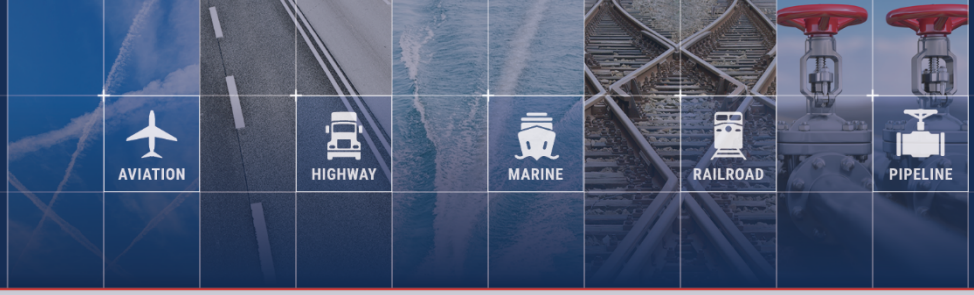

Aviation Investigation Final Report

Location:	DALLAS, Texas	**Incident Number:**	FTW97IA222
Date & Time:	June 14, 1997, 17:25 Local	**Registration:**	N438AT
Aircraft:	Aerospatiale ATR-72-12	**Aircraft Damage:**	Minor
Defining Event:		**Injuries:**	32 None
Flight Conducted Under:	Part 121: Air carrier - Scheduled		

Analysis

The ATR-72-12 transport airplane was at 5,000 feet MSL when the #2 engine fire warning light illuminated. After shutting down the #2 engine and actuating the fire extinguishing system, the crew executed a single engine landing followed by a normal taxi to the ramp and normal passenger debarkation. Inspection of the P&W 127 series engine showed that a fuel transfer tube adjacent to the #2 nozzle was misaligned and 'backed out' of its retaining clip. Fuel streaking and fire damage were evident down the right side of the engine from the #2 nozzle downward along the fuel nozzle ring assembly. The incident occurred 3.4 hours after the fuel nozzles, retaining clips, and transfer tubes were replaced during maintenance on the #2 engine. The engine manufacturer had published several service bulletins addressing the potential of incorrectly installing the retaining clips and recommending that existing clips be replaced with stronger lock plates that provide a positive locking mechanism to avoid misalignment during installation. The manufacturer issued a Service Bulletin in October 1994 and Transport Canada issued an AD in November 1996, both citing how the retaining clips could be installed 'out of position' and recommending that operators use the newer lock plate. The FAA had published a Notice of Proposed Rulemaking (NPRM) on July 17, 1995, addressing the aforementioned issues. FAA AD 98-14-02 was published in the Federal Register on July 1, 1998. The AD was similar to the Canadian AD issued on November 19, 1996.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: the engine fire during descent resulting from a loose, leaking fuel transfer tube due to improper installation and alignment of the transfer tube's retaining clip. Contributing factors were the inadequate design of the clamp, the failure of the operator to comply with the recommendations of the manufacturer's Service Bulletin (SB), and the failure of the FAA to

issue an Airworthiness Directive to mandate the manufacturer's SB.

Findings

Occurrence #1: FIRE
Phase of Operation: DESCENT

Findings
1. (C) FUEL SYSTEM,FUEL FLOW DIVIDER/DISTRIBUTOR - LEAK
2. (C) MISCELLANEOUS,BOLT/NUT/FASTENER/CLAMP/SPRING - LOOSE PART/BOLT/NUT/CLAMP/ETC
3. (C) MAINTENANCE,ALIGNMENT - IMPROPER - COMPANY MAINTENANCE PERSONNEL
4. (C) MAINTENANCE,INSTALLATION - IMPROPER - COMPANY MAINTENANCE PERSONNEL
5. (F) ACFT/EQUIP,INADEQUATE AIRCRAFT COMPONENT - MANUFACTURER
6. (F) INSUFFICIENT STANDARDS/REQUIREMENTS,AIRCRAFT - FAA(ORGANIZATION)
7. (F) MAINTENANCE,SERVICE BULLETIN/LETTER - NOT PERFORMED - COMPANY/OPERATOR MANAGEMENT

Occurrence #2: LOSS OF ENGINE POWER
Phase of Operation: EMERGENCY DESCENT/LANDING

Findings
8. 1 ENGINE
9. ENGINE SHUTDOWN - INTENTIONAL - PILOT IN COMMAND
10. PRECAUTIONARY LANDING - PERFORMED - PILOT IN COMMAND

