



National Transportation Safety Board Aviation Accident Final Report

Location:	WINDSOR LOCKS, CT	Accident Number:	NYC98FA062
Date & Time:	01/21/1998, 2123 EST	Registration:	N15827
Aircraft:	Aerospatiale ATR-42-320	Aircraft Damage:	Substantial
Defining Event:		Injuries:	1 Minor, 38 None
Flight Conducted Under:	Part 121: Air Carrier - Scheduled		

Analysis

During the landing roll, a fire erupted in the right engine. The airplane was stopped on the runway, the engines were shut down, and the occupants evacuated. The investigation revealed that one of three studs used to hold the fuel filter on the fuel/oil heat exchanger had pulled out of the housing. This allowed fuel to spill into the engine bay and come in contact with hot engine surfaces. The installed unit had accumulated about 1,000 hour since overhaul. Examination of the unit revealed the stud had pulled out of an oversized lug hole. Examination of the overhaul manual published by the component manufacturer revealed insufficient information on procedures for working with the lug holes and how to ensure the lug holes were properly drilled and the studs properly inserted in the lug holes.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The improper overhaul of lug holes on the fuel/oil heat exchanger. A factor was the lack of direction contained in the manufacturer's overhaul manual for working with the lug holes.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: LANDING - ROLL

Findings

1. (C) FUEL SYSTEM,FILTER - CROSS/STRIPPED THREADED
2. (C) MAINTENANCE,OVERHAUL - IMPROPER - OTHER MAINTENANCE PERSONNEL
3. (F) CONDITION(S)/STEP(S) INSUFFICIENTLY DEFINED - MANUFACTURER
4. (C) FUEL SYSTEM,FILTER - FAILURE,TOTAL

Occurrence #2: FIRE
Phase of Operation: LANDING - ROLL

Factual Information

HISTORY OF FLIGHT

On January 21, 1998, at 2123 eastern standard time, an Aerospatiale ATR-42-320, N15827, operated by Continental Express as Flight 3332, was substantially damaged during an engine fire after landing at Bradley International Airport, Windsor Locks, Connecticut. There were no injuries to the 2 certificated pilots, or 36 passengers. The flight attendant received minor injuries. Visual meteorological conditions prevailed for the scheduled flight, which originated from Newark, New Jersey, about 2045. Flight 3332 was operated on an instrument flight rules (IFR) flight plan, and was conducted under 14 CFR Part 121.

In a written statement, the captain reported:

"...Upon touchdown [the first officer]...brought the power levers back to the REVERSE position to slow the aircraft, at which time we both heard a loud bang noise from the right side of the aircraft, and noticed a bright orange glow on the ground outside. As we slowed I heard several secondary bangs coming from the right side of the aircraft, and continued to see the orange glow. We stopped the aircraft on the runway and set the parking brake at which time we received a warning from the panel advising that engine #2 was on fire. This was the first time that the warning sounded. We received no fire warning upon landing or throughout the rollout up to this point. At this time I brought the power levers to Ground Idle as [the first officer]...brought the condition levers back to the FUEL SHUT OFF position. [The first officer]...pulled the number two-engine fire handle and I pulled the number one engine fire handle. [The first officer]...then discharged the squibs for engine number two in an attempt to extinguish the fire. The fire did not go out as a result of this effort. At this time [the first officer]...exited the cockpit to assist with the evacuation as I called for the evacuation to the left side of the aircraft. I continued securing the cockpit. After the cockpit was secured, I exited the cockpit and passed through the cabin ensuring that all passengers had exited the aircraft. I followed the Flight Attendant out the rear main cabin door, and advised all of the passengers to leave the area and head toward the terminal and away from the aircraft. Through the evacuation, the right side of the aircraft continued to burn, as well as a pool of jet fuel that had spilled out of engine number 2...."

The flight attendant in the rear of the airplane opened the left side main cabin door and commenced evacuating the passengers. Smoke started to fill the cabin. A non-revenue company pilot, seated in the forward left side seat, opened the forward left side fuselage emergency exit. He exited the airplane and then assisted passengers as they exited. The first officer exited via the left side emergency exit, and the captain who was last out of the airplane exited through the main cabin door.

The fire was extinguished by airport firefighters.

The accident occurred during the hours of darkness at 41 degrees, 56 minutes north latitude, and 72 degrees, 41 minutes west longitude.

