NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF AVIATION SAFETY
WASHINGTON, D.C. 20594

September 12, 2002

POWERPLANTS GROUP CHAIRMAN'S FACTUAL REPORT

NTSB ID No.: DCA02MA054

A. ACCIDENT

Location: Tallahassee, Florida

Date: July 26, 2002

Time: 0537 eastern daylight time (EDT)

Aircraft: Boeing 727-232F, N497FE, Federal Express flight 1478

B. POWERPLANTS GROUP

Group Chairman:	Gordon J. Hookey National Transportation Safety Board Washington, D.C.
Member:	Paul Gluszek Federal Express Memphis, Tennessee
Member:	Stephen Sheely Pratt & Whitney East Hartford, Connecticut

C. SUMMARY

On July 26, 2002, at 0537 EDT, Federal Express flight 1478, a Boeing 727-232F, N497FE, crashed while on short final approach to runway 09 at the Tallahassee Regional Airport, Tallahassee, Florida. The airplane was on short final approach, configured for landing, when it descended into the trees along the approach and then touched down in the field just past the tree line. The airplane skidded across the field and stopped approximately ½ mile short of the runway to the right of the runway centerline, opposite the direction of travel. The airplane was destroyed by impact forces and fire. Night-time visual meteorological conditions prevailed at the time of the crash. The airplane was operating on an instrument flight rules flight plan under the provisions of 14 Code of

Federal Regulations Part 121 as a regularly scheduled cargo flight from Memphis, Tennessee to Tallahassee. The three flight crewmembers were injured.

The airplane had Pratt & Whitney (P&W) JT8D-15 engines installed in the No. 1 and 2 positions and JT8D-15A engine installed in the No. 3 position. The examination of the three engines did not reveal any evidence of an uncontainment, case rupture, preimpact malfunction, or in-flight fire. All three engines had damage to the fan blades consistent with engine rotation. There was a area of scorched grass directly in back of the No. 2 engine. Additionally, there was an area just before the point where the airplane touched down where the vegetation was bent over flat opposite the airplane's direction of travel.

D. DETAILS OF INVESTIGATION

1. Engine description

The No. 1 and 2 engines installed on N497FE were P&W JT8D-15's and the No. 3 engine was a JT8D-15A. The JT8D-15 and –15A engines are dual-spool, low-bypass, axial-flow fully-ducted turbofans that feature a two-stage fan, four-stage low pressure compressor, seven-stage high pressure compressor, nine-chamber can-annular combustor, single-stage high pressure turbine, and three-stage low pressure turbine. The JT8D-15 and –15A engines have a takeoff thrust rating of 15,500 pounds, flat-rated to 84°F.[1]

2. Engine information

Federal Express provided the following information about the three engines installed on N497FE.

	Engine		
	1	2	3
Model	-15	-15	-15A
Serial No.	700303	687651	687563
Total time (hours)	30,380	53,440	21,047
Total cycles	20,850	30,805	16,366
Time since last shop visit (hours)	349	2,838	931
Cycles since last shop visit	273	2,418	777
Location of last shop visit	Celma[2]	Celma	TAP[3]
Date of last shop visit	2/12/02	3/6/00	1/11/01

[1] Flat-rated to a specific temperature indicates the engine will be capable of attaining the rated thrust level up to the specified inlet temperature.
[2] GE Engine Services Celma, Petrópolis, RJ, Brazil
[3] TAP Air Portugal, Lisbon, Portugal

Date of installation	4/13/02	5/16/00	5/7/01
Time since installation (hours)	195	1,502	931
Cycles since installation	148	1,298	777
Location of installation	IND[4]	PAE[5]	IND

3. No. 1 Engine Serial No. 700303

The No. 1 engine remained attached to the airplane. The cowlings, which were still locked and closed, were still in place. The cowlings were sooted along their full length. The underside of the cowling from the inlet rearward was torn open exposing the engine. The inlet duct was sooted and the acoustic panel was delaminated at 6 to 9 o'clock.[6]

The engine was complete and intact from the inlet cowl to the thrust reverser. There was no evidence of an uncontainment or inflight fire. After the cowlings were removed, the fan cases were found to be sooted back to the compressor intermediate case.

