
Flight control system failure, Airbus A320 EI-TLI, on 1998-10-18

Micro-summary: A hydraulic warning, soon accompanied by a lightning strike, results in directional control difficulties for this A320.

Event Date: 1998-10-18 at 1424 UTC

Investigative Body: Air Accident Investigation Unit (AAIU), Ireland

Investigative Body's Web Site: <http://www.aaiu.ie/>

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AAIU Report No. 20001/002
AAIU File No. 19980055
Published.: 29/01/2001

Aircraft Type and Registration:	A320-231 EI-TLI
No. and Type of Engines:	2 X I.A.E. V2500-AI
Aircraft Serial Number:	405
Year of Manufacture:	1993
Date and Time (UTC):	18 Oct 98 14.24 hrs
Location:	23 NM SE Dublin Airport
Type of Flight:	Public Transport
Persons on Board:	Crew 2/5 Pax 168
Injuries:	None
Nature of Damage:	Hydraulic Oil Leak
Commanders Licence:	Airline Transport Pilot's Licence
Commanders Age:	32 years
Commanders Flying Experience:	5140 hours (590 on type)
Information Source:	Aircraft Operator. AAIU Field Investigation

SYNOPSIS

On 18th October 1998 the aircraft was on a flight from Rome to Dublin when at 23 NM from Dublin Airport a warning appeared on the aircraft's monitoring system that the hydraulic pressure in one of its hydraulic systems had reduced to a low level. At the same time the aircraft was struck by lightning. The Captain disconnected the autopilot and took over control of the aircraft. Directional control was difficult. "PAN" call (emergency) was then declared and ATC advised of weather conditions at Dublin Airport. The crew noted that No. 3 spoiler on the starboard was stuck in the up position. The aircraft was becoming more difficult to control as the approach speed was reached and a higher speed was selected. The roll to the right became severe at touchdown and full left aileron was used in the landing. Ground spoilers then deployed in the normal way and the aircraft continued the ground roll. On landing it was discovered that No.3 spoiler starboard side remained up and that the spoiler actuator was leaking hydraulic oil.

1. FACTUAL INFORMATION

1.1 History of the Flight

On approach to Dublin the crew had been asked by ATC to reduce speed from 300 kts to 250 kts. While the speedbrakes were extended the hydraulic pressure for the "blue" hydraulic system appeared on the ECAM system (Electronic Centralised Aircraft Monitoring). Whilst the emergency checklist was being carried out the aircraft was struck by lightning. A "PAN" was then declared and the aircraft was vectored by ATC for the ILS on RWY 28. The Captain disconnected the autopilot as it was having difficulty in maintaining directional control of the aircraft with wings level. The crew noted that the No. 3 spoiler on the starboard side was stuck in the UP position. As the aircraft speed was reduced to the speed for the approach it became increasingly difficult to control the aircraft. A higher approach speed was selected but a roll right tendency was observed. It became severe at touchdown and full left aileron was used to keep the aircraft from scraping an engine pod or winglet. Once ground spoilers were deployed the landing gear remained on the ground. From then on a normal roll out was conducted. Subsequently, the Operator removed the flight recorder from the aircraft for readout and the investigation so informed.

1.2 Damage to Aircraft

On inspection of the aircraft on the ground the Captain stated that the No. 3 starboard spoiler remained in the UP position and hydraulic fluid was leaking from the spoiler actuator. The underside of the radome was scorched as a result of the lightning strike.

1.3 Aircraft Information

1.3.1 The Spoiler System

Spoiler panels are installed to support the ailerons for lateral control and to provide increased drag and reduced lift.

This aircraft has five segment spoilers forward of the flaps on each wing. All 10 spoilers are used as lift dumpers on landing. The inner six are used as airbrakes, the outer eight plus the ailerons are used for roll control and the outer four plus ailerons for gust alleviation (see diagram, page 6). Spoilers are numbered 1 to 5 on each wing, inboard to outboard. The spoiler system is supplied by three independent hydraulic systems and three independent computers. The No. 3 spoiler on the starboard side has its hydraulics and computer shared with the corresponding spoiler on the port side. The spoiler panel is activated by an electro-hydraulic servocontrol placed forward of the flaps. When commanded by the computer, the spoiler panel is pushed into the airflow by the action of the actuator rod. The function of No. 3 spoiler panel is therefore to offer sufficient drag to the airflow to act as an aircraft speedbrake in flight.

