April 22, 2010

To: Accident Case File #: MD600N/RN045
N613BP, US Border Patrol Air Operations
San Diego, California
NTSB Identification: WPR10TA016

From: John Hobby, Chief Accident Investigator, MD Helicopters Inc.

Subject: Field Investigation Notes
October 19, 2009 at CBP Hanger, Brown Field, San Diego CA

Copies Furnished: Adrian Booth, The Boeing Company and Tealeye Cornejo, NTSB.

1. Parties to the Investigation:

Tealeye Cornejo, NTSB IIC, Gardena, CA (310) 380-5659
John Hobby, MD Helicopters Inc., Mesa Arizona [redacted]
John McCarthy, CBP/DHS Investigator

2. General Information:

On October 12, 2009 a model 600N helicopter, N613BP (S/N: RN045) made a hard landing while performing practice autorotations at Gillespie Field (KSEE) in El Cajon, CA. The helicopter was operated by the US Customs and Border Protection (CBP) with two instructor pilots onboard. One instructor pilot was a MD Helicopters, Inc. (MDHI) factory training pilot and the other was a CBP standardization instructor pilot. The purpose of the flight was for the MDHI instructor pilot to perform autorotation flight training. Prior to the incident, the pilots performed, power on approaches, hovering autorotations and 90 degree turn autorotations. The 90 degree turn autorotations were initiated from 500 feet AGL to the runway and ended with large ground runs. The MDHI factory instructor pilot was seated in the left seat and the incident occurred when the MDHI factory instructor pilot attempted to demonstrate a left 180 degree turn autorotation from the same 500 feet AGL as the first four autorotations. The pilot reported the autorotation airspeed as 85 to 90 knots and that when he began to roll out of the turn it became apparent that the rate of decent was too high and that the helicopter was too low to initiate a flair or a power recovery. The helicopter impacted the runway hard on the left landing gear, collapsing the left gear and sliding along the runway. The helicopter turned to the left almost leaving the runway before stopping. Other CBP pilots were on the ground and video taped the incident. The incident occurred at about 10:45 AM in visual meteorological conditions with calm winds. No injuries were reported.

The helicopter sustained substantial damage to the left side of the fuselage. The left landing gear struts were not fractured but the forward and aft attaching structure on the left side of the fuselage was substantially damaged. Damage included the left engine side mount, torn firewall skin and the left forward and aft landing attachment fittings torn from the fuselage structure. There was no visual damage to the main rotor hub, blades, tailboom or stabilizers. The lower wire strike blade extension contacted the ground and was broken off but the helicopter belly did not contact the ground.

3. Aircraft Maintenance History:

The aircraft total time at the time of the incident was 3192.5 hours. The most recent maintenance action was a receiving inspection that included weighing the aircraft. This logbook entry is dated 10/7/2009 at 3190.0 hours. The last 100 hour/annual inspection was performed on 4/5/2009 at 3153.5 hours. The 100 hour/annual inspection were noted as being performed in accordance with manufactures maintenance manual CSP HMI-2. Review of the compliance logs showed the Manufacturer Service Bulletins and Airworthiness Directives to be in compliance.

4. Aircraft Performance and Weight & Balance Data:

a. Weight & Balance:

The following weight and balance calculations were made based on pilots' statement and the helicopters Flight Loading Report dated October 8, 2009. Based on these weights the helicopter was within weight and balance limits.

WEIGHT & BALANCE - N613BP

	Weight (lbs)	Arm (inches)	Moment (inch lbs)
Basic Empty Weight	2376.0		247816.8
Pilot	215.0	43.0	9245.0
Copilot	215.0	43.0	9245.0
Fuel (6.8 lbs/gal)	600.0	82.1	49260.0
Aux Tank	0.0		0.0
Gross Weight	3406.0		315566.8
LONGITUDINAL CG		92.7	
MAXIMUM GROSS WEIGHT			4100 LBS
LONG CG LIMITS			91.0-96.0

b. Operational Performance Data:

The airport elevation is 388 feet and the weather was reported as overcast with a temperature of 68˚ F and calm winds. The pilot reported in his written statement that the main rotor RPM during the autorotations was in the lower part of the green arc – even going below the green arc occasionally if the collective was raised during the decent. The main rotor RPM range is 90 % – 106.4 %. At the helicopters weight and density altitude, the main rotor RPM should have been above the 106.4 % red line limit requiring the pilot to increase collective pitch to maintain the RPM within limits. With the main rotor RPM not fully available to the pilot, the autorotation capability is diminished (having main rotor RPM at the high end of the operating range during the autorotation flair provides the maximum rotor energy to cushion the landing).

