AVIATION LITIGATION & ACCIDENT INVESTIGATION

D. MICHAEL ANDREWS

Aviation Litigation & Accident Investigation

Aviation litigation can be extremely complex and often involves determining the respective liability of manufacturers, maintainers, retrofitters, dispatchers, pilots and others. In some circumstances, the age of the aircraft involved can limit or completely preclude an injured party from compensation. In this book, Beasley Allen lawyer Mike Andrews discusses the complexities of aviation crash investigation and litigation. He provides basic instruction on preserving evidence, insight into legal issues associated with aviation claims, and anecdotal instances of military and civilian crashes.

D. Michael Andrews

Photo by L. Scott Marshall

Mike Andrews joined Beasley Allen Law Firm in 1998, working in the Products Liability and Personal Injury Section. His practice concentrates on complex product liability cases involving serious injury or death. Mike enjoys highly technical cases and has a passion for working on behalf of injured children, along with an interest in cases involving traumatic brain injuries. In 2007 and 2015, he was selected as the Beasley Allen Lawyer of the Year for the Products Liability Section. Mike graduated cum laude from Faulkner University's Thomas Goode Jones Law School. He is a Martindale Hubbell AV Rated attorney.

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Published 2017
Printed in the United States of America
First Edition

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PREFACE

We are called to help others, particularly those who are in need. Our firm motto stands for the belief and practice that we help those who cannot help themselves. Every one of my clients has needs and each one of their needs is different because they have all been affected by tragedy in different ways. It is my responsibility and privilege to speak on their behalf, to work on their behalf, and ultimately to hold someone or some entity responsible for that harm. What we do is help others who truly need it the most, those who cannot, for whatever reason, stand up and speak on their own behalf.

In every product case, we ask, “Where is the product?” As a general rule, no product equals no case. The product is the primary source of evidence. We need to secure the evidence and begin an engineering evaluation, determine what happened, where the stresses that caused a failure originated, and how they were applied. For example, post-crash evaluation of normally rotating parts (propellers, pumps, etc.) reveal whether those parts were operating at the time of impact.

An aircraft is a complex piece of equipment. It involves complex systems that have to work consistently in the right order, every time. In aviation, there is a smaller margin for error or product failure than most cases involving automobiles or other simpler products.

Our firm is divided into practice sections and I am a Principal in our product liability section. A product liability case involves an instance in which a product (automobile, aircraft, equipment, etc.) has failed and someone has been injured or killed. Ultimately, we seek a safer, alternative design that would have prevented the harm. Because of our expertise in complex litigation, it is not uncommon for us to be called upon to handle high-profile and very complex cases. Our job is to find out what has happened, how it happened, and why it happened – including how the product involved in the accident could have been designed differently.

INTRODUCTION

Normally when we look at a flock of birds, we tend to view them as beautiful or at least innocuous. We rarely see a flock of birds as a potentially deadly force.

Yet the collision of a passenger jet with at least one bird nearly resulted in catastrophe and was responsible for an epic landing on the Hudson River, no loss of any of the 155 lives onboard, a pilot's heroism, and a Hollywood movie.[1]

"I think a lot of people started praying and just collecting themselves…It was quite stunning…It was a great landing," said one passenger.[2]

That it was a great landing is an understatement given that air traffic controllers reported that the plane cleared the George Washington Bridge leading into New York City by only 900 feet.[3]

Only 15 people were taken to hospitals.[4] The plane was only airborne for less than three minutes.[5] The now-famous pilot, Captain Chesley (Sully) Sullenberger, reported the air strike to air traffic controllers and alerted the emergency status of his flight.[6] Even more fascinating is that pilots do not typically train how to land on water.[7] The pilot's heroism continued even after the landing because he refused to leave the plane before walking through the plane, filling with water, two times to ensure no one else was still onboard.

Following the crash landing, the CEO of U.S. Airways would not provide immediate speculation as to the cause of the incident, noting that the National Transportation Safety Board (NTSB) would be completing an investigation on site.[8]

An airliner disappeared without a trace. That was the news headline that people awoke to one morning in March 2014.

Between Beijing and Kuala Lumpur, the now-famous Malaysia Airlines Flight 370 became untraceable on radar; 239 people were onboard.[9]

Authorities and investigators analyzed debris that washed ashore and data from satellites and other sources, resulting in multiple theories – including a commonly held one that the plane was not under human control when it crashed into the water, likely at a rate of 12,000 feet per minute.[10] The theories hinged upon the location of discovered debris, the condition and position of the plane parts and mechanics, and simulations generated by Boeing experts.[11]

A large number of investigators and experts became involved in the mystery, as every detail about what happened before the incident and about the communications data available during the flight and about the condition and location of the debris were essential to trying to understand how and why so many people lost their lives.[12]

Large airliners gaining national attention are not the only aircraft to disappear and result in loss of life. Recently, the waters of Lake Erie obscured the remains of a private plane and its passengers, and a bag was found in Cleveland, Ohio.[13] Its owner was the pilot of the plane that had just taken off with six people aboard before vanishing from radar.[14] The people onboard were the pilot’s family and neighbors; they were returning from a weekend of family time and fun.[15]

On November 26, 2011, the owner of a tree farm near Crystal Lake, Illinois, heard an airplane making troubling sounds. Moments later, a Cirrus SR20 airplane broke through the clouds above his head and crashed nose-first into a soybean field. Aboard the airplane were Ramie Harris, a 21-year-old Wheaton College junior; her sister Shey, her father Ray, who piloted the plane; and Chris Backus, a friend of one of the sisters. All four passengers died at the scene.

Just twenty miles away, another small airplane crashed while transporting a medical patient from West Palm Beach, Florida, to a Chicago area airport. On board the Piper Navajo airplane, which belonged to Trans North Aviation Limited, were the pilot, a pilot-in-training, a flight paramedic, the patient, and his wife. Three of the airplane's occupants died from their crash injuries at the scene or *en route* to the hospital, including the patient and his wife.

Also in November 2011, a Cirrus SR22 airplane nosedived into Florida's Loxahatchee wilderness, killing an experienced commercial airplane pilot and his cousin, who held a private pilot's license. NTSB investigators found that the airplane's emergency parachute had been deployed, but they do not yet know what caused the aircraft to fail.

The day before Thanksgiving 2011, a twin-engine Rockwell Aero Commander 690A took off from Mesa, Arizona. Less than five minutes later, the airplane's smoldering ruins were strewn about the Superstition Mountains, the result of the airplane's collision with a mountain peak. That crash killed an experienced pilot, his three young children, and two other men, one a commercial pilot and the other an aviation mechanic.

Though the later incidents involved only smaller planes, the questions and potential causes of the incidents are similar or the same as those raised with the larger aircraft in the earlier incidents described above.

Did the pilot make a mistake? Was there a mechanical failure in the plane's structure or electronic controls? Did the weather cause a mechanical or structural failure, or was the plane improperly maintained?

PART I:
WHO, WHAT, WHERE & HOW
OF AVIATION LITIGATION

WHAT DANGERS ARE INVOLVED IN AVIATION RELATED CLAIMS?

Flying is an inherently dangerous way of traveling. Soaring through the sky at hundreds of miles an hour, thousands of feet above the ground in an airplane or helicopter leaves little room for error. One small mechanical problem, misjudgment, or faulty response in the air can spell disaster for air passengers and even unsuspecting people on the ground.

According to the National Transportation Safety Board (NTSB), flying remains one of the safest forms of transportation, especially when compared to automobiles. NTSB records indicate that air travel is sixty-two times safer than traveling by car or truck, and the odds of dying in an aviation crash of some kind are, for U.S. residents, far more remote than dying in a car crash. But numbers can distort the truth.

Statisticians who say that air travel is safer than highway travel make their claim by calculating number of deaths per miles traveled. However, if you look at the number of deaths compared to the number of journeys made, air travel becomes a lot more dangerous. In other words, if there were as many airplane and helicopter flights as automobile journeys, then people would be twelve times more likely to die in an airplane crash than on the road. Fatalities per 100 million passenger miles are on average 4.5 for cars and trucks, 2.7 for trains, and 55.0 for airplanes.

This is why it is crucial for the aviation industry, including manufacturers, pilots, mechanics, and air traffic controllers, to adhere to the highest possible standards at all times. Unfortunately, this is not always the case. Decades of NTSB aviation crash investigations have found that the majority of crashes – from helicopters and private airplanes to large passenger jets – are preventable.

WHO & WHAT CAN CAUSE A CRASH: A BRIEF SUMMARY

Mechanical Failure

By some estimates, mechanical failures cause up to 22 percent of aviation crashes. Historically, aircraft manufacturing defects, flawed aircraft design, inadequate warning systems, and inadequate instructions for safe use of the aircraft's equipment or systems have contributed to numerous aviation crashes. In such cases, the pilot may follow every procedure correctly but still be unable to avert disaster.

Improper or Poor Maintenance

Aging aircraft sometimes develop flaws and deficiencies that are not easily detectable.

Commercial aircraft that fly internationally may be repaired, tuned up, and inspected by mechanics halfway around the world, sometimes not in accordance with Federal Aviation Administration (FAA) regulations.

Neglect

Often, simple neglect can have disastrous consequences, as was the case for Alaska Airlines Flight 261, which crashed into the Pacific Ocean in 2000, killing all eighty-eight people aboard. Investigators ruled the probable cause of that crash to be a loss of control resulting from "Alaska Airline's insufficient lubrication of the jackscrew assembly" on the plane's horizontal stabilizer trim system.

Pilot Error

Aviation crash data shows that nearly half (49 percent) of all air crashes are caused by pilot error.

Most pilot errors or "cockpit errors" as they are sometimes called, manifest as a pilot's faulty response to either a mechanical problem or adverse weather conditions.

Inadequate training and failure to follow proper emergency procedures under duress are common underlying causes of pilot error.

Other types of pilot error may include unprofessional conduct, navigational mistakes (improper altitude, speed), miscommunication with air traffic controllers, improper management of fuel levels, and improper use of critical equipment, such as landing gear and the de-icing system.

Also, although not true errors, pilot fatigue and loss of spatial awareness have been the documented cause of numerous crashes. These causes will be explored in further detail later in this book.

HOW TO EVALUATE AVIATION ACCIDENT CLAIMS[16]

Because flight safety depends on several complex, interconnected systems encompassing pilot training and experience and ranging to mechanical maintenance and structural integrity of the aircraft, liability issues can be just as complex.

In the case of pilot error, for example, negligence, recklessness, and other misconduct can cause a pilot to face both civil and criminal charges. A commercial pilot's error is also the airline's error under the "respondeat superior" law, which means that both pilots and their employers can be held liable for personal injury and wrongful death claims. Pilots of private airplanes and the owners of private aircraft a can be held liable for damages under the "vicarious liability" legal theory.

If mechanical failure or other flaws played a role in an aviation crash, other parties, such as the manufacturers of the aircraft and/or its components, may be held liable under product liability and strict liability claims.

In many cases, airlines and/or manufacturers of aircraft will contact the survivors of an aviation disaster, or their families. An insurance company representing an airline or a manufacturer may offer to settle a family's claim very quickly. An insurance company may also attempt to offer some type of "advance" to help with many of the costs faced by families as the result of a death or severe injury. One should not accept any of these offers or sign anything without speaking to an attorney. In many instances, an insurance company will offer to settle a victim’s claims for an amount substantially less than that to which the victim is entitled.

AIRCRAFT BASICS & DANGERS

Aerodynamics

A lawyer with an aircraft case would be wise to take the time to learn the basics of aerodynamics forces, stability, and control – in short, aeronautics.[17] Such understanding, though, will require study of highly complex information that includes algebra and trigonometry.[18] Concepts such as lift, drag, and longitudinal modes will help explain the aircraft's rate of climb, Dutch roll, climb angle, and take off. [19]

Below is a sampling of the type of aerodynamics not covered in detail in this book, but which may prove helpful in understanding the practical aspects of your case:

> An aircraft, even a helicopter, can be approximated as a solid body with six "degrees-of-freedom." Taking the x-axis to be forward, the y-axis to the right, and the z-axis downward, the aircraft can translate along and rotate about each axis, hence, the six possible motions. If we add structural deformations such as wing bending, fuselage torsion, and flutter (so-called aeroelastic effects), then the number of degrees-of-freedom increase. An aircraft is usually symmetrical about the x-z plane called the plane of symmetry. Motion of the aircraft in the plane of symmetry is referred to as longitudinal motion. This motion is a combination of pitching and heaving where the aircraft pitches, or rotates, about its center of gravity (*cg*) while the *cg* translates along the x- and z-axes. Motion of the plane of symmetry is called lateral-directional motion. Here the aircraft rolls about the x-axis, yaws about the z-axis and translates to the side along the y-axis.
>
> […] The elevator, hinged to the fixed horizontal stabilizer, moves up or down as the pilot respectively pulls or pushes on the control wheel. This causes the aircraft to nose up and down, respectively. Rotating the control clockwise will

> cause the right aileron to move upward and the left aileron downward. This produces a rolling moment about the x-axis that moves the right wing downward and the left wing upward. When the pilot pushes with his right foot on the right rudder pedal, the trailing edge of the rudder, hinged to the vertical stabilizer (or fin), will move to the right. This produces an aerodynamic force on the vertical tail to the left, which, in turn, results in a nose-right yaw of the aircraft about the z-axis.
>
> The control surfaces are positioned in response to the movement of the control wheel and rudder pedals as just described. The surfaces are connected to the pilot controls mechanically by a system of push-pull rods and wire cables. In modern transport and military aircraft, the mechanical connecting system is replaced by hydraulic or electrical actuators driven by signals from transducers positioned by the pilot, an autopilot, or a stability augmentation system. Some such systems, depending upon the extent of electronic controls, are called "fly-by-wire" systems.[20]

It is not the point of this book to get into great detail, but you can refer to this book's list of references to find more in-depth publications that include such material. Suffice to say that you, as a sole practitioner, will need not only experts but also at least a basic understanding of how an aircraft operates in order to properly represent your client.