1.3.2 Technical History

In 1993 the aircraft manufacturer issued a report on this type of failure ref. “Inboard Spoiler Actuator Piston Rod Bearing Break” and issued a Service Bulletin in 1994 following a number of such instances in flight. This failure was the 38th instance of actuator failure reported to the servocontrol manufacturer since a retrofit programme commenced in 1994.

Investigation of defective actuators, forming part of the servocontrol, confirmed that the bearing breakage was a fatigue failure resulting from an excessive out of squareness of the actuator housing. The manufacturers identified a 337 unit batch affected by the improper machining of the actuator housing backface and cited that there may have been more. In fact the figure was nearer to 500. A modification, consisting of installing a reinforced bearing able to withstand the geometric variation of the housing, was issued by the manufacturers in Oct 94.

Service Bulletin SB320-27-1086 was issued to cover this modification of servocontrols of spoiler No.2 and 3 (compliance recommended) and SB320-27-1087 was issued for spoiler No.1 in January 1995 (compliance desirable). The former bulletin was to be carried out on the complete fleet prior to the latter bulletin. Revision 3 of the former was issued in Nov.’95 and Revision 2 of the latter in April ‘96. These bulletins were applicable only to servocontrols from serial numbers 0639 to 3086

These bulletins identified the serial numbers of the defective servocontrols and the aircraft in which they were installed. Accomplishment for the bulletin appropriate to spoiler No. 2 and 3 was recommended to be done before 6500 flight cycles or within six months from the date of issue of the bulletin whichever occurs later.

At the time of the incident (Oct ‘98) spoilers No.1 to No.3 on each wing (i.e. total 6) had servocontrols which were subject to the issued Service Bulletins but had not been changed. They had been fitted to the aircraft in April 1993, at the time of aircraft manufacture. In Jan.‘99 the status of the spoiler servocontrols remained the same as above with the exception of the replaced defective unit on starboard spoiler No. 3.

On the same date, of a fleet of 10 aircraft, five were not subject to this modification and on the remaining five aircraft, there were a total of 22 servocontrols which were the subject of these service bulletins.

In April 1999, a further Service Bulletin A320-27-1127, was issued by the aircraft manufacturer . The modification was “recommended” and to be completed not later than Dec.2001. This latest bulletin drew attention to a case of a servocontrol bearing breakage occurring to an A320 at the end of 1998 where the servocontrol serial number was within the range 0639 to 3086 and confirmed that, although the original bulletin had been issued in Oct ‘94,”*the retrofit action had not been completed.*”

Three further cases of piston rod bearing breakage were experienced with servocontrols having serial numbers lower than 0639. This latest bulletin also extended the previous defined corrective action to the batch of servocontrols from serial numbers 0001 to 3086.

This latest bulletin affected four of the aircraft belonging to the then existing fleet and was again revised in Oct.99.

On the 18th Sept.'99 an Airworthiness Directive (AD) was issued by the French DGAC making accomplishment of the modification "Mandatory" stating that the resulting condition of servocontrol failure *"could lead to a transient perturbation of the aircraft trajectory and to a reduction of the handling qualities"* of the aircraft. On the 18th July 2000 the FAA issued their AD, with an accomplishment time scale of a further 28 months from the date of issue. The purpose was *"to prevent failure of the servocontrol piston rod, which could result in reduced controllability of the airplane."*

By March 2000, two of the early aircraft were no longer part of the fleet and a total of 6 servocontrols (two inboard on each of three aircraft) remained to be changed.

1.4 Organisational Information

The Operator contracted a maintenance organisation in the UK to carry out scheduled and certain unscheduled maintenance on this aircraft. This was to be carried out at the 'C' check inspections. On EI-TLI the servocontrols were replaced during the 'C' check carried out in April '99. The aircraft manufacturer recommended that servocontrols for spoilers No. 2 and 3 be carried out on aircraft fleets before that for spoiler No. 1.

The Service Bulletins are the subject of a retrofit campaign managed by the UK servocontrol manufacturer from its customer support office in Paris. The campaign was managed in such a way as to give priority to aircraft whose units had reached or were close to the recommended cycles of 6500 flight cycles. A lead time of two to three months was required for the exchange units.

The proposal for the four aircraft affected by SB. A320-27- 1127 was to change these actuators as modified ones became available from the item manufacturer. However, the servocontrol manufacturer did not have an adequate supply of "pool exchange" items and this extended the time during which unmodified servocontrols were allowed to remain on the aircraft.

