COMMENT RESPONSE DOCUMENT

EASA CRD of ESF D-13 on CS 25.807g(1) and g(7) at Amdt 15 : "Increase of Maximum Passenger Seating Capacity for Type III exit
Applicable to Airbus A321-27xNX / -25xNX
[Published on 20 December 2016 and officially closed for comments on 17 January 2017]

Commenter 1: Boeing Commercial Airplanes - System Safety & Regulatory Affairs – 10 January 2017

Comment # 1 - General

The 35-passenger Type III exit rating we have today is appropriate given the significant (and growing) portion of the flying public that have difficulty using Type III exits. Numerous evacuation research studies involving Type III exits, including the FAA CAMI testing (Report No. DOT/FAA/AM-02/16) showed that differences in the physical characteristics of the individual test subjects (e.g., age, gender, girth, height) result in large differences in emergency evacuation performance. Boeing testing has demonstrated that the high step up and step down heights, combined with the relatively small exit opening make Type III exits more difficult to use by older and mobility impaired persons than other exit types.

When EASA first considered introducing Type III exit access (13" passageway) and Automatic Disposing Hatch (ADH) requirements, it was Boeing's position that these are significant improvements that warranted an increase in the passenger rating for the improved Type III exits. However, EASA disagreed at the time and adopted these significant safety enhancements with no corresponding increase in the passenger rating of Type III exits. Since the baseline for this proposed ESF is CS-25, Amdt 15, which includes these improved requirements, significant additional improvements would be needed to justify an increased passenger rating. The proposed five inch increase in the height of the exit combined with an Automatically Opening Exit (vs. ADH) cannot be considered significant enough to justify a rating increase of five passengers. These changes do not address the main issue that makes Type III exits difficult to use by such a large percentage of the flying public, which is the high step up/step down heights.

Comment :

Given the baseline for this proposed ESF is CS-25, Amdt 15, which includes the recently adopted improved requirements related to Type III exits (e.g., access, automatic disposing hatch), the proposed compensating factors are not significant enough to justify a five passenger increase in the exit rating.

EASA response: PARTIALLY AGREED

[1] The ESF is based on the following requirements as defined in CS 25 Amdt.15:

- ***Unobstructed opening 36 x 20 inches with corner radius of 7 inches [25.807(c)(3)]***

- ***Maximum step up 20 inches maximum step down 27 inches [25.807(c)(3)]***
- ***Access to the exit 13inches with the exit centreline as a front border for seats [25.813(c)(2)]***
- ***10 inch overlap between exit clear opening and passageway [25.813(c)(2)]***
- ***Automatic disposal hatch with an maximum opening time of 10 seconds [25.813(c)(6)]***
- ***24/42 wide external escape path on the wing [25.810(c)]***
- ***Single or dual lane escape slide with an inflation time of maximum 10 seconds [25.810(d)(4)]***
- ***The credit for a Type III exit arrangement in accordance with the above is 35 passenger seats [25.807(g)] in case of single exit while 65 for a dual exit arrangement [25.807(g)(7)]***

Guidance material

- ***Seat cushion compressibility AC 25.17A***

[2] For the certification of the Boeing B737NG the CRI D-14 (page 8) stated that in order to provide criteria for an increase at aircraft level of the Maximum Passenger Seating Capacity: “To make available such an ESF/SC combination to applicants coming with a comparable proposal.” With this CRI the following criteria were defined:

- ***Improved exit opening time***
- ***Access of 13“ with 10” within the projected opening of the exit***
- ***Defined seat cushion encroachment***
- ***Compliance with 25.562 except (c)(5) & (6)***
- ***Proof that the evacuation rate is consistent with neighbouring exit types***

[3] The Airbus’ design proposes increases / improvements above the basic requirements ([1]) in the following areas:

- ***Larger opening: provide an exit clear opening of 41” x 20”***
- ***Smaller step-up: maximum step-up 14,8” and maximum step-down 27” [25.807(c)(3)]***
- ***Faster opening: provide an automatic opening door with an opening time <10 sec***
- ***Larger escape path: larger than 24”/42” wide external escape path on the wing [25.810(c)]***
- ***Faster inflating slide: dual lane escape slide with an inflation time of < 10 seconds***
- ***Faster “exit ready” time: exit opening and slide availability optimized to an exit ready time < 10 seconds, by this the first person on ground time is improved significantly***

CS 25.562 except (c)(5) & (6) is already included in the proposed Certification Basis.

