall that putatively separates safety investigation from judicial probes. Data gathered by independent safety investigations has been appropriated by judicial action, and formal accident reports are used routinely either as evidence in court or as preparatory reading for prosecutors and judges. Despite the clear proscriptions in international treaties, professional arrangements and even national codes, Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR) records have been admitted as evidence in criminal prosecutions in several ICAO countries (Michaelides-Mateou & Mateou, 2010; North, 2002).

Prosecution of pilots, controllers and mechanics is often based on general hazard statutes that have evolved from road traffic laws which criminalize the reckless endangerment of people or property (Esler, 2009; Tingvall & Lie, 2010). The leeway in such statutes for what can be considered sanctionable behavior is of course important for any open and democratic justice system. Nevertheless, it has led to very general risk statutes (such as Netherlands Aviation Act §5.3), which can, depending on prosecutorial ambition, criminalize anything that can be construed as dangerous in hindsight. US Federal Aviation Regulation (FAR) 91.13 holds this potential, for example, though it has not been extensively relied on for criminal prosecution of pilots or controllers:

- a) No person may operate an aircraft in a careless or reckless manner so as to endanger the life and property of others.
- b) No person may operate an aircraft, other than for the purpose of air navigation, on any part of the surface of an airport used by aircraft for air commerce (including areas used by those aircraft for receiving or discharging persons or cargo), in a careless or reckless manner so as to endanger the life and property of others.

The criminalization of error in aviation, particularly through criminal categories such as “causing air disaster” (RTE, 2009), may represent a jurisprudential evolution similar to that of “hate crime,” which went from a broad, amorphous social

concept to a determinate legal construct inside of a few decades through judicial rhetoric and successive jurisprudential meaning-making (Jacobs & Henry, 1996; Phillips & Grattet, 2000). Groups from inside the aviation industry suggest that this represents “overcriminalization” (Garland, 2002; Husak, 2008).

This paper presents data that supports the notion of a criminalization trend in aviation, and details the concerns about prosecuting practitioners (in part by borrowing from research in other fields). These are divided up as concerns about the wisdom, the fairness, and the utility of criminally prosecuting practitioners. It concludes with a review of current and possible countermeasures.

Cases

In 1956, an Air France captain was convicted of involuntary manslaughter after 56 passengers were killed in a DC-6 visual approach accident at Cairo airport on a flight en route from Saigon to Paris (Esler, 2009). Since then, criminalization of pilots, controllers, and mechanics has occurred or is occurring in many other countries, including the U.S., the U.K., Japan, New Zealand, China, Libya, Korea, Yugoslavia, France, Argentina, Romania, Taiwan, Italy, Switzerland, Canada, Brazil, Indonesia, the Netherlands, Russia, Kenya, Turkey, Venezuela, Portugal, India, Spain, and Iran (Michaelides-Mateou & Mateou, 2010). Since criminal prosecution occurs almost only under state or national statutes, an exhaustive global corpus of cases is difficult to track and build. Yet, according to Michaelides-Mateou & Mateou (2010), almost half of these criminal cases have been brought since 2000 (see figure 1 for a graphical condensation of their case descriptions), attesting to a strong criminalization trend in aviation. The trend not only affects pilots, mechanics and air traffic controllers, but increasingly accountable managers and nominated post holders. A number of cases are presented in more detail in the appendix to this paper.

