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AIRPORTOPS

RISKS *on Feathered Wings*

As air traffic and wildlife populations increase, collisions between aircraft and wildlife — especially birds — are increasingly likely.

BY LINDA WERFELMAN

Wildlife strikes at airports around the world destroyed more than 163 aircraft and killed more than 194 people from 1988 through 2005, and the threat to human health and safety is increasing, a 2006 report by the U.S. Federal Aviation Administration (FAA) says.¹

The report warned of an increase in the “risk, frequency and potential severity of wildlife-aircraft collisions” during the next decade, primarily as a result of three factors:

- The replacement of older aircraft with three or four engines with quieter, two-engine aircraft “increases the probability of life-threatening situations resulting from aircraft collisions with wildlife, especially with flocks of birds,” because of the reduction in engine redundancy. In addition, research indicates that birds “are less able to detect and avoid modern jet aircraft with quieter engines than older aircraft with noisier engines” — one of the reasons

that bird strikes damage engines more often than any other aircraft component.

As an example of the extent of the change, in 1969, 75 percent of the 2,100 passenger aircraft in the United States had three or four engines; by 2008, only about 10 percent of the 7,000 passenger aircraft in the United States will have three or four engines.

- The populations of many species most commonly involved in strikes — and many bird species with the largest body weights — have increased dramatically in recent years. For example, the Canada goose population in Canada and the United States increased about 7.9 percent a year from 1980 through 2005, and the population of white-tailed deer — estimated at 350,000 in 1900 — increased to at least 17 million in 1997.
- As wildlife populations have increased, so has air traffic — 29.9 million aircraft

Wildlife Strikes Involving U.S. Civil Aircraft, 1990–2005

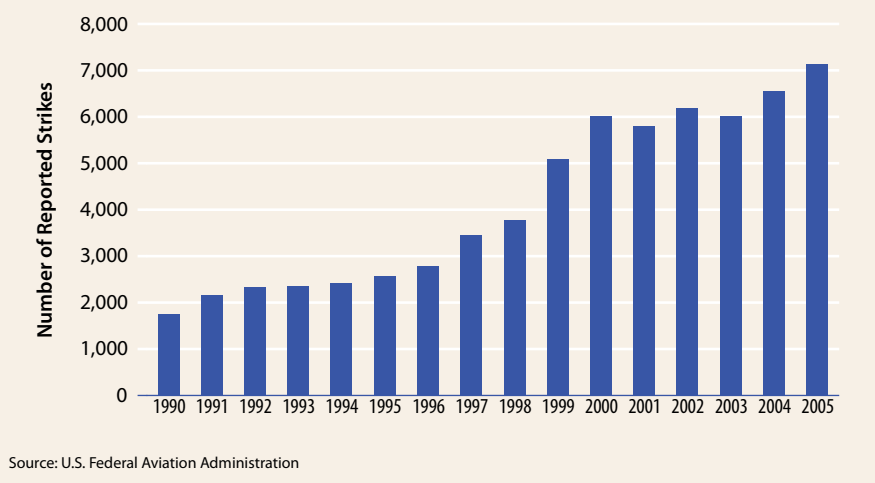


Figure 1

movements in the United States alone in 2005, compared with 17.8 million in 1980, the report said. Growth is expected to continue to increase by at least 2 percent each year through the end of the decade.

New Technologies

As wildlife strikes increase, airport authorities are turning to a variety of programs to remove birds and other wildlife from the paths of aircraft.

Among the new technologies is a laser bird repellent, the TOM500, developed by Lord Ingénierie for the French Direction Générale de l'Aviation Civile and being tested at Montpellier Airport in France.

