

Crash of Cessna 500, N113SH
Following an In-Flight Collision with Large Birds
Oklahoma City, Oklahoma
March 4, 2008



Accident Report

NTSB/AAR-09/05
PB2009-910405



**National
Transportation
Safety Board**

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**National
Transportation
Safety Board**

490 L'Enfant Plaza, S.W.
Washington, D.C. 20594

National Transportation Safety Board. 2009. *Aircraft Accident Report: Crash of Cessna 500, N113SH, Following an In-Flight Collision with Large Birds, Oklahoma City, Oklahoma, March 4, 2008*. Aircraft Accident Report NTSB/AAR-09/05. Washington, DC.

Abstract: This report describes the crash of a Cessna 500 about 2 minutes after takeoff from Wiley Post Airport in Oklahoma City, Oklahoma. The airplane impacted one or more large birds, which likely damaged the airplane's wing structure. The safety issues discussed include airframe certification standards for bird strikes, inadequate Federal Aviation Administration (FAA) enforcement of wildlife hazard assessment requirements for airports located near wildlife attractants, the lack of published information regarding aircraft operational strategies for pilots to minimize bird-strike damage to aircraft, and inadequate FAA detection of and intervention in improper charter operations. Safety recommendations concerning these issues are addressed to the FAA.

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Abbreviations and Acronyms

AC	advisory circular
AFD	Airport Facilities Directory
agl	above ground level
ANPRM	advance notice of proposed rulemaking
ARAC	Aviation Rulemaking Advisory Committee
ASR	airport surveillance radar
ATC	air traffic control
BAM	bird avoidance model
CAMI	Civil Aerospace Medical Institute
CFR	<i>Code of Federal Regulations</i>
CRM	crew resource management
CVR	cockpit voice recorder
DNA	deoxyribonucleic acid
DOD	Department of Defense
DOT	Department of Transportation
ERAU	Embry-Riddle Aeronautical University
FAA	Federal Aviation Administration
FSAW	flight standards information bulletin for airworthiness
FSDO	flight standards district office
ft-lb	foot-pound

IFR	instrument flight rules
in	Inch
KCAS	knots calibrated airspeed
kts	Knots
lb	Pound
MKT	Mankato Regional Airport, Mankato, Minnesota
msl	mean sea level
NBAA	National Business Aviation Association, Inc.
NTSB	National Transportation Safety Board
OKC	Will Rogers World Airport, Oklahoma City, Oklahoma
POI	principal operations inspector
PWA	Wiley Post Airport, Oklahoma City, Oklahoma
SAFO	safety alert for operators
TIS	time in service
USDA	U.S. Department of Agriculture
VFR	visual flight rules
VLJ	very light jet

Executive Summary

On March 4, 2008, about 1515 central standard time, a Cessna 500, N113SH, registered to Southwest Orthopedic & Sports Medicine Clinic PC of Oklahoma City, Oklahoma, entered a steep descent and crashed about 2 minutes after takeoff from Wiley Post Airport (PWA) in Oklahoma City. None of the entities associated with the flight claimed to be its operator. The pilot, the second pilot, and the three passengers were killed, and the airplane was destroyed by impact forces and postcrash fire. The flight was operated under 14 *Code of Federal Regulations* (CFR) Part 91 with an instrument flight rules flight plan filed. Visual meteorological conditions prevailed. The flight originated from the ramp of Interstate Helicopters (a 14 CFR Part 135 on-demand helicopter operator at PWA) and was en route to Mankato Regional Airport, Mankato, Minnesota, carrying company executives who worked for United Engines and United Holdings, LLC.

The National Transportation Safety Board determines that the probable cause of this accident was airplane wing-structure damage sustained during impact with one or more large birds (American white pelicans), which resulted in a loss of control of the airplane.

The safety issues discussed in this report focus on airframe certification standards for bird strikes, inadequate Federal Aviation Administration (FAA) enforcement of wildlife hazard assessment requirements for airports located near wildlife attractants, the lack of published information regarding aircraft operational strategies for pilots to minimize bird-strike damage to aircraft, and inadequate FAA detection of and intervention in improper charter operations. Safety recommendations concerning these issues are addressed to the FAA.

1. Factual Information

1.1 History of Flight

On March 4, 2008, about 1515 central standard time,¹ a Cessna 500, N113SH, registered to Southwest Orthopedic & Sports Medicine Clinic PC of Oklahoma City, Oklahoma, entered a steep descent and crashed about 2 minutes after takeoff from Wiley Post Airport (PWA) in Oklahoma City. None of the entities associated with the flight claimed to be its operator.² The pilot, the second pilot,³ and the three passengers were killed, and the airplane was destroyed by impact forces and postcrash fire. The flight was operated under 14 *Code of Federal Regulations* (CFR) Part 91 with an instrument flight rules (IFR) flight plan filed. Visual meteorological conditions prevailed. The flight originated from the ramp of Interstate Helicopters (a 14 CFR Part 135 on-demand helicopter operator at PWA) and was en route to Mankato Regional Airport (MKT), Mankato, Minnesota, carrying company executives who worked for United Engines and United Holdings, LLC.⁴

The flight was cleared for takeoff from runway 17L at 1512:35, and the flight crew's departure clearance was to turn right to a heading of 200° and maintain an initial altitude of 3,000 feet above mean sea level (msl).⁵ The flight departed, and, at 1514:12, the flight crew checked in with the Oklahoma City departure controller, reporting that the flight was climbing out of 2,000 feet for 3,000 feet.⁶ About 28 seconds later, the flight crew checked in again, reporting that the flight was level at 3,000 feet. The departure controller acknowledged, advised that the flight was in radar contact, and issued instructions to turn the airplane right to a heading of 290° and climb to 15,000 feet. There was no response from the flight crew. At 1515:03, an unknown person reported on the PWA local control frequency, "I just saw an airplane crash and explode."

The flight's assigned heading after takeoff from PWA carried it over the southeast corner of Lake Overholser. A witness who was standing in the parking lot southwest of the lake reported that he heard what "sounded like an engine compressor stall"⁷ and that he saw the airplane

¹ All times are central standard time unless otherwise indicated.

² Representatives from Southwest Orthopedic, Interstate Helicopters, and United Engines were interviewed. A summary of their descriptions of their respective involvement with the flight is provided in Section 1.17.

³ The terms "pilot" and "second pilot" are used in this report (rather than more traditional terms, such as "pilot-in-command" and "copilot") to avoid inaccurate descriptions based on any regulatory interpretation of the flight's operation.

⁴ The public docket for this accident is available from the NTSB's website at <http://www.nts.gov/dockets/aviation/DFW08MA076/default.htm>.

⁵ All altitudes are in feet above msl unless otherwise indicated.

⁶ The departure controller did not respond to the flight crew's report. Review of recorded communications showed that the controller was handling a landline coordination call at the time.

⁷ A compressor stall, or surge, is a disruption of the airflow through a gas turbine (jet) engine and typically results in pop or bang noises.

descending at a 60° to 70° nose-down attitude. He stated that “gray smoke” was trailing from the airplane and that he saw what appeared to be pieces of a bird and feathers floating down. Several witnesses stated that the “smoke” that trailed the airplane appeared to be white, and some identified that it appeared to emanate from the airplane’s left engine or left side. One witness stated that the airplane “puffed a large white cloud of smoke” before it began a spin to the ground; additional witnesses predominantly reported that the airplane rolled left and spiraled or spun to the ground. One witness stated that, after the airplane crashed, he observed the remains of two large white birds in the water but that when he returned with his boat to recover the remains, they were gone. This witness commented that a flock of pelicans had been in the area for about 2 weeks before the accident.

A security camera located about 1/2 mile southwest of the accident site captured images of the accident airplane descending steeply, nose down to the ground while emitting a visible trail. (See figure 1.) The video also showed that a large fireball followed the airplane’s impact.

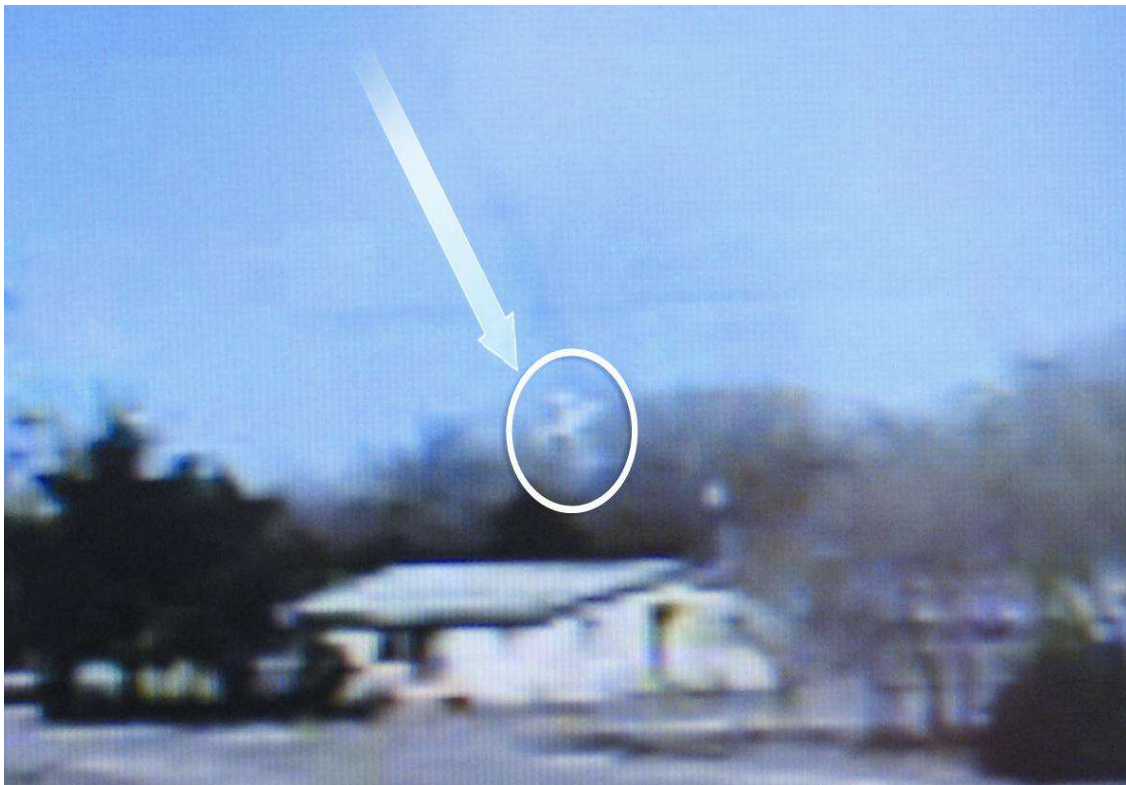


Figure 1. Screen capture of a video image showing the accident airplane (circled) and the visible trail behind it (to the right of and approximately parallel to the arrow) before ground impact.

1.2 Injuries to Persons

Table 1. Injury chart.

Injuries	Flight Crew	Cabin Crew	Passengers	Other	Total
Fatal	2	0	3	0	5
Serious	0	0	0	0	0
Minor	0	0	0	0	0
None	0	0	0	0	0
Total	2	0	3	0	5

1.3 Damage to Airplane

The airplane was severely fragmented and fire damaged due to the impact and postcrash fire.

1.4 Other Damage

No other damage was reported.

1.5 Personnel Information

1.5.1 The Pilot

The pilot, age 44, held an airline transport pilot certificate with a rating for airplane multi-engine land and type ratings for the CE-500 (Cessna 500), Cessna CE-650 (Citation III), and Learjet airplanes. He held a first class airman medical certificate issued July 26, 2007, with no limitations. He also held commercial privileges for airplane single-engine land and a flight instructor certificate for single-engine, multi-engine, and instrument airplanes.

His current log information, believed to have been kept on a laptop computer that was destroyed in the accident, could not be retrieved for review. On the basis of other available records, the pilot accumulated an estimated 6,100 total flight hours, including about 5,000 hours pilot-in-command time and about 668 hours in turbine-powered airplanes.⁸

⁸ The pilot's flight-time estimates are based on information compiled from several sources, including the pilot's paper logbook (in which the last entry was dated October 13, 2006), recurrent training records, four FAA airman medical certificate applications submitted since 2005, and interviews with acquaintances familiar with his flying. Some of these records contained discrepancies; therefore, the flight-hour estimates are approximate.

The pilot performed the accident flight outside his regular employment. He was regularly employed as the chief pilot of a company for which he flew a Cessna CE-550 (Citation II)⁹ airplane in a Part 91 corporate capacity; a coworker stated that the pilot flew the CE-550 airplane frequently in the days preceding the accident flight and that he met recent flight experience requirements. Other pilots who had flown with him stated that he had flown the accident airplane before; however, records of these flights were not located.

The pilot completed the initial type rating course for the CE-500 on February 22, 2004. He completed single-pilot training for the CE-550 under Cessna exemption 4050¹⁰ on April 19, 2004. He completed single-pilot recurrent training for the CE-550 on June 7, 2005, June 10, 2006, and July 14, 2007. A compliance form for the pilot's July 2007 training indicated that the CE-500/CE-S550 differences training block was checked. According to the training center manager, this meant that the pilot had also been properly trained to fly the CE-500 as a single pilot.

The pilot's most recent formal flight training was completed on September 21, 2007. The training was an initial type rating course for the CE-650, which requires a two-pilot crew.¹¹ The instructors stated that the pilot demonstrated above-average flying skills but that his crew resource management (CRM) skills needed work throughout his training because he tried to do too much himself rather than divide the workload with the other crewmember. The instructors attributed this to his single-pilot background, and one instructor stated that it was not uncommon for pilots who are accustomed to flying alone to need additional training to learn how to work as a team.

During interviews, pilots who knew the accident pilot generally described him as a "good guy" with a "good reputation." A review of Federal Aviation Administration (FAA) accident, incident, and enforcement records for the pilot indicated no history of violations or certificate actions. FAA records indicated that a Notice of Disapproval was issued to the pilot on May 19, 2001, for the airline transport pilot certificate and Learjet type rating flight test; he passed the test 2 days later.

1.5.2 The Second Pilot

The second pilot, age 40, held a commercial pilot certificate for airplane single-engine and multi-engine land and instrument airplane. He also held a flight instructor certificate for single-engine and instrument airplanes. He held a second class airman medical certificate issued July 26, 2007, with no limitations.

A review of the second pilot's logbook revealed that he had accumulated about 1,378 total flight hours, of which 1,245 were pilot-in-command hours. He logged 78 hours second-in-command time in turbine-powered airplanes (2.5 hours in a Falcon 20F, 2.3 hours in a

⁹ The CE-500 type rating includes the CE-550.

¹⁰ Cessna exemption 4050 allows for the single-pilot operation of CE-550, CE-S550, and CE-560 airplanes.

¹¹ According to the pilot's coworker, their employer sent the pilot to the training because the company had planned to acquire a CE-650.

CE-500, and 73 hours in a CE-550).¹² He had accumulated about 45 flight hours in the preceding 90 days (23 hours of which were logged in the preceding 30 days) with no flight hours recorded in the 24 hours that preceded the accident.

The second pilot performed the accident flight outside his regular employment. He was regularly employed at a company for which he flew a Cessna CE-340 (twin-engine, piston-powered, light airplane), and he ran his own flight school. He had also worked part-time for the accident pilot's employer, flying in that company's CE-550 airplane, and had previously flown with the accident pilot. His logbook showed that he had flown in the accident airplane on August 24 and 25, 2007, which were his only flights recorded in a CE-500; he logged no landings for those flights.

Another pilot, who had previously flown as a pilot-in-command in the accident airplane with the second pilot, stated that the second pilot was a "fill-in guy" who was building flight time and that, when a second pilot was not required, it was nice to take someone to fill in the seat but not fly. He described the second pilot as a "class act" person who, as a pilot, was good with checklists and was calm, collected, and knowledgeable.

A review of FAA accident, incident, and enforcement records indicated no history of violations or certificate actions. FAA records indicated that a Notice of Disapproval was issued to the second pilot on May 19, 1992, for a multi-engine and instrument rating practical test; he subsequently passed the test on November 17, 1992.

1.6 Airplane Information

The Cessna 500 is low-wing airplane powered by two Pratt & Whitney Canada JT15D-1A turbofan engines. It is equipped with straight wings with integral wet-wing fuel tanks,¹³ a conventional tail, and retractable tricycle landing gear. The accident airplane was manufactured in 1975 and had a seating capacity of five passengers and two pilots.

The airplane's logs recorded a basic operating weight of 6,674 pounds (lbs). According to the manufacturer's data, the airplane was modified in accordance with Cessna Service Bulletin 32-23, which resulted in a maximum ramp weight of 12,000 lbs, and a maximum takeoff weight of 11,850 lbs. No weight and balance form showing a calculation for the accident flight

¹² All of the second pilot's experience in turbine-powered airplanes was accumulated between July 26, 2006, and October 1, 2007. His logbook showed no record that he had completed the aircraft familiarity, CRM training, or engine-out procedure requirements of 14 CFR 61.55(b) that would be needed to serve as second-in-command of an aircraft type-certificated for more than one required pilot. Title 14 CFR 61.51(f) states that, to log second-in-command time, a person must be qualified in accordance with 14 CFR 61.55.

¹³ An integral wet-wing fuel tank is constructed of the wing structure itself, which is sealed to hold fuel. On the Cessna 500, sections of the integrated tanks extend forward of the wing spar to the wing's leading edge.

was located. On the basis of available records, the accident flight's estimated takeoff weight was about 11,437 lbs.¹⁴

1.6.1 Engine and Airframe Certification Standards Pertaining to Birds

The accident airplane's engine model is subject to the bird-ingestion certification standards of 14 CFR Part 33, which contains various engine performance requirements that address a number of bird-ingestion scenarios. According to the standard for a single, large-bird ingestion specified in 14 CFR 33.76(b), the engine must be able to ingest a 4-lb bird while operating at 100 percent power at an airplane speed of 200 knots (kts) without releasing hazardous fragments, catching fire, separating from the airframe, or losing the ability to be shut down. Certification tests for the JT15D-1A turbofan engines were performed using a 4-lb bird carcass propelled at 293 kts into an engine operating at maximum continuous power.

