



National Transportation Safety Board Aviation Accident Final Report

Location:	Medford, OR	Accident Number:	SEA03FA024
Date & Time:	01/08/2003, 1815 PST	Registration:	N409QX
Aircraft:	Bombardier DHC-8-401	Aircraft Damage:	Substantial
Defining Event:		Injuries:	1 Serious, 31 None
Flight Conducted Under:	Part 121: Air Carrier - Scheduled		

Analysis

The aircraft, which was on a downwind for a night visual approach, impacted a flock of Lesser Scaups (diving ducks). The nose structure of the aircraft and the windshield directly in front of the captain received multiple bird strikes. Some of the birds penetrated the aircraft's skin, but there was no direct penetration of the windshield. Although the windshield was not penetrated, hundreds of small pieces of glass were ejected from the most inner of the windshield's three panes, and approximately 70 of these pieces imbedded themselves in the face, forehead, and scalp of the captain. The first officer ultimately completed a successful landing, while using backup flight instruments. The investigation determined that the windshield certification process defined in Part 25 of the Federal Aviation Regulations and the Canadian Aviation Regulations does not take into account the effects of multiple bird strikes on the same windshield.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The fracture and spalling of the inner-most pane of the aircraft's port side windshield while on a downwind for a night visual approach due to an imposed load beyond that required for windshield certification (multiple bird strikes). Factors include a dark night, and a flock of ducks (Lesser Scaups) flying in the location of the visual traffic pattern.

Findings

Occurrence #1: IN FLIGHT COLLISION WITH OBJECT

Phase of Operation: APPROACH - VFR PATTERN - DOWNWIND

Findings

1. (C) WINDOW, FLIGHT COMPARTMENT WINDOW/WINDSHIELD - FRACTURED
2. (C) WINDOW, FLIGHT COMPARTMENT WINDOW/WINDSHIELD - OVERLOAD
3. (F) OBJECT - BIRD(S)
4. (F) LIGHT CONDITION - DARK NIGHT

Factual Information

HISTORY OF FLIGHT

On January 8, 2003, approximately 1815 Pacific standard time, a Bombardier DHC-8-401, N409QX, collided with an undetermined number of birds approximately four miles northeast of Rogue Valley International Airport, Medford Oregon. The airline transport pilot in the left seat received serious injuries, and was temporarily unable to perform his flight crew duties, but the first officer was uninjured. The flight attendant and the 29 passengers were not injured. The aircraft, which was being operated on a scheduled 14 CFR Part 121 flight by Horizon Airlines, sustained substantial damage. The flight crew, which had been on an IFR flight plan, departed Seattle International Airport, Seattle, Washington, at 1726.

According to the flight crew, what appeared to the first officer as a flock of seven or eight birds suddenly appeared in front of the aircraft while they were approaching Medford on a clear dark night. At the time of the event, the aircraft was descending through approximately 3,900 feet, on an extended right visual downwind for runway 32. The birds were momentarily illuminated by the aircraft's approach lights and flare lights, but before the flight crew could take any action, several of the birds impacted the aircraft's nose and windshield. The force of the impact fractured the inner pane of the forward windshield on the captain's side of the aircraft, and numerous small pieces of the glass hit the captain in the face, scalp and chest. The captain, who was cut by the glass in several places, turned over control of the aircraft to the first officer, who asked the tower to turn up the brightness on the runway lights, because she had momentarily lost sight of the runway due to the distraction of the impact. About 20 seconds after the impact, the aircraft experienced a partial loss of electrical power resulting in the aircraft's primary navigational, flight, and avionics displays becoming inoperative. The first officer then slowed the aircraft and configured it for landing according to the checklist, while using the backup attitude indicator as her primary flight instrument. The captain then declared an emergency and advised the tower that there had been an injury to a flight crew member. During this sequence, both engine fire warning lights on the glare shield came on, but there was no audible fire warning tone, nor did either fire T-handle illuminate. After the aircraft was established on final approach, the captain was able to lean forward to read the secondary airspeed indicator and make airspeed callouts to the first officer. About five minutes after the impact with the birds, the first officer executed a successful landing at Medford.

INJURIES TO PERSONS

At the time of the impact, hundreds of pieces of glass of various sizes and shapes separated from the windshield's inner pane and traveled toward the aft wall of the flight deck. The captain, who at the time of the event was wearing special polycarbonate safety glasses, was hit in the upper torso, face, and scalp by numerous pieces of fractured glass. He sustained between 60 and 70 cuts to his face and scalp, and ultimately received approximately 20 stitches to the injuries that were severe enough to warrant such treatment. In addition to the glass that penetrated his skin, numerous smaller pieces of glass became lodged between his eyeballs and his eyelids, but did not penetrate the membrane of either surface. Many of the cuts to his forehead and scalp bled heavily, and the dripping blood interfered with his ability to see. The force of the glass impacting his face knocked his safety glasses to the floor, and when later recovered, the lenses of the glasses were determined to have been scratched and gouged by the impacting of the glass. In addition to the damage to the lenses, the frames themselves were

twisted, bent, and nicked. Later, after the captain was taken to the hospital, emergency room personal spent approximately three hours removing pieces of glass from his skin and eyes. Two days after the event, the forehead, cheeks and nose area of the captain turned a light brownish-green due to the bruising associated with the force of the glass impacting his face.

