Aviation Investigation Final Report

Location:	FLUSHING, New York	**Accident Number:**	NYC00LA040
Date & Time:	November 27, 1999, 10:30 Local	**Registration:**	N521DA
Aircraft:	Boeing 727-232	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	73 None
Flight Conducted Under:	Part 121: Air carrier - Scheduled		

Analysis

The B727 was dispatched with the APU inoperative. The captain elected to start all engines prior to pushback due to a short taxi. After pushback, and during a forward tow, a shear pin on the tow bar failed, and the airplane rolled into a tug. Examination of the tow bar revealed looseness in the head, and worn holes for the shear pins. Metallurgical examination of the shear pins found pre-existing cracking and the pins were softer than specified. The pushback operation was conducted by contract personnel. The failed tow bar had been inspected daily by contract personnel with no problems noted and it continued in use. A fleet wide campaign found 63 percent of the tow bars in need of maintenance. The investigation revealed the airline did not have a preventative maintenance program for their tow bars, or a program to train the contract personnel in inspections of the tow bars, and to monitor their inspections.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: was the use of a defective tow bar, due to the lack of an adequate inspection by contract personnel, the airlines lack of an adequate preventative maintenance program for the tow bars, and the lack of oversight by the airline on the contract personnel who inspected the tow bar. A factor was the softer than specified shear pins used in the tow bar.

Findings

Occurrence #1: ON GROUND/WATER COLLISION WITH OBJECT
Phase of Operation: TAXI - PUSHBACK/TOW

Findings
1. (C) MISC EQPT/FURNISHINGS - FAILURE
2. (C) SUPERVISION - INADEQUATE - COMPANY MAINTENANCE PERSONNEL
3. (C) CONDITION(S)/STEP(S) INSUFFICIENTLY DEFINED - COMPANY MAINTENANCE PERSONNEL
4. (F) INSUFF STANDARDS/REQUIREMENTS,OPERATION/OPERATOR - COMPANY/OPERATOR MGMT
5. (F) MATERIAL DEFECT(INADEQUATE QUALITY OF MATERIAL) - MANUFACTURER

Factual Information

On November 27, 1999, about 1030 eastern standard time, a Boeing 727-232, N521DA, operated by Delta Air Lines (DAL) as Delta Shuttle flight 1749, was substantially damaged during pushback from its gate at LaGuardia Airport (LGA), Flushing, New York. The 3 certificated pilots, a check airman, 4 flight attendants, 65 passengers, and 3 ground crew personnel were not injured. Visual meteorological conditions prevailed for the scheduled passenger/cargo flight that was destined for Ronald Reagan Washington National Airport (DCA), Washington, DC. An instrument flight rules (IFR) flight plan had been filed for the flight that was conducted under 14 CFR Part 121.

The airplane was parked at gate number 3, at the Marine Air Terminal. It was being dispatched with the auxiliary power unit (APU) inoperative. The three engines were started prior to the start of the pushback.

The cockpit was occupied by the captain, first officer, second officer, and a second officer check airman.

According to the captain:

"...A normal push-back commenced onto the company ramp. Initially, the tug pushed us straight back, and then it turned the aircraft approximately 90 degrees, tail pointing west...As the nose of the aircraft moved from left to right, simultaneously I heard 'set your brakes' from the tug driver as a 'crunching' sound emanated from the right side of the aircraft...."

According to the second officer check airman:

"...The backward movement [push] was then stopped, and the aircraft began a slight forward movement with the nose moving slowly to the right. Within a few seconds, the nose movement to the right accelerated, at which time the taxi director signaled to apply the brakes, and I heard the words 'Stop, Stop' several times...[the captain] immediately applied the brakes. At the same instant, a loud bang was heard emanating from the right side of the aircraft...."

Similar statements were received from the first and second officers.

There were three persons on the ground crew, two wing walkers, and the tug driver who was also in communication with the cockpit flight crew via the interphone.

According to the tug driver:

"...I pushed it back from gate #3 toward [taxiway] Alpha-Charlie and came to a full stop. I then

put the tractor in reverse and began the pull-forward. While making the turn toward the yellow taxi line I heard a 'pop'. I told the captain on the headset to 'set your brakes' several times, but the aircraft was already coming at me quickly since the engines were running. I stopped the tractor hoping it would stop the plane, but the plane bent the tow bar and hit the tractor. I was not at the turn limit when the shear-pin broke."

Both the left and right wing walkers reported they heard the shear pin break followed by the airplane striking the tug. The right side wing walker could see the first officer and signaled for him to set the brakes.

After electrical power was brought to the airplane, the engines were shut down, and the passengers exited the airplane through the rear air-stair door. The passengers were then escorted to the terminal.