5. Systems Examination:

Examination of the helicopter was conducted at the CBP hanger, Brown Field, San Diego CA. Recovery was done by CBP and consisted of removal of the main rotor blades and hoisting the helicopter onto a flat bed truck, transporting and unloading the helicopter at the CSP's Brown Field hanger. The helicopter was positioned on a helicopter dolly and supported by jacks on the left side and wooden pallets under the belly. Inspection of the helicopter was done inside the CBP hanger in daylight hours.

a. Airframe/Landing Gear:

The helicopter exhibited extensive damage to the left side of the airframe in the area of the outboard landing gear damper attachment structure. The left landing gear struts were not broken but completely spread with the landing gear damper attachment structure torn and the structure severely deformed from the landing gear strut/damper over travel. The left landing gear struts were gouged and scratched in the area where they pass through the fuselage. The aft left landing gear damper upper cap was bent and the forward left lower damper cap was separated from the damper body from the over travel. The landing gear strut and brace attachment fittings on the center beam appeared undamaged. However, there were contact marks on the fittings indicating over travel. There was no visual damage to the right struts or fuselage strut attachment structure. The canopy, upper fuselage and belly of the aircraft were undamaged.

b. Cockpit Instruments, Crew & Passenger Seating/Restraint System:

The instrument and center console slant panel showed no evidence of damage. Both cockpit seat box structures were modified to incorporate a removable style access cover. There was some waviness to the left seat structures aft section but it is suspect that this was due to the landing gear forward strut/damper attachment damage. There was no noted damage to the right seat box structure. The crew and passenger restraint system functioned normally and the attachment points showed no evidence of damage.

c. Engine:

The aircraft was equipped with a Rolls-Royce 250-C47M Turbo shaft engine, SN: CAE-847825. The left engine mount was bent and fractured due to the engine mount attachment to the landing gear damper fitting that was displaced by impact damage. No engine related issues are suspect or reported by the pilots.

d. Main Rotor System:

The main rotor hub, blades and upper controls showed no visual evidence of impact or damage.

e. Main Transmission and Drive System:

The main rotor transmission, Notar transmission and Notar fan assembly rotated freely when the main rotor hub was rotated. Rotating the rotor head verified the operation of the overrunning clutch, continuity of the main rotor drive shaft and engine to transmission driveshaft. There was no visual evidence of engine misalignment however, due to the left engine mount damage; excessive misalignment is suspect.

f. Anti-torque System:

There was no visual damage to the tailboom, Notar empennage or Notar fan blades.

g. Flight Control System:

The helicopter was configured with duel controls and right hand command. Control continuity was verified for all main rotor controls. Control rods, links and bellcranks up to the main rotor hub appeared undamaged. The anti-torque pedals moved freely and resulted in a corresponding Notar fan pitch change and movement of the rotating cone.

h. Fuel System:

The main fuel tank contained approximately 600 pounds of fuel. The engine fuel pump return line fitting was broken at the engine firewall and a small amount of fuel from this line leaked on the runway. The broken fitting appeared to be related to the landing gear strut/damper and engine mount attachment fitting damage. No other fuel leaks were reported.

6. Investigator Comments:

- All observed damage to the helicopter appears to be the result of impact forces.
- Examination of the helicopter did not identify any fault or malfunction.
- The pilots' report of the autorotation RPM being in the lower part of the green arc indicates the autorotation RPM was set below the specified limits in maintenance manual, CSP-HMI-2, Chapter 18-10-60, Table 502 (the autorotation RPM chart in the maintenance manual ensures sufficient autorotation RPM is available at minimum gross weight).
- With the autorotation RPM set low, the pilot had less rotor energy available to perform the autorotation landing.

