CRD - NPA 13/2004

Comment	Response

I-B. Proposals Transposed JAA NPA 25E-337

Paragraph *6.*

Cmt. *3 / FAA, USA*

Comment	Response
Paragraphs 6.b. of proposed AMC to proposed CS 25.901(c) Replace '3%' with 'a few percent' in the affected paragraph The current wording implies a level of accuracy on the threshold of detectability which is not warranted.	Agreed. Quoting a precise figure in the AMC is not adequate here. The 3% figure may prove to be invalid in some cases. It could depend for instance on the number of engines installed (2, 3 or 4) and could be pessimistic or optimistic. "3%" will be replaced by "a few percent".

Cmt. *4 / FAA, USA*

Comment	Response
Paragraphs 6.b.(2) of proposed AMC to proposed CS 25.901(c) Replace the lead in and subparagraph (a) in the affected paragraph with: "Multiple Engine IFSD. Typical engine IFSD rates may not meet the AC 25.1309-1B guidance that calls for 1 x 10-9 per hour for a catastrophic multiple engine IFSD. However, engine IFSD rates have been part of the historically-accepted service experience upon which that guidance was based, and these IFSD rates are continuously improving. Consequently: (a) Current typical turbine engine IFSD rates, and the resulting possibility of multiple independent IFSD's leading to a critical power loss, are considered inherently acceptable for compliance with § 25.901(c) without the need for quantitative assessment" The current wording refers to an exceptional provision in the AC/AMJ 25.1309, which the FAA considers un-harmonized.	Agreed. The proposed text is clearer and will be used to replace the NPA text.

Cmt. *5 / FAA, USA*

Comment	Response
Proposed AMC to proposed CS 25.901(c) Harmonization of FAR 25.901(c) with this proposal will require depend on resolution of outstanding “specific risk” issues with CS/FAR 25.1309. There is a proposed joint EASA/FAA/CTA/TC and Industry (via ARAC) tasking to more consistently assess the anticipated risk variations and uncertainty allowable for catastrophic failure conditions. The current FAR 25.901(c) is not harmonized with the current CS 25.901(c) or FAR/CS 25.1309(b). The FAA has concluded that for catastrophic failure conditions, the predicted average rate of occurrence is not always sufficient to support a finding that the failure is not anticipated to occur for the purpose of FAR 25.901(c). The current FAR 25.901(c) compliance means take into account certain anticipated risk variation and uncertainty that current FAR/CS 25.1309(b) compliance means may not address. The FAA intends to develop a single consistent acceptable means of compliance based upon the best of both approaches. The FAA appreciates the continued support of EASA in this effort.	Noted. The Agency supports harmonisation of CS-25 and FAR-25 as far as practicable, however, in this case it has decided not further delaying the publication of this material which is a significant improvement of the current CS 25.

Comment	Response
Cmt. *9 / GE Aircraft Engines, USA*	
AMC 25.901(c) paragraph 6a Request paragraph 6a be deleted, or that a working group be convened to develop clearer guidance which can be followed in practice. There have been numerous attempts to use the proposed guidance of paragraph 6a since the material was drafted by PPIHWG. Attempts to prove that a given thrust loss is ‚detectable' by a flight crew have been extremely difficult and have relied unduly on the individual interpretation of the certification engineer involved. The underlying concern, the potential for accidents similar to the Potomac river 737, is valid and deserves consideration during the safety analysis. However, the guidance as it stands is so nebulous that attention does not focus on this type of event, but a much wider set of events, many of which require such a concatenation of adverse circumstances that they are not, in fact, 'foreseeable'.	Not agreed. The Agency is not aware of any difficulties resulting from application of the proposed material, as described by the commentor. Considering this is an important safety issue (a fact fully acknowledged by the commentor), it does not plan to delete paragraph 6.a. The Agency is ready to review the text in the future should any real difficulty be encountered during certification exercise.

Comment	Response

II-B. Proposals Transposed JAA NPA 25E-338

Paragraph *1.*

Cmt. *14 / DGAC, France*

Comment	Response
Editorial comments 1 In 25.933 (a)(1)(i) the word 'airplane' is used when everywhere else in CS-25 the word is 'aeroplane'. This should be made consistent. 2 Paragraph 8of AMC refers to 25.933 (a)(2). It is suggested that this should be 25.933 (a)(1)(ii).	1. Agreed. "airplane" is changed to "aeroplane". 2. Agreed. Reference is changed to 25.933(a)(1)(ii).

