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A Review of Issues Related to the Fitment of Automatically Disposable Hatches at Type III Exits With Regard to the Number of Certificated Passenger Seats

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Final Report

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NOTICE

This research was commissioned by Transport Canada by means of the Memorandum of Cooperation regarding Civil Aviation Research and Development between the Civil Aviation Authority of the United Kingdom and the Department of Transport of Canada. This activity has been carried out in cooperation with the Federal Aviation Administration and the UK Civil Aviation Authority under the auspices of the International Cabin Safety Research Technical Group whose goal is to enhance the effectiveness and timeliness of cabin safety research.

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16. Abstract

This study was commissioned by Transport Canada (TC) in support of a cooperative regulatory activity between itself, the European Aviation Safety Agency (EASA), and the United States Federal Aviation Administration (FAA) regarding Type III exit access and ease of operation.

EASA has formulated a Notice of Proposed Amendment (NPA) and Regulatory Impact Assessment (RIA) under the auspices of a Rulemaking Group (CS 25.040) comprising representatives from TC and the FAA and from aircraft operators, aircraft manufacturers, and cabin crew organizations.

The subject NPA proposes that CS-25 be amended to require that airplanes should be configured with Automatically Disposable Hatches (ADHs) at Type III exits and with applicability should be to airplanes with a passenger seating capacity of 40 or more. The objective of this report was to address any issues that might affect the selection of 40 passenger seats as the lower limit for installation of ADHs at Type III exits. Therefore, this study considers the safety impact of the proposed regulation should it be applied to airplanes with a passenger seating capacity between 20 and 80.

A benefit analysis carried out for ADHs at Type III exits suggests that the life-saving potential for airplanes with a passenger seating capacity of less than 40 is small compared to larger airplanes. A review of the CAR 525/CS-25/14 CFR 25 exit requirements pertinent to airplanes certificated with a passenger seating capacity between 20 and 80 suggests that evacuation capability increases as passenger complement decreases, and that enhancements to evacuation capability are not warranted for airplanes with a passenger seating capacity of less than 40.

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LIST OF ACRONYMS

ADH	Automatically Disposable Hatch
CAR	Civil Aviation Regulations
CFR	Code of Federal Regulations
EASA	European Aviation Safety Agency
FAA	Federal Aviation Administration
NPA	Notice of Proposed Amendment
UK CAA	Civil Aviation Authority of the United Kingdom

EXECUTIVE SUMMARY

This study was commissioned by Transport Canada (TC) in support of a cooperative regulatory activity between itself, the European Aviation Safety Agency (EASA), and the United States Federal Aviation Administration (FAA) regarding Type III exit access and ease of operation.

EASA have formulated a Notice of Proposed Amendment (NPA) and Regulatory Impact Assessment (RIA) under the auspices of a Rulemaking Group (CS 25.040) comprising of members from TC and the FAA and from aircraft operators, aircraft manufacturers, and cabin crew organizations.

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A benefit analysis carried out for ADHs at Type III exits suggests that the life-saving potential for airplanes with passenger seating capacity of less than 40 is small compared to larger airplanes. A review of the CS-25/14 CFR 25/CAR 525 exit requirements pertinent to airplanes certificated with a passenger seating capacity between 20 and 80 suggests that evacuation capability increases as passenger complement decreases, and that enhancements to evacuation capability are not warranted for airplanes with a passenger seating capacity of less than 40.

1. DEFINITION OF TERMS USED IN THIS REPORT.

Automatically Disposable Hatch (ADH) is a Type III exit hatch that is automatically disposed of such that it does not require manual intervention to ensure that it is located in a position that does not present an impediment to evacuation.

Automatic Hatch is a Type III exit hatch that incorporates the features of an Automatically Disposable Hatch (ADH) and utilises some form of stored energy to ensure that the hatch opens rapidly.

2. INTRODUCTION.

This study was commissioned by Transport Canada (TC) in support of a cooperative regulatory activity between itself, the European Aviation Safety Agency (EASA), and the United States Federal Aviation Administration (FAA) regarding Type III exit access and ease of operation.

EASA have formulated a Notice of Proposed Amendment (NPA) and Regulatory Impact Assessment (RIA) with the support and guidance of a Working Group (25-040) comprising of members from Aircraft Operators, Aircraft Manufacturers and Cabin Crew representatives as well as the US FAA and Transport Canada. This Working Group is subsequently referred to as 'The Group'.