Operational Summary for EI-TLI up to April 2000 from date of manufacture:

Total Hours: 20,000 hrs Total Cycles: 8275 cycles Hours/cycle:
2.42 hrs

Cycles/year: 1182 cycles.

1.5 Meteorological Conditions

The weather forecast for Dublin given by the military meteorological service in Rome was:

Wind	-	220/10 kts
Visibility	-	10 km
Significant Weather	-	nil
Cloud	-	BKN 1200/BKN 1800 CB

2. ANALYSIS

The aircraft Operator considered this incident to be of a serious nature. It also happened at a time when the workload on the crew was at its greatest. At the same time as the crew were engaged in the emergency checklist the aircraft was struck by lightning. On finals the aircraft required full left aileron to compensate for the loss of lift from the starboard wing and again on roll out after touchdown.

This type of failure was the 38th instant of actuator failure reported to the actuator manufacturer since the retrofit programme commenced in 1994. This on average is almost 9 occurrences per year. By its nature and use a spoiler failure, particularly on approach to land must be considered serious. In this particular case the crew experienced severe handling problems during approach.

The first Service Bulletin was issued in Oct '94, yet by January '99 only one actuator had been changed on EI-TLI. This situation must be considered to be unsatisfactory. The delay could have been due to the long accomplishment timescale as allowed for in the original Service Bulletin. This stated that accomplishment “ *is recommended before servocontrols have accumulated 6500 flight cycles or within 6 months whichever occurs later*”. With average flight cycles of 1182 per year for EI-TLI, this allowed time scale would permit units to remain on the aircraft for several years before being changed. Clearly a more urgent action was required.

The SGAC and the FAA finally recognised the need to have the retrofit made mandatory. Even so, the failure rate should have warranted a more urgent and aggressive retrofit plan to be implemented sooner, whereby replacement servocontrols would have been more readily available.

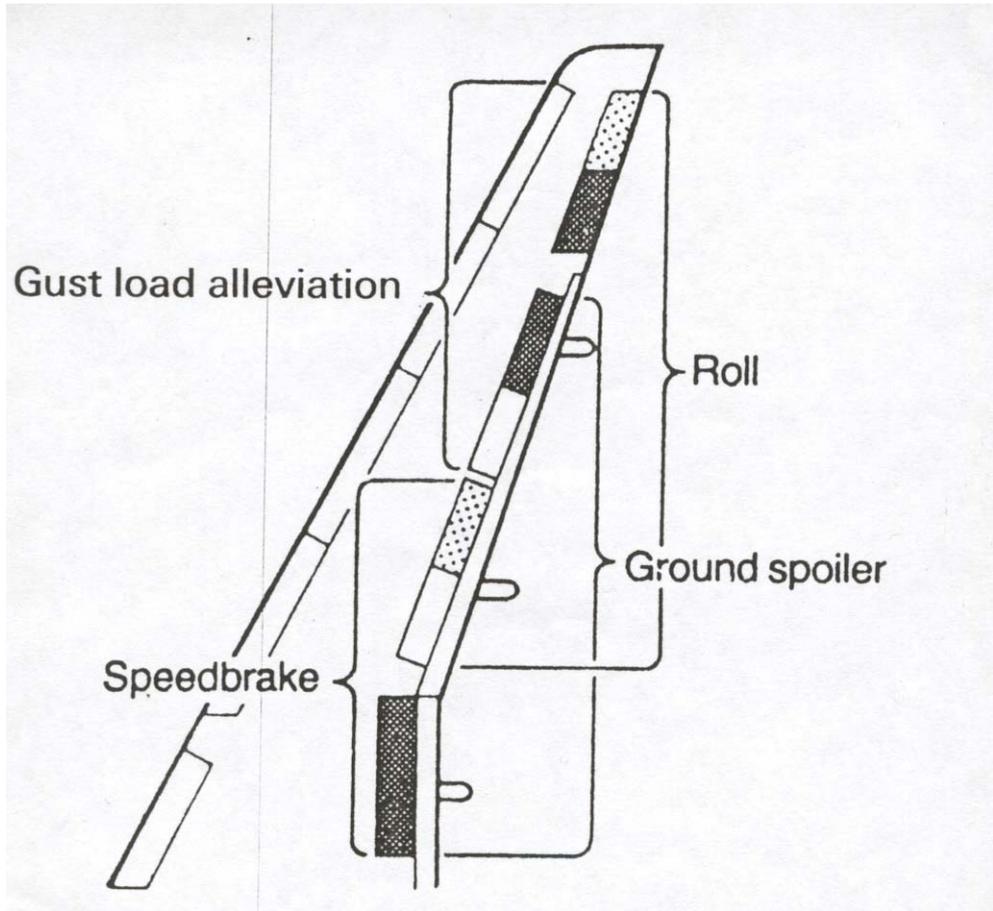
3. CONCLUSIONS

- (a) The long lead time of servocontrols forwarded to the manufacturer for retrofit action was unsatisfactory. There were no pool exchange items available.