The accident airplane's airframe and windshield are subject to the bird-strike certification standards for transport category airplanes, as specified under 14 CFR Part 25. According to 14 CFR 25.571(e)(1), the airframe general structure must be able to withstand an impact from a 4-lb bird at the airplane's sea-level V_c (design cruising speed), which is 287 kts for the Cessna 500, without precluding the airplane from successfully completing the flight. Title 14 CFR 25.631 states that the empennage (tail structure) must be able to withstand an impact from an 8-lb bird at sea-level V_c without precluding the airplane from continued safe flight and landing. Title 14 CFR 25.775(b) states that the windshield must be able to withstand impact from a 4-lb bird at sea-level V_c without allowing the bird to penetrate the windshield.

1.6.2 Single-Pilot Exemptions

According to the *Cessna Citation Model 500 Airplane Flight Manual*, the airplane was originally certificated under 14 CFR Part 25, which requires that a two-pilot crew operate the airplane. However, the FAA subsequently allowed for certain exemptions, including the Cessna 4050 and the Shannon 6480 exemptions, which allow for single-pilot operation of the CE-500 and other specific airplanes. Shannon exemption 6480G had been granted to Southwest Orthopedic for the accident airplane.¹⁵

¹⁴ According to weight estimates derived from a fueling ticket, a manifest maintained by Interstate Helicopters, and witness statements, the airplane carried about 3,913 lbs of fuel (full fuel capacity of 584 gallons at 6.7 lbs per gallon), the crew and passengers weighed about 950 lbs, and the baggage weighed about 50 lbs. About 150 lbs of fuel was burned during taxi. The airplane's center of gravity limitations at the estimated takeoff weight allowed for a variety of possible passenger seating positions; however, the seating arrangement of the passengers on the accident flight is unknown.

¹⁵ The Shannon exemption administrator stated that no airplane modifications are required for the exemption. According to the Shannon licensing agreement with Southwest Orthopedic, a pilot could be authorized to fly the accident airplane single-pilot under the Shannon exemption after receiving specific training and having the pilot's name on file with Shannon. The accident pilot was not listed on the accident airplane's Shannon authorization documents; he had previously completed single-pilot training for the CE-550 under the Cessna 4050 exemption. According to the manager of the training center that provided the pilot's CE-500/CE-S550 differences training, the training conducted for all three types of single-pilot exemptions (Sierra exemption is the third) is virtually the same.

1.6.3 Maintenance Records

Southwest Orthopedic acquired the airplane in October 2004. The logbooks indicated that, at that time, the airframe had accrued 6,361.7 hours time-in-service (TIS) and 5,952 cycles, the left engine had accrued 6,456.4 hours TIS and 5,998 cycles, and the right engine had accrued 11,153.6 hours TIS and 10,092 cycles. Review of available maintenance records for the time that Southwest Orthopedic owned the airplane revealed no chronic or recurring maintenance items. The most recent maintenance on the accident airplane was performed between November 5, 2007, and January 29, 2008.¹⁶

Title 14 CFR 91.417(a)(2)(i) states that each registered owner or operator of an airplane must keep records containing the total TIS of the airframe and each engine. Southwest Orthopedic's flight logs for the period between October 20, 2004 and May 20, 2007, were provided for review, but no flight logs were supplied for the period between May 20, 2007, and the date of the accident. Review of available flight and maintenance logs revealed numerous omissions and errors. Various maintenance repairs performed on the airplane in December 2004, October 2005, March 2007, April 2007, and October 2007 were recorded in documents supplied by a maintenance provider but were not documented in the airplane logbook, and a total of 15.2 hours and 7 cycles on the airframe and engines were unaccounted for between December 1, 2006, and April 2, 2007. Also, a review of flight logs revealed that numerous mathematical errors were recorded as the times and cycles for the airframe and engines; most of these errors involved 1 cycle or 1 hour or less, but some resulted in the airframe cycles being underreported by 500 cycles, the time on the left engine being underreported by 500 hours, and the right engine cycles being overreported by 1,000 cycles on some of the records.

The review and mathematical reconciliation of available records revealed that, as of May 20, 2007 (the most recent available flight log), the airframe had accrued about 6,487 hours TIS and 6,058 cycles, the left engine had accrued about 6,582 hours TIS and 6,095 cycles, and the right engine had accrued about 11,277 hours TIS and 10,188 cycles.¹⁷

1.7 Meteorological Information

About 1519, the automated weather observing system at PWA reported wind from 150° at 9 kts, 10 miles visibility, clear of clouds, temperature 52° F, dew point 16° F, and a barometric pressure setting of 29.86 inches (in) of mercury.

¹⁶ This maintenance was documented in the aircraft logbook and in the records supplied by the maintenance provider. During this maintenance visit, the Phase 5, 13, 18, 22, 34, 49, and 53 inspections were completed on the airplane and the Phase 8 oil change was completed on both engines. The aileron cables and rudder cable were also replaced, and the system was rerigged. Several other minor maintenance actions were recorded.

¹⁷ These estimates include reconciliation of the discovered mathematical errors and are based on an assumption that the times and cycles recorded for the airplane as of October 2004 are correct; no mathematical reconciliation was performed on entries recorded before that date. Reconciliation of the airplane's available records indicates that, during Southwest Orthopedic's ownership of the airplane from October 2004 up to May 20, 2007, the airframe accrued 124.8 hours TIS and 106 cycles, the left engine accrued 125.5 hours TIS and 97 cycles, and the right engine accrued 123.6 hours TIS and 96 cycles.

1.8 Aids to Navigation

No problems with any navigational aids were reported.

1.9 Communications

During pretakeoff communications with the ground controller, the flight crew read back the flight's IFR clearance, to which the PWA ground controller responded, "Readback correct, I was barely able to read ya on that transmitter, though." Subsequently, the PWA local controller who cleared the flight for takeoff also noted that the radio transmission was weak, to which a crewmember replied, "Okay, is that any better right there?" The local controller responded, "That's a lot better."

1.10 Airport Information

PWA is a public-use,¹⁸ general aviation airport; it does not have scheduled air carrier operations and is not certificated under 14 CFR Part 139. PWA is located about 7 miles northwest of Oklahoma City at an elevation of 1,299 feet. Runway 17L/35R has a concrete surface and is 7,198 feet long and 150 feet wide. At the time of the accident, the airport employed a general aviation manager, five maintenance personnel, and one electrician.

According to air traffic control (ATC) staff at Will Rogers World Airport (OKC), in Oklahoma City, PWA departures are assigned radar headings in accordance with the OKC-PWA letter of agreement, which instructs PWA tower controllers to issue an initial heading of 200° for aircraft departing to the south, as was the case with the accident airplane. This heading is intended to separate PWA departures from traffic near OKC. PWA departures are all initially cleared to 3,000 feet on departure (the minimum vectoring altitude in the area is 2,700 feet) to avoid overhead traffic (notably OKC arrival aircraft) turning over and near PWA at 4,000 feet. One corporate pilot based at PWA said that, when departing PWA to the south, he seldom needed to level off his airplane at 3,000 feet; he said that most of the time, an OKC controller would promptly clear his flight to climb to 15,000 feet.¹⁹

Two large lakes, a river, and a wildlife refuge area are located within a 5-mile radius of PWA. These include Lake Overholser, which is southwest of PWA and was overflown by the accident flight; Lake Hefner, which is northeast; and Stinchcomb Wildlife Refuge, which is adjacent to the airport on the west and includes a sedimentation basin from the North Canadian River that contains four smaller lakes.

Following the accident, a U.S. Department of Agriculture (USDA) wildlife biologist performed a site survey at Lake Overholser on March 14, 2008, and observed 16 American white

¹⁸ A public-use airport is an airport that is open to the public and is either publicly owned, privately owned but designated by the FAA as a reliever airport, or privately owned but having scheduled service of at least 2,500 annual enplanements.

¹⁹ He estimated that 5 out of 150 departures required him to level off his airplane at 3,000 feet.

pelicans; 9 were soaring about 1,000 feet above ground level (agl), and 7 were on the lake. The wildlife biologist also observed 106 ring-billed gulls, 11 geese (Canada goose species), 58 double-crested cormorants, 4 pied-billed grebes (small, diving waterbirds), 74 American coots (waterbirds), 1 snowy egret, and various ducks, including 96 common mergansers, 18 Northern shovelers, 4 blue-winged teals, and 31 mallards.

1.10.1 Wildlife Hazard Management at Wiley Post Airport

The FAA Airport Facilities Directory (AFD) entry for PWA contains the remark, “Flocks of birds on [and in the vicinity of the airport in] ... all quadrants.” PWA does not have and is not required to have a wildlife hazard management plan.²⁰ The airport’s general aviation manager stated that standard practice is to keep wildlife off the airfield. He said that, when air traffic controllers report or maintenance personnel observe birds on the airport, blank ammunition or pyrotechnics can be used to frighten the birds away from the runways but that such techniques are seldom needed and have only been used about six or eight times in the preceding 6 years. He stated that controllers reported to him three aircraft bird-strike events during that timeframe. For the period from 1990 to June 2008, the FAA National Wildlife Aircraft Strike Database for Civil Aviation²¹ included eight reported bird strikes for PWA.

FAA Advisory Circular (AC) 150/5200-33B, *Hazardous Wildlife Attractants On or Near Airports*, contains standards and practices that are recommended for operators of public-use airports. The AC states that the standards and practices must be used for those “airports that have received Federal grant-in-aid assistance.” PWA is a federally obligated airport.²² According to the AC, airport operators should establish a distance of 5 miles between the farthest edge of the airport operations area²³ and any wildlife attractant that could cause hazardous wildlife movement into or across the approach or departure airspace.²⁴ The AC also states that operators of airports surrounded by woodlands, water, or wetlands should provide for a wildlife hazard assessment conducted by a wildlife damage management biologist; PWA had not conducted a wildlife hazard assessment.

1.10.2 Wildlife Hazard Management at Nearby Certificated Airport

OKC is a Part 139 certificated air carrier airport located about 8 miles south-southeast of PWA. The area between the two airports contains wildlife attractants common to both, including

²⁰ The wildlife hazard management plan requirements of 14 CFR 139.337 apply only to certificated airports.

²¹ The database is managed by the USDA, Animal and Plant Health Inspection Service, Wildlife Services, in cooperation with the FAA.

²² Federally obligated airports receive Federal financial assistance under the Airport Improvement Program; in accepting such grants, these airports must comply with FAA advisory materials and other specified conditions.

²³ An airport operations area is any area of an airport used or intended to be used for landing, takeoff, or surface maneuvering of aircraft.

²⁴ Approach or departure airspace is the airspace within 5 miles of an airport through which aircraft move during landing or takeoff.

Lake Overholser. For the period from January 1990 to June 2008, the FAA National Wildlife Aircraft Strike Database included 364 reported bird strikes for OKC.

Following a deer strike event in November 1992 and several bird strikes in 1995 and 1996, OKC requested that a wildlife hazard assessment be performed.²⁵ In May 1998, the USDA provided OKC its comprehensive assessment of wildlife hazards at OKC and in surrounding areas. The report, which contained surveys documenting “only large, hazardous species numbers,” stated that Lake Overholser and other area lakes and reservoirs attracted thousands of waterfowl and gulls from the late fall to early spring. The report also noted that flocks of pelicans in the area should be monitored when in the vicinity of the airport. In accordance with its certification requirements, OKC used the USDA’s wildlife hazard assessment as a basis for developing a wildlife hazard management plan, which is contained in its airport certification manual as an FAA-approved chapter.²⁶

1.11 Flight Recorders

1.11.1 Cockpit Voice Recorder

The accident airplane was equipped with a B&D Instruments and Avionics cockpit voice recorder (CVR)²⁷ designed to record 30 minutes of analog audio, including channels for each flight crewmember and the cockpit area microphone, on a continuous loop tape. Examination revealed that the CVR showed impact damage. Extraction of the tape revealed that the tape transport was jammed and that the tape was severely stretched and wrinkled. No useable audio was recovered from any channel. The airplane owner’s pilot, who last flew the airplane in early January 2008, stated that the CVR tested operative for that flight and that he was unaware that it was inoperative.

²⁵ According to 14 CFR 139.337(b), certificated airports must perform wildlife hazard assessments if an air carrier aircraft encounters multiple wildlife strikes, receives substantial damage due to any wildlife strike, or ingests wildlife into an engine, or if wildlife of a size or in numbers capable of causing any such air carrier event is observed to have access to any airport flight pattern or aircraft movement area.

²⁶ OKC’s wildlife management plan specifies that the airport operations manager’s responsibilities include identifying wildlife that are hazards to aviation; taking aggressive action to disperse wildlife presenting a hazard to aviation; responding to notifications from air traffic controllers, pilots, and others on wildlife strike and sightings and taking appropriate action; notifying air traffic controllers of any wildlife activity that may pose an imminent danger to aircraft; and issuing notices to airmen to warn pilots of wildlife activity. OKC also has a full-time USDA wildlife biologist assigned to the airport to assist with wildlife hazard issues.

²⁷ The CVR was not required equipment for the accident airplane. According to 14 CFR 91.609(e), multiengine, turbine-powered airplanes that have a passenger seating configuration of six or more and for which two pilots are required must be equipped with an approved CVR.

1.11.2 Flight Data Recorder

The airplane was not equipped, and was not required to be equipped, with a flight data recorder.²⁸

1.12 Wreckage and Impact Information

The wreckage was located in a wooded area about 4 miles south of PWA. The airplane was severely fragmented and fire damaged due to the impact and postcrash fire, and wreckage debris was scattered along an approximate 185° magnetic heading over an area about 300 feet long and 200 feet wide. Structures from the nose, tail, and both wingtips were identified. Both engines were identified and recovered with the wreckage for examination. The flight control surfaces were identified and found attached to their respective mounting structures.²⁹ There was no evidence that any pieces of the airplane separated in flight.

The bulkhead between the cockpit and the baggage compartment, fragments from the cockpit acrylic windows, and about 80 percent of the cockpit window mounting structure were identified. Most of the structure on each wing forward of the rear spar was either consumed by fire or could not be conclusively identified, and very little of the wing leading edge structures was found. Extensive examination revealed no evidence of a bird strike or bird-remains residue on the identifiable pieces of the cockpit and bulkhead, on the cockpit window structures or window fragments, or on the few pieces of identifiable wing leading edge structures. No evidence of a bird strike was found on the empennage; however, unidentified splatter residues on the right horizontal stabilizer and the right side of the vertical stabilizer were collected for analysis.

The Smithsonian Institution's Feather Identification Laboratory performed deoxyribonucleic acid (DNA) analysis on the recovered splatter residue; the DNA analysis identified the residue as the remains of an American white pelican. This species (*Pelecanus erythrorhynchos*) is common in central Oklahoma from March to May,³⁰ ranges in weight from about 8 to 20 lbs³¹ and in length from about 50 to 65 in, and has a wingspan of about 96 to

²⁸ According to 14 CFR 91.609(c)(1), an approved flight recorder is required for multiengine, turbine-powered airplanes manufactured after October 11, 1991, that have a passenger seating configuration of 10 or more.

²⁹ Both elevators were found intact and attached to their respective horizontal stabilizers, the rudder was intact and attached to the vertical stabilizer, the right aileron and the flaps were intact and attached to their respective mounting structures, and the left aileron (which was recovered in two pieces) remained attached to its mounting structure at all mounting points.

³⁰ Oklahoma City Audubon Society Bird Records Committee, 2006.

³¹ A variety of resources indicated differing weight ranges for the American white pelican, and at least one resource reported that an American white pelican could weigh as much as 30 lbs. On July 23, 2009, an avian expert from the Smithsonian Institution's National Museum of Natural History provided an evaluation of the ranges from an avian bird mass expert, who indicated that, based on the data samples considered in the various publications, an extreme maximum estimate for the American white pelican is likely closer to about 20 lbs. Published resources reviewed include the following: (a) D.A. Sibley, *The Sibley Guide to Birds* (New York: Alfred A. Knopf Publishing Group, 2000); (b) J.B. Dunning, ed., *CRC Handbook of Avian Body Masses* (Boca Raton, Florida: CRC Press, LLC, 1993); (c) J.B. Dunning, ed., *CRC Handbook of Avian Body Masses* (Boca Raton, Florida: CRC Press, LLC, 2008); and (d) the Cornell Lab of Ornithology and American Ornithologists' Union online resource, "*The Birds of North America Online*" <<http://bna.birds.cornell.edu/bna>> (accessed May 11, 2009).

114 in.³² (See figure 2.) The examination of a preserved American white pelican at the Smithsonian Institution's ornithology collection showed that the bird's body could be about 30 in long with a 12- to 15-in diameter.



Figure 2. American white pelicans.

1.13 Medical and Pathological Information

1.13.1 Autopsy and Toxicology Reports

Final autopsy reports for the pilot and second pilot had not been completed as of the date of this accident report's publication. The State of Oklahoma's Office of the Chief Medical Examiner provided the National Transportation Safety Board (NTSB) a letter on June 22, 2009, confirming that the cause of death for all occupants was "blunt force and blast injuries" and generally describing the associated fragmentation and dispersal.

