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# Aircraft Secondary Barriers and Alternative Flight Deck Security Procedures

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## Foreword

This document was prepared by Special Committee 221 (SC-221) and approved by the RTCA Program Management Committee (PMC) on September 28, 2011.

RTCA, Incorporated is a not-for-profit corporation formed to advance the art and science of aviation and aviation electronic systems for the benefit of the public. The organization functions as a Federal Advisory Committee and develops consensus based recommendations on contemporary aviation issues. RTCA's objectives include but are not limited to:

- Coalescing aviation system user and provider technical requirements in a manner that helps government and industry meet their mutual objectives and responsibilities;

- Analyzing and recommending solutions to the system technical issues that aviation faces as it continues to pursue increased safety, system capacity and efficiency;

- Developing consensus on the application of pertinent technology to fulfill user and provider requirements, including development of minimum operational performance standards for electronic systems and equipment that support aviation; and

- Assisting in developing the appropriate technical material upon which positions for the International Civil Aviation Organization and the International Telecommunication Union and other appropriate international organizations can be based.

The organization's recommendations are often used as the basis for government and private sector decisions as well as the foundation for many Federal Aviation Administration Technical Standard Orders.

Since RTCA is not an official agency of the United States Government, its recommendations may not be regarded as statements of official government policy unless so enunciated by the U.S. government organization or agency having statutory jurisdiction over any matters to which the recommendations relate.

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# 1.0 INTRODUCTION

## 1.1 Purpose and Scope

Since September 11, 2001, the Department of Transportation (DOT), the Federal Aviation Administration (FAA), the U.S. Congress, and the International Civil Aviation Organization (ICAO) have issued a series of new standards to protect flight decks from intrusion and penetration by small-arms fire (14 CFR 25.795). These have resulted in the installation of reinforced flight deck doors by U.S. and international passenger-carrying[1] air carriers flying to/from the United States. These doors provide protection when they remain closed and locked throughout a flight. The operational reality, however, is more complex.

On many flights the flight deck door cannot remain closed for the entire duration of the flight. On longer flights the flight deck door must be opened for crewmembers to access lavatory facilities, to transfer meals to aircrew, and also to switch crew positions on longer flights for crew rest purposes. The flight deck access procedures used by crewmembers are integral in protecting the flight deck, as is the door itself.

During the opening and closing of the flight deck door, or “door transition”, the protective anti-intrusion/anti-penetration benefits of the reinforced door are reduced if established procedures and/or equipment are not properly utilized by crewmembers. Regulators have noted this vulnerability and mandated supplemental procedures during door transition. Both the FAA and ICAO have defined these supplemental procedures. For example, according to 14 CFR 121.584(a)(1), no one may unlock the flight deck door unless, “The area outside the flight deck door is secure.” ICAO provides for similar guidance during door transition.

The FAA has determined that additional regulatory guidance material, to supplement the existing regulations, would be desirable to provide more specific guidance to the FAA and to industry.

When closed and locked, as required in 14 CFR 121.587 (a), the flight crew compartment door provides increased security against potential threats. However, 14 CFR 121.587 (b) allows the door to be opened under certain circumstances, and it is during these times that the flight deck becomes vulnerable to hostile individuals or groups. FAA regulation 14 CFR 121.587 specifies requirements related to the closing and locking of the flight crew compartment door:

A. Except as provided in paragraph (b) of this section, a pilot in command of an airplane that has a lockable flight crew compartment door in accordance with Sec. 121.313 and that is carrying passengers shall ensure that the door separating the flight crew compartment from the passenger compartment is closed and locked at all times when the aircraft is being operated.

B. The provisions of paragraph (a) of this section do not apply at any time when it is necessary to permit access and egress by persons authorized in accordance with 14 CFR Part 121.547 and provided the 14 CFR Part 119 operator complies with FAA approved procedures regarding the opening, closing and locking of the flight deck doors.

To date, passenger-carrying air carriers have utilized several methods to support security during the periods of flight when the flight deck door is open. One method employs a combination of procedures using crewmembers to monitor the area and/or aircraft equipment, including galley carts to block access to the flight deck.

[1] The FAA mandate for a fortress door only applies to passenger-carrying air carriers.

An additional method, one that two major US airlines implemented on their own initiative, blocks access to the flight deck through the presence of an Installed Physical Secondary Barrier (IPSB)- a device that crewmembers deploy prior to opening the flight deck door. Additionally, Boeing and Airbus have designed variants of the IPSB as options on certain models of their next generation aircraft.

After nearly nine years of experience with reinforced flight deck doors, the FAA and industry stakeholders have agreed in principle to review procedures used during flight deck door transitions.

The work of RTCA SC-221, Secondary Barriers, has focused on four activities:

1) Develop consensus-based recommendations for interpretation of applicable regulatory requirements;

2) Review procedures and aircraft equipment currently in use by U.S. air carriers to secure the flight deck and adjacent area during door transition;

3) Provide recommendations and guidance for IPSB applications; and

4) Provide recommendations for standardization of procedures for use of “Secondary Barrier Systems” (SBS) by crewmembers.

The Committee’s specific guidance, or terms of reference (TOR) associated with those tasks are noted below.

A. Invite participation from appropriate regulators, industry representation, and other applicable parties, specifically the Transportation Security Administration (TSA), Federal Air Marshals, aircraft manufacturers, equipment manufacturers, airlines, modification centers, pilots and flight attendants associations, and other trade associations.

B. Review the existing protection procedures employed by crewmembers and aircraft equipment manufacturers relevant to the opening, closing and locking of the flight deck door, including securing the area outside the flight deck door.

C. Recommend methodologies that may be employed to comply with applicable regulatory requirements while developing and recommending guidelines to comply with federal regulations.

D. Review a representative sample of current aircraft cabin interior layouts to determine IPSB performance criteria and any associated difficulties that particular layouts may pose.

E. Develop guidelines for IPSB Applications. The guidelines will contain common design characteristics, minimum performance criteria, installation guidance and approval certification guidance for IPSB. It will also contain recommended procedures for use of the IPSB.

F. Review the standards and procedures used by major airlines that use an IPSB to determine if they can serve as the baseline for the special committee recommendations.

This RTCA document provides guidance for use of various Secondary Barrier Systems (SBS) as acceptable means of compliance with current U.S. regulations, as well as an evaluation of best practices, and other considerations to be taken into account when determining compliance with these regulations. Secondary Barrier Systems provide a solution to this need by providing an extra layer of defense during door transitions.

The purpose of these systems is to provide an obstacle that will delay an attacker long enough for crewmembers to close and secure the flight deck door. These systems are not intended to stop the initiation of an attack, nor protect the flight deck for an indefinite period of time. It is simply a delaying system.

The concept of a secondary barrier system is built around the idea that protection of the flight deck door requires the crew to provide a secure zone aft of the door, large enough for crewmembers to maneuver in and out of the flight deck efficiently and securely. This secure zone need only exist for the time necessary for the door transition to be safely accomplished. After the door transition is complete and the door is once again locked closed, this secure zone no longer needs to be actively protected.

Development of the secondary barrier system concept evolved over time as each airline sought to comply with the post-9/11 regulations. One airline, United, conducted an internal risk assessment of the threat to the flight deck and elected to develop a more robust system than was required by regulation.

The Installed Physical Secondary Barrier (IPSB) was developed to ensure the distance and time requirement of the secondary barrier system could be accomplished in a predictably reliable manner. For those air carriers not equipped with an IPSB, they have developed various alternate methods to accomplish the same goal.

This document provides general guidelines, which apply to all secondary barrier systems, regardless of the type selected, as well as specific guidelines, which apply only to the type of secondary barrier system that is described. These specific guidelines are categorized by the type of secondary barrier system`:

- Installed Physical Secondary Barriers (IPSB),
- Improvised Non-installed Secondary Barriers (INSB), and
- Human secondary barriers.

Compliance with the guidelines in this document is recommended as one means of ensuring that the equipment will perform its intended function(s) (see section 1.5) satisfactorily under all conditions normally encountered in routine operations. Any regulatory application of these standards is the sole responsibility of the appropriate governmental agencies.

This document is laid out in the following sections:

- Section 1 of this document provides information on the purpose and scope of the secondary barrier system initiative and informs the development of related system characteristics and guidelines in follow-on Section 2.
- Section 2 of this document contains general as well as functional guidelines for secondary barrier system equipment. These guidelines describe desired system performance under standard operating and environmental conditions.
- Section 3 of this document provides information on other considerations in designing and implementing a secondary barrier system.
- Section 4 of this document provides information on environmental considerations that may affect equipment performance.

## 1.2 System Overview

The Secondary Barrier System (SBS) is a set of procedures and/or equipment onboard the aircraft that allows the crew, during authorized ingress/egress or flight deck door transition, to recognize, react, and respond to a potential threat by closing the flight deck door before the threat can reach the flight deck. In other words, the SBS is defined as a combination of people, procedures and/or equipment onboard the aircraft that provides for the space and time needed behind the flight deck door to secure the flight deck environment during door transition.

Components of SBS include:

- crewmembers (pilots, flight attendants or flight deck/cabin jumpseaters),
- equipment, such as galley carts or other improvised non-installed equipment (INSB); or, an installed physical secondary barriers (IPSB), and
- standard operating procedures (SOPs).

## 1.3 Discussion of Threat

The most serious credible threat to crewmembers and airborne law enforcement personnel is posed by a team of highly trained, armed, athletic individuals who are intent on using deadly force to defeat all security measures preventing their ability to infiltrate the flight deck.

A review of current commercial aviation security threat mitigations reveal a predisposition towards two major elements of security threats: a focus on interdicting a pre-meditated intent to do harm, and a focus on interdiction of weapons or improvised weapons which can be used to aid an attack. These security layers do not and cannot predict random attacks by mentally unbalanced passengers or others intent on committing acts of violence.

The vulnerability of the flight deck exists regardless of whether the intruder is a part of a pre-meditated, coordinated attack, or if the intruder is a random, criminal, or deranged passenger. The consequences of a breach of the flight deck are equally catastrophic.

## 1.4 Assumptions and Scope

The design guidelines presented in this document assume that:

- The primary focus is to be U.S. aircraft, current fleet, 14 CFR Part 121 operations equipped with an enhanced flight deck door.

- Aircraft not required to have an enhanced flight deck door, such as cargo aircraft, are not a part of the scope of this committee's guidance.

- The guidelines provided in this document are not meant to be exhaustive or comprehensive. The committee's work focused on an evaluation of current best-practices for secondary barrier systems, and developing performance guidelines for the IPSB.

- SC-221 makes reference to the Airbus privacy door system because, according to our committee's judgment, it meets the definition a secondary barrier system; and it is a best-practice currently employed by a manufacturer that supplies some types of aircraft to U.S. air carriers. (SSI deleted information here). It is the position of SC-221 that the privacy door system designed by Airbus could possibly provide an equivalent level of security to the guidelines we've proposed for the IPSB. That, however, would require additional evaluation. SSI referenced in this section can be requested by contacting the FAA's Flight Standards Office (AFS-007).

- The guidelines outlined in this document are focused on intended functionality rather than engineering requirements or specifications.
- Any evaluation of an SBS should assume multiple attackers as the most serious credible threat to the flight deck.
- The guidelines recommended by SC-221 are meant to serve as a reference point against which specific designs can be measured.
- The guidelines complement TSA's existing layers[1] of security for the aviation sector while complying with existing Title 14 of the Code of Federal Regulations (CFR). It is assumed that an attacker or attackers have successfully thwarted the existing layers of U.S. aviation security.

These design guidelines do not specifically address the following:

- Other emerging aircraft security technologies not known or addressed by this committee.
- The cost-benefit analysis of secondary barrier system options.
- Cargo carriers without an enhanced flight deck door.
- Specific guidelines for current privacy door systems on the Airbus A380.

Notwithstanding the above-mentioned exceptions, this document is intended to represent a set of recommendations and guidelines that air carriers, aircraft manufacturers, and equipment vendors can use as a baseline for current and future secondary barrier system design, evaluation and implementation.

## 1.5 Intended Function(s)

A Secondary Barrier System (SBS) is intended to increase the overall security of the aircraft environment by securing and protecting the fight deck from intrusion using a combination of people, procedures, and/or equipment onboard the aircraft. The SBS is intended to provide for the space and time needed behind the flight deck door to secure the flight deck environment during door transition.

The SBS is intended to supplement, not replace, the enhanced flight deck door required by 14 CFR 121.313.(j). It is not intended to be a second "enhanced" fortress-type door, although the guidelines from this document do not preclude the option of an air carrier installing a second enhanced flight deck door in place of an IPSB.

Key elements in meeting the intended functions of the SBS include:

A. Communication and coordination of ingress/egress intentions to relevant crewmembers.

B. Enhancement of the situational awareness of crewmembers and other official personnel on the aircraft during door transition.

C. Early warning of potential threats during the time the flight deck door is open.

D. Provisions for an adequately protected area behind the flight deck door for a period of time necessary to secure the door should an attempt be made to breach the flight deck.

E. Provisions for procedural guidelines for crewmembers to ensure an adequate area immediately outside of the flight deck door is clear while the flight deck door is in transition.

[1] http://www.tsa.gov/what-we-do/layers/index.shtm

F. An “adequate area” behind flight deck door is defined as enough space for a crewmember to deploy an IPSB or INSB, to open and close the flight deck door, and to monitor the area behind the flight deck door during door transition. This area should normally be able to accommodate a cabin crewmember as well as the individual exiting the flight deck. An “adequate area” should prevent an attacker from reaching through and holding the flight deck door open.

## 1.6 Operational Goals

The Secondary Barrier System (SBS) is defined as a combination of people, procedures and/or equipment onboard the aircraft that provide for the space and time needed behind the flight deck door to secure the flight deck environment during door transition. The system is designed to delay the ingress of unauthorized personnel until the flight deck door can be both closed and secured in the face of a threat. In order to be effective, the SBS should include the following operational, workload and usability factors associated with the transport category aircraft environment

- Crewmember situational awareness during door transition.
- Flight deck protection during door transitions.
- Passenger awareness and compliance with air carrier procedures associated with door transition (Note: passengers are not a part of the SBS).
- Aural warning by crewmember of an attempt to breach the flight deck.
- Deterrence of intentional hijacking attempts or other violent behavior from passengers.
- Crew-based training programs that maximize situational awareness and minimize the potential for crewmember injury.

## 1.7 Review of Existing Procedures

In order to determine the scenarios and evaluation protocols that would be used to assist with the creation and testing of any SBS design guidelines, it was imperative that the committee first understand the current procedures, methods and equipment being used by various U.S. Airlines to help protect the flight deck door during transition.

Understanding staffing requirements for flight attendants relevant to commercial operations was also important. Flight attendant staffing is determined, in part, by the number of passenger seats onboard an aircraft (14 CFR Part 121.391). Flight attendant staffing levels vary from single flight attendant operations to multiple flight attendant operations. Therefore for any door transition the committee used the minimum staffing level as one of the baseline tests. This meant that some scenarios would be tested with a single flight attendant protecting the flight deck door during transition. In situations where more than one flight attendant was part of the minimum crew, the information gathered below reflected that the highest number of flight attendants present for door transition was usually two; even if the flight attendant minimum crew was more than two.

To determine the methods to be evaluated, the committee, through the Association of Flight Attendants-Communication Workers of America (AFA), sent out an email questionnaire to the AFA member airlines’ safety committee representatives. The various methods documented would then be used to help determine the baseline methods to evaluate the protection methods currently in use by U.S. air carriers.

Representatives from nine airlines responded. They represent carriers that conduct single flight attendant domestic operations to multi flight attendant international operations. Therefore equipment available also varied.

AFA asked the flight attendant safety representatives to answer the following questions:

- *Do you use a service cart or any other type of physical device to block the aisle during cockpit door transitions?*
- *If you use a service cart to block the aisle, are you required to remain with the cart or can you step away from the cart? (as long as you maintain the FAA's expectation of attendance).*
- *Do you stand in front of the cart or behind it?*
- *If you do not use a cart or physical device to block the aisle, do you post a monitoring Flight Attendant in the secure area to scan for suspicious behavior while the door is in transition?*
- *If a potential threat is detected while the cockpit door is in transition, are Flight Attendants at your carrier instructed to verbalize any type of specific command or code word to signal that the open cockpit door should be closed immediately?*
- *Finally, and of prime importance, how many Flight Attendants are required to accomplish your carrier's access procedures?*

Responses to the questions above are considered sensitive information (SSI), which can be requested by contacting the FAA's Flight Standards Office (AFS-007).

With this information several scenarios were selected that would use one or two flight attendants to protect the flight deck during door transition. Relevant to the number of attackers, the committee determined that the various attack scenarios would include one or two attackers. In addition, testing scenarios would vary between utilizing only a human barrier or a barrier that included a human and equipment found on an aircraft.

Using the scenarios, Federal Air Marshals (FAMS) acting as pilots, flight attendants and attackers a demonstration was conducted for the committee at the FAMS Washington DC Field Office in an aircraft cabin mock up. The purpose of this March 2009 demonstration was to familiarize the committee members with the dynamics and speed of the attack and thus allow for the development of effective evaluation protocols.

The first evaluation was conducted at the FAMS training facility in Atlantic City, New Jersey on May 13, 2009. They were conducted on the L1011 and B727 aircraft at that facility. The working group evaluated the speed a person could move through the cabin towards the flight deck door. In addition, the group evaluated scenarios with a simulated video surveillance system and simulated opaque barrier.

The next evaluation was of bi-fold doors in use on some aircraft conducted at Dulles International Airport (IAD) on September 1, 2009.

These evaluations provided the committee with a reasonable estimate of the time required to close the flight deck door in response to a threat of an attack and the velocity an attacker could move through the cabin toward the flight deck door.

The next step was to determine an additional time factor to compensate for the predictability of the testing environment, where test subjects knew they would be attacked as opposed to the "average crew on an average day". Throughout 2010 a "First Look" test was conducted with crews asked to demonstrate door transitions with an unexpected emergency command. The time demonstrated to close the fight deck door was recorded.

On October 14, 2010 an evaluation of the video surveillance system and installed opaque barrier installed on a B777 aircraft was conducted. Speed at which an attacker could move through the cabin toward the flight deck door was also re-evaluated.

On March 24, 2011 the committee evaluated flight deck protection methods with and without galley carts or similar obstacles. These evaluations utilized physically fit individuals with extensive training in defensive tactics or close quarter combat skills. It was conducted in Dallas Texas onboard a committee participant airline's selected aircraft**.**

## 1.8 Definitions of Terms

This section contains a definition of terms used that may have multiple, special, or unique meanings in this document. Additional definitions for terms that are well established and do not have a special or unique meaning in this document are in Appendix A.

*Door Transition*: Whenever the flight deck door is not closed and locked.

*Equivalent Level of Security:* An "equivalent level of security" is an "approximately equal level of security" that may be determined by qualitative or quantitative means. As such, it may involve a change to the level of expected risk that is not statistically or mathematically significant as determined by qualitative or quantitative risk analysis. An "equivalent level of security", for example, may be claimed by an IPSB design that does not call for the "positive control" of the flight deck door during its transition by virtue of the mitigation of related risk by more robust design criteria that combines greater structural integrity, in accordance with AC 25.795-1A, with advanced surveillance and control systems.

*Human Secondary Barrier:* A secondary barrier system where the impeding device is one or more crewmembers. Passengers to not meet the criteria for a human secondary barrier.

*Improvised Non-installed Secondary Barrier (INSB):* A physical device or object on an aircraft that is temporarily used to provide supplemental security for the flight deck during door transition. An example is a galley cart.

