

SERIOUS INCIDENT

Aircraft Type and Registration:	Airbus A319-131, G-DBCD	
No & Type of Engines:	2 International Aero Engine V2522-A5 turbofan engines	
Year of Manufacture:	2005 (Serial no: 2389)	
Date & Time (UTC):	2 April 2019 at 2150 hrs	
Location:	En route London Gatwick Airport to Palma De Mallorca Airport, Spain	
Type of Flight:	Commercial Air Transport (Passenger)	
Persons on Board:	Crew - 6	Passengers - 63
Injuries:	Crew - None	Passengers - None
Nature of Damage:	None	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	38 years	
Commander's Flying Experience:	10,296 hours (of which 2,931 were on type) Last 90 days - 122 hours Last 28 days - 45 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and the operator's safety report	

Synopsis

During pre-departure maintenance activity to resolve a flight control status message, the No 1 spoiler was unintentionally left in the MAINTENANCE position with the maintenance key installed. During the flight, the spoiler was able to 'float' up resulting in uncommanded left roll and vibration. The crew landed the aircraft without further incident.

The operator's internal investigation identified a number of factors which contributed to the maintenance error and it made 11 internal recommendations.

History of the flight

Following a flight control status message prior to departure, maintenance activity intended to deactivate the No 1 spoiler on the left wing was completed. This was undertaken to allow the aircraft to depart with the defect deferred in accordance with the Minimum Equipment List.

The departure was normal but whilst in the cruise, the crew noticed that the aircraft was flying 2° left wing down with 2.4 units of right rudder trim; a light "rumble" was apparent.

As the flight progressed, the crew monitored the situation and consulted with the operator's maintenance control. The senior cabin crew member was asked to visually check the wing

and its control surfaces for anything unusual. In the absence of any warnings or confirmed abnormalities, the crew decided to continue the flight to the planned destination.

During the approach with the autopilot engaged, when FULL flap was selected the aircraft rolled noticeably to the left and deviated from the flight director command bars. This was accompanied by buffeting and vibration which felt like “light turbulence”. The crew observed the operating spoilers on the right wing were repeatedly extending and retracting and that the autopilot had applied 6.6 units of right rudder trim as it regained the approach profile.

The crew reviewed the situation and decided to continue the approach. At 1,000 ft agl, the stable approach criteria were met and at 800 ft agl the handling pilot disconnected the autopilot. This introduced a further roll to the left which was contained by the pilot. The aircraft was out of trim and required continual sidestick input, sometimes to nearly full extent, to maintain the approach profile. The crew reviewed the situation again and decided to land. The landing and taxi to stand were without incident.

On arrival, maintenance staff inspected the aircraft and found that instead of the No 1 spoiler being deactivated it had been left in the MAINTENANCE position with the maintenance key still installed. The ‘*remove before flight*’ flag attached to the maintenance key had been cable tied to the spoiler actuator, Figure 1. In this configuration the spoiler could move away from its stowed position in an uncontrolled manner which would cause the anomalies experienced by the crew.

The spoiler was then correctly deactivated, and the aircraft returned to Gatwick Airport without further incident.

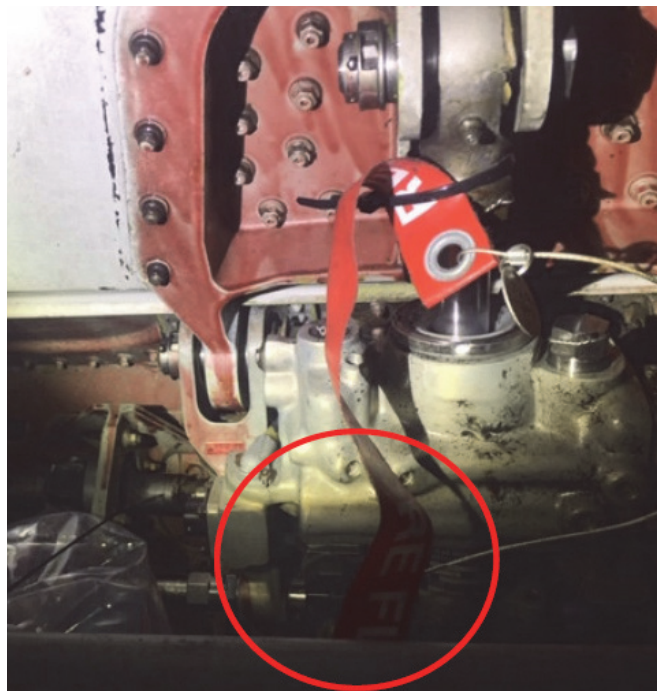


Figure 1

Spoiler maintenance key and flag as found on arrival

Maintenance activity

The aircraft had returned to stand due to a flight control (FLT CTL) status message which had been displayed to the flight crew whilst taxiing. Two licensed aircraft engineers (LAEs) were sent to meet the aircraft and investigate the cause of this message. They had just commenced their shift. On arrival at the aircraft, they debriefed the flight crew and began their fault finding. During this process, they had to go outside of the aircraft to restore ground power after it had failed.