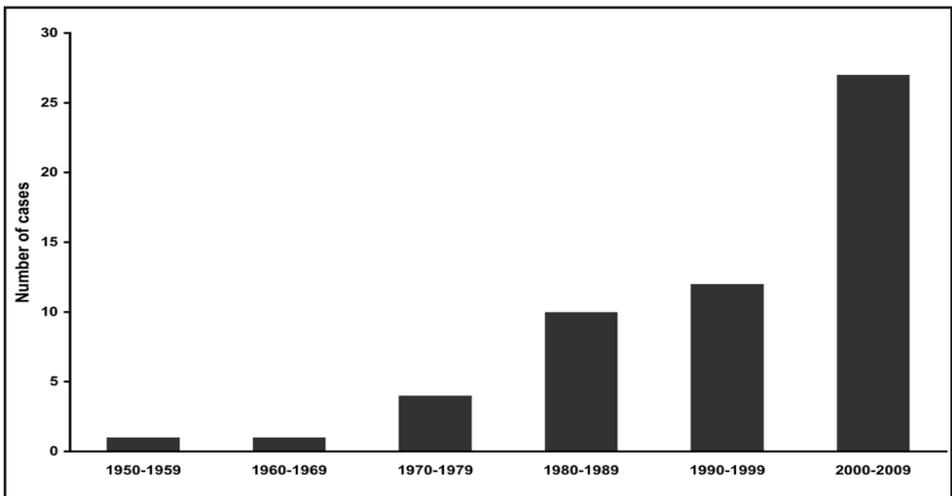


Figure 1: Number of worldwide cases of criminalizing human acts in aviation accidents and incidents per decade since 1950.

The criminalization trend in aviation mirrors developments (and concomitant concerns) in other fields, including shipping (Wallis, 2010), construction (ENR, 1997), chemical processing (Prakash, 1985), and health care (Grunsven, 1996; ISMP, 2007; Pandit, 2009; Skegg, 1998; Ukens, 2002), where “cases of doctors being subjected to criminal prosecution are on the increase” (Pandit, 2009, p. 379) and nurses’ errors are increasingly criminalized, also in the U.S. (Mee, 2007).

Concerns

Concerns with the criminalization based on such cases and other statutes, can be divided up into those about the wisdom, fairness and utility of prosecution.

Wisdom of prosecution

A focus of the industry has been on how judicial action in the aftermath of accidents and incidents interferes with independent safety investigations and destroys the willingness of people to voluntarily report errors and violations (Berlinger, 2005; Brous, 2008; Chapman, 2009; Dekker, 2007a, 2009; FSF, 2006; Thomas, 2007). Criminalization thus hampers the development of “safety cultures”: organizational cultures that encourage honest disclosure and open reflection on their practices with the aim to constantly improve quality and safety (Lauber, 1993).

A survey conducted by Michaelides-Mateou & Mateou (2010) confirms the preponderance of fear about prosecution and its detrimental effects on contributing to safety improvements. Says one of their respondents: “People cannot work with the fear of being prosecuted haunting them. Blaming and punishing someone will not help aviation safety. How can safety lessons be learnt if everyone is too scared to report an error or mishap?” (p. 282). Practicing under the threat of prosecution can only serve to hide errors, to condition people to get smarter at making evidence of possible criminalizable acts disappear, to discourage people from reporting their mistakes (Chapman, 2009; Michaelides-Mateou & Mateou, 2010).

Willingness to participate in independent safety investigations has also been found to go down when pilots or controllers have knowledge of previous criminal prosecutions: they do not want to incriminate themselves. Increasingly, pilots, mechanics and air traffic controllers refuse to participate in an independent safety investigation without the presence of a union representative or even a lawyer (Michaelides-Mateou & Mateou, 2010). This is testimony to the problem of co-mingling safety investigations and criminal probes, as it can stop people from cooperating with either of them (North, 2002).

Another effect is practicing more defensively, which may increase the unnecessary use of resources (Sharpe, 2004) or investments in paper trails that limit exposure and liability. Including managers in prosecution (particularly after pilots have died) may bring such adverse consequences. Organizational safety management can become an activity centered around reducing a company’s exposure and protecting management structures from criminal liability, which serves neither safety nor justice (Michaelides-Mateou & Mateou, 2010). Accountability demands that are seen as unreasonable and illegitimate (e.g. those imposed by the criminal justice system) can interfere with the conscientious execution of safety-critical work. There is experimental evidence suggesting that with unreasonable account-

ability demands, cognitive effort gets deflected into the management of liability risks—to the detriment of task-orientation (Lerner & Tetlock, 1999).

