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**Subject: safety recommendations on the accident occurred on September 29<sup>th</sup> 2013, at Rome Fiumicino airport (Italy), to A320-200 registration marks EI-EIB.**

## **1. Synopsis**

On September 29<sup>th</sup> 2013, at 18.11 UTC, the aircraft A320-200 registration marks EI-EIB, flight AZ063, while approaching the final destination of Rome Fiumicino (LIRF) airport at the end of a flight departed from Madrid airport with 151 pax and 6 crew on board, experienced a technical problem during the landing gear normal extension. This circumstance was notified to the crew by the Master Warning and the triggering of the ECAM message “L/G GEAR NOT DOWNLOCKED”.

During missed approach standard procedure and following holding on Campagnano VOR, the crew carried out a g-force manoeuvre (maximum value of 1.75g – DFDR data) with LG lever down, then a LG recycle and later on performed LG gravity extension, but all measures were unsuccessful. Consequentially, the crew requested an emergency landing to Rome Fiumicino airport (LIRF).

Approaching Rome Fiumicino airport RWY 16L, the aircraft touched down on the runway at 19.00 UTC with the right LG only partially extracted (picture 1). At landing, the mass of aircraft was 58.864 kg (DFDR data).

The flight crew shutoff both engines just before touchdown. The aircraft came to rest after scraping the right engine just few meters off the runway (RH side); the subsequent evacuation was uneventful and no injuries were suffered.



**Picture 1: aircraft just after the accident.**

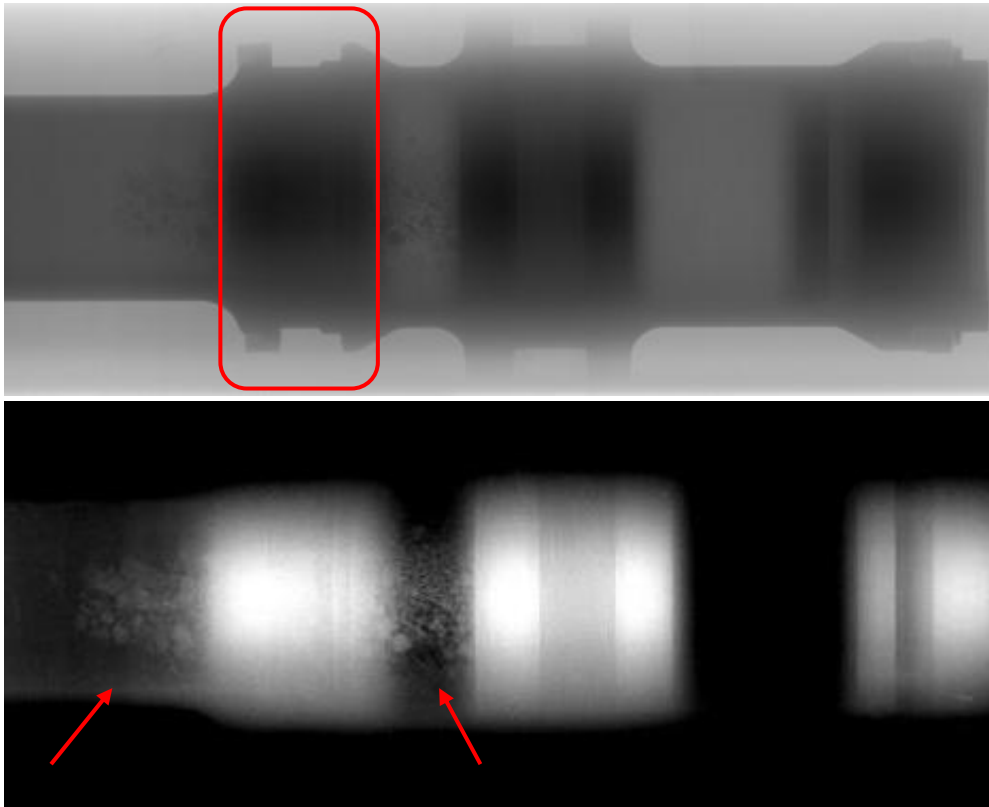
While on site, the investigators noticed the right MLG door actuator only partially extended and the right MLG not in the up-lock position, but stuck on the door (the door was not touching the terrain and no signs of ground contacts were present on it – picture 2). At removal of the jammed actuator, the door fully opened and the gear correctly extended and locked.



