

**SERIOUS INCIDENT**

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|--|--|-------------------|
| <b>Aircraft Type and Registration:</b> | Dornier 328-300, G-CJAB  |                   |
| <b>No &amp; Type of Engines:</b>       | 2 Pratt & Whitney Canada PW306B turbofan engines   |                   |
| <b>Year of Manufacture:</b>            | 2002   |                   |
| <b>Date &amp; Time (UTC):</b>          | 3 March 2009 at 1645 hrs   |                   |
| <b>Location:</b>                       | Inbound to Southampton Airport   |                   |
| <b>Type of Flight:</b>                 | Commercial Air Transport (Non-Revenue)   |                   |
| <b>Persons on Board:</b>               | Crew - 2   | Passengers - None |
| <b>Injuries:</b>                       | Crew - None  | Passengers - N/A  |
| <b>Nature of Damage:</b>               | None   |                   |
| <b>Commander's Licence:</b>            | Airline Transport Pilot's Licence  |                   |
| <b>Commander's Age:</b>                | 62 years   |                   |
| <b>Commander's Flying Experience:</b>  | 14,124 hours (of which 3,580 were on type)<br>Last 90 days - 11 hours<br>Last 28 days - 5 hours                    |                   |
| <b>Information Source:</b>             | Aircraft Accident Report Form submitted by the pilot and manufacturer's airworthiness investigation interim report |                   |

**Synopsis**

During cruise and on the approach in IMC, over a period of approximately 15 minutes all five display screens in the cockpit failed successively. An uneventful ILS landing was completed using the standby instruments.

**History of the flight**

The aircraft was being ferried after an extended period without flying. The engines were started using the APU due to the unavailability of ground power and the aircraft then departed Biggin Hill Airfield at 1610 hrs on a non-revenue flight to Southampton. After approximately 20 minutes, whilst established in the cruise in IMC at FL080, Multi-Function Display (MFD) 1 failed. 10 minutes

later MFD 2 failed, followed shortly by Primary Flight Display (PFD) 2. The flight continued to Southampton, but whilst the aircraft was intercepting the ILS localiser for Runway 20, PFD 1 failed. Finally, on short final to land, the Engine Indication and Crew Alerting System (EICAS) screen failed. The crew completed the abnormal procedures checklist section 9-1, and carried out a successful landing using the standby instruments.

**Aircraft history**

The aircraft had been removed from service due to airframe damage about a year earlier. The damage to the tail section had been repaired successfully, but the

aircraft had only flown just over three hours since then, being kept in a hangar the remainder of the time. The owners had not stored the aircraft in accordance with the Approved Maintenance Manual requirements for long-term storage, but in a state of readiness for operation, with regular engine ground runs and the completion of routine continuing airworthiness maintenance requirements.

### **Initial engineering findings**

Troubleshooting work carried out after the landing at Southampton confirmed that all five display units had failed completely. No other defects could be identified on the aircraft. The failed components were all DU-870 type display units, part number 7014300-902. The replacement display units worked without recurrence of the problem and the aircraft was released serviceable. Following removal, the failed units were returned to the display unit manufacturer for detailed investigation.

### **Detailed engineering findings**

The display unit manufacturer tested the units and confirmed that the display units' outputs were valid, but that the displays themselves remained blank. They then carried out detailed strip examinations, which determined that the High Voltage Power Supply (HVPS) unit had failed in each case. These components were returned to the HVPS manufacturer, who confirmed that the same transformer (SMI-20-04) had failed in each unit. The transformers were epoxy encapsulated and the potting around the secondary winding had failed, most likely due to overheating, causing the winding to short-circuit.

### **Component service history and modification standard**

The service history for each of the display units was reviewed along with the modification standard. The failed transformers fitted to the removed display units

were obsolete. This failure mode had been identified in 2001 due to a series of premature failures of the display screens and a new standard transformer was introduced in late 2002. The new standard formed part of a series of three modifications - J, K and L (introduced by service bulletins A21-2249-018, A21-2249-020 and A21-2249-021 respectively), which were developed to give better high temperature tolerance to the display units. Modification N (SB A21-2249-026), which added temperature indicators to the HVPS assembly, was also introduced to assist with future failure analysis of the units. Records identified that none of the five failed units had been returned for repair or overhaul since original installation, consequently none of these modifications had been embodied.

### **Aircraft equipment cooling system**

Cockpit ambient air is used to cool the display units once installed in the aircraft; a fan draws the air into the system and it is then ducted around the instrument panel. The manufacturer states that the units should not be run continuously in an ambient environment that exceeds 55°C. The maximum recommended cockpit air temperature is 40°C, as the display unit runs approximately 15°C hotter than the cooling air. The manufacturer also recommends that the displays be turned off when not required when the electrical power is on during maintenance. This information was communicated to operators in a Technical News Letter (A23-2249-003), issued by the display unit manufacturer. It is possible to switch off the fan via the Environmental Control System (ECS) panel on the flight deck, or by pulling the appropriate circuit breaker. However, if the fan fails during normal operation an amber caption appears on the EICAS screen. The aircraft manufacturer requested the operator of the incident aircraft to carry out additional inspection of the aircraft's cooling system, but no abnormalities were identified.

**Other incidents**

A further three recent incidents of this aircraft type experiencing loss of displays (on the ground, rather than in-flight) have also been identified. All three aircraft had been subject to extended periods without airborne operation. Some of the failed units were modified to 'N' standard and data from the temperature recording strips is assisting with those investigations.

**Further work**

The aircraft manufacturer has drafted a new service bulletin which highly recommends checking units which are modified to 'J' standard and ensuring that at least four of the five display units fitted to each aircraft have this modification embodied, otherwise a unit modified to 'K' standard or above should be fitted. EASA are considering whether any of the relevant service bulletins should be mandated. Investigations into the effect on display units of periods of extended ground maintenance operation, or inactivity, are also continuing.

**Conclusion**

Given the short period of time between display unit failures during the incident flight, it is unlikely that all five were random failures. However, it is also unlikely, given the UK climate in which the aircraft was operated and stored, that the ambient temperature of the cockpit exceeded 40°C for a sustained period of operation of the units. Given the lack of any additional findings from inspection of the incident aircraft, it has not been possible to determine a common trigger mechanism for the possible overheat and breakdown of the transistor potting, although investigations into the failure of other units in the world fleet may lead to a definitive cause being identified. The issue will continue to be monitored by EASA under their Airworthiness Review Meeting process until they consider the problem to have been adequately addressed.