

## Certification Authorities for Transport Airplanes (CATA)

### CATA Worklist Item (CWI) FAA-001 – Flightcrew Emergency Exits Proximity

Date Raised:	03 Apr 2017	Updated: 20 September 2019	Status: <b>Closed</b> <i>September 24, 2019</i>
Subject:	<b>Flightcrew Emergency Exits Proximity</b>		
Related Issue(s): (Identify Discussion Paper number, if any)	None		

#### **Description of Issue(s):**

(Give a brief background of issue(s))

Flightcrew emergency exits are permitted to be outside the flightdeck, i.e., in the passenger cabin, for airplanes with 20 or fewer passenger, if they are conveniently located and readily accessible. No formal guidance exists for the definition of "convenient and readily accessible". Airplanes with a maximum passenger capacity of 19 passengers are becoming ever larger, and the distance from the flightdeck to the available exits is increasing. FAA and TCCA have informally established a limit of 30 feet from the aft-most point of the pilot's seat to the forward edge of the emergency exit as the limit at which an exit is no longer convenient and readily accessible. Recent programs have indicated the need to formalize and harmonize guidance in this area.

#### **Background:**

The provision to permit use of "convenient and readily accessible" passenger exits to serve as flightcrew exits for airplanes with 20 or fewer passengers was adopted at a time when such airplanes were relatively small, and the distances were relatively short. At that time, the FAA did not consider it necessary to address a distance limit. When the FAA did address the subject of distance to exits for passenger exits, the standard adopted at Amendment 25-67 permitted exits to be up to 60 feet apart [ref. § 25.807(c)(7)]. This leads to a maximum distance of a passenger to an exit of 30 feet. On the face of it, if such a distance is acceptable for a passenger, it would seem to be acceptable for flightcrew. However, the flightcrew are not able to evacuate immediately, since they have additional duties to perform that may result in further delay. In addition, egress from the flightdeck is not as easy as entering a passenger aisle, which may add a further delay. TCCA established a limit of 30 feet for one of its certification programs in 1998 via certification memo SY-6. At that time, FAA contacted other applicants with the potential to have a similar situation and confirmed that they were not near the 30 foot limit.

More recently, both US and Canadian applicants have proposed airplanes that would significantly exceed 30 feet from the flight crew seat to the closest passenger exit.

#### **Proposed Prioritization:**

(Per CATA Technical Issues List Prioritization schema, SME proposes along with authority CATA members)

Question	Answer
1. Is there an active working group related to this issue?	No
2. In which documents are there deviations amongst the authorities?	None known
3. Was this issue raised by or at the CMT?	No
4. What is the level of impact on projects in the future (i.e. minor, major, critical)?	Could involve design changes, which could be major.
5. How many authorities does the issue impact?	Currently TCCA and FAA but could impact all.
6. What is the approximate technical complexity of the issue (i.e. low, medium, high)?	Medium

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#### Recommendation:

(SME proposes expected resolution of the issue)

CATA to create a technical task group made up of specialists from all four member authorities to develop common advisory/guidance material with respect to this topic, and namely the definition of “convenient and readily accessible”. Absent a common approach among CMT member authorities an un-level playing field could develop and a competitive advantage could be conveyed to one manufacturer over another.

#### CATA Decision:

(Using CATA criteria for determination of technical issues)

CATA accepted this harmonization task. Anticipated outcome for the CATA would be quadrilateral agreement to a draft harmonized guidance to be included to this CWI. Under the CATA agreement, this harmonized guidance when applies by the certificating authority (CA) in future programs, by means of an issue paper/CRI/CM/FCAR (as applicable), will be accepted by any CMT-member validating authority.

#### Final CATA Position:

(Explain agreement, dissent or conclusion on this CWI)

The CATA accept the SME team recommendations and the proposed guidance paper. The guidance paper is appended directly to this form. The CWI form and guidance paper document an interim CMT member authority agreement that member authorities may reference when they are acting as the certificating authority (CA). Following CA endorsement for a particular project, the other CMT member authorities, when acting as validating authority, will accept the approach. This CWI is closed.