Comment	Response

II-B. Proposals Transposed JAA NPA 25E-338

Paragraph *7.*

Cmt. *1 / FAA, USA*

Comment	Response
Paragraphs 7.c.(2) of proposed AMC to proposed CS 25.933(a)(1) Add the following to the end of the affected paragraph: In addition to requiring full performance accountability as it relates to the specific airplane performance requirements of Subpart B, all other aspects of the airplanes performance following a non-restowable inflight thrust reversal (e.g. capability to climb and maintain 1000 feet AGL) must be found adequate to comply with the intent of CS 25.933(a)(1)(ii). The existing wording focuses primarily on the implications of applying the Subpart B performance requirements to an unwanted inflight thrust reversal rather than the broader issue of what level of airplane performance is required to comply with the intent of CS 25.933(a)(1). While clearly these are related, the existing wording does not establish the overall minimum acceptable level of airplane performance required to comply with CS 25.933(a)(1). FAA experience in applying this policy to certification by controllability has made it evident that the overall intent of the performance assessment and it's relationship to the reliability option must be further highlighted. The proposed words are being added to the proposed FAA AC and associated Generic Issue Paper for that purpose. Alternatively, this proposal and a similar proposal affecting paragraph 7.c.(3) could be combined and added in paragraph 7.c.(1). However, putting these 'reminders' directly into each of the specific applicable sections rather than in the general section may make them more visible and hence more effective.	Agreed. This sentence is clarifying the rule intent.

Cmt. *2 / FAA, USA*

Comment	Response
Paragraphs 7.c.(3) of proposed AMC to proposed CS 25.933(a)(1) Add the following to the end of the affected paragraph: The airplane performance capabilities following a non-restowable inflight thrust reversal must be such that the probability of preventing continued safe flight (e.g. capability to climb and maintain 1000 feet AGL) and landing at an airport (i.e. either destination or diversion) is extremely improbable. The existing wording focuses primarily on the implications of applying the Subpart B performance requirements to an unwanted inflight thrust reversal rather than the broader issue of what level of airplane performance is required to comply with the intent of CS 25.933(a)(1). While clearly these are related, the existing wording does not establish any minimum acceptable level of airplane performance as is clearly required to comply with CS 25.933(a)(1). FAA experience in applying this policy to certification by controllability has made it evident that the overall intent of the performance assessment and it's relationship to the reliability option must be further highlighted. The proposed words are being added to the proposed FAA AC and associated Generic Issue Paper for that purpose. Alternatively, this proposal and a similar proposal affecting paragraph 7.c.(2) could be combined and added in paragraph 7.c.(1). However, putting these 'reminders' directly into each of the specific applicable sections rather than in the general section may make them more visible and hence more effective.	Agreed. This sentence is clarifying the rule intent.

Comment	Response
Cmt. *15 / DGAC, France*	
Figures 2 and 3 in the proposed AMC 25.933 are the same as figures 1 and 2 in the appendix K to CS-25 proposed by EASA's NPA 11/2004. The wording associated with these figures is not the same in both documents. In one case the safety factors are specified in the airworthiness code, in the other case they are in the interpretative material. There seems to be inconsistency in texts and in status of these texts, associated with some duplication. It is suggested a complete review of the subject to avoid duplication or unwarranted differences in texts if duplication is found necessary. May be, addition of a cross reference to appendix K in AMC 25.933 (a)(1) would be sufficient.	Not agreed. The text related to the effect of failure conditions of systems on structures in AMC 25.933 is equivalent to the relevant text in the proposed Appendix K in NPA 11/2004 but not identical. The text is tailored to the specific system of reversing. It can therefore not be easily replaced by a simple cross-reference. Moreover the use of the proposed Appendix K is required for certain systems (not for reversing sytems) and therefore in Book 1 of CS-25, whereas the AMC 25.933 text related to this subject only applies if the "controlability option" is used, which justifies its place in Book 2 of CS-25.

Comment	Response

II-B. Proposals Transposed JAA NPA 25E-338

Paragraph *8.*

Cmt. *10 / GE Aircraft Engines, USA*

Comment	Response
AMC 25.933 paragraph 8d Request paragraph 8d(1) be replaced by the statement: " Show that engine spool-down characteristics or potential reverser damage are such that no significant net reverse thrust would be developed by the failed engine", or that a working group be convened to develop clear and technically sound guidance. The current wording of 8d(1) has been interpreted as requiring a flight test to demonstrate the transient engine thrust during a burst disk and reverser unstow event. This approach would present significant safety and practicability barriers to an applicant, since a disk burst is itself an unsafe behavior of the engine. The wording should therefore be clarified to focus on the thrust developed by the engine and to enable an analytical approach.	Not agreed. The proposed text does not provide a real improvement, as compliance finding will always be open to such demonstration. The Agency believes that the current NPA text is sufficiently mature for application and wants to gain experience before deciding on further actions. Convening a new working group at this stage for the purpose of developing more guidance would not be an efficient use of resources.