FLIGHT RECORDERS

The airplane was equipped with a cockpit voice recorder (CVR) and digital flight data recorder (DFDR). Both units were removed and forwarded to the Safety Board Laboratory in Washington, DC for evaluation. The cockpit voice recorder did not provide any information

that was not obtainable elsewhere and a transcript was not prepared. The flight data recorder was examined and report prepared.

WRECKAGE AND IMPACT INFORMATION

Examination of the right engine area disclosed fire damage to the right engine cowling, and to the right trailing edge wing and wing flap. The wing flaps were set at 30 degrees. Several wires along the aft spar were burned, and examination of the rear spar revealed it had been warped about 1/8 inch.

The airplane was equipped with two Pratt & Whitney of Canada (PWC) PW121 series engines. A fuel/oil heat exchanger was located on the left side of each engine, about halfway back from the nose. A fuel filter was part of the heat exchanger. On the right engine, one of three studs used to hold the nuts that secure the filter cover to the heat exchanger was pulled out, and the filter housing was bent away from its fitting about 1/2 inch. The remaining two studs were found to be partially extracted from their holes. The inside of the filter housing, which contained fuel, was exposed.

FIRE

The pilots reported that they were not aware of a fire until after touchdown. Examination of the engine revealed that, in the area of the fuel leak, there were no fire detectors. However, there was ambient air flow through that portion of the engine, and it exited around the exhaust stack on the engine.

TESTS AND RESEARCH

A Safety Board Powerplants Group was appointed to assist in the investigation. According to the Chairman's report:

"...The disassembly and inspection of the fuel heater assembly commenced in the presence of the Powerplant Group on February 2, 1998. The top several threads in the hole where the stud disengaged were completely destroyed. The two other filter cover studs were found partially disengaged in the housing but were bent. All three filter cover stud holes showed indications that the studs were cross-threaded into the holes....."

Examination of the holes (lugs) that the studs fit into revealed:

"...The top three or four threads were heavily damaged and almost nonexistent, the next thread or two with less damage and remaining bottom threads with no damage. The lug cross-sections and polymer molds exhibited extraneous thread marks that were offset from the tapped threads...."

The fuel heater was manufactured by Steward, Warner and carried a part number of 10718D/AF. The serial number was 510. The unit had accumulated 14,615.8 hours and 18,104 cycles since new. Continental Express used a 1,200 hour check interval, and a 6,600 hours overhaul interval. Prior overhaul records were not required to be kept and were not available for review. Following the overhaul by Kansas Aviation of Independence, on July 30, 1997, the unit was returned to Continental Express and subsequently placed on the engine as a unit on August 27, 1997. Continental Express had no record of removing, servicing or performing any maintenance on the unit since its installation. The unit had accumulated 1,004.7 hours and 1,084 cycles since installation, and was scheduled to be checked when it reached 1,200 hours time in service.

Material was found in the threads of the stud that had pulled out. The material was analyzed and found to be consistent with the aluminum base alloy used for the housing, and the stud. Examination of the stud hole revealed it was oversized. However, exact hole measurements could not be taken due to hole damage. A no-go gage could be partially inserted in the holes.

Testing performed at PWC found that stainless steel 303 studs would shear at 125 inch-pounds, and the studs made from the stronger A-286 material would shear at 250 inch-pounds. In the testing, the studs sheared, but did not pull out of the housing.

The maximum fuel pressure inside the housing was 50 psi. The force required to pull out the three studs was calculated at 13,653 pounds.

Examination of the Steward Warner Component Maintenance Manual revealed following:

1. - No requirements for inspecting the studs for straightness.
2. - No information as to whether a stud would be removed if it were bent, with no other physical damage noted to the housing or stud.
3. - The stud replacement repair procedures, gave a general technique for the removal of studs, but did not provide specific details such as; drill size, drill depth, or the use of drill guides.
4. - There were no notes, cautions or warning that damage to the housing threads were not repairable and when the housing was to scrapped.
5. - No final inspection was specified after a repair, such as a torque check for the proper engagement of the stud with the housing and whether the stud was straight.

ADDITIONAL INFORMATION

The investigation revealed that the fire occurred initially in an area not protected by fire detectors. In addition, there was an ambient air flow in the area of the fuel spill from front to rear, due to forward motion of the airplane through the air, and propeller air flow.