The FAA's Civil Aerospace Medical Institute (CAMI) performed toxicology testing on the pilot's samples. The toxicology report indicated that the samples tested negative for ethanol and a wide range of drugs, including major drugs of abuse (marijuana, cocaine, phencyclidine, amphetamines, and opiates). The report indicated that cyclobenzaprine³³ was detected in the lung

³² Information from the Cornell University Ornithology Laboratory website, *All about Birds* <http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/American_White_Pelican.html> (accessed May 11, 2009).

³³ Cyclobenzaprine, often known by the trade name Flexeril®, is a prescription muscle relaxant.

and muscle samples and that 0.085 (µg/mL, µg/g) cyclobenzaprine was detected in the sample identified as blood.

1.13.2 Pilot's Medical History

A review of the pilot's FAA airman medical records showed that, in 1998, an aviation medical examiner noted on the pilot's airman medical application that the pilot had a history of gout.³⁴ On May 29, 2001, CAMI issued a letter to the pilot cautioning him that, because of his history of gout, operation of an aircraft would be prohibited at any time new symptoms or adverse changes occur, or if he experienced any side effects from or required a change in medication. The records showed that, on the pilot's January 20, 2003, medical application and all subsequent applications, the pilot reported no further history of gout or the use of any medication.

After receiving the toxicology test results from CAMI on May 8, 2009,³⁵ the NTSB contacted a member of the pilot's family to obtain more information about why the pilot was taking cyclobenzaprine, how long he had been taking it, and who may have prescribed it. The family member reported that the pilot's spouse could not recall what medications that the pilot may have been taking or for what reason. The family member did not respond to requests for the name of the pilot's physician.

A pilot who had flown with the accident pilot while working for the same employer and who completed simulator training with him in September 2007 reported that the accident pilot flew with his shoes off.³⁶ The pilot recalled that the accident pilot told her that his feet hurt when he wore shoes because of a nerve condition that he had "forever" and that might require surgery. According to a simulator instructor who provided the training, the accident pilot complained often about foot problems and often took his shoes off in the classroom and in the simulator; however, the instructor reported that it did not affect the pilot's performance. The instructor could not recall the name of the medical problem but said that he thought that it made the pilot's feet feel tingly and numb. The check airman who observed the accident pilot during his most recent check on September 21, 2007, observed no physical deficiencies with the accident pilot. The check airman recalled that the pilot took his shoes off during ground school but that it did not affect the pilot's performance during flight training. The check airman stated that the pilot had no problems performing engine-out maneuvers.³⁷

³⁴ Gout, which is a kind of arthritis caused by too much uric acid in the blood, can trigger an attack of sudden burning pain, stiffness, and swelling in a joint, most commonly the big toe, or in the foot, ankle, or knee. Such attacks can last from days to weeks and can recur unless the gout is treated. On the pilot's FAA airman medical examinations from May 13, 1998, to January 17, 2002, the pilot reported use of allopurinol, a medication commonly used to treat gout.

³⁵ The Oklahoma County Medical Examiner's office was delayed in submitting the samples to CAMI.

³⁶ The accident pilot's use of shoes during the accident flight was not determined.

³⁷ Engine-out maneuvers typically require effective application of the rudder pedals.

Other persons interviewed who knew the accident pilot stated that he was very healthy, worked out, and kept his weight down. A person who had lunch with the accident pilot on the day of the accident stated that the pilot seemed well rested, in a good mood, and wide awake.

1.14 Fire

Witnesses reported seeing white or gray “smoke” as the airplane descended, and video evidence from a security camera showed that the airplane emitted a visible trail and that a large fireball emerged after the airplane impacted the ground. The airplane was heavily damaged and mostly consumed by a fuel-fed, postcrash ground fire.

Examination of the airplane’s horizontal stabilizer at the accident site revealed that it was oriented leading-edge down on top of a ground crater that contained fire-damaged wreckage debris. Dark brown to black soot patterns on the left and right horizontal stabilizers and elevators corresponded to the location of fire-damaged wreckage in the crater below. Soot patterns that extended into crush-damage folds on the trailing edge of the left elevator skin corresponded to an area where a damaged tree or tree limb came to rest on top of the wreckage. (See figure 3.)



Figure 3. Horizontal stabilizers and elevators with fire-damaged wreckage below.

1.15 Survival Aspects

The accident was not survivable due to impact forces.

1.16 Tests and Research

1.16.1 Engine Examinations

Examination of the engines revealed that neither engine showed any indication of a case rupture, uncontainment, or in-flight fire. A feather fragment, determined to be consistent with pelican feathers, was found embedded in a rivet hole in the right engine's inlet duct.

Examination of the right engine revealed that a quadrant of four fan blades showed soft-body impact damage³⁸ that coincided with a cluster of fan exit vanes that were splayed apart. The fan blades were all in place but were bent rearward against the fan exit vanes and compressor inlet vanes. The low compressor case was intact but was buckled around its circumference and bent inward slightly at one location. The fan case inner diameter did not have any circumferential rub marks.

Examination of the left engine revealed that most of the fan blades were fractured adjacent to the blade root platform with the fractured ends bent opposite the direction of rotation. The left engine's fan exit vanes and compressor inlet vanes were packed with finely chopped wood. The low compressor case showed circumferential rub marks in the fan blades' plane of rotation; the location of the rub marks corresponded with the circumferential rub marks observed on some of the fan blade tips.

1.16.2 Aircraft Performance Radar Study

The NTSB conducted an aircraft performance radar study using OKC airport surveillance radar (ASR)³⁹ data, video footage,⁴⁰ witnesses' descriptions of the airplane's descent, and evidence at the crash site. The study used this information and airplane simulation⁴¹ results to calculate the accident airplane's approximate flightpath, orientation, airspeed, descent rate, and other performance parameters throughout the accident flight.

³⁸ Soft-body impact damage is characterized by large-radius of curvature of the blade deformation. Soft-body impact damage can result from impacts with pliable objects, such as birds, ice slabs, tire rubber, and plastic objects.

³⁹ ASRs are short-range (60-nautical-mile) radar systems that produce radar returns every 4.3 to 4.6 seconds for use in providing ATC services.

⁴⁰ Analysis of the video footage indicates that, at impact, the airplane's flightpath angle was about 46° to 51° nose down.

⁴¹ The simulation represented the Cessna 500 engine thrust capabilities and aerodynamics in a flaps-up configuration. Simulation parameters for airplane weight, wind speed and direction, and temperature were selected to approximately reflect the accident flight conditions.

Review of available OKC ASR data, which included both primary and secondary returns,⁴² showed that the radar observed 5,985 primary targets in its coverage area during a 10-minute period about the time of the accident.⁴³ Of these thousands of primary targets, postaccident processing of the data identified that, between 1512:00 and 1514:59, 19 intermittent primary returns appeared within a 0.35-nautical-mile radius of the accident airplane's track over the southeast corner of Lake Overholser. About 1514:45, the airplane was headed south-southwest at an altitude of about 3,050 feet and was traveling about 190 kts calibrated airspeed (KCAS) when its flight track intersected the flight track of the primary returns. About that time, the airplane entered a rapid descent, and the primary returns moved from the area of the intersection toward the northwest, over Lake Overholser. (See figure 4.) Birds, such as the American white pelican, are capable of reflecting primary radar returns.

The simulation provided a reasonable estimate of the accident airplane's performance during the climb and a plausible scenario for the track and orientation of the airplane during its descent; the estimated airplane performance and scenario are generally consistent with the known information. In particular, the simulation required a left roll of the airplane and a turn to the southeast to move from the last radar returns toward the accident site; this left roll is consistent with witnesses' observations of the accident airplane. (See figure 5.) Further, for the simulated airplane to then move toward the right to achieve a track of 185° at impact (the orientation of the debris path at the accident site) with a descent angle consistent with the video footage of the accident airplane and with the position of the wreckage at the accident site, the simulated airplane's left roll had to continue through the inverted position.

⁴² Primary radar returns, which are reflected by objects in the path of the radar beam, contain no information about the altitude or identity of the objects reflecting them. The signal strength and quality of primary returns depend on many factors, including the range to the object, the object's size and shape, and atmospheric conditions. These characteristics of primary returns make it difficult to distinguish individual aircraft from each other and from other objects, such as flocks of birds. Secondary returns, which are derived from responses from an airplane's transponder, improve the consistency and reliability of radar returns by providing information about a transponder-equipped airplane's position, identity, and altitude (if Mode C-equipped).

⁴³ It is not known how many of these primary returns were visible on the controller's display. Typically, some filtering occurs, in which weak primary returns are not processed to be shown on a controller's display.



Figure 4. Plot showing primary and secondary radar returns with overlay of the simulation flightpath.



Figure 5. Simulation-based illustration of the airplane's descent and left roll through the inverted position.

1.16.3 Bird-Strike Energy Study

According to the airframe standard that applies to the Cessna 500, the wing structures are certificated to withstand an impact from a 4-lb bird at an airplane cruise speed of 287 kts without precluding the airplane from continued safe flight and landing. The NTSB performed a bird-strike energy study that determined that the kinetic energy of such a strike (4-lb bird, 287-kt airspeed) is 14,586 foot-lbs (ft-lbs).⁴⁴

As determined in the airplane performance study, the accident airplane was cruising about 190 KCAS (about 198 kts true airspeed) when it encountered a cluster of primary radar returns. American white pelican remains were identified on the wreckage, and the maximum weight of the American white pelican is about 20 lbs. According to the energy study, the kinetic energy of such a strike (rounding the relative speed between the airplane and the bird to 200 kts and using the maximum pelican weight) could have been as high as 35,416 ft-lbs for one bird.

1.17 Organizational and Management Information

Following the accident, interviews with representatives from Southwest Orthopedic, Interstate Helicopters, and United Engines revealed that none considered themselves or their

⁴⁴ A ft-lb is a unit of energy; 1 ft-lb is equivalent to the amount of energy needed to raise a 1-lb object a distance of 1 ft.

companies to be the flight's operator. Many of these people had preexisting relationships or previous contacts with each other through the local aviation community; Interstate Helicopters and dozens of corporate airplanes, including the accident airplane, were based at PWA, and several local pilots made themselves available to cover trips for other corporate flight departments by performing freelance or contract work.

1.17.1 Interstate Helicopters

Interstate Helicopters of Bethany, Oklahoma, was founded in 1978 and had been located at PWA since September 2004. The company held an operating certificate to conduct Part 135 on-demand helicopter operations; it did not have any airplanes on its operating certificate at any time. At the time of the accident, the company had two helicopters on its operating certificate and provided helicopter sales, service, and management. The company employed three full-time pilots, one contract instructor, and a few contract pilots.

Days before the accident, the then-president of United Engines directed his executive assistant to contact Interstate Helicopters to see if the flight from PWA to MKT could be arranged. The executive assistant stated that she usually called Interstate Helicopters for flights because United Engines was already using Interstate Helicopters at the time she was hired; she said that whenever she called Interstate Helicopters to arrange flights, Interstate Helicopters' manager usually replied to her within a day with a flat, total-rate quote for the trip. A former executive assistant stated that the company first started using Interstate Helicopters a few years ago, after the company's previous president learned of Interstate Helicopters through a business acquaintance who was a frequent Interstate Helicopters customer. The former executive assistant recalled that Interstate Helicopters' prices were very competitive and that they were a little bit cheaper than two airplane charter companies that United Engines had also used.

The current president of United Engines stated that he believed that the accident flight was a charter flight; he said that he had flown on airplane charters provided by Interstate Helicopters multiple times. He said that his company did not favor any particular charter operator and that it did not lease or purchase aircraft block time. He noted that, years ago, his company had a share or partnership in an airplane but sold it.⁴⁵ He said that he had never discussed Interstate Helicopters' status as a charter operator and that, since the accident, his company now requires copies of the pilot and aircraft certifications as well as insurance information.

When asked who the operator of the accident airplane was, Interstate Helicopters' owner stated that he "put the flight together" for people whom he knew.⁴⁶ He stated that he did not have control of the accident flight; he said that Southwest Orthopedic's pilot was responsible for that. Interstate Helicopters' owner described the arrangement as a dry lease of the accident airplane (a

⁴⁵ He stated that the company sold its interest in the airplane, which was a Beechcraft 90C (King Air) maintained under Part 135 by another company, because it did not get much use.

⁴⁶ He stated that he was acquainted with two of the passengers for about 1.5 years because they were good friends with the owners of another airplane that he flies.

dry lease involves the leasing of an aircraft without the crew) and described his role as finding the airplane and putting together the information for the people who asked him to set up the trip.

Interstate Helicopters' owner said that, after United Engines contacted him for the flight, he called Southwest Orthopedic's pilot and asked if the airplane was available; the owner's pilot told him that it was. Interstate Helicopters' owner subsequently called the accident pilot, who agreed to fly the airplane. Interstate Helicopters' owner said that he knew that the accident pilot had a good reputation through word of mouth; he had no résumé or flight time statement from the pilot. Interstate Helicopters' owner asked the accident pilot to provide a copilot. According to the second pilot's spouse, the accident pilot contacted the second pilot for the flight, and he agreed because he wanted to build flight hours. Interstate Helicopters' owner did not know the second pilot, his qualifications, or his background.

According to the manager of Interstate Helicopters, the accident flight was planned to depart from Interstate Helicopters' ramp at 1500. The second pilot arrived about 1400, and the pilot arrived shortly thereafter, at which time they began to preflight the airplane. Interstate Helicopters' manager assisted in flight preparation by cleaning and stocking the airplane and loading the coffee. She also greeted the passengers in the parking lot when they arrived about 1450, assisted them with their bags, and asked them their weights. She provided the passenger weight information to the pilot, asked him how much fuel was to be put on board, and arranged for the fueling.

1.17.1.1 Invoices to United Engines

There was no record of an invoice for the accident flight. Copies of 19 previous invoices (which were obtained from United Engines) showed that, from August 2005 to February 2008, Interstate Helicopters had billed United Engines more than \$116,000 for the use of nine airplanes, including small business jets, twin-engine turboprop airplanes, and a light, piston-powered, twin-engine airplane. Sixteen of the invoices showed "aircraft lease" in the description block and three showed "sales demo." On some invoices, expenses such as fuel, landing fees, pilot expenses, meals, and overnight fees were itemized as separate charges. On other invoices, only a single amount was billed. One such consolidated invoice stated, "includes aircraft lease, fuel, pilot fees, and meal," and another stated "includes aircraft lease, fuel, and pilots." One invoice that listed "sales demo" on the description line had itemized charges for 10.4 hours flown at a rate of \$950 per hour and fuel charges for flights to six different cities.

1.17.1.2 Payments to Southwest Orthopedic

Deposit records showed that Southwest Orthopedic had received payments from Interstate Helicopters and other parties related to use of the accident airplane. The remittance note on two deposit slips showed "airplane lease" and "plane rental"; the memo line of one payment check showed "airfare" and another showed "travel." The most recent payment from Interstate Helicopters was made on June 7, 2007.

1.17.2 Management of Southwest Orthopedic's Airplane

Southwest Orthopedic & Sports Medicine Clinic PC was founded by an individual who owned the accident airplane, which was operated under Part 91 for the owner's use. The airplane was not listed on any operator's Part 135 operating certificate. The owner stated that the airplane was for sale at the time of the accident but that he intended to use it until it was sold.

The owner said that his pilot managed the airplane's maintenance and upkeep. He stated that his pilot was not an employee or a contractor and that he paid the pilot only when he flew the airplane for him.⁴⁷ The owner said that he had previously owned a Cessna 500 that his pilot flew for him from 1993 until 1995, when he sold the airplane. The owner said that he purchased the accident airplane in 2004 after his pilot contacted him and suggested that he purchase another airplane that the pilot could fly for him. The owner paid his pilot a finders' fee for locating the accident airplane.

The owner's pilot, who was regularly employed as an airline pilot and had formerly worked as the director of operations and chief pilot for a Part 135 charter operator, stated that he managed the accident airplane's maintenance and logbooks in his spare time for no pay. He estimated that the owner typically used the airplane only 3 or 4 times a year and that the airplane flew about 10 or 12 times per year. The owner's pilot stated that he last piloted the airplane in early January 2008.

According to the airplane's owner, his pilot had approached him about dry leasing the airplane to other people to recoup some of the "losses" related to the expense of owning the airplane. During a postaccident interview, when asked to define the term "dry lease," the owner said that "it's a plane without the fuel or something like that. I don't know. [My pilot] handles all that." He said that his pilot would usually, but not always, call him when someone wanted to use the airplane, which he would approve if he did not need to use the airplane himself. The airplane's owner had no written or verbal lease agreements but said that he received \$800 per hour when the airplane was used by someone else. He stated that he did not know the two accident pilots or that his airplane was being flown that day. He said that his pilot "took it on himself to schedule the airplane."

The owner's pilot stated that the owner of Interstate Helicopters had used the airplane three times in the previous 2 years and had contacted him about using the airplane for the accident flight. The owner's pilot said that he told Interstate Helicopters' owner that he was unavailable to fly the trip himself. The owner's pilot said that the operator of the flight was "[Interstate Helicopters' owner], I guess, Interstate Helicopters or whatever he calls it."

1.17.3 Federal Aviation Administration Oversight

The FAA Flight Standards District Office (FSDO) in Oklahoma City has a service area that covers the State of Oklahoma, and the facility has direct oversight of flight operations at

⁴⁷ The owner said that he had paid for some of his pilot's recurrent training. He said that he sometimes paid another pilot to fly the airplane when his pilot was not available.

PWA. The unit operational supervisor described PWA as a very active airport at which about 50 jet and turboprop airplanes were based; he said that he had never seen the accident airplane and did not know where it was kept. The facility manager described the FSDO as consistently short-staffed with significant turnover in personnel; 10 out of 30 inspectors were new. The unit operational supervisor said that the FSDO sometimes received reports or complaints about operators at PWA but that often such complaints were nonspecific and difficult to address. He noted, "If there is a suspicion we need to investigate, we will, but if not, there are plenty of other things that have to be done."