The captain reported that the force of the glass hitting him in the face caused him to be stunned, dazed, and a little disorientated, but he felt that he was not totally incapacitated. He said that for the first two minutes after the impact, he was dazed and not thinking clearly, and had a hard time locating knobs and switches that he was use to manipulating on a daily basis. He ultimately was able to read the secondary airspeed indication, but had some trouble seeing because of the amount of blood that was dripping down from his forehead. During an early post-accident interview, the captain said that he felt that if the other pilot had have been incapacitated that he could have kept control of the aircraft, but in a later telephone conversation he stated that he was not sure that his original evaluation of his capability to control the aircraft during the sequence of events was correct.

DAMAGE TO AIRCRAFT

Inspection of the aircraft revealed that one or more ducks impacted the airframe in four separate locations (see diagram #1). The most forward impact point was on the centerline of the aircraft, near the top rear of the forward nose compartment (Zone 212). The bird(s) that collided with the aircraft at that point penetrated the honeycomb skin (see photo #1) and impacted the DC Contactor Box (DCCB), resulting in 18 of the 31 circuit breakers opening do to impact forces, not thermal overloading (see photo #2). The popping of the circuit breakers resulted in the first officer flying the aircraft by reference to the standby instrument pack, eventually aided by airspeed callouts from the captain. In addition to the flight instrument limitations, the Audio and Radio Control Display (ARCDU) showed numerous red fail lights, and the engine fire lights on the glare shield illuminated (there was no engine fire warning tone nor illumination of the T-handles). The crew also discovered that there was no elevator trim, and that the nose wheel steering did not work after touchdown.

The second impact point was on a line almost directly in front of the captain at the riveted seam between the forward nose compartment (Zone 212) and the flight crew cabin (Zone 211). The impact at that location resulted in a partial penetration and a separation of the riveted seam along approximately two feet of its length (see photo #3). This impact did not directly alter the function of any electrical or mechanical subcomponents.

The third impact occurred about two feet below the first officers front windscreen, just aft of the aforementioned 211/212 rivet seam. Although the aircraft skin was dented and buckled at this location, there was no penetration.

The fourth impact area was on the windscreen in front of the captain (see photo #4). All glass panes of this window fractured, and hundreds of small irregular pieces of glass were ejected from the inner-most pane into the left side and center of the flight deck. In addition to the aforementioned injuries to the captain, the captain's seat and floor area, and most of the center console were covered with large quantities of broken glass (see photo #5). Further inspection revealed that no direct penetration of the windshield occurred, although a small amount of blood and vitreous fluid from the bird(s) passed between the edge of the windscreen and the rubber seal that holds it in place on the airframe.

METEOROLOGICAL INFORMATION

According to the crew, at the time of the accident there were no clouds of any type in the sky around Medford. The night was dark and clear, and the visibility was good enough that they had clearly seen the lights of Medford while more than 90 miles north of the city. The temperature at the airport was seven degrees centigrade, and the dew point was zero degrees. The winds were clam.

ADDITIONAL DATA AND INFORMATION

After the accident, the pilot's windscreen was removed from the aircraft and delivered to the NTSB for further inspections and evaluation. After an initial inspection at the NTSB's Northwest Regional Office, the windshield was transferred to the facilities of Sierracin/Sylmar Corporation, the manufacturer, for a multi-party NTSB-supervised inspection and evaluation. During this process it was determined that this windshield (Sierracin P/N 802600-07, S/N 317) is a three-pane windshield, consisting of an outer "sacrificial" glass pane, a middle (buried) chemically tempered (strengthened) structural glass pane, and an inner (toward the crew) chemically tempered (strengthened) structural glass pane. All three panes are of different thicknesses, and the outer and inner panes are joined to the middle pane by two adhesive interlayers (one on each side of the middle pane). The inspection process determined that all three glass panes met the thickness requirements of Sierracin/Sylmar Acceptance Test Procedure 02-74-300-444, Revision E, and the two chemically strengthened panes met the surface compression (strength) requirements of Sierracin/Sylmar Acceptance Test Procedure 02-74-300-495, Revision A.

Further inspection of the windshield determined that on each pane there was a clearly discernable point from which a series of fracture lines ran radially out to the border of the pane on all four edges. On the outer pane, this point was located approximately six inches from the aft edge and three inches down from the top. On the center (imbedded) pane, the radiation point was located six inches from the aft edge and one-half inch directly above the point on the outer pane. On the inner pane, this point was located about eleven inches from the aft edge of the pane, and eight inches from the top edge. The direct-line distance from the radiation point on the outer pane to the radiation point on the inner pane was approximately eight inches (see diagram #2). It was also determined that when the windshield was inspected on the ground after the accident, but prior to being removed from the aircraft, neither of the adhesive interlayers had failed, and no portion of the bird(s) had penetrated the windshield itself. It was also noted that in less than one-tenth of one percent of the surface area of the inner pane did the glass separate from the adjacent adhesive interlayer. Instead, the large number of small pieces of glass that were ejected into the flight deck area separated intergranularly from a deeper layer of the inner pane itself (spalling).

