

Bell 206L-1, N206DD

AAIB Bulletin No: 7/2001 **Ref:** EW/G2001/01/06 **Category:** 2.3

Aircraft Type and Registration: Bell 206L-1, N206DD

No & Type of Engines: 1 Allison 250-C28B turboshaft engine

Year of Manufacture: 1979

Date & Time (UTC): 7 January 2001 at 1918 hrs

Location: British Virgin Islands

Type of Flight: Public Transport

Persons on Board: Crew - 1 - Passengers - 6

Injuries: Crew - None - Passengers - None

Nature of Damage: Serious damage resulting from roll over and salt water immersion

Commander's Licence: Federal Aviation Administration Licence

Commander's Age: 53 years

Commander's Flying Experience: 10,400 hours (of which 3,800 were on type)
Last 90 days - 45 hours
Last 28 days - 28 hours

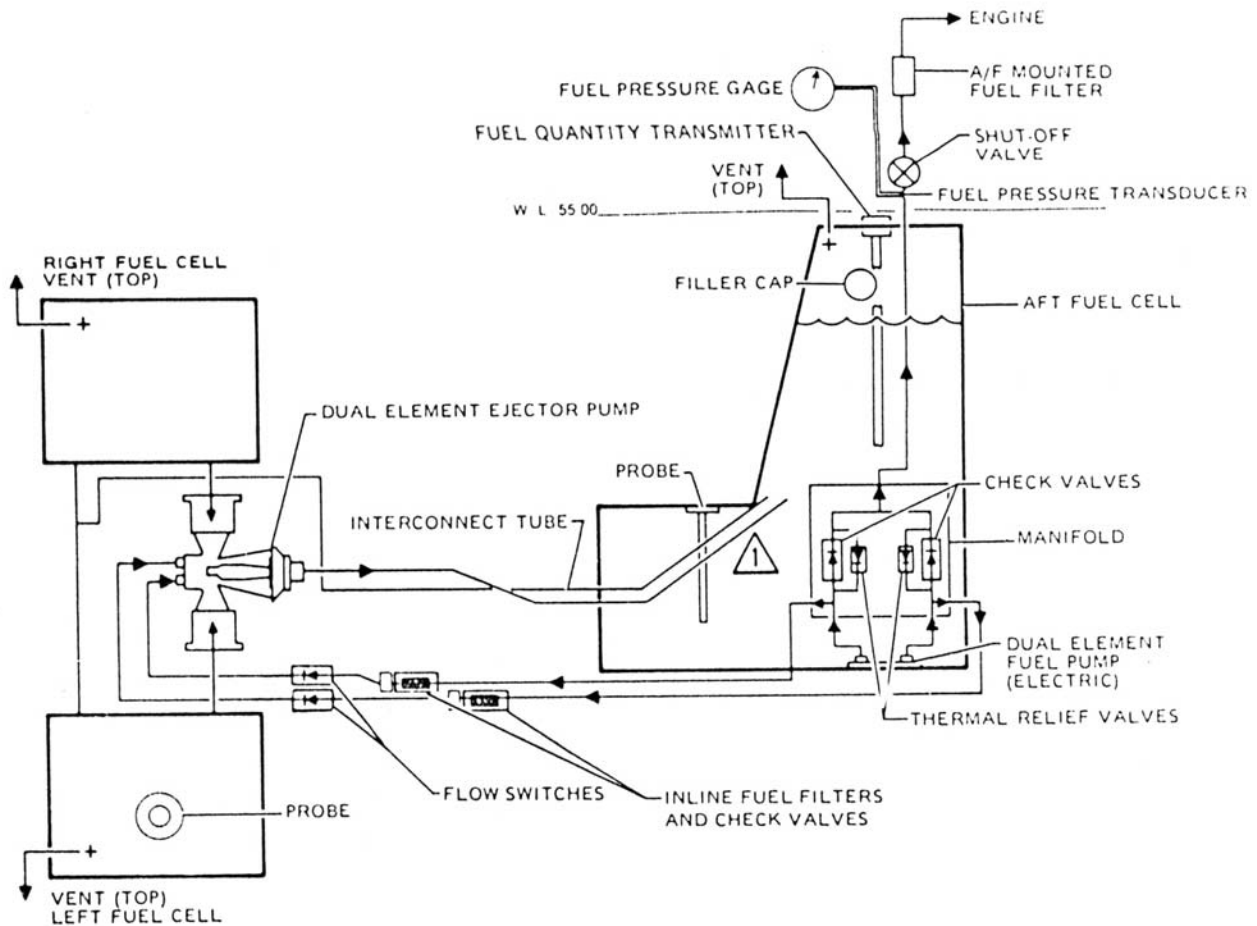
Information Source: Aircraft Accident Report Form submitted by the pilot and wreckage examination conducted by a representative of the manufacturer

History of the flight

The helicopter was engaged in flying a coastal sightseeing tour from Beef Island airport in the British Virgin Islands, with six passengers on board. It was flying at an altitude of some 300 feet just off the north west shoreline of the Island of Virgin Gorda when without warning, the pilot noticed the left fuel boost pump low pressure warning light illuminate. He re-set the circuit breaker, to no effect, but some 10 seconds later the right fuel boost pump warning light also illuminated. The pilot recalled that the fuel gauge at this time was indicating some 150 lbs, but that this quickly rose to 350 lb for some five seconds. He did not see the low fuel level warning light illuminate. Some 15 seconds after the first indication of low fuel pressure, the engine stopped and so from approximately 200 feet he entered autorotation and stretched the glide towards the shore as far as he was able. The helicopter landed in a level attitude onto the water, but despite deployment of the skid mounted flotation bags, it rolled over onto its right side in some three feet of water. All the passengers were uninjured and, having exited through the left side doors, they waded ashore.