*Ingress/Egress:* Entry into the flight deck/Exit from the flight deck.

*Installed Physical Secondary Barrier (IPSB):* A secondary barrier that is installed as a permanent physical feature of an aircraft.

*May:* The term "may" in this document is used for items that are optional. They may be done or not.

*MOPS:* Minimum Operational Performance Standards.

*Must:* The term "must" in this document is used for items which are requirements, but required either by a "shall" in this document or by some other document (e.g., a regulation).

*Positive Control:* The idea that the crewmember has immediate control of the door or other equipment that he is controlling, in contrast with someone who is not in immediate and tactile control of the item in question.

*Privacy Door System*: The intention of the Privacy Door is to screen the area between the RHS monument (e.g. Flight Crew Rest Compartment, FCRC) and LHS monument (e.g. Lavatory) and to limit the access to crewmembers only. The door is usually closed during the entire flight and secured open during taxi, take-off and landing to avoid a third obstacle in the escape path in the event of an emergency evacuation.

*Note:* *The Airbus Privacy Door System is an opaque door aft of the cockpit stairs between LHS and RHS monuments. A locking system restricts access to the area aft of the cockpit door in case the privacy door is closed. It can be unlocked by authorized personnel using an access code. The locking system unlocks automatically if the correct code is entered, and there is no feedback from the flight crew required, which is a different philosophy than for the secure cockpit door. The Airbus Privacy Door ensures Safety by providing unrestricted venting in case of cockpit and cabin decompression and by providing means for emergency access.*

*Reaction Time:* The time required, once recognized, to make a decision to respond.

*Recognition Time:* The time required to perceive the threat as a threat.

*Response Time:* The time required to verbalize and/or act in accordance with SOP, so as to close and lock the flight deck door.

*Risk Mitigation:* Actions taken to reduce either the probability or consequences of a threat to the level at which the risk is acceptable. Implied in this definition is the need to track the risk mitigation plan in order to determine if the mitigation has been effective over time.

*Secondary Barrier System (SBS):* A combination of people, procedures and/or equipment onboard the aircraft that provide for the space and time needed behind the flight deck door to secure the flight deck environment during door transition.

*Secure*: Protected against a threat or vulnerability.

*Shall:* The term "shall" in this document is used to indicate requirements, for items, which are requirements, as opposed to "should" items, which are recommendations. Compliance with all "shall" statements is necessary in order to use this document as a means of compliance with a TSO or Advisory Circular which invokes this document.

*Should:* The term "should" in this document is used to denote recommendations or guidelines that do not constitute a requirement. Compliance with all "should" statements is not necessary in order to use this document as a means of compliance with a TSO or Advisory Circular which invokes this document. However, deviations from the recommendations (should statements) must be justified.

*Threat Mitigation Time (TMT):* The total time required to recognize, react and respond to a threat by closing and locking the flight deck door. This may be accomplished by any combination of people, procedures and/or equipment onboard the aircraft that provide for the space and time needed behind the flight deck door to secure the flight deck environment during door transition. In other words, TMT is accomplished by proper use of the secondary barrier system (SBS). TMT is measured from the initiation of an attack until the attacker(s) reaches the flight deck door. For the SBS to be successful, TMT must be at least equal to or greater than the time it takes to recognize an attack is in progress, react to that attack by making a decision to act, and then respond to the attack by employing appropriate procedures.

*Vigilance: Also known as vigilance task*[1]. A type of task where a user must maintain attention on the task while waiting for an uncommon, unpredictable event, such as monitoring security cameras or radar display.

[1] http://www.interaction-design.org/encyclopedia/vigilance.html

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# 2.0 SECONDARY BARRIER SYSTEM (SBS) PERFORMANCE GUIDELINES

## 2.1 General Requirements and Guidelines

This section contains guidelines that apply, regardless of which type of barrier is selected.

Specifically, the three types of Secondary Barrier Systems (SBS) are:

- Installed Physical Secondary Barriers (IPSB),
- Improvised Non-installed Secondary Barriers (INSB), and
- Human secondary barriers.

The committee recommends the following SBS guidelines:

- The effectiveness of a SBS is judged by its demonstrated ability to delay an attempted breach for at least 5 seconds. This demonstration can be accomplished by test and/or analysis
- The SBS shall maintain its integrity to the extent that access to the flight deck is denied for at least 5 seconds starting from the point when the SBS is first engaged or touched.
- The SBS shall provide for a protected distance behind the primary flight deck door which provides enough room for crewmembers to monitor the barrier and for crewmembers to enter or exit the flight deck. The SBS should be placed an adequate area behind the flight deck door in order to prevent an attacker from reaching through and holding the flight deck door open.
- The minimum protected distance between the SBS and the flight deck door shall take into account inward or outward opening doors.
- The SBS shall be visible from either the flight deck viewing port, an installed camera system or other approved method.
- The SBS shall include crewmember procedures, along with appropriate training.
- The SBS shall adequately describe and demonstrate the proper interface between current aircraft equipment, the IPSB/INSB/Human secondary barrier, and crewmember procedures.
- Threat Mitigation Time (TMT) is the sum of recognition time, reaction time and response time. The TMT shall be demonstrated to be at least 5 seconds.
- The SBS shall not impede FAMS operational tactics.

### 2.1.1 Intended Function(s) of Equipment

The equipment shall perform its intended function(s) as defined by the manufacturer, and its proper use shall not impede the normal operation of the aircraft or its occupants.

### 2.1.2 Airworthiness

As stated in the "System Overview" portion of this document, an effective SBS is comprised of a "set of procedures and/or equipment onboard the aircraft that allows the crew, during authorized ingress/egress or flight deck door transition, to recognize, react, and respond to a potential threat by closing the flight deck door before the threat can reach the flight deck." In considering the airworthiness aspects of such systems, it is appropriate to call up the requirements associated with FAA Order 8130.2F (CHG 5) - Airworthiness Certification of Aircraft and Related Products. This order states that such systems, in relation to the installation in which they are situated, need to conform to the type design and be in "a condition for safe operation" within the installation environment.

In discerning what "FAA-approved" data may be used to guide the design of such Installed Physical Secondary Barrier Systems, it is useful to call up in-place and approved guidance that has been developed for similar aircraft installations. These include:

a. AC 25.795-1A (Flight deck Intrusion Resistance); and

b. AC 25.795-2A (Flight deck Penetration Resistance)

In dealing with design guidance issues associated with the development of airworthy systems capable of preventing unauthorized flight deck intrusions, AC 25.795-1A is instructive in that it details criteria capable of addressing such intrusions in the operational environment, given a closed and locked flight deck door. Intrusion resistance, in the context of this Advisory Circular, refers to the ability to "resist forced entry by a person who is not authorized by the pilot in command to enter the flight deck"… and includes the ability "to resist attempts to enter the flight deck through use of simple tools, such as pocket knives, nail files, or keys". Designing installations in accordance with the provisions of this Advisory Circular frees the flight crew, secured within the flight deck environment, to continue to perform flight operational duties from their cockpit seats without worrying about the integrity of the flight deck door.

It needs to be noted that AC 25.795-1A design guidance for an IPSB entails consideration of the same guidance documents and standards called up by this Advisory Circular as follows:

A. 14 CFR 25.772 requires that the pilot compartment door, and therefore the installed physical secondary barrier, has features that allow the crew to directly enter the passenger compartment in the event that the barrier becomes jammed. If there are passenger emergency exits in close proximity to the flight deck, compliance with 14 CFR 25.809, "Emergency exit arrangement," can be shown using a method in which the flight deck windows need not have the ability to be opened from the outside. In this case, the door needs to facilitate entry by rescue personnel;

B. Many airplanes are designed to utilize the flight deck door opening as a decompression pathway to demonstrate compliance with the installed physical secondary barrier system requirements of 14 CFR 25.365. Therefore, the locks and/or other features of the installed physical secondary barrier system that satisfies AC 25.795-1A may be designed to allow for extremely rapid opening times;

C. Due to the fact that 14 CFR 25.777 requires that the flight controls be designed for pilots from 5 feet, 2 inches to 6 feet, 3 inches in height, consideration must be given to these statures in complying with the egress requirements of 14 CFR 25.772 and 25.809;

D. Considered a part of the airplane interior, the flight deck boundary must also meet the requirements of 14 CFR 25.771 with regard to noise, light and odors, and the flammability requirements of 14 CFR 25.853.

In the matter of "penetration resistance" as specified in AC 25.795-2A, this design guidance need not be applied to IPSB design requirements as it confounds the overriding requirement for Federal Air Marshals to employ their tactics when this barrier is deployed. Additionally, the "penetration resistance" Advisory Circular is not intended to address the situation characterized by a transitioning flight deck door and cannot be expected to apply in similar situations against IPSB operations.

In summary, the satisfaction of the airworthiness requirements associated with Secondary Barrier Systems will require that related designs conform to the type design while being in a condition for safe operation within the context of the installation environment. Satisfaction of the safety considerations require that system operation does not impede or adversely impact the procedures and requirements associated with the necessary operation of other flight systems.

In the procedural sense, Secondary Barrier System design can be deemed to be compliant if it is consistent with design guidance resident within AC 120-48 (Communication and Coordination between Flight Crewmembers and Flight Attendants) and AC 120-71A (Standing Operating Procedures for Flight Deck Crew Members) while being complemented with effective support in the form of manual codification and training programs.

In the equipment sense, type design issues may be addressed by utilization of the guidance resident within AC 25.795-1A (Flight Deck Intrusion Resistance) and, to a lesser extent, the stipulations associated with table 1 of NILECJ-STD-0306.00, May 1976 (Physical Security of Door Assemblies and Components) and related Class IV requirements. Depending on the complexity of the secondary barrier system, the certification requirements may be as simple as 14 CFR Part 121 field approval up to a 14 CFR Part 25 STC or TSO.

### 2.1.3 Fire Protection

All materials used shall be self-extinguishing except for small parts (such as knobs, fasteners, seals, grommets, and small electric parts) that would not contribute significantly to the propagation of a fire.

> Note: *The14 Code of Federal Regulations (CFR), Part 23 and Part 25 - Appendix F contains the method of compliance in the United States.*

Applicable 14 CFR Part 25 and Part 121 regulations must be met for the fabrication and installation of a physical barrier in a manner similar to that proposed for AC 25.795-1A-compliant installed physical secondary barrier systems. Accordingly, and as is the case with AC 25.795-1A, compliant installed physical secondary barrier systems, the requirements of 14 CFR 25.771 with regard to noise, light and odors, and the flammability requirements of 14 CFR 25.853 must also be met.

### 2.1.4 Threat Mitigation Time (TMT) Considerations

As stated earlier, Threat Mitigation Time (TMT) is the sum of recognition time, reaction time and response time. The TMT shall be demonstrated to be at least 5 seconds.

Threat Mitigation Time (TMT) is the total time that that the SBS provide for the space and time needed behind the flight deck door to secure the flight deck environment during door transition, measured from the initiation of an attack until the attacker(s) reaches the flight deck door. For any system to be successful, TMT must be at least equal to or greater than the time it takes to recognize an attack is in progress, react to that attack by making a decision to act, and then respond to the attack by employing appropriate procedures.

Section 2.1.5 specifies that the SBS must delay an intruder for at least five seconds. This section, and the subsequent sub-sections, provides a set of factors that may independently, or in some combination, impact the TMT for the individual components of the SBS. For example, an airline choosing to use flight attendants as part of their SBS will have to account for factors such as age, stress, and fatigue, which may negatively impact the crew's ability to serve as a secondary barrier. This document is not requiring that each individual factor or consideration be independently measured in terms of reaction time. Rather, this document places the requirement for TMT on the effectiveness of the SBS as a whole, including all components. In our research we noted that experts addressed similar challenges by combining recognition and reaction time in their own studies, coining phrases such as, 'recognition reaction time', or 'choice reaction time' (See section 2.1.4.1).

The committee also concluded that even if we did not measure recognition and reaction time independent of response time, the combined time required to recognize, react to and respond to an attack would nonetheless be captured in the requirement stated in section 2.1.5, based on the research, evaluations, and demonstrations conducted as part of the preparation for this document. In other words, knowing that TMT is the sum of recognition, reaction and response times does not necessitate separate measurements of each.

#### 2.1.4.1 Baseline Reaction Times

There are several factors and components which impact reaction times, or the time it takes for an individual to respond, given a prompt or cue. The Human Factors literature talks about a "baseline" reaction time, which would be the fastest time you can expect an individual to respond, given the best case scenario. For example, if you have a healthy, young, college aged student sitting in a quiet laboratory with instructions to press a button when he/she sees a flash on the computer screen, the average "simple" reaction time has been found to be approximately 190ms (0.19 sec)[1]. This can be considered a best-case scenario, or baseline, because the individual is young, healthy, focused on a single "simple" task entailing one stimuli (i.e., looking at a computer screen), with a single response (i.e., their hand on a button to be pushed when they see the flash).

It is important to establish the best-case scenario in a laboratory environment, so we have a baseline to compare against. However, it is important to recognize that in this example, the individual has no distractions or "confounding factors" which might otherwise negatively impact, or slow their response time down.

In the real world of airline operations the flight crew has many distractions, are often multi-tasking working on several crew duties, they may be tired, stressed, etc.

[1] Welford, A. T. 1980. Choice reaction time: Basic concepts. In A. T. Welford (Ed.), Reaction Times. Academic Press, New York, pp. 73-128.

In a mid-flight scenario, there are an unlimited number of ways in which a potential threat may manifest itself, and an unlimited number of possible responses and factors, which could negatively impact or add on to the baseline reaction time. In the Human Factors literature, the scenario where there are multiple stimuli each requiring a different and separate response, is called recognition reaction time, and adds a significant amount to the simple reaction time.

In one research study, they found that for six stimuli, the recognition reaction time is 630ms (0.63 sec)[1] because this type of reaction time is the most similar to a real-life emergency situation; this is the baseline reaction time the committee chose to use. This time can be considered the minimum or best case scenario reaction time that needs to be factored in when showing compliance with the requirement for TMT called out in section 2.1.5. The following sections and subsections provide additional factors, which need to be considered when showing compliance to the TMT requirement.

### 2.1.4.2 Factors Affecting Threat Mitigation Time (TMT)

This section contains summaries of factors that may negatively impact TMT. While it is beyond the scope of the committee to do additional scientific research on these factors, it is evident to the committee that they have a clear impact on reaction time. These factors should be considered when making recommendations on the time required to respond to a potential attack on the flight deck, or on recommended crewmember procedures used during door transition. Therefore, a buffer was added to TMT to account for these factors.

#### 2.1.4.2.1 Altitude

High altitudes, as well as rapid changes in altitude, have been shown to have a negative effect on cognition and reaction time[2]. It has been shown that mean reaction time is significantly impaired at cabin altitudes above 13,000 feet. The average commuter airplane reaches cruising altitudes of 30000 feet MSL, with a cabin altitude of 8000 feet. At typical cabin altitudes for commercial airline operations, the negative effects on cognition and reaction time may be noticeable during long-range flights.

#### 2.1.4.2.2 Fatigue

Fatigue impacts flight attendants and pilots. Fatigue is characterized by a general lack of alertness and degradation of mental and physical performance that can result from extended wakefulness, insufficient sleep, and disruption of the circadian cycle, the cycle that dictates when individuals are tired and when they are at their peak alertness. Symptoms of fatigue include impaired mood, forgetfulness, reduced vigilance, poor decision making, slowed reaction time, poor communication, nodding off, or becoming fixated, apathetic, or lethargic. Fatigue is also very individualistic. Individuals in similar circumstances can become fatigued at different times and to different degrees of severity.

[1] Sternberg, S. 1969. Memory scanning: Mental processes revealed by reaction time experiments. American Scientist 57: 421-457.

[2] Dykiert, Dominika, David Hall, Nikki van Gemeren, Richard Benson, and Geoff Der. "The Effects of High Altitude on Choice Reaction Time Mean and Intra-Individual Variability: Results of the Edinburgh Altitude Research Expedition of 2008." Neuropsychology. 24.3 (2010): 391-401. Print.

Scientific research has demonstrated that most people need 8 hours of sleep in each 24 hour period to sustain peak performance. A 2009 study[1] showed that two days of sleep restriction, resulting in five hours of sleep per night, caused subjects to react more slowly to stimuli, and in some cases to miss stimuli completely.

Crewmembers are particularly susceptible to fatigue due to the nature of their jobs, shifting schedules, and variety of locations where they are sometimes required to sleep. Most airlines operate 24 hours a day including extended duty days, rotating shifts, and frequent time zone changes, each of which can contribute to fatigue and negatively impact reaction time. Consider some additional factors:

- In a survey of 9,180 flight attendants 84% reported being fatigued. Of those experiencing fatigue, 71% reported their safety-related performance was affected[2].
- Flight attendants can be scheduled to work up to 14 hour days. This 14-hour duty period may be extended up to 20 hours if additional flight attendants are added. These work periods can also be extended further due to flight delays, unscheduled landings, or late flight arrivals.
- The current regulations require that crewmembers receive a minimum scheduled rest period of 9 consecutive hours between shifts. This rest period may be reduced to 8 hours if the subsequent rest period is increased. Even when taken in their entirety, breaks do not include travel time or time to check in and out of hotels, so crewmembers could frequently work long shifts with no more than five or six hours of sleep per night and thus can be expected to be operating while fatigued.
- Some of the duties that flight attendants are responsible for include attending to passenger safety and comfort needs, helping passengers with luggage, managing unruly passengers, conducting meal services, and responding to passenger calls. Typically, flight attendants are on their feet for most of their shift, resulting in physical and emotional fatigue.
- The longer an individual has continuously been doing a job without of break, sometimes referred to as "time on task," the more likely the individual is to be fatigued.

The effects of fatigue on aircrew performance are a significant concern to commercial aviation stakeholders as well as regulators. While a detailed analysis of the effects of fatigue on crewmember performance is beyond the resources available to this committee, it is clear that fatigue impacts the components of TMT. This is one of the reasons an additional safety factor was added to the demonstrated TMT which led to the committee's recommendation of a minimum 5 second delay.

[1] Cote, K. A., C. E. Milner, B. A. Smith, A. J. Aubin, T. A. Greason, B. P. Cuthbert, S. Wiebe, and S. E. G. Duffus. 2009. CNS arousal and neurobehavioral performance in a short-term sleep restriction paradigm. Journal of Sleep Research18(3): 291-303. Scheduled rest. 121.467 (Flight Attendants) Only based on schedule.

[2] Avers KB, King SJ, Nesthus TE, Thomas S, Banks J; Flight Attendant Fatigue, Part I: National Duty, Rest and Fatigue Survey; DOT/FAA?AM-09/24, December 2009

#### 2.1.4.2.3 Stress

Stress, like fatigue, is an inevitable part of commercial aviation and clearly affects crewmember performance. Stress by crewmembers varies by workload, phase of flight and other external stressors such as a disturbance in the cabin or other irregular event. The accumulated effects of stress can lead to procedural or judgment errors[1] which need to be taken into consideration when using crew members as part of the secondary barrier system.

The baseline number for reaction time used in this document was obtained from experimental data collected in a pristine laboratory setting, with minimal distractions and environmental stressors. A mid-flight situation is filled with noise, distractions, and other factors which taken in isolation would be problematic, but taken in combination with a crew member operating under stress are even more problematic[2]. When considering the numerous and varied crewmember responsibilities, it is reasonable to assume that their attention may be diverted from searching for potential threats, and even more so when they are under stress.