The NPA proposes that CS-25 be amended to require that airplanes be configured with Automatically Disposable Hatches (ADH). Whilst the Group considered that the regulatory activity should be directed to airplanes type certificated to 40 passenger seats or more, this study considers the implications of any regulatory change to aircraft with passenger seating capacities ranging from 20 to 80 since the benefits, and possibly costs, will vary with the size of airplane.

This report addresses the following issues in order to assess the value to varying size airplanes of requiring Automatically Disposable Hatches at Type III exits:

1. Benefit in terms of potential life saving

2. Evacuation capability afforded by the current design requirements in relation to the number and size of exits

3. Other operational and design related issues that might affect evacuation capability

Reference in this report to Title 14 Code of Federal Regulations (CFR) Part 25 means 14 CFR 25, CS-25 and CAR 525. Similarly, reference to paragraph 25.807 means 14 CFR 25.807, CS-25.807 and CAR 525.807.

This report has been produced in fulfilment of Task 3.1 of Annex 07-08/1 to the Memorandum of Co-operation (MoC) Regarding Civil Aviation Research and Development between the Civil Aviation Authority of the United Kingdom (UK CAA) and the Department of Transport of Canada which came into force on 1 September 2000.

3. BENEFIT ANALYSIS.

A benefit analysis (reference 1) relating to automatic Type III exits, carried out on behalf of Transport Canada and the UK CAA, suggested that the assessed benefit from Automatic Hatches at Type III exits varied significantly with airplane size. Figure 1 shows the assessed mean benefit, in terms of potential number of lives saved per year, for western built airplanes resulting from the introduction of Automatic Hatches at Type III exits for aircraft with varying seating capacities.

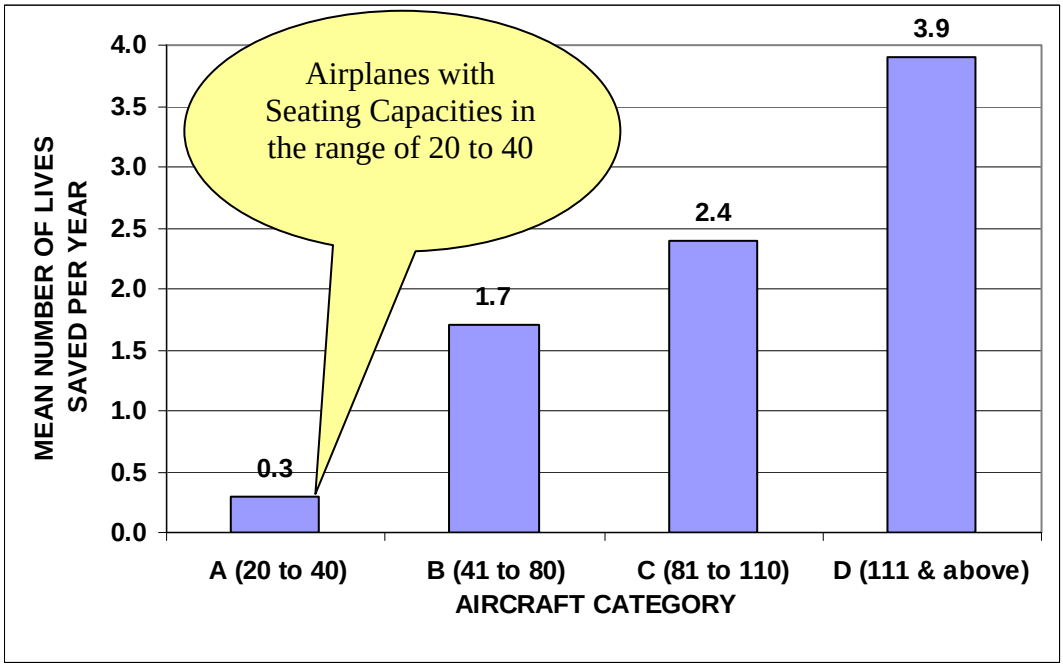

Figure 1. Potential Number of Lives Saved per Year for Airplanes of Varying Seating Capacity

When benefit is expressed in terms of life saving per flight, a similar pattern is revealed in terms of its variation amongst airplanes of varying seating capacities as illustrated in figure 2.