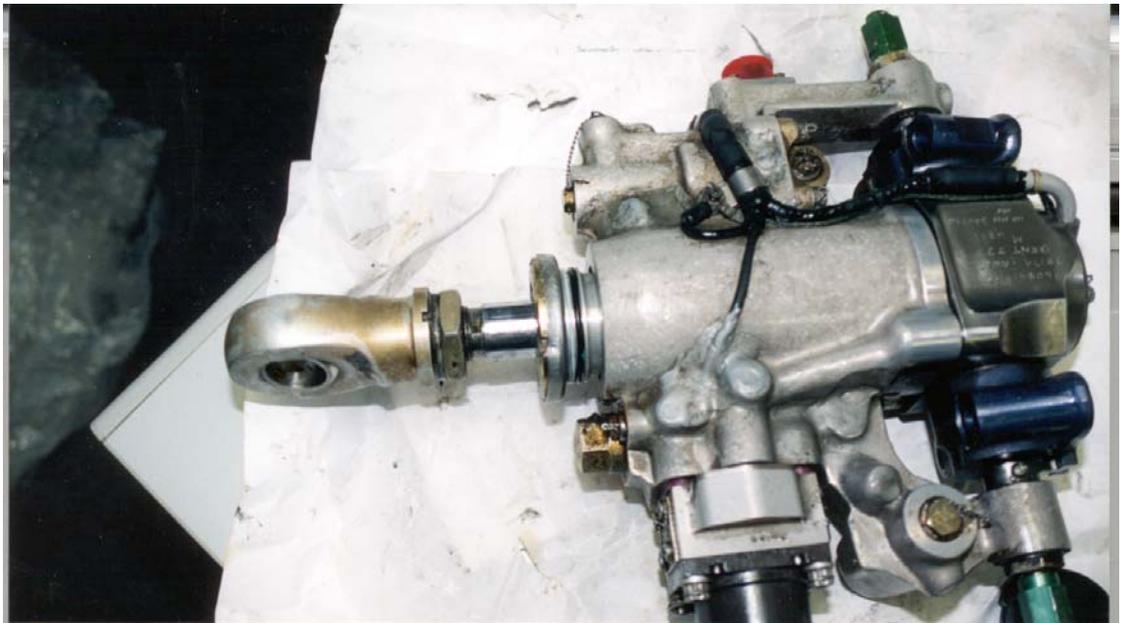
- (b) The fact that the operator contracted a maintenance organisation away from base in the U.K. to carry out the removal of the servocontrols during “C” checks increased the time span.
- (c) The aircraft manufacturer issued several revisions of the Service Bulletins since 1994 and was obviously monitoring the retrofit action worldwide. However this retrofit action, in effect, depended on the average number of flight cycles per flight hour. This would allow unmodified servocontrols to remain installed on aircraft engaged in medium or long flights for longer periods. Eventually the DGAC and FAA, although late in recognising the requirement for more definite action, made the SB mandatory.
- (d) The accomplishment time scale is considered too long, particularly as the servocontrol defect was first notified to the aircraft manufacturer in 1993. This would apply, in particular, to the FAA Airworthiness Directive.
- (e) The aircraft was struck by lightning following the event and the Captain then disconnected the autopilot as it was having difficulty in maintaining directional control of the aircraft. It is evident that the crew handled the aircraft in a very professional manner during this critical phase of flight to touchdown.

4. RECOMMENDATIONS

- 4.1** It is recommended that the aircraft manufacturer negotiate more fully with equipment vendors prior to issue of service bulletins so that exchange items are more readily available to operators within a reasonable timeframe. **(SR 1 of 2001)**
- 4.2** The FAA should reconsider the reduction of the accomplishment time scale as required by AD 2000-11-21. **(SR 2 of 2001)**



The A320 Spoiler System.



Photograph showing defective servocontrol.