Exemption No. 10703

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
RENTON, WASHINGTON 98057-3356

In the matter of the petition of **BaySys Technologies** for an exemption from §§ 25.785(d), 25.807(c)(1), 25.807(c)(5), 25.809(f)(1), 25.813(b), 25.813(e), 25.857(e), and 25.1447(c)(1) of Title 14, Code of Federal Regulations	**Regulatory Docket No. FAA-2012-0361**

PARTIAL GRANT OF EXEMPTION

By letter dated October 12, 2012, Nick Olmsted, Director of Certification, BaySys Technologies, PO 18321 Parkway, Melfa, Virginia, 23410, petitioned the Federal Aviation Administration for exemption from §§ 25.785(d), 25.807(c)(1), 25.807(c)(5), 25.809(f)(1), 25.813(b), 25.813(e), 25.857(e), and 25.1447(c)(1) of Title 14, Code of Federal Regulations (14 CFR). The requested exemption, if granted, would permit relief from these regulations to allow carriage of 15 non-crewmembers (commonly referred to as supernumeraries) in a compartment behind the flight deck on Boeing Model 747-400F airplanes.

The petitioner requests relief from the following regulations:

> **Section 25.785(d), at Amendment 25-64** – "If the seat backs do not provide a firm hand hold, there must be a hand grip or rail along each aisle to enable occupants to steady themselves while using the aisles in moderately rough air."
>
> **Section 25.807(c)(1), at Amendment 25-67** – requires that one Type III passenger emergency exit be provided on each side of the fuselage.
>
> **Section 25.807(c)(5), at Amendment 25-67** – requires that at least one pair of Type III passenger emergency exits be provided if Type IV exits are specified but cannot be located over the wing.
>
> **Section 25.809(f)(1), at Amendment 25-47** – requires that a self-supporting escape slide or equivalent be provided as the assist means at passenger emergency

exits that are more than six (6) feet from the ground with all landing gear extended.

Section 25.813(b), at Amendment 25-46 – "For each passenger emergency exit covered by § 25.809(f), there must be enough space next to the exit to allow a crewmember to assist in the evacuation of passengers without reducing the unobstructed width of the passageway below that required for the exit."

Section 25.813(e), at Amendment 25-46 – "No door may be installed in any partition between passenger compartments."

Section 25.857(e), at Amendment 25-60 – limits a Class E cargo compartment to airplanes used only for the carriage of cargo.

Section 25.1447(c)(1), at Amendment 25-41 – requires, in pertinent part, that oxygen dispensing units must be automatically presented to the occupants before the cabin altitude exceeds 15,000 feet.

Related sections of the regulations:

Section 121.583(a) – contains, in pertinent part, a listing of categories of persons who may be carried aboard an airplane in part 121 service without complying with all the requirements of part 121 pertaining to carriage of passengers.

The petitioner supports its request with the following information:

This section quotes, in pertinent part, the relevant information from the petitioner's request, with minor edits for clarity. The complete petition is available at the Department of Transportation's Federal Docket Management System, on the Internet at http://regulations.gov, in Docket No. FAA-2012-0361.

1) Airplane Model

This petition is submitted in support of modifications to a Boeing B747-400F freighter Supplemental Type Certificate (STC) project number ST15315LA-T. The applicable Type Certificate Data Sheet is A20WE with a certification basis of Part 25 of the FAR effective February 1, 1965, as amended by Amendments 25-1 through 25-67. This submission is an update to the prior submissions, comments and teleconferences. Changes are marked by change bars in the margins.

2) Regulations

A supplemental type certificate (STC) project has been submitted to the FAA Aircraft Certification Office in support of this project. In order to comply with 14 CFR regulations, this petition is therefore submitted to request that the identified model airplane as identified in this STC project be exempted from 14 CFR part 25 Regulations:

- 25.785(d) (amendment 25-64), Firm handhold on the main cargo deck;
- 25.807(c)(1) (amendment 25-67), two Type III exits, one on each side on the upper deck;

- 25.807(c)(5) (amendment 25-67), requirement for Type III exit in lieu of Type IV due to overwing constraints ;
- 25.809(f)(1) (amendment 25-47), Assist mechanism (slide) from Emergency exits
- 25.813(b) (amendment 25-46), assist space next to emergency exits;
- 25.813(e) prohibits installation of interior doors between passenger compartments.
- 25.857(e) (amendment 25-60), Class E cargo compartment use for cargo only;
- 25.1447(c)(1) (amendment 25-41) automatic presentation of O2 masks while in cargo bay.