**Picture 2: right main landing gear partially open.**

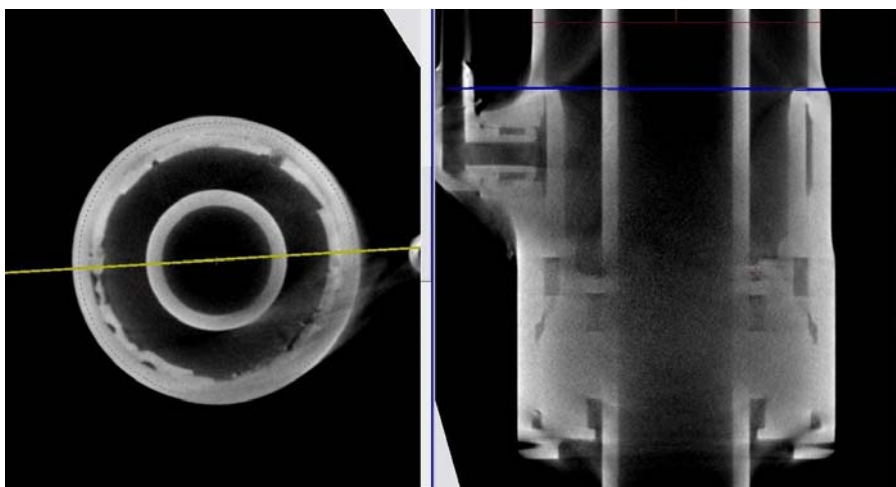
## 2. Findings

Early X-Ray analysis carried out at the labs of the Italian Air Force on the failed actuator (P/N 114122012, S/N CH0907025) revealed the presence of heavy debris in the damping housing (picture 3) together with the absence of some damping components (only the retaining ring appeared to be present - red box on picture 3).



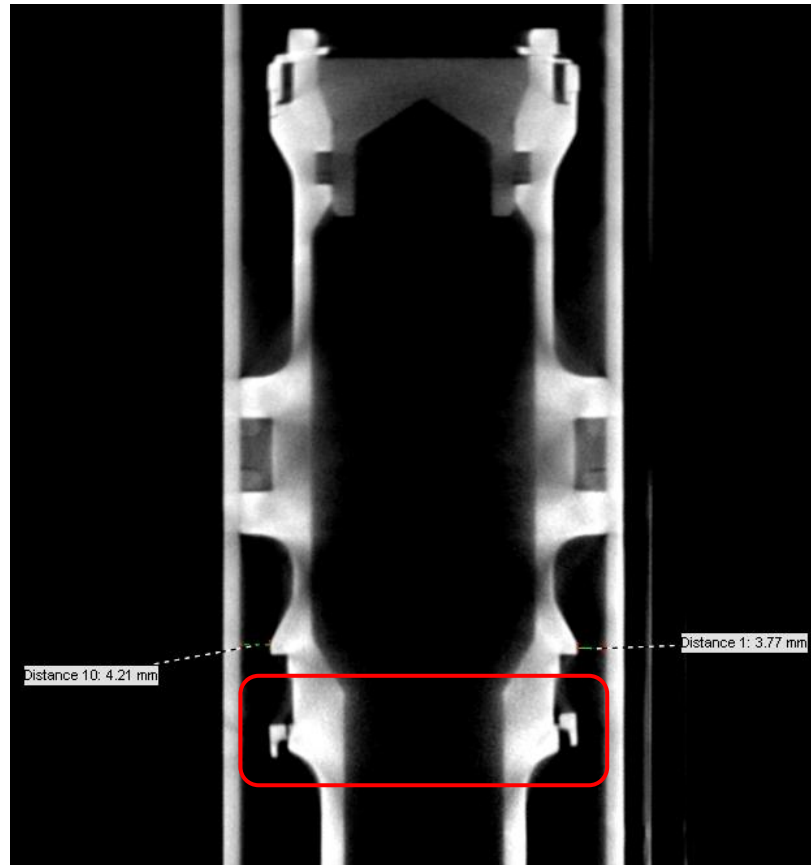
**Picture 3: evidences from X-Ray analysis.**

The following CT scan carried out at Astrium facilities (Bordeaux, France) confirmed this condition and clarified that only the retaining ring was present on the damaged area. In addition damages on the lip of the damping housing were detected (picture 4).



