
Starter fire, Douglas DC-8F-55, November 20, 1997

Micro-summary: A #4 engine starter fire on climbout resulted in a diversion and evacuation of this Douglas DC-8.

Event Date: 1997-11-20 at 1312 EST


Investigative Body: National Transportation Safety Board (NTSB), USA

Investigative Body's Web Site: <http://www.nts.gov/>

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		NTSB ID: MIA98IA035		Aircraft Registration Number: N55FB	
		Occurrence Date: 11/20/1997		Most Critical Injury: None	
		Occurrence Type: Incident		Investigated By: NTSB	
Location/Time					
Nearest City/Place MIAMI		State FL	Zip Code 33166	Local Time 1312	Time Zone EST
Airport Proximity: Off Airport/Airstrip		Distance From Landing Facility:		Direction From Airport:	
Aircraft Information Summary					
Aircraft Manufacturer Douglas		Model/Series DC-8F-55		Type of Aircraft Airplane	
Sightseeing Flight: No			Air Medical Transport Flight: No		
Narrative					
Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:					
<p>On November 20, 1997, about 1312 eastern standard time, a Douglas DC-8F-55, N55FB, registered to Agro Air Associates, Inc., operated by Fine Air Services, Inc., as flight 363, experienced an in-flight fire in the No. 4 engine compartment area after takeoff from the Miami International Airport, Miami, Florida. Visual meteorological conditions prevailed at the time and an IFR flight plan was filed for the 14 CFR Part 121 non-scheduled, international, cargo flight. The airplane sustained minor damage and the airline transport-rated captain, first officer, and flight engineer, were not injured. The flight originated about 1303, from the Miami International Airport, Miami, Florida.</p> <p>The captain stated that climbing through 13,500 feet, the fire warning bell sounded and the fire warning light illuminated for the No. 4 engine. He silenced the fire warning bell and checked the engine instruments for the No. 4 engine, noting no abnormal indications, and reduced the thrust lever to idle. The fire light remained illuminated and he initiated the engine fire emergency checklist; the first fire bottle was discharged. The fire warning light remained illuminated and he waited 30 seconds, then ordered the second fire bottle to be discharged which extinguished the light. He then advised the air traffic controller of a precautionary engine shutdown but did not declare an emergency, and requested "men and equipment standing by"; the flight was returning to Miami. The flight landed uneventfully on runway 9R at 1335, and while rolling off the runway on a high speed taxiway, the fire indication activated again. The first officer visually observed fire from the inboard side of the No. 4 engine cowling and notified the tower controller that they were bailing out of the airplane and stated that they had requested fire rescue be standing by. The controller advised on the frequency that the fire rescue vehicles were responding. The land evacuation emergency checklist was followed and all flightcrew members exited out of the main entry door using the emergency escape rope. The captain stated that while sliding down the escape rope, he reached a point of the rope that contained a knot and he fell about 8 feet to the ground. Airport fire rescue personnel and equipment responded and extinguished the fire.</p> <p>The flight engineer stated that the No. 3 engine was started first, followed by the No. 4 engine which he noted that the No. 4 engine was slow to accelerate during the start sequence. He reported that the start valve for the No. 4 engine did close as indicated by an increase in the pressure in the manifold. The remaining engines were started at the hold short location and the flight departed. While climbing through 13,000 feet, he first heard the fire warning bell for the No. 4 engine, then observed the fire warning light. The captain confirmed that the fire was from the No. 4 engine and he brought the thrust lever to idle, but the light remained illuminated. The first fire bottle was discharged but the fire warning light remained illuminated. The second fire bottle was discharged and the light extinguished within 2-3 seconds. He further stated that he attempted to move the generator drive lever to the disconnect position but was unable to fully push the lever down. The flight returned and landed uneventfully on runway 9R, then while taxiing on the high speed taxiway, the fire warning light for the No. 4 engine illuminated again. He asked the first officer to verify that a fire condition existed which the first officer confirmed. The</p>					
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remaining engines fire shut-off levers were pulled and they evacuated the airplane out of the main entry door using the escape rope. The flight engineer further stated that the No. 4 constant speed drive (CSD) temperature indicator was normal and the low oil pressure light for the No. 4 CSD was not illuminated until the fire bell and light came on. The airplane was towed to the ramp for further examination.

According to the airport Fire/Property Record report, the fire rescue station was notified of the inbound airplane with a precautionary engine shutdown at 1325, and an Alert 1 was declared which pre-positioned units on the apron. After touchdown, the Alert 1 was changed to an Alert 3 and the pre-positioned units responded and extinguished the fire at the No. 4 engine position.