A new CWI will be opened to document the “phase 2” objectives described in the enclosure.

#### Release of CWI:

CATA Representative	Name	Signature	Date
ANAC	Marcelo Leite		24.09.19
	Daniel Pessoa		24.09.19
EASA	Colin Hancock		24.09.19.
	Mathilde Labatut		24.09.19
FAA	Tom Groves		9.24.19
TCCA	Canh Nham		Sept 24, 2019



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### Guidance Paper to CATA CWI FAA-001

#### 1.0 INTRODUCTION

- (1) This paper is provided for information and guidance purposes. It describes an acceptable means of demonstrating compliance with CFR/CS/RBHA/AWM (5)25.807(j) *Flight crew emergency exits* (hereafter referred to generically as (5)25.807(j)) for airplanes having a passenger seating capacity of 20 or less. According to CATA processes, if an applicant and their responsible design approval authority agree to apply the compliance methodology described in this paper, the other three CMT authorities, when validating the design, will accept the same methodology.
- (2) This paper describes a two-phase approach:
  - (a) Phase 1: An interim, 30 foot limit, developed from past experience and other qualitative considerations. This phase is complete and documented in this paper, as described in Section 3.1.
  - (b) Phase 2: A research program intended to establish test and analysis-based methods for determining compliance to (5)25.807(j) for airplanes having a passenger seating capacity of 20 or less. This research program is in the planning stages, the outcome of which will be documented in a future revision to this paper (see Section 3.2 for an expanded description).

#### 1.1 Purpose

- (1) The purpose of this paper is to describe an acceptable means of showing compliance with harmonized (5)25.807(j) *Flight crew emergency exits*. This standard requires that flight crew emergency exits be located in the flight crew area, for those airplanes in which the proximity of passenger emergency exits to the flight crew area does not offer a “convenient and readily accessible” means of evacuation of the flight crew, and for all airplanes having a passenger seating capacity greater than 20.
- (2) This paper focusses on providing an interpretation of “convenient and readily accessible” for use in the context of determining maximum permissible flight crew emergency exit path distance in those transport airplane designs having a passenger seating capacity 20 or less (normally associated with executive jet configurations).

#### 2.0 BACKGROUND

##### 2.1 History of Relevant Transport Category Airplane Design Standards

- (1) The concept of “convenient and readily accessible” with regards to flight crew emergency exits was introduced more than 60 years ago. Since then, the aeronautical industry has undergone significant changes in design methodology, manufacturing processes and materials. During the same period, the experience and knowledge accumulated through lessons learned in general and specifically from accident investigation have brought about better design standards and a higher level of safety. The following is a summary of the main changes promulgated in this period, which have direct or indirect implications to the subject addressed in this paper.
  - (a) Flight Crew Emergency Exits
    - (i) U.S. CAR Part 4b 1950 - *Airplane Airworthiness Transport Categories*, § 4b.362, *Emergency Exits*, of the Civil Air Regulations, only contained general requirements for emergency exits, without a specific reference to flight crew emergency exits.





