

Drop in engine power in cruise, forced landing at an aerodrome

Aircraft	Aeroplane Diamond DA40D registered F-GUVQ
Date and time	Sunday 26 June 2011 at 16 h 45 ⁽¹⁾
Operator	Company
Site of accident	In cruise, above Montélimar aerodrome (26)
Consequences	None

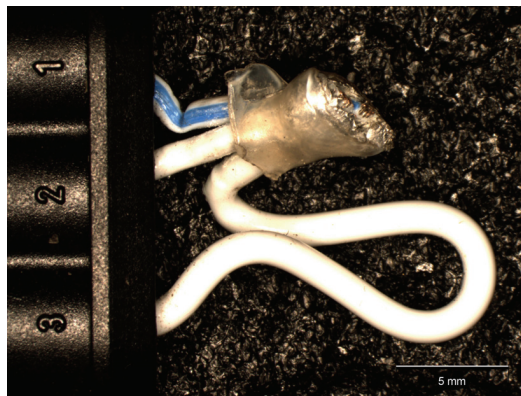
⁽¹⁾Local time.

CIRCUMSTANCES

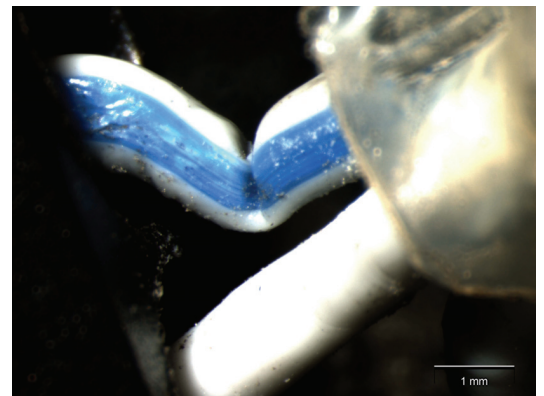
The pilot was navigating between Clermont-Ferrand Aulnat (63) and Cannes Mandelieu (83) aerodromes. After about 1 hour of flight, in cruise at FL 95, above Montélimar aerodrome, the pilot noticed the "ECU⁽²⁾ A fail" and "ECU B fail" warning lights come on and a drop in engine power to around 5%. He made an emergency landing at Montélimar aerodrome.

⁽²⁾Engine Control Unit.

On the ground, a wire from the Vrail plug of the Prail Valve (rail pressure control valve) was recovered severed inside its sheath. Examinations carried out showed that at the place where the wire was severed the sheath was crushed and the cable was bent. The airplane was equipped with a Thielert TAE 125-02-99 engine. In the event of an electrical failure in the power supply of the rail pressure control valve, the Prail valve opens fully and the fuel pressure drops in the inlet duct, leading to a near total loss of engine power.



General view of the Vrail
plug after removal



Close-up of cut wire inside the sheath

On 5 March 2009, the Prail valve was replaced by a new model and the Vrail plug had been modified, by application of the Thielert TM TAE 125-1008 P1 service bulletin, made mandatory by an EASA airworthiness directive. In order to install this new socket, the wires had to be cut and new connectors fitted. Given the time that passed between this operation and the incident, it was not possible to determine the precise circumstances of this maintenance operation. The initial deterioration of the wire inside its sheath nevertheless probably occurred at this moment.

The head of the maintenance workshop⁽³⁾ explained that since December 2010, ECU warnings had appeared repeatedly. The Prail valve had been replaced on several occasions, in December 2010 and in May 2011, without the warnings curtailing. These successive changes probably contributed to the deterioration of the Vrail plug wire.

After the incident on 26 June, these warnings continued and led to changes of engine, electrical loom and FADEC⁽⁴⁾. Failure of a switch enabling the pilot to switch to FADEC channel B was finally identified as being the cause of these warnings, unrelated to the 26 June incident. However, no specific check on the fuel pressure control chain existed to make it possible to detect the wire failure before the incident.

SIMILAR EVENTS

On 12 July 2008, in the Netherlands, the pilot of a Robin DR400-135 registered PH-SVU, equipped with a Thielert TAE 125-01 engine, made an emergency landing in a field after a total loss of power. The investigation conducted by the Dutch Safety Board (Onderzoeksraad Voor Veiligheid - OVV) showed that this loss of power resulted from a short circuit on the Vrail plug power cable. The OVV published the final report in February 2011, in which it recommended that EASA review certification of the TAE 125-01 engine, insisting on the application of the fail-safe principle to each of the engine's components, as well as to the engine installation in its entirety, including its electronic failure modes.

On 7 June 2007, in Denmark, the pilot of a Diamond DA40 D registered OY-RBB, with a Thielert TAE 125-01 engine, made an emergency landing in the country after a total loss of power. The investigation led by the Danish Investigation Board (Havarikommissionen for Civil Luftfart og Jernbane – HCLJ) showed that the Prail valve power supply had very probably been interrupted, without the source of the loss of power being formally established. The investigation also showed that in the event of an electrical power failure in the fuel pressure control loop, the system was not fail-safe as it led to a sudden drop in pressure in the common inlet duct. The HCLJ issued the same safety recommendation as the OVV. To date, EASA has not responded to this recommendation.

On 14 February 2009, a similar loss of power occurred on the engine of a Diamond DA40D registered F-HDIC, leading to a forced landing in the country that caused serious injuries to its occupant. This loss of power was due to incorrect crimping during modification of the Vrail plug.

CONCLUSION

The incident was due to the deterioration of a wire from the Vrail plug, probably during the replacement of the latter in March 2009. Successive interventions, during which the Prail valve was connected and disconnected on several occasions, probably led to the final break in the wire.

This break led to the full opening of the Prail valve. The resulting fuel pressure in the inlet rail then dropped, leading to a significant loss of engine power and the impossibility of maintaining level flight.

SAFETY RECOMMENDATION

Note: In accordance with Article 17.3 of European Regulation (EU) 996/2010 of the European Parliament and Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation, a safety recommendation shall in no case create a presumption of blame or liability for an accident, a serious incident or an incident. The addressee of a safety recommendation shall inform the safety investigation authority which issued the recommendation of the actions taken or under consideration, under the conditions described in Article 18 of the aforementioned Regulation.

The investigation showed that in the event of an electrical power cut to the Prail valve, the pressure in the common inlet duct dropped suddenly and the pilot had to make a forced landing. Several events of this type have occurred, and gave rise to safety recommendations. One person was seriously injured. The cutting of the wire on the F-GUVQ probably occurred following a maintenance action in March 2009, however, since this action, no check had enabled the failure to be detected until this event occurred.

The fuel pressure control chain could be improved, without the engine's full certification being reviewed. In fact, the absence of redundancy on this critical system can rapidly lead to an emergency situation. In the same way, for the F-GUVQ and PH-SVU events, specific checks during maintenance servicing would have enabled the detection of the fault on the cable before the event.

This is why the BEA recommends that:

- **EASA require that Thielert improves the electrical part of the fuel pressure regulation system on TAE 125 engines, in such a way as to make them less vulnerable to power outages;**
- **EASA require that Thielert develops specific checks following operations on the fuel pressure regulation chain, in order to detect possible failures.**