Aircraft Basics

An aircraft is not simply a cargo area, cockpit, wings, landing gear, and the tail.[21] It contains multiple systems that combine into one extremely complex system that is affected by air traffic control, the environment, and other external forces.[22]

An accident involving an aircraft can be caused by even a single, seemingly small mishap or error or environmental factor, or multiple factors can be at fault.[23] While aircraft are complex, when investigating such accidents, attorneys and investigators can use logic to realize that discovering one fatal cause can eliminate the need to look for additional failures.[24] Engine failure negates the need to look for a problem in the flight control systems but would direct investigators to look into why the engine failed, such as bad fuel or a crew member error or ice or birds.[25] In short, there are almost countless factors that could cause or contribute to an aviation accident.

As a word to the wise, an aviation case is highly technical and complex and requires more thorough legal research early in the case than other types of cases.[26]

Aircraft Crash Causes

As discussed, aircraft crashes can be caused by a number of factors: human error on the ground before or during the flight and in the air; weather conditions; manufacturing defects such as poor design or structural problems causing mechanical failure; etc.

The latter of these factors fall into the category of products liability and will be discussed in further detail in the subsequent pages.

Human Error

The most serious type of human error in an aviation situation is that of a pilot.[27] Pilot error is the most frequently cited cause of airplane crashes by NTSB investigators.[28] In fact, a pilot's erroneous response (known as "cockpit errors") to poor weather conditions and mechanical problems is the underlying cause of most crashes.[29] Negligence, lack of training, and miscommunication are other causes, as well as, in NTSB's words, "noncompliant behavior, intentional misconduct, or lack of commitment to essential tasks," all of which constitute a lack of professionalism.[30]

In the history of aviation, there has rarely been a crash where NTSB did not assign some responsibility to the pilot, even if the wings fell off. NTSB almost always claims it was at best a combination of some mechanical or manufacturing defect and the pilot's inability to keep the plane in the air. While I usually focus on product liability and often represent the pilot or his family in my firm's aviation cases, the practitioner cannot rule out the pilot's operations.

Pilots must make good judgment calls and must rightly control the aircraft.[31] An example of a potentially fatal judgment error is a pilot's choice to fly into a storm or other increasingly dangerous weather conditions where ultimately the pilot may lose reference to the horizon.[32] On the other hand, neglecting the landing gear when descending at an airport is an example of a blatant mistake in controlling the plane.[33]

Pilot Paperwork

If you represent the pilot or the pilot's family, you must be prepared when the pilot is blamed. An easily overlooked aspect to the pilot's liability includes the pilot's paperwork.

Much litigation has focused on insurance coverage of pilots without current medical certification.[34] Insurance policies sometimes explicitly exclude coverage of a pilot without a current medical certification, while other policies do not.[35] Courts are divided on the enforceability of such coverage exclusion when a policy does include such a clause, unless there is proof of causation between the accident and the pilot's lack of proper medical certification.[36]

Insurance policies typically also require valid pilot license and proper rating.[37] Whether a valid pilot's license includes a student pilot certificate is yet to be conclusively decided by the courts.[38]

Regarding instrument ratings, it often depends on the details of the flight and the weather conditions:

> "If a noninstrument rated pilot has an accident while flying in conditions mandating Instrument Flight Rules (IFR), the courts will often look at the whole flight, and especially the conditions present at the inception of the flight, to determine whether the pilot was appropriately rated. Several courts have upheld the denial of coverage where it is found that a pilot qualified under Visual Flight Rules (VFR) only took off under IFR conditions. Other courts have held a similar policy exclusion inapplicable where a VFR pilot has taken off under VFR conditions but encountered IFR conditions in midflight."[39]

Aircraft ratings are less contentious, especially if a policy states that a pilot without the appropriate aircraft rating is not covered, in which case courts have upheld the exclusion.[40] (FAA regulations are helpful in confirming the correct rating.[41])

One recent example of an accident relating to the pilot's qualifications was a crash in which the family of a brother and sister was killed in southern Illinois on New Year's Eve.[42] The family is suing the estate of the pilot, alleging he was not qualified to fly the private aircraft during poor weather conditions.[43]

All four people aboard the Nashville-bound single-engine Piper died when the plane crashed into a wooded area near the town of Vienna, Illinois, including brother and sister Jordan Linder, 35, and Jasmine Linder, 26, both residents of Iowa.[44] The crash also killed pilot Curt Terpstra, 34, of Pella, Iowa, and Krista Green, 37, of Altoona, Iowa.[45]

The four Iowans were headed to Nashville when they made an unscheduled stop in Hannibal, Missouri, due to poor weather conditions, the lawsuit alleges.[46] Mr. Terpstra allegedly tried to resume the flight to Nashville a few hours later despite the weather forecast calling for severe weather.[47]

According to *The Des Moines Register*, the complaint claims that Mr. Terpstra "was unqualified to fly the plane at the time of the crash, noting he was only allowed to fly during certain times, weather and cloud ceiling conditions. The suit notes that thunderstorms were forecast along with other poor weather conditions during the second leg."[48]

In resuming the flight despite the forecast, Mr. Terpstra failed in his obligation to understand the weather conditions, the lawsuit asserts. Jordan Linder sent a video he took during the flight to a family member, which showed darkness and electrical storms. Mr. Linder's sister-in-law told *The Des Moines Register* that the video "was completely black. All I could see was lightning."[49]

“Given the weather conditions and cloud ceiling, there was no way he could legally fly at a safe altitude,” a lawyer for the Linders’ estates told *The Register*.[50] *The Register* also reported that Mr. Terpstra was not very experienced as a pilot.[51] His flight records show that the last time he flew before the crash was in July and that he had less than nineteen hours of experience flying at night and zero flight time in conditions calling for reliance on instruments.[52]

Pilots are not the only humans who can make mistakes with catastrophic results.[53] The flight crew can too.[54] Crew members can accidentally input the wrong directions in the navigation system.[55] There was one such case where the consequence was the Korean aircraft’s inadvertent flight over hostile territory…and ultimate destruction by a hostile aircraft.[56]

Ground personnel can be at fault as well.[57] A mechanic could jam the controls by having left a tool in the frame, or the lineboy could refuel the aircraft with the wrong fuel.[58] Air traffic controllers are known to make mistakes too; in one case, the controller directed the incoming craft with an inaccurate altitude by 1,000 feet, causing the pilot to dive the airplane into the ground.[59] The pilot was partially to blame in that case because he should have executed a missed approach. [60]

In-House Examples of Cases Involving Human Error[61]

In 2007, Beasley Allen filed a lawsuit on behalf of an Alabama woman who watched her husband and son die in a Calera air show crash. We filed a wrongful death suit against the plane’s owner and its late pilot’s estate.

On September 23, 2006, our clients and their son attended the “Wings and Wheels Air Show” in Calera, Alabama, which was sponsored by the Birmingham Aero Club Air Safe Foundation. Our client and his son were paying passengers on a Beech Bonanza F33 aircraft provided by its owners for use at the show.

Shortly after takeoff from the Shelby County Airport, the airplane experienced a total loss of engine power and inadvertent stall due to a lack of fuel.

The surviving widow and mother wanted the complete story of this airplane crash to be made public so that in the future safety is the paramount issue for the Air Show and pilots. The deaths in this case were senseless and entirely preventable.

The Birmingham Aero Club Air Safe Foundation and the pilot failed to ensure there was enough gas in the plane's engine before taking off with these two victims. Once the pilot realized his plane was out of gas, he maneuvered the plane in a manner that was contrary to accepted pilot standards. Thus, our client witnessed the horrific deaths of her husband and only son, which caused her tremendous mental pain and anguish.

Our firm filed another wrongful death lawsuit – alleging negligence, gross negligence and vicarious liability – on behalf of the family of a student pilot, who was killed March 24, 2014, when the Piper PA-44-180 aircraft he was co-piloting as a flight student crashed near Brunswick, Georgia, after departing from North Carolina, with the intended destination of Jacksonville, Florida.

Our lawsuit alleged the plane was not airworthy, and mechanical failure resulted in the crash, killing our client's husband and the other student pilot during the flight. The plane was owned, leased, and maintained and/or operated by the defendants, Airline Transport Professionals Holdings Inc., ATP USA Inc., ATP Flight Academy LLC, ATP Flight Academy of Arizona LLC, and ATP Aircraft 2 LLC.

The flight school should have known the aircraft was not properly maintained and posed an unreasonable risk to all persons operating, flying and being flown on board. However, it did not warn the pilots about possible problems with the aircraft, and it should have known that the student pilots did not have the training or experience to operate the plane under conditions it knew to be unsafe. As a result, our client lost his life.

The subject aircraft was a complex twin-engine aircraft, having no de-icing capability on its wings and tail surfaces. Radar indicated that the subject aircraft was at an altitude of 8,000 feet at 5:40 p.m. when it began a rapid descent, reaching an altitude of 300 feet at 5:44 p.m., and crashing following an in-flight break-up near Brunswick, Georgia, causing severe injuries and death to both student pilots.

The right vacuum pump on the subject aircraft was inoperative prior to and at the time the subject aircraft departed North Carolina. The ATP defendants knew or should have known of this fact. The left vacuum pump on the subject aircraft failed during the flight at some point prior to the subject aircraft's rapid descent and crash.

Weather Conditions[62]

Adverse weather conditions, such as lightning strikes, unpredictable down drafts, and excessive turbulence are blamed in about 5 percent of aviation crashes, while the causes of an additional 33 percent of aviation crashes remain undetermined.[63]

According to NTSB senior meteorologist Donald Eick, nature supplies "sign posts in the sky" for pilots and others involved in aviation.

Eick complied a 128-page presentation describing the effects of weather on aviation and flight. His conclusion was that "most weather-related accidents and incidents are preventable." His presentation stressed the dangers of thunderstorms, dust storms creating blowout conditions, adverse winds, etc.

This information makes the roles of weather reporting services, pilots, and others critical for preventing weather-related accidents. Thus, most accidents caused by engines ingesting water or dust, lightning or wind causing damage to the aircraft, etc., could have been the results of human error or poor judgment.

Another Major Factor in Aviation Cases: The Government

The government can be an actor in more than one role even within one aviation case. The government can be the defendant or can be a source of a violation and thus the liability of the manufacturer or pilot. The government is usually involved in the investigation and is responsible for taking legal steps to prevent similar accidents in the future.

National Transportation Safety Board (NTSB)

In 1926, Congress passed the Air Commerce Act and gave the U.S. Department of Commerce the authority to conduct investigations into aviation accidents' causes.[64] In 1940, the Civil Aeronautics Board's Bureau of Aviation Safety was established and instead assigned the authority and charge to investigate aircraft crashes.[65]

Then, in 1967, Congress created the Department of Transportation (DOT), combining all agencies over transportation into the one department.[66] It also created the National Transportation Safety Board, an independent agency within the new Department of Transportation.[67] This agency has since taken on the responsibility of investigating accidents not only in aviation, but also highway, marine, pipeline, railroad, and other accidents.[68]

In 1974, Congress felt NTSB (and any other agency) could not properly conduct oversight and investigations without complete separation from any other entity or agency of the U.S. government, so Congress recreated it outside of the jurisdiction or confines of the DOT.[69] Now NTSB solely and objectively investigates and recommends changes without control over any direct operations of any transportation method (unlike when it was within DOT).[70]

In 1996, NTSB received a new task from Congress: helping those who are victims of aviation crashes.[71] This program has grown to assist victims of all types of transportation-related accidents and has even resulted in the creation of the NTSB Training Center, whose purpose is to increase expertise and skills.[72]

The NTSB's accomplishments since its initial creation include:

- Investigations of 132,000 aviation accidents and thousands of "surface transportation accidents;"
- Publication of more than 13,000 safety recommendations;
- Creation and maintenance of an Aviation Accident Database available to the public online.[73]

Federal Aviation Administration (FAA)

As aviation grew into an industry, particularly after World War I, many thought it was necessary to have federal action to establish and enforce safety standards, enabling the industry to thrive commercially.[74] Thus, Congress passed the Air Commerce Act in 1926, which authorized the Secretary of Commerce to regulate air traffic, license pilots, and certify aircraft, among other duties.[75]

The Air Commerce Act marked the beginning of the journey to what became the Federal Aviation Agency and ultimately the Federal Aviation Administration.[76]

The work of the FAA is evident in this excerpt from its website:

> Between 2001 and 2007, aviation witnessed one of its safest periods for scheduled air carriers. Not counting the terrorist activities of September 11, 2001, there were only three fatal accidents in 2001; none in 2002; two in 2003; one in 2004; three in 2005; two in 2006; and none in 2007. Fatal accidents became rare events with only .01 accidents per 100,000 flight hours or .018 accidents per 100,000 departures.[77]

The FAA now has a hand in just about every aspect of aviation. To conduct the Administration's duties, it has the following offices:

- Aircraft Certification Offices (ACO)
- Airports Regional Offices
- Flight Standards District Offices (FSDO)
- Manufacturing & Inspection District Offices (MIDO)
- Aircraft Evaluation Groups (AEG)
- International Field Offices (IFO)
- Certificate Management Offices (CMO)
- Regional Offices
- Security and Hazardous Materials Offices
- Mike Monroney Aeronautical Center
- FAA Academy
- FAA Leadership & Learning Institute (FLLI)
- Logistics Center
- William J. Hughes Technical Center[78]

The FAA requires a three-step process for an aircraft design to be certified:
1) Approval of each proposed design (including of engines and propellers);
2) Issuance of a type certificate;
3) Issuance of a production certificate, if the prototype complies with the approved design specifications in the type certificate.[79]

The FAA also certifies airmen and is the governing agency over air traffic control at airports.[80] It is responsible for weather reports and aeronautical charts as well as removing airport hazards and ground obstructions.[81]

Of course, one of the primary roles of the FAA, as with any other government agency or department, is the promulgation of a sizeable body of regulations, governing the many details of aviation operations, crafts (even seat cushions), etc. As indicated above, proving an actor within your case as guilty of violating one of these regulations might prove beneficial to your case, particularly if the regulation was a necessary safety standard or related to the pilot or other personnel's licenses.

