Aviation Investigation Final Report

Location:	Boston, Massachusetts	**Accident Number:**	NYC01LA077
Date & Time:	February 6, 2001, 12:00 Local	**Registration:**	N1457B
Aircraft:	Fokker F28 MK 0100	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	30 None
Flight Conducted Under:	Part 121: Air carrier - Scheduled		

Analysis

During engine start, while being pushed back, both engines went to a high power setting. The airplane pushed forward against the tow bar, sheared a pin, bent the tow bar, and struck the tug. Before engine start, maintenance personnel had conducted an automated check which included automatic movements of the control wheel and throttles. The flight crew returned to their seats while the test was being conducted. At the completion of the test, the airplane was returned to service and maintenance personnel departed the cockpit. The captain initiated the BEFORE STARTING ENGINES checklist without either pilot first completing a cockpit flow setup as required by company procedures. The checklist was then interrupted by a cockpit visitor and a non-pertinent conversation took place for 3 1/2 minutes. When the checklist was resumed, several items had been missed. As the checklist was continued, the call out THRUST LEVERS was made by the first officer, and the correct response of CLOSED was given by the captain. Push back was initiated, and the captain verbalized starting the first engine as required by the checklist. As the first engine was being started, the captain initiated another non-pertinent conversation with the first officer. The second engine was then started without verbalization as required by company checklist procedures. Although company checklist procedures made both pilots responsible for ensuring a normal start, neither pilot detected that the engines were accelerating above normal idle. According to follow-up testing, the engines accelerated to a power setting that corresponded to the last position of the throttles at the completion of the automated test by maintenance.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the failure of the flight crew to follow the checklist prior to engine start, and their subsequent diverted attention during engine start.

Findings

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

Findings
1. (C) CHECKLIST - NOT FOLLOWED - FLIGHTCREW
2. (C) DIVERTED ATTENTION - FLIGHTCREW

Factual Information

On February 6, 2001, about 1200 eastern standard time, a Fokker F28 Mk 0100, N1457B, operated by American Airlines as flight 1813, was substantially damaged during engine start and pushback, at Logan International Airport, Boston, Massachusetts. The 2 certificated airline transport pilots, 2 flight attendants, and 26 passengers were not injured. An instrument flight rules (IFR) flight plan had been filed, but not activated for the scheduled passenger flight. Visual meteorological conditions prevailed for the flight that was operated under 14 CFR Part 121.

The flight crew flew the airplane from Washington, DC, to Boston. They reported that during the approach into Boston, they experienced auto-throttle, auto-pilot, and stabilizer trim faults. The discrepancies were written up and maintenance was notified. After arrival at the gate, the captain went inside to prepare for the return flight to Washington. The first officer conducted a walk around inspection.

To clear the discrepancies prior to the next flight, maintenance personnel initiated a, "40 Full System Check." The check was conducted from a test panel located in the cockpit, and included multiple automatic movements of the control wheel and throttles. While the test was in progress, the pilots returned to the cockpit and sat in their seats. At the completion of the 40 Full System Check, maintenance personnel cleared the discrepancies and returned the airplane to service.

According to a transcript of the cockpit voice recorder, following the departure of the maintenance personnel, and with both pilots in their seats, the captain initiated the Before Starting Engines checklist at 1151:43.

At 1151:58, the first officer called, "fuel panel" however, the captain did not respond to the challenge and instead stated, "let's un, before I forget, lets update…" Four seconds later, the gate agent came to the cockpit and asked if everything was fixed. A discussion with the gate agent ensued.

At 1152:55, the captain said, "all right, now, where were we?", and the first officer replied, "okay, we're at I-R-S's" (Inertial Reference System). This was the item prior to the fuel panel. Both pilots then started to address their FMS (Flight Management System) setup.

At 1153:16, the company's Boston chief pilot arrived at the cockpit door, and the captain introduced himself.

From 1153:16 through 1156:44, the chief pilot, captain, and first officer engaged in a conversation not related to the checklist. The chief pilot departed at 1156:44, after which, the

flight crew entered into a discussion about the FMS. During this time, there were also momentary conversations with the gate agent.

At 1157:54, the tug driver established contact with the cockpit by interphone.

At 1158:01, the captain called, "brakes released", and asked for the checklist.