Fairness of Prosecution

Over the last fifteen years, doubts have increasingly been voiced about the fairness of criminalizing errors that are made in the course of executing normal professional duties with no criminal intent in aviation and other fields (Mee, 2007; Merry & Peck, 1995; Moran, 2008; Reissner, 2009). There is also concern about the capriciousness of criminal prosecution: why some professionals, in some countries, get prosecuted for errors that have no such consequences elsewhere. Doubts also exist about the ability of a judiciary to make sense of the messy details of practice in a safety-critical domain (R. E. Anderson, 2005), let alone resist common biases of outcome knowledge and hindsight in adjudicating people's performance (J. C. Anderson, Jennings, Lowe, & Reckers, 1997; Arkes, Saville, Wortmann, & Harkness, 1981; Berlin, 2000; Dripps, 2003; Hawkins & Hastie, 1990; Hugh & Dekker, 2009; LaBine & LaBine, 1996; Laudan, 2006; Roese & Olson, 1996).

These doubts about a judiciary's ability to fairly adjudicate in the wake of professional mistake are amplified by a broad research consensus in safety research. Errors by pilots, controllers and mechanics, made in the normal pursuit of their duties, are heavily anchored and embedded in normal contexts in which they perform skilled work under conditions of resource constraints and outcome uncertainty (Woods, Dekker, Cook, Johannesen, & Sarter, 2010). This has raised significant skepticism about whether error can be punished or sanctioned away. Error is an inevitable part of the complex system in which it is generated (Amalberti, 2001, 2006; Clarke & Perrow, 1996; Leveson, 2002). Errors and other undesired outcomes are the inevitable product of the structural interactive complexity and tight coupling of the aviation system (Perrow, 1984). They occur not because unreliable people undermine otherwise smooth and well-functioning organizational processes. Rather, they emerge non-randomly as the side effects of well-organized processes (Pidgeon & O'Leary, 2000). Error in complex systems seems inevitable, no matter what sanction it might invite (Vaughan, 1996). Accidents that result in part from these inevitable errors are by definition unforeseeable and unintended. This makes it hard for accidents to meet the judicial principle of a *mens rea* (guilty mind) and thus puts them at odds with criminal prosecution (Michaelides-Mateou & Mateou, 2010).

For most professionals, a mistake that results in an incident, adverse event or inadvertent death is antithetical to their identities. It militates against their goals of delivering safe and efficient service (Berlinger, 2005; Sharpe, 2004; Wolf, 1994). Such errors, and their consequences, are experienced as a devastating failure to live up to the duty ethic inherent in the profession, and a betrayal of the trust that passengers or other users have put in it. The memory of mistake typically stays with professionals for many years (Serembus, Wolf, & Youngblood, 2001) and can cause excessive stress, depression, anxiety and other psychological ill-health (Berlinger, 2005; Lerner & Tetlock, 1999). Guilt and self-blame are also very common. Professionals can deny the role of the system or organization in spawning their mistake (Meurier, Vincent, & Parmar, 1998; Snook, 2000), despite the large research base to the contrary (Woods, et al., 2010).

When error gets criminalized, it can lead to sick leave, divorce, exit from the profession permanently or the committing of suicide (Chapman, 2009; Meszaros & Fischer-Danzinger, 2000; Moran, 2008; Tyler, 2003; Wolf, 1994). Another response to litigation, though rare, is anger and counter-attack, for example by filing a defamation lawsuit (R. E. Anderson, 2005; Sharpe, 2004). Criminalization can also have consequences for a person's livelihood (and his or her family), as licenses to practice may be revoked automatically which in turn can generate a whole new layer of anxiety and stress.

In the most constructive response, professionals try to process and learn from the error, discussing details of their error with their employer, contributing to its systematic investigation and helping with putting safety checks and improvements in place (Christensen, Levinson, & Dunn, 1992). The role of the organization in facilitating such coping (e.g. through peer and managerial support and appropriate structures and processes for learning from failure) is hugely important (Dekker & Laursen, 2007). It is crucial that employees do not get constructed as if they are the source of the problem and treated as somehow "troubled" as opposed to "normal" employees (Cooper & Payne, 1988; Dekker & Laursen, 2007). In aviation, and particularly in air traffic control, critical incident stress management (CISM) programs have been instituted in several countries. These voluntary peer programs have evolved from stress management interventions in particularly fire fighting and rescue services personnel and were first treated with suspicion by professionals because of the stigma of psychological infirmity its use might attract. It is now accepted and standard procedure in many organizations, however. Management has noticed that CISM helps professionals reenter productive operational life sooner after an incident, which benefits both organization and individual (Leonhardt & Vogt, 2006).