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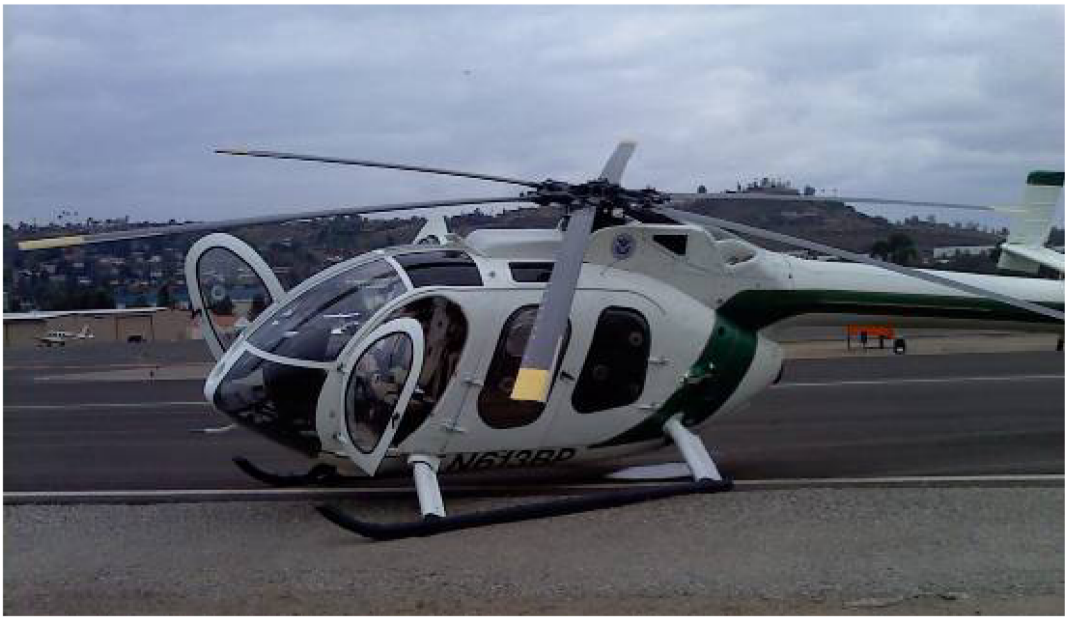
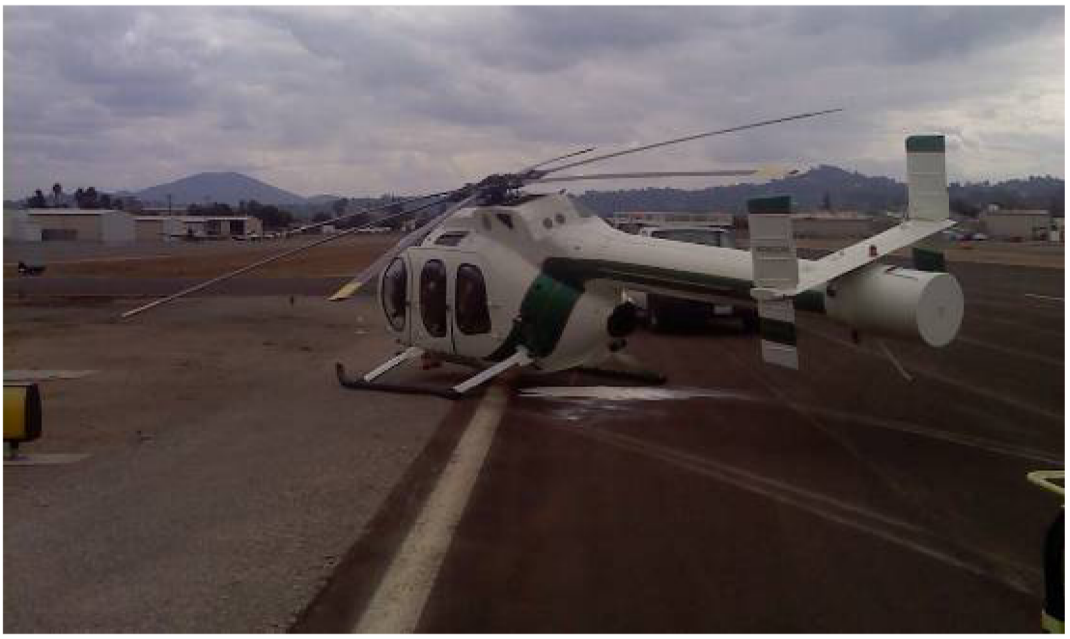
7. **Photos:**