In addition, this petition proposes a definition of Supernumeraries who may have limited access to the main deck cargo compartment, that mirrors the classifications listed in 14CFR 121.583 (a)(1)-(7).

3) Purpose

The owner/operator of the aircraft desires to use this freighter aircraft for types of cargo that require care, or inspection, or both, during flight (e.g., live animals and/or hazardous materials), in addition to continuing the original mission of carrying cargo freight. To support this usage of the aircraft, the owner/operator has requested to increase the number of personnel carried on the upper deck from 8 persons @ taxi, takeoff and landing (TT&L) (comprising of 10 seats - four seats on the flight deck and six seats on the upper deck) to a maximum total of 19 TT&L seats (four flight crew seats on the flight deck and up to 15 additional persons). These additional 15 persons may be qualified as Supernumeraries as defined herein, and once trained and qualified and during specific flight operations as listed below, may be permitted access to the main deck cargo area in flight under limitations listed below. The designation of and purpose of supernumeraries is discussed in subparagraph 5.a.3. below. As these purposes and the necessary configuration of the aircraft is not in accord with the regulations of 14 CFR part 25; this petition is therefore submitted to request specific exemptions from 14CFR part 25 regulations.

Summary of the proposed operations of the aircraft and applicability of this proposed exemption [hereafter referred to as “operation type,” by alpha designator]:

A. Operations for cargo flights with carriage of live animals on the main cargo deck that require care and inspection during flight, or cargo flights configured for animal carriage; with the following cargo excluded from carriage: hazardous material whose carriage is governed by regulations in 49 CFR Part 175, ignition sources (open flame, articles producing sparks, hot surfaces), lithium batteries, explosives, radioactive materials, flammable liquid fuel, oxidizers, plutonium, dry ice. For these operations for carriage of, or configured for carriage of live animals, the maximum proposed TTL person

count is 19 on the upper deck, of which 15 may be designated as Supernumeraries who, when trained and qualified, may be authorized access to the main cargo deck during flight under limitations proposed herein. During these operations and in case of emergency landing, the egress path and related cargo deck limitations are as proposed herein.

B. Operations as originally specified in the TCDS; carrying cargo; with a maximum of 8 persons on upper deck as per TCDS, with no access to the main cargo deck during flight. During these operations the emergency egress path is as originally designated per TCDS, via the upper deck R1 right door or Flight Deck emergency hatch.

C. Operations carrying cargo on the main deck that require care and/or inspection during flight; types of cargo are unchanged from those permitted by original TCDS; A maximum of 8 persons may be carried on the upper deck; A maximum of three supernumeraries may, when trained and qualified, be authorized access to the main deck in flight with limitations listed in this exemption; supernumeraries are limited to the categories specified in §§ 121.583(a). During these operations the emergency egress path is as originally designated per TCDS, via the upper deck R1 right door or Flight Deck emergency hatch.

4) References

1. Type Certificate Data Sheet A20WE, Boeing 747
2. FAA Exemption 1870E, pertaining to B747-400F: Exemption from 14 CFR 25.807(c)(1), 25.807(c)(5), 25.809(f)(1), 25.813(b), Allowance of non-crew members on the upper deck of 747-200F, 747-200C, certain 747-100 airplanes when in the main deck cargo configuration, and 747-400F. (Exemption No. 1870E dated September 8, 1993)
3. FAA Exemption 6463, pertaining to B747-100/200 cargo aircraft.
4. FAA Exemption 7900, pertaining to B747-100/200 cargo aircraft.
5. FAA Exemption 8587B, pertaining to B747-400 (“combi”) aircraft
6. FAA Exemption 8536A, pertaining to Boeing 747-100, 747-100B, 747-100B SUD, 747-200B, 747-200C, 747-200F, 747-400, 747-400F.
7. NM-09-27, Special Airworthiness Information Bulletin: In-flight access to Class E cargo compartments, May 12, 2009
8. FAA STC project number ST15315LA-T
9. Telecon on August 29, 2012 between BaySys and the FAA.