Neither CISM, nor people's progress through post-incident phases, has been investigated specifically for the influence of (criminal) prosecution. Prosecution probably affirms feelings of guilt and self-blame and exacerbates their effects, which are linked to poor outcomes in other criminological settings (Christensen, et al., 1992; Friel, White, & Alistair, 2008). At the same time, prosecution could destroy most opportunities for intervention by the employer or peers because it introduces new equations of mistrust, which can already be a problem after an adverse event (Scott, Hirschinger, & Cox, 2009). In addition, there could be organizational expediency and economy in not combating criminal prosecution of an employee as it publicly locates the source of the organization's safety problems in that single individual. Meaningful access could be cut off entirely when the professional is incarcerated (Learmount & Modola, 2004), and, not surprisingly, the prognosis for psychological health is never very good in that case (Friel, et al., 2008).

Utility of Prosecution

There is no conclusive evidence about the extent to which the purposes of criminal justice (e.g. retribution, rehabilitation, prevention, and deterrence—specific or general) are served by the criminalization of professional mistake (Dekker, 2007c; Dekker & Hugh, 2009; A.F. Merry & McCall Smith, 2001). In fact, the prosecution of professionals can distort the allocation of scarce societal resources within the criminal justice system (Jacobs & Henry, 1996) when there are already bodies in place (e.g. accident investigation boards, medical discipline committees) that could be better positioned to deal effectively with the aftermath of failure in those

systems (FSF, 2006). In addition, broader, systemic interventions are known to have better safety effects than the prosecution of individuals. So how can a criminalization trend in aviation be explained?

Over the last 30 years the societal interpretation of accidents has shifted dramatically. Failures such as the Three Mile Island nuclear accident and the collision of two 747's at Tenerife in the seventies made society more "risk conscious" (I. Wilkinson, 2001). Accidents today are not seen as meaningless coincidences but as evidence that a particular risk was not managed well. And behind such mismanagement there are people, single persons, or single acts of omission or commission by those persons (Bittle & Snider, 2006; Green, 2003). Accidents are failures of risk management, which opens the door for the search (judicial or otherwise) for someone who did not manage risk well. The accident can go, or even needs to go, on somebody's account (Douglas, 1992).

The end of the twentieth century has also seen an increase in the democratization and accessibility of knowledge, as well as consumer vocalism and activism. These can put the failings of complex systems (or alleged failings of individuals in them) on fuller display (Anon., 2005; Pandit, 2009) and animate societal responses to them. The media doubtlessly enjoys a strong role in celebrating certain accidents, while being able to ignore others (Dekker, 2007b; Ditton & Duffy, 1983; Ödegård, 2007; Palmer, Emanuel, & Woods, 2001). A recent study links cultural and political populism to the punitiveness of a country's criminal justice system (Miyazawa, 2008). Media coverage of an event has been shown to articulate and animate social reactions to the point of constructing anti-heroes (Elkin, 1955; McLean & Elkind, 2004) and their crimes (Dekker, 2007b; Ericson, 1995; Innes, 2004; Jacobs & Henry, 1996; Tuchman, 1978). There is a strong basis to believe that the coverage of, and discourse surrounding social issues (e.g. accidents and human error), can be linked at least in part to political populism, judicial responses and the criminalization of new categories of human action (Blackwelder, 1996; Engbersen & Van der Leun, 2001; Husak, 2008; Jacobs & Henry, 1996; Phillips & Grattet, 2000).

A gradual reduction in the acceptance of risk altogether (Beck, 1992) has accompanied these developments, and there are now societal expectations that some safety-critical activities are entirely accident-free, with a zero-tolerance of failure. Aviation may have its own success to thank for this in part. Its increasingly flawless performance may have sponsored a societal belief in its infallibility and a concomitant political intolerance of failure (Amalberti, 2001). This means that almost of necessity, explanations of residual failure in these systems get deflected toward individual culprits (Perrow, 1984). The prosecution of individuals may thus hold some utility both for society and, in the Perrowian argument, for its intent on preserving a particular economic and social order (Goode, 1994). As Perrow (1984) pointed out about "human error":

...if this attribution can be made, that is the end of serious inquiry. Finding that faulty designs were responsible would entail enormous shutdown and retrofitting costs; finding that management was responsible would threaten those in charge, but finding that operators were responsible preserves the system... (p. 146)

A letter sent by the Boeing Corporation to the independent safety investigation of two inexplicable 737 crashes in the 1990s was seen by Byrne as an example of this. Investigators had found no evidence that the crew had done anything wrong, but the manufacturer expressed its dismay about the “desire of certain participants in our group to revisit, reexamine, and theorize about airplane system failures that could have contributed to the accident...” (Byrne, 2002, p. 162).