Examination of the cockpit revealed that the following circuit breakers were tripped:

1) No. 4 engine continuous ignition 2) No. 4 engine oil cooler door control 3) No. 4 engine low pressure pneumatic temperature control 4) No. 4 engine fuel flow 5) Jet pump valves and oil cooler door override 6) No. 4 engine Anti-ice valve 7) No. 4 engine low pressure pneumatic control 8) No. 4 engine fuel and oil pressure indicator.

Examination of the flight engineer's panel revealed that the No. 2 engine CSD disconnect was activated and a placard was in place which indicated that it was inoperative. Additionally, the No. 4 engine CSD disconnect was noted to be partially activated. All four fire shutoff levers were observed to be pulled which was accomplished in accordance with the land evacuation checklist. Additionally, the No. 3 and No. 4 bottles that contained halon were observed to be discharged which was accomplished in accordance with the Engine Fire checklist.

Examination of the No. 4 engine revealed that the right lower aft cowling had a burn hole, and a blowout panel on the right forward cowling was separated. The area aft of the separated panel exhibited evidence of high heat. A low pressure fuel hose from the "nash" engine driven booster pump to the fuel/oil heat exchanger was failed at the inlet fitting of the heat exchanger. Heat damage was noted to the ignition exciter box, and the nearby generator cables exhibited heat damage which removed the cable insulation. The constant speed drive (CSD) was observed to be severely damaged by fire; the CSD drive shaft was not failed. The inlet fitting for the oil line from the CSD oil tank at the CSD was observed to be failed; the oil line was noted to be free of obstructions. The CSD oil tank was noted to be empty and the engine oil tank was noted to be 2/3 full. The three-inch diameter pneumatic shutoff butterfly valve assembly "start valve", was noted to be in the full "open" position. A pneumatic duct of about 2 feet in length on the inboard side of the No. 4 engine was noted to be separated from its' slip joint assembly. That location was just forward of the pneumatic starter assembly. Heavy sooting was noted on the inboard forward section of the engine in the area of the engine oil supply tank. Examination of the pneumatic starter housing revealed damage, but all starter reduction gears were intact with no evidence of failure and the starter output shaft was not failed. Examination of the CSD cable pulley system for the CSD disconnect revealed it was frozen and could not be moved, the CSD had not been disengaged. The fuel pressure and dump valve was noted to have a section missing near a steel fitting located at the bottom of the unit as viewed when installed on the engine. The oil cooler door was noted to be in the full "open" position and the heat exchanger door was fully closed. The start valve which was found in the full open position was removed for further examination. The failed fuel line, oil line, pneumatic starter assembly, generator cables, and fuel pressure and dump valve were removed from the airplane and sent to the NTSB Metallurgy Laboratory located in Washington, D.C.

Metallurgical examination of the pneumatic starter assembly by the NTSB Metallurgy Laboratory revealed that fragments of the inner wall were missing, and a portion of the outer wall was missing. The blades were bonded to the housing and could not be moved by hand. The outboard portion of the blades exhibited uneven wear and there was no evidence of bent blades. Examination of the failed fuel line, fuel pressure and dump valve assembly, and failed oil line revealed no

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evidence of preexisting cracks. Examination of the generator control cables revealed no evidence of electrical arcing. A copy of the metallurgy report is an attachment to this report.

Visual examination of the start valve revealed a foreign substance along the length circumferentially of the inside diameter of the valve body. The threaded butterfly backing plate could not be moved by hand to the fully closed position; binding was noted before the fully closed position. No lead seals were present externally. Heat damage was noted to the electrical portion of the solenoid valve and to the cover of the actuator body. Marks associated with a hammer were noted on the exterior portion of the valve body. Disassembly of the start valve was accomplished which revealed blockage of one of the top orifices of the solenoid switcher valve housing. Blockage of the other top orifice was also noted by a fine granular red colored substance associated with the preformed packing. The material was submitted to the manufacturer of the start valve for analysis which revealed it to be burnt silicon with small traces of dry film lubricant. The silicon was similar to that used in manufacturing of the silicon "O-rings." The dry film lubricant is used on the actuator and piston to reduce wear. Following removal of the actuator body, from the valve body, the threaded butterfly backing plate was noted to move freely from the full open to full closed position. Visual check of the butterfly valve disk revealed no evidence of malfunction. The pneumatic piston assembly would not travel the full length of the actuator body. There was no evidence that the threaded butterfly backing plate was adjusted to compensate for the failure of the pneumatic piston assembly to go full travel toward the closed position. The filter assembly was pressure checked and found to be within limits. The shaft assembly indicator was noted to move freely. Two dents were noted on the pneumatic piston assembly.

