Shorts SD3-60-300, D-CFAO

AAIB Bulletin No: 3/2002	**Ref: EW/G2001/12/08**	**Category: 1.1**
INCIDENT		
Aircraft Type and Registration:	Shorts SD3-60-300, D-CFAO	
No & Type of Engines:	2 PT6A-67R turboprop engines	
Year of Manufacture:	1988	
Date & Time (UTC):	17 December 2001 at 2200 hrs	
Location:	Near Manchester Airport	
Type of Flight:	Public Transport (Cargo)	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Oil contamination within intake, inside nacelle and on stabiliser	
Commander's Licence:	Airline Transport Pilots Licence (German)	
Commander's Age:	37 years	
Commander's Flying Experience:	2,999 hours (of which 720 were on type)	
	Last 90 days - 64 hours	
	Last 28 days - 21 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional AAIB inquiries	

Shortly after taking off on a scheduled flight from Manchester to Paris, the left engine fire warning activated. The engine was shut down in accordance with the abnormal procedures checklist for an engine fire and the first fire bottle was discharged, following which the fire warning light extinguished. The commander informed ATC of the situation and of his intention to return to Manchester. He additionally requested that the airfield fire service vehicles be positioned close to the runway. The aircraft landed without further incident.

A subsequent inspection of the engine revealed no evidence of a fire, although engine oil had been deposited inside the nacelle, in the engine intake and on the horizontal stabiliser.

A feature sometimes observed on the PT6 engine, particularly the -67 variant, is a tendency for oil to accumulate in the accessory gear case, resulting in an apparent reduction of oil contents when measured by the oil tank dipstick. The oil pressure pump and all the scavenge pumps are driven by accessory gears attached to the rear of the gas generator. The scavenge line from the engine No 1 bearing (which is at the rear of the engine) drains back into the accessory gear case. The accessory gear case scavenge pump then returns the oil to the tank. It is considered that following the in-flight shutdown, the gas generator continued to rotate, albeit at low speed, under the action of ram air. In this condition, it is probable that the scavenge pump was not emptying the gear case as rapidly as it was being filled.

The layout of the engine is such that the oil level in the accessory gear case can reach a point where the No 1 bearing becomes flooded, resulting in oil venting into the engine intake, and subsequently draining into the nacelle. Oil passing through the engine would be deposited on the horizontal stabiliser.

The engine manufacturer advises that oil flooding in the accessory case can leak out via the accessory pad seals. A Service Bulletin (SB) No 14108R3, issued in October 1992, with Revision No 3 dated September 2000, addressed this particular problem by modifying the scavenge pumps to improve oil scavenging.

The team of engineers who worked on the aircraft found a small, unrelated oil leak. They also found evidence of contamination on two of the fire-wire connectors. These were cleaned and the engine, which required replenishment with 6 quarts of oil, was ground run; this included a period at high power.

The aircraft was declared fit for service and two days later (on 19 December) another attempt was made to depart for Paris. However, whilst waiting at the runway holding point, the No 1 engine fire warning system activated once again. The engine fire procedure was carried out and, since the fire warning did not cease following the initial shot, both fire bottles were discharged. As with the previous incident, no evidence of fire was found during the subsequent examination.

Following the second incident, both fire-wire loops around the No 1 engine and the fire-wire control unit were changed. The problem has not recurred since this rectification.