Incident Site



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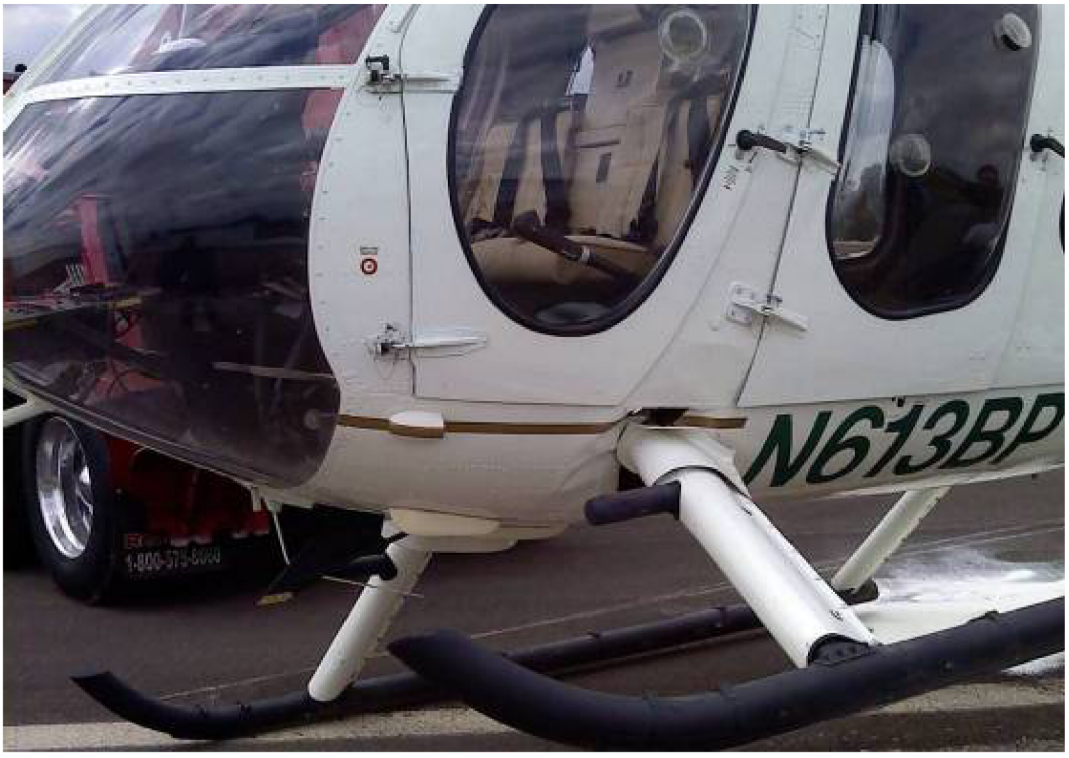