But the FAA is not the only government agency involved in the aviation industry; the National Weather Service and other government weather services contribute to the safety of the aviation industry. [82]

Thus, the aviation industry is dominated by agents and other federal government personnel.[83] Aircraft certification and inspection, aviation personnel licensure, air space allocation, air traffic control, and weather information are all responsibilities of the U.S. government.[84] In addition, the government is a major aircraft and airport owner and operator.[85] Thus, the government may be held liable based on any of these responsibilities.[86]

NTSB v. FAA

Sometimes the government agencies interact and disagree on what is safe for airliners and the public.

For example, in September 2016, NTSB issued recommendations in response to a March 2015 crash of a Delta Airlines jet, Flight 1086, that veered off a snowy runway and skidded thousands of feet before plowing into an embankment.[87] The plane was carrying 132 people.[88]

NTSB investigators concluded the probable cause of the crash was pilot error but reiterated previous recommendations that the FAA issue stricter landing rules for certain passenger jet models, and that manufacturers develop new technology that can better guide pilots landing in potentially dangerous conditions.[89]

NTSB, which can only inform aviation policy but not change or enforce it, issued a similar call the year before, but its recommendations went unheeded by the FAA and aircraft makers.[90] After the Delta 1086 crash, NTSB classified the response to its recommendations as "unacceptable."[91]

In 2013, then NTSB Chairman Deborah Hersman told FAA regulators that they should reconsider their approval of the powerful lithium-ion batteries used in Boeing's new 787 Dreamliner jets.[92]

Ms. Hersman told FAA authorities that "the assumptions used to certify the battery must be reconsidered."[93] As some news outlets had pointed out, those assumptions were based on information provided by Boeing about the potential risks of using the batteries.[94]

Boeing's Dreamliner 787s incorporated a major redesign of the airplane infrastructure, much of which centers on the use of powerful lithium-ion batteries to control systems that are normally controlled by hydraulics.[95] Replacing the hydraulics with electronics and building the plane out of a carbon fiber composite instead of aluminum alloy significantly lightened the aircraft, generating substantial fuel savings, and made the airplanes substantially cheaper and easier to maintain.[96]

But a fire that broke out aboard a Japan Airlines (JAL) Dreamliner in Boston and another apparent fire that melted the battery of an All Nippon Airways (ANA) Dreamliner in Japan demonstrated the actual problems with the batteries may have been much greater than the problems Boeing postulated.[97]

According to *The New York Times*, Boeing officials said that the lithium-ion batteries used in the Dreamliners “were likely to emit smoke less than once in every 10 million flight hours.”[98]

Those incidents aboard JAL and ANA, however, showed that the figure could have been a wild underestimation of the batteries’ flaws.[99] Once the Dreamliners were in service, Ms. Hersman said, batteries emitted smoke on two different airplanes less than two weeks apart in less than 100,000 commercial flight hours.[100]

According to the Associated Press, Boeing told regulators that if the lithium battery short-circuited in one cell, the short circuit would be contained within that cell.[101] However, in the case of the JAL 787 that caught fire on the tarmac at Boston’s Logan airport, “the fire started with multiple short-circuits in one of the batteries’ eight cells,” which spread to the other cells in an “uncontrolled chemical reaction known as ‘thermal runaway.’”[102]

Boeing received FAA approval to conduct a series of test flights on the Dreamliners.[103] According to the FAA, “the primary purpose of the test flights will be to collect data about the battery and electrical system performance while the aircraft is airborne.”[104]

Meanwhile, the battery flaws were adding up to a major headache for Boeing and its Dreamliner customers.[105] All Nippon Airways, for instance, was forced to cancel 450 domestic and international flights affecting nearly 60,000 customers while it tried to find safe replacement airplanes for other routes.[106]

International Government

Typically, foreign governments have immunity from liability thanks to the Foreign Sovereign Immunities Act of 1976 (FSIA).[107] FSIA does include several exceptions, one being that foreign governments are still liable for claims against their commercial activities.[108] Operating a national airline is one such commercial activity; thus, foreign governments are sometimes named party to a lawsuit arising from an aviation incident.[109]

In 2013,[110] columnists Matier and Ross at the *San Francisco Chronicle* reported that San Francisco International Airport (SFO) officials and other aviation authorities were concerned about Asiana Airlines' unusually high rate of aborted landings or "go-arounds" at SFO, where one of the South Korean operator's flights crashed upon touchdown, killing three and injuring some 180 others. The incident, and Asiana's poor SFO landing record, underscore what aviation officials say is a big disparity between U.S. aviation safety standards and those of most other countries.

According to an *L.A. Times* report, "a wide range of U.S. aviation experts" believe that "the United States and a handful of European nations, by a wide margin, have better-trained pilots, more sophisticated regulatory agencies that closely monitor operations, and airlines that vastly exceed minimum government requirements.

"Although all commercial airlines that fly into the U.S. must meet minimum international standards, only a few rise to the same level as the domestic industry," the *L.A. Times* reported.

In Asiana's case, one deficiency may be in pilot training requirements. Some U.S. aviation experts contend that the crash of Asiana 214 and the operator's poor SFO-landing record indicate that its pilots may be too dependent on automatic controls and not adequately trained to land an airplane manually.

Any deficiency of skill in operating an airplane manually could spell disaster, especially in takeoff and landing procedures, which are more complicated and require greater skill than autopilot may provide.

Investigators are trying to understand why the three pilots aboard Asiana 214 failed to notice the airplane's improper landing speed and altitude until it was too late. To date they have found no evidence that the Boeing 777 had any electronic or mechanical problems that could have contributed to the disaster. So, for now, the training, experience and qualifications of Asiana 214's pilots remain at the center of the probe.

Asiana Airlines insists that it meets or exceeds U.S. and international standards, but company officials said that they were "in the process of reexamining our procedures and training."

The *L.A. Times* reports that of the nearly 300 aviation crashes worldwide involving large passenger airplanes since 1990, 87 percent involved foreign carriers, even though they represent a substantially smaller share of air traffic. The FAA has restricted or banned airlines from twenty-three countries from entering U.S. airspace. Most of the banned airlines are based in Asia and Africa.

PART II:
LIABILITY OF THE ACTORS INVOLVED

PILOTS

Human error, particularly pilot error, is the primary cause of most aviation accidents.[111] Pilots are usually held to the standards of negligence, unless state laws impose different or additional duties.[112] Through *respondeat superior*, the pilot's liability may be imputed to her employer if she was acting within her scope of authority or duties as an employee when the accident occurred.[113]

Facts such as the terrain, flight plan, etc., are essential for a pilot to know, and if the pilot does know all relevant facts, then she can be held liable for an accident.[114] But if the pilot has no way to know all the facts necessary for safely operating the aircraft and successfully completing the flight, the Flight Service Station or air traffic controller is supposed to supply such facts to the pilot.[115]

A duty of reasonable care to the aircraft's passengers and other airborne aircraft is required of the pilot, regardless of her experience.[116] The Federal Aviation Regulations (FARs) define this standard of care and operation details such as who, where, when, and how an aircraft may be operated.[117] If the pilot violates a FAR, the state law may consider that negligence *per se*.[118] A much higher degree of care is required of common carriers' pilots than others.[119]

The pilot takes on a number of specified responsibilities including:

1) "The duty to operate the aircraft in a safe manner." This includes cockpit controls; liability has been found where a pilot incorrectly turned off a fuel valve or erroneously adjusted wing flaps.[120]
2) The duty to notice and avoid other air traffic, including the responsibility to avoid blind spots and watch for other, perhaps negligently operated aircraft.[121]
3) The duty to be cautious in avoiding other obstructions such as wires and power lines (though the pilot will not be

considered at fault if an air traffic controller guides him too low and into such an obstruction).[122]

4) The duty to refuse to proceed with a flight when a hazard such as bad weather is known.[123]

A pilot can be liable under a different theory than negligence, such as when a pilot violates the terms of his medical certificate or flies without a certificate at all or under the influence of alcohol.[124] Such circumstances can lead to the pilot's liability for willful misconduct and a plaintiff's punitive damages.[125]

Crop dusting or other flights that can be considered ultrahazardous can cause the pilot to be found strictly liable, eliminating the plaintiff's need to demonstrate negligence or an intent to harm.[126]

MANUFACTURERS: DESIGN & PRODUCTION DEFECTS

On March 25, 2017, the Crenshaw family from Jackson, Tennessee, were flying home from a trip to Disney World in Florida when their plane crashed.[127] Federal investigators at the crash site collected evidence and talked with eyewitnesses, but initial reports indicated the plane may have just started coming apart in the sky.[128]

One eyewitness was driving along the highway when she spotted the troubled airplane.[129] "It spun around and took a nose dive down. The wing came down over us, the wind carried it over into the field," said this eyewitness.[130] If it did indeed come apart in the sky, there must have been a design or manufacturing defect or both.[131]

The aircraft should be designed to save you from injury or death in event of a crash. Sadly, that is not always the case.

In another of our cases, our client's husband was killed on July 29, 2010, when the plane he was piloting crashed in a wooded area near Canton, Mississippi. The lawsuit alleged the plane was defectively designed, ultimately leading to the crash.[132]

Our lawsuit alleged that at the time our client's husband was killed, the aircraft he was flying was defective and unreasonably dangerous in its design.[133] We alleged that the plane was not flight worthy, and this was a crash that should never have happened.[134]

As noted previously, aircraft manufacturing defects, flawed aircraft design, inadequate warning systems, and inadequate instructions for safe use of the aircraft's equipment or systems have contributed to numerous aviation crashes.[135] In such cases, the pilot may follow every procedure correctly but still be unable to avert disaster.[136]

Design Defects

Another of the FAA's duties includes issuing certifications for designs of aircraft and their components.[137] In one of our cases, we found that the defendant engineering company lied to the FAA about the design for a new component. The defendant company was ordered by the FAA to fireproof its turbocharger oil tanks. Rather than follow the *In response*, the defendant installed an untested and uncertified oil tank.

Rather than perform tests on its modified tanks to ensure compliance with the FAA directive, the defendant claimed it relied solely on oral representations from another company that the process was a valid means of fireproofing aluminum oil tanks. As a result, the defendant knowingly and intentionally misrepresented to the FAA that it had performed tests to certify the new tanks, when in fact it had not. Such a misrepresentation led to the approval by the FAA of the new aluminum oil tanks, and also to the tragic deaths of our plaintiffs.

There was also a question whether the plaintiff's claims were barred by the General Aviation Revitalization Act (GARA). GARA is a statute of repose that prohibits personal injury and wrongful death actions against the manufacturers of general aviation aircraft and aircraft parts, if such actions arise from accidents occurring more than eighteen years after delivery of the aircraft to its first purchaser or, with respect to new or replacement parts, more than eighteen years after installation of the part (49 *U.S.C.* § 40101 (1994)).

But under GARA, this period of repose does not apply to cases – like ours – in which the manufacturer knowingly misrepresents or conceals certain safety information from the FAA (49 *U.S.C.* § 40101(2)(b)(1) (1994)).