Cmt. *11 / GE Aircraft Engines, USA*

Comment	Response
AMC 25.933 paragraph 8d Request paragraph 8d include the statement: 'Cascade-style reversers may be shown to produce no net reverse thrust in the event of a disk burst.', or that a working group be convened to develop clear and technically sound guidance. Since the time when PPIHWG recommended this text, more technically informed study of disk burst events by the major engine manufacturers has shown that it is not physically credible for an engine to produce any net reverse thrust after a disk burst has occurred, if the reversers are of the transcowl/ cascade type. Attempts to comply with the guidance of paragraph 8d have also revealed that it is based upon a misconception of the likely debris, and of the potential effects upon the engine. The disk burst data supporting this concern was not available to the task group of PPIHWG addressing 25.933, and therefore they were not in possession of significant material facts when they made their recommendation. The material has since been presented in the PPIHWG forum without technical objections being raised by any participant, other than to limit it to cascade-style reversers. It is a matter of some urgency that the misconceptions in the current advisory material be corrected. GEAE requests that the comment disposition team listen to presentations by the major engine manufacturers, where substantiating technical detail can be presented to show that the current AC is in error. A white paper is attached summarizing some of the technical points.	Not agreed The argument developed by the commentor involves a very severe event resulting in the immediate destruction of the engine; however, less severe engine rotor burst may leave the motor delivering some thrust for a short time while releasing parts large enough to disable the thrust reverser retention system. In other words, the most severe event may not be the worst case. The Agency is still concerned that an uncontained engine failure may cause a hazardous thrust reverser deployment. All recent powerplant installations have embodied specific design precautions addressing the issue, pre-empting this requirement. The Agency believes that the current NPA text is sufficiently mature for application and wants to gain experience before deciding on further actions. Convening a new working group at this stage for the purpose of developing more guidance would not be an efficient use of resources.

Comment	Response
Cmt. *16 / DGAC, France*	
The proposed AMC may be seen as modifying the airworthiness code (Book 1 of CS-25) : this fundamental comment on 'rulemaking by advisory material' was identified by commenters on the JAA NPA as shown in note 1 of part II.D of this EASA NPA. There is at least one case where the 'rulemaking by advisory material' seems obvious. Indeed in §8 the following can be found: 8.b.(1) The thrust reverser system should be designed so that any inflight thrust reversal that is not shown to be controllable in accordance with Section 7,above, is extremely improbable (i.e., average probability per hour of flight of the order of 1 E-9/fh. Or less) and does not result from a single failure or malfunction. And 8.b.(2) For configurations in which combinations of two-failure situations (ref. Section 5, above) result in inflight thrust reversal, the following apply: ... And 8.b.(3) For configurations in which combinations of three or more failure situations result in inflight thrust reversal, the following applies: ... The text of 8.b.(1) is a copy of the proposed 25.933 (a)(1) (although only section 7 of the AMC is referenced, not 25.933). Consequently, the two and (in underlined and bold type in the proposed NPA itself) clearly add something to 25.933 (a)(1). CS 25.933 (a)(1) should be modified to reflect the intent.	Not agreed. The AMC is providing clarification regarding the interpretation of "extremely improbable" for 2 and 3-failure mode scenarios.

Comment	Response

III-B. Proposals Transposed JAA NPA 25E-339

Paragraph *1.*

Cmt. *6 / FAA, USA*

Comment	Response
Proposed AMC to CS 25.1189 The FAA does not support adoption of this proposal for the reasons noted in our comments to JAA NPA 25E-339 as documented in Section III-D of this EASA NPA-13-2004. However, given the response to our comment in Section III-D, we look forward to working with EASA in the future to resolve this issue.	Noted. The Agency believes that the current NPA text is sufficiently mature for application and wants to gain experience before deciding on further actions. If experience shows a need to improve the text a joint rulemaking activity with FAA will be considered.

Cmt. *12 / CAA, UK*

Comment	Response
For NPA 25E-339 Powerplant Shut-Off, we believe there is an administrative issue that has arisen since the original work. JAR-25, Amendment 16 introduced a change to JAR25.1181(b) to require JAR 25.863 to be applicable to designated fire zones. Accordingly, we consider that 'CS 25.863' should be added to Section 3 RELATED JAR SECTIONS of AMC 25.1189. Further, an ARAC working group produced a proposal for Advisory Material to CS 25.863 (expected to be introduced by EASA sometime) that included some advice about flammable fluid drainage. We do not consider that there is any incompatibility problem between the new 25.1189 material introduced here or the new 25.863 Advisory material to be introduced later.	Agreed. CS 25.863 will be added in the list of related requirements.

