

Proposed Temporary Deviation on Powerplant and Fuel System related Alerts

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, several inappropriate or missing alerts related with powerplant – fuel system were identified:

1.OVTQ warning at take-off. In certain take-off conditions, OVTQ (over torque) red warning can be transiently displayed on EWD while no specific crew action is needed.

2. ECAM Warning During Engine Relight in Flight. In certain conditions, during engine in-flight restart, "ENG 1 PROP SYS OIL PRESS LO" ECAM warning is inappropriately triggered with an associated " ENG MASTER LEVER ... OFF" procedure which is not to be applied.

3. Misleading fuel system ECAM cautions and deferred procedure following electrical busbar failures.

Following DC1+DCEss failure, ECAM cautions are erroneously triggered to indicate a fault of MAIN+STBY 1 and 4 pumps, crossfeed valves 1-4 and FQMS 1 and 2.

The deferred procedure displayed in case of DC1+DCEss is not appropriate. It is requested to initiate gravity feeding immediately while one pump per feed tank is operating normally, which is found misleading.

ECAM cautions to indicate crossfeed valves 1-4 fault are also erroneously triggered in LMES situation.

4. Absence of alert in case of propeller coarse pitch failure

In case of propeller coarse pitch failure (resulting in propeller feathering), all engine indications remain normal except for a green F next to propeller 4 speed indication and a green box around it. After the take-off, no ECAM caution or warning is displayed. There is no clear indication to the crew that the affected engine is not delivering power.

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 AMC 25.1309 9 c further specifies that:

“(1) The required information will depend on the degree of urgency for recognition and corrective action by the crew. It should be in the form of :

(i) a warning, if immediate recognition and corrective or compensatory action by the crew is required;

(ii) a caution if immediate crew awareness is required and subsequent crew action will be required;

(iii) an advisory, if crew awareness is required and subsequent crew action may be required;

(iv) a message in the other cases.

[...]

(2) [...] Reliable failure monitoring and indication should utilise current state of the art technology to maximise the probability of detecting and indicating genuine failures while minimising the probability of falsely detecting and indicating non-existent failures. Any indication should be timely, obvious, clear, and unambiguous.

(5) Even if operation or performance is unaffected or insignificantly affected at the time of failure, information to the crew is required if it is considered necessary for the crew to take any action or observe any precautions. Some examples include reconfiguring a system, being aware of a reduction in safety margins, changing the flight plan or regime, or making an unscheduled landing to reduce exposure to a more severe Failure Condition that would result from subsequent failures or operational or environmental conditions”.

EASA CS25.1322 requires that:

“If warning, caution, or advisory lights are installed in the cockpit, they must, unless otherwise approved by the Agency, be –

(a) Red, for warning lights (lights indicating a hazard, which may require immediate corrective action);

(b) Amber, for caution lights (lights indicating the possible need for future corrective action);

(c)

(d)”

EASA AMC 25.1322 paragraph 8.2 further specifies that:

“The alerting system should be designed to avoid false and nuisance alerts. The possible effects of a false alert should be assessed for each function and taken into account in establishing the required Safety Objectives. In addition, the occurrence rate of false and nuisance alerts should be low enough to maintain crew confidence in the alerting system”.

The warnings referenced under 1 and 2 in the statement of issue above are therefore not compliant with CS 25.1309(c) and CS25.1322(a) as they are provided when there is no unsafe system operating condition and no corrective crew action is required. Additionally, they may mislead the crew into taking inappropriate action such as reducing engine power or aborting engine relight.

The cautions and deferred procedure referenced under 3 in the statement of issue are not compliant with CS25.1309(c) as they are falsely referring to non-existent failures and 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 situations.

The absence of alert referenced under 4 as referred in the statement of issue is not compliant with CS25.1309(c) as no clear information is provided to the crew to indicate that one engine is not delivering power (see in particular AMC 25.1309 5 c (5)).

Due to this identified non-compliance, 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.

The applicant has identified the following mitigations for the particular scenarios described on the statement of issue:

- For case 1) it should be noted that the warning is meant for maintenance only and is only a distraction for the crew.
- For case 2) a limitation will be raised and included and included in the AFM asking the pilot to disregard any Propeller Oil pressure warning during startup until engines are stabilised at Flight Idle. In case warning continuing after stabilization, the pilot is requested to follow the procedure: “THR LEVER to IDLE and ML to OFF”.
- For case 3) there will be:
 - A QRH for ELEC DC BUS 1 + ESS FAULT that includes instruction to:
Disregard DEFERRED PROCEDURES ALL PHASES, except:
AT TOP OF DESCENT: CAB ALTLDG ELEV
 - A QRH procedure for ELEC DC BUS 1 + ESS FAULT mitigates these anomalies in the interim.
- For case 4) it should be noted that at system level, extended feathered idle operations (low rpm and high torque with low oil film thickness) may damage the first stage gear train. Nevertheless, the integrity of the Propeller Gear Box (PGB) will not be compromised for the duration of the flight, but a post flight overhaul of the PGB will be required.

Supported by these considerations, Airbus SAS request EASA to grant a Temporary Deviation with regards compliance with CS25.1309(c) and CS25.1322 as interpreted by AMC 25.1322 par 8.2 requirements.

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.