Fuel system description

The fuel system on the Bell 206L-1 Long Ranger is similar to that on the smaller Jet Ranger in that the main fuel tank is integral with the rear passenger bench seat. However, the system capacity is greater on the B206L-1 as two additional fuel tanks are located beneath the cabin forward seats. The main tank capacity is 76 US gallons and each forward tank is 11 US gallons, giving a total capacity of 98 US gallons. On N206DD this capacity had been further increased to 110 US gallons by the installation of the filler neck 'range extender' modification.



Fuel system schematic

Fuel is transferred from each forward cell into the main fuel tank by the action of a dedicated dual element ejector (jet) pump powered, respectively, by fuel under pressure from the output side of the left and right fuel boost pumps sited on the floor of the main tank. These fuel bleeds are passed through wire mesh filters/check valves upstream of the jet pumps and are sensed by flow switches. Loss of the fuel flow is indicated to the pilot by the respective boost pump warning light. Thus if the fuel pumps were to fail, or the supply in the main tank becomes exhausted, then these lights should illuminate. Fuel quantity in the main and additional tanks is measured using capacitive type sensors, their outputs being summed and presented as a total quantity on a single gauge on the instrument panel. As the forward tanks are interconnected, the single probe fitted to the left forward tank normally senses the quantity in both forward tanks.

Wreckage examination

The British Virgin Islands (BVI) are classified as a British Overseas Territory and the investigation of air accidents is the responsibility of the United Kingdom. These are conducted under the Dependant Territories Regulations and, in this particular case, the AAIB elected to conduct the investigation using the Air Accident Report Form (AARF) procedure. As the helicopter type is manufactured in Canada and the type certificate is held by the same country, an Accredited Representative was appointed by the Transport Safety Board of Canada under the provisions of ICAO Annex 13, Chapter 5. The Director General of Civil Aviation in the BVI also requested assistance from the FAA and through this route an investigator from Bell Helicopters was invited to examine the wreckage. The summary of his report is reproduced below.

"Examination of the dynamic components of the helicopter did not disclose evidence of pre-impact problems. Water was found in the engine nozzle fuel line and airframe filter. Also, the airframe fuel filter was found only 20% full of liquid but is typically found full of fuel under normal circumstances. Whether the water ingress into the fuel line was as a result of the mishap is unknown; however, no breaks were seen in the lines and fittings attached to these components. A significant amount of contamination was found in the left side inline fuel transfer filter. The nature of this contamination indicates it was present in the filter before the mishap occurred. The amount of debris on the filter screen likely resulted in fuel bypassing the screen at some point; however, no debris was seen in the ejector pumps downstream of the filters. The presence of debris in other areas of the fuel system was not determined"

The debris referred to above took the form of paint flakes, white with a green primer backing up to .25 inches by .25 inches, and fragments of a thin transparent plastic-like sheet material, approximately .001" thick, the largest fragment being some .3 inches by .25 inches, Figure 1. The method by which this helicopter was being refuelled was not established

This helicopter was manufactured on 6 April 1979 since when it was reported to have flown for a total of some 21,000 hours

An accident with similar characteristics occurred to a Bell 206L-1, G-WARM, in 1981 and was reported upon in AAIB Bulletin 15/81, ref. EW/C759/01. In that case the engine stopped after the left boost pump warning light illuminated, but with a reported 100 lbs of fuel indicated on the gauge. Subsequent examination revealed the fuel transfer system was heavily contaminated with similar debris and that the venturi of the left jet pump was partially obscured by a complete 'O' ring seal. It was also established that the helicopter was being refuelled in the field from a drum fitted with a manually operated pump but that no debris or water filter had been installed. Subsequent to that accident the manufacturer published Technical Bulletins 206L-81-64 and 206L-1-65 relating to the fuel system.

Discussion

The examination of N206DD by the manufacturer's representative failed to reveal any pre-accident defects, other than the presence of concentrated debris in left jet pump supply fuel filter. In the absence of any reports of electrical supply failure, the fact that both fuel boost pumps failure lights illuminated within a short time of each other strongly suggests that the fuel in the main tank became exhausted, and this view is supported by the stoppage of the engine shortly afterwards. The indication of some 150 lbs of fuel remaining on the cockpit gauge would also suggest that the forward left fuel tank was nearly full, i.e. that this fuel had not been transferred to the main tank. In the opinion of the investigator from the manufacturer who examined the helicopter, sufficient debris was obscuring the filter mesh to cause fuel to flow through the by-pass, although the by-pass opening was reported to have been uncontaminated, as was the left filter when examined. Thus, although no debris was found in the jet pumps when the helicopter was examined, it seems likely

that debris had indeed obstructed the left side of the dual element jet pump interrupting the transfer of fuel. If the main tank had become exhausted due to a problem with the fuel transfer system the low fuel warning light should have illuminated when some 10 gallons remained. The pilot reported that he did not see this warning and no explanation could be found for its absence.