According to one inspector who had worked at the Oklahoma City FSDO, he and another inspector looked into several suspected improper operations at PWA and made several attempts to follow up on tips and allegations of illegal Part 135 activity, but they did not identify any illegal operations.⁴⁸ He stated that catching a violator would entail an "on-scene-challenge inspection," which was difficult, and that such inspections could not be based on an assumption that an operation was illegal; inspectors needed to have a clear, coordinated plan.⁴⁹ Also, he said that the FSDO had an iron-clad reliance on R-items (required work activities) to the exclusion of any ad hoc surveillance.⁵⁰ He said that he believed that the FSDO's manpower and budget were inadequate for the effort needed to catch charter-rule violators.

A maintenance provider at PWA said that he had not seen an FAA inspector conduct a ramp check at the airport in 8 to 10 years. He said that "the fear of a ramp check used to be heard about a lot but not anymore." He stated that almost all aircraft were presented to him as Part 91 aircraft but that he felt that there were a lot of aircraft being operated under Part 91 "through a stretch of a rule." He believed that the longer the "134 and a half"⁵¹ situation went on unenforced, the worse it would get. One Part 135 charter airplane operator at PWA stated that he believed that "under the table" operations had been going on at the airport for years. He said that

⁴⁸ He reported that he came close to completing an enforcement action on a suspected noncompliant operator in 2003, but the pilot, who was based at PWA, was killed in an airplane accident before the appeals process had been completed. More information about the accident, FTW04FA204, is available on the NTSB's website at <<http://www.nts.gov/ntsb/query.asp>>.

⁴⁹ According to FAA Order 2150.3B, *Compliance and Enforcement Program*, before initiating an investigation into a possible violation, FAA investigative personnel must determine whether there is a basis for the investigation and develop an investigative plan of action that is coordinated with supervisors, supporting offices, and legal counsel, if needed. Part of this plan includes consideration of what evidence is needed, how it will be obtained, what records should be inspected, and whether those records will be provided voluntarily. In the event that needed records are not provided voluntarily, FAA investigative personnel may obtain an administrative subpoena to compel the disclosure of the requested records.

⁵⁰ According to FAA Order 1800.56H (which was in effect at the time of the accident), *National Flight Standards Work Program Guidelines*, R-items comprise the FAA's mandatory core inspection program based on critical oversight issues that have been identified at a national level and must be accomplished to ensure that the FAA fulfills its statutory and regulatory oversight responsibilities. R-items, which include required inspections of Part 121 and 135 operators (among others) and flight operations, have priority over other work activities. In contrast, P-items (planned surveillance work activities) make up the depth and substance of each office's annual work program by providing comprehensive, targeted inspections to meet special surveillance requirements for individual certificate holders within the FSDO's geographic district. FSDOs are tasked to consider completing P-items within the scope of the available resources, and FSDO managers are accountable for balancing surveillance, certification, and investigation priorities.

⁵¹ This slang term is meant to refer to noncompliant charter operations by implying that an operation that is not quite Part 135 would be called Part 134 ½ (which does not exist).

he believed that a noncompliant charter operator could offer trips to customers for thousands of dollars less than what a compliant Part 135 operator could charge.

1.17.3.1 Oversight and Surveillance of Interstate Helicopters

The principal operations inspector (POI) for Interstate Helicopters had been assigned to the certificate 2 days before the accident. The previous POI was assigned to a different FSDO about 6 months before the accident, and the unit operational supervisor had temporarily assumed the oversight duties. The unit operational supervisor recalled receiving a complaint in January 2007 that Interstate Helicopters was using airplanes to conduct charter operations. He stated that the complaint did not provide details but that he assigned two inspectors to look into it. One of the inspectors stated that he was authorized a 2-hour block of time on February 10, 2007 (a Saturday), for surveillance of Interstate Helicopters but that he was unsuccessful in verifying the complaint. This inspector stated that, on a previous occasion, when he was at PWA performing flight checks, he saw Interstate Helicopters' owner fueling a Cessna 500 and suspected that he was preparing to perform a charter flight. The inspector said that he waited half a day for passengers to show up so that he could ask them questions, but none arrived by the time that he left.

1.17.3.1.1 Special Emphasis Inspection: Operational Control

On August 17, 2007, the FAA issued Notice 8900.16, *Special Emphasis Inspection: Operational Control*, to ensure continued compliance with the operational control requirements of Part 135. The notice directed POIs to inspect all Part 135 certificate holders to ensure compliance with operational control policies, procedures, and prohibitions. FAA headquarters mandated that the Oklahoma City FSDO complete the inspections of the operators within its oversight by December 18, 2007.

Because of staffing issues, the Oklahoma City FSDO needed help to meet the deadline, and an inspector from the Fort Worth FSDO was assigned to assist for 2 weeks. The inspection of Interstate Helicopters, which was completed in November 2007, discovered some minor paperwork issues, primarily with the wording in manuals. On-the-spot corrections were made, and the FAA determined that no enforcement action was warranted.

1.17.3.1.2 Postaccident Enforcement Action

On September 12, 2008, the FAA initiated an emergency revocation of Interstate Helicopters' operating certificate based on Interstate Helicopters' involvement with the accident airplane on the date of the accident. The FAA's enforcement action report for the revocation cited 14 CFR 91.13(a), which pertains to careless or reckless operation; 14 CFR 119.5(g), acting as a commercial operator without, or in violation of, an appropriate certificate and appropriate operations specifications; 14 CFR 119.5(l), operating an aircraft in violation of an operating certificate or appropriate operations specifications; 14 CFR 135.21(a), which pertains to manual

requirements; 14 CFR 135.343, which pertains to crewmember initial and recurrent training; and 14 CFR 135.3(a), which contains additional crewmember training and qualification rules.

Interstate Helicopters appealed the FAA's action, and a hearing was scheduled to be held before an NTSB Administrative Law Judge on October 7, 2008. However, the hearing proceedings record⁵² noted that the FAA and Interstate Helicopters had reached a settlement. Interstate Helicopters agreed to withdraw its appeal of the certificate revocation, and the FAA agreed "to not unreasonably delay recertification and to put [Interstate Helicopters] ... next in line for the potential recertification" and to not unduly delay any application to accomplish multi-aircraft certification. The FAA also agreed not to take any further enforcement action against Interstate Helicopters regarding the investigation of the matter. On January 20, 2009, Interstate Helicopters gained a new certificate for Part 135 helicopter operations.

1.18 Additional Information

1.18.1 Bird Avoidance Model

The bird avoidance model (BAM) was developed by the U.S. Air Force to provide pilots and flight planners with a decision-making tool about the probability of bird activity in user-selected locations. BAM is based on more than 30 years of historical bird habitat, migration, and breeding behavior data and provides a relative probability of bird strike for a particular geographical area. Postaccident queries of the BAM indicated that a "medium" risk of a bird strike was present in the PWA area at the time of the accident.

1.18.2 Wildlife Strike Reporting

FAA AC 150/5200-32A, *Reporting Wildlife Aircraft Strikes*, encourages pilots, airport operators, aircraft maintenance personnel, or anyone else who has knowledge of a strike to voluntarily report it to the FAA using FAA Form 5200-7, *Bird/Other Wildlife Strike Report*. The AC provides electronic access to the form and methods for submitting it, as well as information on accessing the FAA National Wildlife Strike Database and the procedure for submitting animal remains to the Smithsonian Institution for species identification. The collected data are used to identify the wildlife species that are most commonly involved in strikes, the seasonal patterns of strikes for various species, and the extent and types of aircraft damage resulting from strikes. Reporting, data collection, and other bird-strike related issues were discussed extensively at the NTSB's June 9-11, 2009, public hearing.⁵³

⁵² *FAA v. Interstate Helicopters, Inc.*, October 7, 2008, *Oklahoma City, Oklahoma* (Washington, DC: National Transportation Safety Board, 2008) docket SE-18367.

⁵³ NTSB, "Landing of U.S. Airways Flight 1549, Airbus A320, N106US, in the Hudson River, Weehawken, New Jersey, January 15, 2009," public hearing, Washington, D.C., June 9-11, 2009 <<http://www2.nts.gov/Weehawken-NJ/Default.html>> (accessed June 22, 2009).

From 1990 through 2007, the FAA National Wildlife Strike Database received 82,057 reports of wildlife strikes, 97.5 percent of which involved birds.⁵⁴ About 92 percent of the reported bird strikes occurred at or below 3,000 feet agl,⁵⁵ and 62 percent occurred during the day. About 37 percent occurred during takeoff and climb, and 60 percent occurred during the descent, approach, or landing roll. In 2005, the USDA compared wildlife strike data from three airports and three airlines with the FAA's data for various years from 1991 to 2004; the research determined that only about 21 percent of the known strike data were captured in the FAA National Wildlife Strike Database.⁵⁶

In 2009, the FAA introduced a number of initiatives to improve the usefulness of its wildlife strike database. On May 15, 2009, the FAA awarded a contract for performing a statistical analysis of the current wildlife strike data to estimate what percentage of known bird-aircraft strikes are being reported and to determine what level of reporting would be required to be statistically valid. Also, in April 2009, the FAA awarded a contract for improving the wildlife mitigation website to ensure that it is up-to-date, user-friendly, and has the technical support necessary to maintain the wildlife strike reporting functions and database.⁵⁷

Also, in an effort to educate the aviation community on the importance of reporting wildlife strikes, the FAA contracted with Embry-Riddle Aeronautical University (ERAU) to conduct an outreach and education program beginning in fiscal year 2009. ERAU has identified five segments of the aviation community that will be targeted, including airport management and operating personnel, commercial air carriers, the business jet community, private/general aviation, and ATC groups. ERAU plans to exhibit at nine major seminars or conferences each year to distribute literature emphasizing the importance of wildlife strike reporting and to demonstrate the FAA National Wildlife Strike Database's extraction capabilities.

1.18.3 Related Federal Aviation Regulations

1.18.3.1 Aircraft Lease Requirements

A dry lease, according to FAA AC 91-37A, *Truth in Leasing*, involves the leasing of an aircraft without the crew, whereas a wet lease, which is defined under 14 CFR 119.3, involves

⁵⁴ Mammals were involved in 2.4 percent of the strikes and reptiles made up 0.1 percent. For more information, see *Wildlife Strikes to Civil Aircraft in the United States 1990-2007*, FAA National Wildlife Strike Database Serial Report No. 14 (Washington, DC: U.S. Department of Transportation, FAA, and U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, 2008).

⁵⁵ Seventy-three percent of the strikes occurred at 500 feet agl or lower, and about 60 percent occurred at 100 feet agl or lower.

⁵⁶ For more information, see Sandra E. Wright and Richard A. Dolbeer, "Percentage of Wildlife Strikes Reported and Species Identified Under a Voluntary Reporting System," *Proceedings, 2005 Bird Strike Committee-USA/Canada 7th Annual Meeting, Vancouver, British Columbia, Canada* (Lincoln: University of Nebraska, 2005).

⁵⁷ The website, which contains links to numerous sources of wildlife hazard information and the online strike-reporting form, can be found at <<http://wildlife-mitigation.tc.faa.gov>> (accessed June 29, 2009).

“any leasing arrangement whereby a person agrees to provide an entire aircraft and at least one crewmember.” AC 91-37A states:

normally, in the case of a dry lease, the lessee exercises operational control of the aircraft. Conversely, in a wet lease, the lessor normally exercises operational control. The determination in each situation as to whether the lessor or lessee exercises operational control requires consideration of all relevant factors present in each situation. The terms of the lease itself are important, but since they may not reflect the true situation, the actual arrangements and responsibilities should be given very careful consideration.

Title 14 CFR 91.23 outlines truth-in-leasing requirements for identifying, in a lease contract, the regulations under which the aircraft has been maintained and who is responsible for operational control. It also states the requirements for filing a copy of the lease with the FAA and for notifying the local FSDO before a flight is operated under it; however, this regulation applies only to large aircraft. Title 14 CFR 1.1 defines a “large aircraft” as having a maximum certificated takeoff weight of more than 12,500 lbs (the accident airplane’s maximum certificated takeoff weight was 11,850 lbs).

1.18.3.2 Sales Demonstration Flight Requirements

According to 14 CFR 91.501(b)(3), which applies to turbine-powered multiengine airplanes, “flights for the demonstration of an airplane to prospective customers [may be conducted under Part 91, Subpart F] when no charge is made except for those specified in paragraph (d).” Paragraph (d) specifies that the following may be charged as expenses for a specific flight: fuel, oil, lubricants, and other additives; travel expenses of the crew; hangar and tie-down costs; insurance; landing fees, airport taxes and similar assessments; customs, foreign permit, and similar fees; in-flight food and beverages; passenger ground transportation; flight planning and weather contract services; and an additional charge equal to 100 percent of the expenses for fuel, oil, lubricants, and additives.

1.18.4 Previously Issued Safety Recommendations

1.18.4.1 Bird-Strike Hazard Mitigation

Following two serious bird-strike events involving Part 121 air carrier airplanes,⁵⁸ on November 19, 1999, the NTSB issued several safety recommendations to the FAA and other

⁵⁸ On February 22, 1999, a Boeing 757 operated under Part 121 by Delta Air Lines, Inc., as a scheduled passenger flight, sustained substantial damage after penetrating a flock of starlings (*Sturnus vulgaris*) during takeoff from Covington, Kentucky. The flight crew entered the airport traffic pattern for an immediate return for landing and landed the airplane without further incident. On March 4, 1999, a Douglas DC-9-15F, operated under Part 121 by USA Jet Airlines, Inc., as a domestic air cargo flight, sustained a severe engine-power loss after encountering a flock of large birds, which the operator reported as “snow geese,” while on final approach for landing in Kansas City, Missouri. The pilot regained enough power in one engine to continue the approach and land the airplane

Federal agencies related to wildlife hazard management and bird strikes; seven of these recommendations are discussed below.⁵⁹ These issues were also discussed during the NTSB's June 9-11, 2009, public hearing.

In the November 19, 1999, letter, the NTSB stated to the FAA that it was concerned about the effectiveness of voluntary bird-strike reporting, noting that "the voluntary reporting system has not resulted in the provision of adequate data on bird-strike hazards, and this has hindered the proper evaluation of the problem and implementation of safety improvements." The NTSB issued Safety Recommendation A-99-91, which asked the FAA to do the following: "Require all airplane operators to report bird strikes to the Federal Aviation Administration." However, the FAA responded that it planned no action to address the recommendation because it believed that the reporting procedures were sufficient to obtain adequate trend analysis data and that such a regulation would be difficult to enforce. As a result, the NTSB classified Safety Recommendation A-99-91 as "Closed—Unacceptable Action" on May 11, 2000.

The NTSB also stated to the FAA that it was concerned that more than 50 percent of reported bird strikes lacked information about the species of bird, some reports misidentified the bird, and often the reports lacked information on body weight or other characteristics. Because such information is critical in developing effective control methods, the NTSB issued Safety Recommendation A-99-92, which asked the FAA to do the following:

Contract with an appropriate agency to provide proper identification of bird remains, establish timely procedures for proper bird species identification, and ensure that airport and aircraft maintenance employees are familiar with the procedures.

On February 14, 2000, the FAA responded that, as part of an interagency agreement with the USDA's Wildlife Services National Research Center, the FAA had funded a contract with the Smithsonian Institution to assist in the preparation and identification of bird-strike remains. As a result, the NTSB classified Safety Recommendation A-99-92 as "Closed—Acceptable Action" on May 11, 2000.

The NTSB observed that various Federal agencies involved in aviation and wildlife protection have different missions and, sometimes, conflicting responsibilities and mandates. Because the goals of improving aviation safety and promoting wildlife conservation through habitat protection, restoration, and enhancement sometimes conflict, the NTSB recognized that a multi-agency, unified approach was needed to address the problem of bird-strike hazards. The NTSB issued Safety Recommendation A-99-94, which asked the FAA to do the following:

With representatives from the U.S. Department of Agriculture, the Department of the Interior, the Department of Defense, and the U.S. Army Corps of Engineers, convene a task force to establish a permanent bird strike working group to

without incident. More information about these accidents, NYC99LA064 and CHI99FA102, respectively, is available on the NTSB's website at <<http://ntsb.gov/ntsb/query.asp>>.

⁵⁹ The full text of the November 19, 1999, recommendation letter is available at <http://www.nts.gov/Recs/letters/1999/A99_86_94.pdf> (accessed on May 11, 2009).

facilitate conflict resolution and improve communication between aviation safety agencies and wildlife conservation interests.

The NTSB issued separate, similarly worded companion recommendations that also asked each agency to work with the FAA on the task force; Safety Recommendation A-99-95 was issued to the USDA, A-99-96 to the U.S. Army Corps of Engineers, A-99-97 to the Department of Defense (DOD), and A-99-98 to the Department of the Interior.

On September 15, 2003, the FAA responded that it had formed an interdepartmental working group to draft a Memorandum of Agreement that established a permanent Bird Strike Working Group to facilitate conflict resolution and improve communication between aviation safety agencies and wildlife conservation interest groups. The FAA noted that representatives from the USDA, the DOD, the Department of Commerce, and the Environmental Protection Agency were on the working group. As a result of the FAA's development of the Bird Strike Working Group, the NTSB classified Safety Recommendation A-99-94 as "Closed—Acceptable Action" on October 8, 2003. Similarly, as a result of each respective agency's participation in the working group, Safety Recommendations A-99-95 through -98 were all classified "Closed—Acceptable Action."

