NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

AIRWORTHINESS GROUP FACTUAL REPORT

December 26, 2006

A. ACCIDENT DCA06FA058

Location:	Memphis, Tennessee
Date:	July 28, 2006
Time:	1125 Central Daylight Time (CDT)
Aircraft:	FedEx Express Flight 630, McDonnell-Douglas (Boeing) MD-10-10F, N391FE

B. AIRWORTHINESS GROUP

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C. SUMMARY

On July 28, 2006, about 1125 Central Daylight Time, FedEx Express (FedEx) flight 630, a McDonnell-Douglas (Boeing) MD-10-10F (MD-10), N391FE, crashed while landing at Memphis International Airport (MEM), Memphis, Tennessee. The left main landing gear collapsed after touchdown on runway 18R, and the airplane came to rest on the runway. After the gear collapsed, a fire developed on the left side of the airplane. The two flight crewmembers received minor injuries during the evacuation, and one nonrevenue FedEx pilot was not injured. The postcrash fire substantially damaged the airplane's left wing and portions of the left side of the fuselage. Flight 630 departed from Seattle-Tacoma International Airport (SEA), Seattle, Washington, and was operating under the provisions of 14 *Code of Federal Regulations* (CFR) Part 121 on an instrument flight rules flight plan.

D. DETAILS OF THE INVESTIGATION

1.0 Wreckage

The airplane came to rest on the left side of Runway 18R at the M4 taxiway exit about 6,050 feet from the approach end of the runway (Figure 1). The left main landing gear (LMLG) collapsed during the accident sequence and was folded aft with the strut in a horizontal position and the truck beam in a vertical position (Figure 2). The truck beam positioning actuator was fractured from the truck beam while the axles were in the normal position. The aft tires of the LMLG impacted the left inboard flap damaging it and deforming it upwards. The left side of the airplane was resting on the left nacelle, the left wing outboard flap hinge fittings, and the left wingtip while the right side was resting on the right main landing gear (RMLG) inboard tires. The left engine aft mount was fractured and the left engine was canted upwards about the forward mounts. A post crash fire ensued on the left side of the airplane consuming the number 3 slat, the inboard end of the number 4 slat, the left and upper portions of the left nacelle, and the left side of the engine case. The remainder of the left wing and nacelle sustained moderate to heavy fire damage. There was some minor sooting to the left fuselage in the vicinity of the wing attach area. The nose landing gear (NLG) was intact and turned to the right about 20° and was resting on only the left tire. The left NLG tire had no tread evident, some of the reinforcing plies showing, and cross-wise scuffing while the right NLG tire appeared essentially normal. The RMLG was intact with the two inboard tires contacting the ground. The RMLG forward, inboard tire tread was considerably worn while the other three appeared essentially normal. The rest of the airplane was undamaged. The flaps and slats were in the deployed position and the left engine thrust reverser was in the deployed position. The right engine thrust reverser was in the stowed position.

Figure 1 – FedEx MD-10-10F, Runway 18R, Memphis, TN

Figure 2 – Collapsed LMLG

The LMLG outer cylinder was fractured midway through the air filler valve boss at port A on the aft side of the outer cylinder (Figure 3). The fracture continued around the circumference of the outer cylinder at the same level for about 240°. The fracture then turned upwards and continued the rest of the circumference about 5 inches above the level of the filler valve on the forward side of the outer cylinder. A piece of the outer cylinder about 5 inches high by 8 inches wide was recovered on the runway. The LMLG lower side brace remained attached to the lower outer cylinder and the upper side brace was twisted about 90° along its length. The LMLG retract actuator was in the extended position and the rod end was fractured. The LMLG lock links were fractured.

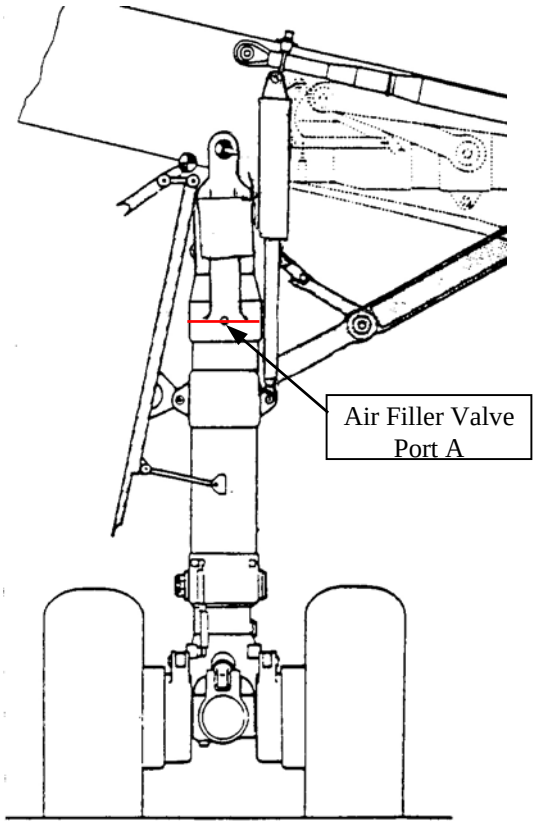

Figure 3 – LMLG
(Looking Fwd)

The first piece of debris from the accident airplane found on the runway was a small lower section of the threaded portion of the air filler valve boss from the aft side of the outer cylinder. The piece was found about 3,430 feet from the approach end of the runway. The filler valve normally installed in the boss was found about 3,713 feet from the approach end of the runway. The section of LMLG outer cylinder described above was found about 3,915 feet from the approach end of the runway. Several other pieces of debris including a piece of the upper piston stop, the LMLG proximity target, the LMLG auxiliary spacer, LMLG door fragments, and various pieces of the inner cylinder were found on the runway between the filler valve boss and the airplane. The upper piston stop, auxiliary spacer and upper chamber all exhibited compression damage.