The device uses a green laser beam — safe for the human eye — to scan runways and frighten away birds. Several months after installation of the TOM500 at Montpellier Airport, birds no longer appeared in the runway area; no bird strikes have occurred at the airport with the device in operation.²

Another new system is DeTect's Merlin radar system, being tested at Dallas/Fort Worth International

Airport in Texas and Kennedy International Airport in New York. This system detects birds but does not scare them away and often is paired with other bird-scaring technologies.^{3,4}

Millions in Damages

The FAA report included an estimate that aircraft strikes of birds and other wildlife cost the U.S. civil aviation industry US\$557 million a year, plus 580,029 hours of aircraft down time.

The data showed a dramatic increase in reported wildlife strikes in the United States in recent years — a trend that is likely to continue, the report said. From 1990 through 2005, authorities received reports of 66,392 wildlife strikes involving civil aircraft in the United States (Figure 1). Of these, 97.5 percent involved birds. In the final year of the period, 7,136 wildlife strikes were reported — more than quadruple the 1,744 strikes reported in 1990.

The report said that the increase probably was a result of several developments: Aircraft operations and wildlife populations both increased, leading to an increase in the actual number of wildlife strikes, and awareness of

the problem increased, leading to an increase in reporting of the events.

Nevertheless, the report estimated that less than 20 percent of wildlife strikes for the 16-year period were reported to FAA; in addition, information about the extent of damage and cost estimates often was incomplete.

Of the wildlife strikes reported during the 16-year period, 144 involved reports of injury or death to humans — nine deaths and 172 injuries. Waterfowl and birds of prey were most frequently identified as the types of birds involved, and deer were the most frequently identified terrestrial mammals (land-based mammals, excluding bats).

Engines Incur Most Damage

The report said that commercial aircraft were involved in 84 percent of the reported wildlife strikes in the 1990–2005 analysis. Reports were received from throughout the United States, including some from U.S. territories, and from other countries if U.S.-registered aircraft were involved.

Of the bird strikes, 51 percent occurred between July and October, and 63 percent occurred during daytime. About 59 percent of bird strikes occurred during the landing phase of flight, and 38 percent occurred during takeoff and climb; 60 percent occurred 100 ft above ground level or lower.

Of the terrestrial mammal strikes, 58 percent occurred between July and November — 33 percent of deer strikes occurred in October and November. Sixty-three percent occurred during nighttime, 55 percent during the landing roll and 34 percent during the takeoff roll; 8 percent occurred when the aircraft was in the air — for example, when an aircraft's landing gear struck a deer.

Aircraft engines were the components most often damaged by bird strikes,

accounting for 32 percent of all damaged components, the report said. Of the 8,750 reported bird strikes involving aircraft engines, more than 400 involved more than one engine: 421 events involved strikes to two engines, 10 involved strikes to three engines, and five involved strikes to four engines. Of the engines that were struck, 3,011 were damaged: 2,822 events involved damage to one engine, 93 involved damage to two engines, and one involved damage to three engines.

Of the reported terrestrial mammal strikes, the components most often reported as damaged were the landing gear, propeller and wing/rotor.

Of the 64,734 bird strike reports, 53,309 discussed the extent of damage to the aircraft. Less than 1 percent of the aircraft were destroyed, 4 percent incurred substantial damage, 8 percent incurred minor damage, and 85 percent were not damaged.

Of the 1,420 terrestrial mammal strikes reported, 1,022 reports discussed the extent of damage to the aircraft. Of these, 2 percent of the aircraft were destroyed, 5 percent incurred an undetermined amount of damage, 28 percent incurred substantial damage, 29 percent incurred minor damage, and 36 percent were undamaged.

Overall, the report said, strikes involving terrestrial mammals resulted in damage to 64 percent of the aircraft, and strikes involving birds damaged 15 percent of aircraft.

Of the reports that discussed economic loss, the average was \$113,000 per incident; of those that discussed aircraft down time, the average was 163.9 hours per incident. Many reports, however, did not discuss losses, so the actual numbers are estimated to be considerably higher, the report said.

In some instances, losses totaled millions of dollars.

