

SERIOUS INCIDENT

Aircraft Type and Registration:	Beech 200 Super King Air, G-FSEU	
No & Type of Engines:	2 Pratt & Whitney Canada PT6A-41 turboprop engines	
Year of Manufacture:	1978 (Serial no: BB-331)	
Date & Time (UTC):	28 February 2020 at 1415 hrs	
Location:	Doncaster – Sheffield Airport	
Type of Flight:	Commercial Air Transport	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Flap motor burnt out	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	35 years	
Commander's Flying Experience:	856 hours (of which 393 were on type) Last 90 days - 18 hours Last 28 days - 2 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB	

Synopsis

While climbing through 8,800 ft after departing Doncaster-Sheffield Airport, the pilots noticed an electrical smell on the flight deck followed by a build-up of grey smoke in the cabin. A MAYDAY was declared and on the approach the flaps were selected down but remained in the retracted position. The aircraft landed without further incident.

The smoke was caused by overheating of the flap motor. The flaps UP limit switch had not operated due to wear in the system and so electrical power continued to be supplied to the motor after the flaps reached the retracted position prior to takeoff. The flap motor Circuit Breaker was found to be intermittent and had not initially tripped to protect the motor from overload.

History of the flight

Prior to a flight from Doncaster-Sheffield Airport to Wick Airport, the commander checked the flap system by operating the flaps through their full range and visually comparing each position against the flap indicator. The flaps were returned to the retracted (UP) position and the aircraft made a flapless take off from Runway 20.

As the aircraft climbed through 8,800 ft, the pilots noticed an electrical burning smell in the cockpit and decided to return to Doncaster. There was no obvious source for the smell

and none of the circuit breakers (CB) had operated. Grey smoke was then seen in the cabin. The commander declared a MAYDAY to Scottish ATC(C) and requested an ILS approach for Runway 20, while the co-pilot searched for the origin of the smoke in the cabin. However, the source could not be identified.

On the approach to Doncaster, the commander selected the flaps to the APPROACH position but there was no movement. An inspection of the CB panel found that the CB for the flap motor had tripped.

The aircraft made an uneventful landing at Doncaster and was met by the airport Rescue and Fire Fighting Service who used thermal imaging equipment to search for hot spots. A hotspot was detected on the left of the fuselage, below the floor near the centre of the cabin where the flap motor was located. There was no evidence of fire.

Flap control system

Two flaps are mounted on each wing and are driven by an electric motor and gearbox located below the floor to the left of centre of the cabin. The gearbox drives four flexible drive shafts each connected to a jackscrew via a flap actuator, which moves the flaps to the position selected by the pilot.

The flap selector has three positions: UP, APPROACH and DOWN. When the pilot selects one of these positions, electrical power is supplied to the motor to move the flaps. Once the flaps reach the selected position, a cam connected to the right inboard flap by a link-arm assembly operates a limit switch to disconnect electrical power to the motor. At the same time a second winding in the motor is activated which causes the motor to act as a brake to prevent the flaps from travelling past their selected position.

Maintenance

The manufacturer changed the maintenance schedule of the flap system from phased based maintenance to flap cycles in January 2019, which reflects the actual usage of the flaps.

The flap motor, gearbox and flap actuators were replaced during the Phase 3 maintenance carried out on 17 January 2020 and had operated for 56 flap cycles prior to this event.

Maintenance actions

Examination of aircraft

Examination of the aircraft, by the operator's engineers, discovered evidence of heat damage and a burnt smell from the flap motor (Figure 1). A check of the flap motor CB was carried out and was found to be intermittent in operation.



Figure 1

Flap motor showing evidence of damage due to overheating

Cause of the smoke in the cabin

The maintenance organisation believed that wear in the flap cam and link-arm assembly prevented the flap UP limit switch from operating when the flaps retracted. As a result, electrical power was continuously supplied to the motor, which overheated, emitting fumes and smoke into the cabin. Normally, the CB would operate to protect the motor; however, it is likely that an intermittent fault meant it did not initially trip.