Formal Safety Recommendations

Australian Transport Safety Bureau

On 30 November 2010 the ATSB had, in close consultation with Rolls-Royce and the UK Air Accidents Investigation Branch, established that the occurrence was directly related to the fatigue cracking of an oil feed stub pipe within the No.2 engine's HP/IP bearing support structure. The ATSB identified the following safety issue:

Safety issue

Misaligned stub pipe counter-boring is understood to be related to the manufacturing process. This condition could lead to an elevated risk of fatigue crack initiation and growth, oil leakage and potential catastrophic engine failure from a resulting oil fire.

Action taken by the ATSB

On 1 December 2010, the ATSB issued the following safety recommendation to Rolls-Royce.

ATSB safety recommendation AO-2010-089-SR-012

The Australian Transport Safety Bureau recommends that Rolls-Royce plc address this safety issue and take actions necessary to ensure the safety of flight operations in transport aircraft equipped with Rolls-Royce plc Trent 900 series engines.

A full copy of the ATSB safety recommendation is available at:

www.atsb.gov.au/publications/investigation_reports/2010/aair/ao-2010-089

Initial action taken by Rolls-Royce

In response to the developing understanding of this safety issue, on 2 December 2010 Rolls-Royce issued NMSB 72-G595 to operators of the Trent 900 engine, which required the specialised examination, measurement and reporting of the stub pipe counter bore geometry in these engines. No assessment or engine rejection criteria were included in the NMSB.

A 20 flight cycle compliance limitation was specified for the completion of the oil feed stub pipe examination.

ATSB assessment

Despite the initial Rolls-Royce action to release NMSB72-G595, the ATSB was concerned that the bulletin did not place assessment and engine rejection criteria on the measurement of the stub pipe counter bore geometry. In addition, the ATSB did not consider the 20 cycle limitation as adequately addressing this safety issue. The ATSB consulted with CASA, who initiated the actions as detailed below.

Action taken by CASA

On 2 December 2010, CASA issued a maintenance direction to Qantas under Regulation 38 of the *Civil Aviation Regulations 1988.* That direction required that Qantas:

> (a) Comply with Rolls-Royce plc Service bulletin number 72-G595 subsequent and any amendment or revision of it, within two cycles from the issue of this direction;

> (b) In the event abnormal or eccentric counter-boring of the tubes described in the service bulletin is identified, this must be recorded as a major defect of the engine;
>
> (c) Upon completion of compliance with the service bulletin an entry shall be made in the aircraft's maintenance records stating what actions were taken to comply with the service bulletin and this direction;
>
> (d) Upon completion of compliance with the service bulletin a written report shall be furnished to [CASA] stating how the service bulletin and this direction were complied with and the outcome of compliance with the service bulletin.

ATSB assessment of the CASA action

The ATSB is satisfied that the action taken by CASA adequately addresses the immediate safety of flight concerns in respect of Qantas operation of A380 aircraft equipped with Trent 900 series engines. Therefore the ATSB makes no recommendation in relation to this issue.

Further action taken by Rolls-Royce in response to the safety recommendation

On 2 December 2010 Rolls-Royce issued Revision 1 to NMSB 72-G595. This revision incorporated assessment and engine rejection criteria for the measurement of potential counter bore misalignments, and in particular, a tightening of the compliance from 20 to two flight cycles.

ATSB assessment of the Rolls-Royce action

The ATSB is satisfied that the action taken by Rolls-Royce adequately addresses the immediate safety of flight concerns in respect of Qantas operation of A380 aircraft equipped with Trent 900 series engines.

Action taken by Qantas

On 2 December 2010, Qantas advised that:

> ...in response to Service Bulletin RB211-72-G595 (Revision 1), and in line with ATSB Safety Recommendation AO-2010-089-SR-012, Qantas will conduct a focused borescope measurement inspection of the HP/IP turbine bearing support structure oil feed tube for concentricity of the counter-bore and inspection of the related components on its RB211 Trent 900 series engines. The inspection results will be sent to Rolls Royce for evaluation. Rolls Royce will then provide Qantas with formal confirmation as to the serviceability of the engine.
>
> These inspections will take place within the next 24 hrs on engines in place on A380 aircraft currently in service, and before further flight on engines on aircraft not yet returned to service.

ATSB assessment of the Qantas action

The ATSB is satisfied that the action taken by Qantas adequately addresses the immediate safety of flight concerns in respect of the operation of its A380 aircraft equipped with Trent 900 series engines. Therefore the ATSB makes no recommendation in relation to this issue.

Airframe certification standards in the case of an uncontained engine rotor failure

Safety issue

The evolution of the current advisory material relating to the minimisation of hazards resulting from uncontained engine rotor failures was based on service experience, including accident investigation findings. The damage to Airbus A380- 842 VH-OQA exceeded the modelling used in the UERF safety analysis and, therefore, represents an opportunity to incorporate any lessons learned from this accident into the advisory material.

Action taken by ATSB

As a result of the identified safety issue, coincident with the release of this investigation report, the ATSB has issued the following safety recommendations to the European Aviation Safety Agency and the United States Federal Aviation Administration.

ATSB safety recommendation AO-2010-089-SR-039

The Australian Transport Safety Bureau recommends that the European Aviation Safety Agency, in cooperation with the US Federal Aviation Administration, review the damage sustained by Airbus A380-842, VH-OQA following the uncontained engine rotor failure overhead Batam Island, Indonesia, to incorporate any lessons learned from this accident into the advisory material.

ATSB safety recommendation AO-2010-089-SR-040

The Australian Transport Safety Bureau recommends that the US Federal Aviation Administration, in cooperation with the European Aviation Safety Agency, review the damage sustained by Airbus A380-842, VH-OQA following the uncontained engine rotor failure overhead Batam Island, Indonesia, to incorporate any lessons learned from this accident into the advisory material