



Aviation Investigation Factual Report

Location:	Philadelphia, Pennsylvania	Incident Number:	ERA09IA056
Date & Time:	November 16, 2008, 09:34 Local	Registration:	N326EN
Aircraft:	DeHavilland DHC-8-311	Aircraft Damage:	Minor
Defining Event:	Sys/Comp malf/fail (non-power)	Injuries:	38 None
Flight Conducted Under:	Part 121: Air carrier - Scheduled		

Factual Information

HISTORY OF FLIGHT

On November 16, 2008, about 0934 eastern standard time, a deHavilland DHC-8-311, N326EN, operated by Piedmont Airlines as USAirways flight 4551, sustained minor damage when it landed with the nose landing gear retracted at Philadelphia International Airport (PHL), Philadelphia, Pennsylvania. The 2 flight crewmembers, 1 cabin attendant, and 35 passengers were uninjured, and visual meteorological conditions prevailed. The scheduled passenger flight was operating on an instrument flight rules flight plan from Lehigh Valley International Airport (ABE), Allentown, Pennsylvania, to Philadelphia, under the provisions of Title 14 Code of Federal Regulations Part 121.

During a telephone interview, the captain stated, and was collaborated by the first officer, that on the morning of the flight, they performed a preflight inspection of the airplane while it was parked, started the engines, and then taxied a short distance to the gate. The captain stated that during taxi to the runway, everything appeared normal. They completed all checklists; the captain maneuvered the airplane onto the runway, and transferred control to the first officer, who was to be the flying pilot. While on initial climbout the captain noted that the nose gear took about "three to four seconds longer to retract than the main landing gear."

During the interview, both crewmembers reported that the flight was uneventful until the base leg of the approach. At that point, after the landing gear handle was selected to the extended position, the main landing gear extended properly, but the flight crew observed cockpit annunciations indicating that the nose gear and doors were not properly configured for landing. The flight crew performed a go-around; left the landing gear extended, and departed the area to attempt to rectify the situation. The first officer transferred airplane control to the captain, and performed the alternate landing gear extension checklist. However, the anomalous indications remained, and the nose landing gear remained retracted for landing.

The flight crew then flew the airplane past the air traffic control tower (ATCT) to enable the ATCT personnel to determine the status of the nose landing gear. ATCT personnel reported that the nose gear doors were open, but that the nose landing gear was not visible. The flight crew then made several attempts to extend the nose gear by using the alternate gear extension checklist, and conferring with the airline's maintenance personnel, but were unsuccessful. The crew subsequently elected to return to the airport to perform a nose-gear-up landing on runway 27L.

During the landing, and after the airplane's main landing gear touched down, the captain held the nose of the airplane off the runway until the slowest speed possible. After the nose contacted the runway, the airplane slid on it for about 525 feet before coming to a stop. There

was no fire. The passengers deplaned via the main cabin door, and were taken to the terminal by a bus.

PERSONNEL INFORMATION

The captain held an airline transport pilot certificate with a rating for airplane multi-engine land, a type rating in the incident airplane make and model, and a commercial pilot certificate with a rating for airplane single-engine land. He reported 7,336 total hours of flight experience, including 2,726 hours as pilot in command (PIC). He reported 6,253 total hours of flight experience in the incident airplane make and model, including 1,832 hours as PIC. His most recent Federal Aviation Regulation (FAR) Part 121 annual check ride was completed on September 24, 2008, and his most recent Federal Aviation Administration (FAA) first-class medical certificate was issued on August 13, 2008.

The first officer held a commercial pilot certificate with ratings for airplane single-engine land, multi-engine land, instrument airplane, and several type ratings, including the incident airplane make and model with second-in-command privileges. She reported 2,553 total hours of flight experience, including 2,005 hours in the incident airplane make and model. Her most recent FAR Part 121 annual check ride was completed on June 18, 2008, and her most recent FAA first-class medical certificate was issued on January 21, 2008.