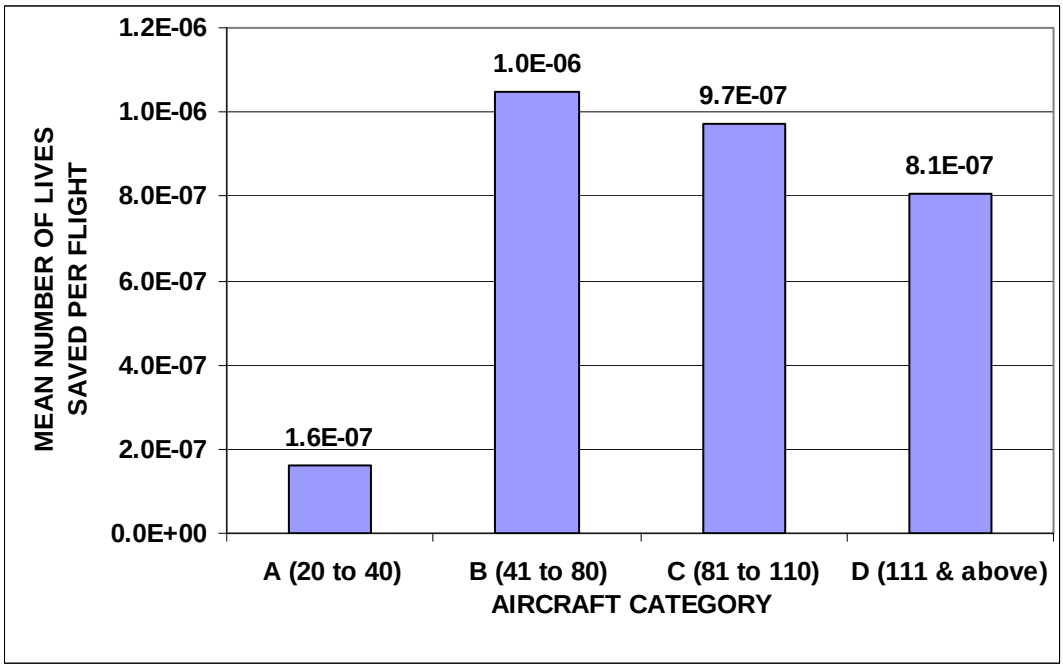

Figure 2. Potential Number of Lives Saved per Flight for Airplanes of Varying Seating Capacity

It may be concluded from this that airplanes with seating capacities of less than 40 are unlikely to realise significant benefit from the introduction of Automatic Hatches at overwing Type III exits.

4. EVACUATION CAPABILITY AFFORDED BY CURRENT REQUIREMENTS.

As part of this study a review has been carried out of the emergency exit requirements contained in 14 CFR 25.807 (Amendment 114), CAR 525.807 (Change 525-8) and CS 25.807 (Amendment 4). The number and size of exits required for airplanes certificated for varying seating capacities has been compared with the actual evacuation capacity that these emergency exit types might provide.

The requirements in these documents are slightly different, and are summarized below by seat capacity for airplanes configured between 20 and 80 passenger seats. There are additional rules relating to minimum exit separation distance that have been excluded from this initial review, as these would apply differently to different airplanes and would only affect the larger airplanes.

14 CFR 25.807/CAR 525.807 requires that for airplanes configured with:

- 20 to 40 passenger seats, they have at least 2 pairs of exits, one of which is a Type II or larger.
- 41 to 110 passenger seats, they have at least 2 pairs of exits, one of which is a Type I or larger.

CS 25.807 requires that for airplanes configured with:

- 20 to 39 passenger seats, they have at least one pair of Type II and one pair of Type III exits or larger[1].

- 40 to 79 passenger seats, they have at least one pair of Type I and one pair of Type III exits or larger[2].

- 80 to 109 passenger seats, they have at least one pair of Type I and two pairs of Type III exits or larger[2].

Thus, for any given maximum number of certificated passenger seats a determination may be made of the number and minimum required size of the emergency exits.

The requirements of CS 25.807 specify the passenger seating capacity that is appropriate to each type of exit pair. Table 1 shows this passenger seating capacity for Type I, Type II, Type III and Type IV exits.

Table 1. Passenger Seating Capacity for Pairs of Emergency Exit Types

Type	Passenger Seats
Type I	45
Type II	40
Type III	35
Type IV	9

Based on the rating of the number of passenger seats contained in table 1 the "Passenger Capacity Ratio" may be derived as follows:

1. From the number of certificated passenger seats derive the minimum number of required exits based on CS 25.807

2. Allocate the number of passenger seats to each of the required exit pairs based on the ratings specified in table 1

3. Evaluate the "Passenger Capacity Ratio" by dividing the number of passenger seats derived from step 2 by the number of certificated passenger seats.

This "Passenger Capacity Ratio" is shown plotted against the Certificated Passenger Seats in figure 3.

Although there are small differences between 14 CFR 25.807/CAR 525.807 and CS 25.807, they do not significantly affect the curve shown in figure 3.