Crashworthiness

It is a common cliché to say that accidents happen. But it is true, even with aircraft. Thus, an accident is undoubtedly foreseeable, and aircrafts must be designed for crashworthiness, or for the aircraft's ability to preserve its passengers' lives and wellbeing in the instance of a crash.[138] In the 1970s, courts began to consider whether manufacturers should be liable for failing to design and produce aircraft such that injuries to passengers in case of a crash be minimized.[139]

Aircrash safety has been a focus of federal government study since during WWII when the Civil Aeronautics Board cooperated with the Army and Navy to determine what about the structure of aircraft cabins contributed to or caused particular crash injuries.[140] Cornell University Medical School further studied the concept and called for changes in designs of cabins to improve passengers' safety in case of a crash.[141] The Crash Survival Design Guide was written to apply engineering principles to aircraft crashworthiness and was last published in 1980 for the United States Army Research and Technology Laboratories.[142]

In short, manufacturers have a legal duty to design their aircraft for crashworthiness.[143] Thus, it is helpful to the attorney to understand certain technical design factors impacting severity of injuries and likelihood of deaths in crashes.[144] A foundational principle in crashworthiness is inertia (objects at rest tend to stay at rest and objects in motion tend to remain in motion); to change objects' conditions requires an exchange of energy.[145] If this energy exchange is too abrupt or is uncontrolled, damage can occur – or injury if the objects involved are humans.[146]

The technical design factors that should be considered include the following:

- airframe and cabin integrity;
- restraint systems;
- cabin and cockpit environment;

- energy absorption; and
- the post-crash environment.[147]

The above factors are essentials for "people-packaging."[148] No one would transport porcelain china in packages of rocks.[149] Neither should people be packaged in dangerous cabins that could harm their contents.[150]

A helpful concept to consider when understanding crashworthiness is secondary impact, in which additional injuries occur after the initial crash.[151] This can happen when the wounded sustain additional harm from a part of the aircraft that could have been prevented by a different, safer design.[152]

Airframe and Cabin Integrity
An aircraft must have a cabin with reasonable integrity in case of one or more impacts.[153] If the cabin cannot hold together and spills out its human cargo on the first impact, any additional safety designs or precautions will be pointless.[154] It must also not collapse inward and crush its passengers.[155] Currently, the majority of aircraft can only protect against about one-half of the gravitational forces that humans can endure without injury.[156] Technology in most cases could improve this, but instead designers sacrifice adequate safety to save cost or improve performance.[157]

Restraint Systems
Proper restraints are also necessary to ensure the safety of occupants.[158] If the restraints are inadequate, passengers could be tossed about the cabin due to inertia and abrupt stops or impact.[159] Federal regulations restrict crashworthiness in this area because currently only lap belts are required, leaving passengers' heads and upper torsos vulnerable.[160] The addition of shoulder harnesses would avert perhaps as many as one fourth of all head injuries sustained in aircraft incidents, according to the NTSB.[161] The limits of such harnesses are further described below:

> Presently, such harnesses [with shoulder straps] are required only in the front seats of aircraft manufactured after July 18, 1978. Furthermore, seat belts are only required to withstand 9 "G's" p. 27 gravitational force, which is less than half the strength of even an inadequate airframe, and, surprisingly, is less than a third of the required strength of automobile seat belts.[162]

Seat belts are also pointless if the seats are not adequately secured. Federal regulations currently require seats to have only slightly more strength than the belts.[163] Often, seats rip from the anchoring and the passengers are restrained to a seat that has now become a projectile.[164] The proper restraint system should: "not only be strong enough to withstand high G loads for a short time, but also must neither injure its user nor permit inadvertent release or discharge of its user until he desires, at which time it should release easily."[165]

Cabin and Cockpit Environment

After the previously mentioned Delta crash on a snowy runway in 2015, NTSB investigators reiterated previous recommendations that the FAA develop stricter regulations and require that manufacturers design new technology that can better guide pilots landing in potentially dangerous conditions.[166]

The *Wall Street Journal* reports that Airbus Group SE and European regulators have taken an approach more in line with the NTSB's recommendations:

> "Starting seven years ago, European Airbus has focused on marketing a proprietary system, now installed on about 430 airliners, that automatically assesses speed, altitude, flight-control settings and other variables eight times a second to provide cockpit warnings that a plane won't be able to stop safely on a runway," WSJ reported.[167]

Boeing, based in Chicago, has been working on a number of voluntary approaches to improving safety but is not in line with designing new cockpit warning systems such as those Airbus and EU regulators support.[168]

Additionally, people are not the only objects within aircraft subject to inertia and thus must be restrained properly.[169] Knobs and levers and loose items can be lethal to passengers.[170] Designs must take such dangers into consideration and include smooth, soft surfaces and energy absorption materials.[171]

Energy Absorption

The cabin must have energy absorption, but the exterior airframe must also absorb energy from impact.[172] If the frame does not dissipate energy adequately, the humans inside may experience forces to the heart or spine that are too much to survive.[173] When the nose cones, wings, and landing gears crumple, the energy load is dissipated, improving the occupants' chances at survival.[174] If the craft is engineered correctly, incredible energy forces can be dissipated before encountering the cabin and injuring the occupants.[175]

The Post-Crash Environment

Survival after the crash itself is just as essential to ensure.[176] Manufacturers of course cannot control how the passengers react or what the weather may be at the time of the crash, or where the crash may have occurred.[177] But manufacturers should design the craft such that passengers can evacuate safely.[178]

An estimated 40 percent of aviation fatalities have resulted from post-crash fires and the resulting smoke and toxic gases.[179] The fuel system is a large factor in the likelihood and magnitude of such fires.[180] Of particular importance is where the system is located as compared to the passenger compartment.[181] Efforts must be made to avoid the probability of both fuel spillage and ignition, but manufacturers have been slow to use the more costly fuel systems that are designed to reduce such catastrophes.[182]

A proper fuel system, though, should at least comply with the following standards:

"1. Location away from the anticipated impact areas and the passenger compartment;
2. Use of materials and designs which minimize rupture and spillage, and which directs unavoidable fuel spillage away from the passenger compartment;
3. The installation of fire walls between the passenger compartment and the fuel system."[183]

The likelihood of escape is improved if the aircraft is designed to include:

"1. Clear access to emergency exits;
2. Emergency exists which are easy to operate;
3. Crash-resistant emergency exits which will not jam on impact;
4. Cabin materials which are flame resistant and which do not emit toxic gases when ignited;
5. Adequate fire extinguishing system."[184]

Most post-crash deaths appear to be from the smoke and gases, rather than from the fire itself, according to studies.[185]

Federal regulations specify standards of flame-retardancy of materials within the cabin, but these standards are inadequate.[186] Even the FAA has indicated that the seat cushions cannot retard a significant flame.[187] Others have reported that while the cushion foam is more resistant to fire ignition, the foam burns faster and more toxically after being ignited.[188]

Other hazards to consider include toxic cargo such as pesticides or other chemicals, inadequate oxygen in the cabin, and impact in water requiring flotation devices.[189]

The likelihood of escape is improved if the aircraft is designed to include clear access to emergency exits.

Surviving a crash is more likely if cabin materials are flame-resistant and do not emit toxic gases when ignited.

Production Defects

Design is not the only products liability issue involved in aircraft cases. An aircraft may be designed well, but if it is not manufactured properly, or thoroughly inspected after production, the manufacturer may well be liable. Evidence is essential in proving manufacturer liability.[190] The liability is typically apparent if the evidence is sufficient, but most contested cases revolve around the plaintiff's evidence and its adequacy.[191] Additionally, exculpatory clauses or other allocations of risk can complicate cases, resulting in manufacturers' claims of preclusion from liability.[192] Causation, of course, is always a source of contention as well.[193]

Components of an aircraft can be faulty due to the manufacturer's poor production.[194] For example, the manufacturer could have manufactured the product in such a way that it was too weak to carry a reasonable load.[195] The manufacturer may also have produced the part so that stress is concentrated where it leads to fatigue and ultimately failure of the part.[196]

(It would be wise to note here that a structural component may also fail due to pilot error.[197] Pulling back too hard at excessive speeds can cause weight and gravity to produce loads on the structure that are too high for its design.[198] Similar results can occur trying to fly through a storm as well.[199])

Other aspects involved in manufacturing liability include:

- Duty to test or inspect;
- Marketing defects – warnings and instructions;
- Duty to warn or repair after sale;
- Service bulletins and service letters;
- Airworthiness directives.[200]

In most modern aircraft crash cases, the claims are strict liability against the manufacturer of the aircraft.[201] Strict liability claims have also been filed against the manufacturers or suppliers of the aircraft parts and sometimes accessories.[202]

MECHANICAL FAILURE:
AIRLINES, FLIGHT SCHOOLS, MECHANICS, ETC.

Statistics indicate mechanical failures cause up to 22 percent of aviation crashes.[203]

Improper Maintenance or Neglect[204]

Aging aircraft sometimes develop flaws and deficiencies that are not easily detectable. One of our firm's cases involved an antique biplane. It took off and gained a little altitude over the runway before crashing into the airport parking lot.

Photo by Jeff Schmerker

Several witnesses said the engine was making odd noises, proving the point that it is crucial to talk with eye witnesses on the scene because they will have noticed and will describe noises on the scene. A person's ear will pick up on something that sounds odd or different than normal. In this case, we investigated the possibility of fuel starvation.

Photo by Jeff Schmerker

Commercial aircraft that fly internationally may be repaired, tuned up, and inspected by mechanics halfway around the world, and sometimes not in accordance with FAA regulations. Often, simple neglect can have disastrous consequences, as was the case for Alaska Airlines Flight 261, which crashed into the Pacific Ocean in 2000, killing all eighty-eight people aboard. Investigators ruled the probable cause of that crash to be a loss of control resulting from “Alaska Airlines’ insufficient lubrication of the jackscrew assembly” on the plane’s horizontal stabilizer trim system.

In July 2014, the FAA sought $12 million in penalties from Southwest Airlines for improperly repairing its fleet of Boeing 737 jets.[205] The airline had contracted with Aviation Technical Services, Inc. (ATS), to perform the repairs, and in three separate cases the company failed to follow proper procedures.[206] Failure to follow strict regulations for the repair and maintenance of aircraft can threaten the integrity of the aircraft and safety of passengers and crew.[207]

Southwest returned the jetliners to service and operated them when they were not in compliance with regulation.[208] The FAA noted that all of the work was done under the supervision of Southwest Airlines and that the company had the responsibility of ensuring the work was performed properly.[209]

The FAA alleged that beginning in 2006, Southwest conducted so-called "extreme makeover" alterations to eliminate potential cracking of the aluminum skin on forty-four jetliners. Investigators determined that ATS failed to follow proper procedures for replacing the fuselage skins on the aircraft, which were improperly stabilized during the work.[210]

FAA investigators also found that ATS workers applied sealant beneath the new skin panels but did not install fasteners in all of the rivet holes during the right timeframe for the sealant to be effective.[211] The agency said that, as performed, the work could have resulted in gaps between the skin and the surface to which it was being mounted, potentially allowing moisture to penetrate the skin and corrode.[212]

In the third case, the FAA said that Southwest Airlines failed to properly install a ground wire on water drain masts on two of its Boeing 737s, a safety violation that could have resulted in lightning strikes on the aircraft.[213]

Another maintenance-related incident involved two young pilots from South America who were attending a renowned flight school. The pilots were shuttling an aircraft in need of maintenance to a facility in Florida from North Carolina.

A least one of the vacuum pumps in the engines was not working. The pump can power many different components, but in this situation, it powered the artificial horizon, which is on the dash to help the pilot orient in relation to the ground. Spatial disorientation is possible even for capable, experienced pilots. After the first pump malfunctioned, the second pump did also and the pilots lost indicators of the artificial horizon. The student pilots were flying a craft that should not have been flown by even an experienced pilot.

As noted above, NTSB almost always assigns some degree of liability to the pilot, even in the flight school case. In this situation, NTSB is focusing on the flight school, and the crash was caused by equipment failure, preventable with proper maintenance.

In a rare case in which NTSB said it was not pilot failure, the fuel manifold was found to be choked by debris, resulting in a fatal accident in Atlanta, Georgia.[214] "Post-accident testing of the fuel manifold showed that it was not operating normally and was contaminated with debris," NTSB stated in its final report of the crash that killed pilot Greg Byrd, his sons Christopher and Phillip, Christopher's fiancée, Jackie Kulzer, and their dog.[215]

"The composition of debris and its origin could not be determined, but it was likely that the debris moved within the fuel manifold during operation and resulted in fluctuating power indications."[216]

Mr. Byrd, a former police officer in Asheville, North Carolina, told air traffic control the Piper 32R-300, also known as a Piper Lance, was having trouble gaining altitude.[217] He then reported that the airplane was going down.[218]

The airplane took off from DeKalb-Peachtree Airport and went just two miles before it crashed into a median wall on I-285.[219] Although there was normal traffic on the Interstate at the time, nobody on the ground was injured.[220]

"I don't believe that it was the pilot's fault," NTSB lead investigator Eric Alleyne told local news.[221] "I think he did a good job trying to maneuver the airplane the way he did. It's just unfortunate that it ended up in an accident and lives were lost."[222]

Witnesses told NTSB that the airplane's engine sounded like it was at "wide open throttle," yet the aircraft was flying low in the moments before it crashed and exploded.[223]

According to the *Atlanta Journal-Constitution*, days before the crash, Mr. Byrd had barely cleared a thicket of trees at the end of the DeKalb-Peachtree Airport runway.[224] He texted his mechanic the following day.[225] He told the mechanic that while "the run-up was good … he wasn't getting full rpm at full power while static," NTSB investigator discovered.[226] Shortly afterward, he texted his mechanic that "everything was normal."[227] His mechanic clearly missed the debris, resulting in loss of life.