1.18.4.2 Operational Control Inspections

Following the NTSB's investigation of a February 2, 2005, accident in Teterboro, New Jersey, involving a Bombardier Challenger CL-600-1A11 that was operated under a suspect charter arrangement⁶⁰ between Platinum Jet Management, LLC, and Darby Aviation (a Part 135 certificate holder), the Board issued Safety Recommendation A-06-67 on November 7, 2006, which asked the FAA to do the following:

Review all charter management, lease, and other agreements between 14 *Code of Federal Regulations* Part 135 certificate holders and other entities to identify those agreements that permit and/or enable a loss of operational control by the certificate holder and require revisions of any such arrangements.

In its response, the FAA noted that it had developed Notice 8900.16, *Special Emphasis Inspection: Operational Control*, which applied to more than 2,300 operators. However, the FAA stated that it did not believe that reviewing existing leases or arrangements between certificate holders and other entities would ensure the prevention of unacceptable lease arrangements and relationships. The FAA stated that, instead, it took measures to issue specific aircraft and pilot operational restrictions and requirements in the air carriers' operations specifications; to ensure that operations specifications are understandable, relevant, and address operational control issues; to train FAA inspectors to be aware of the trend of unacceptable lease activities; and to provide operators clear guidance so that they can ensure their lease arrangements and relationships are brought into and remain in compliance. The FAA further stated that it

⁶⁰ For more information, see *Aircraft Accident Report: Runway Overrun and Collision, Platinum Jet Management, LLC, Bombardier Challenger CL-600-1A11, N370V, Teterboro, New Jersey, February 2, 2005*, Aviation Accident Report NTSB/AAR-06/04 (Washington, DC: NTSB, 2006).

considered its actions complete. The NTSB responded that, although the FAA's actions were commendable, they did not constitute an acceptable alternative to the recommended action of reviewing all charter management, lease, and other agreements. The NTSB classified Safety Recommendation A-06-67 as "Closed—Unacceptable Action" on August 8, 2008.

1.18.4.3 Disclosure of Names of Charter Aircraft Operator, Owner, and Broker

During its investigation of a November 28, 2004, accident involving a Canadair, Ltd., CL-600-2A12 that crashed during takeoff in Montrose, Colorado,⁶¹ the NTSB found that the customers did not know that the accident flight was provided by a different operator than they thought was providing it. As a result, the NTSB issued Safety Recommendation A-06-43 on August 4, 2006, asking the Department of Transportation (DOT) to do the following:

Require that, for 14 *Code of Federal Regulations* (CFR) Part 135 on-demand air taxi flights, the following information be provided to customers and passengers at the time the flight is contracted and at any point there is a subsequent change: the name of the company with operational control of the flight, including any doing business as names contained in the operations specifications; the name of the aircraft owner; and the name(s) of any brokers involved in arranging the flight.

On September 20, 2006, the DOT responded that it would continue its ongoing work with the on-demand air charter industry, directly and through its representative organizations, to ensure that complete and accurate information is available to the public about such operations. Further, on January 26, 2007, the DOT published an advance notice of proposed rulemaking (ANPRM) requesting public comments on the actions recommended by the NTSB. In the ANPRM, the DOT posed several practical questions for public comment, including the following: "What form should any notice requirement, if adopted, take? That is, is verbal notice sufficient, or must the notice be in writing?" As a result of the DOT's ongoing actions, the NTSB classified Safety Recommendation A-06-43 as "Open—Acceptable Response" on May 2, 2007.

1.18.4.4 Cockpit Voice Recorder Functionality Tests

Following the NTSB's investigation of the March 23, 2004, accident involving a Sikorsky S-76A++ helicopter that crashed into the Gulf of Mexico after the flight crew failed to identify and arrest the helicopter's descent for undetermined reasons,⁶² killing all 10 people on board, the Safety Board issued Safety Recommendation A-06-23 on March 24, 2006, which asked the FAA to do the following:

⁶¹ For more information, see *Aircraft Accident Brief: Crash During Takeoff in Icing Conditions, Canadair, Ltd., CL-600-2A12, N873G, Montrose, Colorado, November 28, 2004*, Aviation Accident Report NTSB/AAB-06/03 (Washington, DC: NTSB, 2006).

⁶² For more information, see *Controlled Flight Into Terrain, Era Aviation, Sikorsky S-76A++, N579EH, Gulf of Mexico, About 70 Nautical Miles South-Southeast of Scholes International Airport, Galveston, Texas, March 23, 2004*, Aviation Accident Report NTSB/AAR-06/02 (Washington, DC: NTSB, 2006).

Require all operators of aircraft equipped with a cockpit voice recorder (CVR) to (1) test the functionality of the CVR before the first flight of each day as part of an approved aircraft checklist and (2) perform a periodic maintenance check of the CVR as part of an approved maintenance check of the aircraft. The CVR preflight test should be performed according to procedures provided by the CVR manufacturer and should include listening to the recorded signals on each channel to verify that the audio is being recorded properly, is intelligible, and is free from electrical noise or other interference. The periodic maintenance check of the CVR should include an audio test followed by a download and review of each channel of recorded audio. The downloaded recording should be checked for overall audio quality, CVR functionality, and intelligibility.

On July 7, 2006, the FAA responded that it would issue a Safety Alert for Operators (SAFO) to advise operators to test the functionality of CVRs before the first flight of each day and to recommend that they add a CVR functionality check to their approved checklist. The FAA stated that it would also issue a Flight Standards Information Bulletin for Airworthiness (FSAW) to instruct FAA inspectors to ensure that operators perform periodic maintenance checks for all possible combinations of intercom and microphone audio selections available to and selectable by the flight crew. On April 12, 2007, the NTSB noted that the SAFO did not include the specific, detailed information described in the recommendation and that the FSAW had not yet been issued. Safety Recommendation A-06-23 was classified “Open—Unacceptable Response” pending the FAA’s revision of the SAFO and issuance of an FSAW with sufficient detail to ensure that nonfunctional CVR systems are identified and repaired as quickly as possible.

2. Analysis

2.1 General

Review of the accident airplane's available flight and maintenance logs revealed numerous omissions and errors. Although the maintenance records for the accident airplane were not kept in accordance with 14 CFR 91.417, no maintenance discrepancies were identified to be related to the cause of the accident.

The airplane was severely fragmented and fire damaged due to the impact and postcrash fire, and wreckage debris was scattered over an area about 300 feet long and 200 feet wide. The accident was not survivable for the airplane occupants because they were subjected to impact forces that exceeded the limits of human tolerance.

The following analysis describes the accident flight sequence, engine and airframe certification standards for bird strikes, airport wildlife hazard assessment and mitigation requirements, pilot operational strategies to help minimize aircraft damage sustained in the event of a bird strike, and the importance of compiling the most complete bird-strike database possible.⁶³ Further, although the accident pilot was trained and qualified to fly the accident airplane in a noncommercial capacity, several issues related to the identity of the operator and the manner in which the flight was conducted suggest that the flight was a noncompliant commercial charter; these issues are discussed in detail in Section 2.4. FAA oversight, CVR functionality, and pilot medical issues are also discussed.

2.2 Accident Flight Sequence

The flight departed from PWA and climbed to its assigned altitude of 3,000 feet. The flight's assigned heading and altitude carried it over the southeast corner of Lake Overholser at an altitude of about 1,800 feet agl. Witnesses near the lake reported seeing the airplane roll to the left and spiral nose-down to the ground about 4 miles from PWA. One witness reported seeing bird remains fall into the water. A security camera located about ½ mile southwest of the accident site captured images of the accident airplane descending steeply, nose down to the ground.

2.2.1 Loss of Control of the Airplane

As noted in the aircraft performance radar study, the airplane's rolling, steep descent began about the time its flight track intersected the flight track of numerous primary returns. Based on the bird evidence identified on the wreckage, a witness' observation of bird pieces and

⁶³ The NTSB's June 9-11, 2009, public hearing and the report for its associated accident address additional bird-strike related topics that are not included in this report.

feathers floating down, and another witness' observation of bird remains in the water, these primary returns were likely reflected from a flock of American white pelicans. Analysis of available radar data showed that the airplane's steep, rapid descent included a left roll through the inverted position by the time that the airplane impacted the ground.

Structures from the nose, tail, and both wingtips were conclusively identified at the accident site and in the recovered wreckage. Examination of the identified flight control surfaces revealed no evidence of precrash malfunction; however, flight control continuity could not be established because of the ground-impact and postcrash fire damage. Examination of dark, soot evidence on the airplane's left and right horizontal stabilizers and elevators revealed evidence of exposure to smoke from burning ground-fire debris, and no evidence of an in-flight fire was found. There was no evidence of a bird strike to the empennage; however, American white pelican splatter residue was identified on the right horizontal stabilizer and the right side of the vertical stabilizer.

The cockpit window mounting structure and bulkhead between the cockpit and baggage compartment were recovered and examined extensively. There was no evidence that a bird penetrated the cockpit; thus, it is unlikely that a bird strike incapacitated either pilot or damaged the airplane's cockpit controls.

The airplane's wings could not be reconstructed due to the damage and the postcrash fire. The pieces that were recovered did not have any evidence of a bird strike, but the extent of the ground-impact crush and postcrash fire damage to the wing structures precluded a conclusive determination as to whether or not any bird-strike damage was sustained in flight. However, witnesses reported and video evidence showed that, as the airplane descended, it emitted a visible trail from its left side. In the absence of evidence of an in-flight fire, the light-colored trail from the airplane's left side as it descended likely resulted from a bird strike on at least the left wing's leading edge structure, breaching the integral wet-wing fuel tank and resulting in a visible fuel or fuel-vapor trail.

2.2.1.1 Bird-Strike Certification Standard for Cessna 500 Wing Structures

In accordance with the transport category airplane requirements of 14 CFR 25.571(e)(1), the wing structures of the Cessna 500 are certificated to withstand an impact from a 4-lb bird while cruising at 287 kts without precluding the airplane from continued safe flight and landing. The NTSB's bird-strike energy study determined that the kinetic energy of such a strike is 14,586 ft-lbs. However, the accident airplane was cruising about 200 kts when it encountered American white pelicans, which have a maximum weight of about 20 lbs. The kinetic energy of a strike with a single pelican would have been as high as 35,416 ft-lbs, which far exceeds the demonstrated kinetic energy of the airplane's certification standard; thus, the accident airplane was likely not capable of continued safe flight and landing after sustaining one or more such impacts on a wing structure. Therefore, the NTSB concludes that the airplane's departure from controlled flight likely resulted from wing structure damage sustained during an in-flight collision with a flock of American white pelicans, which far exceeded the airframe's design certification limit.

2.2.1.2 Bird-Strike Certification Standards for Different Airframe Structures

The bird-strike certification criteria for Part 25 airplanes (such as the accident airplane) specify that the windscreen and other airframe structures (including the wing) be able to withstand an impact with a 4-lb bird, whereas the empennage (tail structure) must withstand impact from an 8-lb bird (as specified in 14 CFR 25.571 and 25.631, respectively). In 1993, the FAA revisited the bird-strike certification issue by forming an Aviation Rulemaking Advisory Committee (ARAC): the General Structures Harmonization Working Group. This ARAC working group included personnel from the FAA, the Joint Aviation Authorities (which represents the civil aviation regulatory authorities of a number of European States), and aircraft manufacturers and was tasked to “develop new or revised requirements for the evaluation of transport category airplane structure for in-flight collision with a bird, including the size of the bird and the location of the impact on the airplane.”⁶⁴

Although the working group was unable to reach a consensus on the requirements, it produced a report in 2003 that detailed the differing viewpoints within the group.⁶⁵ In the report, the FAA defended its 8-lb bird-strike requirement (which is more stringent than the Joint Aviation Authorities’ requirement) for the empennage of airplanes certificated under Part 25, stating that, “in the absence of a definitive risk assessment showing that an 8 [lb] bird strike to the empennage, occurring at V_c , at sea level, is an unrealistic energy criterion, the FAA sees no justification for diminishing the ... requirement.”

The NTSB commends the FAA for its commitment to preserving the more stringent Part 25 bird-strike requirement for empennage components. However, the FAA also stated that the Part 25 “requirement for the remainder of the airframe structure, of continued safe flight and landing after impact with a 4 [lb] bird at V_c ... is probably inadequate as a structural criterion, although it is likely that most airframe structure has acceptable capability due to structural redundancy typical of modern airplane construction.” The FAA further stated that it “believes that service experience demonstrates that bird strikes pose a real threat to safety and that there is considerable room for improving the bird strike capability of modern aircraft.” However, the FAA did not take any action to improve the bird-strike certification requirements.

According to USDA research published about 2 years after the working group’s findings, the risk to aircraft posed by bird populations has increased in the last few decades due to a number of factors, including an increase in air traffic volume.⁶⁶ Also, although populations of bird species, in general, have declined, the populations of nearly all of the large bird species

⁶⁴ See *Federal Register*, vol. 58, no. 48 (March 15, 1993), p. 13817.

⁶⁵ *General Structures Harmonization Working Group Report*. Version 2, dated June 30, 2003. Available on the FAA’s website at http://www.faa.gov/regulations_policies/rulemaking/committees/arac/media/tae/TAE_GSH_T2.pdf, accessed July 24, 2009.

⁶⁶ Air traffic volume has increased from about 17.8 million aircraft movements in 1980 to 29 million as of 2004. For more information, see Sandra E. Wright and Richard A. Dolbeer, “Percentage of Wildlife Strikes Reported and Species Identified Under a Voluntary Reporting System,” *Proceedings, 2005 Bird Strike Committee-USA/Canada 7th Annual Meeting, Vancouver, British Columbia, Canada* (Lincoln: University of Nebraska, 2005).

(those with mean body masses greater than 8 lbs) in North America have increased significantly in the past 30 years.⁶⁷

In recent correspondence with NTSB, the FAA stated that the rulemaking that added the 8-lb bird-strike criteria specified in 14 CFR 25.631 was completed in 1970 after an aircraft accident in 1962 prompted a review of existing statistical bird-strike data.⁶⁸ As a result of the review, the FAA concluded that

most existing transport airplanes were inherently bird resistant, although a few types, such as the one ... that crashed [in 1962], were not sufficiently resistant in the empennage area. After considering (various) factors, the FAA determined that a specific rule applying to the entire airplane would only add to the substantiation effort without providing any significant design changes.

The NTSB disagrees with this view from the FAA because it suggests that more stringent requirements can only be justified reactively through a statistically significant increase in bird-strike injuries and fatalities; it does not consider that a review of the standards is warranted based on the latest statistical data for bird populations and on evidence that bird-strike risks to aviation are increasing.

The NTSB interprets the FAA's claim that Part 25 airplanes are "inherently bird resistant" to imply that the entire airplane would allow for continued safe flight and landing following a strike with an 8-lb bird at cruise speed. The NTSB observes, however, that there is no requirement for airframe manufacturers to demonstrate such capability over an entire airframe through analysis or testing. Thus, the NTSB questions how the FAA, without requiring manufacturers to substantiate this implied level of protection, can be satisfied that an airplane would be capable of continued safe flight and landing following an impact with an 8-lb bird.

The American pelican that the accident airplane encountered is very large and is not representative of the general risk that bird populations present to aircraft; thus, there is no basis to suggest that airframe components should be certificated to withstand impacts from birds of such size. However, the NTSB is concerned that the current airframe bird-strike certification standards, which are inconsistent in that different criteria apply to different structures on the same airplane, have evolved piecemeal as a result of past accidents and do not uniformly address the risks to aircraft presented by current bird populations. Therefore, the NTSB concludes that the current airframe certification standards for bird strikes are insufficient because they are not based on bird-strike risks to aircraft derived from analysis of current bird-strike and bird-population data and trends and because they allow for lower levels of bird-strike protection for some structures on the same airplane. The NTSB recommends that the FAA revise the bird-strike certification requirements for Part 25 airplanes so that protection from in-flight impact with birds is consistent across all airframe structures. The FAA should consider current military

⁶⁷ For more information, see R.A. Dolbeer and P. Eschenfelder, "Amplified Bird-Strike Risks Related to Population Increases of Large Birds in North America," *Proceedings, International Bird Strike Committee, May 5-9, 2003, Warsaw, Poland*, IBSC26/WP-OS4 (2003).

⁶⁸ In e-mail correspondence dated February 23, 2009, the FAA's Office of Accident Investigation, Recommendation and Analysis Division, provided an attachment that responded to the NTSB's November 24, 2008, request for information about the history of the airframe certification standards.

and civilian bird-strike database information and trends in bird populations in drafting this revision.

2.2.2 Loss of Power in Right Engine

The airplane's left engine showed no evidence of preimpact malfunction or in-flight fire. The right engine displayed soft-body impact damage and feather fragments consistent with the engine's ingestion of an American white pelican (the likely source of the splatter remains found on the right side of the empennage). The rearward bending of the fan blades and the absence of circumferential scoring in the fan case indicate that the right engine subsequently stopped operating before the airplane impacted the ground. Although the mass of an average American white pelican far exceeds the engine's certification standard for large-bird ingestion (the engine's large-bird ingestion certification tests were performed using a 4-lb bird carcass), the accident airplane's right engine did not release any hazardous fragments.

Evidence observed in the left engine, including fractured fan blade ends bent opposite the direction of rotation, circumferential scoring inside the low compressor case, and finely chopped wood debris, indicates that the left engine was operating at a high level of power at the time of ground impact. The Cessna 500 is designed and certificated to fly when one engine is inoperative, and the accident pilot was trained in engine-out procedures. Therefore, the NTSB concludes that the accident airplane's left engine was capable of producing sufficient thrust for the airplane to continue to fly with the right engine inoperative and that the loss of power in one engine would not alone result in a loss of control of the airplane.