[1] CS 25.807 defines an exit type as being of a minimum dimensioned size. Therefore a larger exit could be used in place of a required type by, for example, defining it as oversized.

The "Passenger Capacity Ratios" for a range of airplanes with Type III exits, and with a Part 25 certification basis, are also shown in figure 3.

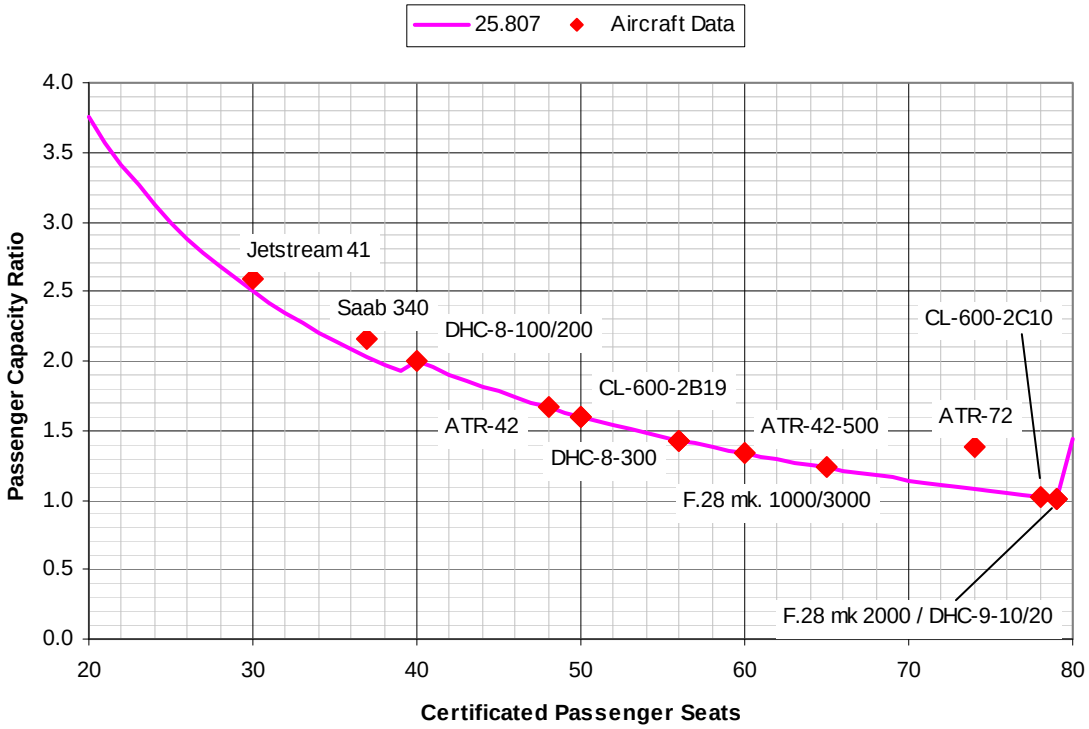

Figure 3. Comparison of Exit Capacity to Number of Seats

It may be seen that the "Passenger Capacity Ratio" for airplanes type certificated for a maximum seating capacity in the range of 20 to 40 passenger seats tends to be twice that of aircraft with a maximum seating capacity in the range 41 to 80 passenger seats. It should be noted that some aircraft have exits that are larger than the minimum required by Part 25.

5. OTHER ISSUES.

There are other issues affecting the variation in evacuation capability with the number of certificated passenger seats as illustrated in figure 4. The primary issues are that airplanes certificated for:

1. More than 50[2] passenger seats require 2 Cabin Crew members

2. More than 44 passenger seats need to demonstrate evacuation capability by means of an emergency evacuation demonstration

3. 40/41[3] passenger seats or more must have an exit on each side of the fuselage that meets the minimum dimensions of a Type I floor level exit.

[2] Canadian Operational Requirements specify "…the crew includes at least one flight attendant for each unit of 40 passengers or more."