Photo 1: No. 1 engine with cowling removed

All of the fan blades were in place and intact. Many of the fan blades had soft body impact damage[7] on the leading edges. The leading edge tip corners were broken off or bent and curled opposite the direction of rotor rotation.[8] Several fan blades had organic material and dirt pressed against the underside of the midspan shrouds.

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[4] Indianapolis, Indiana
[5] Paine Field, Everett, Washington
[6] All references to position or directions, as referenced to the clock, will be as viewed from the rear, looking forward, unless otherwise specified.
[7] Soft body impact damage is characterized by the large radius of curvature of the deformation to the blade, typically a fan blade. Soft body impact damage can result from impacts with pliable objects such as birds, ice slabs, tire rubber, wood, and plastic objects.
[8] The JT8D-15 and -15A engines rotate clockwise as viewed from the rear.

There was one fan blade that had the mid span shrouds shingled.[9] The fan rotor could be rotated by hand.

Photo 2: No. 1 engine's fan blades showing soft body impact damage and organic material on underside of mid span shrouds

The fourth stage turbine blades were all in place and intact. The tailcone and mixer were still in place. There was no metal spray on the fourth stage turbine blades, tailcone, mixer, or tailpipe.

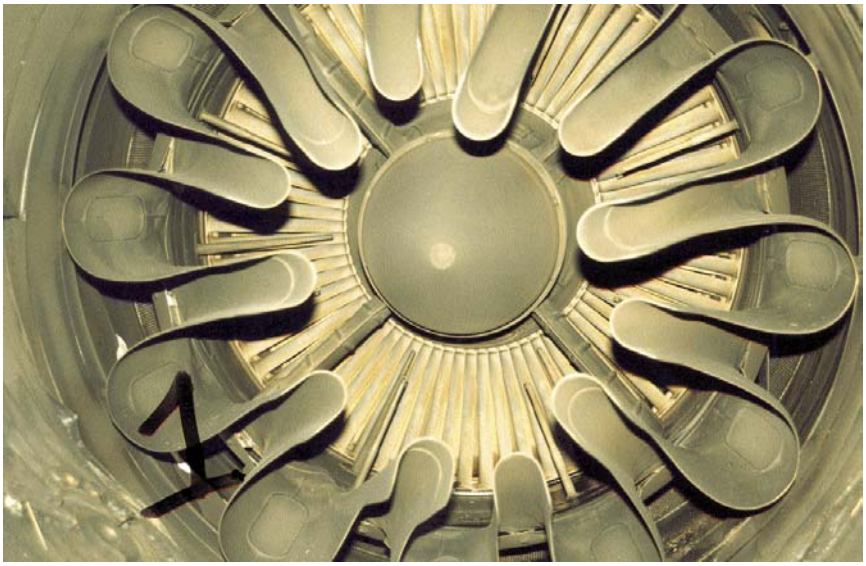

Photo 3: No. 1 engine's 4th stage turbine blades showing no damage

[9] Shingled is the condition of the mid span shroud overlapping the shroud of an adjacent blade in lieu of abutting at the contact surfaces.

The thrust reverser buckets were stowed and there was no dirt or organic material in the cascades.

The gearbox was broken and partially detached from the engine. The fuel control and fuel pump were separated from the gearbox and wedged between the fan duct and cowling at 2:30 to 3:00 o'clock. The throttle linkage was severed.

4. No. 2 Engine Serial No. 687651

The No. 2 engine was still in the tail of the airplane, but was separated from the airplane at the cone bolts and was laying on the ground on its left side. There was a 14-foot long wedge-shaped area of scorched vegetation extending rearward from the engine's tailpipe.

Photo 4: Area of scorched grass in back of No. 2 engine's exhaust

The engine was complete from the inlet case to the thrust reverser. There was no evidence of an uncontainment and the engine did not have any fire damage.