2.3 Mitigating Bird-Hazard Threats

Birds are a known hazard in the PWA area, as noted in the FAA AFD. Postaccident queries of the BAM indicated that a "medium" risk of a bird strike was present in the PWA area at the time of the accident. Although a postaccident review of ATC radar data showed that a cluster of primary targets that was likely a flock of American white pelicans was observed by radar near the time and area where the accident occurred, the radar signature was not likely significant enough to be obvious on the controller's display, which is not designed for bird-hazard detection. Further, the cluster of returns (identified through postaccident data processing) was unlikely to have attracted the controller's attention because an ATC radar detects a large number of primary targets during the course of the day (more than 5,000 primary returns were detected in the 10 minutes surrounding the accident time). Typically, the only primary returns that may attract a controller's notice on a display are strong, consistent primary returns that track in a manner consistent with an aircraft in flight.

Controllers are required to provide bird activity reports to pilots when such information is available.⁶⁹ However, review of available log data and recorded radio transmissions showed no

⁶⁹ FAA Order 7110.65, *Air Traffic Control*, paragraph 2-1-22, "Bird Activity Information," states that controllers should "issue advisory information on pilot-reported, tower-observed, or radar-observed and pilot-verified bird activity." According to air traffic controller duty priorities, issuance of bird activity information to pilots is classed as an additional service. Additional services are provided to the extent possible contingent only

evidence that the controllers had any information about any known bird activity that could have been used to alert the flight crew of a heightened bird hazard.

2.3.1 Airport Wildlife Hazard Assessments and Management

FAA AC 150/5200-33B, *Hazardous Wildlife Attractants On or Near Airports*, states that airports that have received Federal grant-in-aid assistance must comply with the AC's standards and practices. The AC states that operators of airports surrounded by woodlands, water, or wetlands should provide for a wildlife hazard assessment (which includes birds) conducted by a wildlife damage management biologist. It also states that airport operators should establish a distance of 5 miles between the farthest edge of the airport operations area and any wildlife attractant that could cause hazardous wildlife movement into or across the approach or departure airspace. The accident airplane crashed about 4 miles south of PWA after encountering American white pelicans over Lake Overholser at its assigned departure altitude. Because PWA is located near attractants and is federally obligated, the airport should have conducted a wildlife hazard assessment in accordance with the AC.

The NTSB is concerned that the FAA did not detect that PWA had not performed a wildlife hazard assessment, especially considering that PWA is surrounded by multiple attractants, some of which (including Lake Overholser) were known to the FAA because they were detailed in the FAA-approved wildlife management plan of OKC, a nearby Part 139 certificated airport. Although the Board recognizes that there are nearly 4,000 noncertificated public use airports in the U.S. and that the level of oversight provided to such airports is lower than the level provided to Part 139 airports, the FAA has a responsibility to ensure that the requirements are met, particularly for those airports, like PWA, that receive Federal funding.

As referenced previously, the risks to aviation posed by bird populations have increased in the last few decades due to a number of factors. Therefore, the FAA's responsibility for ensuring appropriate wildlife hazard assessments are performed is perhaps more critical now than in past decades. The NTSB concludes that, because an airport's wildlife hazard management plan is based on a wildlife hazard assessment, PWA's failure to perform such an assessment, as required, prevented the determination of what mitigation measures, if any, could have been implemented to reduce the risk of an in-flight collision with American white pelicans. Therefore, the NTSB recommends that the FAA verify that all federally obligated general aviation airports that are located near woodlands, water, wetlands, or other wildlife attractants are complying with the requirements to perform wildlife hazard assessments as specified in FAA AC 150/5200-33B, *Hazardous Wildlife Attractants on or Near Airports*.

upon the controller's ability to fit them into the performance of higher priority duties, such as aircraft separation, and on the basis of limitations of the radar, volume of traffic, frequency congestion, and controller workload.

2.3.2 Precautionary Operational Strategies for Minimizing Airframe Bird-Strike Damage

To date, efforts to mitigate the risk of bird strikes have focused on wildlife hazard management programs at airports and notification and data resources, such as remarks regarding bird activity in the AFD, development and use of the BAM, and wildlife strike reporting compiled in the FAA National Wildlife Strike Database. However, these efforts aim primarily at avoiding bird strikes altogether. Another approach to the issue includes exploring considerations for operational strategies that might reduce the severity of the aircraft damage sustained during an in-flight collision with birds.

The severity of a bird strike against the airframe depends primarily on the kinetic energy of the bird relative to the airplane (the “bird-strike energy”). The certification standards do not specify this bird-strike energy directly; instead, they indirectly specify the energy through bird masses and airplane speeds that must be considered during a strike. It is reasonable to assume that, in general, the airframe will meet the requirements of the standards for bird-strike energies that are less than or equal to the energies implied by the standards. In this way, the severity of damage from impacts with larger birds may be reduced by decreasing the aircraft speed such that the bird-strike energy would be less than the energy demonstrated during certification; any such speed reduction will be limited by the airplane’s minimum safe airspeed that must be maintained for any given configuration and phase of flight.

For any airplane, it is possible to define airspeeds, as a function of bird weight, that will result in the equivalent bird-strike energy demonstrated during the certification standards. It is also possible to define minimum safe airspeeds, as a function of airplane weight and flap setting, to provide adequate stall margin for maneuvering. Together, these sets of airspeeds define upper and lower speed limits within which the airplane will be both at a safe flying speed and below the bird-strike energy defined by the certification standards. Such information may help pilots devise operational strategies for minimizing the severity of a potential bird-strike when operating in areas of known bird activity.

For example, figure 6 shows how these two sets of airspeeds can be illustrated for an airplane like the Cessna 500. The figure shows two bird-strike energy speed curves: The blue line corresponds to the certification standard for the airplane’s windshield, wing, and other structures (which are based on an impact from a 4-lb bird at 287 kts), and the red line corresponds to the certification standard for the empennage (which uses an 8-lb bird at 287 kts). The figure also shows the exemplar airplane’s minimum safe airspeed (defined as 1.3 times the stall speed), as a function of weight, in various flap configurations (shown in solid, dashed, or dotted black lines).

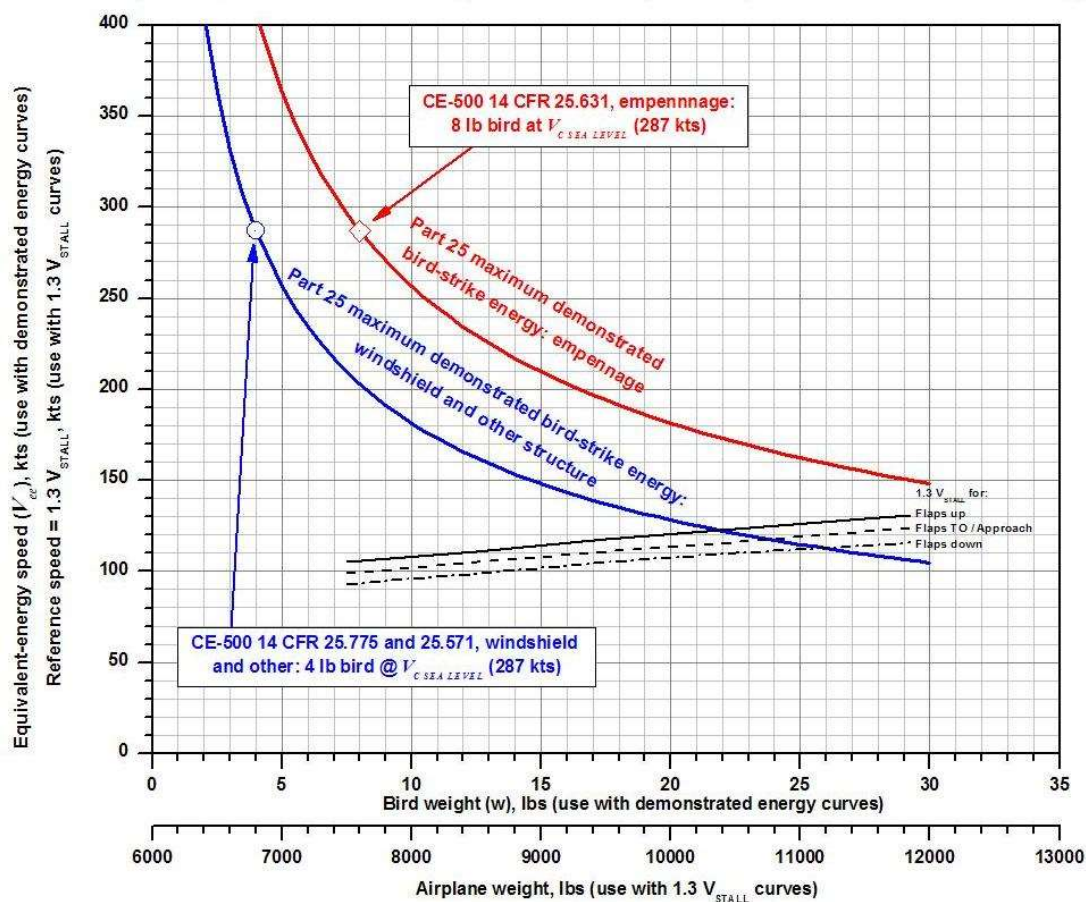


Figure 6. Exemplar reference chart showing airplane speed and bird-weight relationships for equivalent bird-strike energy.

Using this chart, if a pilot of the exemplar airplane operating at a gross weight of 11,200 lbs were concerned about the possibility of a collision on the airplane's wing structure with birds as large as 10 lbs during a flaps-up climb, then the pilot might choose an airspeed between about 129 to 180 kts until reaching an altitude where the risk of a bird strike is reduced; the limits of this range represent the airplane's minimum safe airspeed for the specified gross weight and the maximum airspeed that would allow for a collision with a 10-lb bird while remaining below the airplane's bird-strike energy for the wing structure demonstrated in compliance with regulations.⁷⁰ Similarly, using the same airplane scenario but assuming a 20-lb bird, the chart

⁷⁰ The speed range in the example was derived from referencing the chart as follows: Using the airplane weight scale below the chart, the pilot would follow a vertical line upward from the 11,200-lb mark until it intersects the flaps-up minimum safe airspeed curve (depicted by a solid black line). The location of this intersection (vertically) corresponds with about 129 kts on the airspeed scale on the left of the chart. To determine the maximum airspeed that would allow for a collision with a 10-lb bird while remaining below the airplane's demonstrated bird-strike energy for the wing structure, the pilot would, from the 10-lb bird-weight mark, follow a vertical line upward until it intersects the energy curve for the windshield and other structures (depicted by a solid blue line). The location of this intersection (vertically) corresponds with about 180 kts on the airspeed scale.

shows that the airspeed range for sustaining such a strike narrows considerably to about 129 to 130 kts.

The NTSB recognizes that pilots face many safety of flight considerations for airspeed selection during airport departures and arrivals; these may include, but are not limited to, ATC clearances, maneuvering requirements, and desired climb performance or descent rates. The NTSB does not expect that a pilot flying an aircraft in an area with a high risk of bird strikes would select airspeed based on bird-strike energy considerations alone. However, knowledge of the range of target airspeeds within which the aircraft can operate below the bird-strike energy defined by the certification standards could be useful in scenarios in which flying within the target airspeed range is feasible without compromising other safety of flight issues. Therefore, the NTSB concludes that reference charts that depict both the airspeeds at which the airframe can sustain strikes from various-sized birds without exceeding certification standards and minimum safe airspeeds could help pilots devise precautionary operational strategies for minimizing potential airframe bird-strike damage in high-risk areas for bird strikes. The NTSB further concludes that reliable information about the mass, numbers, and activity of birds likely to be encountered near the airports of operation is necessary for pilots who wish to devise precautionary operational strategies for minimizing potential airframe bird-strike damage. Therefore, the NTSB recommends that the FAA require aircraft manufacturers to develop aircraft-specific guidance information that will assist pilots in devising precautionary aircraft operational strategies for minimizing the severity of aircraft damage sustained during a bird strike, should one occur, when operating in areas of known bird activity. This guidance information can include, but is not limited to, airspeed charts that depict minimum safe airspeeds for various aircraft gross weights, flap configurations, and power settings; and maximum airspeeds, defined as a function of bird masses, that are based on the aircraft's demonstrated bird-strike energy.

2.3.3 Bird and Other Wildlife Strike Reporting

Information collected on FAA Form 5200-7, *Bird/Other Wildlife Strike Report*, is compiled by the FAA National Wildlife Strike Database and used to identify the wildlife species most commonly involved in strikes, the seasonal patterns of strikes for various species, and the extent and types of aircraft damage resulting from strikes. According to the FAA, these data and species information are “critical for biologists developing and implementing wildlife risk management programs at airports because a problem that cannot be measured or defined cannot be solved.”⁷¹

Although the FAA has developed ACs and contracted for educational outreach programs to encourage pilots, airport operators, maintenance personnel and others to report wildlife strikes to the FAA, such reporting is not mandatory. Nearly a decade ago, the NTSB expressed concerns about the effectiveness of voluntary reporting, concluding in a November 19, 1999, safety recommendation letter to the FAA that “the voluntary reporting system has not resulted in the provision of adequate data on bird strike hazards and this has hindered the proper evaluation of the problem and implementation of safety improvements.” In that letter, the NTSB issued Safety

⁷¹ FAA National Wildlife Strike Database Serial Report No. 14.

Recommendation A-99-91 that asked the FAA to do the following: “Require all airplane operators to report bird strikes to the Federal Aviation Administration.”

However, the FAA responded that it planned no action to address the recommendation because it believed that the reporting procedures were sufficient to obtain adequate trend analysis data. The FAA also stated that a requirement for all pilots to report bird strikes would be difficult to enforce. As a result, the NTSB classified Safety Recommendation A-99-91 as “Closed—Unacceptable Action” on May 11, 2000.

However, according to USDA research, only 21 percent of the known strike data were captured in the FAA National Wildlife Strike Database; this research showed that some airports and air carriers routinely collect significantly more reports of wildlife strikes than are voluntarily reported to the FAA. The NTSB commends the FAA for awarding a contract to conduct a statistical analysis of the current strike data to estimate what percentage of known bird-aircraft strike are being reported and to determine what level of reporting would be required to be statistically valid; however, the project is under way, and the analysis has not yet been completed and distributed for review. The NTSB concludes that the low level of participation in voluntary wildlife strike reporting has resulted in data that severely underestimate the number and type of actual wildlife strikes and that such incomplete data have limited effectiveness for use in developing wildlife risk management and hazard mitigation programs. Also, such incomplete information could reduce the effectiveness of any efforts to develop information that will assist pilots in developing operational strategies for minimizing the risk and severity of bird strikes. Although the FAA has taken measures to increase the aviation community’s awareness of the importance of voluntary wildlife-strike reporting, the NTSB concludes that a wildlife-strike reporting requirement would improve the quality of the data in the FAA National Wildlife Strike Database. The NTSB acknowledges that, as a practical matter, a wildlife strike reporting requirement for all pilots would be difficult for the FAA to enforce; however, the NTSB notes that certificated airports, air carriers, commercial operators, and certain fractionally owned, managed aircraft are subject to the oversight of FAA inspectors. Thus, enforcement protocols are already in place to obtain data from those operators. Therefore, the NTSB recommends that the FAA require all Part 139 airports and Part 121, Part 135, and Part 91 Subpart K aircraft operators to report all wildlife strikes, including, if possible, species identification, to the FAA National Wildlife Strike Database.

2.4 Identity of the Operator

Following the accident, representatives from Interstate Helicopters, Southwest Orthopedic, and United Engines all denied responsibility for operating the flight, and no documented aircraft lease, time-sharing, pilot services, or other agreements were discovered to help determine the identity of the operator or the nature of the flight (commercial or noncommercial). The accident pilot was certificated, trained, and qualified to fly the accident airplane in noncommercial operations as a single pilot. The second pilot was not trained, qualified, or current to fly the accident airplane; however, because the pilot was authorized to fly the accident airplane as a single pilot, the second pilot could occupy a cockpit seat and assist the pilot as directed.

On September 12, 2008, the FAA initiated an emergency revocation of Interstate Helicopters' operating certificate based on Interstate Helicopters' involvement with the accident airplane on the date of the accident. The NTSB concludes that, at the time of the accident, Interstate Helicopters was operating the accident airplane in commercial service contrary to its FAA-issued Part 135 operating certificate, which, at the time, did not authorize operation of the accident airplane or any other fixed-wing aircraft. However, neither the pilot nor the second pilot were trained or qualified to fly the accident airplane in any Part 135 commercial charter operation, and the accident airplane was not maintained in accordance with Part 135 commercial maintenance requirements.

Although Interstate Helicopters held a valid Part 135 operating certificate, its certificate was for helicopter operations. However, Interstate Helicopters' actions with regard to the accident flight gave the customer all outward appearances that the flight was a commercial charter flight. When a United Engines representative requested the flight from PWA to MKT, Interstate Helicopters' owner ensured that an airplane and pilots were provided. Interstate Helicopters' manager had quoted flat total rates in response to requests for similar flights in the past, and, as evidenced from previous invoices, Interstate Helicopters would likely have been paid directly for the accident flight. Further, the passengers arrived at Interstate Helicopters' ramp to board the accident airplane and were greeted by Interstate Helicopters' manager, who assisted with their bags, obtained their weight information, and ensured that the airplane had been cleaned and stocked. From the passengers' perspective, all of Interstate Helicopters' actions with regard to the accident flight mirrored the typical services that a Part 135 operator would perform when providing a compliant commercial charter flight, and the president of United Engines stated that he believed that the flight was a charter.

