

OPERATOR SUPPORT DEPARTMENT

INVESTIGATION REPORT

REF : MTEA 2008/237-1

ENGINE FAMILY	N/S	DATE OF REPORT	WARRANTY CLAIM	COMMERCIAL FILE		
ARRIUS 2B2	32155	28 th January 2009	N/A	N/A		
OPERATOR	DATE OF ARRIVAL	REASON FOR ENGINE RETURN				
National Air Ambulance	06 th August 2008	HELICOPTER ACCIDENT INVESTIGATION (31 st July /2008)				
ACCIDENT	INCIDENT					
OUI <input checked="" type="checkbox"/> NON <input type="checkbox"/>	OUI <input type="checkbox"/> NON <input checked="" type="checkbox"/>					
REFERENCE ACCIDENT / INCIDENT						
2008/237						
ENGINE MODULE	S/N	WORKS PERFORMED	TOTAL HOURS	TOTAL CYCLES	HOURS SINCE OH	CYCLES SINCE OH
Regulation harness	690B	Investigation	1170.28			
Control harness	680B	Investigation	1170.28			
Module 01	1048	Investigation	1170.28			

Circumstances reported to Turbomeca :

According to preliminary information, during an EMS mission, both engines would have stopped one after the other. The aircraft crashed to the ground.

CONCLUSION

- The examinations performed on the Monitoring & Control harness and on the Regulation harness did not reveal any abnormality,
- The 'Reference shaft / Power shaft' assy was damaged during the accident,
- This damage led to an inability to measure the torque which led to the loss of the torque indication and the display of the message '0x22' (equivalent to 'TQ channel failure' message), during the engine test performed on the test bench.

VALIDATION	APPROVAL
Date : 27 th February, 2009 Validated by DVD/VEA	Date : 27 th of February, 2009 Approved by J50/TEN

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ATTENDEES

- Marc LEVER	Accident Investigator - BEA
- Frédéric WALBROU	Accident Investigator - BEA
- Philippe LAPLACE	Accessories / equipments specialist - TM
- Pierre ITURRIA	Accident Investigator - TM
- Jean-Louis LALAAS	Accident Investigator - TM

1.1 TECHNICAL REPORT

A) REGULATION HARNESS (0 319 76 828 0 - S/N 690 B)

Visual inspection

- ✓ Connectors : No damage observed
- ✓ General condition of the harness : No damage observed

Electrical test

- ✓ Functional tests performed on TURBOMECA/TARNOS bay : Conforming to Acceptance Test Procedure (ATP)

B) MONITORING & CONTROL HARNESS (0 319 76 827 0 - S/N 680 B)

Visual inspection

- ✓ Connectors : No damage observed
- ✓ General condition of the harness : No damage observed

Electrical test

- ✓ Functional tests performed on TURBOMECA/TARNOS bay : Conforming to Acceptance Test Procedure (ATP)

C) REDUCTION GEAR MODULE (MODULE 01 - M01) (70 EM 017 020- S/N 1048)

The 'Reference shaft / Power shaft' assy (0 319 14 812 0 - S/N B1117) was removed from the Module 01 to proceed to its visual inspection.

The first findings revealed a movement of the 'Reference shaft' with regard to the 'Power shaft'. This movement was made upward (approx. 2 mm) and in rotation (approx. 12,4 °) and was the consequence of the impact undergone by the 'Power shaft' during the crash. (See photos n° 1 and n° 2)

This finding is consistent with the damage observed on the splines of the Power shaft.

Principle of torque measurement

The torquemeter is a phase displacement torquemeter type, its system mainly includes:

- . The 'Power shaft' fitted with 4 equidistant teeth.
- . A 'Reference shaft' also fitted with 4 equidistant teeth.

These 8 teeth form a phonic wheel of the torque measuring system.

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The rotation of the phonic wheel formed by the 4 teeth of each shaft, in front of an electromagnetic sensor produces a pseudo-sinusoidal alternating voltage in the sensor. This voltage is sent to the Engine Electronic Control Unit (EECU).

The EECU measures the phase displacement between the signals produced by each tooth of the phonic wheel.

When the load on the shaft changes, the 'Power shaft' twists and the 'Reference shaft' does not. This causes the distance between the teeth of the phonic wheel to change and thus the phase of the current generated by the sensor is displaced. The EECU measures this displacement which is proportional to the amount of torque on the 'Power shaft'.