This is where the utility of prosecution for some groups becomes the unfairness of prosecution for others (Menkel-Meadow, 2000). Even victims of the results of the pilot or controller error sometimes see this, which puts them in sharp contrast to the focus of criminal prosecution on the single acts of single people. After an air traffic controller was jailed in the wake of a 1976 accident over Zagreb that killed 176 people, the father of one of the victims led a campaign to prevent the controller’s jailing. His campaign was unsuccessful, but the father joined efforts to free the controller after he had served two years (Geoffrey Thomas, 2002). Jailing individuals after system failure can be seen as unfair and counterproductive even by the primary victims; it can be seen as scapegoating (Mellema, 2000), which gets the organization or other people off the hook and oversimplifies the complexity of contributory events. Most importantly, prosecution of an individual may not give primary victims confidence that a similar incident will be prevented in the future.

Countermeasures

The criminalization trend over the last fifteen years has exposed the difficulty of how and where the line between honest professional mistake and criminally liable act should be drawn, and by whom. This makes coordinated global action very difficult (Esler, 2009). Professional bodies have proposed to increase their defensive posture in response to the criminalization trend, for example by being more careful with external liaisons, particularly when it comes to sharing safety-related information (ICAO, 2007). In Canada, for instance, some airlines have asked their regulator to sign a non-disclosure agreement before safety inspections are conducted. One aim could be to protect the identity of employees who might, by disclosing information about incidents or violations, offer evidence of what can later be construed as criminal activity (Schmidt, 2009).

Various industries and countries have moved to different solutions. Most initiatives remain local and contingent on national law (under which most criminal prosecution occurs). Some initiatives locate the power to draw the line between acceptable and sanctionable performance more strongly inside of professions, for example by a re-asserted role of ethics or similar committees. At least one country has installed a so-called judge of instruction, who functions as a go-between before a prosecutor can go ahead with a case against a professional by checking the prosecutor’s homework and ambitions and weighing other stakeholders’ interests (which can work as long as those are fairly and equitably represented) (Dekker, 2009).

Other initiatives, most of them local or industry specific, are being developed and range from raising awareness and rallying opinion (FSF, 2006; GAIN, 2004; ICAO, 2007); to alternative dispute resolution and mediation and the legal protection of certain statements by professionals in the wake of failure (e.g. “I’m sorry” laws) (Berlinger, 2005; Sharpe, 2003); to stonewalling, by keeping the independent safety investigation open until the period of limitation for criminal prosecution

has expired (this may be many years); or by refusing to cooperate with any inquiry at all and destroying safety-related data before any access can be gained from the outside (Dekker, 2007c). Jointly, these effects create an adversarial stance that severely reduces openness, and could be counterproductive to longer-term societal efforts to achieve a balance between learning and accountability in safety-critical systems (Anon., 2009; Dekker, 2007c; FSF, 2006; ISMP, 2007; Michaels, 2008; Pandit, 2009; Ter Kulle, 2004; G. Thomas, 2007).

The data presented in this paper shows that the current protections offered by ICAO Annex 13 and similar treaties are insufficiently anchored in national laws, safety regulations and legal practices—a lack from which very few countries seem exempt. Transnational initiatives, for example in the European Union, are currently being undertaken that try to address this (TTE, 2010). In the end, countermeasures should focus on the implementation of strong national legislation that fairly balances accountability and learning. Norwegian and Danish examples of establishing a compulsory, non-punitive, and strictly confidential reporting system for aviation incidents could represent one example, of both the difficulty and modest possible success. In Denmark, immunity against use of such a report in prosecution is guaranteed within 72 hours of the incident. This provision made that air traffic control reporting rates tripled from one year to the next (Norbjerg, 2003). Not long after it was implemented, the law was tested in court, though, importantly, not in a case that involved a loss of life. A pilot who was brought to court in 2002 on the basis of an incident report submitted by himself saw the evidence from his own report thrown out because of the new law. Yet he was found guilty of negligence and perhaps left wondering whether not submitting a report might have been a better idea after all. And of course, even in these laws there are always provisions that exclude deliberate negligence—a category that remains hard to define and is always open to judgment (Dekker, 2007c).