The airplane was pushed back from the gate with hydraulic pressure removed from the nose wheel steering unit, and the torsion links connected. Two shear pins were installed on the tow bar to prevent nose wheel movement in excess of 78 degrees either side of center. An inspector from the Federal Aviation Administration (FAA) reported that one of the shear pins was fractured.

According to the Safety Board Materials Laboratory report, examination of the shear pins revealed, evidence of a pre-existing crack in the area of failure. Hardness testing on both shear pins revealed a lower level of hardness than specified by DAL.

The tow bar was forwarded to DAL Engineering Department in Atlanta, Georgia, for further examination. The examination was witnessed by an inspector from the FAA. According to a written report of the examination from DAL, the shear pin holes were elongated about 0.030 inches, and the tow bar was worn on the bottom of the head. In addition the head was loose on the tow bar.

At LGA, the Delta Shuttle was not co-located with the rest of the DAL flights. The ground handling was accomplished by contract personnel, who were not rated airframe and powerplant mechanics. DAL had developed and used a daily examination form for the condition of their tow bars. According to the form from LGA, tow bar 43677 had been examined daily, and continued in service with no problems noted. The investigation revealed that DAL did not have a preventative maintenance program for the tow bars, or a program in place to train the contract personnel on the proper inspection of the tow bars, and to monitor the inspections they conducted.

After the accident occurred, DAL conducted a fleet wide examination of their tow bars. According to data from the inspection, of 361 tow bars that were examined, 228 were found to have discrepancies that needed correction.

After the accident, the tug driver was given a toxicological examination in accordance

with the operators procedures. The examination was negative for drugs and alcohol.

The readout of the digital flight data recorder (DFDR) revealed the airplane had been on a heading of about 073 degrees, and in 3 seconds shifted to a heading of about 85 degrees where it remained until loss of power to the recorder. As the airplane arrived on the new heading of about 085 degrees, the longitudinal acceleration recorded a peak of -0.16 Gs. The time of the peak G was 20 minutes and 24 seconds. Although the accident occurred during a forward tow, there was insufficient data from the DFDR to define the transition from pushback to forward tow.

The cockpit voice recorder was listened to at the Safety Board Laboratory and found to contain 30 minutes of back ground noise along with some non-pertinent conversations.

According to the DAL B727 manual, the APU inoperative procedure was to start engines one and three prior to pushback. According to the DAL Ramp Service Manual, the APU inoperative procedure was to start engines one and two. According to the expanded checklist for the Boeing 727, a pilot has the option of starting three engines at the gate. According to the DAL safety representative who participated in the accident, all engines were started due to the close proximity to the departure runway which would have given time for the proper warm-up of the engines.

According to Boeing, each engine produces 800 pounds of thrust at idle. The minimum force necessary to keep an airplane in motion once it is rolling was 0.016 times the weight of the airplane. The brake away force to initiate movement was estimated at 1.5 times the force necessary to keep it moving. The computed takeoff weight was 142,740 pounds.

Pilot Information

Certificate:	Airline transport; Flight engineer	**Age:**	45,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:**	No
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	August 25, 1999
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	7561 hours (Total, all aircraft), 1111 hours (Total, this make and model), 168 hours (Last 90 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Boeing	**Registration:**	N521DA
Model/Series:	727-232 727-232	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Transport	**Serial Number:**	21472
Landing Gear Type:	Retractable - Tricycle	**Seats:**	160
Date/Type of Last Inspection:	November 24, 1999 Continuous airworthiness	**Certified Max Gross Wt.:**	185200 lbs
Time Since Last Inspection:	9 Hrs	**Engines:**	3 Turbo jet
Airframe Total Time:	61269 Hrs	**Engine Manufacturer:**	P&W
ELT:	Not installed	**Engine Model/Series:**	JT8D-15
Registered Owner:	DELTA AIR LINES	**Rated Power:**	15500 Lbs thrust
Operator:		**Operating Certificate(s) Held:**	Flag carrier (121)
Operator Does Business As:		**Operator Designator Code:**	DALA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	LGA ,22 ft msl	**Distance from Accident Site:**	
Observation Time:	10:51 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Scattered / 2500 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Broken / 14000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	17 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	320°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	12°C / 7°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	(LGA)	**Type of Flight Plan Filed:**	IFR
Destination:	WASHINGTON , DC (DCA)	**Type of Clearance:**	None
Departure Time:	00:00 Local	**Type of Airspace:**	

Airport Information

Airport:	LA GUARDIA AIRPORT LGA	**Runway Surface Type:**	
Airport Elevation:	22 ft msl	**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	8 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	65 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	73 None	**Latitude, Longitude:**	40.7691,-73.869293(est)

Administrative Information

Investigator In Charge (IIC):	Hancock, Robert
Additional Participating Persons:	DENNIS SCARFEO; GARDEN CITY , NY JOHN R POTTHAST; ATLANTA , GA
Original Publish Date:	December 4, 2000
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=47839