In addition to environmental stressors, sources of stress often come from individuals' personal lives. These may be just as distracting as physically present stressors, such as noise or responding to disruptive or demanding passengers.

It is impossible to eliminate sources of stress, as they are inherent in the aviation environment, and what is considered stressful may differ from one individual to the next. There are different reactions to stress, as well; some are able to function more efficiently due to the adrenaline released under high levels of stress, while others go into a mild state of shock, during which their reactions times are three times what they would be otherwise. Additionally, the effects of stress interact with other factors, such as fatigue. For example, a crewmember that is both stressed and tired may react significantly slower than a crewmember that is only either stressed or fatigued.

#### 2.1.4.2.4 Individual Differences

Reaction time is also affected by individual differences such as age and gender. As noted in section 2.1.4.1, a college-aged individual will typically react to visual stimuli in 0.19 seconds. While some crewmembers may have reaction times that are comparable, many others may not, due to a variety of factors such as age, physical differences, etc[3].

Studies show that reaction times begin to slow between the ages of 20 and 50[4]. After this, cognition and reaction times begin to deteriorate more rapidly. Older crewmembers are more likely to suffer from ailments such as arthritis. While this does not affect their cognition, it could affect their ability to physically react by closing the flight deck door.

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[1] Macdonald, James S.P., and Nilli Lavie. "Load Induced Blindness." Journal of Experimental Psychology: Human Perception and Performance. 34.5 (2008): 1078-1091. Print.

[2] Trimmel, M., and G. Poelzl. 2006. Impact of background noise on reaction time and brain DC potential changes of VDT-based spatial attention. Ergonomics 49(2): 202-209

3 Der, G., and I. J. Deary. 2006. Age and sex differences in reaction time in adulthood: Results from the United Kingdom health and lifestyle survey. Psychology and Aging 21(1): 62-73

[4] Welford, A. T. 1977. Motor performance. In J. E. Birren and K. W. Schaie (Eds.), Handbook of the Psychology of Aging. Van Nostrand Reinhold, New York, pp. 450-496

In the US, there is no age limit for flight attendants. There is an age limit for commercial airline pilots employed by airlines certified under 14 CFR Part 121. Commercial airlines cannot employ pilots after they reach the age of 65 unless performing another role, such as a flight engineer.

Physical differences can also play a role in reaction time. There are human physical differences between men and women, which can affect the response to a security incident. A December 2009 FAA report[1] notes that 79% of flight attendants are female with an average height of 5 feet 5 inches, 155 pounds, and 45.9 average age.

Females tend to be smaller than males possibly limiting their strength compared to a man. Smaller framed individuals are more easily pushed out of the way. Additionally, men tend to have slightly thicker and longer limbs than women allowing for increased strength and range of motion in certain situations. These physical differences may result in women presenting a less effective barrier.

#### 2.1.4.2.5 Vigilance

Vigilance is defined as the ability to sustain attention during prolonged, monotonous tasks. Vigilance is especially difficult to sustain in "monitoring" tasks where an individual must maintain attention while waiting for an uncommon or unpredictable event. These are sometimes referred to as "life guard" tasks, since a lifeguard may sit by a swimming pool for hours on end waiting for an emergency event. Since the emergency events are so rare, the lifeguards may become complacent and distracted, making it more difficult to maintain vigilance in monitoring. Similarly, crewmembers may be lulled into complacency since attacks on crewmembers and/or attempts to breach the flight deck door are so infrequent.

There has been research into the effects of vigilance to accomplish a task over time (See Warm et al. 2008). Vigilance requires hard work and is stressful (Human Factors, 50, 3, 433-441). The main finding from vigilance research is that vigilance declines over time spent monitoring, also known as vigilance decrement. In a classic study, Mackworth showed that individuals monitoring displays for important signals (such as the hand of a laboratory clock making small but detectable jumps) suffered performance losses after only 30 minutes of monitoring. The accuracy of their signal detection declined by 10-15% within this period and then showed a more gradual decline over the remainder of the watch period. Other researchers have shown vigilance decrements within the first 15 minutes of a watch, with experienced as well as novice "watch-keepers", and in real operational settings, such as sonar detection and radar display monitoring, as well as in the laboratory.

### 2.1.5 Response Time and Threat Mitigation Time (TMT)

As was mentioned in section 2.1.4.1, baseline reaction time is based on healthy, college-aged individuals. In reality, the average flight crewmembers are significantly older than this and may have a variety of minor health issues. Thus, we can expect flight crewmembers to have longer recognition and reaction times than a typical college-aged individual.

Response time is the time it takes to close the door once the threat has been recognized and a decision has been made to react. A variety of research tests were conducted to determine an acceptable Threat Mitigation Time.

[1] Avers KB, King SJ, Nesthus TE, Thomas S, Banks J; Flight Attendant Fatigue, Part I: National Duty, Rest and Fatigue Survey; DOT/FAA?AM-09/24, December 2009

In one test the participants completed multiple trials. As might be expected, the test subjects got better and more efficient with practice. The time to close the door became shorter as the tests continued, with an average of XX seconds (SSI) to close the door at the end. This was felt to be the best case or minimum reaction time, as participants had a chance to practice, knew they were in a testing environment, and knew what was being tested.

A second test used trained airline crewmembers that were asked to demonstrate door transition procedures several times. At some point in the demonstration, an emergency command (SSI) was given. A timer was started at this point and stopped when the door was closed. This test was conducted only once per crew, to ensure that test subjects (in this case the flight crew), were not benefiting from artificially “quick” reaction times that would have resulted from “practice effects.” The average reaction time during these tests was XX seconds (SSI) with a maximum of XX seconds (SSI) and a standard deviation of XX seconds (SSI). It is expected that these results are generalized to represent response times that can be expected from an average crewmember on an average day.

A third test utilized physically fit males trained in either law enforcement or military defensive tactics, and protective equipment for multiple test repetitions. The purpose of this evaluation was to determine if a highly trained, alert and physically fit crewmember could defend the flight deck door with and without a galley cart. In this scenario, the door was closed more quickly that the tests conducted in Atlantic City and in the random crew tests. We attributed this difference to the training these volunteers had undergone and the fact that they knew the attack is imminent. Response time ranged from XX-XX seconds (SSI). The percentage of time the flight deck door was breached is SSI. SSI referenced in this document can be requested by contacting the FAA’s Flight Standards Office (AFS-007).

Based on the evaluations discussed above and the research literature, it was concluded that a secondary barrier system shall meet a TMT of 5 seconds. TMT can be likened to a rejected take-off (RTO) response, where a crew has a defined amount of time to recognize, react and take appropriate action. The individual times that the committee determined for recognition, reaction and response time is SSI. SSI referenced in this section can be requested by contacting the FAA’s Flight Standards Office (AFS-007).

## 2.2 General Airline Operating Procedures

This section contains general guidance for airlines to use when developing crewmember procedures in coordination Secondary Barrier Systems (SBS).

The requirements to implement procedures that promote the safe operation of SBS apply to IPSB, INSB, or human secondary barriers. Subsequent sections provide additional guidance for each of the various types of secondary barriers. These recommendations are discussed below and should be considered minimum guidelines:

- AC 120-48

Advisory Circular 120-48 (Communication and Coordination between Flight Crewmembers and Flight Attendants) details the need to coordinate the activities of both flight crews and flight attendants to avoid the onset of problems capable of adversely impacting flight safety and security. Prime among these issues are the two major problems associated with flight attendant observance of sterile cockpit procedures; these being the discernment of “sterile cockpit time” along with an understanding of “sterile cockpit meaning”.

“Sterile cockpit time” describes the time when flight attendants should know that sterile cockpit procedures are in effect. This knowledge needs to be conveyed through prior communication with the flight crew or through some sort of signaling technique. In any event, sterile cockpit times will be operator-specific and will need to be the subject of dedicated pre-flight briefings that cover anticipated times that need to be respected while outlining methods capable of addressing those that are not. In this fashion, flight deck door transitions can be organized to take place outside of “sterile” conditions; a particularly critical factor when dealing with SBS characterized by a need for the flight deck door to be positively controlled by aircrew personnel during transition.

Flight attendants need to understand the meaning of “sterile cockpit” so that they might better discern what issues and information merit contact with flight crewmembers. Interruptions can distract flight crew and have a detrimental effect on their performance; particularly when one is called upon to positively control the flight deck door during flight attendant entry to, or departure from, the flight deck environment.

Alternately, hesitancy or reluctance on the part of a flight attendant to contact the flight crew with important safety information, due to a misconception of the sterile cockpit rule, is potentially even more serious than the unnecessary distraction caused by needless violations of the sterile cockpit. Accordingly, flight attendants need to understand what information warrants compromising sterile cockpit procedures in advance of the requirement to do so. This knowledge may be the subject of dedicated pre-flight briefings as was the case for relating when sterile cockpit procedures are anticipated to be in effect.

In addition to the delineation of sterile cockpit procedures, AC 120-48 goes on to highlight the need for pre-flight briefings to address procedures related to the actual entry and exit of the flight deck environment. These procedural considerations will be driven by the air carrier’s operations and will need to be codified in appropriate manuals while being the subject of training programs that cover both normal and emergency operations. These training programs will reinforce desired procedures and practices and better ensure the required coordination between flight crew and flight attendants during critical flight deck door transitions.

- AC 120-71A

In the area of flight deck procedures utilized by dedicated flight crews, Advisory Circular 120-71A (Standing Operating Procedures for Flight Deck Crew Members) requires that these crews share a common view of the “mental model of each task” at hand and that this mental model, in turn, be founded on standard operating procedures (SOPs). These shared “mental models” can be viewed as the flight deck crews’ understanding of the relationship between an input and the resulting output of a procedure or its component part. These “mental models” are used by crewmembers to predict outcomes that could be produced from an array of possible inputs. Accordingly, procedures need to be designed to be compatible with these expectations in order to minimize the potential for error. AC 120-71A goes on to state that these SOPs need to be “clear, comprehensive, and readily available in the manuals used by flight deck crewmembers”. It notes that adequate SOPs are central in the promotion of “higher levels of safety” if they:

A. Are appropriate to the situation;

B. Are practical to use;

C. Are understood by the crewmember;

D. Clearly delineate crewmember responsibilities;

E. Are the subject of effective training; and

F. Are reinforced by the positive attitudes displayed by instructors, check airmen, and managers.

Lacking these elements, the AC notes that flight crews will feel themselves to be participants in an "undesirable double standard condoned by instructors, check airmen, and managers" and may "end up doing things one way to satisfy training requirements and check rides, but doing them another way in 'real life' during line operations". The formation of such double standards, when considering the threat posed by ineffective flight deck door transitions, dictates the requirement for related procedures to embody the elements noted above.

The following is a list of procedural and training considerations that every airline should have in place for times when the flight crew needs to be away from the flight deck/cockpit, regardless of what type of barriers are used (e.g., IPSB, INSB, or human barrier):

- Procedures must accompany any IPSB or alternative secondary barrier system.
- Procedures should include an emergency command to warn crewmembers of an unauthorized attempt to breach the flight deck.
- Positive control of the flight deck door should be maintained at all times during door transition.
- Prior to deploying any secondary barrier system the area around the flight deck door must be clear of passengers.
- Any procedures associated with the SBS must take into consideration FAMS requirements (SSI). SSI referenced in this section can be requested by contacting the FAA's Flight Standards Office (AFS-007).
- Attendants used to monitor aisle/passengers in a human barrier system should have no other duties during door transition.
- Human barrier systems should include instructions to the passengers in the forward section to fasten seat belts or some other instruction that limits movement. Any passenger movement into the aisle during door transition should be treated as a threat and action should be taken to close the flight deck door.
- Door transitions should not occur during sterile cockpit operations unless the Captain is exercising emergency Captain's authority.
- A notification procedure to inform the flight deck crew that the cabin crew is ready to accomplish door transition
- Confirmation procedures that delay measures and/ or equipment are in place before the flight deck door is opened for personnel ingress or egress from the flight deck.
- A procedure to confirm the identity of the crewmember before the flight deck door is opened to accommodate ingress.
- A confirmation procedure that the area between the flight deck door and the barrier (IPSB, INSB or human barrier) is clear before opening the door for the egress of personnel from the flight deck;
- Once door transition is complete, confirmation that the flight deck door is properly locked.

- Enhanced self-defense training for flight attendants should be required for any SBS. The level of training will be determined by the degree to which the defensive system depends on the active response of flight attendants to defeat the attacker. Any proposed additional training should be described in the test plan and demonstrated to be effective.
- Enhanced self-defense training should include:
    1) Use of force
    2) Defensive tactics
    3) Psychology of survival
    4) Threat recognition and response
    5) Behavior observation and analysis techniques

## 2.3 Installed Physical Secondary Barriers (IPSB)

The IPSB is an installed physical device designed specifically to prevent an attacker or attackers from reaching the flight deck during door transition (ingress or egress). The IPSB can be used as a stand-alone device or in conjunction with other secondary barrier methods as long as the SBS meets the threat delay timing requirements found in section 2.1 of this document. The recommendations in this section apply the best practices of two airlines that chose to use the IPSB as the basis of their SBS. Below are some examples of existing IPSBs.

In 2002 United Airlines developed the first "installed" type SBS. The early procedures and equipment were tested and modified as a result of operational feedback, and provided the basis for current SBSs being used by other carriers.

While the guidelines for the IPSB are designed to delay an attacker for a minimum number of seconds needed to secure the flight deck door, a carrier may elect to design the IPSB to meet the more robust guidelines of the primary door, such as outlined in AC 25.795-1A. Boeing's B787 is an example of an IPSB designed to use this more robust standard.

Some air carriers have elected to purchase the option of a privacy door system, in conjunction with a camera or other identification system, and procedures, such as those offered on the Airbus A380. The system offers several features, such as preventing awareness of the flight deck door transition to potential intruders.

For many carriers, an appropriate threat mitigation plan may be to choose to install a secondary barrier system, which incorporates the primary flight deck door, an IPSB, and crewmember procedures. This will delay attackers during the vulnerable time of door transition, and does not put an increased burden on cabin crewmembers to physically defend against an attempted breach of the flight deck.

The IPSB also acts as a 'force multiplier' in the sense that it takes the place of a cabin crewmember that is not available on smaller aircraft, which are staffed with a single flight attendant. This time period, as detailed in section 2.1 of this document, has been determined to be five seconds, and can be met through the following design guidelines:

- An acceptable IPSB design should meet or exceed the applicable impact requirements shown in table 1 of the National Institute of Law Enforcement and Criminal Justice (NILECJ) Standard 0306.00, released in May 1976, for the Physical Security of Door Assemblies and Components. It was formulated by the Law Enforcement Standards Laboratory of the National Bureau of Standards under the sponsorship of the National Institute of Justice (NIJ).

- Class IV requirements which represent the highest level identified in the standard are recommended for use. However two blows for each applicable requirement without total failure will be deemed sufficient. Threat recognition will be evident after one blow.
- Applicable requirements will be based on barrier design. The NILECJ-STD-0306.00 requirements are recognized as the standard of security door assemblies by the American Society for Testing and Materials (ASTM). It was also used as the basis for the development of AC 25.795-1A (Flight Deck Intrusion Resistance). The standard is primarily concerned with typical entry doors for residences and small businesses. While the standard does not address persons using skilled methods of entry, it does address the capability to frustrate determined persons from committing forced entry. To this end, portions of this standard and its test methods are applicable to this requirement.
- There are four basic types of testing that are relevant for a standard door type IPSB, as noted in Table 2-1. These address resistance to impacts on the door, its locking bolt and hinge, and resistance to forcible opening by pulling on the doorknob or handle.

Table 2-1 provides a list of various tests, test methods, measured parameters and requirements. Depending on the design, the proposed IPSB may not have detailed features described in this table. However, if such features exist, they should be addressed as with door features.

**Table 2-1 Resistance Criteria**

| Test | Test Method | Measured Parameter | Requirements per NILECJ |
|---|---|---|---|
| Panel Impact | 5.15 | Impact resistance of door or boundary panel | 2 blows of 200 J (221.3 ft•lbf) |
| Bolt Impact | 5.18 | Impact resistance at bolt | 2 blows of 200 J (221.3 ft•lbf) |
| Hinge Impact | 5.17 | Impact resistance at hinge | 2 blows of 200 J (221.3 ft•lbf) |
| Knob Torque | 5.12 | Pulling resistance at doorknob or handle | 118 ft•lbf |

- The IPSB can sustain physical damage and/or fail during an attack as long as delay criteria specified in section 2.1 are met.
- If the design includes a latching mechanism it should be tamper resistant. Applicable 14 CFR Part 25 and Part 121 regulations must be met for the fabrication and installation of a physical barrier. Showing compliance to the existing applicable Federal regulations will adequately demonstrate that the IPSB installation will not pose an unacceptable level of risk to the aircraft or its occupants. Applicable regulations will be dependent on secondary barrier design.
- The design must allow visibility of the flight deck and area aft of the flight deck door. The SBS shall be visible from either the flight deck viewing port, an installed camera system or other approved method.
- The design must allow access through the IPSB from the cabin side in a reasonable time. This time must not be shorter than delay time specified in section 2.1.

- IPSB should be easy to deploy. It should not take more than one individual to deploy or stow.
- The design should allow flight attendants to maintain situational awareness of the area both aft and forward of the barrier.
- The design should not have any features that could injure a crewmember in either the deployed or stowed condition.
- Training on the use of the IPSB will be required. Training on the use should be provided to all applicable crewmember personnel per the training requirements in subparts N and O of 14 CFR Part 121.
- Visual and/or other indications that the IPSB is deployed and secured properly should be provided. These indications should be able to be seen in all airplane lighting conditions. In the case of a power failure, other methods should be employed to ensure visibility of the IPSB.
- Consideration should be given to the ease of installation, removal and maintenance.
- Installation, removal, adjustment and repair procedures should be covered within the Operators manuals per 14CFR121.135.
- An MEL condition will be defined, utilizing either maintenance or operational measures.
- If the IPSB design incorporates an electrical latch…(SSI). SSI referenced in this section can be requested by contacting the FAA's Flight Standards Office (AFS-007).
- The IPSB shall be designed so that it cannot be operated in any position, combination or sequence that would result in a condition detrimental to the safe operation of the aircraft.
- Placards should be used to identify any unique operating characteristics required for safe operation. Instructions should be visible in all airplane lighting conditions and in all positions of the secondary barrier. In case of a power failure, other methods should be employed to ensure visibility of the required placards.

Procedures for the Installed Physical Secondary Barrier (IPSB) should include:

A. Briefing of flight attendants when "sterile operations" can be expected to be in effect and what types of information merit transfer to the flight deck during sterile operations;

B. Communication between flight deck and flight attendant crewmembers designated SOP commands for the purpose of ingress or egress of the flight deck.

C. Detailed SOP for a crewmember to positively control the flight deck door, during transition;

D. Confirmation that the IPSB is deployed and properly locked before door transition is accomplished;

E. Confirmation of the identity of the crewmember before the flight deck door is opened to accommodate ingress;

F. Confirmation that the area between the flight deck door and the IPSB is clear before opening the door for the egress of personnel from the flight deck;

G. Confirmation that the flight deck door is locked once closed by the authorized crewmember.

H. Procedures for door transition should include a goal to accomplish door transition in 3 seconds or less.

I. An air carrier's procedures should include an emergency command, which warns other crewmembers of an attempt to breach the flight deck.

### 2.3.1 Speed of Setup and Release

IPSB should be able to be deployed in a reasonably short amount of time.