Both LAEs had been issued with tablet devices containing approved aircraft maintenance data which was accessed via an APP. After some confusion surrounding the fault codes and difficulty with the Trouble Shooting manual (TSM), it was confirmed that the No 1 spoiler actuator was not operating correctly.

The LAEs then referred to the paper copy of the Minimum Equipment List (MEL), kept in the flight deck, to see if the aircraft could be dispatched with this defect. Dispatch of the aircraft was allowable with the No 1 spoiler deactivated providing the appropriate procedure in the Aircraft Maintenance Manual (AMM) had been completed. This procedure required the use of a special tool, a spoiler maintenance key, which had to be collected from the engineering stores. Both LAEs returned to the engineering offices to collect the tool and their wet weather clothing due to the worsening weather conditions.

On returning to the aircraft the LAEs completed the deactivation procedure. It was now cold and raining. An operational test was carried out and indications from the ground and on the flight deck displays were as expected. A check to see if the spoiler could be manually raised was not carried out.

The LAE who had completed the deactivation was unable to complete the technical log as his hands were too cold and he “could not feel his fingers”, so the other LAE completed the certification; which was outside the scope of his approval. The aircraft then departed.

Review of Maintenance Activity by the LAEs

When the LAEs later learnt of the flight crew reports of a control anomaly, they realised that the spoiler had been incorrectly locked out and they reviewed the deactivation procedure on a desk top computer.

During their review, the LAEs identified the following issues that may have contributed to their error:

- The tablet device did not allow multiple tabs to be used in the APP which made navigation between the TSM and the AMM “clunky”.
- The APP does not remember the last location so every time a manual is re-opened, the user must scroll repeatedly to find the page previously being used.

- The AMM procedure for spoiler deactivation contains references to all the spoiler positions and the different modification states that are available for the spoiler actuator. This made it difficult to identify the relevant sections of the procedure to use, relating to the modification status and position of the actuator, on the tablet device they were using.
- Post-modification spoiler actuators have an identification plate indicating the OPERATIONAL and MAINTENANCE positions; pre-modification actuators do not.
- The instructions in the AMM clearly indicate the installation of the spoiler maintenance key, but due to the sentence construction the removal instruction is not as clear, Figure 2 and 3.

(a) Install the (98D27603002000)**KEY-SPOILER MAINTENANCE**, (98D27603002001)**KEY-SPOILER MAINTENANCE** (3) on the servocontrol and turn it a quarter turn counterclockwise to the 'M' position (Maintenance). The servocontrol is in maintenance position.

Figure 2

Instruction to install spoiler maintenance key

(f) Turn the (98D27603002000)**KEY-SPOILER MAINTENANCE**, (98D27603002001)**KEY-SPOILER MAINTENANCE** (3) a quarter turn clockwise to the 'O' position (Operation) and remove it. The servocontrol is in operational position.

Figure 3

Instruction to remove spoiler maintenance key

The weather conditions were reported as “very bad”, it was raining hard and there was a driving wind. The tablet device is housed in a rubberised case with a lip surrounding the screen, this collected rain water which had to be tipped away before each use and the remaining water residue made the screen less responsive to the touch commands. This made scrolling through the pages difficult.

Neither LAE had deactivated a spoiler actuator for aircraft dispatch before, although both had fitted the spoiler maintenance key during hangar maintenance where it is left in place, along with a ‘gag’ on the actuator rod to ensure the spoiler does not move if hydraulic power is inadvertently applied during the maintenance activity.

Operator’s internal safety investigation

Staff from the Operator’s Engineering Quality department conducted an internal ‘formal’ safety investigation. The stated intention of the investigation was to determine the cause or causes of the incident with a view to eliminating or minimising the probability of recurrence. It was not intended to be critical of individuals or apportion blame.

This internal investigation included:

- interviews with the engineering staff involved in the maintenance activity to deactivate the spoiler;
- a review of the AMM task and its presentation;
- a review of how the maintenance information was accessed using the software and devices supplied by the operator;
- an inspection of the spoiler maintenance key and a review of its use; and
- a review of previous similar events involving spoiler deactivation.