Photo 5: No. 2 engine with cowl removed

All of the fan blades were in place and intact. Most of the fan blades had the leading edge tip corners bent and curled opposite the direction of rotor rotation. None of the fan blade mid span shrouds were shingled. The fan rotor could be rotated by hand.

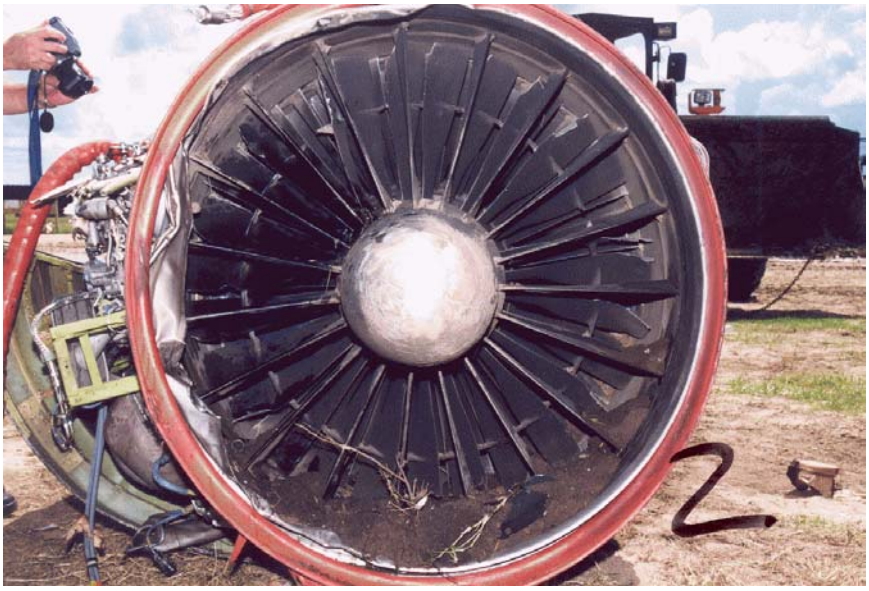

Photo 6: No. 2 engine's fan blades showing curled leading edges at the tips (P&W)

The fourth stage turbine blades were all in place and intact. The tailcone and mixer were still in place. There was no metal spray on the fourth stage turbine blades, tailcone, mixer, or tailpipe.

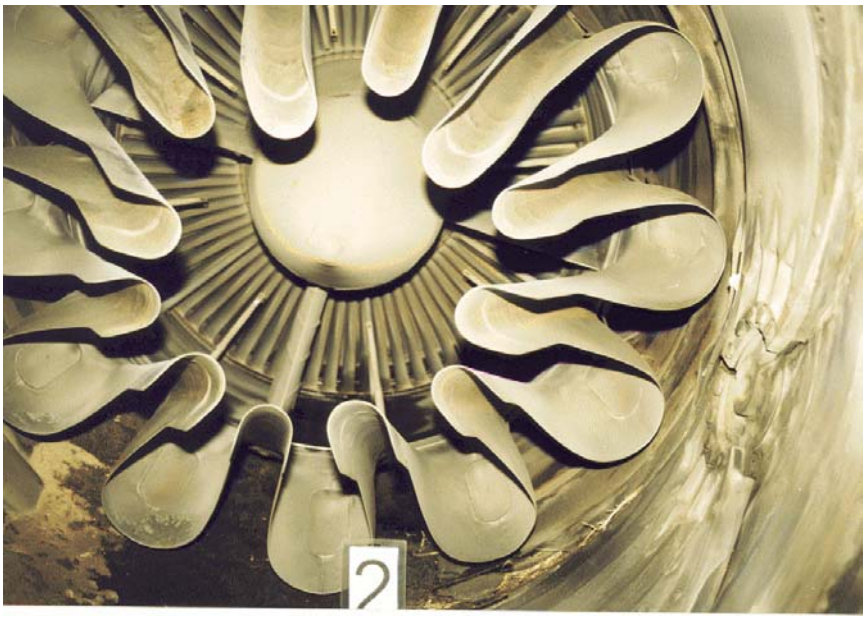

Photo 7: No. 2 engine's 4th stage turbine blades showing no damage

The thrust reverser buckets were stowed and there was no dirt or organic material in the cascades.