### 2.3.2 Ease of Setup and Release

As stated in 2.3, the IPSB should be easy to deploy. It should not take more than one individual to deploy or stow.

## 2.4 Improvised Non-Installed Secondary Barriers (INSB)

The goal of this section is to find an adequate delay as defined in section 2.1.

The requirements in this section apply only for airlines that have chosen to use the INSB in lieu of an IPSB. If this form of SBS has been selected, the requirements in this section must be followed in addition to those in section 2.1.

The results of the committee's evaluation of existing operating procedures were SSI. SSI referenced in this document can be requested by contacting the FAA's Flight Standards Office (AFS-007).

In order to enhance the effectiveness of INSB procedures, the committee recommends the following:

- The use of a minimum of two attendants along with an aisle obstruction One attendant should monitor the aisle and obstruction while the other provides service to the flight deck. This allows situational awareness to be maintained of the forward cabin area.
- Recognition of the fact that flight attendant blockers on the flight deck side of the galley cart were more effective than those on the cabin side of the cart. This may not be possible due to space constraints of some aircraft configurations.
- Enhanced training programs to ensure the delay recommended in section 2.1 is provided. These training programs should also address mitigations to the increased risk of injury to flight attendants who are required to defend the flight deck. While the INSB's use of galley carts or other equipment provides for more of an impediment to an attacker, it should be understood that the primary method of delay comes from the defensive efforts of cabin crewmembers.
- The limitations of individual differences between cabin crewmembers, as described in section 2.1.4.2.4 should be taken into account in the development of procedures to accompany the INSB.
- For cabin configurations with only one mandatory flight attendant, it is recommended that additional measures be put into place to provide for an equivalent level of security. Some ideas for additional security measures include:
    - Additional announcements to passengers, requiring them to remain seated and to fasten their seatbelts.
    - Additional procedures for flight deck crewmembers to be responsible for clearing the area aft of the flight attendant during door transition.

- Considerations for turbulence or other environmental conditions can prevent the use of galley carts as a barrier due to inflight safety concerns.

Procedures for the Improvised Non-Installed Secondary Barrier (INSB) should include:

A. Briefing of flight attendants when “sterile operations” can be expected to be in effect and what types of information merit transfer to the flight deck during sterile operations;

B. Communication between flight deck and flight attendant crewmembers designated SOP commands for the purpose of ingress or egress of the flight deck;

C. Detailed SOP for a crewmember to positively control the flight deck door, during transition;

D. Confirmation that the IPSB is deployed and properly locked before door transition is accomplished;

E. Confirmation of the identity of the crewmember before the flight deck door is opened to accommodate ingress;

F. Confirmation that the area between the flight deck door and the IPSB is clear before opening the door for the egress of personnel from the flight deck;

G. Confirmation that the flight deck door is locked once closed by the authorized crewmember;

H. Procedures for door transition should include a goal to accomplish door transition in 3 seconds or less;

I. An air carrier’s procedures should include an emergency command, which warns other crewmembers of an attempt to breach the flight deck.

### 2.4.1 Speed of Setup and Release

The INSB should be able to be set up in a reasonably short amount of time.

### 2.4.2 Ease of Setup and Release

INSB should be easy to deploy. It should not take more than one individual to deploy or stow.

## 2.5 Human Secondary Barriers (i.e., Flight Attendants, Pilots or Other Cabin Crewmembers)

The requirements in this section apply only to airlines that have chosen to use human secondary barriers. Human barriers consist of a combination of flight attendants and pilots. Passengers must not be used as human secondary barriers. If air carriers elect to use this form of barrier, the requirements in this section must be followed in addition to those in section 2.1.

The topics covered are:

1) Training

2) Uniforms

3) Crewmember(s) as warning only:

a) Based on data collected by the committee, an unimpeded attacker who is within a certain distance (SSI) to the flight deck can reach the flight deck door before the crewmembers can close and secure the door. Therefore, in order for an air carrier to successfully employ crewmembers as a warning only, the airline should ensure passengers are aft of this distance. SSI referenced in this document can be requested by contacting the FAA's Flight Standards Office (AFS-007).

b) Human factors considerations, such as the effects of fatigue, stress vigilance task, age, etc, have a larger impact on a human-only barrier system. This must be taken into account when developing SOPs and training for the human barrier option.

4) Blocking crewmember (s):

a) Blocking crewmember without additional equipment:

- In the test described in section 2.1.5, using highly trained attackers and defenders, the percentage of time the flight deck door was breached is SSI. SSI referenced in this document can be requested by contacting the FAA's Flight Standards Office (AFS-007). Based on these test results, the committee determined that using blocking crewmembers without additional equipment did not produce satisfactory results.

- Human factors considerations, such as the effects of fatigue, stress vigilance task, age, etc, have a larger impact on a human-only barrier system.

- In airplanes staffed with multiple flight attendants, a minimum of two attendants must be used in a procedural-based barrier system. One attendant is dedicated to monitor the aisle while the other provides service to the flight deck. This allows situational awareness of the aisle to be maintained during door transitions. Adhering to this guideline does not imply satisfactory results.

- For cabin configurations with only one mandatory flight attendant, it is recommended that additional measures be put into place to provide for an equivalent level of security. Some ideas for additional security measures include:
  - Additional announcements to passengers, requiring them to remain seated and to fasten their seatbelts.
  - Additional procedures for flight deck crewmembers to be responsible for clearing the area aft of the flight attendant during door transition.

- Enhanced self-defense training for flight attendants (beyond what is required for the INSB) is required for a human secondary barrier system. As stated in section 2.2, while any secondary barrier systems will require some level of self defense training, a human secondary barrier system will require the highest level of training due to the reliance exclusively on crewmembers, without the aid of a physical device to delay an attacker for the time necessary to adhere to minimum time requirements. Enhanced training will also serve to prepare crewmembers mentally for what will undoubtedly be a violent encounter. Any proposed additional training should be described in the test plan and demonstrated as effective.

- The limitations of individual differences between cabin crewmembers, as described in section 2.1.4.2.4 should be taken into account in the development of procedures to accompany the human secondary barrier.

### 2.5.1 Training

Although flight attendants must have strength, stamina, and agility in order to perform their usual duties, their training includes no instruction in the use of force. The following options may better prepare flight attendants for their roles as secondary barriers:

- Enhanced training should include training in the use of force, defensive tactics, the psychology of survival, threat recognition, and behavior observation and analysis techniques.
- Since this training will largely determine the success of a Human secondary barrier system, it will need to be mandatory and robust.
- The physical and aptitude requirements for flight attendants who adopt responsibilities associated with the human secondary barrier will be substantial, and will have a profound effect on current flight attendant hiring standards.

### 2.5.2 Uniforms

One of the purposes of crewmember uniforms is to allow easy identification of the crewmembers to the passengers in the event of an emergency situation. In addition to appearance considerations, the air carriers' selection of a uniform should take into consideration the flight attendants' safety and security-related duties.

Many air carrier policies prescribe uniform standards that consist of a variety of uniform pieces including pants, jackets, skirts, dresses, and shoes. The choice of a flight attendant uniform can negatively affect the flight attendant's ability to delay an attacker for the minimum required time. Wearing pants and flat shoes can assist with a security response by allowing more range of movement and a better response to a defense scenario.

As mentioned earlier in this paper, female flight attendants account for 79% of the total workforce, and are often required by their employers or pressured by cultural norms to wear uniforms that include skirts and high heels. Therefore, when choosing a female flight attendant uniform the following should be considered:

- High heels can add to the ease with which a flight attendant can be pushed out of the way, as it raises her center of gravity and makes her less stable.
- Skirts and dresses can limit the range of motion and make it more difficult for a flight attendant to defend herself against an attacker.

Similarly, uniform pieces such as ties and scarves can be used against the crewmember. Therefore, thought should be put into requiring "break away" type uniform pieces that can be easily pulled off the individual during a physical altercation.

While it is not the intent of the committee to dictate flight attendant uniform styles or otherwise affect customer service or customer satisfaction metrics, it should nonetheless be understood that secondary barrier systems that depend primarily on cabin crewmembers for defense of the flight deck (the INSB or human secondary barrier) will most likely require uniform modifications to meet system performance goals.

### 2.5.3 Passengers as Secondary Barriers

There have been a number of instances of passenger intervention during in-flight security breaches. The TSA lists passengers as a "layer of security[1]," leading to the belief in some quarters that passengers are a reliable obstacle to a potential violent attack of the flight deck.

Flight attendants are trained to recruit able-bodied passengers to provide additional assistance to cabin crew when reacting to in-flight events, which may include everything from a mildly disruptive passenger to a more serious potential threat to the security of the cabin or flight deck. (SSI). SSI referenced in this section can be requested by contacting the FAA's Flight Standards Office (AFS-007).

It is unreasonable to expect passengers to consistently and effectively intervene in an abrupt and violent attack on the flight deck. They are likely to be hindered by many of the same issues as flight attendants, particularly the discrepancy between their own lack of training or physical capabilities and the presumably highly-trained, motivated, athletic attacker.

The time required to recognize, react and respond to an attack is also a key factor, which argues against the passenger as an effective measure to prevent an attempted breach of the flight deck. Some passengers may be aware of cabin crewmembers preparing for a door transition, but most will not. And even if passengers are aware of an impending door transition, it is unreasonable to expect passengers to be prepared to react to any attempt to attack the flight deck. The timeframe of any attack to the flight deck would be only a few seconds, which is far too quick for passengers to respond under most circumstances.

In addition, passengers are often susceptible to the psychological phenomenon known as the "bystander effect- a phenomenon in which the greater the number of people present, the less the likelihood for others present to help the person in distress. This can be due to several factors, including a diffusion of responsibility among the group and others' failure to react, which may lead an individual to believe that a response is neither necessary nor appropriate.

Even a passenger trained in some form of self-defense and relatively impervious to the "bystander effect" will face issues such as reaction time or seating location in the aircraft. Because passengers are required to be buckled into their seats during door transitions, a passenger who decides to respond may be unable to do so in the time required to defeat an attack.

While the committee recognizes that there have been numerous instances of passenger intervention during a cabin disturbance, we also recognize that there have been other instances where passengers did not respond. Due to this lack of consistency, passengers are not considered a predictably reliable option for preventing an attempted violent or sudden breach of the flight deck. We therefore did not include the possibility of passenger intervention as a mitigating measure.

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[1] http://www.tsa.gov/what-we-do/layers/index.shtm

[2] see:http://psychology.about.com/od/socialpsychology/a/bystandereffect.htm

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## 3.0 CONSIDERATIONS FOR NON-US CARRIERS

Air carriers outside the United States use procedures and equipment not employed by some U.S. carriers at this time. These include video cameras to monitor the area outside the flight deck door and opaque curtains to obscure the area around the flight deck door from view from the cabin.

### 3.1 Video Camera Systems

The video camera system provides a better view of the area outside the flight deck door than a viewing port in the flight deck door and is therefore a preferable solution.

However, the video camera system, like the viewing port, is a passive defensive tool, and is inadequate, by itself, to defend the flight deck. A video camera system provides a visual aid to crewmembers, but does not provide the ability for crewmembers to physically secure the flight deck door. The vulnerability of a flight attendant to an attack occurs when his or her back is turned to an attacker with the flight deck door open. Laying responsibility for reacting to and responding to an attack on the flight attendant in this compromised position is unreasonable, since the flight attendant’s own situational awareness is reduced when their back is turned to the attacker.

It must therefore default to the crewmember on the flight deck side of the door, who is facing aft towards the threat, to maintain positive control of the door and be in a position to respond to an attack by securing the flight deck door. After evaluating current retrofitted IPSB and INSB options, the committee recommends SOPs should include the requirement for a crewmember to be on the flight deck side of the door, standing and maintaining positive control of the door.

### 3.2 Opaque Curtains

An opaque curtain or other similar device, whether used with or without a video system, reduces situational awareness of the area aft of the curtain for crewmembers between the curtain and the flight deck door. Conversely, cabin crewmembers in the remainder of the cabin lose situational awareness of the area forward of the curtain.. The opaque curtain allows potential attackers to get closer to the flight deck door before being detected by forward cabin crewmembers, and before defensive actions can be taken. For this reason the use of opaque curtains or barriers are not recommended unless the secondary barrier system warns the crew of an attack prior to attackers reaching the barrier, as well as providing an adequate delay to reaching the flight deck door. There is an SSI requirement for any IPSB or INSB to provide for an unobstructed view of the primary flight deck door. SSI referenced in this document can be requested by contacting the FAA’s Flight Standards Office (AFS-007).

### 3.3 The Airbus Privacy Door System

The Committee acknowledges the unique design characteristics of Airbus’ privacy door system. The privacy door system uses two opaque doors, a camera system and locking system, and when properly used, provides a high level of confidence of the identity of the person seeking entry onto the flight deck.

It is the position of SC-221 that the privacy door system designed by Airbus could provide an equivalent level of security to the guidelines this committee has proposed for the IPSB. It is furthermore the view of the committee that a more comprehensive evaluation is required before a judgment could be made as to the efficacy of Airbus’ privacy door system.

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# 4.0 EQUIPMENT PERFORMANCE – ENVIRONMENTAL

## 4.1 Aircraft Equipped with Crew Rest Facilities

Aircraft configured with dedicated crew rest facilities need to take special care when employing a secondary barrier system. Deployment of an IPSB or INSB can create an unacceptable level of noise to the walls used to anchor or support the barrier and adjacent to the crew rest area. Without careful consideration of the noise and/or vibration effect of the IPSB or INSB on the crew rest compartment, cabin crewmembers may inadvertently disturb crewmembers during crew rest. Because the ambient noise level in the forward cabin is higher than in the crew rest facility, this increased noise level may not be immediately noticeable to cabin crewmembers.

The following guidelines should be considered when designing and installing an IPSB for a new aircraft, for an after-market IPSB or for an INSB:

- An IPSB should be designed so as to minimize the potential for noise due to inadvertent loss of control by cabin crewmembers during opening, closing, deploying or securing the device.
- An IPSB should be designed so that its anchor points on the bulkhead or other internal walls minimize the potential for noise transfer to the crew rest area.
- Cabin crewmembers should be trained on how to minimize the creation of inadvertent, excessive noise during opening, closing, deploying and securing an IPSB or INSB.
- Cabin crewmembers should be trained on how to minimize inadvertent, excessive noise during door transitions, especially communication via the intercom, or opening and closing of the flight deck door.

Aircraft manufacturers should consider other methods to minimize unwanted noise in the crew rest facility including the possibility of locating the crew rest area further away from the flight deck door, or adding insulation to the crew rest facility walls.

## 4.2 Environmental and Test Performance Requirements

This section is intended to ensure that all secondary barriers operate properly and effectively in all appropriate environmental conditions. A barrier that does not work properly under the range of environmental conditions (e.g., temperature variations, humidity, sand, etc.) will be ineffective. Thus, all installed physical secondary barrier systems shall meet the requirements in this section. All non-installed secondary barrier systems may also be expected to meet some or all of the requirements in this section as well, as deemed relevant by the appropriate regulatory aviation authority (FAA).

The environmental tests and performance requirements described in this subsection are intended to provide a laboratory means of determining the overall performance characteristics of the equipment under conditions representative of those that may be encountered in actual operations.

Some of the environmental tests contained in this subsection need not be performed unless the manufacturer wishes to qualify the equipment for the particular environmental condition. These tests are identified by the phrase “when required.” If the manufacturer wishes to qualify the equipment to these additional environmental conditions, then these “when required” tests will be performed.

Unless otherwise specified, the test procedures applicable to a determination of equipment performance under environmental test conditions are set forth in RTCA DO-160G.

Some of the performance requirements in are not required to be tested to all of the conditions contained in RTCA DO-160G. Judgment and experience have indicated that these particular performance parameters are not susceptible to certain environmental conditions and that the level of performance will not be measurably degraded by exposure to these particular environmental conditions.

The SBS should comply with applicable environmental and test performance requirements found in RTCA DO-160G.

## MEMBERSHIP

**RTCA Special Committee 221**
**Aircraft Secondary Barriers**

### CO-CHAIRS

| | |
|---|---|
| Ed Folsom | United Airlines, Inc. |
| Rick Schiefelbein | The Boeing Company |

### DESIGNATED FEDERAL OFFICIAL

| | |
|---|---|
| Pat Hempen | Federal Aviation Administration |

### MEMBERS (See Appendix B for criteria)

| Name | Organization |
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| Pascal Andrei | Airbus Americas, Inc. |
| Jim Andresakes | Air Line Pilots Association |
| Chris Baur | Continental Airlines Inc. |
| Greg Bergner | Air Line Pilots Association |
| David Bernier | Transportation Security Administration |
| Giff Beuker | Continental Airlines Inc. |
| John Black | Association of Flight Attendants |
| Dominique Bonnet | Air France |
| William Bozin | Airbus Industries |
| Edward Bradford | DHS/TSA/FAMS |
| Krystal Brown | DHS/TSA/FAMS |
| Joseph Burns | United Airlines, Inc. |
| Maik Buttelmann | Airbus Deutschland GmbH |
| Rudy Canto | Airbus Industries |
| Sheryl Clarke | ExpressJet Airlines |
| Russ Cooper | Air Canada Pilots Association |
| Bill Crooks | Allied Pilots Association |
| Souhaiel Dallel | Africa West, Tunisair |
| Maryanne DeMarco | Coalition of Airline Pilots Associations |
| Xavier Depin | Airbus Americas, Inc. |
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| Colleen Donovan | Federal Aviation Administration |
| Arnaud Du Bedat | International Federation Airline Pilots' Associations |
| Jeffrey Dye | United Airlines, Inc. |
| Allen Ellison | Federal Bureau of Investigation |
| Simon Espensen | Cimber Sterling |
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| Derek Freeman | Delta Air Lines, Inc. |
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| Shimin Gu | CARERI |
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| Craig Hall | Air Line Pilots Association, Air Jazz |
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| Jill Jeske | Delta Air Lines, Inc. |
| Jose Jimenez | DHS/TSA |
| Mike Karn | Allied Pilots Association |
| Etsuo Kato | Japan Airlines |
| Casey Kinosz | General Aviation Manufacturers Association |
| Candace Kolander | Association of Flight Attendants |
| Art Kosatka | TranSecure Inc. |
| Tony Laubser | South African Airways |
| Leon Laylagian | United Parcel Service |
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| Kate Malone | Air Line Pilots Association, Continental Airlines |
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| Michael Massoni | Southwest Airlines |
| Edward Miller | Air Jamaica |
| Tom Miller | Delta Air Lines, Inc. |
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| Dinkar Mokadam | Association of Flight Attendants |
| Vito Montelcon | National Counterterrorism Center |
| Harold Moses | RTCA, Inc. |
| James Nauman | TESTCORP |
| Rohn Newman | Delta Air Lines, Inc. |
| Jay Norelius | The Spectrum Group |
| Todd O'Brien | Air Line Pilots Association |
| Pat O'laughlin | US Airways |
| Paul Onorato | Coalition of Airline Pilots Associations |
| Reuven Pedatzur | International Federation Airline Pilots' Associations, Arkia Israel Airlines |
| Francisco Pinies | SEPLA |
| Robb Powers | Alaska Airlines |
| Olivier Pujol | Airbus SAS |
| David Reynolds | British Air Line Pilots' Association |

| **Name** | **Organization** |
|---|---|
| Yvette Rose | Cargo Airline Association |
| Hebb Russell | CRUPAX |
| Salaa Sabreddine | International Federation of Air Line Pilots' Associations, Air Algerie |
| Kurt Schmidt | Federal Bureau of Investigation |
| Jo Schoenmaker | Dutch Air Line Pilots Association |
| Robert Semprini | Continental Airlines Inc. |
| Steve Sevier | US Airways |
| Chad Smith | Delta Air Lines, Inc. |
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| Mike Snowden | Air Line Pilots Association, Continental Airlines |
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| Howard Taylor | American Airlines, Inc. |
| Eric Thacker | Air Transport Association of America |
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| Nico Voorbach | Lufthansa |
| Mark Weiss | APA Mark Weiss Security Consulting, LLC |
| Norm White | National Counterterrorism Center |
| Jerry Wright | Air Line Pilots Association |
| Stefan Zigerli | International Federation of Air Line Pilots' Associations, Swiss Airlines |

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# APPENDIX A ACRONYMS AND GLOSSARY

## ACRONYMS

The following is a list of acronyms used in the document:

| | |
|---|---|
| AC | Advisory Circular |
| ARINC | Aeronautical Radio Incorporated |
| ARP | Aerospace Recommended Practice |
| CFR | Code of Federal Regulations |
| FAA | Federal Aviation Administration |
| GAMA | General Aviation Manufacturers Association |
| ICAO | International Civil Aviation Organization |
| SAE | Society of Automotive Engineers |
| SAE AIR | Society of Automotive Engineers Aerospace Information Report |
| SAE ARP | Society of Automotive Engineers Aerospace Recommended Practice |
| SAE AS | Society of Automotive Engineers Aerospace Standard |
| TSO | Technical Standard Order |
| WG | Working Group |

## GLOSSARY

The following is a glossary of terms in the document. Additional words that have a special or unique meaning in this document are contained in section 1.8.