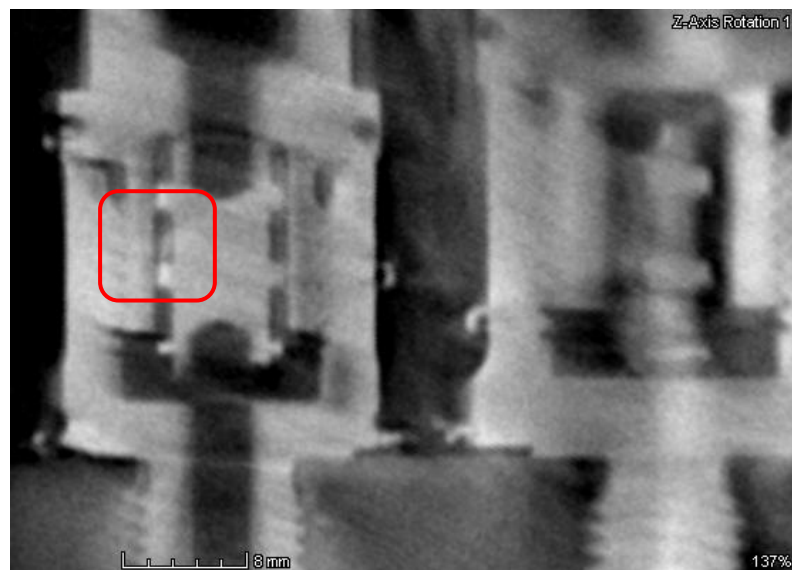
**Picture 4: evidences from CT scan.**

The retaining ring has been found out of the design position (picture 5).



**Picture 5: evidences from CT scan.**

Presence of one debris is showed on picture 6 in the restrictor area (retractor one).  
CT scan of the left door actuator (not failed one) showed all internal components in their correct position.



**Picture 6: evidences from CT scan.**

After these analysis, following bench test were carried out at the actuator manufacturer premises of General Electric UK in Cheltenham and at aircraft manufacturer premises of Airbus UK in Filton. At installation on the bench test at GE UK, the actual length of the failed actuator was measured 817.2 mm, 222.8 mm less than the full extension length of 1040.0 mm.

When the hydraulic pressure was slowly increased, no movement was observed till it reached 320 psi; at this value a very smooth movement to 819.1 mm length was observed and pressure suddenly decreased to 282 psi. After that the test has been stopped in order to install the actuator on the test rig at Airbus UK facilities in Filton where an agreed test plan has been carried out.

GDO test, freefall manoeuvres and one flight cycle at 3000 psi (complete landing gear up and down procedure at same hydraulic pressure used on the aircraft) have been carried out keeping in mind the issue to perform tests on a failed actuator on which we could not know its condition just before the event.

Anyway, the failed actuator appeared really jammed, it was impossible to carry out the GDO test but the freefall manoeuvre successfully worked thanks to the weight of the landing gear leg that pushed down the jammed door. The LG reached the down-lock position, while the door remained not fully open, but enough to allow the LG to complete the sequence.

The flight cycle carried out worked properly and the timing was comparable with a non failed one (MLG door open time on the failed actuator: 3.17s and 4.25s; typical MLG door open time at same rig: 3.10 +/- 0.10s).

After that, the tests proceeded going back to the GE UK facilities at Cheltenham in order to complete the test bench plan and to go on with the disassembly of both actuators removed from the accident aircraft.

On the failed actuator (right one) the maximum length reached during the GE test was 1037 mm at 1000 psi.

The test bench on the left actuator only revealed an actuator extension damping speed out of tolerance (faster than the maximum allowed), but no irregular findings to be reported.

The disassembly provided full confirmation of all the above mentioned evidences on the right actuator, while on the left one, presence of contamination was clearly shown (picture 7-8, red arrow and circle).



**Picture 7: contamination found on LH MLG door actuator.**



**Picture 8: contamination found on LH MLG door actuator.**

At the time of the event the aircraft had accumulated 7974 FH and 6010 cycles, and the actuators were installed on aircraft since new on July 8<sup>th</sup>, 2010.

Maintenance records of these actuators, that are subject to monitoring/inspection in accordance to AD 2011-0069R1 issued by EASA on April 11<sup>th</sup> 2012, didn't reveal any previous anomaly or malfunction. The last check of the PFR messages (AD 2011-0069R1) has been carried out on September 23<sup>th</sup> (with no findings) while the last GDO test (AD 2011-0069R1) has been carried out (with no findings) on July 30<sup>th</sup>, 308 FC before the event.