EASA considers the proposed improvements mature enough and in line with what has been approved before for an increase in passenger credit.

[4] The gender – age – size issue was not considered in past certification projects and conditions for testing are defined in Appendix J of CS 25 Amdt. 15.

[5] The limits of 40 / 75 passengers' credit were not intended as a goal but were set as values not to exceed. Those limits are consistent with those granted on previous projects introducing similar exit arrangements (39 / 79).

Based on the comments received, to maintain consistency with the previous projects, the value of the passengers' credit not to exceed for the single exit arrangement is set to 39, whereas for the dual exit arrangement is set to 73. This latter value stems from the application of the same criteria adopted in the CS 25.807(g)(7) where the credit for dual exit arrangements is reduced by 5 when the exits are separated less than three seat rows.

The text of the ESF is amended as follows:

- […]
- For the single OWE configuration, should the tests demonstrate an evacuation performance which would lead to a passenger credit above 39, the credit of the new over-performing Type III emergency exit will be in any case limited to 39.
- For the dual OWE configuration, should the tests demonstrate an evacuation performance which would lead to a passenger credit above 73, the credit of the new over-performing Type III emergency exit will be in any case limited to 73.

[6] It is to be noted that the increase in passenger credit for the new Type III exit can be required to achieve a MPSC above the current certified value (220), but not to reach the maximum MPSC intended by the applicant in the frame of the project.

Comment # 2 - Conditions for the Acceptance of the ESF

EASA (and the FAA) have already defined what is needed for an exit rating of 40 passengers; it is a Type II exit. The significant benefit of an overwing Type II exit compared to an overwing Type III exit is the much lower step up/step down heights, combined with the increased clear opening height. These enhancements make Type II exits far easier to use by all persons, including those with limited mobility due to age, gender, size, or impairment. Therefore, any non-standard exit with a proposed 40 passenger; rating should be based on equivalency to a 40 passenger rated Type II exit and not on minor improvements over a Type III exit, which are conservatively rated with reason, as discussed in Comment # 1. In other words, a proposed non-standard exit with a passenger rating that is the same as that of a

standard exit should provide evacuation capability that is comparable to the standard exit. This same philosophy should also be applied to the analysis of a pair of the Type III’s. If the enhanced combination of two “over-performing Type III” exits is to have the same passenger rating as a Type B exit (i.e. 75 passengers) it should provide evacuation performance that is comparable to that of a Type B exit.

Comment :

The proposed text states: *The applicant should demonstrate through testing that the OWE exit configuration provides a proportionate increase in evacuation performance over the standard Type III defined by the following requirements ….*

It is proposed to be amended as follows :

The applicant should demonstrate through testing that the OWE exit configuration provides an ~~proportionate increase in~~ evacuation performance ~~over~~ that is equivalent to a standard ~~Type III~~ Type II exit defined by the following requirements…

EASA position: PARTIALLY AGREED

Refer to §[5] of the EASA response to Commenter 1 - Comment #1

EASA does not consider the comparison with Type II appropriate, because the performance of the proposed Type III is based on time, size and slide performance rather than dimensions only.

Moreover, the credit of 40 for a Type II emergency exit is given regardless of the exit configuration:

- ***Over the wing / not over the wing***
- ***With slide / without slide***
- ***With or without step-up / step-down***

Instead, the proposed A321 ACF exit arrangement is a controlled evacuation path for the evacuees from the cabin to the ground and includes considerations on the exit’s dimensions, sizes, time and slide performances.