The gearbox assembly remained attached to the engine and all of the accessories remained attached to the gearbox. The throttle linkage was severed, but the fuel control unit throttle arm was in a part power position, 1 ¼-inches from the idle stop. There was fuel in the filter bowl and a sample was collected to be analyzed. Refer to Section 7 for the results of the fuel tests.

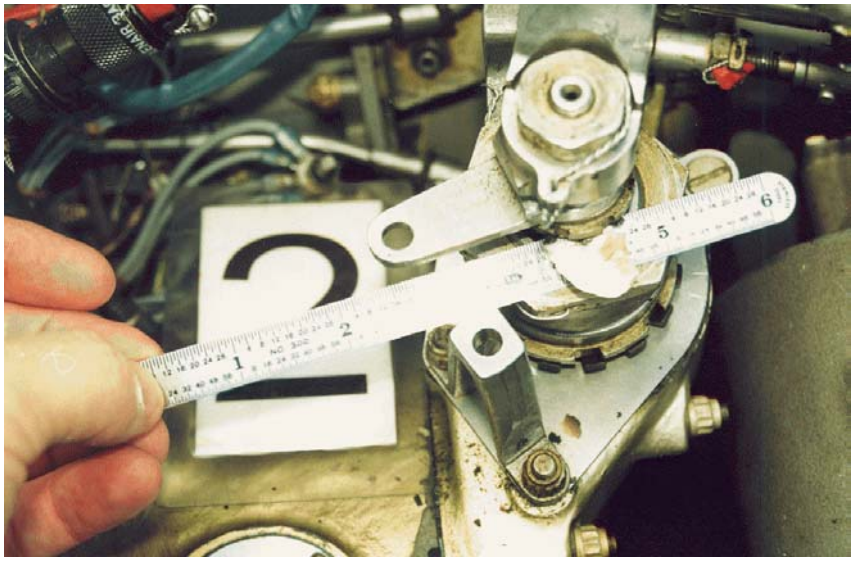

Photo 8: No. 2 engine's fuel control throttle arm 1 ¼-inches from idle stop

5. No. 3 Engine Serial No. 687563

The No. 3 engine was separated from the airplane at the cone bolts. The engine was laying on its right side directly against the right side of the fuselage adjacent to the forward cargo door with the front of the engine facing in the same direction as the airplane.

Photo 9: No. 3 engine on right side of fuselage

The inlet duct, the lower cowl, and the forward portion of the upper cowl were missing. The aft portion of the lower cowl remained on the engine. The engine was complete from the inlet case to the thrust reverser. There was no evidence of an uncontainment and the engine did not have any fire damage.

All of the fan blades were in place and intact. All of the fan blades had soft and hard body impact damage[10] to the leading edges. In addition, the leading edge tip corners were bent and curled opposite the direction of rotor rotation. None of the fan blade mid span shrouds were shingled. There was one fan blade that had a piece of metal that was foreign to the engine embedded in the leading edge. The fan rotor could not be rotated.

[10] Hard body impact damage is characterized by a serrated appearance and deep cuts or tears to the airfoil's leading and trailing edges. Hard body impact damage can result from the impact with metal parts, concrete, asphalt, and rocks.