Conclusion

Criminalization of errors ultimately raises the question of who—in a society or an organization or a profession—gets the power to draw the line between acceptable and unacceptable behavior, to draw a moral boundary, and who gets to enforce it (Dekker, 2009). Just as Foucault (1982) described about France 150 years ago, different professions, branches of government and institutions might be vying for power and influence over the moral and legal privilege of calling something a criminal or otherwise sanctionable act. From this point of view, the line is not a location but a judgment, influenced by politics, power, or even sensationalism and populism (Dekker, 2009; Foucault, 1982; Morrill, Snyderman, & Dawson, 1997; Osborne, Blais, & Hayes, 1999). In the meantime, however, criminal prosecution of professionals such as pilots, air traffic controllers, or mechanics is increasingly seen as a threat to safety. Its effect on willingness to report and disclose safety-related information is well documented. What is encouraging is that the field of aviation has also germinated a number of cross-industry initiatives aimed at mitigating the effects of criminal prosecution (FSF, 2006; ICAO, 2007), something that is not likely to abate in the near future (Esler, 2009; Michaelides-Mateou & Mateou, 2010).

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Appendix — selected cases

Fourteen passengers died in a Swissair DC-8 runway overrun accident at Athens on a flight from Geneva en route to Mumbai and Beijing in October 1979. The airplane had been carrying sixteen tons of extra fuel due to uplift constraints at Athens, and had been at maximum landing weight. The runway was extremely slippery due to rain and rubber deposits and its profile made the end of the runway hard to see. A trial was held in April 1983 and the captain and first officer were convicted of manslaughter, criminal negligence and interruption of air traffic. They were sentenced to five years imprisonment. Swissair offered to post the twenty million drachma bail (then \$266,000), to allow the crew to leave Greece. The captain refused, however, wanting to make this a test-case for the tenability of criminalizing pilot error (Venet, 1984).

In November 1989, a British Airways 747 carried out a missed approach to Heathrow in thick fog, narrowly missing a hotel near the other end of the runway. Two years later, the captain was found guilty in a split verdict of negligently endangering the aircraft and its passengers, the first time in British aviation history. The problem had begun much earlier, with a dinner in Mauritius that incapacitated both the copilot and the flight engineer through gastroenteritis during the flight. The airline had routinely been giving dispensations to copilots unqualified to fly low-visibility approaches, and did so in this case as well, a practice that had been condoned by the Civil Aviation Authority (CAA). Interestingly, and quite uniquely, the aviation prosecutor in Britain is employed by the CAA. Having been convicted and demoted, the captain eventually committed suicide (S. Wilkinson, 1994).

In January 1992, an Air Inter Airbus A320 crashed into a mountain near Strasbourg, France, while executing a night approach, killing all 87 persons aboard. Although the flight crew performed the approach correctly, a contributing factor in the accident was an uncommanded descent by the A320 of 3,200 feet per minute instead of the required 700, only two nautical miles from the airport. The accident became a prime example of “mode error” where crews are led to believe that they are making inputs and giving the automation instructions in one mode (in this case: Flight Path Angle) whereas the aircraft is actually in a different mode (Vertical Speed) (Sarter & Woods, 1995, 1997). Criminalization didn't occur until a full fourteen years after the accident when five current and former Airbus executives, including the A320 chief designer; two retired Air Inter executives; the former head of the country's Direction Générale de l'Aviation Civile (DGAC) and the aviation authority's retired certification director, as well as an air traffic controller, were prosecuted in French criminal court for negligent homicide. Even though they were acquitted, Airbus and Air France (which by then had taken over Air Inter) were found liable for pain and suffering of victims' families, and a subsequent trial was scheduled to determine monetary compensation (Esler, 2009).