**Alternate method**: Alternate Method(s) are those combinations of personnel, equipment and procedures employed in lieu of an Installed Physical Secondary Barrier (IPSB) system to secure the flight deck whilst the flight deck door is in transition.

**Demonstration**: Demonstration is the method of verification where qualitative versus quantitative validation of a requirement is made during a dynamic test of the equipment. In general, software functional requirements are validated by demonstration since the functionality must be observed through some secondary media.

**Door transition**: Door transition is the action of opening and closing a flight deck door for the purpose of authorized personnel ingress to, or egress from, the flight deck environment. This action commences from the initial unlocking of the flight deck door and terminates when this door is again in the locked state.

**FAA**: Federal Aviation Administration is a federal agency in the Department of Transportation that is responsible for the safety of civil aviation in the United States.

**RTCA**: A volunteer, not-for-profit organization that develops technical guidance for use by government regulatory authorities and by industry.

**Secondary barrier system**: Secondary Barrier Systems provide an obstacle that will impede an attempt by unauthorized personnel to gain access to the flight deck whilst the flight deck door is in transition. The purposes of these systems are to delay such an attempt rather than stop it an indefinite period of time.

**Situational awareness**: Situational awareness is the perception of environmental elements within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future.

**TOR**: In the case of RTCA Sub-Committee 221, Terms of Reference (TOR) are the written guidelines used to describe the purpose, roles and structure of the Sub-Committee and provide its members with a clear definition of the project's scope.

**TSA**: Transportation Security Administration is a federal agency established in 2001 with the express purpose of safeguarding United States' transportation systems and to insure secure air travel.

## APPENDIX B SENSITIVE SECURITY INFORMATION (SSI)

The purpose of RTCA SC-221 is to address perceived weaknesses in our commercial aviation industry's defense of the flight deck from unwanted intrusion, to identify current best-practices and other ways to better protect the flight deck during door transitions, and to develop guidelines for a new innovation, the installed physical secondary barrier, or IPSB.

In order to accomplish the goals outlined in our committee's terms of reference, we needed to evaluate the current threat to the flight deck, test the industry's current flight deck security systems, evaluate various methods currently in use to protect the flight deck, and make conclusions as to what worked, what didn't, and how best to proceed in the future.

The further we progressed in our work, we realized we were walking into uncharted territory. Of course we knew that the subject of our discussions would be sensitive in nature, because we were talking about aviation security vulnerabilities, threats, and defensive strategies. But the question remained, when does a general conversation become sensitive security information?

This question lingered over the group discussions. RTCA, after all, is an organization built around the premise of open, public discussion. The difference for this committee was that we were doing something that hadn't been done at RTCA before now, and hadn't been done in the aviation community before now. In the almost 10 years since the terrorists attacks of September 2001, no federal agency had yet done as comprehensive an analysis of the threat, vulnerability and mitigations to address security of the flight deck as this committee was currently undertaking.

Volunteers representing a diverse group of stakeholders, including aircraft manufacturers, air carriers, regulators, pilot and flight attendant associations, trade associations, and other unregulated groups, including international colleagues, have done the work of this committee. The implications of our work were significant- the result of this analysis has the potential to significantly impact commercial aviation security. In addition, some of what we learned was going to be classified as sensitive security information (SSI). This is what made the work of RTCA SC-221 unique.

As it became clearer that some of our discussions would include SSI, we took proactive steps to address the security concerns of the committee. First, we sought advice from David Bernier, the TSA liaison to the FAA, and Pat Hempen, our committee's designated federal official (DFO).

Our initial analysis determined we had the following problems:

- RTCA didn't have a process in place to manage security sensitive information (SSI).
- SC-221 is discussing information, which had the potential to be security sensitive information.
- There was a disagreement among stakeholders as to what constitutes SSI and WHO has a need to know.
- SC-221's final report is required to be a public document, and cannot be limited by SSI protocols.

After consultation with the TSA and FAA, the committee elected to implement the following measures:

- After it became clear that SC-221 would be handling potentially security sensitive information, committee leadership took steps to limit access of information to the public.
- In order to minimize the amount of email traffic, including email with attached documents, SC-221 created a private website, and took steps to make the website a secure website, including use of passwords to access sensitive pages. Only members of the committee had access to the password.
- As the committee's work progressed, we took the additional step of putting individual passwords on individual documents. All sensitive documents required another password to read.
- The committee regularly changed the website and document passwords.
- The committee set up a standard for 'need to know' for the committee. Unless an interested participant registered as an official member of SC-221, they were not allowed to access the website or the controlled documents.
- Committee members were briefed on how to handle SSI, including reminder to not forward documents to those without need to know, and to delete or otherwise destroy previous copies of SSI material.
- We reminded members that they were not authorized to determine 'need to know'- this was the responsibility of committee leadership.
- We asked the TSA and FAA committee representatives to do a periodic review of our documents to determine the extent of actual SSI content.
- Individuals who wanted access to the Committee's documents or website were first required to sign a confidentiality agreement, and had to officially register with RTCA as a member of SC-221.
- Criteria for membership: as per RTCA past practices, if an individual has attended at least one plenary or working group meeting, they were required to register as a member of the special committee through RTCA. Additionally, there were individuals who had not attended a meeting in person, but made contributions to the committee and asked to be included.
- The committee added required SSI information in header and footer of sensitive documents.

In addition to these short-term measures, the committee implemented the following long-term mitigation steps:

- The TSA and FAA each reviewed the committee's final document for SSI. The TSA and FAA mutually agreed on what information would be considered SSI.
- The committee scrubbed the draft document of identified SSI information, and placed that information into a dedicated SSI document.
- The draft document was subsequently declared to be free of SSI.
- The SSI document will contain all SSI information
- The new draft final report will contain a SSI appendix.
- This appendix will describe the background and processes that RTCA, TSA, FAA and SC-221 have put into place to protect SSI, and will refer the reader to the SSI document for more detailed information.
- FAA Flight Standard Division, AFS-007, will manage the SSI document. AFS-007 and TSA will determine if the requestor has met the need to know standards for SSI information related to the SC-221 Committee's work.

The leadership of SC-221, including the FAA DFO and TSA representative, has determined the following topics to be SSI:

- 1.4: reference to international carriers
- 1.7: answers to questionnaire
- 2.1.5: specific number values, emergency command, references to specific results of tests that determined TMT, including a breakout between recognition, reaction and response time
- 2.2: reference to FAMS tactics
- 2.3: reference to electrical latch
- 2.5: reference to specific distances, blocking crewmembers
- 2.5.3: other suggestions for an acceptable human secondary barrier
- 3.2: reference to unobstructed view

Industry stakeholders seeking additional information concerning SSI from RTCA Special Committee 221 should contact the office of SSI at the FAA, or contact AFS-007.

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# APPENDIX C OTHER REFERENCE MATERIAL

The following is list of major documents that contain regulations, requirements, or guidelines that may have an impact on the design of secondary barrier systems.

## C.1 INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO) PUBLICATIONS:

1. ICAO ANNEX 14, *INTERNATIONAL STANDARDS AND RECOMMENDED PRACTICES – AERODROMES (VOL. I – AERODROME DESIGN OPERATIONS)*, SECOND EDITION, ICAO, MONTREAL, CANADA, JULY 1995.
2. ICAO ANNEX 15. *WORLD GEODETIC SYSTEM-1984 (WGS-84), INTERNATIONAL STANDARDS AND RECOMMENDED PRACTICES, AERONAUTICAL INFORMATION SERVICES*, ANNEX 15 TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION, 10TH EDITION, JULY 1997.
3. ICAO 8400/5. *PROCEDURES FOR AIR NAVIGATION SERVICES ICAO ABBREVIATIONS AND CODES*. FIFTH EDITION- 1999.

## C.2 FEDERAL AVIATION ADMINISTRATION (FAA) PUBLICATIONS:

4. TITLE 14 OF THE CODE OF FEDERAL REGULATIONS (CFR) 29.1322, *WARNING, CAUTION, AND ADVISORY LIGHTS.*
5. TITLE 14 OF THE CODE OF FEDERAL REGULATIONS (CFR) 91, *GENERAL OPERATING AND FLIGHT RULES.*
6. TITLE 14 OF THE CODE OF FEDERAL REGULATIONS (CFR) 121, *OPERATING REQUIREMENTS: DOMESTIC, FLAG, AND SUPPLEMENTAL OPERATIONS.*
7. FAA ADVISORY CIRCULAR (AC) 25-11, *TRANSPORT CATEGORY AIRPLANE ELECTRONIC DISPLAY SYSTEMS AND DISPLAYS.*

## C.3 MILITARY PUBLICATIONS:

8. MILITARY STANDARD 1472D (1989*), HUMAN ENGINEERING DESIGN CRITERIA FOR MILITARY SYSTEMS, EQUIPMENT, AND FACILITIES.* WASHINGTON, DC: U.S. DEPARTMENT OF DEFENSE.
9. MILITARY SPECIFICATION MIL-L-85762A, *LIGHTING, AIRCRAFT, INTERIOR, NIGHT VISION IMAGING SYSTEM (NVIS) COMPATIBLE.*
10. DOD, *GPS STANDARD POSITIONING SERVICE PERFORMANCE STANDARD*, OCTOBER 2001.

## C.4 OTHER PUBLICATIONS:

11. ARINC 429 *DIGITAL INTERFACE TRANSFER SPECIFICATION.*

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# APPENDIX D WORKING GROUP REPORTS

Alternate Means Working Group Meeting
Federal Air Marshal Service Training Facility
Atlantic City, New Jersey
May 13, 2009

**Attendees:**
Chris Baur (CAL)
Pat Hempen (FAA)
Lowell Dimoff (FAMS)
Pat Hempen (FAA)
Kate Malone ALPA (CAL)
Ed Folsom (UAL)
Chuck Stewart (UAL)
Tim Manuge (ACPA)
Howard Taylor (APA)
Candace Kolander (AFA)
John Black (AFA)
Chad Smith (ALPA/DAL)
Mike Fredericks (ALPA)
Craig Foushee (Reliant Protection Group)
Rick Schiefelbein (Boeing)
Scott Graham (ALPA)
Anthony Minor (ACPA)
Mark Weiss (APA)
Bob Semprini (CAL)
FAMS support personnel and role players

A significant threat to flight crew and airborne law enforcement personnel responsible for preventing unauthorized access to the flight deck is posed by a team of highly-trained, potentially armed, athletic individuals intent on using deadly force to defeat all security measures preventing their ability to infiltrate the flight deck. Current intelligence indicates that the probability of such an attack is high enough to warrant evaluation of current procedures and equipment designed to thwart such an attack when the flight deck door is opened during normal flight operations, as well as proposed improvements to the same.

The purpose of this meeting was to:

- Quantify, through testing, the time required to close the flight deck door in response to a threat.

- Quantify, through testing, how much additional time each of the procedures currently in use in the aviation industry in the United States provide to close the flight deck door over the use of no additional procedures.

- Quantify, through testing, how much additional time each of the procedures currently in use in the international aviation industry and not currently employed in the United States to close the flight deck door provides over the use of no additional procedures.

- Identify new or additional procedures that are not currently in use that may be used to give the crew time to close the flight deck door before an attacker can reach it and attempt to quantify the time each provides for that purpose.

Testing was designed based on the following assumptions:

General Assumptions:

1) Due to the physical restrictions of the aircraft environment, scenarios and procedures can be adequately evaluated with two attackers.
2) Attacks initiated at attackers discretion. *This is the case with all attempts to breach existing security procedures and introduces the element of surprise to some extent.*
3) In a testing scenario, the element of surprise is reduced. (Something bad is going to happen and soon or we would not be in the simulator) We will attempt to mitigate and quantify this through the use of multiple role players. Role players will be briefed on their responsibilities and their skill set only. As far as practical, no group of role players will be subjected to the same scenario more than once. (ability to participate as role players is limited by liability constraints of the testing facility)
4) During each test, the flight deck door will be opened to 90 degrees from its closed position or the maximum physical limit, whichever is less. (either door limitations or the limit that the crewmember can maintain positive control of the door)
5) Evaluation by human factors experts of testing methodology, assumptions, both general and scenario specific, and the resulting data is essential to drawing valid conclusions.

Specific Procedures to be tested:

1) Time to close door:

   General assumptions:

   The door will be opened to 90 degrees from the closed position, the physical limit of the door, or as far as it can be opened with the crewmember maintaining direct control of the door, whichever is less. The reasoning behind this is that the only time the door is being opened is to allow a person to enter or leave the flight deck, or to pass meals or other items to or from the flight deck. The size of the door, food trays, people etc makes it necessary to open the door 90 degrees, to the limits of the door or crewmember control if it is less in most cases.

   Specific Tests:

   The "crewmember" in control of the door will close the door in response to an emergency command. Time will start when the panic command is initiated and end when the door is closed. There will be no actual attack occurring. The test will be divided into three sections.

- "Crewmember" is warned that a panic command is imminent, asked if they are ready and then the panic command will be issued.

- Panic command is issued during different scenarios that would cause the door to be opened. (person entering or leaving the flight deck, handing meals into or trays out of the flight deck etc.).

- "Crewmember" is unable to close the flight deck door as a result of an unexpected obstruction. "Crewmember" must evaluate and resolve the situation, then close the flight deck door (a jacket, towel or similar item on the floor in the door jam).

2) Baseline: How long does it take an attacker to reach the flight deck door from various positions in the cabin.
   a. Seated
   b. Standing
      i. No obstructions
      ii. No procedures in effect

3) It is safe to open the flight deck door in the opinion of the flight deck crew members? (ICAO annex 17)
   a. Viewing port in flight deck door
   b. Closed Circuit Television (CCTV)
      i. Scenario specific assumptions:
         1. No additional crewmembers required or utilized during door transition.
         2. Crewmember on the flight deck determines via available means (visual or via interphone) that it is safe to open the flight deck door.
         3. No "two person" rule
         4. If no one other than uniformed crewmembers are visible from the flight deck, it is safe to open the door.

4) Blocking Crew Member:
   a. Blocking crew member acts as a warning only, no attempt to interfere with attack.
   b. Blocking crew member attempts to thwart attack with basic flight attendant training.
   c. Blocking crew member attempts to thwart attack utilizing Crew Member Self Defense Training (CMSDT) techniques.
      i. Scenario specific assumptions:
         1. "Two person" rule in effect.

5) "Improvised secondary barrier" utilizing existing aircraft equipment (galley cart etc) with a blocking crew member.
   a. Blocking crew member acts as a warning only, no attempt to interfere with attack.
   b. Blocking crew member attempts to thwart attack with basic flight attendant training.
   c. Blocking crew member attempts to thwart attack utilizing Crew Member Self Defense Training (CMSDT) techniques.
   d. Scenario specific assumptions:
      i. "Two person" rule in effect.

6) Opaque barrier between cabin and flight deck door
   a. Curtain
   b. Privacy door
      i. Scenario Specific assumptions:
         1. No additional crewmembers required or utilized during door transition.
         2. Crewmember on the flight deck determines via available means (visual or via interphone) that it is safe to open the flight deck door.
         3. With and without the "two person" rule
         4. If no one other than uniformed crewmembers are visible from the flight deck, it is safe to open the door.

Upon arrival at the FAMS training facility, availability of equipment, personnel and an unexpected reduction in the time the aircraft were available placed restrictions on our ability to conduct the tests as planned. These restrictions included:

- Aircraft were available from 0900-1330
- 7 role players were available (ability to surprise role players and pacing tests to avoid fatigue)
  - 2 male "pilots"
  - 3 male "attackers"
  - 2 "flight attendants" (1 male, 1 female)
- Inability to construct a "privacy door" for testing
- Tests were video recorded, however, this video (and the video of the March 3, 2009 demonstrations at the FAMS Washington Field Office) is currently unavailable for analysis by the working group.

As far as possible tests were conducted as planned, when this was impossible tests were modified or omitted.

Tests were conducted onboard a Boeing 727 and a Lockheed L-1011. The Boeing 727 is a single aisle, narrow body aircraft on which the flight deck door opens into the flight deck. The Lockheed L-1011 is a two aisle, wide body aircraft on which the flight deck door opens into the cabin. Both aircraft were equipped with standard flight deck doors as opposed to the "fortress doors" now in use on the civil fleet. These doors are lighter than the "fortress doors". The tests were constructed so that the time ended when the attackers reached the door, as opposed to breaking it down or forcing it open to minimize the effect of this difference.

View of the 727 flight deck door from the cabin was unobstructed. The L-1011 had a bulkhead between the seating area of the cabin and the galley/flight deck door area. The bottom half of this bulkhead was opaque and the top half was translucent. This bulkhead partially or completely obscured direct view of the flight deck door, depending on one's position in the cabin seating area.

Timing:

- For the purpose of these tests, time was started when the attackers interacted with the "barrier" or procedure with the clear intent to defeat it and gain access to the flight deck. (i.e. lunging at the "flight attendant" started the time where as standing to open an overhead bin or asking to use the lav did not) Time stopped when the attackers reached the flight deck door, whether it was closed or not, or when the test was ended to prevent injury to the participants (two times out of 60 test runs).
- Time was recorded by two individuals observing the tests.
    - An active flight attendant
    - An active Federal Air Marshal

Role Player Briefing:

1. Pilot
    a. Open door when you feel it is safe to do so, maintain control of the door and be ready to close it in the event of an attack.

**Alternate Means Working Group**
**End of Year Summary 2009**

The December plenary meeting was cancelled. This gave us some breathing room, but we need to catch up and be prepared to offer some recommendations for the March meeting. I have prepared a general summary of our work to date. The rankings are mine, set in jell-o and subject to your input.