AIRCRAFT INFORMATION

According to FAA records, the airplane was manufactured in 1990 and was equipped with two Pratt & Whitney PW123 turboprop engines.

According to the operator, the airplane was certificated for a maximum gross weight of 43,200 pounds, and at the time of the incident, it weighed 37,996 pounds. The airplane's most recent inspection was completed on October 1, 2008 in accordance with an FAA-approved continuous airworthiness inspection program. At the time of the incident, the airplane had accumulated 33,224 total hours in service.

METEOROLOGICAL INFORMATION

The 0954 recorded weather observation at PHL included winds from 280 degrees true at 24 knots with gusts to 30 knots, 10 miles visibility, scattered clouds, temperature 9 degrees C, dew point minus 3 degrees C, and an altimeter setting of 29.70 inches of mercury.

AIRPORT INFORMATION

Runway 27L was 10,506 feet long and 200 feet wide. The runway surface was asphalt, and dry. A foam agent was applied to the airplane immediately after coming to rest by Airport Rescue and Fire Fighting (ARFF).

WRECKAGE AND IMPACT INFORMATION

According to the FAA inspector who responded to the accident, the airplane came to rest on the runway centerline, between taxiways U and Y. The nose landing gear doors, hinges, and the skin on the underside of the fuselage sustained scrape damage due to contact with the runway surface. The damage was confined to the nose gear doors and adjacent skin surfaces. No structural damage was reported.

Airport personnel and mechanics utilized air bags to lift the nose of the airplane off the runway surface. The FAA inspector then looked into the nose gear well, and found the nose wheels canted at an angle, which wedged them against the nose wheel well structure. Personnel used a pry bar to free the nose wheels from the wheel well, and the nose gear was then swung freely to its normal extended position, and locked in the down position. The airplane was towed to a maintenance hangar for additional examination. The links on top of the steering column were found to be fractured and pushed upward. The nose wheel over steering or frangible fuse pin was still intact.

Approximately 1 week after the incident, another of the operator's DHC-8-102 airplanes was inspected, and the links on top of the steering column of that airplane were also found fractured. The steering links from both airplanes were sent to the National Transportation Safety Board Materials Laboratory for examination.

There was no determination as to when the damage occurred to either airplane.

TEST AND RESEARCH

Nose Wheel Steering Links

According to the Safety Board's Material Laboratory Factual Report, the steering link assembly attached to the nose landing gear steering cylinder, and it served to convert linear movement of the steering cylinder to rotary motion of the nose gear strut, which then provided nosewheel steering capability. Examination of the incident airplane's steering link revealed that the inner ring portion, that normally encircled the center bushing, had fractured, and the rings had been deformed outwards. Manipulation revealed that the telescoping links could be moved inwards and outwards but could not be extracted. The retainers were examined and were found to be correctly wire-locked.

Examination of the fracture faces revealed shear lip features oriented on a 45-degree slant plane and a reduction in cross section adjacent to the fracture face (necking), consistent with the inner rings being circumferentially-loaded in tension beyond their load-carrying capacity. The steering link from the other airplane was in similar condition as the incident steering link and exhibited similar fractures.

The manufacturer's design drawing indicated that the swivel link was to be produced from low-

alloy "4340" steel. Note 7 on the drawing required "heat treat to 180-200 ksi [thousand pounds per square inch] per DCMP-1303 in a protective atmosphere furnace;" 180-200 ksi converts to 40-43 Hardness, Rockwell "C" scale (HRC). Hardness testing was performed by the Safety Board's Material Laboratory on the swivel link lug, and results ranged from 38.3 to 40.0 HRC, which converted to tensile strengths of approximately 173 ksi to 180 ksi, respectively.

According to a representative of the airplane manufacturer, the failure of the nose wheel steering links would "allow the [nose] wheel to roll-over/tilt and get caught on the [nose gear wheel well] structure."