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- (ii) In 1951, the United States Civil Aeronautics Board adopted the first regulation specifically addressing flight crew emergency exits through Amdt. 4b-4.
  - (iii) This Amdt. introduced the expression “convenient and readily accessible”. Even though the U.S. airworthiness standards for flight crew emergency exit have gone through several amendments, the use of the expression “convenient and readily accessible” is still in use. See Table 1.
  - (iv) In 1957, the expression “small airplane” was replaced by “airplanes having a passenger capacity of 20 or less”.
- (b) Maximum Distance between Passenger Emergency Exits
- (i) In 1991, 14 CFR 25.807 [Amdt. 25-67], introduced a limit to the maximum distance between adjacent emergency exits in the passenger cabin. The 60-foot limit was determined by qualitative considerations of the variables influencing an evacuation scenario along with the calculation of the length of fuselage required to accommodate the number of passengers that could be evacuated in 90 seconds using the cabin aisle flow rate determined by the FAA’s Civil Aeromedical Institute and published in their report FAA-AM-78-3. Compliance with this requirement places every passenger no more than 30 feet from an exit.
  - (ii) This requirement is still in force.
  - (iii) The objective was to limit the increase of the distance between each passenger cabin occupant and an exit. A 60-foot limit means that no occupant of the passenger cabin is more than 30 feet away from an exit.

#### 2.2 Executive Airplanes Size Growth

- (1) As the design standards were evolving, the fuselage size of executive jet transport airplanes were growing and becoming longer and longer.
- (2) Since 1957, the demand for executive jet transport airplanes has grown, as has the size of new such airplane models offered on the market. It has become evident that some executive jet models, while having a passenger seating capacity of fewer than 20, have grown in size while at the same time have retained the typical exit configuration of a forward left hand entry door and a right-hand over wing exit.
- (3) As per (5)25.807(j), for an airplane to be allowed to have emergency exits for the flight crew in the passenger cabin two conditions must exist: (1) passenger seating capacity must be 20 or less and (2) exit proximity must offer a “convenient and readily accessible” means of evacuation of the flight crew. Otherwise, the flight crew exit must be in the flight deck. It implies that for an airplane with passenger seating capacity 20 or less, a “convenient and readily accessible” emergency exit in the passenger cabin should be equivalent to having an emergency exit in the flight deck. In order to preserve this equivalence the distance between the flight crew area and a passenger emergency exit cannot surpass a certain threshold.
- (4) In addition, accident investigation experience suggests that the probability of accident borne obstacles to develop in the evacuation path will increase with the distance from the evacuee station to the emergency exit. From this perspective, for airplanes which do not have exits in the flight crew area, the trend of increasing distance between the flight crew area and passenger emergency exit constitute a degradation of the level of safety.

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#### 2.3 Pertinent Contemporary Design Practices

- (1) Until today no executive airplane design with the flight deck emergency exit located in the passenger cabin has been certified with a distance between the flight crew area and the emergency exit larger than 30 feet.
- (2) Large executive airplane designs typically include provisions for an optional flight deck observer seat suitable for occupancy during TTL, even though such seats are not required by operational rules applicable to the type of operations typical for this type of airplane.
- (3) From 2002 to 2003, operational rules have mandated the installation of reinforced flight deck doors for certain operations, adding an obstacle for flight crew emergency egress. However, no executive airplane designs with the flight deck emergency exit located in the passenger cabin have been certified with a secure flight deck door/bulkhead installation.

#### 1. TABLE 1. U.S. AIRWORTHINESS STANDARDS EVOLUTION FOR FLIGHT CREW EMERGENCY EXIT

Year	Reference	Text
1951	U.S. CAR 4b 1950 Sec. 4b.362 Amdt 4b-4(1)	Emergency evacuation. ... (a) Flight crew emergency exits. Flight crew emergency exits shall be located in the flight crew area on both sides of the airplane or as a top hatch to provide for rapid evacuation. Such exits shall not be required on small airplanes where the Administrator finds that the proximity of passenger emergency exits to the flight crew area renders them convenient and readily accessible to the flight crew.
1957	U.S. CAR 4b 1953 Sec. 4b.362 Amdt 4b-5	Emergency evacuation. ... (a) Flight crew emergency exits. Flight crew emergency exits shall be located in the flight crew area, on both sides of the airplane, or, alternatively, a top hatch shall be provide. Such exits shall not be required in airplanes having a passenger capacity of 20 or less if the Administrator finds that the proximity of passenger emergency exits to the flight crew area offers a convenient and readily accessible means of evacuation for the flight crew.
1965	14 CFR part 25 Sec. 25.805 Amdt 25-0	Flight crew emergency exits. Except for airplanes with a passenger capacity of 20 or less in which the proximity of passenger emergency exits to the flight crew area offers a convenient and readily accessible means of evacuation for the flight crew, the following apply: (a) There must be either one exit on each side of the airplane or a top hatch, in the flight crew area. (b) Each exit must be of sufficient size and must be located so as to allow rapid evacuation of the crew. An exit size and shape of other than at least 19 by 20 inches unobstructed rectangular opening may be used only if exit utility is satisfactorily shown, by a typical flight crewmember, to the Administrator.
1998	14 CFR part 25 Sec. 25.807 Amdt 25-94 (Incorporated in	Emergency exits. ... (j) Flight crew emergency exits. For airplanes in which the proximity of passenger emergency exits to the flight crew area does not offer a

