Aviation Investigation Final Report

Location:	CHICAGO, Illinois	**Incident Number:**	CHI95IA313
Date & Time:	September 6, 1995, 09:18 Local	**Registration:**	N414WF
Aircraft:	AEROSPATIALE ATR-72	**Aircraft Damage:**	Minor
Defining Event:		**Injuries:**	18 None
Flight Conducted Under:	Part 121: Air carrier - Scheduled		

Analysis

The airplane was on its first flight of the day after engine fuel system maintenance. While climbing through 7500 feet, the fire warning system activated. The flight crew extinguished the fire, secured the engine, and returned to the departure airport. Examination of the engine revealed that a fuel leak had occurred at the #7 and #8 fuel manifold nozzle transfer tubes. The fuel manifold transfer tube locking plates for the #7 and #8 nozzle assemblies were found improperly installed, and the respective 'O' rings were found to be cut and scratched. Also, the engine's overboard (fuel/oil) drain line was found to be about 99% blocked with a carbon-like material. Additionally, the engine's fuel manifold and turbine support case drain lines were noted to be positioned directly opposite each other within the drain manifold. The drain line's turbine support case fitting had an oversized and offset, crush gasket. The nacelle's interior had a flame discolored area directly below this fitting.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: improper installation of the #7 and #8 fuel nozzle manifold transfer tubes by company maintenance personnel, and an inadequate exhaust drain fitting gasket, which resulted in fuel leaks at the respective 'O' ring/gasket fittings; blockage of the fuel/oil drain manifold; and subsequent fire in the engine compartment.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: CLIMB - TO CRUISE

Findings
1. (C) MAINTENANCE,INSTALLATION - IMPROPER - COMPANY MAINTENANCE PERSONNEL
2. (C) FUEL SYSTEM,NOZZLE - IMPROPER
3. (C) FUEL SYSTEM,LINE FITTING - LEAK
4. (C) FUEL SYSTEM,DRAIN - BLOCKED(TOTAL)

Occurrence #2: FIRE
Phase of Operation: CLIMB - TO CRUISE

Findings
5. (C) ENGINE COMPARTMENT - FIRE

Factual Information

On September 6, 1995, at 0918 central daylight time (cdt), an Aerospatiale ATR 72, N414WF, operated by Simmon's Airlines, Incorporated of Dallas, Texas, as American Eagle Flight number 4118, and piloted by an airline transport rated pilot, received minor damage when its number one engine exhaust section and aft nacelle was involved in a fire. The flight crew shut the engine down and extinguished the fire, and returned the airplane to its departure airport. Visual meteorological conditions prevailed at the time of the incident. The 14 CFR Part 121 flight was operating on an IFR flight plan. No injuries were reported by the 4 flight crew members and 14 passengers. The flight departed Chicago, Illinois, at 0854 cdt.

The on-scene investigation revealed the number one engine's lower cowl interior had heat discoloration under the turbine support case (TSC) drain fitting. Heat discoloration was also noted on the TSC's lower half. Additional heat discoloration was observed on the bell mouth area of the nacelle exhaust trough and associated fire loop hardware. Sooting was observed on the nacelle heat shrouds and tailpipe areas. The TSC drain line fitting had tongue shaped soot patterns originating from its edges.

The engine's drain system manifold (manifold) is located forward of the TSC assembly on the bottom of the engine. Inspection of the manifold found that it would not drain excess fuel overboard as it was designed to do. The exit drain line from the manifold to nacelle drain mast was 99 percent blocked. Removal of the blockage revealed it to be a carbon-like material. The blockage was at the end of the drain line attached to the mast fixture. See drawing appended to this report.

The TSC drain line fitting was removed for inspection. A copper crush gasket (gasket) was found on the fitting's nipple end. The gasket interior size was about 40 percent larger than the nipple size. The gasket was not centered on the exhaust section nipple opening. An offset pattern shaped like the gasket surrounded this opening. The gasket interior and exterior edges were burned and deformed.

Examination of the fuel nozzle manifold found number 7 and 8 fuel nozzle transfer tubes had leaking "O" rings. According to the Federal Aviation Administration Principal Maintenance Inspector (PMI) associated with the investigation, the manufacturer's recommended procedure had not been followed by company maintenance personnel.