An airplane's structure is also prone to decay and needs proper maintenance. Structural parts can fail because of material problems such as wood decay, wear and tear, and even dents in metal.[228] Maintenance is key to preventing or detecting such deterioration, and improper maintenance can fail to discover problems during regular inspections.[229]

DEALERS, OWNERS & LESSORS

In cases of defective aircraft causing injury, strict liability will apply to businesses that sold the aircraft or its component parts.[230] But defective aircraft lawsuits implicating aircraft dealers are rare, while lawsuits against manufacturers comprise of the majority.[231] Sellers of used aircraft may or may not be subject to strict liability.[232]

Strict liability does not always apply.[233] Dealers can additionally face liability for a breach of express or implied warranties, including the implied warranty of merchantability.[234] This is the likely avenue for any plaintiff making a claim for damage to the aircraft or some other economic loss.[235]

A dealer sometimes has the duty to test and inspect its product before selling it; this duty is dependent on the case's facts.[236] Courts have found exceptions to the following rule: "Under a negligence theory, the seller of a product manufactured by another is under no duty to determine whether that product is defective."[237] But the court may find a dealer had a duty to inspect and then warn if at least one of the following is true:

- "the defect is patent or the seller is otherwise put on notice of the hazard;
- the aircraft is used;
- the dealer makes representations or express warranties;
- or the dealer undertakes to inspect, prepare, or repair the aircraft prior to sale.[238]

"If such a duty is imposed, a breach of that duty would enable the plaintiff to recover under the general rules of negligence."[239]

Typically, an aircraft owner is liable depending on its status as a lessor, operator, or air carrier.[240]

At common law, a pilot's negligence will not cause the aircraft owner to be liable if the pilot was not the owner's employee or agent.[241] The owner becomes only a bailor when she surrenders the aircraft to the pilot's control.[242] Typically, per federal law, owner-bailors have no vicarious liability for a pilot's negligent actions.[243] But the Federal Aviation Act does define an aircraft owner as including "owners and lessors who authorize the operation of aircraft."[244] State law has been interpreted to hold aircraft owners as vicariously liable, because the state law's definitions are so similar to the federal law.[245] Courts typically allow the state to expand the liability rather than uphold federal preemption of state law.[246] The Fifth Circuit has held:

> It is one thing to say that the words of a state statute impose vicarious liability on the owner and lessor of an airplane. When those same words embodied in a federal statute are relied upon to widen state tort liability, it is necessary additionally to consider federal-state county and the requirement that Congress clearly manifested an intention to exercise fully its power under the commerce clause. [247]

AIR CARRIERS

If an air carrier advertises as a transportation service to the general public, it is considered a common carrier.[248] Other air carriers are private.[249] A common carrier does not have to have fixed routes or routines (such as an air taxi or charter service), but to be considered a common carrier, it typically needs to have established a place of business.[250]

Typically, an air carrier is liable for negligence but in cases of lack of negligence a carrier can be liable for breach of contract.[251] The court will want to know if the air carrier breached its duties of care, including the degree of care owed to passengers, crew and employees, people on the ground, and other aircraft (such as with other aviation entities).[252] Also, as with other aviation entities, vicarious liability or *respondeat superior* can apply, as can negligence *per se* – the latter occurring if the defendant violated existing law, regulations, or statutes.[253]

THE GOVERNMENT & MILITARY

Even the government can be a defendant in an aviation case. As already indicated, the government plays several roles in the aviation industry. One key way in which it can be liable for an accident is if the government-employed air traffic controller makes an error.[254] In one such case, the controller flew the plaintiff straight into a radio antenna, even though the antenna appeared on the controller's radar.[255] Once the plaintiff files the notices, the government is not required to take any action for six months.[256] Also, the plaintiff has to file a special Federal Tort Claims Act Claim Form within two years of the incident.[257]

The Controller's Handbook, often called "The Bible" by air traffic controllers, is hundreds of pages and must be followed perfectly.[258] Otherwise, the victim may sue the FAA for negligence, per the Federal Tort Claims Act.[259] If the Handbook does not address a unique air traffic situation, the controller must employ his judgment and expertise.[260] Regardless of whether the Handbook covered the situation or not and whether the controller used his best judgment or not, a victim may sue the FAA for negligence if the controller's error was the cause of the accident.[261]

Below are some essentials to know:

- "The lawsuit must be filed in Federal Court, not State Court;
- The judge – not a jury – decides the case;
- No punitive damages can be awarded;
- The victim's attorney can charge a contingency fee of no more than 25 percent of any judgment that the court renders;
- If the FAA settles out of court, the attorney can charge a contingency fee of no more than 20 percent."[262]

The military is another branch of government that can play a role in an aviation accident. Examples involving Osprey and Black Hawk military aircraft will be discussed in further detail in a subsequent chapter.

PART III:
PRACTICAL CASE CONSIDERATIONS

DETERMINATION OF CAUSE OF FAILURE

Investigations

Before anyone touches the crash debris, the scene must be thoroughly photographed.[263] Then, to determine the cause of failure, the first step for an investigator is to figure out whether the engine was running when the craft crashed.[264] If the engine was not, then the next question to ask is why and what, if any, malfunction caused the lack of power.[265] For helicopters and other aircraft with propellers, the investigator needs to collect evidence from the propeller and gearing to understand the amount of power when it crashed.[266]

An investigator must also have a systems schematic, aircraft flight manual, and an illustrated parts breakdown for assistance in determining parts.[267]

Photo courtesy NTSB

Crash scenes can be widespread and just one shred of metal can reveal the cause of the accident to be even the failure of one small part of a larger component, which could have resulted in catastrophic failure to the larger component and thus the entire aircraft.[268] Yet, such determinations can only be made by an expert, or multiple experts.[269]

In general, metal breaks by one of three causes:

- Impact – "the load produced on a part as the result of the impact of the accident;"
- Overload – "the condition where an operating load has exceeded the ultimate strength and the part fails;"
- Fatigue – "a localized change occurring in metals subjected to fluctuating loads, which frequently culminates in progressive cracking up until the point of failure."[270]

Failures from fatigue are typically results of stress from areas that are damaged, improperly heat-treated parts, sharp corners, etc.[271] To give the attorney an idea of the complex nature of recognizing evidence such as fatigue, below is an excerpt describing how fatigue can be detected:

> Usually fatigue cracking is easily recognized as radiating away from an area identifiable as a stress riser. Each cycle increases the crack propagation, and the beginning and end of each cyclic tear is visible as striations. Whenever the fatigue failure is in a part that abrades against another metal part, there is always a chance that the origin of the crack may be obliterated because of rubbing. This can occur particularly in bearing and gear failures.[272]

Fatigue failure is important to an attorney because it can reveal defective design, manufacture, maintenance, materials, or inspections.[273] Any component to an aircraft should be designed so as to ensure that during its specified life, it will not fail from fatigue.[274] Thus, certain components must be regularly replaced according to the components' life specifications.[275] An investigator must know how to recognize a failed part amongst the wreckage pieces.[276]

When the craft's structure fails because it cannot support the load applied to it, the failure is considered an overload failure.[277] A metallurgist can identify if such an overload failure is due to the metal corroded from stress or if it became brittle from hydrogen, the latter of which somewhat mimics brittle plastic after sitting in the sun for a long period of time.[278] When a landing gear with aluminum metal fails after a landing, one needs to investigate whether the aluminum failed as opposed to automatically assuming the pilot made an excessively hard landing.[279]

Metal failure before the craft crashed should be considered in the following cases:

- "Engine failures;
- Transmission failures;
- Gearbox failures;
- Rotor failures;
- Propeller failures;
- Airframe structural failures;
- Flight control failures;
- Gear failures."[280]

Just as taffy narrows near the point of breakage where it was stretched apart, some metals including that used in cables or bolts will demonstrate such narrowing or necking down; this is evidence of ductility or deformation due to load.[281]

Midair separation requires one to look for "bends in the direction of the break."[282] The main span of a wing that broke off during flight will indicate the direction of the break, which can be an indication of overload failure "due to an excessive positive load force (g forces)."[283]

Examples of Investigation Determinations

Propulsion Systems

It is rather obvious that most aircraft have engines.[284] While there are various engine types, all engines do have a high number of moving parts, including piston engines, turbojets, turbofans, and turboshafts.[285] It is important to note that these parts help an investigator after a crash to determine whether the engine was running and sometimes how much if any power it was producing.[286]

Power failures can be caused by a failure within the turbojet itself or in the dynamic system that directs engine power to the propeller or rotor; the latter system contains driveshafts, transmissions, belts, pulleys, etc.[287] The propeller can fail.[288] Also, the engine can be starved of fuel if there is a problem within the fuel system.[289]

Photo courtesy NTSB

Breaking down the evidence and examining the engine, propeller, and data recorders, and talking with witnesses can often reveal whether the engine was working properly when the accident occurred.[290] In one case, two pilots of a police helicopter survived a crash with serious injuries but were able to describe a vibration just prior to a dramatic engine overspeed.[291] They reacted by retarding the engine throttle, and the craft went into auto rotation.[292] Also, the belt and pulley had failure history.[293] Thus, it was concluded that the failure was not with the engine itself but instead the belt or pulley.[294]

One recent incident clearly demonstrates the necessity of investigations. In November 2016, NTSB found that an American Airlines plane's engine disk broke apart just before takeoff; the disk showed signs of fatigue cracking.[295] "A high-pressure turbine disk in the Boeing 767's right engine broke into four pieces, which shot out of the engine's housing," the Associated Press reported, citing NTSB's preliminary report of the October 28 incident.[296]

An analysis of the fragmented disk, 90 percent of which investigators recovered, showed evidence of an irregularity where the fatigue cracking began, the NTSB said.[297] Investigators did not immediately determine what precisely caused the cracking; thus, they conducted metallurgical tests on the fragments.[298]

American Airlines Flight 383 bound for Miami was carrying 161 passengers and nine crew members when the "uncontained engine failure" occurred, followed by a jet fuel-fed fire that consumed the right side of the aircraft.[299] Everyone aboard the airplane was safely evacuated.[300] Twenty-one people were treated for non-life-threatening injuries.

Engine failures of this type are rare and serious occurrences that cause extensive damage to the aircraft.[301] NTSB investigators have identified three previous uncontained engine failures in commercial airliners with the same family of General Electric

(GE) engine as the engines on American Airlines Flight 383: two in the U.S. in 2000 and 2006 and one in New Zealand in 2006.[302]

Lorenda Ward, senior NTSB investigator in charge of the investigation, said in a press conference that parts of the engine were blown 2,000-3,000 feet away from the aircraft, including a metal fragment that crashed through the roof of a UPS facility.[303]

Stability and Control Systems

A sudden departure from an aircraft's flight path and a crash can suggest that there was a loss of control.[304] The loss is likely from the control system, which should be investigated for mechanical or electrical problems such as with the cable pulleys, surface hinges, actuators, and trim tabs described below:

> Smaller movable surfaces are generally found hinged at the trailing edges of the main control surfaces. These are called trim tabs and can be adjusted to relieve the control loads needed to hold the main control surfaces at a given position. The pilot moves a trim wheel or pushes a trim button that, in turn, causes the trim tab to rotate relative to the control surface. The trim tab can be adjusted so that, on a long flight, the pilot need not exert any force on the controls to maintain straight and level flight. Some autopilots fly the aircraft through the trim tabs.
>
> Trim tabs that can be moved electrically can inadvertently be driven to their limits by an electrical malfunction. At sufficiently high speeds, this can impose forces that are beyond the capability of the pilot to resist. Even if he is able to take corrective action, the pilot's reaction time, with regard to ground proximity, may not be sufficient to prevent an impact because of the disturbance of the aircraft by the runaway trim tab. Thus, trim tabs and their

systems should also be checked if loss of control is suspected as the cause of an accident.[305]

Accident Reconstruction Experts

Photo courtesy NTSB

Experts are essential in aviation accident litigation, especially given that rarely are there eyewitnesses to the crash because there are rarely survivors.[306] Thus, the ability to reconstruct what happened is necessary and requires expertise in accident reconstruction, human factors engineering, aircraft design, and more.[307] Hiring experts as witnesses is a necessity for having technical background and evidence and securing victory.[308] You should be able to find an expert for almost any technical field pertinent to discovering the liability in your case.[309]

Experts tend to fall into one of three types: "the generalist, the specialist, and the subspecialist."[310] It is usually most prudent to conduct one's own investigation, rather than just depend on the government's investigation.[311] For such an investigation, your best option is a "generalist" aviation crash reconstruction expert.[312]

An expert of this type will use her extensive, thorough understanding of aircraft design and operation safety as well as accident reconstruction to study the crash debris and the relevant facts before and after the crash to help you hire experts with more narrow expertise.[313]

Reconstruction experts usually will determine causation of the accident was one of the below:

- “A piloting or other human operational error;
- A lack of control;
- Power plant failure;
- Air frame failure;
- Avionics failure;
- Or some other influence such as another aircraft, an air traffic controller, or the weather.”[314]

Human survivability and crashworthiness in design should also be considerations.[315]

Examples of experts on human error and involvement include:

- Pilot experts;
- Flight engineers;
- Flight operations managers and airline personnel;
- Aviation medicine;
- Pathologists;
- Toxicologists;
- Human factors;
- Meteorologists.[316]

Experts on power plant failure include:

- Engine or propulsion experts;
- Failure analysts or metallurgists;
- Propeller and prop specialists;
- Maintenance specialists.[317]

Experts on airframe failure include:

- Aerodynamicists;
- Structural Engineers;

- Failure analysts or metallurgists;
- Maintenance experts.[318]

Other experts include:
- Control systems specialists;
- Experts on avionic failure;
- Electrical and electronics engineers;
- Radio, radar, and navigation experts;
- Experts on survival and crashworthiness design;
- Biomechanical experts;
- Pathologists;
- Toxicologists;
- Post-crash Fire Prevention experts;
- Occupant Restraint Engineers.[319]

After the likely causation is determined, attorneys can move forward with narrowing their focus by hiring specific discipline specialists.[320]

Now that you as the practitioner have figured out what type of specialist or subspecialist expert you need, you must find a properly qualified person who can fit within your budget.[321] This task may prove more challenging than you might expect because the federal government and a few large corporations control most of the industry.[322] The corporations tend to want to protect themselves and each other and hesitate to permit employees to act as experts or otherwise be involved in lawsuits, especially if the litigation relates to their customers, suppliers, or competitors.[323]

The role you need your expert to play will be a factor in choosing your expert.[324] You will need expert testimony during a trial, but you may also hire an expert as a consultant and sometimes his work and even his name may have to be protected from pretrial discovery.[325] An expert with the need for such secrecy would obviously be unable to provide testimony during trial.[326]

There are two more broad categories of experts: “nonprofessional” and “professional.”[327] Nonprofessional experts are those whose knowledge comes only from training and experience gained through the job, whereas a professional gained his expertise with research, formal study, and education.[328] Nonprofessional experts are more likely to identify with your jury as an ordinary person, but a professional expert may impress your jury with his knowledge and may be necessary for issues such as the aerodynamics or crashworthiness of the design of a specific part or system within the aircraft.[329]

The practitioner also needs to consider the geographic or local factor; in other words, juries sometimes trust an expert from their own town or region as opposed to someone from another part of the country or a different country.[330] This tends to be true more so of rural than urban juries.[331]

Data Recovery[332]

It is not uncommon for the entire plane to be obliterated, thus making it difficult to find evidence and determine the cause of a crash. Increasingly, people are forced to look outside the aircraft for data and evidence. Sometimes you can look at what is called the black box, which may or may not contain flight voice recorders. Ultimately, understanding what happened requires a forensic examination of the parts, such as the engines and computers. If you are fortunate to have intact flight data, you can input the data into an animation or flight simulator and determine how the craft was moving and what happened.