For example, the cost of repairs was estimated at \$9.5 million for an Airbus A310 that had multiple bird strikes to an engine during an attempted takeoff from Subic Bay, Philippines, on June 24, 2005 (see appendix, page 40). The engine and cowling were replaced, and the airplane was out of service for four days. The birds were identified as Philippine ducks.

Repairs cost about \$1.5 million after a Dec. 30, 2005, strike in which a vulture crashed through the windshield of a Bell 206 near Washington, Louisiana, U.S., injuring the pilot, who experienced difficulty with his vision as he conducted a precautionary landing because the bird's blood was in his eyes.

The report said that, to fight the problem of wildlife strikes, airport authorities first must assess wildlife hazards on their airports and then "take appropriate actions, under the guidance of professional biologists trained in wildlife damage management, to minimize the problems," the report said.

"The aviation community must also widen its view of airport wildlife management needs to consider habitats and land uses in proximity

to the airport. Wetlands, dredge spoil containment areas, waste-disposal facilities and wildlife refuges can attract hazardous wildlife. Such land uses are often incompatible with aviation safety and should either be prohibited near airports or designed and operated in a manner that minimizes the attraction of hazardous wildlife."

The report also urged more comprehensive reporting of wildlife strikes to enable analysts to more precisely determine the extent of related safety issues and the economic costs of the problem. ●

Notes

1. Cleary, Edward C.; Dolbeer, Richard A.; Wright, Sandra E. *Wildlife Strikes to Civil Aircraft in the United States, 1990-2005*. Federal Aviation Administration (FAA) National Wildlife Strike Database, Serial Report No. 12. Washington, D.C. June 2006.
2. Lord Ingénierie. *Bird Strike: Laser Bird Repellent TOM500*. <www.lord-ing.com/eng/newpr.htm>.
3. DeTect. *Merlin*. <www.detect-inc.com/radar/?p=radar>.
4. Schofield, Adrian. "New Birdstrike Technology Trials Under Way at U.S., French Airports." *Airports*. Oct. 17, 2006.

How to Report a Strike

The Federal Aviation Administration (FAA) asks that wildlife strikes in the United States and those involving U.S.-registered aircraft in other countries be reported using FAA Form 5200-7 or via the Internet at <<http://wildlife-mitigation.tc.faa.gov>>.

Bird species that cannot be identified locally often can be identified by mailing feathers and other remains in a sealed plastic bag, along with Form 5200-7, to:

Feather Identification Laboratory
Smithsonian Institution,

Division of Birds
P.O. Box 37012
NHB, E610, RC 116
Washington, DC 20013-7012

These items also may be sent by express mail services to:

Feather Identification Laboratory
Smithsonian Institution
NHB, E610, MRC 116
10th and Constitution Ave. NW
Washington, DC 20560-0116

Envelopes should identify the contents as "safety investigation material."

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Appendix
Selected U.S. Wildlife Strikes, 2005