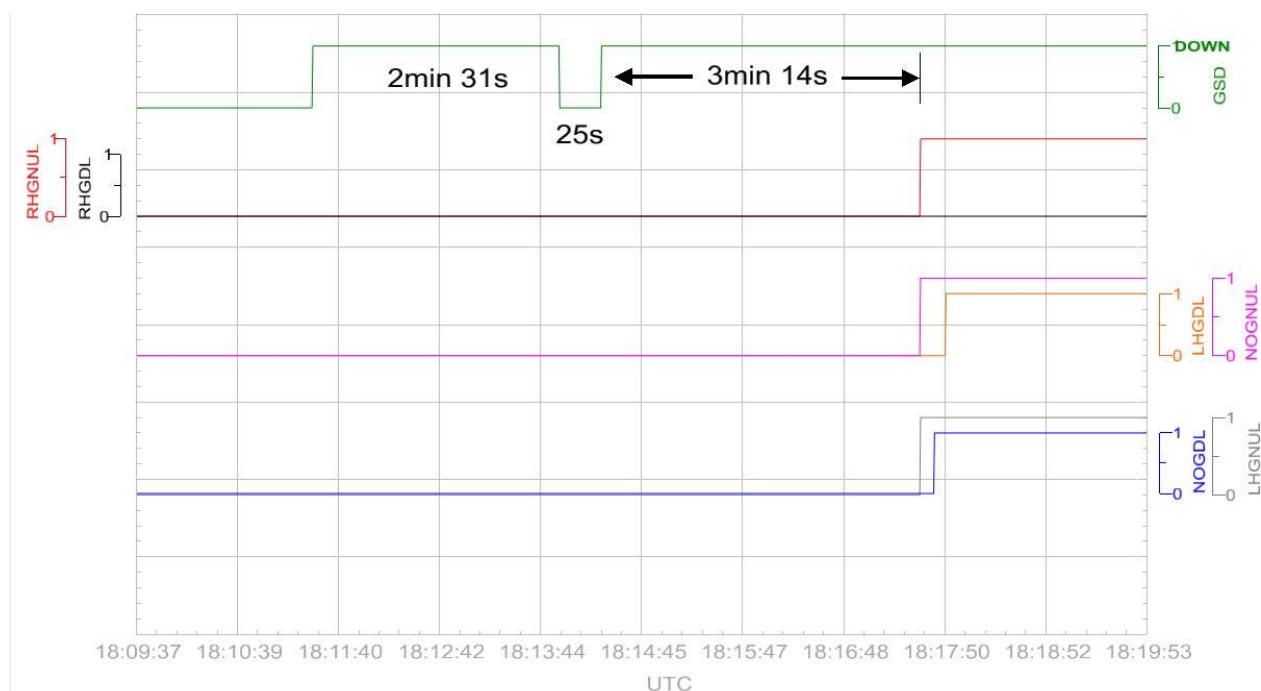
The analysis carried out on the PFR messages of the accident flight showed the expected preliminary "TGT POS" fault message after a 4s confirmation time, but no "TGT POS" messages were presents on the whole CFDS messages downloaded, with reference to the previous flights. The DFDR analysis allowed us to verify that on the flights before the event, no delay was present during the L/G down manoeuvre. On the DFDR parameters there are no signals related to the position of the main landing gear doors, but with reference to the parameter related to the landing gear lever setting (by crew) and the moment in which the landing gears lose the "up-lock" signal, we have verified that the total opening time of the main landing gear doors took about 4.5 seconds. The time needed to show the fault message on the PFR is about 8 seconds (the "4 second delay" timer will start just after that one of the main landing gear doors have completed the opening sequence, about 4 seconds).

Same condition has been verified for the Wizzair case, so there was no way for both cases to have the "TGT POS" messages as preliminary advise of the incoming failure.

In terms of operational procedures, DFDR data showed that before applying the gravity extension procedure, the crew had executed the following sequence of actions:

- normal extension of the L/G with lever set in “DOWN” position for 2’31” with indication of “L/G GEAR NOT DOWNLOCKED”;
- g-force manoeuvre at 1,75g (DFDR data);
- recycle of the landing gear by moving the lever in “UP” position for 25”, followed by repositioning it “DOWN”;
- 3’14” later, activation of gravity extension.

This sequence of actions shows that the crew recycled the landing gear lever once and waited for more than 2 minutes with the gear selected down before starting the landing gear free fall procedure, as requested by the OEB 209/1 dated Feb 2011 and following modifications (OEB 44.00 dated 25 Nov 11 and OEB 44.01A issued on 30 May 2012) that recommends the flight crew, if ECAM triggers the “L/G GEAR NOT DOWNLOCKED” warning, to wait for 2 minutes after the recycling of the landing gear, before extending the landing gear by gravity.



**Picture 9: L/G timing commands from FDR data.**

After gravity extension, crew continued to have a red light on the landing gear indicator panel (RH MLG) and observed that the problem was not solved. DFDR data confirms that the right landing gear remained in a transit condition (“not up-locked”, “not down-locked”) that was permanently maintained until landing.

