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SESSION THREE

ACCIDENT RECONSTRUCTION AND THE USE OF EXPERTS

BY MARSHALL FOREMAN†

THE STARTING point for accident reconstruction is the National Transportation Safety Board (NTSB) investigation. The usual practice is to prove the facts established by the NTSB investigation, supplemented as necessary, as the foundation for expert testimony as to the cause of the accident and such other expert testimony as may be required to establish liability or defenses. A great deal of accident reconstruction work will probably have been done by the time counsel is retained. Using this work and converting it into foundation evidence for expert testimony requires knowledge of what to look for, how to ask for it and how to turn it into admissible evidence. There are some techniques that are helpful in accomplishing this task and there are a few pitfalls and traps to be avoided.

Aviation, like medicine, has a certain amount of technical terminology, and, although you need not be an airman to handle an aviation case, you should have some familiarity with aviation terminology and aviation technical publications. The terminology can be learned by talking to pilots, mechanics, meteorologists and others who are experienced in aeronautics and by reading technical publications and trade journals. Of course you should have a working knowledge of the basic law applicable to aviation accident litigation which includes general tort law, state Aeronautics Acts, the Federal Aviation Act of 1958 and Title 14 of the Code of Federal Regulations. Most of the case law pertaining specifically to aeronautics may be found in the CCH Aviation cases consisting of 10 bound volumes and a current looseleaf service. Lee Kriendler's "Aviation Accident Law," is an excellent treatise. Aviation technical publications are available from a number of sources, particularly the FAA and the NTSB. If you do not subscribe to the various NTSB publications you should at least study their annual list of publications to consider which ones might apply to your case. You will find that the NTSB publishes such things as Notices of Proposed Rule Making, Safety Enforcement Opinions and Orders, Safety Recommendations, Annual Reviews of Aviation Accidents, Briefs of Accidents by make and model of aircraft and, from time to time, they publish special documents such as their outstanding study on 'Aircraft Design Induced Pilot Error.'

Literally hundreds of technical publications are available from the Fed-

† A.B. (1954), Stanford University; LL.B. (1955), Stanford University; American Board of Trial Advocates.

eral Aviation Administration. Basic ones with which you should have some familiarity include the Airman's Information Manuel, The Air Traffic Service Handbooks, Summary of Airworthiness Directives and Advisory Circular Checklist. Additionally, special scientific and technical reports are available from the FAA pertaining to such subjects as Aircraft Control/Stability Augmentation System Evaluation, Fire Resistance of Aluminum Alloy Tubing and Fittings, Crash Loads Environment, Flight Evaluation of an Infrared Spectrometer as a Clear Air Turbulence Detector, Weather Effects on VORTAC Facilities, TACAN Monitor Antenna Tests and Control of Birds on and Around Airports, to name only a few. If any of you think control of birds around an airport is a joke, read *Rapp v. Eastern Airlines, et al.*¹ involving the crash of an Electra due to bird strikes. The Federal Aviation Administration was liable for failing to require removal of attractions to birds on the airport surface.

Armed with a working knowledge of the law peculiar to aviation, a familiarity with the type of information available in the publications and an ability to speak and understand aviation terminology, you are ready to evaluate the accident reconstruction work which already will have been done for you. Under the Federal Aviation Act and the Department of Transportation Act, the National Transportation Safety Board is required to investigate all aircraft accidents involving civil aircraft and to make a finding of probable cause. The Bureau of Aviation Safety of the National Transportation Safety Board investigates all accidents except those involving non-fatalities in fixed wing aircraft of less than 12,500 lbs. certificated gross weight. These non-fatal light aircraft accidents are investigated for the National Transportation Safety Board by the Federal Aviation Administration. In the case of transport type aircraft, particularly where there are passenger fatalities or where the aircraft is one with which there has been limited operational experience, the Bureau of Aviation Safety conducts an investigation that no private litigant could possibly afford. They may use troops marching at arms length to comb the area for bits of wreckage, armed forces helicopters to reach the crash site or to remove critical parts without further damage, specialists from the Armed Forces Institute of Pathology and the National Bureau of Standards, dozens of investigators to search out witnesses and obtain their statements, etc.² However, the Bureau has a modest staff of Air Safety Investigators and light plane accidents simply cannot be given that kind of attention. Non-fatal light airplane accidents involving personal injuries which would require a greater award of damages than in a death case will often be investigated by a single FAA employee whose primary duty is not accident investigation.

In the case of an air carrier accident the NTSB investigation materials are a comprehensive and accurate foundation for accident reconstruction

¹ 264 F. Supp. 673 (D.C. Pa. 1967).