This internal investigation found the following:

- The LAEs did not completely follow the AMM procedure to de-activate the No 1 spoiler and they were convinced the spoiler maintenance key should remain in the actuator, as it does in hangar maintenance situations and with other systems they had worked on.
- The maintenance information, although complete, was difficult to follow as the task included instructions for differing spoiler actuator modification states and for every spoiler position, so the applicable sections had to be identified from the main large body of text.
- The information platform and tablet used by the maintenance staff was more difficult to use in the heavy rain and did not allow more than one document to be open at a time.
- The information platform timed-out after a period of time which required the user to log-in after moving between locations and rather than going to the page being used, it would default to start of the document.
- The performance of information platforms and checklists used by flight crew were more succinct and the information relevant to tasks was easier to access and follow than those supplied to maintenance staff.
- No final or independent physical check to confirm the spoiler lockout was performed.
- The engineers referred to the approved data, but it was primarily to locate part numbers of tooling and to access function check sequences.

The internal investigation report made the following observations:

‘There are several learning points from this event which from an organisational perspective reflect those raised in a similar event in 1993¹.

Footnote

¹ AAIB note -This event to G-KMAM on 26 August 1993 was investigated by the AAIB, see Formal Report AAR 2/1995.

As aircraft technology evolves, we somewhat remove some of the potential maintenance errors, however this evolution also brings an increased reliance of the importance to adhere to maintenance procedures. Those maintenance procedures from a human factor perspective, need to be concise and user friendly. Of a standard which can be followed easily and safely in a time pressured environment. We need to take away or support more, some additional single reliance we put on the certifiers to make safety critical decisions under pressure. As an organisation we rely solely on the certifier in an unscheduled maintenance environment to make decisions on duplicate inspections, where guidance within the approved data would be best place to offer organisational support.'

It went on to review other similar maintenance lapse events and identified five causal factors from the AAIB report AAR 2/1995 in to a similar incident involving an Airbus A320-212, G-KMAM in 1993 that have a direct correlation to the causal factors identified in this event:

- *'During the flap change compliance with the requirements of the Maintenance Manual was not achieved in a number of directly relevant areas.*
- *The re-instatement and functional check of the spoilers after flap fitment were not carried out.*
- *A rigorously procedural approach to working practices and total compliance with the Maintenance Manual was not enforced by local line management.*
- *It is not possible for maintenance staff working on the current generation of aircraft to have enough information about the aircraft and its systems to understand adequately the consequences of any deviation from approved maintenance procedures.*
- *The avoidance of future unnecessary maintenance related accidents with high technology aircraft depends on an attitude of total compliance with approved procedures being developed and fostered within the industry.'*

Operator's additional comment

'Approved data presented by a manufacturer is not always in alignment with good human factor principles. This report demonstrates the importance of how task data is presented to an engineer. In this case, the majority of the task data is not directly related to the deactivation of No.1 spoiler. This led the engineers involved to scroll through several paragraphs of inapplicable data in order to identify the specific parts of the task that applied to them. This can, as it did in this case, lead an engineer to miss essential safety information or critical parts of the task.'

Conclusion

Following maintenance action intended to deactivate a spoiler, the aircraft departed with the spoiler in the maintenance position. This allowed the spoiler to 'float' up in the airflow causing an uncommanded roll input. The aircraft landed without further incident and the spoiler was correctly deactivated for the return flight.

The operator's safety investigation identified that the LAEs had not followed the AMM procedure correctly. The maintenance activity was, by necessity, being conducted in bad weather and it was an unfamiliar task. They were distracted during the task and had difficulty using the APP on the tablet device which was provided to display the required maintenance information.

The LAEs had difficulty interpreting the modification status of the actuator and identifying the relevant sections of the procedure to use, relating to the modification status and position of the actuator, on the tablet device they were using. They were not clear on how the maintenance key was to be used to deactivate the spoiler actuator for dispatch. A physical check for correct deactivation was not completed and an independent check for correct deactivation was not required to be carried out. The log book entry for the deactivation was incorrectly certified.

The operator's report also identified a number of contributory factors including how the maintenance information was accessed and presented to the engineers, and differences in how similar information is presented more effectively to flight crews.

Safety actions/recommendations

The operator's investigation report contained eleven internal recommendations intended to prevent a recurrence. These were made in the following topic areas:

- Improving the ease of access to, and the presentation and clarity, of maintenance information.
- Discussion with EASA and Airbus about the possibility of having critical lock out tasks clearly defined within the MEL in the style of a QRH for use alongside the crew OPS procedures.
- Reviewing the policy and standards for duplicate inspection to clearly identify that this deactivation task should require a duplicate inspection.
- Reviewing the effectivity of current line manager's task audits at the Maintenance Safety Group.
- Highlighting to other engineers the importance of fully understanding the AMM and Trouble Shooting Manual tasks.