Date	Location	Aircraft Type	Phase of Flight	Components Damaged
Jan. 7	Bowerman, Washington	Raytheon Hawker 1000	climb	no. 1, 2 engines
During climb, the pilot pulled the airplane's nose up to avoid birds, possibly dunlins, but they were ingested into both engine cores. A post-landing inspection found that the landing gear also was covered with small birds. The area is a wildlife refuge, but no specific warning had been issued.				
Jan. 12	Tokyo	Boeing 747	takeoff	engine, wing
During takeoff, the crew saw two birds on the runway centerline and other large birds under the airplane's nose and to the left, and then heard a loud bang. The airplane yawed left. An inspection showed that two fan blades had broken through the cowling, and others had been damaged. A bird ingested into the engine was identified as a hooded crow.				
Feb. 18	Oakland, California	McDonnell Douglas MD-10	climb	engine
During climb, a bird of an unidentified species was ingested into the no. 2 engine. An inspection showed that two blades had separated from the inlet fan and one blade had cut through the acoustic panel.				
Feb. 20	Miami	Cessna Citation Ultra	climb	none
The airplane struck a turkey vulture during climb. The crew believed that the impact was not hard and saw no indications of major damage. After landing, a hole with a 1.0-ft (0.3-m) diameter was found in the airplane's tail.				
Feb. 27	Orlando, Florida	Boeing 737-300	takeoff	engine
A gull struck an engine during takeoff. The strike had no apparent effect on engine operation, but a post-landing inspection found that several fan blades were dented.				
March 4	San Jose, California	Boeing 757-200	climb	engine
As the crew rotated the airplane for takeoff, a flock of gulls and small birds landed on the runway. At least one bird was ingested into the left engine. The crew returned to the airport and taxied to the gate. An inspection found that several fan blades were bent.				
March 30	Miami	Swearingen SA 227	landing roll	propeller, fuselage
During landing, a white-tailed deer — the last deer in a group of eight — was struck by a propeller blade, which separated and punctured the fuselage.				
April 1	Oakland, California	Boeing 757-200	climb	engine
During climb, a common loon was ingested into an engine. The crew declared an emergency and landed at a nearby airport. An inspection found that fan blades and the nose cowling had been damaged.				
April 9	Chicago	Boeing 737-300	climb	radome, horizontal stabilizer, engine
During climb, the airplane struck several birds of an unknown species, and one bird was ingested into the no. 2 engine.				
April 17	Brentford, South Dakota	Bell 407	en route	windshield
As the helicopter was being flown to the site of a vehicular accident, three blue-winged teal ducks struck the windshield, which shattered. Blood from the ducks temporarily blinded the pilot, who was directed by his crew to a safe landing site.				
April 20	between Denver and San Francisco	Boeing 777	en route	engine
A bird strike involving an unknown species occurred while the airplane was en route. A post-flight inspection found blade damage.				
April 24	New York City	Boeing 747	takeoff	engine
As the airplane was rotated for takeoff, it struck several gulls. The no. 2 engine was shut down because of vibration, and the crew dumped 18,700 lb (8,482 kg) of fuel before landing. Several fan blades were damaged.				
May 9	Brownwood, Texas	Rockwell NA265	takeoff	engine
The captain rejected the takeoff after hearing a loud bang and losing directional control of the airplane. Bird residue from an unknown species was found in the left engine.				
May 31	Kauai, Hawaii	Boeing 757	takeoff	engine
During takeoff, the pilots saw a barn owl on the right side of the airplane and felt vibration in the right engine. They conducted a precautionary landing at a nearby airport. An inspection found damage to the engine.				
June 10	Kansas City, Missouri	McDonnell Douglas DC-9	climb	engine
During the takeoff roll, the first officer saw a small bird, later identified as an American kestrel, fly in front of the airplane and disappear to the left. As the airplane was rotated, it vibrated and rolled left, and loud banging noises were heard. The crew conducted an emergency landing. An inspection found damage to several fan blades and the fan case.				
June 24	Subic Bay, Philippines	Airbus A310	takeoff	engine, cowling, wing
A loud bang was heard during the takeoff roll, followed by vibration and a "pull" to the right. An inspection found damage to fan blades, the nose cowling and a fan cowling. The bird was identified as a Philippine duck.				

Continued on next page

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Selected U.S. Wildlife Strikes, 2005

