

## Book Notes

AIRCRAFT ACCIDENT RECONSTRUCTION AND LITIGATION, by Barnes W. McCormick, Ph.D, P.E & Capt. M.P. Papadakis, J.D., Lawyers & Judges Publishing Co., 1996

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Aircraft accidents raise questions of causation that can be as intricate and untidy as the scene itself. Even where causation can be determined, a Herculean effort remains in cohesively relaying that often analytical determination through a litigator and onto a lay jury. Resources that frame the reference of the expert and educate the litigator go a long way toward streamlining the presentation of causation evidence.

AIRCRAFT ACCIDENT RECONSTRUCTION AND LITIGATION is a notable effort in providing such a resource. Dr. Barnes McCormick, a renowned aeronautical engineer who has appeared many times as an expert witness, and Myron Papadakis, a litigator and law professor, survey many technical and legal aspects of determining causation. As such, the book may be of great assistance in educating lawyers to better understand the circumstances surrounding aircraft accidents.

The first chapter categorizes types of causation. Human error may result from any of a magnitude of people who are involved neglecting any of a host of individual responsibilities. The aircraft can lose power for several reasons. The instruments that ensure the aircraft's stability are suspect when the accident was preceded by a sudden departure in flight path, for example. Structural stability and design may also be suspect.

Chapter two cursorily introduces aeronautical concepts. *Lift* and *drag* are defined and explained through formulae, charts, and graphs. Knowing the drag, one can determine the amount of power needed to move the aircraft through the air; through a process explained in the text. An aircraft's drag and the lift required are indicators of its overall performance which, although provided in the flight manual, is a composite of analyzing the calculations of the plane's rate of climb, time to climb, angle of climb, takeoff distance, and range. These are briefly explained and

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presented in the text, as is a discussion of the determination of an aircraft's range, stability and control.

The stability and capacity of the structure of the aircraft is the focus of chapter three. The components of structural failure are discussed, including load factor, bearing factor, and strain of the tensile, compressive, and shear types that threaten the structure of the aircraft. Chapter four begins a detailed "dissection" of an aircraft's components, beginning with its engines. All aircraft engines have various moving parts. Analyzing the engine may determine what, if any, power that engine was generating at the time of impact. Various types of engines are detailed and various considerations in analyzing engine failure are discussed.

This dissection continues in chapter five, with a bit more insight toward reading the wreckage. Whether light bulbs were illuminated at impact, for example, can be telling of any problems with the aircraft's electrical systems and of whether the emergency or warning lights were on. Assuming a pristine and problem free aircraft just before impact, for each and every component within an aircraft, witness marks and bent metal can tell a story. Chapter five provides a few aircraft systems to investigate and things to look for (e.g., crush damage, impact marks, puncture marks, smearing) in search of that story.

Backing away from the body of the aircraft, chapter six strives to provide a general understanding of how an airplane operates "within the air traffic control system." The "air traffic control system" begins with the "flight plan," which is required by the FAA for pilots flying under "Instrument Flight Rules" but merely recommended for pilots flying under "Visual Flight Rules." Pilots may only fly under "Visual Flight Rules" during certain meteorological conditions. A brief lesson in reading aeronautical charts and plates, airport depictions, and approach plates is given. The various types of navigation systems that contact aircraft from the ground are briefly discussed. Finally, the many environmental hazards that threaten a take-off or an approach, including wind-shear, turbulence, and lightning, are discussed, as well as methods of determining their role in an accident.

Farther away from the body of the aircraft, the many agencies that govern flight are introduced in chapter seven. "The FAA licenses aircraft and pilots, and controls the operation of the aircraft by the pilots." Every component is manufactured under its regulation. A plane manufacturer must obtain a "Type Certificate" in order to build a new plane. This certificate will "date" the plane's construction relative to the applicable regulations. Once the plane is built, it must maintain its "Airworthiness Certificate" through compliance with repair and maintenance regulations. "The FAA publishes *Advisory Circulars* that provide advice on almost all aspects of the air transportation system ranging from airport

design to markers for powerlines." The National Transportation Safety Board ("NTSB") is a civil aeronautics board that conducts all civilian accident investigation in the United States. The NTSB joins forces with the military to investigate military accidents. Their findings can be obtained upon request, pursuant to either the Freedom of Information Act or discovery. The International Civil Aviation Organization ("ICAO") is a coalition of thirty-three nations that promulgates standards and recommended practices for aircraft operation as well as accident investigation and reporting. ICAO endeavors to gather accident information "considered important from a safety or accident prevention viewpoint." Various other agencies and organizations that can serve as valuable sources of accident information are noted.

As conclusions are drawn from the findings of the investigation, chapter eight describes some of the major causal factors of aircraft accidents. Obvious failures in the aircraft's instruments may indicate a negligent pre-flight check on the part of the pilot or the ground crew, who may even make mistakes that would evade the normal pre-flight procedure. Investigating the position of the switches may reveal that instruments that do function correctly may have been used improperly by the pilot, who may have been a novice, simply mistaken, or intoxicated. Studying the tapes of the air traffic controller's communications with the pilot may reveal error in guidance. In short, the engine system, the fuel system, the external control system, and the structure and design of the aircraft are all potential sources of failure and, ultimately, disaster. An investigator must be mindful of the aspects relevant to "the man-machine interface."