Comment	Response
III-B. Proposals Transposed JAA NPA 25E-339	
Paragraph *6.*	
Cmt. *18 / DGAC, France*	
A definition of 'hazardous quantity' is provided in this AMC (§6 A) and a default value (0.95 liter) is proposed in §7.2. A. Hazardous Quantity: An amount which could sustain a fire of sufficient severity and duration so as to result in a hazardous condition. In §(1)(e) of AMC to CS-E 130, hazardous quantity is also defined, with different wording and with a different default value (0.25 liter). (e) Hazardous quantity : An amount of fluid, vapour or other material which could sustain a fire of sufficient time and severity to create damage potentially leading to a Hazardous Engine Effect. The certification specifications CS-E 130 (c) were elaborated to be consistent with 25.1189. These differences in interpretation should be reviewed and, if possible, eliminated because the safety issue is the same : fire in the aircraft zones surrounding the engine. If the end result is a common definition of hazardous quantity, consideration should be given to the possibility of putting it in CS-Definitions document.	Not agreed. CS-25 is addressing large transport airplane, whereas CS-E is dealing with engine which can equip all types and sizes of aircraft, including single engine general aviation products. Therefore, the definition of hazardous quantity may differ. Moreover, the hazardous engine effect is not necessarily an hazardoes condition at aircraft level.

Comment	Response

0. General Explanatory Note

Paragraph -

Cmt. *17 / DGAC, France*

Comment	Response
Explanatory note, part II.D The JAA response to comments indicates that the intent in some cases was to initiate further rulemaking activity (comments 011, 021, 022, 023,024). What are the EASA's plans in relation to these topics ?	The direct implications on maintenance instructions should be addressed by the Type Certificate holder. Regarding the awareness of maintenance staff, EASA has a general rulemaking task to define "critical systems". It will be considered under this rulemaking task whether the thrust reversing system is a critical system. Under the Commercial Aviation Safety Team (CAST) / Joint Safety Strategy Initiative (JSSI) a report was made related to "Loss of Control", and also the Propulsion System Malfunction plus Inappropriate Crew Response (PSM+ICR) workshop reported on Propolsion system malfunction issues. Both reports contain several recommendations to improve flight crew training with regard to powerplant failure malfunction conditions There are no direct rulemaking tasks foreseen by the Agency on the operational and flight crew training aspects of this topic but when the transition of rulemaking responsibilities takes place the above recommendations should be taken into account when establishing the medium term Agency rulemaking planning

Comment	Response

IV-B. Proposals Transposed JAA NPA 25E-340

Paragraph -

Cmt. *7 / FAA, USA*

Comment	Response
Proposed Amendment to CS 25.1141(f) The FAA supports the proposal as written.	Noted

Comment	Response

GENERAL COMMENT(S)