5) Specific Relief

a. 25.785(d) (amendment 25-64) – seat-back handgrips or aisle rails

1. We note that Exemption 8587B grants an identical petition for 25.785(j) (at a newer amendment), for relief from firm handhold for a similar proposal.

2. The main cargo deck does not have a handrail installed, nor bag bins. The likely configuration will contain only cargo boxes, including those with live animals, and may also have empty pallet locations. Therefore there will be walls upon which to lean but no specific firm handholds the length of the main cargo deck.

3. Purpose of personnel on the main cargo deck in flight:

   a. In order to optimize the usage of the Boeing Model 747-400F as a cargo airplane carrying animals or other cargo requiring care, operators need to be able to accompany their cargo by people whose function is to take care of sensitive cargo and loading and unloading tasks at any port of arrival. Their presence in the aircraft ensures they will be immediately available on arrival to handle the cargo. This is most important in case of transport of perishable goods, items of value, etc.

   b. Some of the cargo items being transported may include live animals, hazardous materials, or valuable or perishable goods that cannot be left unattended, even for the duration of the flight, and the presence of personnel trained and qualified in their handling is necessary on the aircraft on which they are carried. In-flight inspection of the cargo, especially live animals and hazardous materials, enhances safety.

   c. Some of the locations serviced by the cargo carriers may not have ground maintenance centers capable of performing necessary tasks for the operator aircraft nor passenger flights to carry maintenance personnel to the location. The ability to transport company maintenance personnel on company flights increases flexibility of operation.

   d. Non-crewmember passengers carried on Boeing Model 747-400F airplanes are limited. These non-crewmembers, referred to below as “supernumeraries”, shall be:

      (i) physically capable of performing their emergency and normal cargo handling duties; and

      (ii) briefed in the aircraft-specific limitations and use of emergency equipment; and

      (iii) Permitted access to the main cargo deck during climb, cruise and descent segments of flight in accord with limitations of this exemption and the approved STC.

   e. “Supernumeraries” per 121.583 (a)(1) thru (7) may include:

      (i) A crewmember.

(ii) A company employee.

(iii) 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

(iv) A person necessary for—

1. The safety of the flight;
2. The safe handling of animals;
3. The security of valuable or confidential cargo;
4. The preservation of fragile or perishable cargo;
5. Experiments on, or testing of, cargo containers or cargo handling devices;
6. The operation of special equipment for loading or unloading cargo; and
7. The loading or unloading of outsize cargo.
8. A person described in paragraph IV, when traveling to or from his assignment.
9. A person performing duty as an honor guard accompanying a shipment made by or under the authority of the United States.
10. A military courier, military route supervisor, military cargo contract coordinator, or a flight crewmember of another military cargo contract air carrier or commercial operator, carried by a military cargo contract air carrier or commercial operator in operations under a military cargo contract, if that carriage is specifically authorized by the appropriate armed forces.

(v) Supernumeraries will be permitted access to the main cargo deck during climb, cruise, and descent portions of flight in accord with limitations expressed in this exemption petition.

1. Operation A. Maximum 15 supernumeraries may be permitted access to the main deck during climb or cruise during flight operations type “A” as defined above, subject to limitations listed in this document.
2. Operation B. No persons are permitted access to main deck during flight.
3. Operation C. Maximum 3 supernumeraries may be permitted access to the main deck during climb or cruise

during flight operations type C as defined above, subject to limitations listed in this document.

f. Supplemental Oxygen will be discussed in a separate paragraph.

g. A smoke barrier will be established and maintained to isolate the upper deck at all times, except during passage through the barrier as a Supernumerary ascends or descends to the main cargo deck.

h. Handhold provisions in the upper deck per the requirements of [14] CFR 25.785(j) are retained from the passenger configuration. Since installation of handholds in the main deck cargo compartment is impractical, an acceptable level of safety is provided by the crew operated alert system ability to indicate, at the onset of turbulence to Supernumeraries in the cargo compartment, to return to their seats. This mitigation parallels that approved in similar FAA approved exemptions for 747 cargo aircraft.

i. Alerting. We propose installation of a modified Aural-Visual alerting system. This installation will also require [Airplane] Flight Manual [AFM] Supplement limitations for operations and preflight briefings. There are two separate alerts:

(i) Decompression and Smoke/Fire Alert:

An automatically activated aural and visual decompression and smoke/fire alert will be provided and immediately recognizable in accessible areas of the Class E cargo compartment to notify supernumeraries when to don the portable oxygen units, return to their seats and ensure that the smoke barrier is secured (i.e., the doors are closed). As a backup to the automated alert system, the flightcrew will be able to manually activate the alerts. The pre-flight briefing will include training in the sound of the alert, the meaning of the alert, and the response to the alert (i.e., procedures for donning the masks and activating the flow of oxygen).