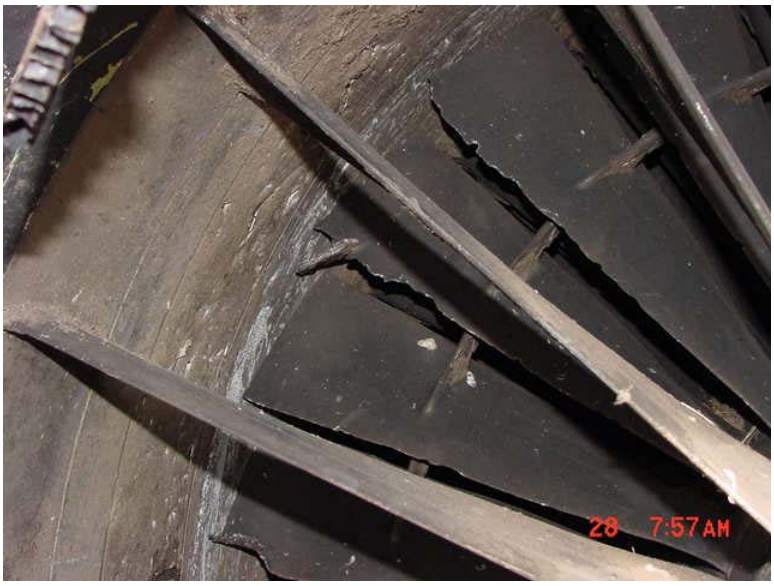

Photo 10. No. 3 engine's fan blades showing soft body impact damage and metallic object embedded into leading edge of one blade (FedEx)

The fan exit duct was cracked circumferentially 360 degrees around between D and E flanges.[11] The fracture was along an irregular line and the fracture surface was coarse, grainy, and at a 45 degree angle to the surface of the duct.

The fourth stage turbine blades were all in place and intact. The tailcone and mixer were still in place. There was no metal spray on the fourth stage turbine blades, tailcone, mixer, or tailpipe.

Photo 11: No. 3 engine's 4th stage turbine blades showing no damage

[11] Gas turbine engine convention is to identify case flanges alphabetically from the front of the engine going rearward. Refer to Appendix 1 for a diagram of a JT8D engine identifying case flanges.

The thrust reverser buckets were stowed and there was no dirt or organic material in the cascades.

The gearbox was separated from the engine and was found about 20 feet behind the engine along the right side of the fuselage in the area of where the right wing would have been located. The gearbox was broken up.

6. Airplane touchdown area

There was a large area just before the point where the airplane touched down beyond the treeline where the trees had been knocked down and the vegetation on the ground was bent over flat opposite the airplane's direction of travel.

Photo 12: Area on ground just before spot where airplane touched down where vegetation was bent over flat opposite the direction of travel of the airplane (Boeing)

7. Fuel tests

Fuel samples were taken from the No. 2 engine's filter bowl plus FedEx provided fuel samples from the No. 1 and 2 sumps and filters from the cart that serviced N497FE before it departed Memphis for Tallahassee.

The results of the fuel tests[12] from N497FE's No. 2 engine fuel filter bowl were:

Gravity, API@60°F	43.3
Flash point, Tag closed cup, °F	125
Freezing point, °C	-48.0

The results of the fuel tests from the sumps and filters of the cart that serviced N497FE were:

	Sump 1	Filter 1	Sump 2	Filter 2
Gravity, API@60°F	43.6	43.6	43.6	43.6
Flash point, Tag closed cup, °F	122	124	122	123
Freezing point, °C	-49.5	-48.0	-50.5	-49.5
Distillation, IBP, °F	343.2	345.5	343.6	341.9
Rcvd, 10 percent, °F	365.0	366.4	365.8	364.3
Rcvd, 50 percent, °F	407.9	408.8	408.0	408.6
Rcvd, 90 percent, °F	472.4	473.2	472.1	474.3
Rcvd, 95 percent, °F	487.9	488.0	487.4	490.4
End point	515.1	513.1	512.2	517.9
Recovery, vol percent	99.0	99.3	99.0	98.7
Residue, vol percent	1.0	0.6	1.0	1.0
Loss, vol percent	0.0	0.1	0.0	0.3

For further details, refer to Appendix 2.

Gordon J. Hookey
Powerplants Group Chairman

[12] Because of the small amount of fuel that was available within the No. 2 engine's fuel filter bowl, the only tests that could be performed were specific gravity, flash point, and freezing point.

APPENDIX

1. Diagram of JT8D engine identifying case flanges

2. Saybolt Laboratory Certificates of Analysis on tests on fuel from No. 2 engine and No. 1 and 2 sumps and filter vessels on cart that serviced N497FE