In the wake of a June 1995 crash of an Ansett de Havilland Dash 8 near Palmston North in New Zealand, accident investigators turned the aircraft's cockpit voice recorder (CVR) over to criminal prosecutors. The crash killed four persons on the aircraft, but not the pilots, who faced possible charges of manslaughter. Pilots in New Zealand instituted proceedings to block the police use of the CVR, saying recorders should only be used for safety and educational purposes. Prosecutors prevailed and regained access to the CVR, but pilots soon began disabling CVRs on their flights. Officials have crafted a plan that would permit police use of

CVRs in future cases, provided New Zealand's High Court deemed it necessary (McKenna, 1999, pp. 47-48).

In May 1996, a ValuJet McDonnell Douglas DC-9 crashed into the Everglades not long after take-off from Miami. A carton with oxygen canisters had been placed in the forward cargo hold of the DC-9, and ignited shortly after takeoff. The fire and smoke incapacitated the crew, rendering the aircraft uncontrollable. All 110 people on board died. The official investigation determined that the oxygen generators were improperly packaged and labeled by ValuJet's contract maintenance provider, SabreTech, though correct packaging and labeling would have required them "to draw a verbal distinction between canisters that were 'expired,' meaning most of the ones they were removing, and canisters that were not 'expended,' meaning many of the same ones, loaded and ready to fire, on which they were expected to put nonexistent safety caps. Also involved were canisters that were expired and expended, and others that were not expired but were expended. And then, of course, there was the set of new replacement canisters, which were both unexpended and unexpired" (Langewiesche, 1998). Three SabreTech mechanics were indicted by a Florida court on criminal charges. The editor of *Aviation Week and Space Technology* "strongly believed the failure of SabreTech employees to put caps on oxygen generators constituted willful negligence that led to the killing of 110 passengers and crew. Prosecutors were right to bring charges. There has to be some fear that not doing one's job correctly could lead to prosecution" (North, 2000). In the ensuing trial, the mechanics were acquitted on the grounds that they "committed mistakes, but they did not commit crimes" (Esler, 2009). The jury did convict SabreTech and ordered it to pay a \$2.9 million fine, though an appeals court overturned this in 2005.

In December 1998, the crew of a Delta Airlines Boeing 767 had to abort its take-off from Amsterdam because of a Boeing 747 being towed across the runway in front of them. Low visibility procedures were in force at the time of the incident. Investigators found how ergonomic issues with a newly added panel, the surface movement radar displays as well as role ambiguities between coach and trainee controller all contributed to the confusion. Two years later, the coach, the trainee and the assistant controller involved were all charged under a section of the Netherlands Aviation Act, (§5.3), which provides that "it is prohibited to provide air traffic services in such a way that persons or property are endangered or could be endangered." Though a conviction was upheld in some sense, no punishment was imposed as the judge acknowledged that the prosecutor had used the incident as a "test case" (Ruitenbergh, 2002).

In September 1999, a Dassault Falcon 900B, operated by Olympic Airways on behalf of the Greek government, was on approach to Bucharest, Romania, when one of the pilots tried to level the aircraft at 15,000 feet with the autopilot engaged. The autopilot disengaged, the artificial flight control feel system failed and a subsequent oscillation caused a violent upset in which passengers in the cabin not wearing seat belts were killed and one passenger and the flight attendant were injured (S. Dekker, 2006). A subsequent criminal trial was conducted in Greece, and the pilot who had been flying the aircraft was found guilty.

In July 2000, an Air France Concorde crashed in Paris after running over a titanium metal strip on the runway, causing tires on one of the main landing gear legs to explode and send fragments into a wing tank, igniting the fuel. The airliner

lifted off the runway but crashed into a nearby hotel seconds later, killing all 109 people on board as well as four on the ground (Esler, 2009). After the investigation, criminal charges were levied against a former regulatory official and two former executives of Concorde's manufacturer. In addition, Continental Airlines, whose DC-10 was suspected of dropping the titanium strip on the runway just before the Concorde took off, was placed under criminal investigation. In 2006, the French Supreme Court refused to dismiss the charges, and a trial was conducted in 2010.