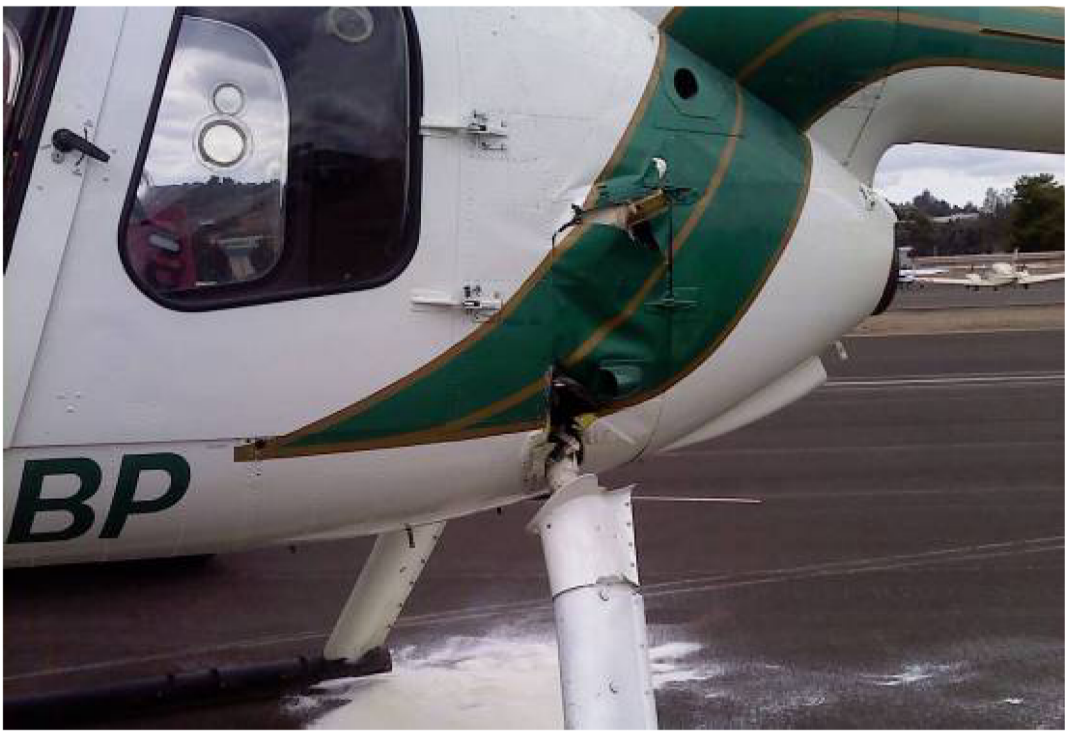
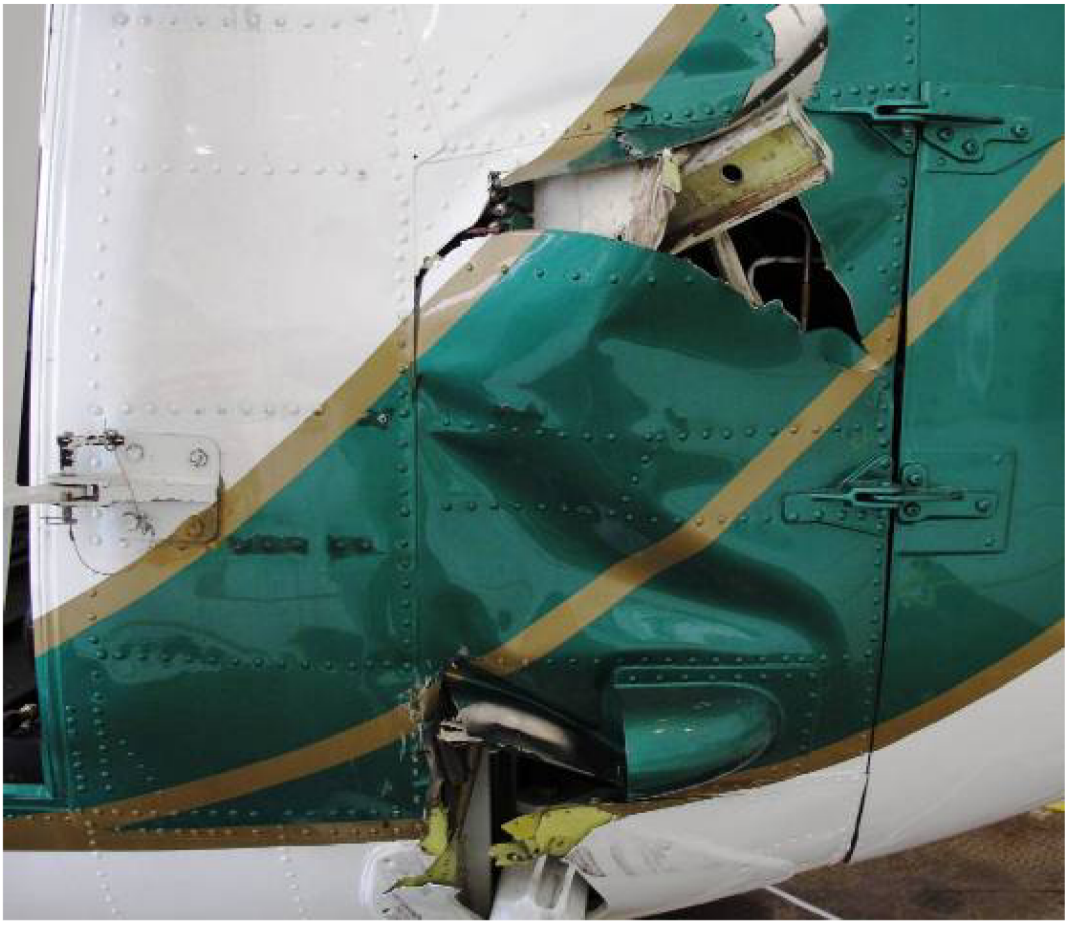