Frangible Fuse

A Frangible Fuse (Towing Fuse) that was located on top of the nose wheel strut was designed to prevent damage to the nose wheel steering mechanism during an over-travel event while being towed. According to a representative of the airplane manufacturer and the operator's maintenance personnel, a rotation of the nose wheel to the left or right, beyond the 120 degree maximum castering range, would allow stops on the retaining flange/locating ring to contact and break the frangible fuse, which could indicate damage to the steering mechanism.

The frangible fuse, which would not have been visible during a normal preflight inspection, was examined after the incident and did not indicate that any castering limitation had been exceeded.

Pilot Information

Certificate:	Airline transport; Commercial	Age:	44, Male
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 1 With waivers/limitations	Last FAA Medical Exam:	August 1, 2008
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	September 24, 2008
Flight Time:	7366 hours (Total, all aircraft), 6253 hours (Total, this make and model), 2726 hours (Pilot In Command, all aircraft)		

Co-pilot Information

Certificate:	Commercial; Flight instructor	Age:	24,Female
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	Airplane single-engine	Toxicology Performed:	Yes
Medical Certification:	Class 1 With waivers/limitations	Last FAA Medical Exam:	January 1, 2008
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	June 18, 2008
Flight Time:	2553 hours (Total, all aircraft), 2005 hours (Total, this make and model), 352 hours (Pilot In Command, all aircraft), 231 hours (Last 90 days, all aircraft), 80 hours (Last 30 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	DeHavilland	Registration:	N326EN
Model/Series:	DHC-8-311	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Transport	Serial Number:	234
Landing Gear Type:	Retractable - Tricycle	Seats:	54
Date/Type of Last Inspection:	October 1, 2008 Continuous airworthiness	Certified Max Gross Wt.:	43200 lbs
Time Since Last Inspection:		Engines:	2 Turbo prop
Airframe Total Time:	33224 Hrs at time of accident	Engine Manufacturer:	Pratt & Whitney
ELT:	C91A installed, not activated	Engine Model/Series:	PTW 123
Registered Owner:	Wells Fargo bank Northwest NA Trustee	Rated Power:	2380 Horsepower
Operator:	Piedmont Airlines	Operating Certificate(s) Held:	Commuter air carrier (135)
Operator Does Business As:	USAir Express	Operator Designator Code:	HNAA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	PHL,36 ft msl	Distance from Accident Site:	1 Nautical Miles
Observation Time:	09:54 Local	Direction from Accident Site:	358°
Lowest Cloud Condition:	Scattered / 4000 ft AGL	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	24 knots / 30 knots	Turbulence Type Forecast/Actual:	/
Wind Direction:	280°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.7 inches Hg	Temperature/Dew Point:	9°C / -3°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Allentown, PA (ABE)	Type of Flight Plan Filed:	IFR
Destination:	Philadelphia, PA (PHL)	Type of Clearance:	IFR
Departure Time:	07:50 Local	Type of Airspace:	

Airport Information

Airport:	Philadelphia International PHL	Runway Surface Type:	Asphalt
Airport Elevation:	36 ft msl	Runway Surface Condition:	Dry
Runway Used:	27L	IFR Approach:	Visual
Runway Length/Width:	10506 ft / 200 ft	VFR Approach/Landing:	Straight-in

Wreckage and Impact Information

Crew Injuries:	3 None	Aircraft Damage:	Minor
Passenger Injuries:	35 None	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	38 None	Latitude, Longitude:	39.868057,-75.238891(est)

Administrative Information

Investigator In Charge (IIC):	Etcher, Shawn
Additional Participating Persons:	Philip E Stauffer; FAA//FSDO; Philadelphia, PA Chad Ballentine; AirLine Pilots Association; Herndon, VA Stephen B Keefer; Piedmont Airlines; Philadelphia, PA Julie Schell; Piedmont Airlines; Philadelphia, PA
Report Date:	June 21, 2010
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=69448

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).