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	AWM Chapter 525 by Change 525-8)	convenient and readily accessible means of evacuation of the flight crew, and for all airplanes having a passenger seating capacity greater than 20, flight crew exits shall be located in the flight crew area. Such exits shall be of sufficient size and so located as to permit rapid evacuation by the crew. One exit shall be provided on each side of the airplane; or, alternatively, a top hatch shall be provided. Each exit must encompass an unobstructed rectangular opening of at least 19 by 20 inches unless satisfactory exit utility can be demonstrated by a typical crewmember.
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#### 2.4 Background of “Convenient and Readily Accessible”

- (1) As mentioned before, since its introduction in 1951, the subjective expression “convenient and readily accessible” has been used to qualify the proximity (distance) of a passenger emergency exit to the flight crew area. The meaning of a subjective expression is determined by its historical context, which is determined by the prevailing perceptions and general notions at the time of its creation.
- (2) In 1951 airplanes were small and distances inside the cabin were short, there were no quantitative emergency evacuation standards, no knowledge of the threat to the occupants represented by the ignition of cabin materials, no standard for maximum distance between passenger seat and emergency exit and no need for reinforced flight deck door. For these reasons, the 1951 context under which the assessment of the proximity of an emergency exit in the passenger cabin for the flight crew was conducted is quite different than today's context.
- (3) In addition to the different context, the use of subjective language has an intrinsic tendency to produce inconsistent interpretations, which are counterproductive when trying to maintain a regulatory level playing field for the aeronautical industry.
- (4) In order to develop an objective interpretation that is consistent with the present state of the art (context), multiple factors along with reasonable assumptions guided by common sense and engineering judgement are considered. Specifically, the changes introduced since 1951 that affected directly or indirectly the emergency evacuation requirements as well as any correspondent assumption and relief provided, the differences between flight crew and passengers with regards to their readiness to evacuate after an accident and the precedent setting design approvals granted until now.
- (5) The creation of a performance standard for cabin emergency evacuation in 1965 was the first of a series of changes that contributed to a higher level of safety during emergency evacuation of transport category airplanes. Although not applicable to airplanes with passenger capacity 20 or less, it laid down the foundation for subsequent improvements with implications applicable to that size of airplane.
- (6) Among other improvements in cabin materials flammability, the introduction of heat release requirements in 1986 is of special interest. In conjunction with smoke emission requirements, it led to additional increase in the level of safety by providing additional improvement of the survival conditions inside the cabin during a fire. Following this development, a few years later, the FAA published 14 CFR part 25 Appendix SFAR 109, which included, on item 12, relief from the heat release and smoke emission requirements for privately operated executive airplanes with passenger capacity up to 60. The relief exempted that size of airplane from compliance with those requirements if it could be shown by test or a combination of test and analysis that the maximum time for evacuation of all occupants did not exceed 45 seconds under the conditions specified in appendix J to part 25. Although the cabin materials heat release and smoke emission requirements were not applicable to airplanes with passenger capacity 19 or less, the relief provided by SFAR 109 provides insight into the understanding of the potential time for deterioration of the cabin conditions on an airplane furnished with materials not compliant with those requirements. That understanding is recognition that under certain conditions the

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environment inside a cabin on fire may become unsurvivable in 45 seconds. This has important implications when developing the interpretation and is one of multiple factors being considered.