² For two informative discussions of investigations of major accidents see McWharter, *Airplane Accident Investigation*, 28 Tenn. L. Rev. 122 (1961); see, Allen, *National Transportation Safety Board Bureau of Aviation Safety*, 34 J. Air L. & Com. 399 (1968).

for the purposes of civil litigation. These materials will include several thousand pages of such things as witness statements, transcripts from the hearing, maps, photographs, diagrams, group reports, etc. These will be available to the public before the finding of probable cause and there is a temptation to start perpetuating testimony by deposition or to start establishing facts by requests for admissions as soon as they are available and before the finding of probable cause is released. I think this is generally undesirable because the finding of probable cause contains valuable reasoning and analysis which may assist in discovery or even indicate a quite different approach to the task of accident reconstruction. Even in the case of a general aviation non-fatal accident, where the finding of probable cause often consists of a single paragraph, consideration should be given to awaiting its release before taking depositions to perpetuate testimony.

The NTSB is not the only source of investigation materials for use in accident reconstruction. If an FAA facility is involved, which is almost always the case, the Facility Chief will prepare an accident package, 'Report of Aircraft Accident,' on FAA form 2452, with attachments. This will not necessarily be a part of the NTSB materials. The package will include such things as statements of FAA employees, position logs, written transcripts of tape recordings of radio communications and records of checks of navigation aids. It may include copies of the flight strips, but not the color coded originals. Thus, if the accident is one in which negligence of air traffic service personnel is suspected, consideration should be given to seeking court assistance to prevent destruction of the original flight strips. A similar situation applies to statements of FAA air traffic service personnel who are asked to make handwritten statements which are reviewed by the Facility Chief after which typewritten statements are prepared for signature and inclusion in the accident package. The original long hand statements are not a part of the package.

An FAA Accident Coordinator participates in investigations to determine if there have been violations of the Federal Aviation Act or Federal Aviation Regulations. His report is in two parts, factual and conclusions. The factual part is available to the public. I do not think the law is clear as to whether the conclusions part is discoverable.

Other FAA reports which may be available are the report of the Accident Incident Analysis Branch, the Regional Office accident file and the Air Traffic Service representative's report. Counsel will not get these reports, or even learn of their existence, simply by studying the NTSB materials. I do not know the FAA's official position regarding release of these reports and I do not recommend asking for them unless you have a specific line of inquiry in mind. However, counsel should be aware of them as possible sources of accident reconstruction materials.

Local agencies, such as the Sheriff's office, the Coroner's office or Fire Department may have accident reports or information which can be particularly helpful in general aviation cases where the NSTB investigation

is seldom as comprehensive as in an air carrier accident. These reports are not usually a part of the NTSB materials.

Technical representatives of airframe, engine, propeller, appliance and parts manufacturers often assist in the investigation and make reports to management, which are not included in the NTSB materials.

Perhaps because of proximity to Mexico our office has been involved in a number of cases arising out of accidents in that country. The Mexican General Office of Civil Aeronautics, Commission of Reports and Investigations of Aviation Accidents does a commendable job of investigation. Reports can be obtained through the United States Embassy in Mexico City. Also there have been cases where our FAA people have investigated the crash of U.S. registered aircraft in Mexico, at least to the extent of examining wreckage after it has been returned to the United States.

There are some important limitations to the usefulness of NTSB materials for accident reconstruction purposes in civil litigation. Most important, I think, is the fact that in a non-air carrier case the materials you get by writing to the Department of Transportation, Federal Building, 17th and H Streets, N.W., Washington, D.C. may not be all the information the NTSB has on the accident and what you get may contain significant errors. In connection with the latter, I have in mind an accident in which the NTSB report indicated that a valve was closed in the intermediate position between detents. The finding of probable cause was based on this information. During discovery it was learned that the valve was in fact open in all intermediate positions and that the manufacturers representative, on whom the air safety investigator relied for information about the valve, had been mistaken. The manufacturers representative so testified in court.

I have personal knowledge of a case where written interrogatories disclosed a manufacturer's engineering report of the accident, a diagram of the aircraft flight path prepared by a manufacturer's engineering staff, several witness statements and several hundred feet of motion picture film of a test flight simulating accident conditions, all of which had been seen by the NTSB air safety investigator but which were not included in the materials received from the Washington office. In a non-fatal case delegated to the FAA the investigator from the local General Aviation District Office had some photographs of the airplane which were not included in the report and which turned out to be persuasive evidence at trial. These cases illustrate the necessity for comprehensive written interrogatories to make certain that you have all of the information available about the accident and that it is accurate.

I understand that NTSB air safety investigators include in their report an analysis which is not released to the public. Hopefully, all of the facts which are used in the analysis are substantiated in the public records. I am aware of no reported case where the NTSB's right to withhold the analysis has been challenged under the Freedom of Information Act.³

³ 5 U.S.C. § 552 (1964).