Factual Information

On June 14, 1997, approximately 1725 central daylight time, an Aerospatiale ATR-72-12 multi-engine transport airplane, N438AT, owned by AMR Leasing Corporation, and operated by Simmons Airlines as American Eagle flight 3538, experienced an in-flight fire within the #2 engine nacelle while on approach to Dallas/Fort Worth International Airport, Texas. The airline transport rated pilot-in-command, first officer, 2 cabin attendants, and 28 passengers were not injured during the uneventful single engine precautionary landing. Visual meteorological conditions prevailed and an Instrument Flight Rules flight plan was filed for the 14 Code of Federal Regulations Part 121 scheduled domestic passenger flight. The flight originated from the William P. Hobby International Airport, Houston, Texas, at 1627.

During an interview with the NTSB investigator-in-charge, the captain stated that the aircraft was at 5,000 feet MSL and about 25 miles south of the airport when the #2 engine fire warning light illuminated. The crew, following standard emergency operating procedures, shut the #2 engine down and actuated 1 fire extinguishing squib bottle into the #2 engine nacelle. The fire warning light went out approximately 5 seconds after the squib was deployed. No secondary signs of fire were detected after the flight crew's emergency actions. The ensuing single engine landing to runway 31R was followed by a normal taxi to the ramp and normal passenger debarkation.

Note: The P&W 127 series engine was installed on this aircraft. This engine's fuel distribution system includes a nozzle ring assembly with 14 circumferentially mounted fuel nozzles. Each nozzle is attached to a boss into which 3 fuel transfer tubes feed fuel to the nozzle. The fuel transfer tubes are retained and held in place by retaining clips (second generation) or lock plates (third generation).

Inspection of the #2 engine by the NTSB investigator-in-charge, revealed that one of the fuel transfer tubes, adjacent to the #2 fuel nozzle, was not seated properly within the nozzle boss. The transfer tube was found misaligned and "backed out" of its retaining clip. Fuel streaking was evident down the right side of the engine from the #2 nozzle down toward a pan, which was located below the fuel nozzle ring assembly on the bottom of the engine. The right side of the engine, adjacent to the fuel nozzle ring assembly, was found scorched upward from the pan toward the #2 fuel nozzle. The scorching pattern and the fuel streaking were consistent with fuel leaking from the #2 nozzle, streaking down the right side of the engine, and pooling in the pan before igniting. The incident occurred 3.4 hours after maintenance had been performed on the #2 engine.

On the night prior to the accident, the airplane was scheduled for routine maintenance, minimum equipment list (MEL) troubleshooting, bleed air system evaluation, and fuel scheduling diagnostics on the #2 engine. The job tasks were assigned to second and third

shift maintenance personnel. One of the engineering orders (EO #P6-7300-001R2) required the inspection and replacement of the fuel transfer tubes and fuel nozzles. All of the transfer tubes were inspected and several damaged tubes were replaced in accordance with (IAW) the maintenance manual. Additionally, all of the fuel nozzles (#'s 1-14) were removed and replaced. According to standard maintenance practice, it is necessary to remove and replace the fuel transfer tube retaining clips when replacing fuel nozzles and fuel transfer tubes.

These maintenance procedures were accomplished with the engine/nacelle attached to the pylon mount. During interviews with several mechanics, it was discovered that the replacement and inspection of the retaining clips located at the upper inboard nozzle positions (#'s 1-3) is mechanically difficult due to the lack of space to work and the need to use mirrors for visual inspection. The type of retaining clips (second-generation) that were installed do not have a positive locked position when seated onto the transfer tubes. The mechanic must insure that the tubes are positioned properly beneath the clips before they are secured into the nozzle boss. During interviews with the FAA Engine Directorate, the operator, and several mechanic/inspectors, it was revealed that it is mechanically possible that the clips can be secured into the nozzle boss with the fuel transfer tubes not seated properly beneath the clip. Additionally, the engine manufacturer has published several service bulletins addressing this issue.