**What We Know:**

- The threat is a team (2 or more)of highly-trained, potentially armed, athletic individuals, intent on using deadly force to defeat all security measures preventing their ability to infiltrate the flight deck. Procedures designed to mitigate this threat will ensure the security of the flight deck in incidents involving mentally ill, belligerent or inebriated individuals.
- Average time required to close and secure flight deck door in response to an emergency command during crew and meal exchanges in a testing environment.
- Average velocity of an individual rushing the flight deck.
- Effectiveness of the "alternate means", *as tested*, was unsatisfactory and require further enhancement to raise effectiveness to an acceptable level.

**What We Think We Know:**

- Procedures should provide for two (2) seconds, in addition to the time required to close the flight deck door in a testing environment, to allow an average crew on an average day to successfully close and secure the flight deck door in the event of an attack. The two (2) seconds comes from FAA requirements for converting accelerate/stop testing data into real world requirements and is a starting point. We need more information to justify validating, decreasing, or increasing it.

- If you can defeat an attack by two people, you can be reasonably assured of defeating an attack by more than two people based on aircraft layout.

**What We Don't Know:**

- Enhancements that would bring "alternate means" effectiveness to an acceptable level. Some thoughts are:
  - Required defensive tactics and mind set training. How much to be effective?
  - Require immediate emergency command if any passenger starts to stand up during flight deck door transition. (May be problematic as most test scenarios started with attackers seated.) Additional testing of this concept may be in order.
- Other procedures or combinations we have not thought of or tried yet.

**In Progress:**

- John Black has reached out to several universities for assistance in determining what the reaction time buffer should be.
- SC221's FDO (Pat Hempen) and I are planning a visit the FAA Technical Center in Atlantic City NJ in an attempt to obtain data to refute, modify or validate the 2 second reaction time assumption, and gather ideas to enhance alternate means procedures.

**Moving Forward:**

Prior to February 15th we need to:

- Obtain the data necessary to make a firm recommendation of the reaction time to add to the time required to close and secure the flight deck door we have identified in testing.
- Identify any enhancements to current procedures (as tested to date) that will bring their effectiveness to satisfactory levels, as well as how to test them so they can be included in our report.
- Identify potential procedures that we have not evaluated yet.

Your input is vital to the successful completion of our working group's efforts. The most difficult task I see is determining what additional procedures or enhancements to existing "alternate means" procedures that will be effective.

## October 2010
## Toronto International Airport

On October 14, 2010, Air Canada hosted RTCA SC-221 Co Chair Ed Folsom and RTCA SC-221 Alternate Means Working Group Chair Scott Graham at Toronto International Airport. They provided a Boeing 777-200 with a closed circuit video system and curtain for evaluation. This meeting was made possible as a result of the efforts of Air Canada Captain Tim Manuge and American Airlines Captain Bill Crooks. Assisting Captain Manuge with the logistics of getting us access to the aircraft was Air Canada Regional Security and Investigations Manager, Neil Armstrong. Assisting with systems operations and proper employment of the technology were Air Canada 777 Standards Pilot JP Floyd and Air Canada Toronto Chief Pilot Captain Dennis Guay. All of these gentlemen went out of their way to ensure all went smoothly and to answer any and all questions. Our appreciation of their efforts and cooperation cannot be overstated.

The CCTV system on the Air Canada 777-200/300 consists of multiple cameras. The system for displaying the area outside the flight deck door consists of three cameras with an over locking field of view and low light capability.

**Camera Locations**

The output is viewed on screens to the left of the Captain's knee and right of the First Officer's knee. The screen consists of a main window that displays one of three views that can be selected by the pilot. Below the main window are three smaller images from all three cameras. By touching any of the smaller images, it is selected to the larger main window.

**Curtains:**

Curtains are mounted to the ceiling, are not attached to the sides and don't reach the floor. They are not opaque, but translucent and blocked approximately 75% of the light passing through it with significant amounts of light and ability to see around it.

As a backup, in case the CCTV system fails, the flight deck door is equipped with a viewing port. This viewing port provides an alternate means of identifying the person requesting access to the flight deck under optimum lighting conditions. The viewing port also provides an increased field of view of one part of the cabin, but with significant blind spots when compared to the CCTV system. In less than optimal conditions, its usefulness is severely degraded. In the pictures below, all that was done to change from optimal to less than optimal was turn off the overhead light just outside the flight deck.

Previous testing has established the speed at which a physically fit individual can run in the cabin of an aircraft. This was confirmed on October 14, 2010 by two 52 year old males onboard this 777-200. Therefore any physically fit individual seated in any seat depicted below (within 26 feet of the flight deck door) can reach the flight deck door before it can be closed unless there is some procedure/equipment employed to impede their progress.

**Opinions and Conclusions:**

As a result of this evaluation and previous data available, the following conclusions have been reached.

1. A CCTV system, as evaluated, provides enhanced visibility and situational awareness to the flight deck crew of the area within 11 feet of the flight deck door.
2. A CCTV system, as evaluated, allows for positive identification of the person requesting access to the flight deck in less than optimal lighting.
3. The flight deck door viewing port allows the crewmember to see further into the cabin, down the left aisle only, under optimal lighting conditions, than a CCTV system.
4. The ability to positively identify an individual through the peephole is adversely affected when lighting conditions are even slightly less than optimal.
5. The partially opaque curtains an evaluated does not prevent the attacker from determining when the flight deck door is opened. They do, however, reduce the crew member's situational awareness as well as time to recognize and respond to a threat.
6. Additional procedures and/or equipment are required to impede an attacker. The camera system alone is not sufficient.

Short Report on Cockpit Door Task

David W. Eccles,
Florida State University
And
Melissa M. Murray,
University of Southern Mississippi

Prepared for Scott M. Graham,
UALMEC Security Chairman
2.23.2010

Dear Scott,
My goal here is to do two things. First, it is to provide you with concepts and findings from the psychological sciences concerned with vigilance and reaction time that I believe relate to the door task you describe. Second, it is to provide some ideas for how to reduce complacency, increase vigilance, and reduce reaction time in relation to an attempts to breach the door.

**Vigilance decrement**

The main finding from vigilance research is that vigilance declines over time spent monitoring, known as the vigilance decrement. In a classic study, Mackworth showed that individuals monitoring displays for important signals (such as the hand of a laboratory „clock‟ making small but detectable jumps) suffered performance losses after only 30 minutes of monitoring. The accuracy of their signal detection declined by 10-15% within this period and then showed a more gradual decline over the remainder of the watch period. Other researchers have shown vigilance decrements within the first 15 minutes of a watch, with experienced as well as novice "watchkeepers", and in real operational settings, such as sonar detection and radar display monitoring, as well as in the laboratory.
See Warm et al. (2008). Vigilance requires hard work and is stressful. *Human Factors, 50,* 3, 433-441.

**Reaction time**

The lower bound for simple human reaction time (RT) is 220ms (just over a quarter of a second). This lower bound is found for what is termed an unanticipated stimulus: subjects *do* expect the onset of a stimulus (e.g., a light coming on) but *do not* know exactly when it will come on within a few minute period. Their job is to respond (e.g., by pressing a button they have their finger on) as soon as the stimulus is presented. Thus, the 220ms statistic does not include any movement time to place the finger on the button, which might well be different from your scenario in which the individual might need to move into a position to *begin* to close the door (e.g., move to the door; get a hand into contact with the door handle). Then you would presumably need to add time to actually close the door. Obviously, I can't tell you how long this would take.

See pages 31-34 of chapter 2 of Schmidt, R. A., & Lee, T., D. (2005). *Motor control and learning: A behavioral emphasis* (4th ed.). Champaign, IL: Human Kinetics.

**Effects on reaction time of concurrent tasks**

When individuals are involved in tasks (e.g., thinking about the baked goods being prepared, to use your example) other than the main task of concern (i.e., closing the door), their RT is slower. A recent study has shown the effect of listening to, and thinking about auditory information (e.g., a recorded message) while visually scanning a scene for important changes (in this case a simulated driving task but compare this with scanning the cabin for sudden movements). In a no- listening condition, individuals reacted on average in around 600ms but in a listening condition RT slowed to around 730ms. Note that the task required more than just detecting the presence of clear stimulus such as a light; it involved scanning a scene to pick up information, which took time. This is why RT was 660ms not 220ms, even without the additional task of listening. But the important point was that when listening was added, RT slowed by nearly 100ms. Presumably, if more concurrent tasks were added, RT would slow again.

See Richard et al. (2002). Effect of a concurrent auditory task on visual search performance in a driving-related image-flicker task. *Human Factors, 44,* 1, 108-119.

Thus, it is impossible for me to give you a definite time that you should build in to allow crew to respond to an attempt to breach the door. If a crew member is standing at the door with their hand on the door and attending in the direction of the passengers so that a sudden rush at the door by a passenger would be detected almost instantly, I think you are safe with 1 second as a maximum reaction time; that is, the time required for the crew member to identify the stimulus (i.e., the rush by a passenger), select the appropriate response, and begin to move. But note that this is only to begin the movement: you will need to add in the movement time required to actually shut the door and secure it. But if the crew member was not attending, then RT will vary dramatically but would certainly be upward of 1 second; perhaps over 2 seconds, in line with the FAA finding you told me about. And if the crew member was not standing at the door with their hand on it, then as I said above, you would need to add in the movement time required to get to the door and shut it, in addition to any RT to the initial passenger-movement stimulus.

**Possible strategies for reducing complacency, increasing vigilance, and reducing RT in relation to an attempted door breach**

In the door scenario, we might consider that the optimal mental state for each member of flight crew might involve a general mindset that there exists a continual threat of attempts to breach the cockpit door. It would also include a sustained level of arousal and alertness in relation to threats from passengers towards the door when it is opened.

For me, it is useful to consider how “psychological strategies” might help the flight crew achieve and maintain such a state. In general, such strategies can encompass a variety of cognitive components (such as self-talk; for example, speaking to oneself internally to help enhance readiness) and behavioral components (e.g., such as purposefully „standing tall‟ to enhance arousal). There has been considerable research on the use of such strategies, especially in sports, with generally favorable and consistent results.

In thinking about how these strategies might help crew members achieve an optimal mental state for the cockpit door task, I believe that, whatever the strategies used, the strategies need to be short, simple, easy to train, and easy to learn, remember, and recall. Following are two such strategies, the first of which is aimed at reducing complacency about attacks in general and the second preparing the crew member for the task of opening the door specifically.

**Reducing general complacency through the adoption of a simple verbal mantra:**

To help the flight crew attain a mindset of “continual threats”, I recommend that the flight crew adopt a routine of saying to themselves and each other “Is this the flight?”. To elaborate, this “mantra” is aimed at promoting the thought, in the here and now, that this could be the very flight upon which the next attack will occur.

**A focusing routine for use immediately prior to door opening:**

To help the flight crew obtain a heightened level of arousal and alertness in relation to threats to the door each time it is opened, I recommend that flight crew adopt a routine wherein they stop all other tasks immediately, however important these tasks may be perceived, and focus attention only on the door task.

In addition, I recommend that a "break" is imposed on a crew member's actions and thoughts (including distractions) that simultaneously provides direction in terms of attention to pertinent information, such as the passengers. To effect this break, the crew member first positions themselves ready to open the door, then turns to face the passengers and scans the passengers while quietly counting out "1, 2, 3, 4, 5" at 1 per second. Then, if the view is clear of threats, the member quietly says, "clear", and then begins to open the door while quietly saying "open". The five second break forces the crew member to slow down, which should help disrupt their busyness and the distractions that go with it, and constrains them to focus on task relevant information. This approach should include a policy that the door cannot be opened until the entire 5 second routine can be completed. For instance, if interrupted at 3 seconds, the crew member should not start back where he/she was at 3 after the interruption has been dealt with.

Eccles, D. W., & Feltovich, P. J. (2008). Implications of domain-general "psychological support skills" for the transfer of skill and the acquisition of expertise. *Performance Improvement Quarterly, 21,* 43-60.

To this point I've dealt with strategies "in" the person, but not out in the environment to help the person. So, it would also be worth considering some sort of visual cue in the environment to remind the attendant of the importance of opening the door. For example, when we see a skull and cross bones on a cleaning product, we are more careful with it because it is a visual reminder of the danger. I am not sure what the image might be, but a notice or sticker on or next to the door may be a trigger that reminds the attendant that an open door presents more danger, and that they should be aware of their surroundings and use the count-and-check routine described above. An excellent and digestible text concerning such notices – as recommended by folks formerly influential at Apple in their interface design labs – is as follows.

Lidwell, W., Holden, K., & Butler, J. (2003). *Universal principles of design*. Rockport Publishers.

At a more organizational level, the use of this strategy would be facilitated by the adoption within the crew of a policy that the door task is the only task required of the crew, and, furthermore, the only job that exists within their job remit, when the door needs to be opened. The policy should state that it is not only permissible to cease all other tasks when the door is to be opened but mandatory. It will obviously help if the policy is discussed explicitly and its understanding is fully shared by the crew members. Also helpful would be to make clear that this policy is not related to any current national threat level; it is standard practice regardless of the nation's threat level.

Finally, is it possible to mandate that the cockpit door is not allowed to be opened until the fasten seatbelt sign is on and all passengers are seated. In my experience, the crew seems to be very successful in terms of vigilance when the seatbelt light is on; if anyone stands up, they are usually quickly and firmly told to sit down. I know that remaining seated was mandatory during the last 30 minutes of flying to Washington Reagan at one time (and perhaps still is) so would it be practicable to use this strategy when opening the cockpit door?

**Alternate Means Working Group – Supplemental Information**

The Alternate Means Working Group met on several occasions to test multiple scenarios relevant to the current practices and procedures utilized at different airlines specific to the opening and closing of the flight deck door. The following background information was used to develop the testing methods and scenarios used to capture timed data for the final report.

One of the first factors reviewed was the staffing requirement for flight attendants relevant to commercial operations. Flight attendant staffing is determined in part by the number of passenger seats onboard an aircraft (14 CFR 121.391). The number of flight attendant staffing varies from single flight attendant operations to multiple flight attendant operations. Therefore for any door transition the group decided to look at the lowest number staffing number as one of the baseline tests. This meant that some scenarios would be tested with a single flight attendant protecting the flight deck door during transition. In situations where more than one flight attendant was part of the minimum crew the information gathered below reflected that usually the highest number of flight attendants present for door transition was usually two even if the flight attendant minimum crew was more than two.

It was therefore determined that the scenarios would use a single flight attendant or two flight attendants to protect the flight deck during door transition. Relevant to the number of attackers, the working group determined that the various attack scenarios would include single, two, or three attackers.

Working group members thought that there were only a few methods being utilized by flight attendants to protect the flight deck during door transitions. In order to support the working group's assumption the Association of Flight Attendants-Communication Workers of America (AFA) sent out an email questionnaire to the AFA member airlines' safety committee representatives. The various methods documented would then be used to help determine the baseline methods to test the various scenarios of attack. Representatives from nine airlines responded. They represent carriers that conduct single flight attendant domestic operations to multi flight attendant international operations. Therefore equipment available also varied.

**AFA asked the flight attendant safety representatives to answer the following questions:**

- *Do you use a service cart or any other type of physical device to block the aisle during cockpit door transitions?*
- *If you use a service cart to block the aisle, are you required to remain with the cart or can you step away from the cart? (as long as you maintain the FAA's expectation of attendance).*
- *Do you stand in front of the cart or behind it?*
- *If you do not use a cart or physical device to block the aisle, do you post a monitoring Flight Attendant in the secure area to scan for suspicious behavior while the door is in transition?*
- *If a potential threat is detected while the cockpit door is in transition, are Flight Attendants at your carrier instructed to verbalize any type of specific command or code word to signal that the open cockpit door should be closed immediately?*
- *Finally, and this is important, how many Flight Attendants are required to accomplish your carrier's access procedures?*

Responses to the questions above are considered sensitive information (SSI), which can requested by contacting the FAA's Flight Standards Office (AFS-007).

**Using the responses above the working group determined that the:**

a. Operational suitability**.** System design must accommodate the need for:

   i. both flight deck and cabin crew to communicate and coordinate the sequencing of the flight deck door for authorized ingress/ egress purposes;
   ii. affirming that flight deck ingress/ egress can be effected within established vulnerability periods;
   iii. alerting flight deck and cabin crews of the fact that established vulnerability periods are about to be exceeded;
   iv. short-circuiting mechanisms and procedures associated with access to or from the flight deck in the event of an emergency situation…(EGRESS);
   v. the development of alternative "Minimum Equipment List (MEL)" measures in the event that the system fails or is rendered unserviceable; and
   vi. augmenting aircrew and Federal Air Marshal situational awareness regards flight deck door transition operations.

b. Workload**.** System design must accommodate the need for:

   i. the timely and effective conduct of flight-related tasks and procedures associated with flight and cabin crew duties; and
   ii. the retention of required situational awareness by Federal Air Marshals (FAMS) or equivalent.

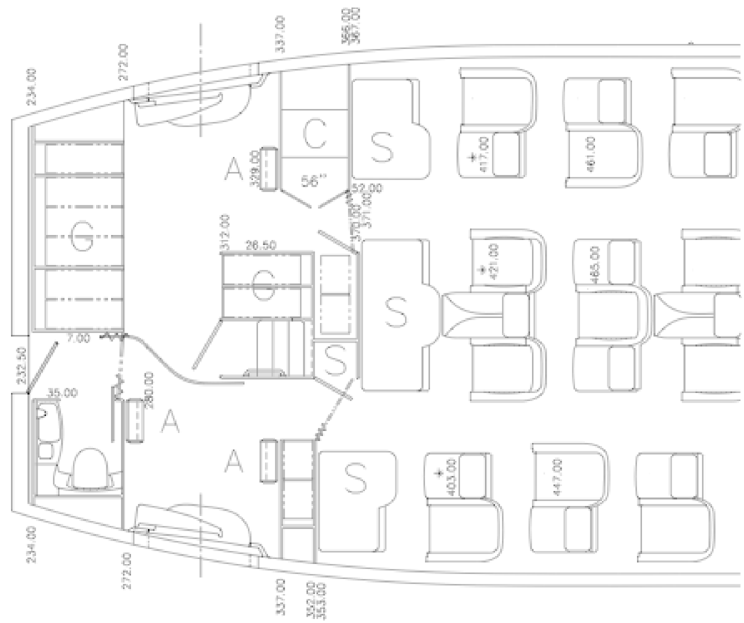
c. Usability. System design must accommodate the need for:

   i. operation by FAMS in an intuitive fashion;
   ii. the minimization of related air and security crew training;
   iii. FAMS engage and de feat threats attempting to breach the flight deck environment; and

The intuitive deployment and stowing of related Secondary Barrier System equipment by FAMS in a timely fashion. The stowing of such equipment must exceed established vulnerability time periods.

