No: 7/91 **Ref: EW/C91/2/1** **Category: 1a**

Aircraft Type and Registration:	De Havilland Canada DHC-7-110, G-BRYA
No & Type of Engines:	4 Pratt & Whitney PT6A-50 turboprop engines
Year of Manufacture:	1981
Date & Time (UTC):	6 February 1991 at approximately 1000 hrs
Location:	6 nm north-east of Lille, France
Type of Flight:	Public Transport
Persons on Board:	Crew - 4 Passengers - 2
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	35 years
Commander's Flying Experience:	3,700 hours (of which 2,000 were on type)
Information Source:	AAIB Field Investigation

After take-off from Lille the autopilot was engaged at 2000 feet with altitude capture armed for level-off at 3000 feet. At 3000 feet the autopilot mode selector lights changed from 'Altitude armed' to 'Altitude capture' but the aircraft failed to level-off. The autopilot was disengaged, the height lock was reset and the autopilot was re-engaged but it still failed to hold the required height. The aircraft was then cleared to FL 100 and a normal climb was resumed with the autopilot engaged once more. At FL 100 the autopilot again failed to level the aircraft. It was then disengaged and the flight was continued in manual control.

The commander reported that in level cruise the elevator control felt slightly stiff, giving him the impression that the autopilot clutches had not disengaged fully. When he began the descent into London City Airport he found that the elevators still felt slightly stiff, the elevator trim was abnormally sensitive and its setting was more nose-down than normal. Nevertheless, despite these abnormalities, he considered that he still had adequate control of the elevators. During the approach to land at London City Airport landing gear and the initial stage of flap were selected without further adverse effects. As the aircraft descended below 1000 feet, elevator control became noticeably stiffer and, when full flap was selected, he found that the neutral trim position was fully forward. In the flare considerable back pressure was needed on the control column and, as this pressure was applied, he heard a slight

snapping or clicking noise from the rear of the aircraft, after which elevator control pressure appeared to return to normal. The first officer reported that he saw the control column jolt backwards during the landing flare.

The readout from the flight recorder showed that, as the aircraft passed 2500 feet in the climb with the autopilot engaged, it pitched down from +5° to 0° and then pitched up to +12°, at which point the autopilot was disconnected. Some 50 seconds later, after the pitch attitude had been returned to normal, presumably under manual control, the autopilot was re-engaged and appears to have controlled the aircraft normally during a climbing turn to the left through 140°. About 2 minutes later, whilst the aircraft was still under autopilot control, a small, regular fluctuation of elevator angle occurred, which was mirrored by similar small fluctuations in the elevator trim and normal g traces. A similar fluctuation of elevator and trim tab angle was seen to have occurred for some three minutes on the previous flight as the aircraft descended to land at Lille. This earlier fluctuation showed clearly on the normal g trace and ceased only when the autopilot was disconnected.

The aircraft was later flown from London to Plymouth with the autopilot disconnected. The pilot on this flight reported that after take-off the elevators became very heavy and that control in pitch had to be assisted by trim and power. He also reported that, even though he had not selected full flap for landing, a very heavy pull on the control column was needed to flare the aircraft, and this heavy pressure produced enough flare only to achieve a very flat landing.

Examination of the aircraft was carried out at Plymouth, in conjunction with the investigation into the incident to DHC-7 aircraft G-BOAW (30 Jan 1991). This earlier incident is the subject of an Inspector's Investigation.

An inspection of the pitch control runs was carried out, requiring removal of the cabin floor and other access panels. On removal of the floor panels in the area of the lavatory, it was found that a major leakage of fluid had occurred, resulting in a build-up of ice on the left hand side of the aircraft below the floor. This ice formed around the pulley group at the rear of the cabin area, immediately below the lavatory, preventing pulley rotation and restricting cable movement. Elevator and pitch-trim cables route over this pulley group which is situated close to the fuselage skin, mounted on small brackets attached to the skin and stiffeners. The space between the cabin floor and the skin is very small in this area.

Once the ice had melted and the area was cleaned, the control system was found to operate freely and no other problems were evident.

An aftercast of the temperatures encountered between Lille and London City Airport at the time of the incident shows that on departure from Lille the ambient temperature was -9°C and on arrival at London City Airport it was -3°C. The temperature on arrival at Plymouth is known to have been well below 0°C.

This incident is the second to have occurred in a period of a week involving DHC-7 aircraft on the British Register. In each case problems relating to pitch control were reported by the crew.

Late on the day of this incident, the Civil Aviation Authority issued Emergency Airworthiness Directive No. 013-02-91, applicable to all DHC-7 aircraft requiring removal of power from the autopilot servos via circuit-breakers and electrical disconnection of the servos. The aircraft accordingly re-entered service a few days after the incident with the autopilot/trim system inhibited. It continued to operate uneventfully with the autopilot inhibited until 14th February 1991 when the Emergency Airworthiness Directive on the fleet was revoked.

The CAA document revoking the Directive continued to require G-BOAW to operate with auto-pilot inhibited.