Other significant limitations on the use of NTSB investigations for accident reconstruction are the requirement that the testimony of air safety investigators be by deposition rather than by personal appearance in court and the proscription of opinion testimony. Do not count on getting court testimony of an air safety investigator, even where he is within the subpoena range. It is likely that the local U.S. Attorney's office will successfully move to quash the subpoena. If you need the testimony of the air safety investigator it should be by deposition and you must get permission from the NTSB following the procedure outlined in their regulations. The deposition of an air safety investigator may not be taken unless the information is unavailable from other sources. However, the Board is quite reasonable in applying this rule, perhaps because it has the power to and does exclude private litigants from the accident site and does not release the wreckage until investigation has been completed. It is not unusual for the air safety investigator to be the only person who will have essential first hand information about such facts as positions of controls, instrument readings, continuity of control cables, nature and extent of damage to aircraft components, wreckage dispersal and identification of wreckage photographs. His deposition to establish such facts will be attended by an attorney from the National Transportation Safety Board who will instruct the witness not to answer questions that call for his opinion. This can raise some knotty problems of distinguishing 'fact' from 'opinion.' For example, the air safety investigator may have noted in his report that a part appeared to have failed under torsional loading, but if you are going to get that information recorded in his deposition you have to ask for it in a way that avoids the appearance of requesting his opinion. This sort of problem can become critical where the salvage has been sold and you cannot locate the part to have your own expert examine it. Counsel caught in that kind of a dilemma should consider asking the Board to waive the rule and permit the air safety investigator to give opinion testimony on that limited subject. There is some authority for this in *Levin v. TWA*.⁴ Also, in *Universal Airlines Inc. v. Eastern Airlines*,⁵ it is suggested that on proper showing the opinion of an air safety investigator may be received in evidence.

It is most unlikely that the NTSB air safety investigator will remember all of the facts when his deposition is taken so the question arises as to whether he can use his report to refresh his recollection. 49 USC § 1441 (e) provides that:

No part of any report or reports of the Board relating to any accident or the investigation thereof shall be admitted as evidence or used in any suit or action for damages growing out of any matter mentioned in such report or reports.

In *Ritts v. American Overseas Airlines, Inc.*,⁶ it was held that an air safety investigator might use his report to refresh his recollection. In *Loebel v.*

⁴ 201 F. Supp. 791 (W.D. Pa. 1962).

⁵ 188 F.2d 993 (CA DC 1951).

⁶ 97 F. Supp. 457 (D.C. D.C. 1947).

American Airlines,⁷ the investigator's report was admitted as prior recollection recorded. There is language in both cases supporting use of the report to impeach the air safety investigator, but it has been my experience that NTSB counsel will not permit that to be done in the investigator's deposition.

The regulations pertaining to testimony of air safety investigators are found in 14 CFR Part 135. An informative discussion of case law on the subject appears in 1965 ABA Section on Insurance Negligence and Compensation Law 580 (1965).

In the case of FAA investigators and employees, as distinguished from Board investigators, personal appearance in court is allowed, but they may not testify as experts or opinion witnesses. FAA General Counsel or the appropriate Regional Counsel may grant permission to deviate from this policy to prevent a miscarriage of justice. Regulations pertaining to testimony of FAA employees are in 14 CFR Part 185.

On occasion you may need the testimony of employees of other government agencies such as the Weather Bureau or the National Aeronautics and Space Administration to lay the foundation for your expert opinion and in such cases appropriate regulations should be consulted.

Checking the accuracy of the NTSB factual investigation and supplementing it as necessary varies with the particular case and no set rule applies. However, in most cases I prefer to use written interrogatories following the conventional Man-Machine-Media concept. Written interrogatories have been criticized as requiring ten hours of work to get one hour of information, but in the early stages of discovery they are generally far more efficient and much less expensive than depositions. The efficiency and lower expense of interrogatories is partly because aircraft accident reconstruction must often be on the basis of excluded causes. That is, all possible causes are investigated and those that cannot be excluded must be acknowledged as probable causes. The plaintiff's counsel should anticipate the defense offering evidence of causes of which there is no hint in the NTSB report. For example, an agricultural pilot was injured due to an alleged defect in his new spray plane. The day before the accident he had been examined by a physician for toxicity and none was found. Unfortunately the physician was unable to testify at the trial and the defense had a field day offering evidence of the hazard of parathion poisoning in agricultural application and how it can affect a pilot's judgment and visual acuity. In a suit against the FAA for alleged negligence of air traffic service personnel, evidence was introduced that the auto pilot malfunction even though the NTSB investigator had been unable to determine the position of the auto pilot controls and there was no evidence of auto pilot malfunction in his report. Litigation arising out of an accident that was attributed by the NTSB to fuel starvation was successfully defended on the ground of pilot incapacity, established by expert medical testimony based on the autopsy showing of a reddened

⁷ 192 F.2d 217 (2d Cir. 1951).

epiglottis. Written interrogatories are the most effective and least expensive means of discovering such defenses which are not evident in the NTSB report.

