

SERIOUS INCIDENT

Aircraft Type and Registration:	LET L-410 UVP-E Turbolet, OK-ASA
No & Type of Engines:	2 Walter M601E turboprop engines
Year of Manufacture:	1990 (Serial Number: 902439)
Date & Time (UTC):	5 November 2012 at 1554 hrs
Location:	Isle of Man (Ronaldsway) Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 2 Passengers - 10
Injuries:	Crew - None Passengers - None
Nature of Damage:	Internal damage to left engine
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	40 years
Commander's Flying Experience:	3,221 hours (of which 2,827 were on type) Last 90 days - 157 hours Last 28 days - 51 hours
Information Source:	AAIB Field Investigation

Synopsis

The aircraft was just airborne from Runway 26 at Isle of Man Airport when there was a sudden, very loud noise. Suspecting an engine failure, the commander closed the throttles and landed ahead on the remaining runway. Examination after the incident revealed that the left engine had sustained damage to the gas generator and power turbine stages, caused by a broken balance plug released from the centrifugal compressor disc.

History of the flight

The aircraft was operating a scheduled flight between Isle of Man and Blackpool; the commander was the pilot flying. The weather conditions were fine and dry, with a surface wind from 340° at 5 kt. At 1546 hrs the flight crew called ATC to request taxi clearance, and received

instructions to taxi to holding point A1 for Runway 26. At 1551 hrs the aircraft was cleared to line up and wait on Runway 26 and at 1553 hrs ATC issued the takeoff clearance.

The aircraft was configured with 18° flap. At the V_1/V_R speed of 81 kt the co-pilot called "V one rotate" and the commander started to raise the nose of the aircraft. As he did so, both pilots heard a loud noise. The commander checked the engine instruments for an indication of a failure, but did not see anything unusual and there was no yaw or abnormal aircraft behaviour. By now the aircraft had become airborne. He retarded both power levers to idle, lowered the nose and landed ahead on the remaining runway. The co-pilot advised ATC that they

were aborting the takeoff. The maximum groundspeed recorded was 101 kt. The aircraft touched down close to the intersection of Runway 03/21 and slowed to taxi speed before vacating at the end of Runway 26. The noise was still present, but much reduced at the lower power settings. The aircraft was taxied back to the parking area and a normal shutdown was carried out.

During the incident ATC instructed one other aircraft to go around. The runway was inspected once OK-ASA had vacated; no debris was found and the runway was re-opened.

Aircraft information

The LET 410 UVP-E is a 19-seat passenger aircraft powered by two Walter M601E turboprop engines. Following a routine maintenance inspection carried out at 0630 hrs, the aircraft flew six sectors prior to the incident and no abnormalities were reported by the crew.

On board were nine passengers and one infant, as well as the two pilots. There was no flight attendant and none was required. The actual takeoff weight of the aircraft was 5,943 kg; the maximum takeoff weight is 6,400 kg.

Airport information

Isle of Man Runway 26 has an asphalt surface which is 2,110 m in length. The runway is 46 m wide, except for starter strips at each end which are 30 m wide. The Takeoff Run Available (TORA) for Runway 26 is 1,909 m. The Runway End Safety Area (RESA) for Runway 26 measures 240 m x 150 m.

The airport at the time of the incident had a surface movement radar system under test. Recorded data obtained from this system was used for the investigation.

Pilot information

The majority of the commander's flying experience was on this type of aircraft. He had been based in the Isle of Man for several months and was familiar with the airport. After the incident he commented that the event was unlike any he had experienced previously while flying or during training. In particular, he remarked on the very high level of noise and the absence of any yaw.

The co-pilot had flown 785 hours on this aircraft type. He described the sound he heard during takeoff as "a terrible noise"; he did not recollect experiencing any vibration. He too commented that the event was unlike anything he had previously experienced.

Engineering information

The aircraft was inspected at Isle of Man Airport the day after the incident. The left engine did not show any external evidence of damage or leaks, however when the propeller was turned by hand a metallic rubbing noise was heard emanating from the power turbine section of the engine. No other aircraft defects were identified.

The left engine was removed from the aircraft and sent to the engine manufacturer for detailed examination, which revealed that a balance plug had broken and had released from the centrifugal compressor disc (Figure 1). Balance plugs are used to balance the compressor disc and are screwed into the disc beneath the compressor blade roots. They are secured to the disc by thread-locking adhesive in addition to centre-punch indentations at the edge of the balance plug holes. The balance plug had travelled along the gas path through the engine, causing damage to the centrifugal compressor, the gas generator and power turbine nozzle guide vanes and turbine blades (Figure 2), as well as damaging nine Intermediate Turbine Temperature (ITT) thermocouples.