Although Interstate Helicopters' owner claimed that he merely "put together" a dry lease arrangement for the customers, there is no evidence that United Engines, after requesting a flight from Interstate Helicopters, had ever directly paid any airplane owners for the use of an airplane or had separately paid any pilots for their services, as would be expected in a dry lease arrangement. Further, although Interstate Helicopters had billed United Engines for previous flights using invoices that itemized certain costs to appear to conform to the cost-sharing provisions of 14 CFR 91.501(d), it did not do so in a consistent way; some invoices itemized expenses, others billed for a flat amount, and at least one "sales demo" flight transported passengers to multiple cities and billed an hourly rate for the airplane. The NTSB concludes that Interstate Helicopters repeatedly labeled invoices as "aircraft lease" and "sales demo" flights, effectively disguising the noncompliant charter flights and circumventing the terms of its operating certificate.

Although Interstate Helicopters was the accident flight's operator, several individuals—the aircraft owner and his pilot, the accident pilot-in-command, and the customers—had the ability to prevent the operation by choosing not to participate but failed to do so, either because they did not fully understand that the arrangement was improper or they did know but disregarded the rules. Scenarios in which parties either inadvertently or intentionally participate in improper charter operations is not a new concern; FAA AC 91-37A, which advises potential aircraft lease or charter customers to be wary of "devious leases and conditional sales contracts" designed to "[evade] compliance with applicable certification and operating rules," is a January 16, 1978, update to a document originally issued in 1972. This AC observed more than

30 years ago that “there are some irresponsible companies that may use various ways to confuse the issue concerning who is the actual aircraft operator. For example, the sham ‘dry lease’ has been used, whereby [the customer is] provided with an aircraft on a lease basis, although it is actually serviced and flown by the leasing company.”

The NTSB is also concerned that some of these practices may be fostered by pilots who are reluctant to question suspicious operations for fear that they may lose their jobs or contract work, aircraft owners or managers who are either ignorant of or complacent about improper operations conducted with their aircraft by lessees, and/or bargain-hunting customers who are aware of the noncompliant nature of a flight but do not fully understand the potential safety and regulatory implications associated with it.

Given the apparent decades-long existence of operational issues similar to those which were observed in this accident, a combination of measures must be taken to ensure that all participants in each facet of a flight operation—the operators, pilots, aircraft owners and managers, aircraft lessees, and charter customers—are aware of and take responsibility for their respective roles. The following analysis describes how expanded lease disclosure, pilot reporting, and carriage disclosure requirements, as well as improved customer awareness resources and Federal oversight and surveillance, could help prevent improper charter operations.

2.4.1 Lease Disclosure Requirements

Postaccident interviews with all the parties who participated in the flight resulted in conflicting accounts of their respective roles. The airplane’s owner stated that he was not sure what a dry lease was and that his pilot handled all the arrangements. The owner’s pilot (a current airline pilot with previous Part 135 charter experience) said that Interstate Helicopters operated the flight. Interstate Helicopters’ owner claimed that the airplane owner’s pilot was responsible for it and that the airplane was dry leased to United Engines. The president of United Engines said that his company did not lease or purchase aircraft block time and that he thought that the flight was a charter. In the wake of the accident, nobody claimed responsibility for operating the flight; without any written agreements, the determination of the operator could only be made after extensive investigative efforts, which included reviewing records of financial transactions.

The investigation revealed that Interstate Helicopters made available to customers the accident airplane and several others under arrangements that it invoiced as aircraft leases. Some of these airplanes (including the accident airplane) that appeared on Interstate Helicopters’ invoices to the passengers’ company did not meet the FAA definition of a “large” airplane (maximum certificated takeoff weight of more than 12,500 lbs), which means that these airplanes were not subject to the 14 CFR 91.23 truth-in-leasing requirements for disclosing operational control, filing copies of leases with the FAA, and notifying the local FSDO before any flights were conducted. The NTSB concludes that the absence of written lease and FAA notification requirements for airplanes that do not meet the FAA definition of “large” increases the likelihood that airplane owners, managers, lessees, operators, and customers could either intentionally or inadvertently participate in improper charters involving such airplanes and that it hinders the FAA’s ability to detect and correct such activity.

A wide variety of airplanes, like the accident airplane, have a maximum certificated takeoff weight of 12,500 lbs or less, and a new class of very light jets (VLJs) is emerging. A VLJ is, by convention, a jet airplane with a maximum takeoff weight of less than 10,000 lbs that is approved for single-pilot operation and can typically seat four to eight people. Several manufacturers have VLJs either in production or under development, and an FAA forecast estimates that 4,875 VLJs will enter the U.S. active fleet by 2025.⁷² The NTSB is concerned that, as more airplanes that are smaller than “large,” as defined by FAA regulations, become widely available and are often used in charter operations, these airplanes will be attractive to improper operators seeking to exploit their ability to operate undetected through the use of lease agreements that are not disclosed to the FAA. The NTSB concludes that 14 CFR 91.23 truth-in-leasing regulations, which exclude an expanding class of turbine-powered airplanes, leave aircraft charter customers vulnerable to operators that attempt to circumvent commercial charter regulations. Therefore, the NTSB recommends that the FAA revise 14 CFR 91.23 truth-in-leasing regulations to include all turbine-powered airplanes.

2.4.2 Pilot Responsibility

Because the pilot did not survive to be interviewed, it is not known to what extent he knew of the nature of the operation—or of the passengers’ understanding of it—when he agreed to Interstate Helicopters’ request for him to fly passengers on Southwest Orthopedic’s airplane under Part 91. In any such scenario, it would be possible for a pilot to be unaware that the passengers’ understanding of the flight operation differs from that which is being provided; this would be dependent upon what information the pilot requested or received and from whom.

According to 14 CFR 91.3, “the pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft.” Therefore, a pilot has a responsibility to understand the nature of that operation. In the case of the accident flight, regulations state that even an unauthorized operator attempting to engage in on-demand operations would be subject to Part 135 rules;⁷³ thus, if the pilot had been aware that the passengers believed that they were on a charter flight, it would have been apparent that the flight should not be performed for a number of reasons, the most obvious of which were that neither he nor the second pilot were trained or qualified in accordance with Part 135, that the airplane was not maintained to those standards, and that neither the pilots nor the airplane were on Interstate Helicopters’ Part 135 operating certificate.

In the United States, pilots are required to file flight plans with the FAA for IFR flights and for visual flight rules (VFR) flights that cross national borders. When a pilot files an FAA

⁷² According to the FAA Aerospace Forecast for fiscal years 2009-2025, this total is lower than the FAA’s previously published VLJ fleet forecast because unforeseen events, which included a VLJ manufacturer bankruptcy and the demise of a VLJ air taxi operator, “dampened expectations for a rapid penetration of VLJs into the market.” For more information, see FAA Aerospace Forecasts FY 2009-2025 <http://www.faa.gov/data_research/aviation/aerospace_forecasts/2009-2025/> (accessed May 11, 2009).

⁷³ Title 14 CFR 135.7, “Applicability of rules to unauthorized operators,” states that “the rules in this part which apply to a person certificated under Part 119 of this chapter also apply to a person who engages in any operation governed by this part without an appropriate certificate and operations specifications required by Part 119 of this chapter.”

flight plan before departure, the pilot provides to the FAA such basic information as the airplane's registration number, the number of people on board, the flight's departure and arrival points, and whether the flight is operating under IFR or VFR. Although FAA Form 7233-1, which collects such flight plan information, is used primarily for ATC services and search-and-rescue purposes, the NTSB notes that it also provides a mechanism for recording operator information. For example, the FAA *Aeronautical Information Manual* provides pilots the following guidance for filling out Block 14 (designated for the pilot's contact information and the aircraft's home base) on the flight plan form: "Enter your complete name, address, and telephone number. Enter sufficient information to identify home base, airport, *or operator* [emphasis added]." ⁷⁴

Had the accident pilot been required to document on the FAA flight plan the identity of the accident flight's operator and whether or not the flight was a commercial operation, he may have been motivated to ask questions of the airplane's owner, Interstate Helicopters, or the passengers if he did not fully understand the nature of the flight operation. Similarly, if he had understood that the flight was an unauthorized commercial charter operation, he may have been less likely to accept it had he been responsible, as the pilot-in-command, for providing the FAA with the identity of the operator and an assessment of the commercial or noncommercial nature of the flight. Therefore, the NTSB concludes that a pilot would be less likely to intentionally or inadvertently agree to fly an unauthorized commercial charter operation if the pilot, as the final authority for the operation of the aircraft, were required to identify on the flight plan the name of the operator and the regulation under which the flight is operating. Therefore, the NTSB recommends that the FAA require that FAA flight plans include a block for the pilot to identify the operator and a block to specify the operating rules under which the flight is being conducted.

2.4.3 Need for Terms of Carriage Disclosure

When United Engines' personnel needed flight services, a representative contacted Interstate Helicopters to set each flight's departure date, time, and itinerary. Although some of United Engines' executives may have had some understanding of the way flight arrangements can be made (the company once owned an airplane that was on a Part 135 certificate), they had no involvement in arranging the accident flight beyond what a typical charter customer would normally assume.

Unlike 14 CFR Part 121 air carriers, Part 135 on-demand operators are not required to issue tickets or other contract documents that clearly indicate to the customer the terms of carriage. With ticketing, customers enter into a contract of carriage with the air carrier, allowing the customer to be certain that they are flying on commercial transportation. Although the DOT is making acceptable progress in response to Safety Recommendation A-06-43 (which pertains to ensuring that charter customers are provided the name of the operator of the flight), the scenario on which that safety recommendation was based involved two properly certificated Part 135 operators and a compliant charter flight; the intent of the recommendation was to ensure that a customer knew which operator was providing the service.

⁷⁴ *Aeronautical Information Manual* (Washington, DC: U.S. Department of Transportation, FAA, 2008), paragraphs 5-1-4 and 5-1-8.

As the accident involving Interstate Helicopters shows, any verbal or other form of unwritten or implied agreement with regard to “the name of the company with operational control” may not protect the customer from noncompliant charter operations; although the customers knew the name of Interstate Helicopters, they did not know that the accident flight was not a charter flight operated in compliance with Interstate Helicopters’ Part 135 operating certificate. Further, following the accident, Interstate Helicopters denied that it was the flight’s operator. The NTSB notes that these additional issues discovered in this accident highlight operational requirements that are subject to oversight by the FAA, not the DOT. Therefore, the NTSB concludes that a requirement for Part 135 on-demand operators to provide customers a written disclosure of the terms of carriage of the flight, similar to what is provided to Part 121 passengers, would eliminate uncertainty about the commercial intent of the flight. Therefore, the NTSB recommends that the FAA require Part 135 on-demand operators to provide their customers with a written document, correspondence, or ticket that expressly describes the terms of carriage, including the regulatory part under which the flight is operated.

2.4.4 Customer Awareness Resources

Representatives from United Engines stated that, following the accident, the company’s policy on charter flights was to require copies of the pilot and aircraft certificates and insurance information. However, the NTSB notes that, when a charter customer attempts to verify the status of a charter company by themselves, they may ask the wrong questions. In the case of the accident flight, had United Engines’ representatives requested copies of pilot and aircraft certificates and insurance information, these documents alone likely would not have revealed that the operator was not certificated to provide Part 135 service in the accident airplane or that the pilots were not qualified to operate under Part 135.

Many aircraft charter guides are available on the Internet, and some provide fairly detailed information,⁷⁵ in some cases without charge. However, some of these guides are sales tools for rating agencies that provide detailed operator, aircraft, and crew information for a fee. Further, on-demand operators’ fleets and pilots may change frequently, making current, accurate information difficult to maintain, and FAA certificate actions, including suspensions and revocations, may not become publicly available in a timely way.

Although the FAA provides a charter aircraft guide on its website, the guide was issued in May 2002 and contains only basic information; it does not provide information about or links to the FAA’s current data on charter operations or information about specific operators.⁷⁶ The NTSB concludes that a comprehensive aircraft charter guide that includes both basic information and reliable, up-to-date FAA information on the certification status of on-demand commercial operators and the aircraft that each is authorized to operate is needed to provide customers with a

⁷⁵ One example is the National Business Aviation Association, Inc. (NBAA), *NBAA Aircraft Charter Consumer Guide*, which provides information, such as how to find charter operators, guidance for placing inquiries with the FAA for charter safety information, and sample questions that consumers may use to vet charter operators. The guide can be requested from the NBAA website at <www.nbaa.org>.

⁷⁶ The guide, “Chartering an Aircraft, a Consumers’ Guide,” is available at <http://www.faa.gov/about/office_org/field_offices/fsdo/grr/local_more/media/How%20to%20Charter%20an%20Aircraft.pdf> (accessed May 11, 2009).

single-source reference to ensure the legitimacy of their charter service options. Therefore, the NTSB recommends that the FAA update and keep current the aircraft charter guide on its website to include reliable information on the certification status of on-demand commercial operators and the aircraft that they are authorized to operate.

2.5 Federal Aviation Administration Oversight and Surveillance

Despite having a qualified inspector workforce and a documented record of inspections and correspondence with Interstate Helicopters, the Oklahoma City FSDO did not prevent Interstate Helicopters from operating what was likely multiple noncompliant charter flights. In the 3 years that preceded the accident, Interstate Helicopters operated at least 19 flights for United Engines⁷⁷ using at least nine different airplanes that were not listed in its operations specifications. During that time frame, the FSDO targeted Interstate Helicopters for inspections at least twice—once in January 2007 in response to a complaint and once in November 2007 as part of a required operational control inspection—but still failed to identify the noncompliant operations.

2.5.1 Inspector Presence

In response to a January 2007 complaint that Interstate Helicopters was using jet airplanes to conduct charter operations, the FSDO's unit operational supervisor assigned two inspectors to look into it; however, at least one of the inspectors was given only 2 hours on a Saturday to investigate the complaint. The Oklahoma City FSDO, which the manager and the unit operational supervisor described as short staffed with high turnover, likely placed a low priority on such ad-hoc surveillance because it can be time-consuming and is not part of the inspectors' required items.

The NTSB was unable to determine if the documented shortcomings in the Oklahoma City FSDO's oversight of Interstate Helicopters were due to shortages in manpower or other resources; however, there appears to be a correlation between the low physical presence of FAA inspectors at PWA and the ability of Interstate Helicopters (and possibly other operators) to operate Part 91 airplanes for hire. One maintenance provider stated that he had not seen an FAA inspector conduct a ramp check at PWA in 8 to 10 years. This maintenance provider, a charter operator, and some FAA inspectors stated that they suspected that some improper activity took place at PWA; however, no violations were ever identified. The NTSB concludes that the level of emphasis that the Oklahoma City FSDO placed on conducting surveillance activities at PWA, which included limited inspector visits and a 2-hour on-site inquiry into a complaint about Interstate Helicopters, was insufficient to detect or deter improper charter activity at the airport. Therefore, the NTSB recommends that the FAA explore and implement strategies to improve on-site inspector surveillance activities at airports and of flight operations to detect and deter improper charter operations.

⁷⁷ It is unknown if other customers were affected because such inquiries were beyond the scope of this accident investigation.

2.5.2 Operational Control Inspections

The November 2007 inspection of Interstate Helicopters was conducted in accordance with FAA Notice 8900.16, *Special Emphasis Inspection: Operational Control*, which was issued on August 17, 2007. Although the notice directed POIs to inspect all Part 135 operators to ensure that none were operating noncompliant charter flights, the inspection of Interstate Helicopters found only a few minor paperwork issues (unrelated to noncompliant charter flights) and failed to detect Interstate Helicopters' repeated operations involving airplanes that were not on its operating certificate.

In the case of the accident flight, Interstate Helicopters had no written agreements with either Southwest Orthopedic or United Engines. The FAA's operational control inspection of Interstate Helicopters likely focused on its operation of aircraft (all helicopters) that were listed in the company's operations specifications. Without some means of determining that other aircraft were being used, the FAA could not detect and correct the type of operational control issues at Interstate Helicopters that facilitated its operation of accident flight as a noncompliant charter. In fact, Interstate Helicopters' involvement with the accident airplane was detected during the accident investigation only through an examination of financial transactions, including invoices from Interstate Helicopters, payments to Southwest Orthopedic, and payments from United Engines, and interviews with representatives from all three entities. As a result, the NTSB concludes, although the FAA inspected Interstate Helicopters in accordance with FAA Notice 8900.16, *Special Emphasis Inspection: Operational Control*, the inspection was insufficient to detect the type of noncompliant charter operations that were conducted by Interstate Helicopters. Therefore, the NTSB recommends that the FAA assess why its existing policies, procedures, and practices resulted in a failure to detect the noncompliant actions of Interstate Helicopters and develop additional methods, measures, or procedures for performing inspections of and following up on complaints about Part 135 on-demand operators that can successfully detect noncompliant charter operations.

2.6 Cockpit Voice Recorder Functionality

Although not required to be equipped with a CVR, the accident airplane was equipped with an older-model CVR designed to record 30 minutes of analog audio. However, a malfunction of the tape mechanism precluded the recovery of any useable audio information. Quality audio information would have helped the NTSB to better understand the flight crew's challenges during the events that led up to and followed the airplane's collision with the flock of American white pelicans.

The characteristics of the accident airplane's CVR tape damage indicate that the damage most likely occurred before the accident flight. Safety Recommendation A-06-23, which was issued on March 24, 2006, and is classified "Open—Unacceptable Response," asked the FAA to do the following:

Require all operators of aircraft equipped with a cockpit voice recorder (CVR) to (1) test the functionality of the CVR before the first flight of each day as part of an approved aircraft checklist and (2) perform a periodic maintenance check of

the CVR as part of an approved maintenance check of the aircraft. The CVR preflight test should be performed according to procedures provided by the CVR manufacturer and should include listening to the recorded signals on each channel to verify that the audio is being recorded properly, is intelligible, and is free from electrical noise or other interference. The periodic maintenance check of the CVR should include an audio test followed by a download and review of each channel of recorded audio. The downloaded recording should be checked for overall audio quality, CVR functionality, and intelligibility.