When all of the facts have been marshalled, whether from the NTSB investigation or investigations by others, expert testimony will usually be required to establish the cause or causes of the accident. Expert testimony is also admissible to establish the elements of actionable negligence if related to a subject that is sufficiently beyond common experience that the opinion of an expert would assist the trier of fact. Most issues of negligence in aviation cases fall within this rule.⁸

Persons without experience in aviation safety or aviation accident litigation will be surprised by the number of areas of expertise which may be involved in reconstructing an aviation accident and by the definitive conclusions that a qualified expert or team of experts can reach. For example, inflight structural disintegration may be established by plotting the wreckage trail; scratching or marks on control cables or shrouds may indicate rubbing or jamming; fluorescent paint may have been transferred by impact from instrument hands showing the instrument reading at impact; smoke marks may establish or rule out inflight fire and deformation of wing; and horizontal surfaces may establish whether structural overload was caused by control forces or by gusts. Examination of propellers and their slask marks can reveal whether power was being produced by the engine at the time of impact, the engine rpm and the ground speed of the aircraft at impact.

The condition of turbine blades can provide a reliable estimate of the rpm of a jet engine at impact. An inflight compressor failure in an axial flow turbine engine may be indicated by heavy deposits of aluminum alloy in the hot section of the engine. The attitude and altitude of an aircraft when it struck a building has been determined from analysis of brick work marks on a propeller blade.

A catastrophic accident due to flap retraction during approach was caused by fatigue failure of a bolt which in turn was caused by over torquing which was established by bolt head imprint marks on the seating surface. Superficial investigation of such an accident would probably have lead to the conclusion that it was caused by the pilot inadvertently raising the flaps. Unfortunately, the pilot is sometimes unavailable to refute erroneous charges of "pilot error," whatever that term may mean.

It is not uncommon in aviation accident litigation to use several experts, having in mind that the probable cause may be determined by the principle of excludable causes and that opposing counsel may advance theories that were not documented by the official investigation. A recent non-jury trial of litigation arising out of the crash of a light twin engined aircraft involved expert testimony on the subjects of aviation medicine, meteorology, air traffic control, radar, the airplane's automatic pilot and instru-

⁸ See, *Bratt v. Western Airlines*, 155 F.2d 850 (10th Cir. 1946); *Culver v. Sekulich*, 344 P.2d 146 (Wyo. 1959); *Berguido v. Eastern Airlines*, 317 F.2d 628 (3d Cir. 1963).

ment flying techniques. Expert witnesses were standing by to be used if anyone had contended that there was engine failure, instrument malfunction or improper loading of the airplane.

What may appear to be a relatively simple case involving loss of control of a twin engine turbo prop airplane following apparent malfunction of one engine may require expert testimony of a metallurgist, an engine structures specialist, a turbine aerodynamicist, a combustion specialist, an engine controls specialists, a propeller aerodynamicist and a flight control stability specialist. Finding experts in these technologies is not easy. Those of us having the good fortune to practice law in Southern California have an opportunity to become acquainted with people in the aviation and aerospace industry and when we need an expert in some exotic technology we usually start with the telephone. For those of you who must earn your living elsewhere, I suggest calling the engineering or science department of a nearby college or university. FAA Advisory Circular 183.29-1E dated 5 January 1970 lists Designated Engineering Representatives who are available for consulting work in structures, systems and equipment, radio, power plants, propellers and flight test analysis. Experts in Aviation Medicine, which is a specialty recognized by the American Medical Association, are listed in the AMA directory.

Consideration must be given to the stage of litigation at which you wish to employ an expert. This, of course, will depend on the nature and complexity of the case, but perhaps even more important is your own level of experience. Unless you are quite knowledgeable in aviation accident litigation you should consider employing a 'general practitioner' aviation accident investigator quite early in the case. He can direct your reading of technical publications, assist you in examining the NTSB report, help you to draft written interrogatories, analyze the answers and generally assist in preparing the case. He may qualify as an expert in some areas and assist you in locating experts in others.

Perhaps you are thinking that accident reconstruction and use of experts in aviation accident litigation is quite expensive. If so, you are absolutely correct! The cost problem is especially acute in representing plaintiffs, who usually have no knowledge of aviation technology and are unacquainted with those who have. Such litigants must rely entirely on their lawyer to marshal the evidence and to find expert testimony to establish the causes of the accident and liability of the defendants. If he does not keep an eye on the economics of accident reconstruction and expert witnesses, he may find himself in one of the pitfalls I referred to earlier, namely, a plaintiff's verdict only slightly exceeding his non-recoverable costs.