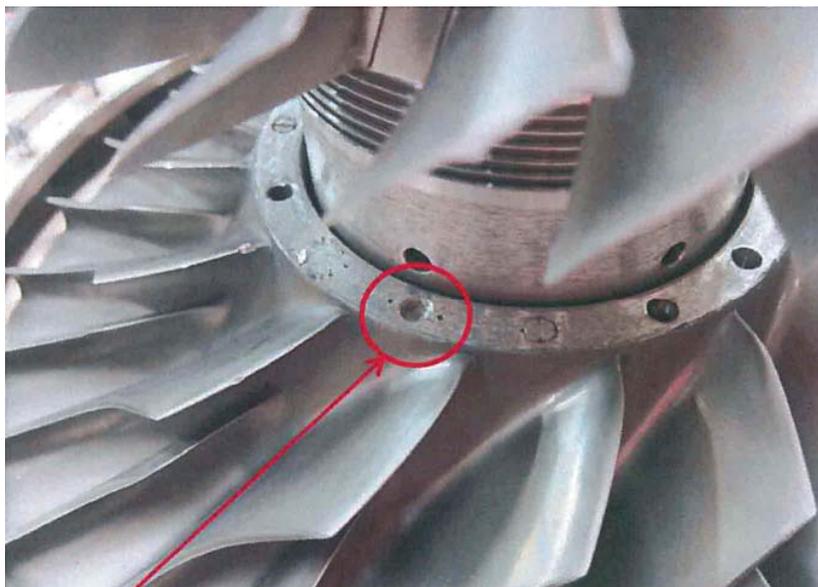


Figure 1

Location of the detached balance plug

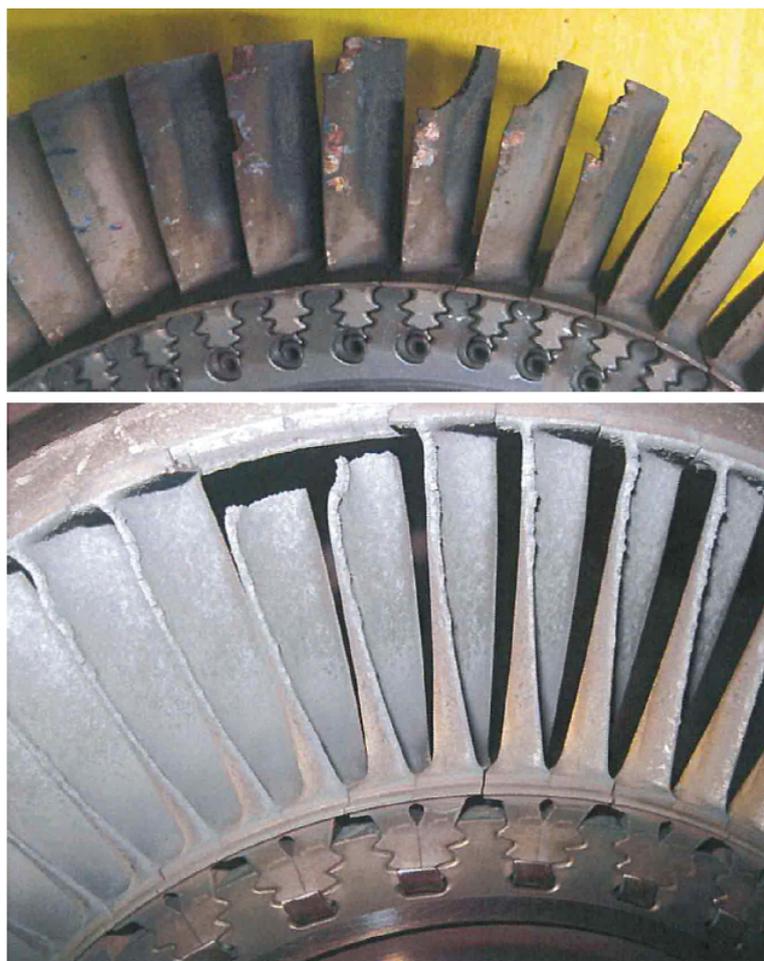


Figure 2

Damage to gas generator turbine (top) and power turbine (bottom)

The damage to the engine was contained within the engine casing and was insufficient to cause a significant loss of power.

Following an investigation by the engine manufacturer, it was concluded that the broken balance plug had failed due to a fatigue crack originating from the thread root of the plug's uppermost screw thread. The fatigue crack's fracture surface exhibited crack initiation from multiple sites, consistent with intensive cyclical loading of the balance plug, caused by the plug becoming loose from the centrifugal compressor disc. Metallurgical examination of the broken balance plug showed that it was manufactured from the required grade of steel and that no anomalies were evident in the material's heat treatment, hardness or microstructure.

The engine manufacturer identified either insufficient assembly torque or ineffective securing of the plug after installation as possible causes for the balance plug becoming loose. The type of balance plug that failed in this incident has been withdrawn from use and the manufacturer is currently evaluating possible design changes to the remaining types of balance plug used in the M601-series of engines, in addition to changes to thread-locking adhesive compositions and plug tightening procedures.

Recorded data

The aircraft was fitted with a CVR and an FDR. The FDR was of Czech origin and a type not familiar to the AAIB. The operator provided an avionics engineer with the manufacturer's interface equipment and software.

The download process yielded data from 76 flights, but not the accident flight. The CVR recording had captured the events, but suffered from a fault on the cockpit area microphone channel, which attenuated the recording. The operator committed to resolving the flight recorder problems. EASA is currently assessing requirements associated with the checking of flight recorders.

Summary

The source of the noise heard by the crew during the takeoff was traced to damage in the gas generator and power turbine stages of the left engine, caused by a broken balance plug released from the centrifugal compressor disc. The damage sustained by the engine was not sufficient to cause a significant loss of power and therefore the usual cues for the flight crew of an engine failure, loss of power and associated yaw, were missing. The flight crew were also startled by the level of noise, as it was outside of any of their previous experience.

The commander suspected a failure of the left engine but was not certain as to what had happened. Realising that there was sufficient runway ahead to land the aircraft safely, he decided to close the power levers and abort the takeoff.