Comment # 3 - Design / Analysis Proposal

Boeing testing with mobility impaired evacuees has demonstrated that over-wing Type II exits provide significantly improved evacuation performance compared to traditional Type III exits. This is due in large part to the much lower step up and step down height requirement associated with Type II exits. Boeing does not believe that simply making a Type III exit taller will have an appreciable effect on its evacuation performance when considering evacuees with limited mobility due to age, gender, size, or impairment.

Regarding the exit opening time, Boeing agrees with EASA’s position in NPA 2008-04 that while an Automatic Opening Exit (AOE) could provide even earlier exit availability time, the additional gain over a well-designed Automatic Disposing Hatch (ADH) would not be significant. This is especially true when an off-wing escape slide is involved, since a faster opening exit could create a hazard if evacuees are able to open the exit and transition to the wing prior to the escape slide fully inflating. Aside from the potential hazard of an adverse interaction between evacuees and an inflating slide, the evacuation from the wing cannot occur until the escape slide is ready for use. Thus the benefit of a faster opening exit is effectively negated.

Regarding the escape route on the wing exceeding the EASA minimum requirements for width and illumination, while beneficial, it does not materially contribute to a faster evacuee flow rate at the overwing exit(s). This is due to the overall evacuee flow rate being limited by the rate the evacuees can get through the exit opening itself. Thus, the proposed escape route, which appears to be consistent with the wing escape routes on other airplanes in-service, does not warrant a higher passenger rating for the overwing exits.

Comment :

The proposed text states :

The design features characterizing the new over-performing Type III exit are:

- *an exit opening size of 20”x41” (unobstructed opening) being 5” higher than the minimum requirements*
- *a door*
  - *fully compliant to CS 25.813[c(6)] at Amdt 15*
  - *which actuation is power assisted*
  - *with an opening time significantly less than what prescribed by CS 25.809[b(2)] at Amdt 15 (i.e.: 10 seconds)*
  - *with a mechanism for immediate activation of the slide*
- *o an escape route (regardless of the number of the exits)*
  - *with a dual lane feature*
  - *with a width in excess of the requirements prescribed by CS 25.810[c(1)] at Amdt 15*
  - *with an over wing illumination level in excess of the requirements prescribed by CS 25.812[g(1)(i)] and CS 25.812[g(1)(ii)] at Amdt 15*

It is proposed to be amended as follows :

While the described design features may exceed the minimum EASA requirements, they do not materially contribute to a faster evacuee flow rate at the overwing exits for a significant portion of the flying public. Thus, they do not compensate for an increased passenger rating for the overwing Type III exits.

EASA position: DISAGREED

Refer to §[4] of the EASA response to Commenter 1 - Comment #1

Given the design features of the door system and the slide, it is expected that the evacuation will not be delayed by the slide inflation. Refer to §[3] of the EASA response to Commenter 1 - Comment #1 for further explanation.

The overall exit's performance is not only based on the door geometry but also on the improved door and slide system. With regards to the door geometry, it exceeds the dimensions of those for which a comparable increase in the passengers' credit has been granted in the past. The increased external escape provisions contribute to the evacuation flow through the exit by avoiding the passengers' queuing and hesitation.

Commenter 2: FAA Aircraft Certification Service–Transport Airplane Directorate Standards – 13 January 2017

Comment # 1 - General

The request is for an increased passenger exit rating for the Type III exits.

The proposed equivalent safety finding (ESF) would give a 40 passenger credit per pair of Type III exits, which equates to the passenger exit rating of the Type II exit. Therefore, we consider that the basis of equivalency should be to the Type II exit standard, since it is established and provides the rating requested. That is, the proposed design does not meet the standard for a Type II exit that is necessary for the 40 passenger credit, and therefore compensating features would be necessary to show that the proposed design is equivalent to the Type II exit.