D) ANALYSIS

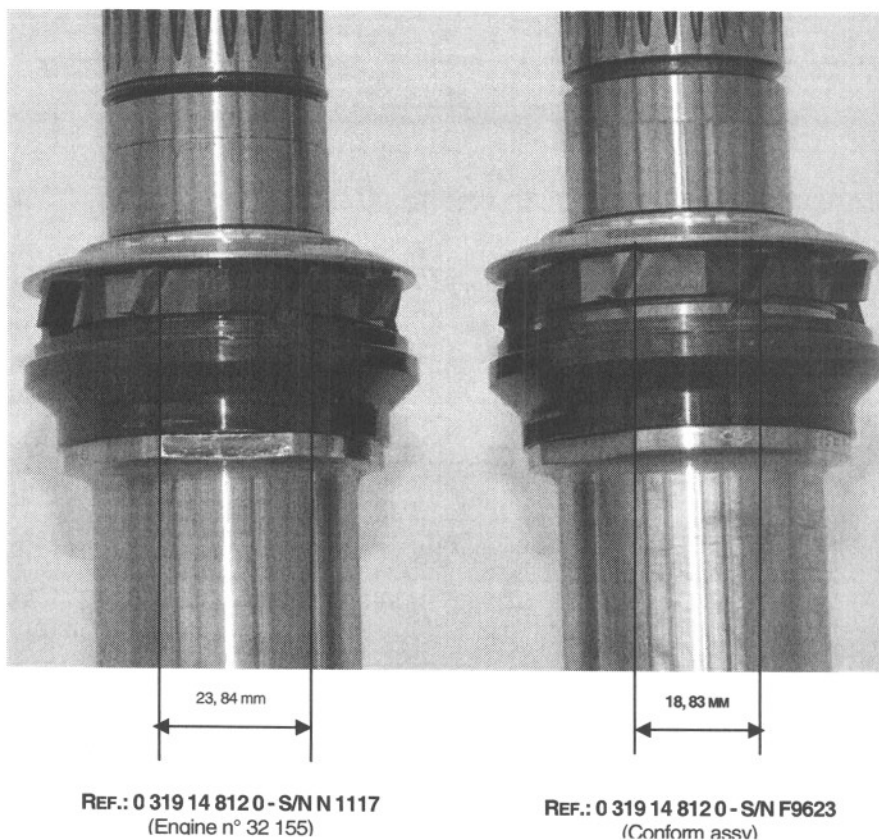
The movement of the 'Reference shaft' with regard to the 'Power shaft' is the result of the rupture of the pin at impact. The variation of consequent phonic distance from the teeth of the phonic wheel in the movement of the 'Power shaft' induced a angle shift (approx. $12,4^\circ$) outside nominal functioning range (maxi of $3,7^\circ$). (See photo n°1)

During the engine test performed on the test bench, the EECU which continuously check the torque signal characteristics has detected a torque value out of nominal range which led to the loss of the torque indication and the display of the message '0x22' (equivalent to 'TQ channel failure' message).

Note: If this torque value out of nominal range had occurred before the EECU shut-off, a "TQ channel failure" message would have been recorded on the EECU memory. No "TQ channel failure" has been recorded on the EECU memory.

1.2 PHOTOS

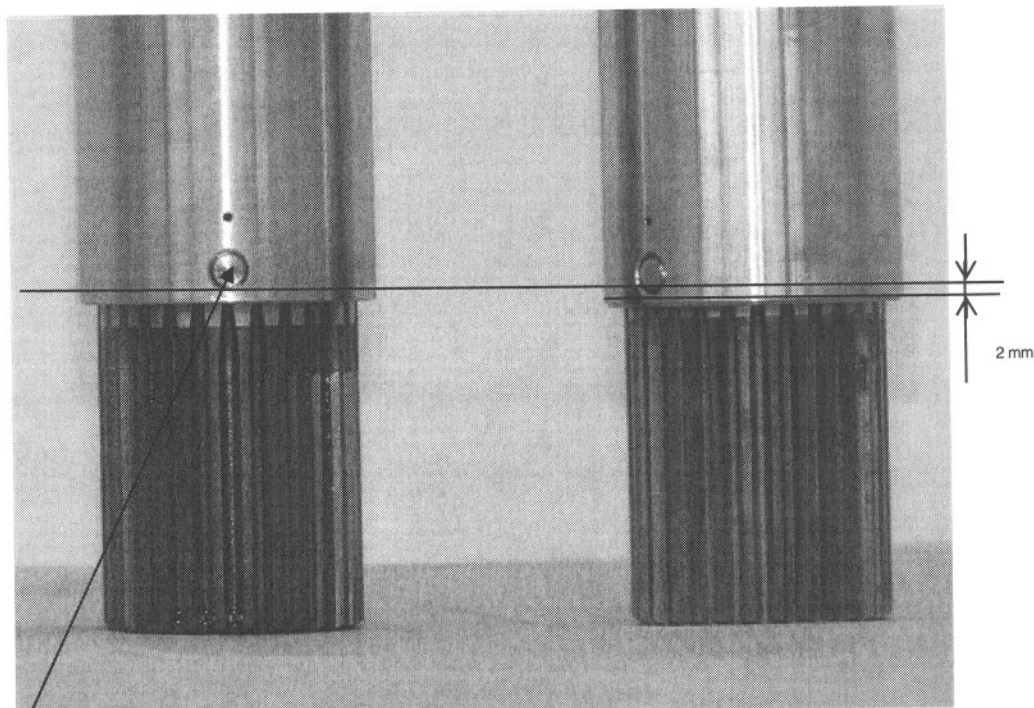
Photo n° 1



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Photo n° 2



Pin

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