In October 2000, a Singapore Airlines Boeing 747 crashed when taking off from Taipei, Taiwan in the dark and bad weather. The aircraft had run into construction equipment on runway 05R, which the crew had mistaken for runway 05L because of inadequate signage and taxiway lighting (burnt-out bulbs and inadequate spacing, among other problems). There was no surface movement radar at the airport. The crew was apprehended later the same evening and detained in Taiwan on suspicion of criminal negligence and manslaughter.

In October 2001, a Scandinavian MD-80 on its take-off run collided with a privately operated Cessna Citation business jet at Milan Linate airport in fog, killing 118 people. The airport surface environment radar system was not working, and taxiway markings had been poor for years. Five Italian officials, including the ex-manager of the Milan Linate Airport, the former director general of the ENAV Italian ATC agency, and a controller, were ultimately convicted of manslaughter and sentenced to between three and eight years in prison. In 2006, an appeals court reaffirmed the convictions (Learmount & Modola, 2004).

In July 2002, a DHL Boeing 757 collided with a Bashkirian Tupolev-154 over Uberlingen, Germany. The two aircraft collided at altitude over an intersection, with the loss of 71 lives. Four years later, negligent homicide charges were brought against eight Swiss air navigation services controllers and managers by Swiss prosecutors. The controller on duty at the time of the accident had been threatened with similar criminal charges, but was stabbed to death by the father of one of the crash victims.

In August, 2005, a Helios Airways Boeing 737 crashed in the mountains close to Athens airport, Greece, with 121 occupants. A failure of the cabin pressurization system led to the incapacitation and death of the crew and passengers. Several prosecutions were launched, including two for manslaughter charges, the first against five Helios officials in Cyprus and the second against six more in Greece (Esler, 2009). Trials were going on in both countries in 2010 (Mail, 2009).

In August 2005, a Tuninter ATR-72 was forced to ditch in the sea off the Sicilian coast after running out of fuel enroute to Djerba, Tunisia from Bari, Italy. The aircraft fuel gauges and indicators had been replaced, mistakenly, with those of the shorter, lighter (but otherwise identical) ATR-42 and had shown that there was enough fuel on board when the aircraft took off. 19 people died. The two pilots were convicted of multiple counts of manslaughter and air disaster, and sentenced to ten years in jail in 2009. In theory, they had the opportunity to reach the Palermo airport for an emergency landing. Five mechanics and managers were also found guilty, with the chief operating officer and maintenance chief sentenced to nine years each (RTE, 2009).

In September 2006, a Gol Linhas Aéreas Boeing 737-800 collided with an Embraer Legacy Business jet over the Amazon, killing 154 people on board the 737. The report, compiled by the Brazilian Air Force's Centro de Investigação e Prevenção de Acidentes Aeronáuticos, or CENIPA, held the Legacy flight crew (two Americans) and four Brazilian air traffic controllers liable for the deaths, resulting in a criminal trial against them (Esler, 2009). A separate investigation instead pointed to systemic and deep rooted problems in the country's military-run air traffic control system, which put the two aircraft on a collision course.

In March 2007, a Garuda Indonesia Boeing 737, overran the runway at Yogyakarta, Indonesia, and caught fire. Although 140 occupants escaped, 21 were killed (among them five Australians) and 12 were seriously injured. In its investigation report, the Indonesian National Transportation Safety Committee listed among probable causes the crew's failure to reject an unstabilized approach, the captain's failure to heed the first officer's repeated calls for a go-around as well as GPWS alerts, and the first officer's failure to take control of the airplane. A year after the accident, the captain was arrested and charged with criminal negligence, manslaughter, and violations of aviation regulations. The Indonesian court's indictment was based on the accident investigation findings, which were used as evidence against the captain (Esler, 2009). He was sentenced to two years in prison. One of the judges remarked that the sentence was about the prevention of future accidents rather than revenge.

In August 2008, a Spanair MD-82 crashed during take-off from Madrid-Barajas Airport, killing 154 people. The take off warning system did not warn the crew of a problem with the slats (high-lift devices on the leading edge of the wing). Mechanics who had worked on the aircraft just before the take off were facing manslaughter charges (Brothers & Maynard, 2008).