AAIB Bulletin No: 12/93 **Ref: EW/G93/09/03** **Category: 1.1**

INCIDENT

Aircraft Type and Registration:	BAe ATP, G-BTPE	
No & Type of Engines:	2 Pratt & Whitney 126 turboprop engines	
Year of Manufacture:	1989	
Date & Time (UTC):	7 September 1993 at 12 46 hrs	
Location:	Manchester Airport	
Type of Flight:	Public Transport (Scheduled)	
Persons on Board:	Crew - 4	Passengers - 63 + 5 infants
Injuries:	Crew - 3 Minor	Passengers - 2 Minor
Nature of Damage:	Smoke in Cabin	
Commander's Licence:	Air Transport Pilots Licence	
Commander's Age:	43 years	
Commander's Flying Experience:	8,406 hours (of which 1,081 were on type)	
Information Source:	Aircraft Accident Report Form submitted by the pilot and AAIB liasion with the airline's Safety Services Department	

The aircraft was due to fly a service from Manchester to Jersey and had just embarked all the passengers. Shortly after the No 2 engine had been started, apparently normally, and the No 2 environmental control system (ECS) pack selected on, a dense blue smoke filled the flight deck and cabin. As the aircraft had not yet been pushed back and the forward door was open, with the airstairs still in place, the commander ordered the cabin crew to evacuate the passengers via the door, this was accomplished without injury. Before the same passengers were re-boarded, less 2 adults with 1 infant who elected not to travel, the aircraft was examined by engineers from the airline.

The oil contents in the No 1 air cycle machine (ACM) at that time appeared to be low so an engine run was carried out on the No 2 engine, initially with the No 2 ECS pack selected on. As no smoke was evident in the aircraft the air crossfeed was opened to the No 1 ECS, whereupon smoke began to appear. It was concluded that an internal oil leak in the No 1 ACM was the likely cause of the smoke and the aircraft was offered back to service with the No 1 ECS inoperative, in accordance with the Master Minimum Equipment List (MMEL).

Approximately 1½ hours later the aircraft had been pushed back from the stand with both engines running, the tug had been disconnected and taxi clearance had been received. The flight crew at this time, however, became concerned about the performance of the No 2 ECS, which was producing a shortfall in air temperature and requested permission from ATC to taxi back onto the stand. They were instructed to hold position. At about this time the cabin crew, having completed the safety briefing and cabin checks, became aware of blue smoke accompanied by a smell of burning and immediately reported this fact to the commander. In consideration that this event could have been a different malfunction, and the delay that would have been incurred in taxiing back onto the stand, the commander ordered an emergency evacuation. This was accomplished using three inflatable slides (forward left and rear left and right) and the right side overwing exit. During the evacuation two passengers and one stewardess sustained minor injuries (neck, elbow and back respectively) for which treatment was given at the local hospital. All three were released the same day. Both flight crew members also received slight injuries.

The evacuation exposed several shortcomings in the seviceability of the escape equipment. It was reported that the co-pilot's escape direct-vision window did not open readily, that the left overwing exit could not be opened and the rear right escape slide did not deploy properly. Also, it was reported by a witness in the airport restaurant that, possibly, the aft baggage door (right) and aft passenger door (left) escape slides had just failed to reach the ground after deployment. Investigation of this report by the airline revealed that no technical defects were apparent in either rear slide. With an intact and deployed undercarriage, the rear slides make an angle to the ground of approximately 45° when deployed, this angle increasing to approximately 60° if, for example, the nose gear has collapsed. The certification requirements for escape slides on the ATP (JAR 25.809 (f) iv) state that they "must have the capability, in 25-knot winds directed from the most critical angle, to deploy and, with the assistance of only one person, to remain useable after full deployment to evacuate occupants safely to the ground." The METAR for 1245 UTC that day stated the wind as 110°/ 17 kt, gusting to 27 kt but it was not established whether assistance was available to steady the lower ends of these slides.

The aircraft was removed from service; the engines were examined internally and subsequently ground run with the ECS systems off. As no defects were discovered and no smoke was produced the aircraft was ferried to its maintenance base, with both ECS isolated, for futher investigation by the airline. The oil from both ACM's was examined and analysed, that from No 2 ECS system being found to be contaminated with iron, chromium and nickel. This ACM was then replaced, following which the problem appeared to have been resolved. However, at the conclusion of futher engine runs with No 2 ECS selected an oil haze appeared, which was aggravated by the selection of the crossfeed valve to open. Selection of the No 1 ECS cleared the system. Futher checks were satisfactorily carried out, as far as possible, to ensure that the system ducting was free of residual oil.

On 21 September 1992, an ATP of the same airline suffered smoke in the cabin which forced an emergency evacuation after landing at Sumburgh (AAIB Bulletin 12/92). On that occasion the smoke was generated by the failure of the No 5 bearing in the right engine, a problem which had occurred some five times before across their fleet of aircraft but which has since been addressed by the replacement of this bearing with one of a later standard. However, a boroscope inspection of the No 2 engine on G-BTPE indicated the No 5 bearing to be in a satisfactory condition. In addition, there was no excessive oil in the inter-combustion chamber (ICC) and no oil wetness of the ducting associated with this engine, both of which might be expected following such a bearing failure. Following previous problems with the bearing and a cracked oil feed pipe in this engine, it was repaired and several associated modifications incorporated. Since that time it had completed 920 cycles in 778 hours after being fitted to G-BTPE, and exhibited a normal oil consumption, with no adverse trends identified by regular oil analyses.

At the conclusion of this investigation, the airline elected to replace the No 2 engine, since when the problem has not re-appeared on this aircraft. However subsequent strip examination of this engine revealed a blockage in the No 5 bearing vent tube, in addition to deterioration of the bearing front and rear seals. These defects were considered the most likely cause of the smoke emissions.

As a result of this incident and the above findings, the aircraft Maintenance Manual Troubleshooting Procedure for smoke in the cabin has been revised by the operator and manufacturer, and a special check has been implemented to inspect Pratt and Whitney PW 126 engine No 5 bearing vent tubes on engines pre-Service Bulletin 21211 standard. This Service Bulletin increases the vent tube diameter to 0.440 inches.