Exit ratings account for many factors including ease of use, effectiveness over a range of occupant sizes as well as average egress rate. This is particularly true for the Type III exit, where FAA research has shown that there is a strong dependence on age and size of the occupant (girth) with regard to egress through a Type III exit. Many of those factors could be missed if the difference in performance that might exist over a minimum Type III exit is not related to the existing Type II standard. While the Type II exit is not only larger than the Type III exit, the Type II exit has reduced step-up and step-down dimensional limitations when located over the wing.

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Per EASA's current rules, automatically stowing Type III exits are the standard.

If additional credit is permitted for this feature over a Type III exit without a stowing exit, it will effectively erode the level of safety intended for Type III exits built to EASA's current standard. Although there is some difference between an automatically opened and an automatically stowed Type III exit, the significant benefit in a

real-world evacuation comes from the automatically stowing feature; this is because the stowage location can impact the entire evacuation process and not just the beginning of the evacuation.

Comment :

1- While automatic opening is a positive feature, we don’t see it as compensating for the reduction in the proposed exit size and increased step-up and step-down dimensions as compared to the Type II exit standard.

2- We are not aware of any assessment of the performance of two Type II exits in close proximity, such as there has been with Type III exits. So, even if the proposed exit is demonstrated equivalent to a Type II exit, the question of dual Type II exits and an appropriate passenger rating would need to be established.

EASA position: PARTIALLY AGREED

Refer to the EASA response to Commenter 1 - Comment #1 paragraph [5] and Comment #2

In addition, it was not the intention to replace the Type II with a credit of 40 by introducing the limit of 40. The position of EASA is to include the effect of fast opening by design, slide performance and beneficial increase in dimension (like done for Type C). For example a Type C exit is the same height, but it is 6 inches wider than a Type I. In addition it is always equipped with a slide and it is ready to be used within 10 seconds. The same principle is applied here.

The limits were set to restrict any attempt to exceed limits set by existing exit Types and access constraints (proximity of exits and evacuee flow).

Commenter 3: TCCA – Civil Aviation Department / Standards Branch – 17 January 2017

Comment # 1 - General

TC notes the proposed Equivalent Safety Finding (ESF) is to be based upon a comparison of the new Airbus Type III exit performance relative to that achievable with the currently required minimum Type III exit. It is further noted that subject to satisfactory design reviews and demonstrations, a single pair of over-performing Type III exits may be granted an increase in the maximum number of passenger seats from 36 to not more than 40, while the increase for the dual Type III installation could range from 66 to 75.

Comment :

The upper limit of the credit requested for the single and dual over-performing Type III exits coincides with the ratings of Type II and Type B exits. TC is concerned that performance testing based on a minimum Type III exit as the baseline will not provide conservative results for values of credit approaching, or equal to, the passenger ratings for Type II and Type B exits.

EASA response: PARTIALLY AGREED

Refer to the EASA response to Commenter 1 - Comment #1 paragraph [5] and Comment #2

Comment # 2 - Design / Analysis Proposal

TCCA agrees that many of the means and provisions identified are compensating features that may support the ESF. However since CS 25.813(c) (6) is now included in the basis of certification, full compliance is required, therefore it is not considered a compensating feature.

Of the design features listed as characterizing the over-performing Type III exits, it is anticipated that the earlier availability of the new exit, significantly less than the maximum 10 seconds permitted by CS 25.809, the immediate activation of the slide and the possibly increase in the evacuation rate due to the unobstructed opening height exceeding the Type III minimum requirement will be the main compensating features justifying the increased rating. The impact of the escape route

enhancements are more difficulty to access. It is understood that the single Type III will have a 42+ inch wide escape path leading to a single lane slide, while that provided for the dual Type III will also have a width in excess of the required 42 inches, leading to a dual lane slide.

With respect to the activities that the applicant will conduct to demonstrate the individual and overall increased evacuation performance, TCCA understands the testing to demonstrate compatibility between the door opening time and slide availability is to validate the mechanism for immediate activation of the slide and therefore the early availability of the escape path.