(ii) Turbulence Alert:

A flightcrew member operated visual alert, which is recognized in the supernumerary seating area and in accessible areas in the Class E cargo compartment, will be installed to indicate, during turbulence or predicted turbulence, that persons must return to their seats. The alert will be clearly distinguishable from the decompression/fire/ smoke alert, so that supernumeraries do not waste time putting on the oxygen masks before returning to their seats. Appropriate procedures and limitations must be established to ensure that the flightcrew member alerts the supernumeraries to return to their seats at the onset of

turbulence. The pre-flight briefing must explain this alert to the supernumeraries.

(iii) Alerting Requirements:

1. Each shall be distinctive and effective. The alert for turbulence will be clearly distinguishable from the alert for decompression & fire/smoke.

2. Visual alerts will be visible from all occupant locations and orientations, during all expected operational conditions including a rapid decompression where moisture in the air may condense.

3. Aural alerts will be loud enough to be heard during all expected operational conditions including a rapid decompression where the ambient noise level will increase.

j. The Public address system will be extended to the main cargo deck; to permit announcements from the flight deck or any interphone location.

k. Intercom phones (interphone) will also be placed on the main cargo deck for two way communications.

l. A Flight Manual supplement shall include the requirement for flight crew pre-flight briefing of the Supernumeraries, including procedures of egress to the Class E compartment, and of emergency procedures including the aural-visual alert signals, smoking, emergency exits, safety equipment, etc. Flight Manual supplement shall include the flight crew procedures related to the operation of Class E aural-visual alert signals.

m. This modification includes a limitation that this aircraft be operated on a private, not-for-common-carriage-of-passengers basis.

b. 25.807(c)(1) (25-67)

Provides, in part, a requirement for Two Type III exits, one on each side on the upper deck, for a passenger (TTL) count of between 10 through 19. See discussion in para c below

c. 25.807(c)(5) (25-67) – Type III exit in lieu of Type IV exit

1. We note that Exemption 1870E grants a similar exemption from these regulations; 1870E applies to this aircraft by model; however the new proposed configuration exceeds the limitations of number of persons per 1870E and the TCDS; nor does 1870E permit access to the main cargo deck in flight.

2. Configuration of TTL on upper deck with respect to egress:

Right Side

a. This aircraft upper deck currently has a right hand door that measures 24”x48” (and meets Type I size, which is larger than Types II, III, IV); As this exit has a step up feature, it cannot properly be classified as a Type I. However, it was approved for emergency exit for the quantity of persons in flight deck and upper deck seating per 1870 original grant of exemption. An escape slide device is on this door that is manually deployed and automatically inflated; this slide is capable of withstanding a 25 knot wind. We propose to maintain this slide.

b. In accord with exemptions 8536A and 8587A, this door with manually deployed and automatically inflated slide has been approved for evacuation of up to 24 persons in a similar aircraft; therefore we estimate that all 19 persons proposed as the maximum count in this petition could safely exit from the right side of the aircraft in the event of an emergency landing.

c. As an alternative, in case this door is found unacceptable as configured, a modification to install supplemental inertial drop reels to provide for evacuation of up to all 19 persons from the upper deck via the right hand door would be proposed. As this mitigation is already approved for up to 19 persons on the upper deck per TCDS A20WE in the case of the 747-200F, we believe this would be acceptable without demonstration of a right hand evacuation.

Left Side

d. There is also an existing emergency hatch located on the left flight deck that currently satisfies the flight crew escape requirements per 25.805. This was approved in Exemption 1870 for use as the second exit for upper deck passengers, using inertial drop reels and harness provisions that are installed in the overhead of the upper deck, to a maximum of 8 persons.