The checklist was resumed at 1158:05, with first officer stating, "where were we, rudder pedals and seats, FMS?", to which the captain replied, "checked." The fuel panel, which had previously been called by the first officer, was not answered by the captain. In addition, the following items, listed below were also not recorded on the CVR as either being called or responded to:

Pressurization
Probe and Window Heat
Emergency Lights
FMP [Flight Mode Panel]
EFIS [Electronic Flight Information System]
Altimeters
Gear Selector/Lights

At 1158:09, the first officer called, "thrust levers", and the captain replied, "closed."

From 1158:14 through 1158:52, the captain and first officer engaged in a discussion about the FMS again. The checklist resumed at 1158:53.

At 1159:44, the first officer radioed Boston Clearance Delivery for pushback and it was approved.

As the pushback was initiated, there was a further discussion between the captain and first officer about the FMS setup.

Prior to engine start, the Before Starting Engines, Five Minutes Prior To Departure, and Prior to Engine Start Or Push-Out checklists had been completed, except for the previously mentioned exclusions.

At 1201:57, the captain stated, "cleared to start.", followed by, "all right, number one." The CAM (cockpit area microphone) recorded several clicks similar to start switch activation.

At 1202:10, the captain initiated a conversation not related to engine starting with the first officer.

The second engine was started without verbal comment, while the conversation between the captain and first officer continued.

At 1202.56, the captain stated, "kay, engine anti-ice on."

At 1203:00, the CAM recorded the sound of several irregular bumps.

At 1203:01, the captain stated, "whoa".

At 1203:02, the CAM recorded numerous sounds of impact lasting for four seconds.

At 1203:06, the captain stated, "we're done."

The engines were shutdown, and stairs were brought to the airplane for the passengers to deplane.

In a follow-up telephone interview, the captain reported that he elected to start both engines while being pushed back, and anticipated a 90-degree turn. The left engine was started first, followed by the right engine. The captain reported that he saw the tug moving to the left of the airplane's nose and assumed the airplane was still under control of the tug driver. He then felt a "ratcheting motion", after which, the airplane stopped. He then shut down both engines. The captain reported his feet were off the rudder pedals during the pushback, and he did not apply brakes until after the airplane had stopped.

The captain also reported that after the occurrence, a ground support person climbed up on the tug and told him that the airplane had struck the pushback tug, and that both engines had been at high power. The captain reported that he thought the throttles were at idle and then touched them, and was surprised that they moved to the idle position. He did not remember the amount of movement.

The captain further reported that he normally checked that the throttles were closed three different times prior to engine start. The first time would be as he entered the cockpit seat, the second time would be during the cockpit flow, prior to reading the checklist, and the third time would be during the checklist. He added that he could not do the first two items because the 40 Full System Check was taking place when he entered the cockpit and took his seat.

The first officer reported that she remembered seeing the throttle positions matched as the number one engine accelerated, and then she diverted her attention to the number two engine gauges as it was being started.

Both pilots reported that they were dividing their time between inside cockpit scans and outside due to the tight maneuvering space. In addition, both pilots believed that the engine starts were normal, and that the throttles had been closed during start.

The flight crew also reported that they were on the third day of a three-day sequence. They had never flown together before this sequence. They had gone on duty at 0830, and been off duty since 1838 on the preceding day. They had made one previous flight during the day, on

the date of the accident.

According to the preface on the checklist:

"The items on the Before Starting Engines checklist will have previously been or will be accomplished by the appropriate crewmember(s) as indicated by the duty assignment column."

"This checklist is accomplished by challenge and response. The First Officer will read the challenge portion. The Captain will respond aloud to all items ensuring accomplishment of all checks and items…."

Under duty assignments, the captain was responsible for ensuring the thrust levers were closed prior to initiating the checklist.

On the Starting Engines Procedures, the captain was expected to verbalize, "Ready to start No 1(2) engine."

Under the duty assignments during engine start, the following responsibility was found for both the captain and first officer:

"Monitor N1, N2, TGT, Fuel Flow, and Oil Pressure as engine accelerates until stabilized at idle RPM."

A review of the digital flight data recorder (DFDR) by the Safety Board revealed that as the left engine was started, it stabilized with the following settings: N1 66 percent; N2 84 percent, EPR 1.33. The start sequence on the right engine was initiated while the left engine was still accelerating. As the right engine was started, and accelerated toward a similar power setting, the longitudinal acceleration changed from rearward to forward, after which the airplane stopped abruptly with no brake pressure applied.