The procedure specifies that the "O" rings be installed onto the transfer tube. The transfer tube is installed into the manifold. It is then removed and the "O" rings examined for damage. If no damage is found, the transfer tube can be installed with the "O" rings. Two of the "O" rings for number 7 and 8 nozzles were cut and had scratches in them. Six other "O" rings were not seated properly. This type of condition creates an internal leak that is bypassed to the

manifold's drain line.

Airplane maintenance records showed both engines on N414WF had their fuel nozzles changed on September 5 and 6, 1995. Flight 4118 was the first flight of the day after the maintenance had been performed. There is no requirement to check the nacelle drain mast line after a fuel nozzle change. The drain line inspection had been accomplished about 100 hours before the nozzle change. This inspection was done within the manufacturer's recommended 300 hour interval.

The drain manifold's fuel nozzle drain line and TSC drain line are positioned directly opposite each other. Leaking fuel is normally ported out the nacelle mast drain attached to the system drain manifold.

The fuel manifold transfer tube locking plates for the number 7 and 8 nozzle assemblies were found improperly installed. According to the PMI, this increases the fuel leak flow rate. Fuel pressure within the manifold lines is approximately 930 pounds per square inch at takeoff. Refer to the maintenance manual excerpt appended to this report for correct installation procedures.

On August 24, 1994, Pratt and Whitney issued a Service Information Letter (SIL) that addressed an improved "O" ring. The SIL states, in part, that some operators had found "O" rings that did not conform to Pratt and Whitney specifications. Pratt and Whitney offered the operators an even exchange of the old stock numbered "O" rings for the newer type (AS3209 and ST3367 respectively). Pratt and Whitney issued Service Bulletin number 21364 on September 16, 1994. The bulletin strongly recommended the use of the new "O" ring. The current Pratt and Whitney illustrated parts' catalog shows the part numbers for both "O" rings. Copies of these documents are appended to this report.

Pilot Information

Certificate:	Airline transport	**Age:**	36,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:**	May 15, 1995
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	12000 hours (Total, all aircraft), 6500 hours (Total, this make and model), 10000 hours (Pilot In Command, all aircraft), 180 hours (Last 90 days, all aircraft), 70 hours (Last 30 days, all aircraft), 7 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	AEROSPATIALE	**Registration:**	N414WF
Model/Series:	ATR-72 ATR 72	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Transport	**Serial Number:**	0414
Landing Gear Type:	Retractable - Tricycle	**Seats:**	68
Date/Type of Last Inspection:	August 20, 1995 Continuous airworthiness	**Certified Max Gross Wt.:**	48500 lbs
Time Since Last Inspection:	100 Hrs	**Engines:**	2 Turbo prop
Airframe Total Time:		**Engine Manufacturer:**	P&W
ELT:	Installed, not activated	**Engine Model/Series:**	PW127
Registered Owner:	AMR LEASING CORP.	**Rated Power:**	2750 Horsepower
Operator:	SIMMONS AIRLINES	**Operating Certificate(s) Held:**	Commuter air carrier (135)
Operator Does Business As:		**Operator Designator Code:**	SIMA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	ORD ,730 ft msl	**Distance from Accident Site:**	
Observation Time:	09:50 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Scattered / 15000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Overcast / 25000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	12 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	200°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	27°C / 17°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	, IL (ORD)	**Type of Flight Plan Filed:**	IFR
Destination:		**Type of Clearance:**	IFR
Departure Time:	08:54 Local	**Type of Airspace:**	Class A

Airport Information

Airport:		**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	
Runway Length/Width:		**VFR Approach/Landing:**	Precautionary landing

Wreckage and Impact Information

Crew Injuries:	4 None	**Aircraft Damage:**	Minor
Passenger Injuries:	14 None	**Aircraft Fire:**	In-flight
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	18 None	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	Gattolin, Frank
Additional Participating Persons:	ROBERT DORN; SCHILLER PARK , IL RONALD J TAYLOR; DFW AIRPORT , TX
Original Publish Date:	October 4, 1996
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=9768