For example, in 2013, investigators retrieved the "black box" data recorder from a UPS cargo airplane that crashed on its pre-dawn approach to Birmingham-Shuttlesworth airport located outside Birmingham, Alabama. The crash killed pilot Cerea Beal Jr., 58, of Matthews, North Carolina, and co-pilot Shandra Fanning, 37, of Lynchburg, Tennessee.

NTSB worked on the scene to document the downed cargo plane and search for further evidence. The data recorder, which was located in a smoldering area of the airplane about three hours into the search, was flown to NTSB headquarters in Washington D.C. NTSB officials hoped the black box would yield flight data that could cast light on possible causes of the crash.

UPS flight 1354 was approaching the runway in Birmingham when it clipped the trees in a residential area near the airport. The plane crashed into an embankment a few hundred yards short of runway 18 in a grassy field. No people on the ground were injured.

Officials sorting through the crumpled plastic and metal debris said that the Airbus A300's engines showed no sign of failure or a pre-engine fire, nor did the pilots issue a distress call or indicate there might be a problem with the aircraft. Dirt and debris were found inside the engine, but NTSB officials said there was no evidence indicating it was there before impact and that it was characteristic of an impact with trees and dirt.

NTSB authorities also sent investigators to Louisville, Kentucky, to review the airplane's maintenance records for possible clues. NTSB expected data from the airplane's black box to provide additional and new information about the crash.

DAMAGES

In aviation cases, a personal injury claim can include the following types of recoverable damages:

- Past and future medical expenses;
- Lost wages and, lost earning capacity;
- Past and future pain and suffering;
- Emotional distress;
- Loss of consortium/association (usually available to married couples only); and
- Punitive damages.[333]

Deciding which of the above to claim and determining the necessary proof for each depends on the jurisdiction. Furthermore, often state law will cap or limit the total potential recovery.[334]

Damages on the Ground

An interesting type of recoverable damages is those incurred on the ground. The first reported aviation lawsuit included a claim for property damages because the aircraft – a hot air balloon – descended into a garden that was subsequently damaged after so many people came to see the balloon.[335] In more traumatic cases, people and property on the ground can sustain severe damage when an aircraft crashes.[336]

For example, in February 2017, a private airplane carrying a family crashed into a pair of Riverside, California, homes, killing four people and injuring at least two others.[337]

Riverside Fire Chief Michael Moore told the Associated Press that the airplane was carrying a husband, wife, and three teenagers.[338] Authorities were able to get some information early in their investigation because one of the teenagers, a female, was thrown from the aircraft on impact and received only minor injuries.[339] Witnesses said the girl crawled out from one of the damaged homes asking for help.[340] The family had spent the weekend at a cheerleading competition at Disneyland and was returning home.[341]

The other injured person was a resident of one of the homes.[342] The AP reported that Riverside firefighters entered one of the homes that was damaged and set ablaze by the crash, and pulled out an unconscious occupant.[343] That person was taken to Arrowhead Regional Medical Center in San Bernardino and underwent emergency surgery the evening of the incident.[344]

Authorities said that evening that additional injuries and fatalities were possible.[345] Firefighters were searching the wrecked homes for additional people.[346] The two homes hit directly by the airplane were destroyed and some of the surrounding homes received minor damage, fire officials told the AP.[347] The airplane reportedly smashed into "hundreds of pieces," the AP reported, and the propeller was found on the roof of a home near the crash site.[348]

Shannon Flores, who teaches elementary school three blocks from where the airplane crashed, told the AP that she and others saw the place from the classroom window.[349] She said they knew something was wrong as it flew past and then they watched as the plane went down "very quickly."[350] Another witness told the AP they thought an earthquake was underway when they heard and felt the impact.[351]

"A full range of damages may be available under such circumstances. The limitations in wrongful death and survival actions remain the same as for other victims."[352] The victims on the ground usually see their claims settled or tried with a focus on damages based on negligence or state law. [353] Damages have been awarded to victims who have been killed or lost their homes or businesses or to the survivors of fatalities. If a business was destroyed, the plaintiff may also be able to recover consequential economic damages.[354] In one case, an aircraft crashed into an apple orchard, and the property owner recovered the economic damages of future profits from selling the apples, above the lost trees' financial value.[355]

NOTES UNIQUE TO AVIATION CASES ABOUT DEFENSES

Aviation cases are unique and complex.[356] Thus, they can involve many challenges you will not encounter in other cases.[357] The typical defenses used against tort claims are of course available to the defendant, but aviation cases provide more defenses as well as limits on recovery.[358] Too, the number of available defendants has decreased as the industry has grown more specialized and many companies have gone out of business.[359] Lastly, prosecution of aircraft crash cases incurs high costs, and government and large corporations within the aviation industry have legal teams on standby, adding to the difficulty of mounting a successful suit against them.[360]

You may not have the opportunity to try your case before a jury if the accident occurred over the ocean; such incidents typically fall under the Death on the High Seas Act (DOSHA), which requires that a federal judge hear the case instead of a jury.[361] DOSHA also requires that only pecuniary damages may be recovered.[362]

When the government is the defendant, as noted previously, the Federal Tort Claims Act applies – also forcing your case before a federal judge instead of a jury.[363] In cases involving government or military aircraft, you may also face the following:

1) "The Military Contractor Defense allows a manufacturer of a defective product to escape liability if (1) the government approved reasonably precise specifications for the product, (2) the product conformed to the specifications, and (3) the contractor warned the government of associated dangers unknown to the government."[364]
2) "The State Secrets Privilege allows the government (even if a nonparty to the action) to withhold documents or other information if the release of such information would compromise national security or foreign policy. When asserted, a plaintiff may be unable to establish a *prima*

facie case, or a defendant can move for summary judgment based on an inability to mount a proper defense."[365]

3) "The Political Question Doctrine allows a manufacturer to escape liability if critical aspects of the case call into question the propriety of the government's use of a product."[366]

If a commercial airline is involved, the Warsaw Convention may be invoked, which includes a presumption of the airline's liability unless willful misconduct applies; this presumption is almost impossible to rebut.[367] However, recovery is limited to $75,000.[368] In recent cases, more major airlines have agreed to higher recovery amounts, waiving the limit, but it is unknown whether that will hold true in future cases.[369]

Congress passed the General Aviation Revitalization Act (GARA) because aviation manufacturers claimed that higher prices, fewer jobs, etc., were caused by drastically increasing product liability litigation costs.[370] "The GARA imposes an 18-year statute of repose on all wrongful death, personal injury or property damage actions against general aviation aircraft and aircraft systems manufacturers.[371] There are limited exceptions to GARA, but the Act is otherwise far-reaching."[372]

As noted elsewhere in this book, even the government almost always finds pilots at least partially at fault. But sometimes pilots, such as the ones we have represented, should not be found at fault.

PART IV:
HELICOPTERS AND OTHER UNIQUE CASES

HELICOPTERS

In November 2011, an Australian woman died of injuries received in a helicopter sightseeing crash in New York City's East River. She was the third woman to lose her life in that crash, which also claimed the lives of her daughter and her daughter's lifetime partner, but spared her husband and the helicopter's pilot.

Also in November 2011, thousands of miles away on the Hawaiian island of Molokai, another sightseeing helicopter suddenly lost altitude and flew into a mountain ridge, killing a newlywed couple from Pennsylvania and a vacationing Canadian couple in addition to the pilot.

What is involved in a helicopter accident?[373]

Because of their unique flying capabilities, helicopters have gained a reputation as the workhorses of the aviation world. Their ability to fly vertically, low to the ground, and hover in position makes these aircraft a key tool and mode of transportation for emergency medical services, commercial transport, law enforcement, recreation and sightseeing, news reporting, offshore use, logging, firefighting, utility work, and several other civil applications.

Compared to other forms of air transport, however, helicopters are statistically the least safe aircraft. According to the Aviation Underwriters Association, the U.S. helicopter accident rate is 30 percent higher than the U.S. general aviation accident rate.

The International Helicopter Safety Team (IHST), a group of 250 helicopter professionals established in 2006 to improve helicopter safety over a ten-year period of time, says helicopter accident rates have remained "unacceptably high," showing no "significant improvement" worldwide over the last two decades.

In fact, helicopter experts at an international helicopter safety symposium noted that instead of improving, there were signs the safety rate could be declining slightly. About 9.1 accidents occur for every 100,000 helicopter operating hours, according to IHST, compared to a rate of 0.175 airplane accidents per 100,000 hours.

Helicopter Association International's compilation of U.S. civil helicopter safety trends shows that 762 helicopter accidents occurred from the beginning of 2007 through the first quarter of 2012. Of those incidents, 111 crashes were fatal, resulting in 240 deaths and about twice as many injuries.

All helicopters are highly complex flying machines. They contain a multitude of mechanical and electronic systems that demand the greatest levels of care and skill in their design, maintenance, and piloting.

Most helicopter crashes are caused by some form of pilot error, including improper or insufficient pilot training; operating the aircraft in poor weather and other unsafe conditions; failure to plan or improperly planning a flight; and poor or improper response to mechanical failure and environmental problems. Other forms of operational error, outside the cockpit, include faulty air traffic control communications and improper maintenance.

A smaller number of helicopter crashes have been blamed on mechanical and electrical malfunctions exclusively. These problems can originate in the design stages with faulty design of the aircraft or one or more of its components. Or, they can occur as errors in the manufacturing and quality control stages.

Liability for helicopter crashes may fall upon a single entity but more typically will be shared among a number of parties, both in FAA reports and in court. For example, the helicopter's manufacturer, owner, pilot, flight school, and dealer may be held responsible for an accident.

Other parties that may share blame are air traffic control operators, airfield or helicopter pad owners, maintenance workers and/or companies, and owners of land or structures that could obstruct the path of a helicopter, such as communications towers, buildings, and vegetation.

What makes helicopter cases unique?

After a helicopter accident, investigators should turn to the same causes common to fixed-wing aircraft such as pilot error, structural failure, fire, and others.[374] But rotary wing aircraft do have unique causes for failure. [375] Below are mechanical failures and other hazards that are unique to helicopters and their accidents.

1. Loss of tail effectiveness

Almost any helicopter with a tail rotor can experience loss of tail effectiveness (LTE). [376] LTE can occur when a pilot is flying at a low speed with a quartering headwind, when hovering in a strong crosswind, or when trying to make a sharp turn. [377] The fuselage rapidly nosedives, and control is lost, causing the pilot to accelerate and tilt the nose downward, even accidentally into the ground if the aircraft was at a low altitude. [378] LTE can be similarly disastrous in the case of power lines or similar low altitude hazards. [379]

2. Mast Bumping[380]

> "Mast bumping is a hazard peculiar to underslung, teetering-rotor helicopters because roll and pitch control depends entirely on the tilting of the thrust vector. […] Excessive flapping of the rotor relative to the shaft can result in the inner walls of the hub striking the shaft where it is already stressed from the torque it is transmitting to the rotor. The added impact stresses from the mast bumping can cause the shaft to fracture, resulting almost always in a catastrophic accident. Under normal operating conditions as the rotor flaps, the thrust vector will tilt, causing the helicopter to follow the tip-path plane so that mast bumping will not occur. However, under a low-g condition where the rotor thrust is low, the rotor will still flap in response to control input, but the helicopter attitude will not follow, resulting

in mast bumping. Military handbooks advise pilots to stay above 0.5 g to avoid this hazard.

"Mast bumping can occur when one is practicing entry into autorotation. If the collective pitch is decreased too rapidly following a reduction in power, thrust, and hence roll control, will be lost. However, the tail rotor above the center of gravity is still producing thrust, causing the helicopter to roll. The pilot instinctively applies lateral stick resulting in lateral flapping and mast bumping. If the pilot does encounter a low-g condition, he is advised to freeze on the lateral control and to apply aft stick to regain rotor thrust. Mast bumping is usually easy to identify because the shaft will be fractured cleanly at the point where the hub will have struck it."

3. Vortex ring state[381]

"Another hazard to avoid in helicopter operation is the vortex ring state. This happens when a helicopter is hovering and then begins to descend. If the rate of descent is too great, the rotor encounters its own wake and an unstable situation occurs where the power required to remain aloft rapidly increases. To avoid this situation, a pilot must remain alert when hovering and not allow any significant descent velocity to develop. Descents should generally be made with some forward speed.

