National Transportation Safety Board
Aviation Incident Final Report

Location:	CHICAGO, IL	**Incident Number:**	CHI00IA037
Date & Time:	12/01/1999, 1431 CST	**Registration:**	N606AW
Aircraft:	British Aerospace BAE 146-200A	**Aircraft Damage:**	Minor
Defining Event:		**Injuries:**	1 Minor, 48 None
Flight Conducted Under:	Part 121: Air Carrier - Scheduled		

Analysis

The airplane collided with the terminal building at the O'Hare International Airport. The captain reported he used the procedures in the BAE 146 Pilot Operating Handbook, to transfer fluid between the green and yellow hydraulic systems while the airplane was parked at the gate. He stated he then set the parking brake and checked the hydraulic system pressure. The captain reported they completed the before start, starting engines, and after engine start checklists at which time he signaled to the ramp personnel to remove the chocks. He reported the airplane then started to roll forward. He stated the parking brake was set and all four engines were running. The captain reported he tried the green braking and emergency yellow brake systems, however, the airplane continued to move. He then selected the anti-skid switch to battery and positioned the thrust levers to fuel off. The airplane traveled approximately 50 feet prior to contacting the bottom of the upper level of the terminal and a lower level door at gate B-20C. Postincident inspection of the brakes, hydraulic system, anti-skid system, squat switches, and related electrical system components failed to reveal why the airplane would have moved with the parking brake set. The initiation of the rolling event was not captured on the DFDR. The airplane is designed so that the DFDR does not record when the parking brake is set. On December 10, 1999, the operator issued an Alert Bulletin, prohibiting flight crews from performing hydraulic system fluid transfers. On August 25, 2000, the operator issued another Alert Bulletin, once again allowing flight crews to perform hydraulic system fluid transfers. On September 1, 2000, another Alert Bulletin was issued once again prohibiting flight crews from performing hydraulic system fluid transfers.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: An undetermined failure in the hydraulic system, which resulted in the airplane's entire braking system becoming temporarily inoperative. A factor associated with the incident was the airport terminal building that was contacted by the airplane.

Findings

Occurrence #1: ON GROUND/WATER COLLISION WITH OBJECT
Phase of Operation: STANDING - ENGINE(S) OPERATING

Findings
1. (F) OBJECT - HANGAR/AIRPORT BUILDING
2. (C) HYDRAULIC SYSTEM - UNDETERMINED
3. LANDING GEAR,PARKING BRAKE - INOPERATIVE
4. LANDING GEAR,NORMAL BRAKE SYSTEM - INOPERATIVE
5. LANDING GEAR,EMERGENCY BRAKE SYSTEM - INOPERATIVE

Factual Information

On December 1, 1999, at 1431 central standard time, a British Aerospace BAE 146-200A, N606AW, operated by Air Wisconsin, as United Express flight 5545 collided with the terminal building at the O'Hare International Airport, Chicago, Illinois. One Air Wisconsin gate agent received minor injuries. The flight crew, 1 flight attendant, and 45 passengers on board the airplane were not injured. The airplane received minor damage, which was limited to the nose cone. Visual meteorological conditions prevailed and an IFR flight plan was filed. The 14 CFR Part 121 flight was originating at the time of the incident with a destination of Moline, Illinois.

The captain reported that while parked at the gate, prior to passenger loading, he noticed the green system hydraulic fluid level was lower then the yellow system hydraulic fluid level. He stated he used the procedures in the Air Wisconsin BAE 146 Pilot Operating Handbook (POH) to transfer fluid between the two systems. He stated he then set the parking brake and checked the hydraulic system pressure prior to accomplishing the before start checklist.

The captain reported they completed the Before Start, Starting Engines, and After Engine Start checklists at which time he signaled to the ramp personnel to remove the chocks. He reported the airplane then started to roll forward. He stated the parking brake was set and all four engines were running. The captain reported he switched to green braking and was still unable to stop the airplane. He then switched to the emergency yellow brake system and the airplane still continued to move. He continued to report that he selected the anti-skid switch to battery and positioned the thrust levers to fuel off. The airplane traveled approximately 50 feet prior to contacting the bottom of the upper level of the terminal and a lower level door at gate B-20C.

Prior to the arrival of the Federal Aviation Administration (FAA) and the National Transportation Safety Board (NTSB) investigators, Air Wisconsin maintenance personnel performed operational checks on both the parking brake and normal brake system. They reported that both systems functioned normally. In addition, they reported that the brakes operated normally when the airplane was towed to the maintenance hangar ramp. An FAA inspector also performed a parking brake functional test on his arrival and reported that the parking brake functioned normally.

On December 2, 1999, Air Wisconsin maintenance personnel, FAA inspectors, and the NTSB inspected N606AW. The brakes, hydraulic system, anti-skid system, squat switches, and related electrical system components were tested. In addition, functional brake tests were performed with the airplane on the maintenance ramp. The airplane and its components functioned normally during these tests. (See attached N606AW Inspection Notes.)