Several scrapes and gouges were evident on the runway where components of the left wing contacted the runway after the collapse of the LMLG. These marks could be followed from their point of first impact to the point where the aircraft came to rest. The left nacelle first contacted

the runway about 3,486 feet from the approach end. The left wing outboard flap, outboard hinge fitting first contacted about 3,498 feet from the approach end while the inboard hinge fitting contacted about 3,512 feet from the approach end. The left wingtip first contacted the runway about 3,499 feet from the approach end of the runway.

2.0 Main Landing Gear

The LMLG Strut Outer Cylinder (P/N ARG7002-503, S/N CPT 0125HT) upper and lower sections were removed from the aircraft. The fracture faces were cut from the sections and sent to the NTSB Materials Laboratory for examination[1]. The LMLG was last overhauled and returned to service on September 5, 1997 by Hawker Pacific Aerospace in Sun Valley, CA. According to the maintenance records, the LMLG outer cylinder had accumulated 33,148 cycles since new at the time of the accident. Further examination of the records revealed that this number was higher than the true number of cycles on the outer cylinder. During the overhaul in 1997, the outer cylinder was replaced with a lower time unit (22,107 cycles) but the higher cycle time (27,042 cycles) was retained for consistency with the other LMLG components and the RMLG.

On July 7, 2005, the aircraft was returned to service after being modified to accept carbon brakes. The modification to the airplane incorporated different wheels, tires, brakes, truck beam assemblies, and wheel speed transducers (WST). The work was performed at Mobile Aerospace Enterprises, Mobile, Alabama. The airplane (and LMLG) had accumulated 868 cycles since the modification at the time of the accident.

The two anti-skid manifolds (ASM), two dual brake control valves (DBCV), one anti-skid control unit (ASCU), two dual wheel speed transducers (WST), and two single wheel speed transducers (WST) listed below were removed from the LMLG and sent to their respective manufacturers for functional test. During the removal of the WST's, the hubcaps and transducers were all found to be normal except the #2 WST connector backshell was loose and the #6 WST was stiff to rotate. The teardown reports and factual information from the examination of the removed components will be documented in addendums to this factual report.

Forward ASM: P/N 33-177, S/N 114
Aft ASM: P/N 33-177, S/N 113
ASCU: P/N 142-109, S/N 108
DBCV: P/N 35950-505, S/N 444076
DBCV: P/N 35950-505, S/N 438942
#1 Single WST: P/N 140-287, S/N 138
#2 Single WST: P/N 140-287, S/N 171
#5 Dual WST: P/N 140-289, S/N 129
#6 Dual WST: P/N 140-289, S/N 156

The following data was gathered on scene and refers to the wheel numbering convention typically used; #1 LMLG forward outboard, #2 LMLG forward inboard, #3 RMLG forward inboard, #4 RMLG forward outboard, #5 LMLG aft outboard, #6 LMLG aft inboard, #7 RMLG

[1] See NTSB Materials Laboratory Factual Report 06-076 for details.

aft inboard, and #8 RMLG aft outboard.

LMLG Tires

Position	P/N	S/N	Retread	Pressure	Tread Depth
1	54IK69-2	60071648	New	175	8/32
2	54IK69-2	61631562	New	165	10/32
5	54IK69-2	23440671	R1	174	8/32
6	54IK69-2	00581434	R7	166	7/32

LMLG Wheels

Position	S/N	Mfg Date	Overhaul
1	H0336	10 99	Major
2	4146	8 05	Minor 1
5	B0194	12 89	Minor 2
6	1618	6 92	Minor 4

LMLG Brakes (P/N 2609412-4)

Position	S/N	Wear Pin 1	Wear Pin 2
1	B0793	2”	2 1/16”
2	B2652	1 13/16”	1 25/32”
5	B2671	1 21/32”	1 11/16”
6	B2699	1 31/32”	1 31/32”

RMLG Wheels and Brakes

Position	Tire Pressure	Wear Pin
3	170	2 27/32”
4	160	1 17/32”
7	170	2 21/32”
8	175	2 21/32”

The strut servicing data was also obtained from the intact RMLG.
X dimension – 11.0”
Lower port (A) pressure - 600psi
Upper port (B) pressure - 500 psi
Stick measurement 3 7/32”

3.0 Maintenance Records

The accident airplane, N391FE, S/N 46625, had accumulated 73,283 hours and 27,002 cycles since new at the time of the accident. The airplane was equipped with General Electric CF6-6 engines and was converted from a DC-10-10F to an MD-10-10F in May 2002.

The last Service Check was performed on July 28, 2006, 3-days since the last service check. The last A Check was performed on July 23, 2006, 8 days since the last A check. The last B Check was the B5 Check performed on June 27, 2006, 34 days since the B4 check. The last C Check was the C6 Check performed on July 07, 2005, 389 days since the C5 check.

In the FedEx maintenance program, landing gear struts are serviced every 6th B Check. The B Checks are typically performed every 90-days so there are approximately 18 months between each gear strut service. The MLG were last serviced in June 2005.

According to Boeing, the MLG outer cylinder has a safe life limit of 46,200 cycles at a Max Gross Weight of 455,000 lbs. The MLG overhaul limit is 30,000 flight hours or 9 years, whichever occurs first.