"On one occasion, a helicopter flown by an inexperienced pilot was hovering above a festival crowd throwing out prize ping pong balls. (The helicopter should not have been there because it was in the middle of the dead man's curve.) It began to descend and the pilot was not able to arrest the descent. It then struck the ground and the fractured

> parts of the blade were thrown, killing some bystanders. None of the three persons onboard the helicopter were hurt."

4. Wire Strikes

Helicopters often fly at low altitudes, making them particularly vulnerable to wire strikes.[382]Because of this, a number of helicopters are designed with in-built wire cutters to cut wires encountered, as long as the wires are not high-voltage power lines.[383] In case of a helicopter wire-strike, typically the pilot or power company are considered at fault.[384] Power companies are supposed to mark power lines, typically with bright orange balls placed along the lines to warn pilots. [385] But the balls' texture can affect the visibility and be impossible to see if a pilot is more than a fourth of a mile away – which means, for a helicopter with a speed of 100 kms, the pilot only has nine seconds to react.[386] The practitioner should do further research to learn of the type of markers required for items of various heights or over canyons and rivers.[387]

5. High stresses caused by fatigue and operating conditions

Helicopters are vulnerable to heavy, unstable loads in conditions of intense vibration, and the numerous component parts must be designed to sustain these conditions but usually only for a limited life.[388] It is important to examine maintenance records, which should reveal if workers complied with the parts limited lives if the crash is found to have been at least partially caused by a failed part.[389]

> "At extremely high forward speeds, the retreating blade will stall and the advancing blade can experience high impulsive loads caused by Mach number effects. These effects impose severe torsional loads on the blades, which are carried by the pitch links. Thus pitch links are parts that deserve particular attention in a helicopter accident.

> “The centrifugal loads at the tips of rotor blades are extremely high. How high would you guess in terms of g’s? Well, for a typical 44-foot-diameter rotor for a medium sized helicopter turning at a tip speed of 725 fps, the centrifugal force at the blade tip equals 747 g’s. Thus, it is easy to understand why, under repeated loadings a tip weight may tear loose, causing a severe unbalance which will rip the mast from its supports. Actually, with the advent of composite blades, main rotor blades have become very reliable and damage-tolerant. A dynamics engineer with one of the major helicopter manufacturers claims that he has never heard of any composite blade failure.” [390]

6. Loss of tail rotor[391]

> “Under ideal conditions and the particular design, a helicopter can be safely landed without a tail rotor. The only chance is to cut the power and go into autorotation. For some helicopters with a large vertical stabilizer it may be possible to keep the airspeed high using the stabilizer to counteract the main rotor torque until close to the ground and then go into autorotation. However, the chances of a successful landing following the loss of a tail rotor are practically nil. The loss of a tail rotor is one of the leading causes of helicopter accidents. Either there is a failure in the gear and shaft system driving the tail rotor or the tail rotor itself loses blades. Thus, following a helicopter accident, a detailed examination of the tail rotor and its drive system is prudent.”

7. Ground resonance[392]

"Ground resonance is a rapidly developing instability which occurs when a helicopter is spinning up its blades to take off. It has demolished many helicopters, particularly during their development. Although the airframe is destroyed by ground resonance, there are usually no casualties associated with ground resonance unless a flying piece of rotor blade happens to strike someone. It is the lead-lag motion of the blades which drives ground resonance. Two-bladed rotors are generally not susceptible to ground resonance, but rotors with three or more blades can experience it. As the blades rotate they lead and lag relative to each other and if this motion is not symmetrical, it moves the c of the total blade system off the axis of rotation.

"The motion of this displaced *cg* has two modes rotating around the axis in opposite directions. The progressive mode rotates in the same direction as the rotor turns, while the regressive mode is in the opposite direction. During start-up, as the rpm increases, an rpm is reached where the frequency of the regressive mode matches the natural frequency of the helicopter sitting on its gear. This is a resonant condition where a system is being forced by the whirling, offset cg at its natural frequency. All multi-bladed rotors have some kind of lead-lag damping (dashpots, elastometric or material damping) to hold the amplitude of the ground resonance to within acceptable limits. However, sometimes, as a result of wear, poor maintenance or poor design, the damping is insufficient and the helicopter shakes itself to pieces before the rotor can be slowed."

8. Blade-airframe strikes[393]

> "Helicopters must be designed to prevent a blade from hitting the airframe, but it is still possible to occur, often from sudden wind gusts or a pilot's abrupt, strong control input such as a sudden yank upward during a low-altitude flight when the pilot sees an obstacle […].
>
> "Although care is taken in the design of a helicopter to avoid the possibility of a blade striking a part of the airframe, it is possible with most helicopters to cause a strike. This usually results form a severe control input by the pilot or from wind gust conditions during a shutdown.
>
> "For example, an extremely high forward speed, a sudden increase in the collective pitch combined with an aft cyclic control can produce longitudinal flapping severe enough for the blade to strike the tail cone. This might happen if a pilot is doing low-altitude flying and suddenly sees an obstacle immediately in front of him (e.g., a wire). Thus, when investigating a helicopter accident, one should look for marks on the airframe, in particular the canopy and tail cone, which might indicate a blade strike. The blades should also be examined for this possibility."

HELICOPTER ACCIDENT EXAMPLES[394]

Unfortunately, we frequently see news stories of crashes involving medical evacuation helicopters. These helicopters seem to crash with alarming frequency.

In one crash in south Alabama, an individual was involved in an automobile accident and a determination was made that he required helicopter transport to the hospital. After loading the patient and taking off in darkness, the craft only gained 1,000 feet in altitude before crashing. It took hours for rescuers to find the crash site and recover the evidence and bodies. The pilot, crew members, and patient all died.

We investigated this case and looked at a combination of factors, such as mechanical failure and weather conditions. The crew was flying in drizzle and fog at night. We considered that the pilot was having to use night vision goggles, and we studied what the weather conditions were at various points during the incident.

We also looked at the mechanical history of the helicopter. We knew that the helicopter was a little older than some and had some prior maintenance issues. Helicopters' electronics are vitally important, and it is important to note that typically autopilot systems and the radar and ground control components can be powered by separate electrical systems.

In another case, the first defendant was a manufacturer of a helicopter, the second a manufacturer of a component part. The pilot and eight others boarded the helicopter in Louisiana to travel to a nearby oil platform in the Gulf Coast. About seven minutes after takeoff, the helicopter suffered a sudden catastrophic failure and crashed into swampy terrain near the Louisiana coast. The helicopter crew made no radio reports of problems. The pilots and passengers, save one, died.

NTSB initially released a preliminary statement indicating a bird strike might have been a precipitating factor in the crash. The helicopter's production glass windscreen had been removed and replaced by the defendant prior to the accident. The glass had been replaced with a lightweight, cast acrylic windscreen manufactured by the second defendant in our case.

After NTSB's preliminary statement, the investigation centered on the helicopter's throttle quadrant and windscreen. Highly unusual, as mentioned before in this book, neither NTSB nor any other party alleged pilot error. NTSB concluded that the bird strike probably precipitated an uncommanded movement of both main engine throttles to "off," causing the catastrophic crash.

The first defendant designed, manufactured, and marketed the helicopter – including its throttle quadrant component that contributed to the crash, after the bird strike. The second defendant manufactured the defective acrylic windscreen that also contributed to the crash after the bird strike. We argued that an alternative design would have prevented the helicopter crash.

The cast acrylic windscreen was a replacement for the laminated glass windscreen with which the helicopter was originally manufactured. The second defendant did not design the acrylic windscreen from scratch; it instead created the windscreen through reverse engineering by copying another windscreen with a mold.

The second defendant simply found a helicopter and started making a mold of the windscreen without doing any research or investigating the history of the helicopter it was copying. The helicopter had a Mexican flag painted on the side and no inquiry was made as to the maintenance or operational history of the helicopter. The second defendant failed to check the thickness of the windscreen on the Mexican helicopter used to make the mold. Furthermore, the second defendant's employee that made the mold had only made one previous windscreen before making the one for the helicopter that killed our plaintiff's husband.

Our expert found that the Mexican helicopter was a non-airworthy type manufactured twenty-five years before. This Mexican helicopter had suffered crash damage and was carried on the first defendant's inventory as a "strike," meaning it was destroyed. Our expert stated, "The choice of this aircraft for the windshield mold [was] a bad one in every respect. [The second defendant's] choice of [the Mexican helicopter] indicates a certain lack of interest at [the second defendant's business] in responsible decision making and safety." A second expert said that using this crashed Mexican aircraft to make the new windscreen mold hid critical information from the FAA. Had the FAA been made fully aware of the facts, the FAA would have never issued the certifying documents for the company to make the windscreen.

The mold was made by mixing wax and gypsum plaster and applying it on another windscreen. The mold was removed after it dried and put in a metal shipping container to mail back to the second defendant's plant in Tennessee. Once in Tennessee, the second defendant's employee checked the form of the mold by placing it inside another set of previously made windscreens. The acrylic windscreen was then checked for thickness around the outside and an average was created, but the second defendant did not have any employees check the thickness of the windscreen's center. Then the second defendant made its own test acrylic windscreen and checked it back with the Mexican helicopter mold to determine fit.

The second defendant's design drawings were not even made until after the acrylic windscreen had been formed.

Even the second defendant's engineer for the project admitted that it would be better engineering to purchase a new windshield that had not been used and follow the precise engineering specifications from the manufacturer (the first defendant) if the goal was to create an aftermarket windscreen just like the original manufactured windscreen.

The second defendant failed to consider:
1) The impact its windscreen would have on a pilot's ability to control his aircraft if the windscreen shattered, and
2) The impact its windscreen would have on flight controls if the windscreen shattered.

The second defendant did not test its windshield to withstand bird strikes, did not consider a bird strike's effect on the windshield, conducted zero analysis of the plastic windscreen from which it copied, and instead operated on "faith" that the windscreen from which it copied could withstand a bird strike.

The second defendant's design engineer had no knowledge and did not read any studies to compare the impact capability of the cast acrylic material it used to stretch acrylic and laminated glass. When the design engineer was asked whether the cast acrylic windscreen it had used had greater impact resistance than the glass windshield used by the first defendant, the engineer stated, "I have no idea."

The first defendant's own in-house expert stated that cast acrylic windscreens absolutely should not have been used because the failure mode of cast acrylic is much more catastrophic in terms of crack initiation and propagation. He later said, "I will not approve cast acrylic even for cabin windows."

The purpose of a windscreen is to provide helicopter pilots and passengers with protection from the outside environment. A windscreen that breaks fails to meet this purpose. A shattered windscreen greatly increases the ambient noise inside the cockpit. Even the first defendant concluded that the root cause of the incident was the rupture of the windscreen.

The first defendant has said that there was little, if anything, the pilots could do in response. The wind caused by the ruptured windows disrupted the pilots to the point that they had no way to communicate what was going on, what their plan was, or how they were going to respond in a coordinated fashion. There was an onrush of 140-knot air.

Under Louisiana's Products Liability Act, we had to prove three things:

1) The product was unreasonably dangerous when put to a reasonably anticipated use;

2) The unreasonably dangerous characteristic of the product was the proximate cause of the accident;

3) The unreasonably dangerous characteristic of the product existed at the time it left the manufacturer's control.

The above fact pattern and the defendants' own experts' statements demonstrated that we were able to prove all three elements.

OTHER UNIQUE AIRCRAFT

Helicopters, or whirlybirds, are not the only unique type of aircraft with unique litigation. Others include amphibious planes, crop dusters, and – most interesting of all – spy planes. Most of the same issues and fundamentals apply as discussed previously, but of course the fact patterns can be significantly different.

For example, litigation involving crop dusters – as mentioned earlier – have even more significant likelihood of damages on the ground. Just a simple Google search of "crop duster crashes" brings many recent news results. Some involve a fatality of the crop duster pilot; other pilots survive with serious injuries. In one recent incident (March 3, 2017), the pilot was 69 years old but had survived and was hospitalized in stable condition.[395] The crash apparently occurred because the crop duster collided with a power line, resulting in a crash into trees.[396] The pilot crawled from the crash debris, which later caught fire.[397]

Amphibious planes, common in Alaska, can and do fairly often crash. In the spring of 2016, the FAA even issued a warning to charter and commuter air operators in Alaska – though the agency had never taken such action.[398] The agency felt the publication or letter was necessary after a year-long increase in crash injuries and fatalities.[399] One such crash involved an amphibious Cessna 206 plane on a commuter flight, which was under visual flight rules.[400] The weather conditions of low clouds and decreased visibility led the pilot to radio to his supervisor that he would attempt flying a different route; ultimately he and three others were killed and a fourth was critically injured.[401]

Similarly, in 2010, former U.S. Senator Ted Stevens survived a ride and crash on an amphibious plane in Alaska.[402] No one thought anyone could have survived the crash, but another pilot saw a hand wave from the wreckage, launching a rescue effort that saved the life of four, including the former senator.[403] Of interest, Sen. Stevens had advocated for the required inclusion of technology he believed would make air traffic in Alaska safer; the downed plane did not include those instruments.[404]

In September 2016, about 48 miles north of Sacramento, California, pilots were training how to fly a U-2 Dragon Lady spy plane – a plane that usually reaches altitudes of 70,000 feet for photography and communication interception and that requires the pilots to wear gear similar to astronauts' pressurized suits.[405] Sadly, the Dragon Lady crashed, and three parachutes carried gear and people to the desert floor, according to witnesses.[406] This plane's home was apparently the nearby Beale Air Force Base, which houses other spycraft and 4,500 military employees.[407] The military did not offer details or comments regarding the cause of the crash and the death of one of the pilots.[408]

MILITARY

Black Hawk Helicopters

It is not unusual for our firm to handle military cases, which usually do not involve spy craft such as the incident in California. But military cases do include a degree of secrecy, which is always a complication.