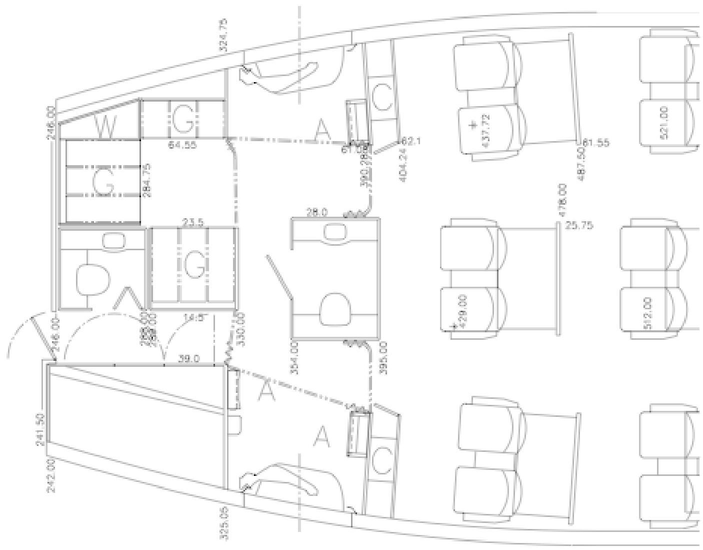
**APPENDIX E SELECTED FLIGHT DECK/FORWARD CABIN LAYOUTS**

# 787-8
## *Arrangement A*



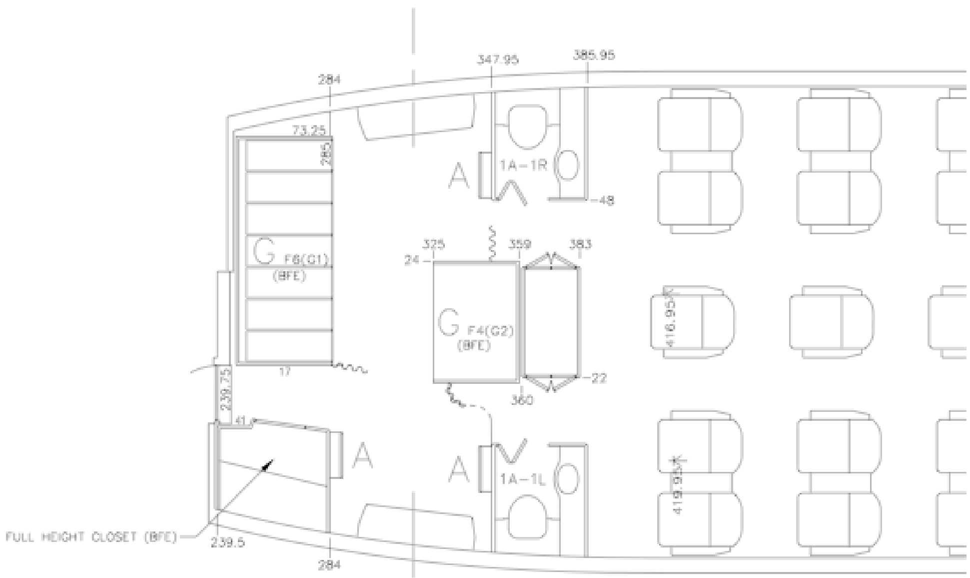

787-SECT41-A
03-12-10

# 777-200
## *Arrangement C*



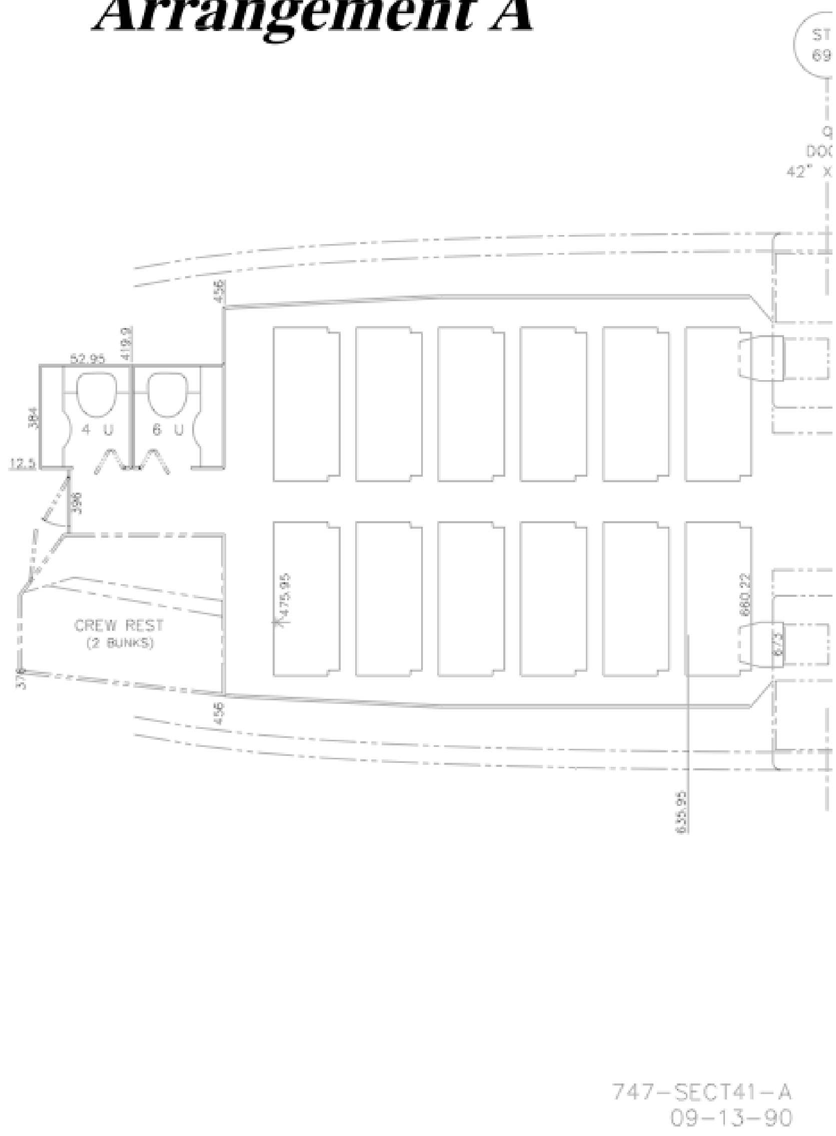
777–SECT41–C
04–08–98

# 767-400
## *Arrangement A*




767-SECT41-A
07-30-01

# 747-400
## *Arrangement A*



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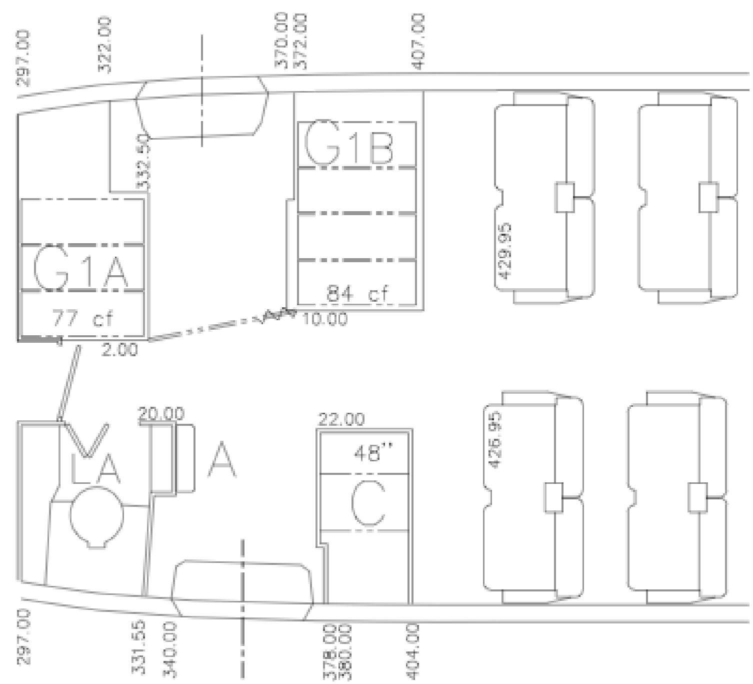
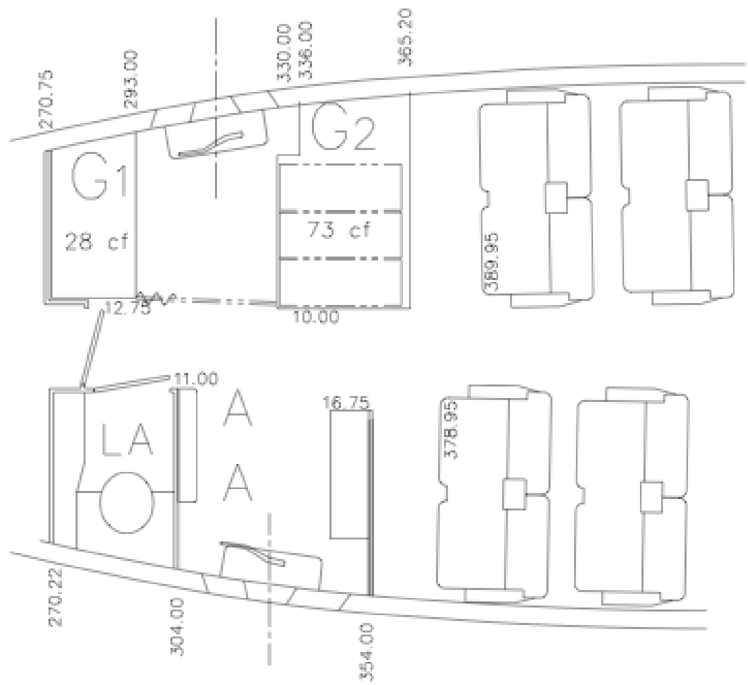



reference: LOPA-5720-2810 (AAL) NT731-NT742

57md218
05/12/10

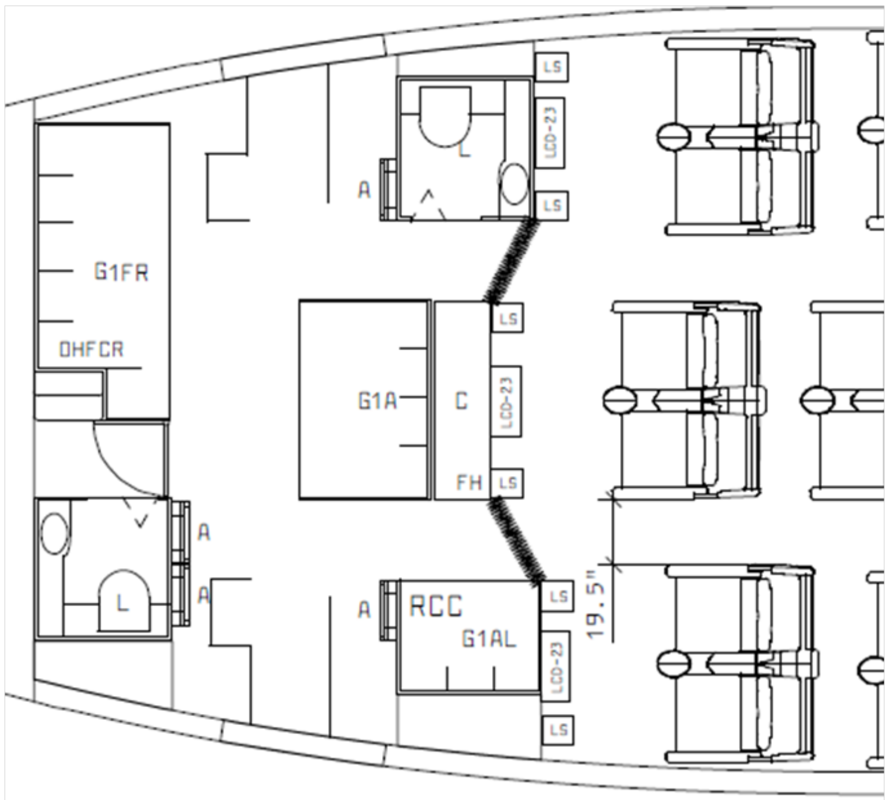
# 737-700
## *Arrangement C*




reference: LOPA-377-0539 (ASA) YA841-YA847

37md1137
05/05/10

# A350



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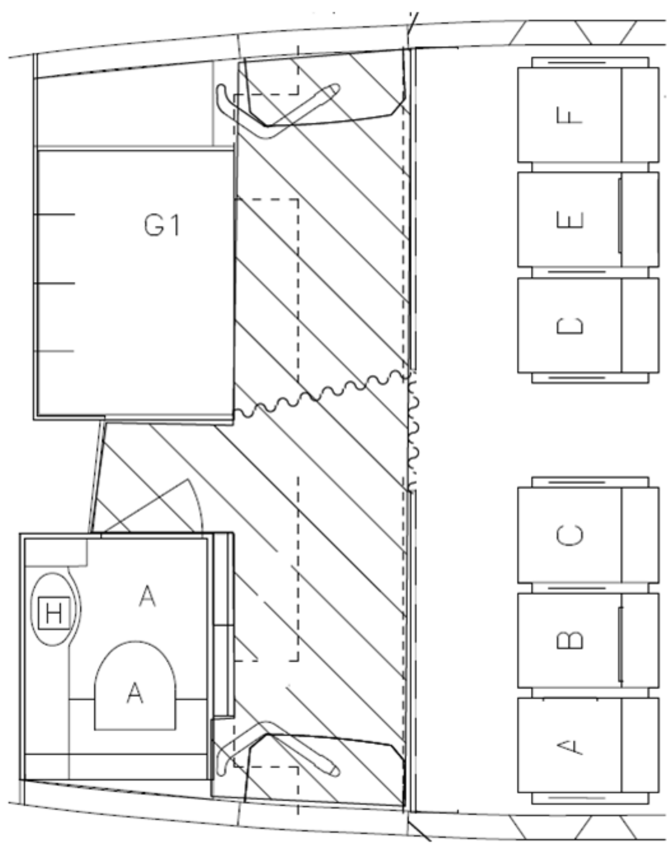
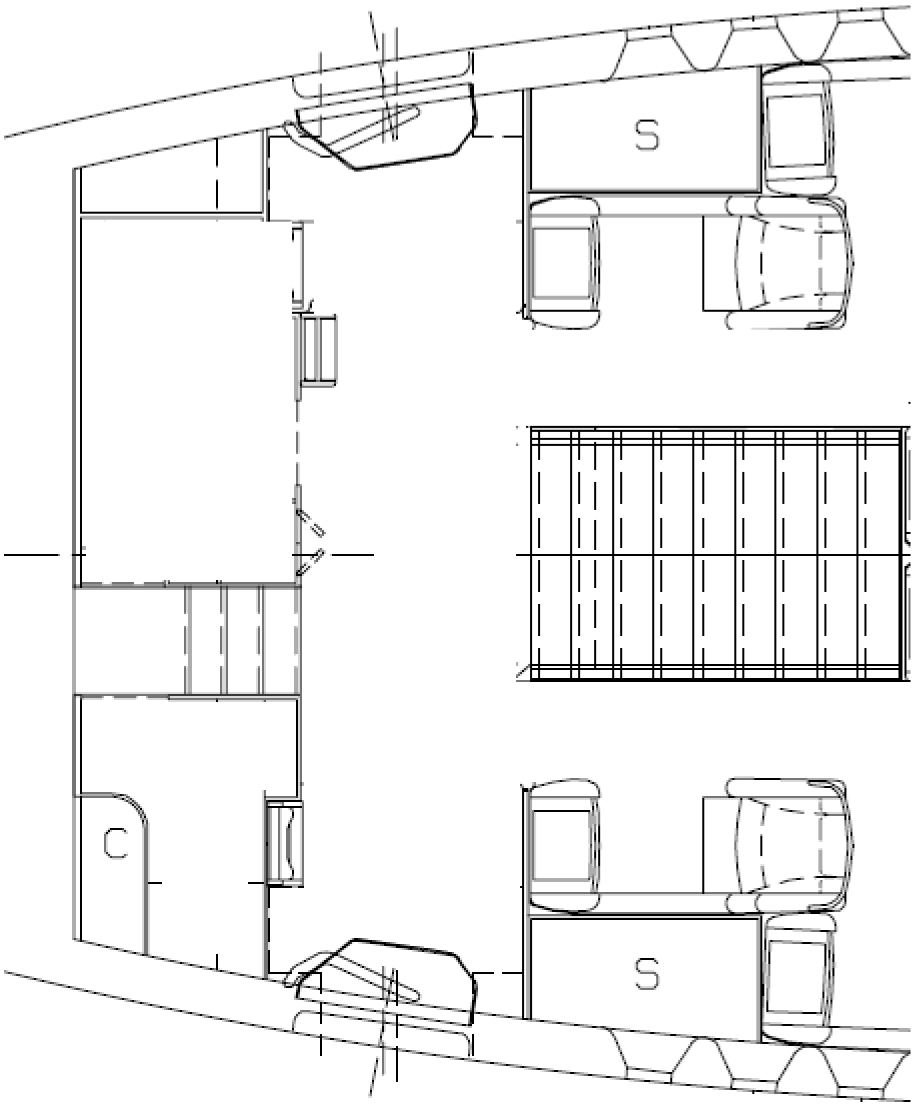
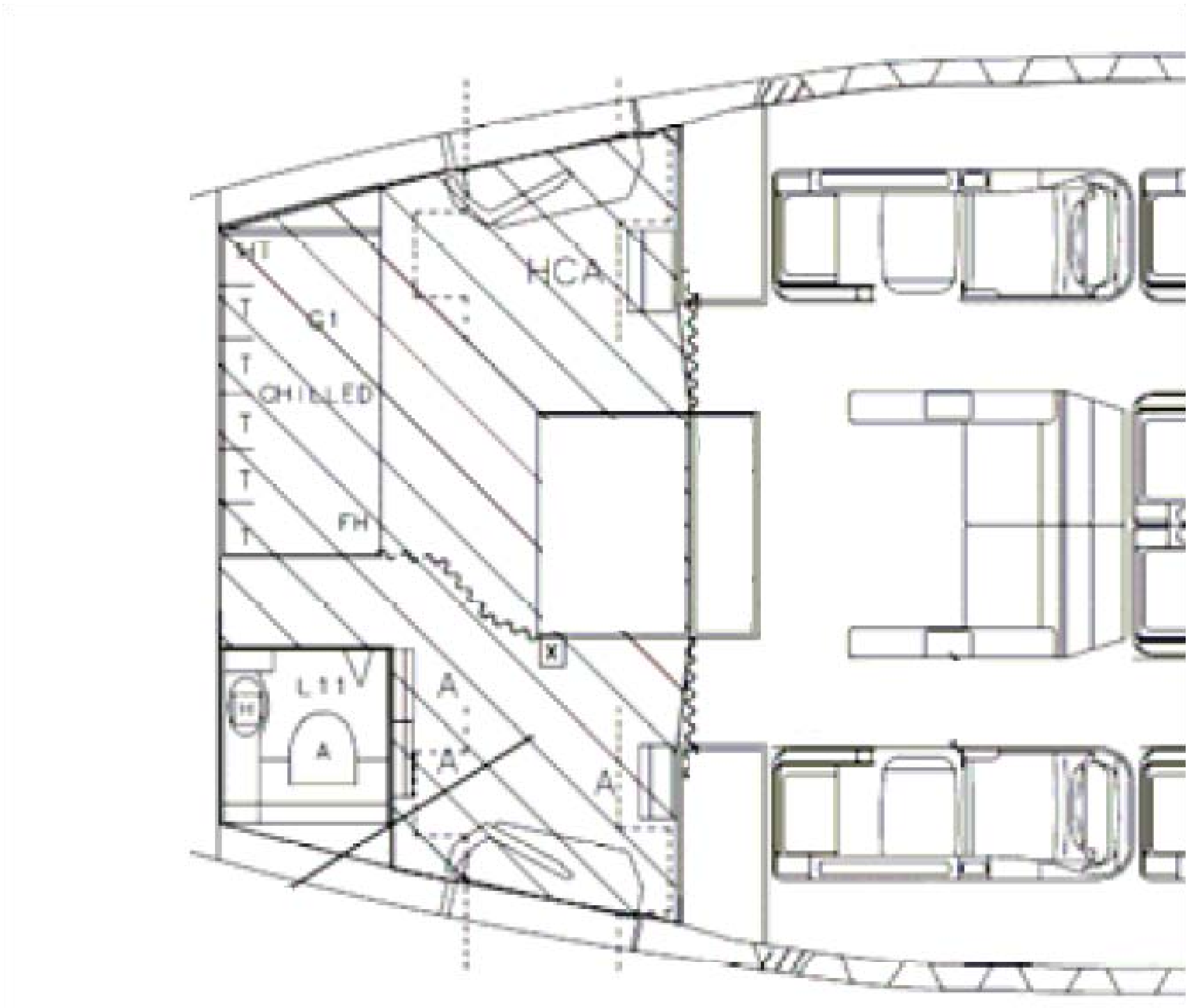