   (i) In accord with exemptions 8170 (initial through E), this hatch with inertial drop reels has been approved for evacuation of up to 8 persons.

   (ii) Therefore if the upper passengers are increased to 19, then 11 of those [who] would need to use an alternate path is shown to be compliant.

   (iii) We therefore propose an alternate left side path for evacuation for at least 11 of the 19 persons proposed for upper deck TTL positions.

e. Lower Deck evacuation left side, required any time more than 8 persons are carried on the upper deck.

   (i) We propose that a second left hand side door, L1 on the main cargo deck, be utilized for evacuation on the left hand side, in case the upper right hand door is blocked and only the emergency hatch is available on the left side.

(ii) There are several precedents for use of a main deck exit for passengers seated at TT&L on the upper deck, reference the type certificate A20WE, for 747's configured for commercial operations. Reference TCDS A20WE and special conditions 25-61-NW-1, 25-71-NW-3; and 25-430-SC. The situation in this aircraft is more conservative than a passenger configured aircraft: in that this aircraft is intended for public use and the upper deck passengers would be "Supernumeraries" (both physically qualified and specifically trained in the aircraft configuration and evacuation procedures). This training/qualification process can be reasonably expected to ensure that Supernumeraries are more physically able and more mentally ready (than the average commercial passengers) to evacuate the upper deck, if necessary, via the stair to the main deck and then out the L1 door. We propose to demonstrate this by test. As discussed in reference (9) teleconference, evacuation demonstration testing will not be required.

(iii) Moreover, we propose that the stair between upper deck and main cargo deck be constrained during operations A & D (when supernumeraries may access the main cargo deck in flight) by conditions similar to those of 25-430-SC; specifically:

1. The stairway must be essentially straight.
2. The stairway must have essentially rectangular treads.
3. With the airplane in level attitude and in each attitude resulting from the collapse of one or more legs of the landing gear, the stairway must have entrance, exit, and gradient characteristics that allow the upper deck supernumeraries to evacuate and exit the airplane through the L1 main deck exit. This must be shown by demonstration, tests, analysis, or any combination thereof.
4. The stairway must accommodate the carriage of an incapacitated occupant from the upper deck to the main deck. The crewmember procedures for such carriage must be established and included in the airplane flight manual.
5. The stairway must be located to provide occupants an adequate descent rate under probable emergency conditions, including a condition in which an occupant falls or is incapacitated while on the stairway.
6. The stairway must be designed and located to minimize damage to its structure during an emergency landing or ditching.

7. General illumination must be provided so, when measured along the center lines of each tread and landing, the illumination is not less than 0.05 foot-candle. This is in lieu of compliance with Sec. 25.812(c), at Amendment 25-116.

8. Means must be provided to assist supernumeraries in locating the stairway in dense smoke conditions as part of compliance with Sec. 25.811(c), at Amendment 25-88.

9. An emergency exit sign meeting Sec. 25.812(b)(1)(i), at Amendment 25-116, must be provided in the upper deck near the stairway visible to supernumeraries on the upper deck as required by Sec. 25.811(d)(1), at Amendment 25-88.

10. Floor proximity lighting required by Sec. 25.812(e), at Amendment 25-120, must be provided along the stairs.

11. The stairway must have a handrail on at least one side to allow occupants to steady themselves during foreseeable conditions, including but not limited to, gear collapse on the ground and moderate turbulence in flight. The handrail(s) must be constructed so there is no obstruction on them that will cause the user to release his/her grip or hinder the continuous movement of the hands along the handrail. Handrail(s) must be terminated in a manner that will not interfere with occupants walking by or create a hazard (such as catching clothing). Petitioner must demonstrate that the design can accommodate the stature of a fifth percentile female and a ninety-fifth percentile male.

12. The public address system must be intelligible in the stairway during all flight phases.

13. “No smoking” and “return to seat” signs must be installed and visible in the stairway both going up and down and at the stairway entrances.

14. During any flight operation where more than eight persons are on the flight, the stair must remain installed between upper and main decks during the entire duration of the flight.

15. Demonstrate that a liferaft can be transported from the upper deck to the main deck with the assistance of two people.