- (7) The 1996 regulatory change that implemented a maximum distance between passenger emergency exits, described in 3.1(d)(i), further enhanced the level of safety by placing each passenger seat not more than 30 feet from an emergency exit. Although only applicable to the passenger seats, it acknowledges a general principle that there is a limit to the distance between the evacuee station and the emergency exit beyond which the level of safety is compromised. For the determination of the maximum distance between exits the FAA relied on empiric data about the feasible average evacuee flow through a single inclined floor aisle (48 evacuee/minute<sup>1</sup>). This is another factor being considered.
- (8) When applying concepts applicable to occupants of the passenger cabin to the flight crew it is necessary to consider the differences with regards to their readiness to evacuate after an accident. Contrary to the passengers, the flight crew have to perform certain tasks before they start to evacuate the airplane<sup>2</sup>. This is another factor being considered.
- (9) At the same time, another difference that should be considered is the fact that in the passenger cabin no obstacles are allowed during TTL. The same is not the case for the flight deck. When evacuating through an emergency exit located in the passenger cabin, the flight crew may have to overcome designed obstacles during TTL. They could be an observer seats, a flight deck door or something else. For this reason, the existence of designed obstacles during TTL is another factor being considered.
- (10) Finally, the last factor being considered is consistence with previous design approvals.

### 3.0 ACCEPTABLE MEANS OF COMPLIANCE

#### 3.1 Assessment of Exit Proximity

- (1) The distance (D) from the flight crew area to the exit in the passenger cabin shall be measured from the pilot/co-pilot seatback, where it adjoins the pilot/co-pilot seat bottom, to the nearest edge of the exit opening parallel to the fuselage longitudinal axis, with the longitudinal adjustment of the pilot/co-pilot seat set to the aft-most position of its displacement range.
- (2) Pending completion of research aimed at providing means to assess the impediment caused by a deployed and occupied flight deck observer seat, this paper establishes that an impediment acceptable to the certifying authority in combination with a 30 foot limit to the distance (D) as defined in 3.1(1), as an acceptable means of compliance to (5)25.807(j) for airplanes having a passenger seating capacity of 20 or less, and that do not have a secure flight deck door.
- (3) Airplanes with secure flight deck doors that do not have a separate crew flight deck egress route through a hatch/window, are outside the scope of this Phase 1 agreement. Installation of a secure flight deck door would appear to preclude characterizing any exits in the passenger cabin as 'conveniently located'.
- (4) Airplanes that have obstacles not discussed above are outside the scope of the phase 1 agreement.

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<sup>1</sup> Civil Aeromedical Institute, Federal Aviation Administration (FAA) Report FAA-AM-78-3 – *Passenger Flow Rates Between Compartments*, January 1978;

<sup>2</sup> Completion of evacuation checklist, opening of exit (if passenger cabin is empty) or wait in the passenger queue.



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#### **3.2 Research Program**

- (1) The objectives of the program are to assess how built-in obstacles in the evacuation path may impede flight crew egress, and to develop test and analysis methods to account for such obstacles when evaluating compliance with (5)25.807(j). The research will focus on the impediment caused by an observer seat, although the research should also be useful for assessing other potential built-in obstacles. The research may also address flight crew actions preceding the initiation of flight crew evacuation.
- (2) FAA Civil Aerospace Medical Institute (CAMI) indicated that they can accommodate this task using airplanes available at the FAA Aeronautical Center, contingent on formal adoption of the task into the CAMI research program. A specific time frame and detailed program objectives will be established as part of the research plan approval process.

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