# A380



# A330/A340



**APPENDIX F DIAGRAMS OF SAMPLING OF IPSBs**


A707

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# APPENDIX G INGRESS/EGRESS PROCEDURAL FLOW CHARTS

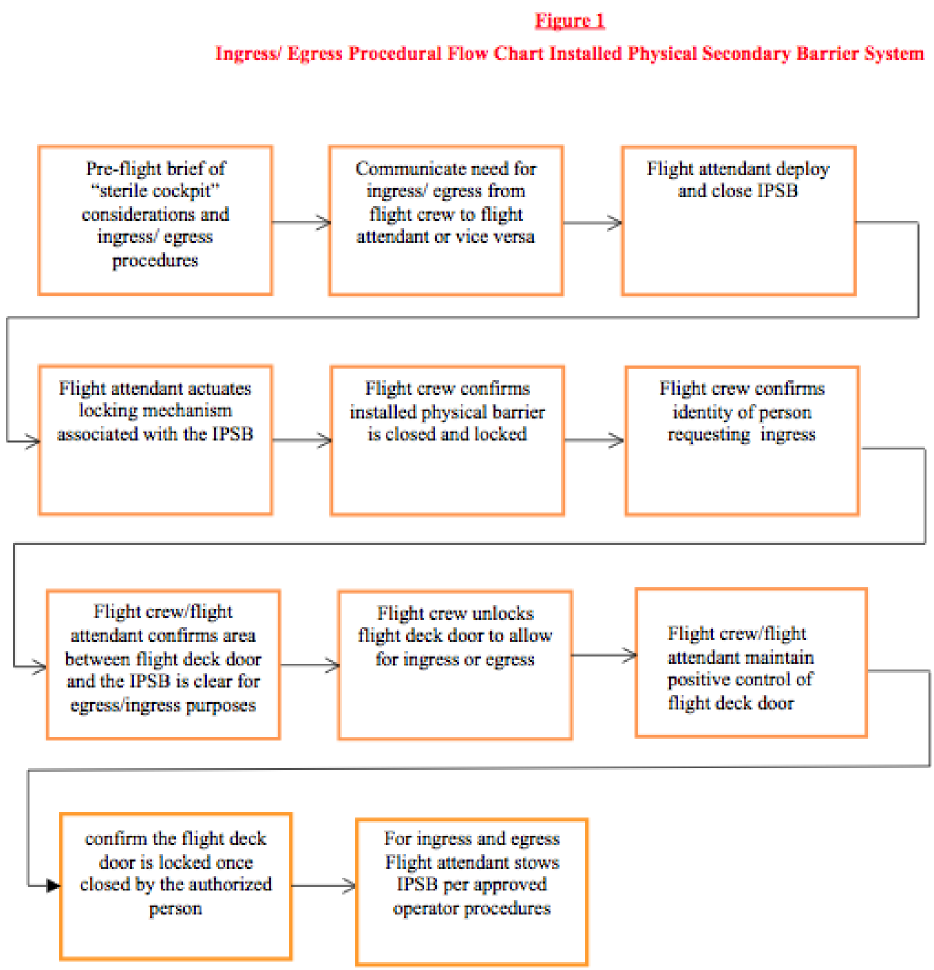
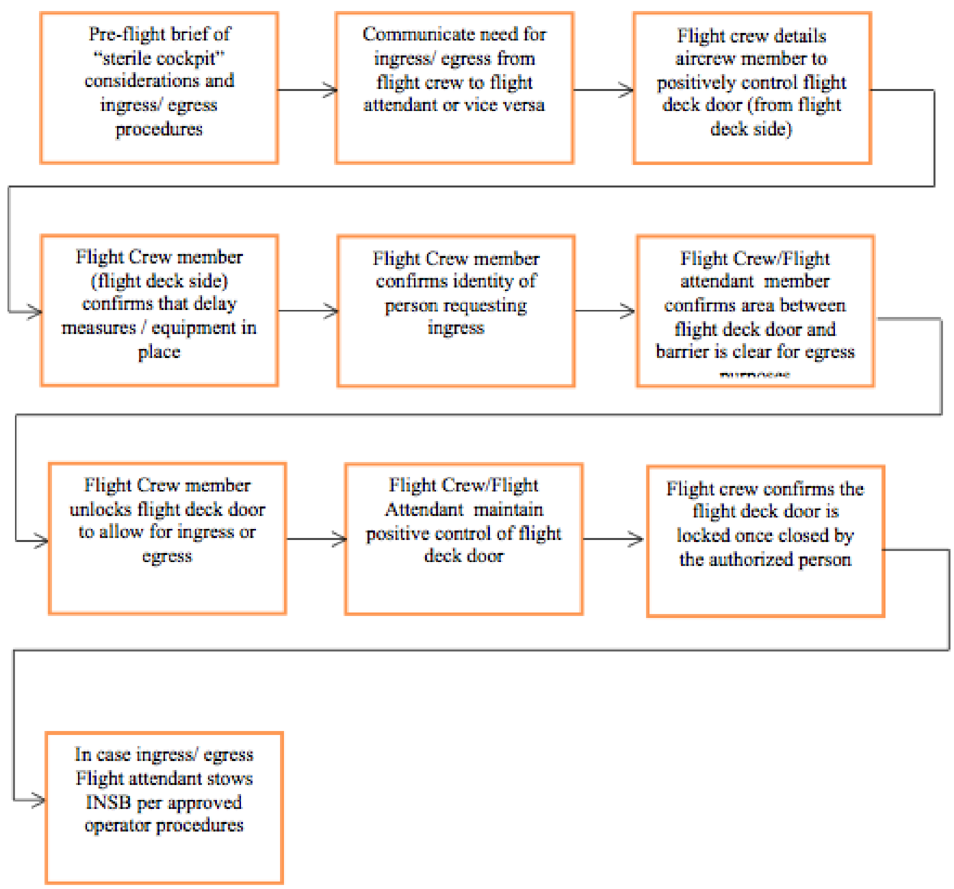



**Figure G-1** **Ingress/Egress Procedural Flow Chart Installed Physical Secondary Barrier System**

**Figure 2**

**Ingress/ Egress Procedural Flow Chart – Improvised Non-installed Secondary Barrier system (INSB) and human barrier system**




**<u>Figure G-2</u> Ingress/Egress Procedural Flow Chart – Improvised Non-installed Secondary Barrier System (INSB) and Human Secondary Barrier**

# APPENDIX H CODE OF FEDERAL REGULATIONS

## H.1 Sec. 121.584

http://rgl.faa.gov/Regulatory_and_Guidance_Library/rg14CFR.nsf/0/a68ca739741a49a08625733800554ac2!OpenDocument

[Requirement to view the area outside the flight deck door.]

[From the time the airplane moves in order to initiate a flight segment through the end of that flight segment, no person may unlock or open the flight deck door unless:

(a) A person authorized to be on the flight deck uses an approved audio procedure and an approved visual device to verify that:

(1) The area outside the flight deck door is secure, and;

(2) If someone outside the flight deck is seeking to have the flight deck door opened, that person is not under duress, and;

(b) After the requirements of paragraph (a) of this section have been satisfactorily accomplished, the crewmember in charge on the flight deck authorizes the door to be unlocked and open.]

Amdt. 121-334, Eff. 10/15/07

## H.2 Sec. 121.587

http://rgl.faa.gov/Regulatory_and_Guidance_Library/rg14CFR.nsf/0/9ed2d8079c21577786256b420072fdef!OpenDocument

Closing and locking of flight crew compartment door.

[(a) Except as provided in paragraph (b) of this section, a pilot in command of an airplane that has a lockable flight crew compartment door in accordance with Sec. 121.313 and that is carrying passengers shall ensure that the door separating the flight crew compartment from the passenger compartment is closed and locked at all times when the aircraft is being operated.

(b) The provisions of paragraph (a) of this section do not apply at any time when it is necessary to permit access and egress by persons authorized in accordance with 14 CFR Part 121.547 and provided the 14 CFR Part 119 operator complies with FAA approved procedures regarding the opening, closing and locking of the flight deck doors.]

Amdt. 121-300, Eff. 1/15/2002

## H.3 Sec. 121.313

http://rgl.faa.gov/Regulatory_and_Guidance_Library/rg14
CFR.nsf/0/8c5c318d8ff947768625733800554a77!OpenDocument

Miscellaneous equipment.

No person may conduct any operation unless the following equipment is installed in the airplane:

(a) If protective fuses are installed on an airplane, the number of spare fuses approved for that airplane and appropriately described in the certificate holder's manual.

(b) A windshield wiper or equivalent for each pilot station.

(c) A power supply and distribution system that meets the requirements of Secs. 25.1309, 25.1331, 25.1351(a) and (b)(1) through (4), 25.1353, 25.1355, and 25.1431(b) or that is able to produce and distribute the load for the required instruments and equipment, with use of an external power supply if any one power source or component of the power distribution system fails. The use of common elements in the system may be approved if the Administrator finds that they are designed to be reasonably protected against malfunctioning. Engine-driven sources of energy, when used, must be on separate engines.

(d) A means for indicating the adequacy of the power being supplied to required flight instruments.

(e) Two independent static pressure systems, vented to the outside atmospheric pressure so that they will be least affected by air flow variation or moisture or other foreign matter, and installed so as to be airtight except for the vent. When a means is provided for transferring an instrument from its primary operating system to an alternate system, the means must include a positive positioning control and must be marked to indicate clearly which system is being used.

(f) A door between the passenger and pilot compartments (i.e., flight deck door), with a locking means to prevent passengers from opening it without the pilot's permission, except that non-transport category airplanes certificated after December 31, 1964, are not required to comply with this paragraph. For airplanes equipped with a crew rest area having separate entries from the flight deck and the passenger compartment, a door with such a locking means must be provided between the crew rest area and the passenger compartment.

(g) A key for each door that separates a passenger compartment from another compartment that has emergency exit provisions. Except for flight deck doors, a key must be readily available for each crewmember. Except as provided below, no person other than a person who is assigned to perform duty on the flight deck may have a key to the flight deck door. Before April 22, 2003, any crewmember may have a key to the flight deck door but only if the flight deck door has an internal flight deck locking device installed, operative, and in use. Such “internal flight deck locking device” has to be designed so that it can only be unlocked from inside the flight deck.
(h) A placard on each door that is the means of access to a required passenger emergency exit, to indicate that it must be open during takeoff and landing.

(i) A means for the crew, in an emergency to unlock each door that leads to a compartment that is normally accessible to passengers and that can be locked by passengers.

(j) After April 9, 2003, for airplanes required by paragraph (f) of this section to have a door between the passenger and pilot or crew rest compartments, and for transport category, all-cargo airplanes that have a door installed between the pilot compartment and any other occupied compartment on January 15, 2002;

1) After April 9, 2003, for airplanes required by paragraph (f) of this section to have a door between the passenger and pilot or crew rest compartments,

a) Each such door must meet the requirements of Sec. 25.795(a)(1) and (2) in effect on January 15, 2002; and

b) Each operator must establish methods to enable a flight attendant to enter the pilot compartment in the event that a flight crew member becomes incapacitated. Any associated signal or confirmation system must be operable by each flight crew member from that flight crew member's duty station.

2) After October 1, 2003, for transport category, all-cargo airplanes that had a door installed between the pilot compartment and any other occupied compartment on or after January 15, 2002, each such door must meet the requirements of Sec. 25.795(a)(1) and (2) in effect on January 15, 2002; or the operator must implement a security program approved by the Transportation Security Administration (TSA) for the operation of all airplanes in that operator's fleet.

[(k) Except for all-cargo operations as defined in Sec. 119.3 of this chapter, for all passenger-carrying airplanes that require a lockable flight deck door in accordance with paragraph (f) of this section, a means to monitor from the flight deck side of the door the area outside the flight deck door to identify persons requesting entry and to detect suspicious behavior and potential threats.]

Amdt. 121-334, Eff. 10/15/07

## H.4 Sec. 121.547

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CFR.nsf/0/e0b0f5b9d1eb3c6b86256d6300720d76!OpenDocument&ExpandSection=-3

Admission to flight deck.

a) No person may admit any person to the flight deck of an aircraft unless the person being admitted is--

(1) A crewmember;

[(2) An FAA air carrier inspector, a DOD commercial air carrier evaluator, or an authorized representative of the National Transportation Safety Board, who is performing official duties;]

(3) Any person who--

i. Has permission of the pilot in command, an appropriate management official of the 14 CFR Part 119 certificate holder, and the Administrator; and

ii. Is an employee of--

(A) The United States, or

(B) A 14 CFR Part 119 certificate holder and whose duties are such that admission to the flight deck is necessary or advantageous for safe operation; or

(C) An aeronautical enterprise certificated by the Administrator and whose duties are such that admission to the flight deck is necessary or advantageous for safe operation.

(4) Any person who has the permission of the pilot in command, an appropriate management official of the 14 CFR Part 119 certificate holder and the Administrator. Paragraph (a)(2) of this section does not limit the emergency authority of the pilot in command to exclude any person from the flight deck in the interests of safety.

Paragraph (a)(2) of this section does not limit the emergency authority of the pilot in command to exclude any person from the flight deck in the interests of safety.

b) For the purposes of paragraph (a)(3) of this section, employees of the United States who deal responsibly with matters relating to safety and employees of the certificate holder whose efficiency would be increased by familiarity with flight conditions, may be admitted by the certificate holder. However, the certificate holder may not admit employees of traffic, sales, or other departments that are not directly related to flight operations, unless they are eligible under paragraph (a)(4) of this section.

c) No person may admit any person to the flight deck unless there is a seat available for his use in the passenger compartment, except--

[(1) An FAA air carrier inspector, a DOD commercial air carrier evaluator, or authorized representative of the Administrator or National Transportation Safety Board who is checking or observing flight operations;]

(2) An air traffic controller who is authorized by the Administrator to observe ATC procedures;

(3) A certificated airman employed by the certificate holder whose duties require an airman certificate;

(4) A certificated airman employed by another 14 CFR Part 119 certificate holder whose duties with that 14 CFR Part 119 certificate holder require an airman certificate and who is authorized by the 14 CFR Part 119 certificate holder operating the aircraft to make specific trips over a route;

(5) An employee of the 14 CFR Part 119 certificate holder operating the aircraft whose duty is directly related to the conduct or planning of flight operations or the in-flight monitoring of aircraft equipment or operating procedures, if his presence on the flight deck is necessary to perform his duties and he has been authorized in writing by a responsible supervisor, listed in the Operations Manual as having that authority; and

(6) A technical representative of the manufacturer of the aircraft or its components whose duties are directly related to the in-flight monitoring of aircraft equipment or operating procedures, if his presence on the flight deck is necessary to perform his duties and he has been authorized in writing by the Administrator and by a responsible supervisor of the operations department of the 14 CFR Part 119 certificate holder, listed in the Operations Manual as having that authority.

Amdt. 121-298, Eff. 7/10/2003

## H.5 Order 8900.1, Vol. 3, Ch. 2, Section 1, 3-47

http://fsims.faa.gov/PICResults.aspx?mode=EBookContents

PROCEDURES FOR OPENING, CLOSING, AND LOCKING OF FLIGHT DECK DOORS

A. Background.

1) On January 15, 2002, 14 CFR Part 25, § 25.772, was amended to require an emergency means to enable a flight attendant to enter the flight deck should the flight crew become incapacitated. This change applies to airplanes that are newly certificated under 14 CFR Part 25 and was not retroactive to existing airplanes. The operational requirements found in 14 CFR Part 121 § 121.313 were also amended on January 15, 2002 to require each operator to establish methods that enable a flight attendant to enter the flight deck in the event that a flight crewmember becomes incapacitated. As with § 25.772(c), these methods are intended for use under emergency conditions and not for routine access to the flight deck. As such, aircraft electronic keypads or electronic pushbuttons installed in the cabin must be used only in emergency situations. (The only time the crew may use the emergency flight deck access procedure during normal operations is when the aircraft is on the ground, the flight deck door is closed and locked, and the flight deck is unoccupied.) Additionally, § 121.313(g) states, in part, "…no person other than a person who is assigned to perform duty on the flight deck may have a key to the flight deck door." Therefore, any keys in the possession of cabin crewmembers that are used for opening bins or containers in the cabin cannot be capable of unlocking the flight deck door.

2) Unless an air carrier has FAA-approved procedures under § 121.587(b), the flight deck door must remain closed during flight time. In order to operate the flight deck door during flight time and permit flight deck access by persons authorized in accordance with § 121.547, Part 121 certificate holders must develop and use FAA-approved procedures regarding the opening, closing, and locking of the flight deck door. These FAA-approved procedures should be included in the operators' operations and flight attendant manuals. Additionally, § 121.313 requires any associated signal or identity confirmation system to be easily detectible and operable by each flight crewmember from his or her duty station. To meet security needs of accomplishing an audio and visual identification, one person on the flight deck is required to visually identify the person seeking access through the viewing port or viewing device.

B. Certificate Holders' Procedures. Certificate holders' procedures must include at least the following:

1) Normal procedures for opening flight crew compartment doors to include:

a) Who is authorized to have access to the flight deck.

b) How a crewmember verifies the identity of a person requesting access to the flight deck. This process must include a positive means for flight crewmembers to identify persons requesting entry to the flight deck and to detect suspicious behavior or a potential threat before unlocking the flight deck door. To meet security needs of accomplishing an audio and visual identification, one person on the flight deck is required to identify visually the person seeking access through the viewing port or viewing device.

c) How flight deck door keypad access codes are disseminated (i.e., flight deck door keypad access codes may be disseminated through the certificate holder's normal manual process).

d) Flight attendant procedures to verify there are no passengers in any forward lavatory, and no passengers are standing in the area surrounding the flight deck door.

e) Flight attendant procedures for blocking the passenger aisle when the flight deck door is opened.

f) Procedures for two-person flight crews, when one flight crewmember leaves the flight deck (i.e., a flight attendant must lock the door and remain on the flight deck until the flight crewmember returns to his or her station).

2) Emergency electronic keypad or emergency pushbutton procedures to include:

a) Events requiring the use of emergency procedures (i.e., pilot alerts).

b) Entering when the flight crew is, or is suspected of being, incapacitated, or there is no response from the flight deck.

c) Keeping the flight deck door locked until an audio and visual verification of the person requesting entry is made.

d) How to determine whether a person requesting access is under duress.

e) How to determine when the flight deck door locking system may be taken out of the deny-access position.

f) Flight deck crew procedures to follow when an electronic keypad or pushbutton is being used to gain unauthorized access to the flight deck.

g) When the flight crew must take immediate action to deny access to the flight deck.

3) Crewmember training programs should include these procedures, associated crewmember duties and responsibilities, crew coordination, and emergency situation training modules in appropriate curriculum segments.

C. POI Approval Process. To comply with § 121.587(b), POIs are to review and approve their assigned certificate holders' procedures in accordance with the current approval process found in Order 8900.1 and the guidance provided in this paragraph.