The pneumatic piston assembly and the actuator body were sent to the FAA and brought by an FAA inspector to the manufacturers facility for further examination. The examination determined that the inside diameter dimension of the lower portion of the actuator body was less than specified in the drawing. The actuator body was hardness tested and also dimensionally tested for roundness. The hardness and roundness tests determined that the unit was not subjected to heat which changed the hardness or roundness of the inside diameter of the actuator body. The serial number marked on the data plate attached to the actuator housing was not correct for the unit per the manufacturer. The actuator body was determined to be incorrect by part number for the part number of the start valve assembly. Also, a passage was not machined as per the manufacturing drawing and the actuator flange which is used to mount the actuator cover was squared off in two location contrary to the engineering drawing. A copy of the report from the manufacturer is an attachment to this report.

Examination of the pneumatic starter assembly revealed as previously mentioned, a hole in the case with fusion of material on the external portion of the housing, adjacent to that area. The inside diameter of the housing near where the pneumatic duct is installed was observed to be dented which continued to the outside surface. The drive shaft was displaced aft about 2 inches, with the turbine blades located at the aft section of the housing. Evidence of circumferential scoring approximately 3/16 inch width was noted forward of the machined surface located on the aft portion of the unit. A serviceable unit was measured and the aft portion of the turbine blades was noted to be 2 1/32 inch forward of the aft portion of the housing. The pneumatic duct that attaches to the pneumatic starter assembly was examined and fusion of material was observed on the exterior inner portion of the duct.

Review of the maintenance records revealed that 3 days before the incident, the No. 4 engine fuel control was removed and replaced due to a discrepancy of compressor stall twice after rotation on the first takeoff. After replacement, the engine was reportedly operated and the fuel control was leak checked. The maintenance records also indicate in part that the start valve which was installed on the No. 4 engine position, was overhauled on September 30, 1994, by a FAA certificated repair station located in Miami, Florida. The overhauled valve was installed on the No. 4 engine position of the incident airplane on October 5, 1994. The start valve was moved from that engine to another engine that was installed in that same position, on April 20, 1997, then again to another engine that was installed in that same position on July 25, 1997. The start valve had

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accumulated a total time of 4,768 hours and 1,857 cycles since overhaul at the time of the incident.


The shop that overhauled the start valve was contacted and according to the work order, there was no work performed to the actuator body bore. The work order indicates that the unit was preinspected, disassembled, cleaned and inspected all parts, replaced 100% kit, disk and bearings, unclogged filter, repaired body, reassembled, tested, and finalized. The repair shop did not have in place a checklist at the time of overhaul to confirm/document the part numbers of the major parts contained in the component that is being overhauled reference to the manufacturers parts list.


Further review of the maintenance records revealed that with respect to the No. 4 position, the pneumatic starter assembly was documented to be damaged three times between December 4, 1996, to and including the incident starter which occurred on November 20, 1997. Damage to the first starter occurred on or about December 4, 1996, and according to a work order for the repair to that starter, extensive internal damage was noted. The date of installation of the first starter and the total cycles since installation at the time of failure was not determined. The second starter which was installed on or about December 4, 1996, was a rebuilt zero (0) time unit that was removed due to internal damage on or about February 3, 1997, only about 2 months later. The second starter had accumulated 155 cycles since installation at the time of failure. The third starter which was installed on or about February 3, 1997, was also a zero (0) time since overhaul unit, and had accumulated 478 cycles since installation at the time of the incident on November 20, 1997.

According to the Director of Quality Control for Fine Airlines, Inc., they operate 13 DC-8 type airplanes and with respect to the starter system, they have a system in place where a warning flag is generated via computer whenever they experience a removal or damage rate of any starter related component that exceeds 3.7 components per month for the fleet of 13 airplanes. There was no record that a warning was generated regarding the incident airplane. The Director of Quality Control also stated that they do not track the starter assemblies as they are an "on condition."

An additional party to the investigation was John Zarcone, Jr., of the Federal Aviation Administration Manufacturing Inspection District Office located in Scottsdale, Arizona.

The airplane minus the retained components was released to Mr. Jose C. Pella, Technical Services Representative of Fine Air, on December 2, 1997. The retained components were released to Mr. Richard E. McCallman on March 25, 1999.