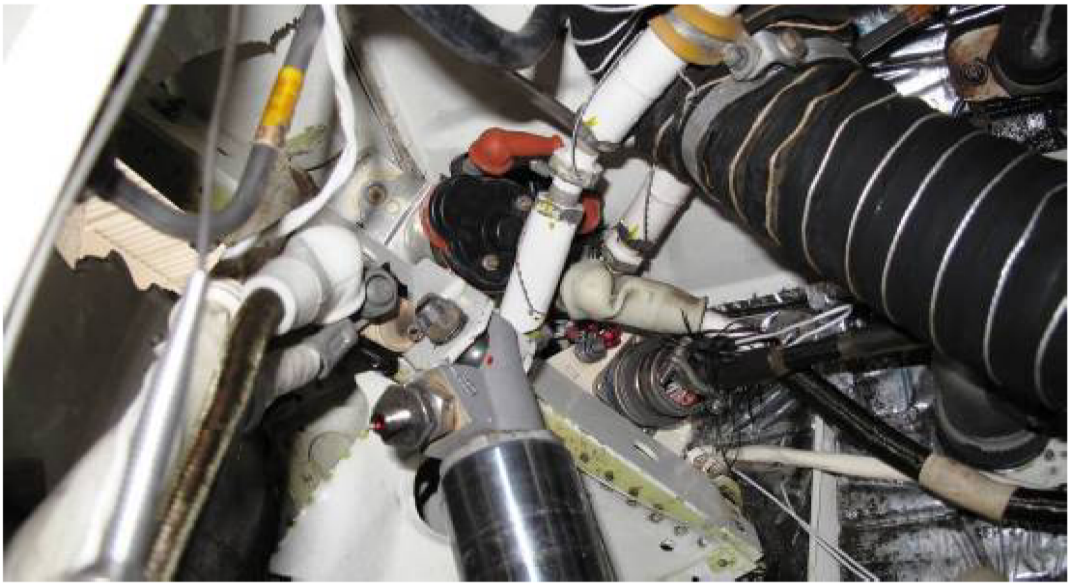
Left Forward Landing Gear



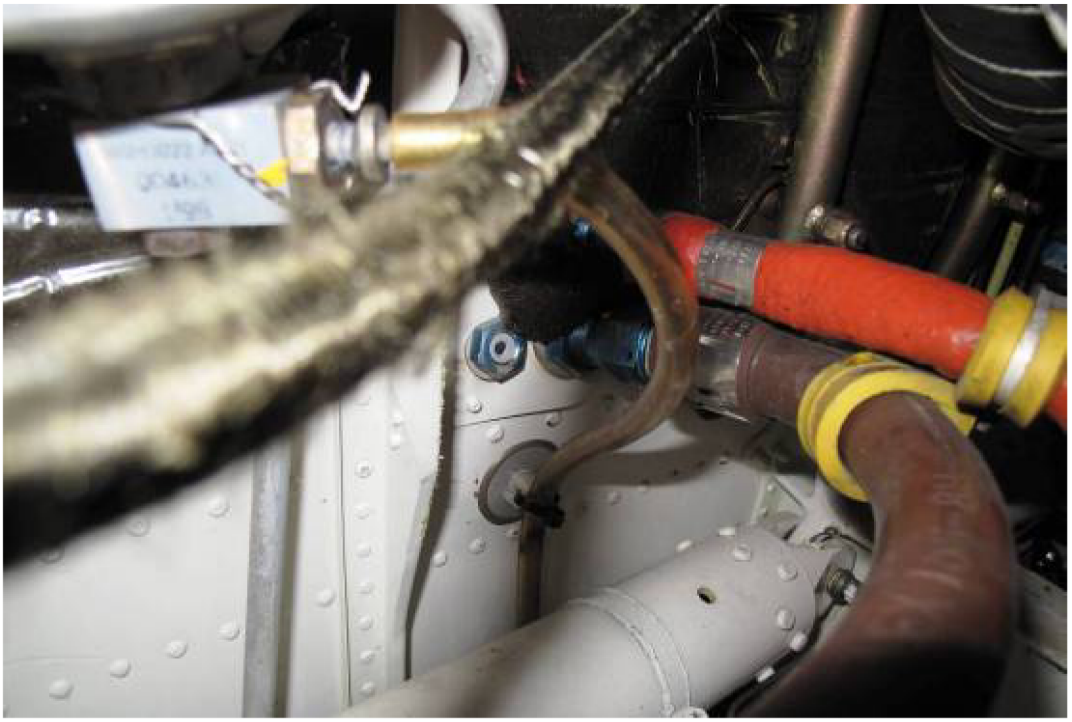
Left Aft Landing Gear



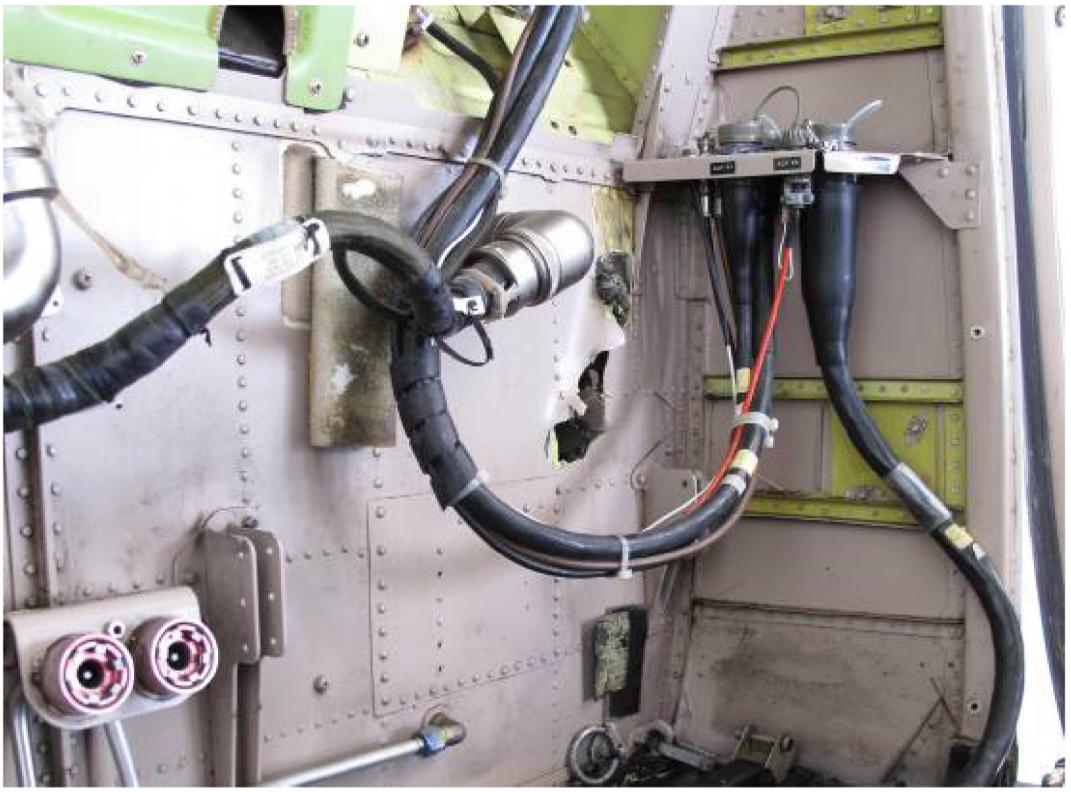