The anti-skid control box was removed from the airplane and shipped to the manufacturer, Dunlop Aviation Braking Systems, Coventry, England, for testing under the supervision of an inspector from the Air Accidents Investigation Branch in the United Kingdom. These tests revealed that Channels 1 & 2 were out of calibration. However, this condition was not relevant to the events of this incident. (See attached Anti-Skid Box test report.)

The cockpit voice recorder (CVR) and digital flight data recorders (DFDR) were removed from N606AW after the incident. Both recorders were sent to the NTSB, Office of Research and Engineering for readout. Examination of the CVR revealed the recording began at the first item of the After Start Checklist and continued for 31 minutes, 1 second. The recording included the impact and subsequent troubleshooting by maintenance personnel.

The landing just prior to the incident was identified on the DFDR. There are several areas of invalid data on the DFDR one of which corresponds with a power interruption on the CVR. The DFDR did not capture the beginning of the incident event sequence. According to the BAE 146 Aircraft Maintenance Manual, a mechanical linkage in the parking brake handle activates three microswitches. One of these microswitches switches off the DFDR. Therefore, the DFDR will not be recording when the parking brake is set. (See attached CVR and DFDR reports.)

On December 10, 1999, another Air Wisconsin flight crew reported a temporary brake failure on another BAE 146, N6068W. This occurrence took place at the Blue Grass Airport in Lexington, Kentucky. The captain of N608AW reported that he performed a hydraulic fluid transfer while at the gate. When the chocks were removed the airplane began to roll forward. The captain reported they used both the green and yellow hydraulic systems and that neither system would stop the airplane. He stated he turned the airplane and the brakes began to function normally. The cause of this loss of braking was not determined.

On December 10, 1999, Air Wisconsin issued Alert Bulletin #99-115, deleting the hydraulic fluid transfer procedures from the BAE 146 POH. The bulletin prohibited flight crews from performing hydraulic fluid transfers. On August 25, 2000, Air Wisconsin issued Alert Bulletin #00-07, once again allowing flight crews to perform the hydraulic fluid transfer procedures. On September 1, 2000, Alert Bulletin #00-08 was issued rescinding Alert Bulletin #00-07.

Pilot Information

Certificate:	Airline Transport; Commercial	**Age:**	, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land; Single-engine Sea	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--w/ waivers/lim.	**Last FAA Medical Exam:**	11/29/1999
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:	16691 hours (Total, all aircraft), 4273 hours (Total, this make and model), 178 hours (Last 90 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	British Aerospace	**Registration:**	N606AW
Model/Series:	BAE 146-200A BAE 146-20	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Transport	**Serial Number:**	E2033
Landing Gear Type:	Retractable - Tricycle	**Seats:**	86
Date/Type of Last Inspection:	11/27/1999, Continuous Airworthiness	**Certified Max Gross Wt.:**	91200 lbs
Time Since Last Inspection:		**Engines:**	4 Turbo Fan
Airframe Total Time:	27836 Hours	**Engine Manufacturer:**	Lycoming
ELT:	Installed, not activated	**Engine Model/Series:**	ALF-502R-5
Registered Owner:	WILMINGTON TRUST COMPANY	**Rated Power:**	6700 lbs
Operator:	AIR WISCONSIN	**Operating Certificate(s) Held:**	Flag carrier (121)
Operator Does Business As:	UNITED EXPRESS	**Operator Designator Code:**	AWAA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Unknown	**Condition of Light:**	Day
Observation Facility, Elevation:	ORD, 668 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	1356 CST	**Direction from Accident Site:**	0°
Lowest Cloud Condition:	Unknown / 0 ft agl	**Visibility**	10 Miles
Lowest Ceiling:	Overcast / 6000 ft agl	**Visibility (RVR):**	0 ft
Wind Speed/Gusts:	17 knots / 23 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	200°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	6°C / -6°C
Precipitation and Obscuration:			
Departure Point:	(ORD)	**Type of Flight Plan Filed:**	IFR
Destination:	MOLINE, IL (MLI)	**Type of Clearance:**	
Departure Time:	0000	**Type of Airspace:**	

Airport Information

Airport:	O'HARE INTERNATIONAL (ORD)	**Runway Surface Type:**	
Airport Elevation:	668 ft	**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	
Runway Length/Width:		**VFR Approach/Landing:**	

Wreckage and Impact Information

Crew Injuries:	3 None	**Aircraft Damage:**	Minor
Passenger Injuries:	45 None	**Aircraft Fire:**	None
Ground Injuries:	1 Minor	**Aircraft Explosion:**	None
Total Injuries:	1 Minor, 48 None	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	PAMELA S SULLIVAN	**Report Date:**	07/17/2001
Additional Participating Persons:	GERALD E FOX; SHILLER PARK, IL TOM WITTMAN; APPLETON, WI WARD ABBS; HARTLAND, WI		
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.ntsb.gov/pubdms/.		

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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. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available here.