There were two fuel shutoffs. An airframe shut off actuated by the fire handle in the overhead panel, and a shutoff in the hydromechanical fuel control unit which was actuated by retarding the propeller condition levers on the center pedestal to the FUEL SHUTOFF position. The location of the ruptured fuel filter cover was between the two fuel shutoffs.

According to the EMERGENCY EVACUATION checklist, the immediate actions items are:

After the aircraft comes to a stop:	Parking Brake	SET
Condition Levers	FUEL SHUTOFF	Fire Handles
PULL Agents	AS REQUIRED	

Note: For an engine fire on the ground, it is not necessary to wait 10 second before discharging the fire extinguishing agents. Both agents will be discharged to the engine with the fire indications.

SECONDARY ACTION

PA	"EVACUATE! EVACUATE!" (Directions)
Min Cabin Lights	ON Tower/Ground (VHF-1)
NOTIFIED Fuel Pumps	OFF Batteries (Before leaving
Aircraft) OFF	

Additional Persons participating in this investigation

Mr. Accident Investigation Pratt & Whitney - Canada Longueuil, Quebec

Alain Bouillard Bureau Enquetes-Accidents Le Bourget, France

Robert Graham Stewart Warner, South Wind Corporation Indianapolis, Indiana

Pilot Information

Certificate:	Airline Transport; Flight Instructor	Age:	27, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	Seatbelt, Shoulder harness
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--no waivers/lim.	Last Medical Exam:	07/22/1997
Occupational Pilot:		Last Flight Review or Equivalent:	
Flight Time:	3200 hours (Total, all aircraft), 850 hours (Total, this make and model), 2400 hours (Pilot In Command, all aircraft), 200 hours (Last 90 days, all aircraft), 65 hours (Last 30 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	Aerospatiale	Registration:	N15827
Model/Series:	ATR-42-320 ATR-42-320	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Transport	Serial Number:	175
Landing Gear Type:	Retractable - Tricycle	Seats:	46
Date/Type of Last Inspection:	12/23/1997, Continuous Airworthiness	Certified Max Gross Wt.:	37059 lbs
Time Since Last Inspection:	201 Hours	Engines:	2 Turbo Prop
Airframe Total Time:	18157 Hours	Engine Manufacturer:	P&W
ELT:	Installed, not activated	Engine Model/Series:	PW121
Registered Owner:	CONTINENTAL AIRLINES	Rated Power:	2150 hp
Operator:	CONTINENTAL EXPRESS	Air Carrier Operating Certificate:	Flag carrier (121)
Operator Does Business As:	CONTINENTAL EXPRESS	Operator Designator Code:	C2XA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Night/Dark
Observation Facility, Elevation:	BDL, 174 ft msl	Observation Time:	2126 EST
Distance from Accident Site:	0 Nautical Miles	Direction from Accident Site:	0°
Lowest Cloud Condition:	Clear / 0 ft agl	Temperature/Dew Point:	3° C / -8° C
Lowest Ceiling:	None / 0 ft agl	Visibility	10 Miles
Wind Speed/Gusts, Direction:	5 knots, 310°	Visibility (RVR):	0 ft
Altimeter Setting:	30 inches Hg	Visibility (RVV):	0 Miles
Precipitation and Obscuration:			
Departure Point:	NEWARK, NJ (EWR)	Type of Flight Plan Filed:	VFR/IFR
Destination:	(BDL)	Type of Clearance:	IFR
Departure Time:	2015 EST	Type of Airspace:	Class C

Airport Information

Airport:	BRADLEY INTL AIRPORT (BDL)	Runway Surface Type:	Asphalt
Airport Elevation:	174 ft	Runway Surface Condition:	Dry
Runway Used:	33	IFR Approach:	Visual
Runway Length/Width:	6846 ft / 150 ft	VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	1 Minor, 2 None	Aircraft Damage:	Substantial
Passenger Injuries:	36 None	Aircraft Fire:	On-Ground
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Minor, 38 None	Latitude, Longitude:	

Administrative Information

Investigator In Charge (IIC):	ROBERT L HANCOCK	Adopted Date:	07/26/2001
Additional Participating Persons:	STEVEN RACICOT; WINDSOR LOCKS, CT PIERRE SCARFO; WASHINGTON, DC DAVID W CASE; WASHINGTON, DC FRED JUNEK; HOUSTON, TX		
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.nts.gov/pubdms/ .		

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