Paragraph -

Cmt. *8 / LFV, Sweden*

Comment	Response
No objections.	Noted

Comment	Response
Cmt. *11 / FGE Aircraft Engines*	
Attachment to Comments: 009 - 011 GE Aircraft Electronics (paper copy of text available) Rotor Burst and Inadvertent Reverser Deployment Introduction In the aftermath of the Lauda accident in the early 1990s, in which a 767 reverser deployed at a high altitude, high airspeed condition and led to loss of control, there was a great deal of attention paid to the potential for inadvertent reverser deployment in flight, and the potential failure modes which could lead to such an event. One of the concerns raised at that time was "What if a rotor burst destroys all of the reverser locks, and the reverser deploys in flight?" In order to address this concern, regulatory/advisory material was written in FAR/JAR 25.933 and in FAR/JAR 25.903d, stating that one of the reverser locks should be out of the rotor burst plane. This paper reviews the practicability and necessity of this guidance. Evidence will be presented to show that deployment of a cascade-style reverser as a result of a rotor burst is irrelevant to airplane control. Service Experience of Rotor Burst The turbofan transport-category fleet has experienced a large number of uncontained rotor events (more than 800) over the last forty years. None of these has ever resulted in in-flight thrust reversal to the extent that airplane handling was affected, even when the reverser actually deployed as a result of the rotor burst. On one occasion, a rotor burst during late climb, on a close-coupled high-bypass installation of the kind referenced in regulatory material as being very sensitive to in-flight deployment, actually resulted in reverser deployment. This was a cascade-type reverser, and the inboard transcowl and the blocker doors were found to be in the deployed position after landing. The crew interpreted all of the indications (loud noise, yaw and fire warning, engine self-shutdown followed by reverser transit and reverser deployment light) following the event as an inadvertent thrust reverser deployment. They reported no difficulty in controlling the aircraft at any time during or following the event. Roll and yaw were well within the range anticipated as a result of the engine thrust loss, and easily handled by the pilot. A comparison of the two in flight deployments – on the same aircraft model, with the same reverser type – offers an excellent opportunity to understand the difference between deployment after a rotor burst and deployment while operating at high thrust. *** TABLE (see paper copy 'Attachment to comments 009-011') *** Fan spooldown characteristics – technical considerations The immediate consequences of an uncontained disk failure are: • Very high unbalance, as soon as the disk fragment begins to separate from the spool or shaft. • Heavy rubs by seals, blade tips etc as the engine actual centerline moves off the design centerline- as a result of the unbalance. Casing deformation under the impact of the disk fragment increases this effect. • Immediate rapid dumping of air from the core and fan overboard, though the hole created by the departing disk fragments. • Surge/stall as the engine cycle is interrupted. • Spooldown of the separated piece of rotor, if the disk failure removed the torque path from one rotor. • Spooldown of the fan and core (air is continuing to dump overboard through the hole in the side, rather than driving the turbines. Friction from severe rubs also brakes the rotors.) Within a very short time after the disk burst begins, the fan and core are windmilling or stationary. The thrust reversal developed by a cascade-type reverser (which has little external drag) in this condition is negligible.	Not agreed The argument developed by the commentor involves a very severe event resulting in the immediate destruction of the engine; however, less severe engine rotor burst may leave the motor delivering some thrust for a short time while releasing parts large enough to disable the thrust reverser retention system. In other words, the most severe event may not be the worst case. The Agency is still concerned that an uncontained engine failure may cause a hazardous thrust reverser deployment. All recent powerplant installations have embodied specific design precautions addressing the issue, pre-empting this requirement. The Agency believes that the current NPA text is sufficiently mature for application and wants to gain experience before deciding on further actions. Convening a new working group at this stage for the purpose of developing more guidance would not be an efficient use of resources.

Comment	Response
Engineering data DFDR data can give some indication of how engines spool down after a disk burst; but the sampling rate is not sufficient to give very accurate results. Also, severe failures such as disk bursts often cause collateral damage to engine instrumentation, DFDR synchronization losses and so on, making data recovery a challenge. Engineering tests have much higher data-sampling rates; tests which have involved either an induced failure (such as fan blade-out tests) or an unexpected rotor failure can give additional perspective on spooldown characteristics. Data from in-service events and from engineering tests is presented below, for the fan spooldown times to idle. *** TABLE (see paper copy 'Attachment to comments 009-011') *** Putting this data in context, the normal time for a reverser to deploy is approximately two seconds (from deploy command to full deploy). This is for a reverser being positively actuated open. A reverser deploying after a rotor burst event is not being actuated, but is moving under the influence of external forces such as aerodynamic or inertia loads. If the actuators are not damaged, it would likely take one or two seconds to deploy after the locks disengaged; the speed of deployment would be limited by hydraulic damping. If the actuators were cut, hydraulic damping would no longer occur, but there would be considerable mechanical friction due to distortion of the actuators and slider tracks, and therefore a longer time to full deployment could be expected, as observed in the Sao Paulo event. . Conclusions A review of the technical data recorded during rotor burst events and other severe engine failures substantiates the proposition that no special design precautions are necessary to prevent in-flight reverse thrust resulting from rotor burst, for cascade-type reversers. Fan spooldown is so rapid in the event of a rotor burst, that by the time the reverser is likely to have deployed, the fan is already at or rapidly approaching idle speed. This spooldown behavior is inherent to turbofans with axial compressors and does not appear sensitive to engine size or design details.	
Cmt. ***13 / CAA, UK***	
Three of the NPAs propose new AMCs. Sections 2 or 3 of these AMCs list the related regulatory material. These sections are given the following titles: RELATED EASA REQUIREMENTS RELATED CS SECTIONS RELATED JAR SECTIONS. We would recommend the titles are made consistent, probably avoiding the use of 'JAR' and that a thorough review of the new requirements and AMCs is made, to take out all inappropriate use of JAR terminology.	Agreed Titles will be made consistent.
Cmt. ***19 / ACG, Austia***	
ACG supports NPA.	Noted