Date	Location	Aircraft Type	Phase of Flight	Components Damaged
Aug. 4	Refugio, Texas	Cessna 421	landing	nose landing gear, propellers
The airplane struck a deer while landing.				
Aug. 17	Merritt Island, Florida	Cessna 421	descent	wing, tip tank, electronics
During descent, a collision with a black vulture “ripped the wing,” tore a hole in a fuel tank and damaged an annunciator light that would have confirmed whether the landing gear had been extended. The pilot conducted an emergency landing.				
Aug. 23	Phoenix	MD Helicopters MD 520	en route	windscreen, rotor blades
During cruise at 400 ft above ground level, a bird — an American coot — hit the windscreen, shattering the left side. In addition, the rotor blades were scratched.				
Sept. 1	Lorain County, Ohio	Falcon 20	climb	engines, tail, wings, fuselage, landing gear
After rotation, the airplane hit a flock of birds, later identified as mourning doves, and the no. 1 engine flamed out. After the crew retracted the landing gear, the airplane struck another flock, and no. 2 engine speed decreased. The crew could not maintain airspeed or altitude, and the airplane crashed into a ditch and an airport perimeter fence.				
Sept. 3	Cleveland	Boeing 757	climb	engines
Just after rotation, the crew saw a large flock of European starlings and tried to avoid hitting the birds. They heard several birds strike the airplane. Engine instrument indications were normal, and the flight was continued to its destination. An inspection found damage to both engines.				
Sept. 13	Fort Worth, Texas	McDonnell Douglas DC-10	landing	engine
During landing, between 15 and 20 rock pigeons were ingested into the no. 3 engine.				
Sept. 30	unknown	McDonnell Douglas DC-10	unknown	engine
During maintenance, technicians found indications that a wood duck had struck the no. 1 engine.				
Oct. 16	Ogdensburg, New York	Raytheon Beech 1900	takeoff	engines, propellers, landing gear, nose, fuselage
During the takeoff run, the airplane struck a coyote, causing the nose landing gear to collapse and propeller blades to cut through the airplane’s skin.				
Oct. 17	Vacaville, California	Raytheon Beech 400	landing	engine, landing gear, fuselage, pitot tube
During the landing rollout, the airplane struck about 20 wild turkeys, including one that was ingested into an engine.				
Nov. 1	Sioux Falls, South Dakota	Airbus A300	climb	engine
While the airplane was climbing through 6,000 ft, a large bird, later identified as a mallard, struck the no. 2 engine. The crew felt engine vibrations and heard related noise. They returned to the departure airport, where an inspection found damage to several fan blades and other parts of the engine.				
Nov. 30	Denver	Boeing 747	approach	engines, wing
During approach, Canada geese struck the no. 1 and no. 2 engines. The engines appeared to continue to function normally, although a subsequent inspection found core ingestion and damage to fan blades in both engines. Holes were found in both flaps, with “a leg with webbed foot” protruding from one hole.				
Dec. 13	Harrisburg, Pennsylvania	Embraer 145	approach	engine
During approach, the crew saw “a streak” outside the left window and felt a jolt. They detected an odor, turned off the air-conditioning pack and reduced power to idle. When they tried to increase power, violent compressor stalls occurred. Investigators said the airplane struck a Canada goose.				
Dec. 28	Chicago	Boeing 737-300	climb	engine
During climb, a large bird — later identified as a snowy owl — was ingested into the no. 2 engine, and the crew performed a precautionary landing. An inspection found that the engine was destroyed.				
Dec. 28	Sacramento, California	Boeing 737-500	climb	engine
The crew saw a large white bird of an undetermined species fly by the left side of the airplane and heard a loud pop before the engine began vibrating. The crew returned to the airport for a precautionary landing. All fan blades were replaced.				
Dec. 30	Washington, Louisiana	Bell 206	en route	destroyed
During cruise at 50 ft above ground level, a large vulture crashed through the windscreen, and the pilot was temporarily unable to see because of wind and the bird’s blood in his eyes. The pilot tried to land in a bean field, but the left skid hit the ground and the helicopter tipped onto its side.				

Source: Cleary, Edward C.; Dolbeer, Richard A.; Wright, Sandra E. *Wildlife Strikes to Civil Aircraft in the United States, 1990–2005*. Federal Aviation Administration National Wildlife Strike Database, Serial Report No. 12. Washington, D.C. June 2006.