Drawing the conclusions arrived at into a "probable cause" argument, chapter nine presents the systematic, check-list type approach to accident investigation. The investigative procedures that occur in the field are listed and described, relying upon the purposes for those specific investigations discussed earlier (e.g., light bulbs, etc.). The fruits of the field investigation will be given to an expert engineer, "who will attempt to put it all together." Investigative checklists will aid in understanding the many components of an accident investigation, as well as help the attorney probe the investigation that was conducted and determine what to request when conducting discovery.

Additional investigative techniques are the focus of chapter ten. Legal investigation, such as that conducted by the NTSB, endeavors to find the "probable cause" or the contributing factors, and gather admissible evidence to that effect. Air traffic controller tapes, cockpit voice recorders, and other sound analysis may also be helpful. Some on-board computer systems may have their memory or information storage analyzed by very specialized experts to probe for system failure. Possible causes and legal theories should be checked in a flight simulator, which

can help evidence or diminish the plausibility of a particular causal theory.

Chapter eleven displays the practical applications of the theories detailed in the earlier chapters. A series of pictures of a helicopter wreck are accompanied by commentary of what can be discerned. The pristine nature of the engine components, for example, and the intact but distorted nature of the blades, suggest that the helicopter crashed because it lost power. A second example demonstrates how distorted engine damage, as opposed to fragmented or shattered engine damage, can indicate that the engine was extremely hot at impact. A third example describes the difference between the damage that would result from a fire (extensive blackening) and the damage that would result from an explosion (much less blackening, more distortion generally). The actuators, or devices that maneuver the flaps and tail, may be read to determine their position at impact. A photo series of propeller reconstruction provides a manner of determining their angle at impact. The leading edge of a tail, if distorted, may indicate sideloading, or flying sideways through an airstream.

Chapter twelve is a "glossary" or sorts, alphabetically listing various "clues" of what to look for when analyzing various parts of aircraft wreckage. When looking at the aircraft doors, for example, the authors offer the following:

Doors should be examined to determine that they were closed and locked at impact. If they are found closed and locked, they were. If they are open or missing, a metallurgist should examine the locks. If they are deformed or broken, the door was closed at impact.

Chapter thirteen forges the conclusions drawn from the accident investigation into the legal theories and concepts under which the evidence will be presented to the jury. Negligence and strict products liability are described, and punitive damages are noted as available under either of those theories if wanton behavior can be shown. The issues are drawn in terms of risk versus utility. Plaintiffs assert the risk of a certain design outweighs its utility, while defendants assert the very opposite. Various other concepts of law, such as the Federal Tort Claims Act, federal preemption, international airline liability, and the military contract defense, are briefly summarized. More importantly, the authors provide reported cases and secondary authorities that may be instructional or helpful in understanding and researching the subject concepts.

The legal researcher will find the most helpful start in the last chapter, which provides a brief outline of each state's law regarding products liability, negligence, wrongful death, aviation, punitive damages, statutes

of limitation, and statutes of repose. The researcher is referred to cases and statutes that are hallmark or instructional on that particular concept.

The text is followed by over two hundred pages of appendices. The appendices provide, among other things, a glossary of aviation terms, sample interrogatories, a civil aviation case "checklist," other resources on aviation law, and "tips" for litigating aviation cases. Additionally, an eighty-two page "Addendum" accompanies the work and provides a host of names and addresses of persons and organizations who may provide additional information and assistance as needed.

Overall, AIRCRAFT ACCIDENT RECONSTRUCTION AND LITIGATION provides a sound introduction to the considerations that must go into aircraft accident causation analysis and litigation. The foreword, written by an accomplished investigator, praises the book as a post graduate guide for the hardware oriented aircraft accident investigator, that lawyers will "probably" appreciate. However, in viewing the work from a legal perspective, it would seem more helpful to the legal researcher and the attorney who wishes to better understand the nuances of his experts' opinions. Providing the concepts of law, the state-by-state reference outlines, the investigation checklists to aid in assessing the adequacy of the investigation, the "tips" for litigating aviation cases, and the fact that the earlier chapters merely endeavor to introduce, or "brush-over," much of the detail and minutia involved in analyzing wreckage that the engineer newly involved in investigation would need; distinctly impresses the reader that the work was emphatically geared for the attorney; and was meant, if at all, only to be a rudimentary reference for the engineer or the investigator. What the work accomplishes most notably is to sort out the complex considerations that comprise the accident in a way that would educate the attorney in understanding the evidence and forging the appropriate theory of the case. In so doing, the work serves as a valuable aid in relaying the results of aircraft accident analysis, as evidence of causation, to a jury.