At the request of the Safety Board, the mechanic who performed the 40 Full System Test, was asked to repeat the same test on the accident airplane. The test was conducted under the supervision of the Federal Aviation Administration (FAA), and American Airlines personnel. The testing revealed that at the completion of the maintenance test, the throttles remained advanced at the 23-degree position, a mid-range position. American Airlines maintenance procedures did not require the throttles to be returned to the idle position at the completion of the maintenance test.

After the test, the throttles were retarded to the idle position, and both engines were started. At idle, the following readings were recorded: N1 23 percent, N2 52 percent, EPR 1.03. The throttles were then advanced to match the readings obtained from the DFDR. The throttle position was 23 degrees, the same position the throttles had been left, at the completion of the maintenance test.

According to personnel from American Airlines and an inspector from the FAA, the linkage between the throttles in the cockpit, and the fuel control units on the engines consisted of control cables and torque tubes. They further stated that there was a direct linkage between the throttles in the cockpit and the fuel control unit on each engine, and any change in engine power would be accompanied by a corresponding change in throttle position in the cockpit.

Further, examination of the airplane revealed the right side shear pin on the tow bar had sheared. The tow bar had been bent against the side of the tug, and the lower fuselage forward of the nose landing gear was crushed. Further examination of the crushed area on the fuselage revealed several broken stringers and ribs in the area, and the forward pressure bulkhead was wrinkled on the lower half. All the ground personnel interviewed reported the engines were at a higher power setting than idle. They also reported the ramp was mostly dry with some wet areas, but no ice, and the temperature was 4 degrees Celsius.

The pilot's were negative for drugs in a company-administered test. No alcohol testing was accomplished.

Pilot Information

Certificate:	Airline transport; Commercial; Flight engineer; Flight instructor	**Age:**	54,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):		**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	October 11, 2000
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	July 24, 2000
Flight Time:	10000 hours (Total, all aircraft), 1600 hours (Total, this make and model), 4000 hours (Pilot In Command, all aircraft), 200 hours (Last 90 days, all aircraft), 70 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Co-pilot Information

Certificate:	Airline transport; Commercial; Flight engineer; Flight instructor	**Age:**	34,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 multi-engine; Airplane single-engine	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	December 12, 2000
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	February 29, 2000
Flight Time:	4600 hours (Total, all aircraft), 600 hours (Total, this make and model), 1550 hours (Pilot In Command, all aircraft), 140 hours (Last 90 days, all aircraft), 65 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Fokker	**Registration:**	N1457B
Model/Series:	F28 MK 0100	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Transport	**Serial Number:**	11469
Landing Gear Type:	Retractable - Tricycle	**Seats:**	94
Date/Type of Last Inspection:	September 9, 2000 Continuous airworthiness	**Certified Max Gross Wt.:**	98000 lbs
Time Since Last Inspection:	864 Hrs	**Engines:**	2 Turbo fan
Airframe Total Time:	18871 Hrs at time of accident	**Engine Manufacturer:**	Rolls-Royce
ELT:	Not installed	**Engine Model/Series:**	Tay 650-15
Registered Owner:	American Airlines, Inc.	**Rated Power:**	15000 Lbs thrust
Operator:		**Operating Certificate(s) Held:**	Flag carrier (121)
Operator Does Business As:	American Airlines	**Operator Designator Code:**	AALA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	BOS,20 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	11:54 Local	**Direction from Accident Site:**	0°
Lowest Cloud Condition:	Scattered / 4500 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	15 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	280°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.73 inches Hg	**Temperature/Dew Point:**	4°C / 1°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Boston, MA (BOS)	**Type of Flight Plan Filed:**	IFR
Destination:	Washington, DC (DCA)	**Type of Clearance:**	None
Departure Time:	12:00 Local	**Type of Airspace:**	Unknown

Airport Information

Airport:	Logan International BOS	**Runway Surface Type:**	Asphalt
Airport Elevation:		**Runway Surface Condition:**	Dry
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	4 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	26 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	30 None	**Latitude, Longitude:**	42.368331,-71.014999

Administrative Information

Investigator In Charge (IIC):	Hancock, Robert
Additional Participating Persons:	Kevin Cahill; Federal Aviation Administration - Boston FSFO; Boston, MA John Darbo; American Airlines; Dallas, TX
Original Publish Date:	September 26, 2001
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=51453