The NTSB concludes that a preflight functionality test of the accident airplane's CVR likely would have detected that the CVR was inoperative. Therefore, the NTSB reiterates Safety Recommendation A-06-23.

2.7 Pilot Medical Issues

The accident pilot's medical history revealed that he had a history of gout. He reported no problems with the condition and no medication use on his January 20, 2003, FAA airman medical application and all subsequent applications. His most recent FAA airman medical examination was on July 26, 2007.

The pilot was known to complain of foot pain for which he found relief by removing his shoes during classroom and flight simulator training and while flying. Instructors who observed the accident pilot in September 2007 noticed that he removed his shoes but reported that he had no problems performing his simulator training and checkride. The NTSB was unable to obtain any documented medical information about the pilot's foot condition, its cause, or when it began; thus, the NTSB cannot assess whether or not the condition may have been impairing.

Cyclobenzaprine, a prescription muscle relaxant, was detected in the pilot's postmortem samples. The NTSB notes that the FAA likely would not certify an airman who reported regular use of cyclobenzaprine (the drug can cause sedation, and the condition for which the drug is being used is possibly, in itself, medically disqualifying).⁷⁸ It is unclear from the information gathered whether or not the pilot's medication use, the condition being treated, or his foot condition (if unrelated) were present at the time of his last FAA airman medical examination and whether or not the pilot likely knew that any one of these issues could potentially disqualify him from pilot duties if reported to the FAA for evaluation.⁷⁹

Medical analysis of the pilot's toxicology findings revealed that the level of cyclobenzaprine detected in the sample identified as blood was several times higher than the

⁷⁸ W.S. Silberman, *Certification Issues and Answers*, Federal Air Surgeon's Medical Bulletin, Winter 2002 (Washington, DC: FAA, 2002) 3-4.

⁷⁹ There is no requirement for pilots to report new medication use or medical conditions between FAA airman medical examinations. However, the accident pilot's cyclobenzaprine use and possibly his foot-pain issue would have been required reporting items if present at the time of his last FAA medical examination. FAA form 8500-8, *Application for Airman Medical Certificate and Student Pilot Certificate*, item 17a requests that an applicant list all prescription and nonprescription medications, and item 18 requests information about specific current medical conditions and past diagnoses, including "other illness, disability, or surgery."

maximum level that would be expected with regular use of a typical dose of the medication but that a number of factors render this detected level unreliable.⁸⁰ Therefore, the NTSB cannot draw any definitive conclusions from the reported presence or the reported level of the cyclobenzaprine detected. In particular, it is not possible to estimate when the pilot might last have used the medication or whether he might have been experiencing any adverse effects from it during the accident flight. However, the circumstances of the accident provide no indication that the airplane's in-flight collision with a flock of American white pelicans resulted from any pilot deficiencies. Further, after the collision, the airplane was uncontrollable. Therefore, the NTSB concludes that there was no evidence that the accident pilot's medical condition or medication use contributed to the cause of the accident.

⁸⁰ Cyclobenzaprine levels can be affected by a patient's regular use of the drug (the levels build up) and by postmortem redistribution; however, the NTSB has no information on when the pilot began taking the drug and whether or not he took it regularly. Also, the condition of the sample used for toxicology testing can affect the level detected. Although no autopsy information was provided regarding the condition or source of the sample, the fragmentation described by the medical examiner's office indicates that the sample was unlikely of ideal quality for testing.

3. Conclusions

3.1 Findings

1. Although the maintenance records for the accident airplane were not kept in accordance with 14 *Code of Federal Regulations* 91.417, no maintenance discrepancies were identified to be related to the cause of the accident.
2. The accident was not survivable for the airplane occupants because they were subjected to impact forces that exceeded the limits of human tolerance.
3. The airplane's departure from controlled flight likely resulted from wing structure damage sustained during an in-flight collision with a flock of American white pelicans, which far exceeded the airframe's design certification limit.
4. The current airframe certification standards for bird strikes are insufficient because they are not based on bird-strike risks to aircraft derived from analysis of current bird-strike and bird-population data and trends and because they allow for lower levels of bird-strike protection for some structures on the same airplane.
5. The accident airplane's left engine was capable of producing sufficient thrust for the airplane to continue to fly with the right engine inoperative, and the loss of power in one engine would not alone result in a loss of control of the airplane.
6. Because an airport's wildlife hazard management plan is based on a wildlife hazard assessment, Wiley Post Airport's failure to perform such an assessment as required prevented the determination of what mitigation measures, if any, could have been implemented to reduce the risk of an in-flight collision with American white pelicans.
7. Reference charts that depict both the airspeeds at which the airframe can sustain strikes from various-sized birds without exceeding certification standards and minimum safe airspeeds could help pilots devise precautionary operational strategies for minimizing potential airframe bird-strike damage in high-risk areas for bird strikes.
8. Reliable information about the mass, numbers, and activity of birds likely to be encountered near the airports of operation is necessary for pilots who wish to devise precautionary operational strategies for minimizing potential airframe bird-strike damage.
9. The low level of participation in voluntary wildlife strike reporting has resulted in data that severely underestimate the number and type of actual wildlife strikes and that such incomplete data have limited effectiveness for use in developing wildlife risk management and hazard mitigation programs.

10. Although the Federal Aviation Administration (FAA) has taken measures to increase the aviation community's awareness of the importance of voluntary wildlife-strike reporting, a wildlife-strike reporting requirement would improve the quality of the data in the FAA National Wildlife Strike Database.
11. The accident pilot was certificated, trained, and qualified to fly the accident airplane in noncommercial operations as a single pilot.
12. The second pilot was not trained, qualified, or current to fly the accident airplane; however, because the pilot was authorized to fly the accident airplane as a single pilot, the second pilot could occupy a cockpit seat and assist the pilot as directed.
13. At the time of the accident, Interstate Helicopters was operating the accident airplane in commercial service contrary to its Federal Aviation Administration-issued 14 *Code of Federal Regulations* Part 135 operating certificate, which, at the time, did not authorize operation of the accident airplane or any other fixed-wing aircraft.
14. Neither the pilot nor the second pilot were trained or qualified to fly the accident airplane in any 14 *Code of Federal Regulations* Part 135 commercial charter operation, and the accident airplane was not maintained in accordance with Part 135 commercial maintenance requirements.
15. Interstate Helicopters repeatedly labeled invoices as "aircraft lease" and "sales demo" flights, effectively disguising the noncompliant charter flights and circumventing the terms of its operating certificate.
16. The absence of written lease and Federal Aviation Administration (FAA) notification requirements for airplanes that do not meet the FAA definition of "large" increases the likelihood that airplane owners, managers, lessees, operators, and customers could either intentionally or inadvertently participate in improper charters involving such airplanes, and it hinders the FAA's ability to detect and correct such activity.
17. Title 14 *Code of Federal Regulations* 91.23 truth-in-leasing regulations, which exclude an expanding class of turbine-powered airplanes, leave aircraft charter customers vulnerable to operators that attempt to circumvent commercial charter regulations.
18. A pilot would be less likely to intentionally or inadvertently agree to fly an unauthorized commercial charter operation if the pilot, as the final authority for the operation of the aircraft, were required to identify on the flight plan the name of the operator and the regulation under which the flight is operating.
19. A requirement for 14 *Code of Federal Regulations* (CFR) Part 135 on-demand operators to provide customers a written disclosure of the terms of carriage of the flight, similar to what is provided to 14 CFR Part 121 passengers, would eliminate uncertainty about the commercial intent of the flight.
20. A comprehensive aircraft charter guide that includes both basic information and reliable, up-to-date Federal Aviation Administration information on the certification status of

on-demand commercial operators and the aircraft that each is authorized to operate is needed to provide customers with a single-source reference to ensure the legitimacy of their charter service options.

21. The level of emphasis that the Oklahoma City Flight Standards District Office placed on conducting surveillance activities at Wiley Post Airport, which included limited inspector visits and a 2-hour on-site inquiry into a complaint about Interstate Helicopters, was insufficient to detect or deter improper charter activity at the airport.
22. Although the Federal Aviation Administration (FAA) inspected Interstate Helicopters in accordance with FAA Notice 8900.16, *Special Emphasis Inspection: Operational Control*, the inspection was insufficient to detect the type of noncompliant charter operations that were conducted by Interstate Helicopters.
23. A preflight functionality test of the accident airplane's cockpit voice recorder (CVR) likely would have detected that the CVR was inoperative.
24. There was no evidence that the accident pilot's medical condition or medication use contributed to the cause of the accident.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was airplane wing-structure damage sustained during impact with one or more large birds (American white pelicans), which resulted in a loss of control of the airplane.

4. Recommendations

4.1 New Recommendations

As a result of this investigation, the National Transportation Safety Board makes the following safety recommendations to the Federal Aviation Administration:

Revise the bird-strike certification requirements for 14 *Code of Federal Regulations* Part 25 airplanes so that protection from in-flight impact with birds is consistent across all airframe structures. Consider the most current military and civilian bird-strike database information and trends in bird populations in drafting this revision. (A-09-72)

Verify that all federally obligated general aviation airports that are located near woodlands, water, wetlands, or other wildlife attractants are complying with the requirements to perform wildlife hazard assessments as specified in Federal Aviation Administration Advisory Circular 150/5200-33B, *Hazardous Wildlife Attractants On or Near Airports*. (A-09-73)

Require aircraft manufacturers to develop aircraft-specific guidance information that will assist pilots in devising precautionary aircraft operational strategies for minimizing the severity of aircraft damage sustained during a bird strike, should one occur, when operating in areas of known bird activity. This guidance information can include, but is not limited to, airspeed charts that depict minimum safe airspeeds for various aircraft gross weights, flap configurations, and power settings; and maximum airspeeds, defined as a function of bird masses, that are based on the aircraft's demonstrated bird-strike energy. (A-09-74)

Require all 14 *Code of Federal Regulations* (CFR) Part 139 airports and 14 CFR Part 121, Part 135, and Part 91 Subpart K aircraft operators to report all wildlife strikes, including, if possible, species identification, to the Federal Aviation Administration National Wildlife Strike Database. (A-09-75)

Revise 14 *Code of Federal Regulations* 91.23 truth-in-leasing regulations to include all turbine-powered airplanes. (A-09-76)

Require that Federal Aviation Administration flight plans include a block for the pilot to identify the operator and a block to specify the operating rules under which the flight is being conducted. (A-09-77)

Require 14 *Code of Federal Regulations* Part 135 on-demand operators to provide their customers with a written document, correspondence, or ticket that expressly describes the terms of carriage, including the regulatory part under which the flight is operated. (A-09-78)

Update and keep current the aircraft charter guide on the Federal Aviation Administration's website to include reliable information on the certification status of on-demand commercial operators and the aircraft that they are authorized to operate. (A-09-79)

Explore and implement strategies to improve on-site inspector surveillance activities at airports and of flight operations to detect and deter improper charter operations. (A-09-80)

Assess why your existing policies, procedures, and practices resulted in a failure to detect the noncompliant actions of Interstate Helicopters and develop additional methods, measures, or procedures for performing inspections of and following up on complaints about 14 *Code of Federal Regulations* Part 135 on-demand operators that can successfully detect noncompliant charter operations. (A-09-81)

4.2 Previously Issued Recommendations Reiterated in This Report

The NTSB reiterates the following safety recommendation to the FAA:

Require all operators of aircraft equipped with a cockpit voice recorder (CVR) to (1) test the functionality of the CVR before the first flight of each day as part of an approved aircraft checklist and (2) perform a periodic maintenance check of the CVR as part of an approved maintenance check of the aircraft. The CVR preflight test should be performed according to procedures provided by the CVR manufacturer and should include listening to the recorded signals on each channel to verify that the audio is being recorded properly, is intelligible, and is free from electrical noise or other interference. The periodic maintenance check of the CVR should include an audio test followed by a download and review of each channel of recorded audio. The downloaded recording should be checked for overall audio quality, CVR functionality, and intelligibility. (A-06-23)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

MARK V. ROSENKER

Acting Chairman

DEBORAH A.P. HERSMAN

Member

KATHRYN O'LEARY HIGGINS

Member

ROBERT L. SUMWALT

Member

Adopted: July 28, 2009

Member Higgins filed the following concurring statement on July 31, 2009.

Board Member Statement

Member Higgins, Concurring

I appreciate the work that has gone into this investigation and report on the crash of a Cessna 500 following an in-flight collision with large birds. My first concern was the issue of FAA certification standards for birds colliding with aircraft. As the report documents, there are different certification standards for aircraft structures, and these standards have evolved over time. For example, the tail of the accident airplane was designed and certified to withstand the impact of an 8-pound bird, while the wing and body of the airplane are certified for a 4-pound bird. The American white pelican involved in this accident could weigh up to 20 pounds. Bird populations are changing and the number of large birds is on the rise, and certification standards have not kept pace with this change. With recent events, it is clear that birds are capable of bringing down not only the 5-passenger jet involved in this accident but also large, transport category airplanes. And, while some may be comfortable with the current standards, I do not believe we should accept the *status quo* when we know from this accident and the US Airways flight 1549 public hearing that the bird strike exposure is increasing.

The recommendation proposed in the report for aircraft-specific guidance to help pilots devise aircraft operational strategies to mitigate bird strike damage is significant and I support it. But I also urged staff to develop a recommendation asking the FAA to revise the certification standards to account for the potential impact of the types and size of birds, like American white pelicans and Canada geese, that we know are hazardous to aviation due to their size, increasing numbers, and attraction to sites near airports. I am pleased that such a recommendation was adopted in this report that, if embraced by the FAA, will accelerate revision of the airframe certification standards to ensure continued safe flight and landing after a bird strike.

And while I agree that the encounter with the white pelicans brought the plane down, this was an illegal flight that never should have taken off in the first place. I am deeply troubled by Interstate Helicopters' clear disregard for the restrictions of its operating certificate and operations specifications, and for the lax oversight and surveillance of Interstate Helicopters by the Oklahoma City Flight Standards District Office of the Federal Aviation Administration.

Interstate Helicopters conducted this flight, and 19 others that we documented in our report with United Engines, contrary to Interstate's operating certificate. Interstate Helicopters repeatedly labeled invoices as "aircraft leases," and "sales demo" flights to disguise noncompliant charter flights. The accident flight was conducted by pilots neither trained nor qualified to fly the accident airplane in any Part 135 commercial charter operation, and conducted in an airplane not maintained in accordance with Part 135 commercial charter requirements. The report also documents the lack of disclosure of the terms of carriage, which leads to a lack of customer awareness about the commercial nature of the flight, so that customers are not able to make informed decisions about the identity of the operator or the nature of the flight.

The POI for Interstate Helicopters had been assigned only 2 days before the accident, and there was turnover among inspectors previously assigned to oversee Interstate Helicopters. Complaints (including one more than a year before the accident) about Interstate Helicopters using fixed wing aircraft to conduct charter operations, contrary to the company's Part 135 operating certificate, were not thoroughly investigated. As a result, these inappropriate operations continued without challenge. The POI who tried to investigate did not have the support of his management. A post-accident emergency revocation action was settled before hearing, and the FAA issued a new certificate to Interstate Helicopters a mere 10 months after the accident. There were no fines, penalties or other sanctions for these illegal flights, and Interstate Helicopters continues to operate as if nothing happened.

The Teterboro accident identified a similar set of unsettling circumstances and we issued recommendation A-06-67 asking the FAA to "review all charter management, lease, and other agreements between 14 CFR Part 135 certificate holders and other entities to identify those agreements..." that permit and/or enable loss of operational control. Instead of reviewing agreements, the FAA issued a notice requiring special emphasis inspections to ensure compliance with Part 135 operational control requirements. Despite this notice and several suspected improper operations at Wiley Post Airport, the Oklahoma City FSDO, with direct oversight of flight operations at that airport, did not identify any illegal Part 135 operations by Interstate Helicopters in the three years that preceded the accident even with a "qualified inspector workforce and documented record of inspections" and the required operational control inspection. That may be because they looked only at the company's helicopter operations and did not dig deeper. How is it that NTSB investigators could find the paperwork and document the illegal nature of the accident flight, and 19 other flights for United Engines, but the FAA could not and did not? There is reason to believe that Interstate Helicopters conducted similar flights for other companies but that could not be pursued in this investigation. Finally, the first of two DOT Inspector General reports was issued in mid-July 2009 with several important headlines: disparate regulatory requirements for on-demand Part 135 operators and Part 121 carriers; the lack of FAA oversight for Part 135 on-demand operators; and the failure to implement no fewer than 16 NTSB recommendations resulting from on-demand Part 135 accident investigations.

I find it disturbing that this set of circumstances still exists even when successful criminal prosecutions for similar behavior are ongoing for those involved in the Teterboro accident that was the subject of a Sunshine meeting when I first joined the Board in 2006. For these reasons, I suggested language that would include the actions of Interstate Helicopters and the inaction of the FAA Oklahoma City Flight Standards District Office as contributing causes in this accident. I am disappointed that my colleagues did not support my proposed amendments to the probable cause. The rules for commercial, on-demand flights were established to protect the traveling public. Unless they are followed and enforced, the public safety is at risk.

5. Appendix

Appendix A

Investigation and Public Hearing

Investigation

The National Transportation Safety Board (NTSB) was notified about the accident on March 4, 2008, shortly after it occurred. NTSB investigators arrived on-scene the following day.

Parties to the investigation were the Federal Aviation Administration and Cessna Aircraft. In accordance with Annex 13 to the Convention on International Civil Aviation, an accredited representative from the Transportation Safety Board of Canada and advisors from Pratt & Whitney Canada participated in this investigation.

Public Hearing

No public hearing was held for this accident.