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Landing Facility/Approach Information						
Airport Name MIAMI INTERNATIONAL		Airport ID: MIA	Airport Elevation 11 Ft. MSL	Runway Used 0	Runway Length	Runway Width
Runway Surface Type:						
Runway Surface Condition:						
Type Instrument Approach:						
VFR Approach/Landing: Forced Landing						
Aircraft Information						
Aircraft Manufacturer Douglas		Model/Series DC-8F-55		Serial Number 45678		
Airworthiness Certificate(s): Transport						
Landing Gear Type: Retractable - Tricycle						
Homebuilt Aircraft? No		Number of Seats: 5	Certified Max Gross Wt. 325000 LBS	Number of Engines: 4		
Engine Type: Turbo Fan		Engine Manufacturer: P&W	Model/Series: JT3D-3B	Rated Power: 18000 LBS		
- Aircraft Inspection Information						
Type of Last Inspection Continuous Airworthiness		Date of Last Inspection 11/1997	Time Since Last Inspection 98 Hours	Airframe Total Time 6015 Hours		
- Emergency Locator Transmitter (ELT) Information						
ELT Installed? Yes		ELT Operated? No	ELT Aided in Locating Accident Site?			
Owner/Operator Information						
Registered Aircraft Owner AGRO AIR ASSOCIATES, INC.		Street Address P.O. BOX 524236				
		City MIAMI	State FL	Zip Code 33152		
Operator of Aircraft FINE AIR SERVICES, INC.		Street Address 2261 N.W. 67 AVE., BLDG. 700				
		City MIAMI	State FL	Zip Code 33122		
Operator Does Business As:			Operator Designator Code: FXLA			
- Type of U.S. Certificate(s) Held:						
Air Carrier Operating Certificate(s): Supplemental						
Operating Certificate:			Operator Certificate:			
Regulation Flight Conducted Under: Part 121: Air Carrier						
Type of Flight Operation Conducted: Non-scheduled; International; Cargo						
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First Pilot Information

Name On File	City On File	State On File	Date of Birth On File	Age 51
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Sex: M	Seat Occupied: Left	Principal Profession: Civilian Pilot	Certificate Number: On File
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Certificate(s): Airline Transport; Commercial

Airplane Rating(s): Multi-engine Land; Single-engine Land

Rotorcraft/Glider/LTA: None

Instrument Rating(s): Airplane

Instructor Rating(s): None

Type Rating/Endorsement for Accident/Incident Aircraft? Yes	Current Biennial Flight Review?
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Medical Cert.: Class 1	Medical Cert. Status: Valid Medical--w/ waivers/lim.	Date of Last Medical Exam: 08/1997
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- Flight Time Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Multi-Engine	Night	Instrument		Rotorcraft	Glider	Lighter Than Air
						Actual	Simulated			
Total Time	18500	11334	3037	11334						
Pilot In Command(PIC)	8879	2520								
Instructor	973									
Last 90 Days										
Last 30 Days										
Last 24 Hours										

Seatbelt Used? Yes	Shoulder Harness Used? Yes	Toxicology Performed? No	Second Pilot? Yes
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Flight Plan/Itinerary

Type of Flight Plan Filed: IFR

Departure Point Same as Accident/Incident Location	State	Airport Identifier MIA	Departure Time 0803	Time Zone EST
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Destination QUITO	State OF	Airport Identifier SEQU	
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Type of Clearance: IFR

Type of Airspace: Class B

Weather Information

Source of Briefing:
Company


Method of Briefing:

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Weather Information					
WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
MIA	1256	EST	11 Ft. MSL	0 NM	0 Deg. Mag.
Sky/Lowest Cloud Condition: Unknown			0 Ft. AGL	Condition of Light: Day	
Lowest Ceiling: Broken		2700 Ft. AGL		Visibility: 10 SM	Altimeter: 30.00 "Hg
Temperature: 27 °C	Dew Point: 20 °C	Wind Direction: 50		Density Altitude: Ft.	
Wind Speed: 14	Gusts: 18	Weather Conditions at Accident Site: Visual Conditions			
Visibility (RVR): 0 Ft.	Visibility (RVV) 0 SM	Intensity of Precipitation: Unknown			
Restrictions to Visibility: None					
Type of Precipitation: None					

Accident Information		
Aircraft Damage: Minor	Aircraft Fire: In-flight	Aircraft Explosion: None

Classification: U.S. Registered/U.S. Soil					
- Injury Summary Matrix	Fatal	Serious	Minor	None	TOTAL
First Pilot				1	1
Second Pilot				1	1
Student Pilot					
Flight Instructor					
Check Pilot					
Flight Engineer				1	1
Cabin Attendants					
Other Crew					
Passengers					
- TOTAL ABOARD -				3	3
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	0	3	3

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Administrative Information

Investigator-In-Charge (IIC)
TIMOTHY W. MONVILLE

Additional Persons Participating in This Accident/Incident Investigation:

ERROL W CUFFE
FAA FSDO
MIAMI, FL

BOB GILDENSTERN
ALLIED SIGNAL
TEMPE, AZ

JIM WIGGINS
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TEMPE, AZ

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