In another military case, we represent the families of marines who were onboard a fully loaded Black Hawk helicopter when it crashed off the coast of Florida. During a training mission, it and another Black Hawk were carrying Marines to practice special operations. One Hawk stayed over the beach, and the other flew over the Gulf into heavy fog and clouds.

We know the missing helicopter's autopilot was not engaged. We know the pilots had a conversation regarding clarity, line of sight, and vision. Sadly, we know that at some point after leaving the beach, the helicopter impacted the water.

In a similar incident in December 2016, two U.S. Army pilots were killed during a routine training flight when their AH-64 Apache helicopter broke apart in mid-air over Galveston Bay in Texas, according to Reuters.[409] The pilots were members of the Texas Army National Guard's 36th Combat Aviation Brigade at Ellington Field near Houston based on reports for KHOU-TV.[410] At least one of the pilots was from the Houston area.[411]

Witnesses told local news that the aircraft appeared to be flying unusually low then they heard a "pop" or small explosion.[412] Black smoke appeared to pour from the aircraft as it spiraled down nose-first into the bay.[413] Media outlets report that the helicopter was submerged upside down in the bay with the wheels extending up, just above the water.[414]

Local first responders and U.S. Coast Guard rescuers arrived soon after the crash happened, but determined that the pilots did not survive.[415] Divers worked to recover the victims.[416] A helicopter blade that was still intact with the rotor and other debris from the aircraft was found along the shore Wednesday evening.[417] Local police stood guard until investigators finished processing the site.[418]

Boeing, the helicopter's manufacturer, claims the Apache is the most advanced multi-role combat helicopter in the world.[419] It is used primarily by the U.S. Army, which began training with it more than 30 years ago and has accumulated more than 4.2 million flight hours.[420] Boeing has recently increased sales of the Apache to other military forces worldwide.[421]

Following its significant role in the first Gulf War and Operation Desert Storm, the Apache was highly criticized for its deficiencies and failures, according to Thomas K. Adams in his 2006 book, *The Army After Next: The First Postindustrial Army*.[422]

On January 30, 2017, the newly sworn-in President Donald Trump authorized a raid in Yemen on Al Qaeda.[423] The raid resulted in one fatality and the injuries of at least three other military members.[424] An MV-22 Osprey flew in to rescue the injured, but the Osprey had to make a crash landing and three more military members were injured.[425] The Marine Corps' $75 million Osprey subsequently had to be destroyed in an airstrike.[426]

The Osprey military aircraft is unique. The Osprey or V-22 is a tilt-rotor aircraft designed during the Vietnam era. Its purpose was to replace some of the heavy-lifting helicopters. During the Osprey's early stages, even Dick Cheney, who was then Secretary of Defense, said it was too costly and was no longer needed. But Congress threatened to sue him.

Osprey V-22

In the late 1990s, one expert described the Osprey to me as an aircraft that is trying to be both a helicopter and an airplane but will never be great at either.

One of our Osprey cases involves a training mission in Hawaii, in which the military personnel were practicing taking off from ships and practicing various landings on shore. One of several V-22 participating in the landings, our V-22 encountered a cloud of dust and sand stirred up by the downwash of the V-22 proprotors. As the Osprey attempted to land, it was waved off and had to circle back to try another landing when it crashed. The Osprey's margin of error is exceedingly small.

The Osprey suffers from a ventilation and filtration system defect. We know that particulate matter (referred to as CMAS, which is typically just dirt or sand) can be ingested into the engine and move beyond the filtration and flow into the turbines where it builds up to reduce air flow. When it senses the apparent loss of power, the engine tries to increase speed and eventually overspeeds and destroys itself. It is a vicious destructive cycle.

In a military case, such as an Osprey case, there is radar data from the plane, engine speed data (which indicates the functionality of each engine), and flight director program data. As noted previously, understanding what happened requires a forensic examination of the parts, such as the engines and computers. If you are fortunate to have intact flight data, you can input the data into an animation or flight simulator and determine how the craft was moving and what happened.

In another Osprey case, we were fortunate to represent the widow of the Marine killed in a crash in North Carolina. In this case, the Marines that were at the helm or in control were literally the best of the best. The pilot and copilot were members of a unique squadron and the best at the time.

Osprey V-22

The Osprey is designed to have unique maneuverability that other aircraft are not designed to have. Although it takes off like a helicopter, when the rotors are tilted in its forward position the Osprey flies and maneuvers like an airplane. But as already noted, the rotors are quite large; thus, it cannot land like an airplane. Rather than relying on ducted-thrust found in the Harrier Jump Jet, Osprey engines rotate to enable the aircraft to transition between helicopter and airplane flight modes.

Even an airplane experiences certain vibrations inherent in the design. But the Osprey has the added component of vibration when the engines are rotated through various angles from airplane to helicopter configuration. The result is excessive wear and tear on components that would not occur otherwise.

Like many aircraft, the V-22 flight control surfaces are controlled and operated by hydraulic pressure. Although the V-22 was intended to replace various existing helicopters, from day one it could not meet most of its weight lifting capacity requirements.

Osprey V-22

Our North Carolina case involved the death of four people, but we know a number of others died in military and in private operation in the design and development stage. A number of years ago, after initial V-22 failures, the manufacturers "went back to the drawing board" and represented to the military that the early Osprey defects were eliminated. To demonstrate the new and improved Osprey, a test flight/media event was staged near the Pentagon.

Unfortunately in that case, though it had been largely redesigned, that aircraft also crashed into the Potomac River.

Following the Potomac crash, the manufacturers again attempted to redesign the Osprey. Because the Osprey could not maintain its weightlifting requirements, the manufacturers decided to cut weight from the aircraft by reducing the amount of hydraulic fluid used to control its systems. In addition to the reduced volume of hydraulic fluid, the manufacturers also changed to smaller diameter hydraulic lines, which required higher operating pressure; as a result the Osprey operates with a 5,000 *psi* system. The lines were constructed of titanium, which is strong and lightweight but susceptible to chaffing from flight vibrations. The Osprey hydraulic system was intended to be triple redundant, meaning it had two back-up systems in case of hydraulic failure.

Rather than being triple redundant, the Osprey was designed in such a way that its system was comprised of three lines that shared a common junction: in effect, one system with three branches. In our case with the squadron's best pilots, a failure happened in that common junction. Ultimately, the system chaffed and a hole developed resulting in total loss of all hydraulic fluid from the control system.

In our case, when the Osprey pilots began to experience warning indicators, their training called for them to push a primary flight control reset button. When they did that, a software problem developed. Investigation later revealed that the Osprey had never been tested with a hydraulic system failure and primary flight control system reset. The various hydraulic and software failures caused the engine to overspeed and take pitch out of the blade. Although the pilots followed procedure and training, from the first warning light to the crash took less than thirty seconds. This is another rare occasion where the pilots were found to not be at fault.

Osprey V-22

In another case, an Osprey crashed during a routine training mission in the Florida panhandle. It was just the latest in a long string of incidents and was the second crash within two months.

According to military statements, the Florida crash occurred during a gunnery training mission involving two Osprey planes flying in formation. A commander at a nearby airfield observed: “When the lead aircraft turned around in the gun pattern, they did not see their wingman behind them, so they started a brief search and found the aircraft had crashed right there on the range.”

The aircraft was found located upside down on the ground, on fire, and with significant crash damage. Surprisingly, although it is built almost entirely of composite materials, the entire aircraft was not consumed in the fire. But all five crewmen were hospitalized with injuries.

As has become customary in these crashes, several mishap boards will investigate and issue reports on the causes of the crash.

Typically, it may be some time before the cause of the crash becomes public. A safety panel is investigating, but its findings will not be released. A separate accident investigation board will also be convened, and parts of its findings may be made public. This crash came just two months after a Marine Corps version of the aircraft, an MV-22 Osprey, went down during a training exercise in Morocco. Two Marines were killed and two others severely injured.

Osprey V-22

CONCLUSION

This book's examples and stories demonstrate the complexity and continued need for aviation litigation. Some of the aircraft discussed in this book carried only one person, while others are commercial airliners full of passengers. Regardless of the size, age or intended use of the aircraft, the basic principles of investigation are the same, and *every* life lost in aviation is a loss that likely could have been prevented. More work needs to be done to ensure that manufacturers and designers put the safety of their products' human cargoes first and that all pilots and maintenance personnel are properly trained and fulfill their respective duties of care.

APPENDICES

TEN TYPES OF TURBULENCE[427]

The following are ten errors that are sure to make a practitioner's flight to success turbulent at best.

1. "Failing to master the facts of your case.
2. Failing to determine all responsible parties and all applicable insurance coverage.
3. Giving your client unrealistic expectations or making promises that you cannot deliver.

"Your case is worth millions of dollars!"
"We have handled air crash cases just like yours many, many times with excellent results!"
"Your case is a slam dunk."
"The plaintiff will never win! We will outspend them and you will win!"
"We will correct that on appeal. The Judge did not understand the case."
"We know the Judge – your case is in the bag!"
"The defense attorney is an arrogant idiot – he cannot possibly win this case."
"Don't worry about the liens, let's settle today at mediation – I can get the liens drastically reduced."
"We never lose a case!"

4. Ignoring medical and other liens.
5. Treating the aviation claims adjuster or opposing counsel rudely or disrespectfully.
6. Forgetting to make consortium claims and other derivative claims.
7. Failing to review medical records, lost wage information and special damages data.
8. Failing to claim all permissible damages.
9. Letting your ego get in the way of obtaining a good result for your client.
10. Failing to give ADR a fair chance."

AVIATION AGENCIES & MANUFACTURERS[428]

Agencies

Department of Transportation
1200 New Jersey Ave SE
Washington, DC 20590

Federal Aviation Administration
800 Independence Avenue SW
Washington, DC 20591

National Transportation Safety Board
490 L'Enfant Plaza SW
Washington, DC 20594

Aircraft Manufacturers

- Airbus
- Dassault
- Northrup Grumman
- Bombardier
- Lockheed Martin
- Raytheon
- Rolls Royce
- Sikorsky
- Boeing

Helicopter Manufacturers

- Augusta Bell/Augusta Aerospace Company
- Boeing
- Brantley International, Inc.
- Enstrom Helicopter Corp.
- Erickson Aircrane
- Eurocopter
- Kaman Aerospace
- MD Helicopters
- Robinson

ABBREVIATIONS AND ACRONYMS[429]

AC. Advisory circular. FAA document that provides guidance on aviation issues.

AFD. *Airport/Facility Directory*. FAA publication on landing facilities including nav and radio info.

AGL. Above ground level.

AIM. *Airman's Information Manual*. Manual containing info for pilots for flying in the National Airspace System (NAS).

ARSA. Airport Radar Service Area. Area around airports controlled by radio. ASRAS are replacing Terminal Radar Service Areas (TRSAs).

ARSR. Air Route Surveillance Radar.

ARTCC. Air Route Traffic Control Centers.

ARTS. Automated Radar Terminal System.

ASR. Airport surveillance radar. Radar used by terminal area to control traffic by azimuth and rage. No altitude info.

ATA. Air Transport Association of America.

ATCT. Airport traffic control tower.

CAA. Civil Aeronautics Authority.

CAB. Civil Aeronautics Board.

CAR. Civil Air Regulation.

DME. Distance measuring equipment.

DOT. Department of Transportation.

FAA. Federal Aviation Administration.

FAR. Federal Aviation Regulation.

FBO. Fixed-base operator.

FL. Flight level.

FSS. Flight service station.

GPS. Global Positioning System.

IATA. International Air Transport Association.

ICAO. International Civil Aviation Organization.

IFR. Instrument flight rules.

INS. Inertial navigation system.

ISA. International standard atmosphere.

MLS. Microwave landing system.

NAS. National Airspace System.

NASA. National Aeronautics and Space Administration.

NDB. Nondirectional radio beacon.

NOAA. National Oceanic and Atmospheric Administration.

NOTAM. Notice to airmen.

NTSB. National Transportation Safety Board.

NWS. National Weather Service.

RNAV. Area navigation.

SID. Standard instrument departure.

SSR. Secondary surveillance radar.

STAR. Standard terminal arrival route.

TACAN. Tactical air navigation.

TCA. Terminal control area.

TRACON. Terminal radar approach control.

TRSA. Terminal Radar Service Area.

UHF. Ultra-high frequency.

VFR. Visual flight rule.

VHF. Very-high frequency.

VLF. Very-low frequency.

VOR. Very-high-frequency omnidirectional range.

VOR/DME. Very-high-frequency omnidirectional range and DME.

VORTAC. Combined VOR and TACAN.

ACKNOWLEDGMENTS

This book would not have been possible without the support of my law firm and partners at Beasley Allen. The collective experience and wisdom of my partners Jere Beasley, Greg Allen, Cole Portis and others has been invaluable to me throughout my career. Additionally, I have learned much by working with attorneys around the country investigating and preparing cases for trial. Our profession is truly strengthened through sharing information and experience. I am proud of and humbled by the opportunity to represent clients who have been injured or killed by defective products. Our firm works diligently to help those who need help the most and strives to give a voice to those who cannot speak for themselves.

- D. Michael Andrews

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