Comment :

The third bullet of the section dealing with demonstrating the increased evacuation performance, TC recommends amending the text "*Testing and / or analysis ….*" be amended to "*Testing and / or analysis based on test…*"

EASA position: PARTIALLY AGREED

Refer to the EASA response to Commenter 1 - Comment #1

The analysis shall be based on relevant test data.

The text of the ESF is amended as follows:

"[...] For the purpose of demonstrating the individual and overall increased evacuation performance the applicant will conduct:

- […]
- testing and/or analysis based on test to compare the evacuation performance of the standard Type III exit as defined by the regulation at Amdt 15 and the proposed design."

Comment # 3 - Conditions for the acceptance of the ESF

Reference is made to four sections of CS 25, Amendment 15, as being relevant to defining the standard Type III exit. Some typos are suspected.

Comment :

1- The first is CS 25.807(g)(3) - geometry, however CS 25.783(g)(3) specifies exit requirements for a passenger seating configuration of 10 to 19 seats. It is suggested that the intended reference is 25.807(a)(3).

2- Similarly the reference to CS 25.813(b)(6), automatic disposal, addresses assist handles whereas CS 25.813(c)(6) specifies automatic disposal.

EASA position: AGREED

The text of the ESF is amended as follows:

"The applicant should demonstrate through testing, with statistically significant results, that the OWE exit configuration provides a proportionate increase in evacuation performance over the standard Type III defined by the following requirements at Amdt 15:

- CS 25.807[a(3)] – geometry
- […]
- CS 25.813[c(6)] – automatic disposal
- […]"

Comment # 4 - Conditions for the acceptance of the ESF

When demonstrating that the new exit configuration will increase evacuation performance, it is assumed that the partial evacuation tests would be combined with evacuation demonstration data for the other exits in the configuration and that the safety margin is applied to the overall result. Due to the cumulative nature of the safety margin it is possible that the entire margin could occur at other than the Type III exits.

Comment :

Due to the cumulative nature of the safety margin it is possible that the entire margin could occur at other than the Type III exits. It is suggested that it [should] be clarified if the expectation is that a specific time margin occur at the overwing exits.

EASA position: ACCEPTED

- ***The test schedule and data analysis have to be presented and concurred by EASA***
- ***The test conditions shall include the individual margins and must be sufficient to identify the performance improvements due to the Type III exit(s). Such margins will be discussed and agreed within the Certification Plans.***

Comment # 5 - Conditions for the acceptance of the ESF

The last two conditions relate to the maximum passenger increase permitted for each configuration are of concern. These limits as proposed of 40 for a single overwing pair of Type IIIs and 75 for a dual overwing pair of Type IIIs are the numbers allocated under CS25.807(g)(1) for a Type II and a Type B respectively. Both of these exit types require features not required of a Type III such as greater exit access (20 inch passageway versus 10/13) and provisions for assist space. The Type II exit minimum dimensions are 20 by 44, thus 3 inches higher than that proposed for the over-performing Type III. For the Type II exit the Step-up and Step-down distances allowed are 10/17 inches, significantly less than those of a Type III (20/27).

Comment :

1- Hence, to grant a Type III exit, even with some additional features relative to a standard Type III, a rating equivalent to that of an exit that requires the additional features mentioned may not be conservative. Thus, a comparison of performance between the over-performing Type III exits and a Type II and Type B would be more appropriate where the same rating is being requested.

2- Using a baseline of a Standard Type III exit should only permit a maximum of something less than that of the next larger exit type. It is suggested that the maximum could be 38 and 71 or that the baseline testing be conducted using Type II and Type B exits.

EASA position: PARTIALLY AGREED

Refer to the EASA response to Commenter 1 - Comment #1 paragraph [5] and Comment #2

- ***As it is not completely impossible that a very high performance could be demonstrated for a Type III to overtake a standard Type II the artificial limit of 39 was set.***
- ***Different parameter are used to define the credits for Type II and especially Type B.***
- ***Compared with current standard set in previous project the values not to exceed are within the same range.***