### 3. Considerations

Recurrence of the accident, that seems fully coherent with the previous two events, one occurred at Newark Liberty International airport (NJ, USA) on January 10<sup>th</sup> 2010 to the A319 aircraft registration marks N816UA (equipped with a MLG door actuator std-10), and the other one

occurred at Fiumicino airport on last June 8<sup>th</sup> 2013 to the A320 aircraft registration marks HA-LWM (equipped with a MLG door actuator std-12, like the one installed on the subject event), poses serious concerns about the effectiveness of the mitigation actions currently in place while taking into account the large fleet potentially affected by the issue.

The DFDR analysis demonstrated that the total opening time of the main landing gear doors in the last two accident flight took about 4.5 seconds. So even if for the Wizzair case it has been individuated a problem solved with the Emergency AD 2013-132-E about the aircraft for which the interlink communication ARINC 429 was installed, the warning message on the PFR should have been not found. Further analysis have been performed on the DFDR data coming from the database of the ANSV Laboratory (A320 family fleet data), and normally the total timing for the main landing gear doors opening has been found between 3.5s to 5s (accident flight included).

In addition, analysis of CFDS during the maintenance actions required by the AD 2011-0069R1 can only highlight a delay as a difference with respect to the opening time of other actuators installed onboard the aircraft, but it cannot be thought as a signal of correct functioning of the parts because it does not provide actual measurements of the performance of each single actuator.

The recent introduction of the P/N 114122-014 as indicated by the SB 32-1407 released in May 2013, and by the OIT 999.0074/13 issued on October 30<sup>th</sup> 2013, that it is intended to fix the problem through a new design of the internal damping mechanism, if effective, could still require too long a time to ensure the highest safety standard before completion of the retrofit of the fleet.

Finally, some additional concerns comes from the clear signs of oil contaminations found on the “not failed” actuator on the two last events (left for the AZ event and right for the Wizzair one). In fact, this condition could be thought as representative of a contamination distributed within the landing gear hydraulic system components that could represent a technical problem for the system itself and not only for the actuator.

EASA has notified on November 13<sup>th</sup> 2013 the PAD 13-125R2 containing reduced inspection (CFDS and GDO) intervals and requiring replacement/retrofit to the std-14 as terminating action for the monitoring and repetitive checks. EASA communicated that, after analysis of the comments received from the online publication and consequential modifications, an AD will be issued on the first part of December and will supersede the actual AD-2011-0069-R1.

#### **4. Safety Recommendations**

Based on the previous considerations and in the meanwhile of achieving any further outcome from the safety investigation currently ongoing, ANSV considers necessary to issue to EASA the following safety recommendations.

##### **Recommendation ANSV-13/2385-13/1/A/13**

The required PFR check cannot be considered a valid method or safety net for the preliminary identification of an incoming failure on the main landing gear door actuators. This kind of maintenance check has been revealed as ineffective on both the last two events. On the other hand the analysis post accident on the components, revealed on all the three cases mentioned, that a X-Ray analysis is able at 100% to identify the failed conditions of the actuator. The damages showed during these X-Ray analysis have been found at a level that is reasonable to state that it should be possible to identify a failure many cycles before the actuator will become stuck. ANSV recommends to take into consideration the possibility to add X-Ray analysis (to be performed



through portable tools for example) to the checks prescribed on the main landing gear door actuators.

**Recommendation ANSV-14/2385-13/2/A/13**

The installation of the std-14 is considered a terminating action for the checks prescribed by AD 2011-0069R1 (same as about the PAD 13-125R2). With reference to the lack of reliability data coming from the A320 family fleet operations on the new modified actuators std-14, ANSV recommends to avoid to completely delete the prescribed checks and inspections in the first part of the substitution campaign of the std-14 on the A320 family fleet.

**Recommendation ANSV-15/2385-13/3/A/13**

Recurrence of the event within such a very short period suggested ANSV to strongly recommends to launch a substitution campaign of the std-12 actuator in the shortest way possible.

**Recommendation ANSV-16/2385-13/4/A/13**

ANSV recommends to take into consideration that the debris coming from a failed actuator have been found inside the actuators “not failed” on both accidents occurred on 2013. With reference to the maintenance actions required by the AD 2011-0069R1 (same as about the PAD 13-125R2), if a faulty actuator is found, the required corrective action is to remove it and to install a new one. No actions required about the hydraulic system that has been found contaminated during both the investigations. ANSV strongly recommends to ask for the proper technical actions to be carried out on the hydraulic system of the landing gear doors to be sure that contamination is not present in case of a landing gear door actuator removal in consequence of the actions prescribed to identify an internal damage (ref AD 2011-0069R1 and PAD 13-125R2).

President of ANSV  
(Prof. Bruno Franchi)