Proposed Temporary Deviation on Landing Gear Emergency Extension

Applicable to A400M

Introductory note:

The hereby presented Temporary Deviation has been classified as important and as such shall be subject to public consultation, in accordance with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.) of which states:

"2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency."

Statement of issue

During A400M certification flight testing, in two instances, landing gear emergency extension did not perform as expected, leaving the Main Landing Gear up and locked.

Following analysis of these events, they were attributed to a particular Electrical Motor Control Unit (EMCU) synchronization issue linked to EMCU FPGA design.

In both cases and as predicted by the supplier, an EMCU reset allowed to complete the Main Landing Gear Doors opening and the emergency extension sequence.

A specific QRH (Quick Reference Handbook) procedure was derived by Airbus for landing gear emergency extension in case of sequence interruption due to EMCU synchronization issue.

However, Electronic Centralized Aircraft Monitoring (ECAM) procedures for landing gear emergency extension are still not adequate to cover the above issue and are not correct. Affected failure procedures include:

- Total engine flame out
- Emergency electrical configuration
- Loss of both normal DC electrical buses
- Loss of Yellow hydraulics
- Loss of Blue and Yellow hydraulics
- Landing gear not locked down alert
- Loss of both landing gear control computers

EASA CS 25.729 (c) requires that:

"(c) Emergency operation. There must be an emergency means for extending the landing gear in the event of –

(1) Any reasonably probable failure in the normal retraction system; or

(2) The failure of any single source of hydraulic, electric, or equivalent energy supply".

EASA CS 25.1301 (a)(1) requires that:

(a) *Each item of installed equipment must: (1) Be of a kind and design appropriate to its intended function"*.

EASA CS 25.1309 (a) (1) requires that:

> *"(a) The aeroplane equipment and systems must be designed and installed so that:*
>
> > *(1) Those required for type certification or by operating rules, or whose improper functioning would reduce safety, perform as intended under the aeroplane operating and environmental conditions"*.

EASA CS 25.1309 (c) requires that:

> *"(c) Information concerning unsafe system operating conditions must be provided to the crew to enable them to take appropriate corrective action. A warning indication must be provided if immediate corrective action is required. Systems and controls, including indications and annunciations must be designed to minimise crew errors, which could create additional hazards*".

EASA considers that A400M's Landing Gear Emergency Extension system has proven to be unreliable and therefore not compliant with CS25.729(c) at all times. It's reliability is not appropriate to it's intended function, and so is not compliant with CS25.1301(a). It is also not compliant with CS25.1309(a)(1) as it does not perform as intended as required by certification rules.

Additionally, the A400M's ECAM procedures for emergency landing gear extension are not compliant with CS25.1309(c) as they may mislead the crew into taking inappropriate action, which could create additional hazards. Additionally, they unnecessarily lead to a further increase in workload in high workload and/or time critical situations.

Due to these identified non-compliances, Airbus has requested EASA a Temporary Deviation to allow the A400M aircraft being certified.

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The applicant agrees to improve the A400M design after initial EASA A400M certification, through the following final fix to be implemented before first A400M aircraft Entry Into Service (EIS):

- Modification of the EMCU design to correct the synchronization issue linked to EMCU FPGA, leading to a new EMCU P/N D24364000-503.

- Modification of the ECAM to update the landing gear emergency extension procedure allowing

In addition the current LG emergency extension system design will be improved via the following design changes to be introduced also before EIS:

- Modification of the logic in the Emergency Extension Control Unit (EECU) to allow extension of all Main Landing Gears in case of EMCU and/or Electrical Back-up Mechanical Actuator (EBMA) failures.
- Modification of the Nose/Main door up lock EMAs addressing a failure to unlock in MLG Door Up-lock due to quality problems.

Airbus SAS request EASA to grant meanwhile a Temporary Deviation with regards compliance with CS25.729(c), CS25.1301(a), CS25.1309(a)(1) and CS25.1309(c) supporting such request on the following mitigations:

- A QRH (Quick Reference Handbook) procedure has been implemented that:
  - Supersedes the ECAM procedure, and
  - Introduces a new improved procedure to cope with this EMCU synchronisation issue and to avoid spurious warnings to be triggered and
  - To clarify and improve the wording.

  That i.a.w. Airbus is providing both a reliable and functional emergency procedure for the extension of the landing gear as well as suitable information to the flight crew for them to take the appropriate corrective actions in case they will need to apply this procedure.
- Additional quality inspections have been introduced in the manufacturing process of the Nose/Main door up lock EMAs (Electrical Mechanical Actuators).

As EASA conclusion, a Temporary Deviation for the A400M can be granted by EASA associated to the following condition:

> This EASA Temporary Deviation will be valid since initial A400M certification until 31st December 2012 or until first A400M aircraft entry into service, whichever will occur first.