Review of the engine manufacturer's maintenance manual revealed that it contained specific descriptions of the correct and incorrect installation of the transfer tubes and retaining clips. The manual also warned that the clips can be bent out of position if incorrectly installed. Additionally, the manufacturer had made available a third-generation lock plate that, when installed, was significantly stronger and provided for a positive locking mechanism so that the transfer tube cannot be misaligned when the lock plate is secured into the nozzle boss. In a strength comparison test conducted by the NTSB investigator-in-charge and the FAA, it took 2 to 6 pounds of tension to pull the second-generation clip off of the transfer tubes at the 14 nozzle positions. With tension in excess of 50 pounds applied to the third-generation lock plate, the transfer tube remained properly retained and the lock plates did not yield.

Transport Canada issued Airworthiness Directive (AD) CF-96-22 on November 19, 1996. The directive discussed several past incidents of P&W 100 series engine fuel leaks, which resulted in either in-flight shutdowns or fire warnings. The majority of these fuel leaks had occurred shortly after fuel manifold maintenance actions, and through investigations by Canadian authorities, the fuel transfer tube retaining clips (second-generation) had been determined to be a contributing factor. The directive required installation of the third-generation lock plates during the next engine change, fuel nozzle change, or before November 30, 1998, whichever occurred first. P&W Canada also determined that the second-generation clips were sensitive to installation and could be installed "out of position." P&W Canada Service Bulletin (SB) 21373, dated October 27, 1994, introduced the third-generation lock plate, which "prevents incorrect installation" and holds the fuel transfer tubes in position more securely.

On August 8, 1996, P&W Canada issued a Service Information Letter. Excerpts from the letter

include: "Service Bulletin 21373 introduces new fuel manifold transfer tube lock plates. This SB requires transfer tubes of post SB21077 configuration. The transfer tubes and lock plates are commercially supported by Support Program A95050. This lock plate and transfer tube combination will ensure correct installation of these components and represents a significant improvement over previous configurations. P&WC recommends the incorporation of post SB21373 lock plates and post SB21077 transfer tubes at the next disassembly of the fuel manifold system."

Several days after the accident and after review of Service Difficulty Reports (SDR's) on P&W series 100 engine installations that showed a trend of fuel leaks with the second-generation clips, the NTSB investigator-in-charge discussed the possibility of the FAA issuing an AD similar to the Canadian AD. It was discovered that the FAA had published a Notice of Proposed Rulemaking (NPRM) on July 17, 1995, addressing the aforementioned issues. FAA AD 98-14-02 was published in the Federal Register on July 1, 1998. The AD was similar to the Canadian AD issued on November 19, 1996.

Pilot Information

Certificate:	Airline transport; Commercial; Flight engineer; Military	**Age:**	47,Male
Airplane Rating(s):	Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	February 19, 1997
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	16000 hours (Total, all aircraft), 3200 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Aerospatiale	**Registration:**	N438AT
Model/Series:	ATR-72-12 ATR-72-12	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Transport	**Serial Number:**	438
Landing Gear Type:	Retractable - Tricycle	**Seats:**	64
Date/Type of Last Inspection:	June 1, 1997 Continuous airworthiness	**Certified Max Gross Wt.:**	48500 lbs
Time Since Last Inspection:	68 Hrs	**Engines:**	2 Turbo prop
Airframe Total Time:	5444 Hrs	**Engine Manufacturer:**	P&W
ELT:	Installed, not activated	**Engine Model/Series:**	PW-127
Registered Owner:	AMR LEASING CORP	**Rated Power:**	2750 Horsepower
Operator:	SIMMONS AIRLINES	**Operating Certificate(s) Held:**	Commuter air carrier (135)
Operator Does Business As:	AMERICAN EAGLE	**Operator Designator Code:**	SIMA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	DFW ,603 ft msl	**Distance from Accident Site:**	
Observation Time:	17:30 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Scattered / 2900 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	9 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	40°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	32°C / 26°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	HOUSTON , TX (HOU)	**Type of Flight Plan Filed:**	IFR
Destination:	(DFW)	**Type of Clearance:**	IFR
Departure Time:	16:27 Local	**Type of Airspace:**	TRSA

Airport Information

Airport:	DALLAS/FT WORTH INTL DFW	**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	Localizer only
Runway Length/Width:		**VFR Approach/Landing:**	Precautionary landing

Wreckage and Impact Information

Crew Injuries:	4 None	**Aircraft Damage:**	Minor
Passenger Injuries:	28 None	**Aircraft Fire:**	In-flight
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	32 None	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	Lemishko, Alexander
Additional Participating Persons:	ANTHONY D PIRRELLO; DALLAS , TX
Original Publish Date:	July 17, 2001
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=20071