Aft Left Landing Gear Attach Structure



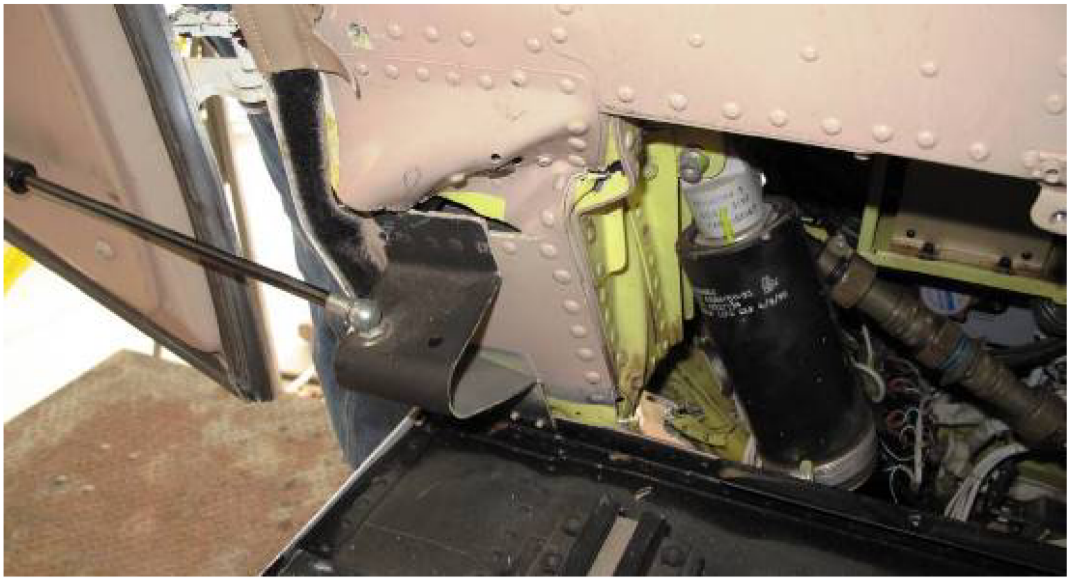
Aft Left Landing Gear Damper Attach and Engine Mount



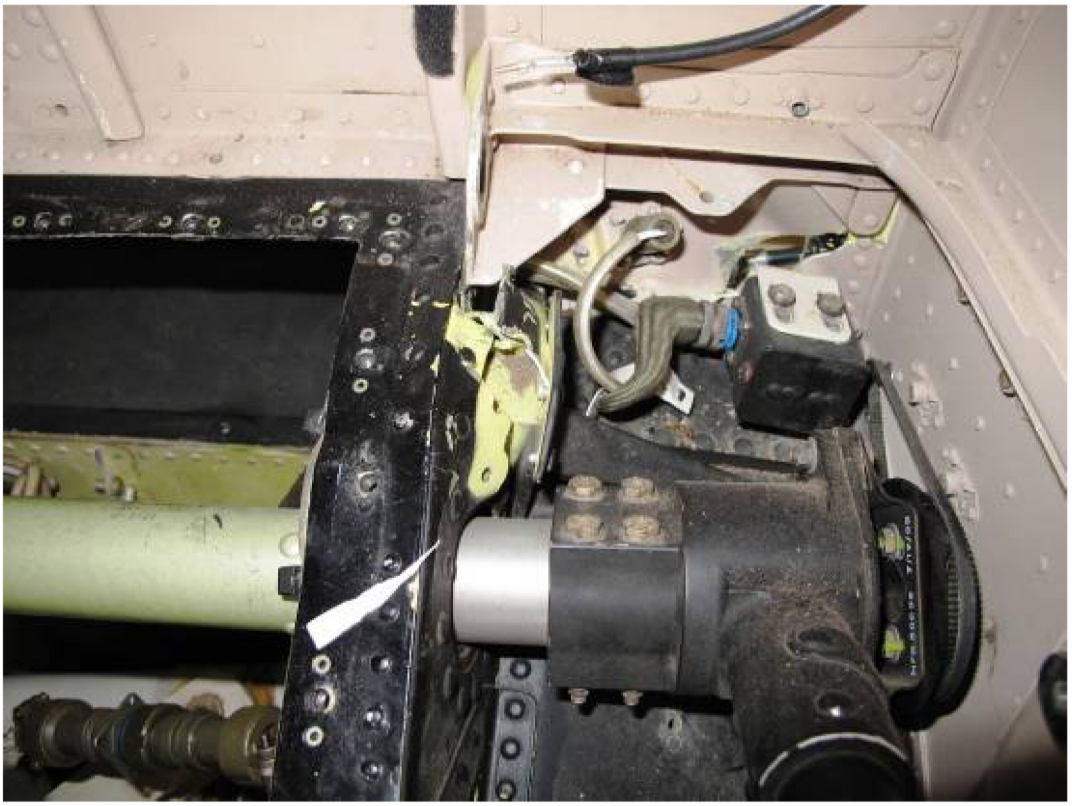
Engine Fuel Pump Return Line Fitting



Left Cabin Area, Station 124.0



Left Cabin Cant. Station 78.50 and Foot Well Area



Left Collective and Damper Attach Fitting