[3] 40 for CS 25.807 and 41 for 14 CFR 25.807/CAR 525.807

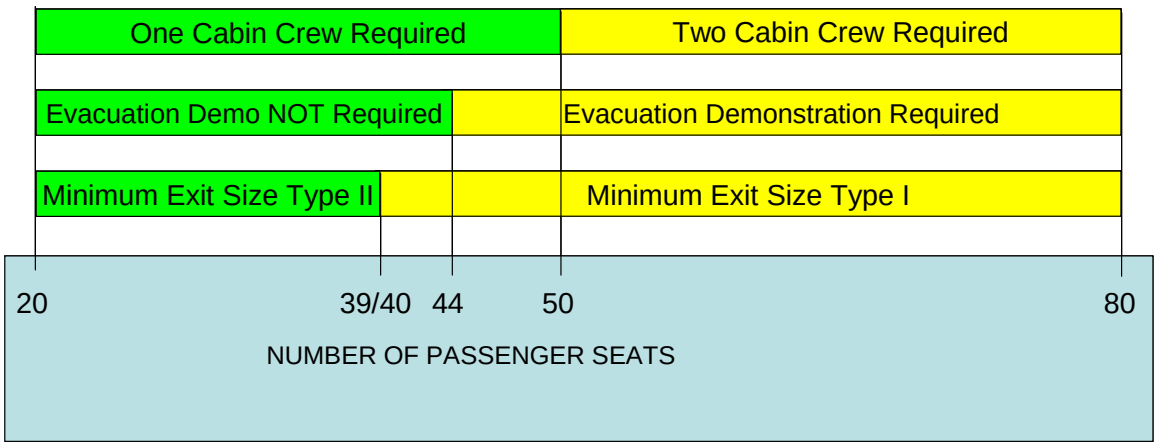

Figure 4. Variation of Evacuation Issues With Number of Certificated Passenger Seats

5.1 NUMBER OF CABIN CREWMEMBERS.

For airplanes certificated for 50 passenger seats or less, only one cabin crewmember is required. This might be considered to have a detrimental effect on the evacuation capability of these airplanes. However, for these smaller airplanes, the flight crew are likely to assist in the evacuation and their relative proximity to the passengers and probably the floor level exits could compensate for there being only one cabin crew member.

5.2 EMERGENCY EVACUATION DEMONSTRATION.

Part 25 requirements do not require an emergency evacuation demonstration to be carried out as part of the certification of airplanes configured with 44 passenger seats or less. When this requirement was first introduced by the FAA, it was an amendment to the operating rules of Part 121. The justification contained in the NPRM for this rule change states:

"These amendments require demonstrations only for airplanes with seating capacity of more than 44 passengers. After consideration of the relatively small size of the passenger cabin, close proximity of crewmembers and past experience showing comparatively little difficulty in emergency evacuation, the Agency believes demonstrations need not be conducted for these smaller airplanes."

5.3 MINIMUM FLOOR LEVEL EXIT SIZE.

Aircraft Type Certificated for more than 40[4] passenger seats must have an emergency exit conforming to the minimum dimensions specified for a Type I exit. This would suggest that airplanes below this seating capacity do not need the enhanced evacuation capability afforded by exits of this size and an adequate safety standard is achieved with the smaller Type II exits.

[4] 14 CFR 25 and CAR 525 specify Type I exits for aircraft with passenger seating capacities greater than 41

6. DISCUSSION AND CONCLUSIONS.

For airplanes type certificated for less than 40 passenger seats both the design and operational requirements are less demanding in relation to evacuation issues than they are for larger airplanes. These issues include the need for only one cabin crewmember, the preclusion of a requirement to carry out an emergency evacuation demonstration and that the required floor level exits are smaller than those specified for aircraft with more than 40 passenger seats. Furthermore, smaller airplanes might be considered to have design features that could detract from their evacuation capability such as sunken aisles.

However, any proposed regulatory change needs to be justified based on its impact on safety and cost. Costs of fitting Automatically Disposable Hatches at Type III exits are not currently available, however it is considered likely that they would not vary significantly with airplane size. This would mean that relative to the total cost of an airplane an ADH would be proportionately more expensive on smaller airplanes. On a similar basis, any weight increase is likely to affect smaller airplanes to a greater extent than larger aircraft.

The benefit analysis carried out for Automatic Hatches at Type III exits suggests that the life saving potential for airplanes with passenger seating capacities of less than 40 is small compared to larger aircraft. The reasons for this are likely to include the fact that smaller airplanes tend to have an improved evacuation capability compared to larger aircraft of up to 80 passenger seats, due to the number and size of their required exits. Based on the exit ratings specified in CS-25, 14 CFR 25 and CAR 525 airplanes type certificated for less than 39 to 40 passenger seats would have an evacuation capability that is in the region of twice that of an aircraft type certificated for 80 passenger seats.

7. REFERENCES.

1. RGW Cherry & Associates Limited, *A Benefit Analysis for the Installation of Automatic Hatches at Type III Exits*, 0942/R/000308/KK. RGW Cherry & Associates Limited.