A review of the Federal Aviation Administration and Transport Canada regulations that dictate the design, construction, and testing parameters for windshields in pressurized transport category airplanes (Part 25.775 for both), determined that the penetration limitation requirements defined there do not directly address multiple bird impacts of the same windshield.

Remains of the birds that impacted the aircraft were collected and sent to both the Smithsonian National Museum's Department of Natural History and to the United States Department of the Interior's Fish and Wildlife Service. Both institutions identified the subject birds as Lesser Scaups (*Aythya affinis*), a diving duck with an average body weight of just under two pounds. According to the Fish and Wildlife Service, the Lesser Scaup is a regular visitor to

the lakes and ponds in the county within which the Medford Airport is located (Jackson County). The Wildlife Service's forensic ornithologist further stated that Lesser Scaups often migrate after sunset.

Pilot Information

Certificate:	Airline Transport; Flight Instructor	Age:	54, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine; Instrument Airplane	Toxicology Performed:	No
Medical Certification:	Class 1 Valid Medical--w/ waivers/lim.	Last Medical Exam:	11/05/2002
Occupational Pilot:		Last Flight Review or Equivalent:	06/14/2002
Flight Time:	18662 hours (Total, all aircraft), 4922 hours (Total, this make and model), 2 hours (Last 24 hours, all aircraft)		

Co-Pilot Information

Certificate:	Airline Transport; Flight Instructor	Age:	45, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine; Instrument Airplane	Toxicology Performed:	No
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim.	Last Medical Exam:	07/02/2002
Occupational Pilot:		Last Flight Review or Equivalent:	01/15/2002
Flight Time:	9241 hours (Total, all aircraft), 1288 hours (Total, this make and model), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	Bombardier	Registration:	N409QX
Model/Series:	DHC-8-401	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Transport	Serial Number:	4051
Landing Gear Type:	Retractable - Tricycle	Seats:	75
Date/Type of Last Inspection:	12/10/2002, Continuous Airworthiness	Certified Max Gross Wt.:	64500 lbs
Time Since Last Inspection:	168 Hours	Engines:	2 Turbo Prop
Airframe Total Time:	2760 Hours	Engine Manufacturer:	Pratt & Whitney
ELT:		Engine Model/Series:	PW 150-A
Registered Owner:	HORIZON AIR INDUSTRIES INC	Rated Power:	
Operator:	HORIZON AIR INDUSTRIES INC	Air Carrier Operating Certificate:	Flag carrier (121)
Operator Does Business As:	Horizon Airlines	Operator Designator Code:	QXEA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Night/Bright
Observation Facility, Elevation:		Observation Time:	
Distance from Accident Site:		Direction from Accident Site:	
Lowest Cloud Condition:	Clear	Temperature/Dew Point:	7° C / 0° C
Lowest Ceiling:	None	Visibility	20 Miles
Wind Speed/Gusts, Direction:	Calm	Visibility (RVR):	
Altimeter Setting:		Visibility (RVV):	
Precipitation and Obscuration:			
Departure Point:	Seattle, WA (SEA)	Type of Flight Plan Filed:	IFR
Destination:	Medford, OR (MFR)	Type of Clearance:	VFR
Departure Time:	1726 PST	Type of Airspace:	Class E

Airport Information

Airport:	Rogue Valley Int. (MFR)	Runway Surface Type:	Asphalt
Airport Elevation:		Runway Surface Condition:	Dry
Runway Used:	32	IFR Approach:	Visual
Runway Length/Width:	8798 ft / 150 ft	VFR Approach/Landing:	Full Stop

Wreckage and Impact Information

Crew Injuries:	1 Serious, 2 None	Aircraft Damage:	Substantial
Passenger Injuries:	29 None	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Serious, 31 None	Latitude, Longitude:	42.446944, -122.860556

Administrative Information

Investigator In Charge (IIC):	Orrin K Anderson	Adopted Date:	12/03/2004
Additional Participating Persons:	Michael Benedict; Portland FAA FSDO; Hillsboro, OR David Lawson; New York ACO, FAA; Valley Stream, NY Dennis Meier; Horizon Air; Portland, OR David Fisher; Bombardier Aerospace; Downsview, Ontario, Jan Olson; Sierracin/Sylmar Corp.; Sylmar, CA Hin Tsang; Transport Canada; Ottawa, Ontario, CD,		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov , or at 800-877-6799. Dockets released after this date are available at http://dms.nts.gov/pubdms/ .		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report.