(iv) Comments on the Stair: In the event of failure of landing gear on one side, and aircraft tipover, calculations show that the maximum increased angle will be approximately five

degrees. The existing stair, with both non-skid treads and firm railing, is easily navigable at any angle both plus and minus five degrees for a physically fit individual. The writer draws on 20 years of commissioned Naval service on numerous US Naval ships and 12 years of actual continuous sea time, climbing similar stairs in all weather and sea states both inside and external to the ship with roll & pitch exceeding 5 degrees and the additional constraint of yaw, in stating this opinion.

f. Discussion of Smoke propagation.

(i) In reference 9, the FAA requested BaySys provide test data showing concentration /density of smoke present in the stairwell, upper deck and flight deck under specified conditions; BaySys will conduct such testing. A copy of the company test plan will be provided to the FAA, as well as the results, including video documentation.

(ii) This testing will document whether there is a significant "smoke chimney" effect in case of emergency landing where ECS is turned off and evacuation is ordered, and both the emergency hatch and the L1 door are used, thereby potentially introducing a path for smoke propagation via the stair into the upper deck and out the right upper deck door and/or emergency hatch. We note that the aircraft is not yet modified in any way to include the proposed changes to the smoke barrier, emergency lighting, etc; therefore the testing for smoke demonstration (and evacuation) will be in conditions more severe than anticipated in the aircraft.

(iii) Company testing data will show not only an anticipated level of smoke but also the ability of a crew to exit via the stairs and L1 door in dense smoke conditions, within acceptable timeframes. The company test plan includes training/qualification of a similar nature that will be required of "supernumeraries" as discussed in this petition. As discussed in reference (9) teleconference, evacuation demonstration testing will not be required.

(iv) Due to the nearly straight path down the stair and out the L1 door, and arms-length distance between the bottom of the stair and the L1 door, we believe that it is very likely that a trained, qualified and physically fit crew can don breathing devices/masks, descend the stairs and exit the L1 door within 90 seconds. In addition, if shown necessary by an excessive smoke chimney effect during company testing, we also believe the flight deck crew can also don breathing devices/masks and exit the emergency hatch within 90 seconds.

g. Proposed Limitations include:

(i) Installation of at least 11 inertia reels on the main deck adjacent to the main deck entry door.

(ii) Requirement to maintain the stair locked in the down position during all phases of flight when TTL count exceeds 8;

(iii) Requirement that the smoke barrier be frangible, if the smoke barrier is of a solid construction.

(iv) Meet the proposed limitations listed above in paragraph (5.c.2.e.iii)

(v) Demonstration by test that at least 11 of 19 persons can descend and exit via the L1 door; including an incapacitated person, with a goal to show that all 19 persons located on the upper deck are able to exit within the prescribed 90 second time limit. As discussed in reference (9) teleconference, evacuation demonstration testing will not be required.

(vi) Flight Manual entries that mandate these operational limitations.

(vii) Inclusion of this evacuation plan in the FAA approved training plan for this exemption & STC.

d. 25.809(f)(1) (25-47) – passenger emergency exit provisions

1. We note that Exemption 1870E grants a similar exemption for these regulations; 1870E applies to this aircraft by model; however the new proposed configuration exceeds the limitations of number of persons; nor does 1870E permit access to the main cargo deck in flight.

2. On the right side of the aircraft,

a. While 25.809(f)(1) requires automatically deploying assist means, we note that the right hand door already is configured with manually opened door with an automatically deployed slide that meets the requirements of 25.809(f)(1). Citing the precedent of 1870E and Boeing's reported experience with 747 model aircraft equipped with this means as discussed in 1870E, we feel that this right hand door provides an adequate means of egress when combined with limitations on Supernumeraries as discussed above, e.g. "..physically capable" and "...specifically briefed" for up to 19 persons as proposed in this petition. This escape means has been demonstrated to be effective at providing safe evacuation of occupants to the ground.

b. A large number of Boeing 747-200F/200C and 400F aircraft have the manually deploying slide; commonality of configuration and crew training is an economic benefit.

c. A Boeing survey of similar aircraft (discussed in 1870E), documented that the majority of affected airplanes in service are equipped with manually deployed slides. No adverse experience has been reported with these manually deployed slides provided for specially trained "crew," which suggests the validity of a determination at this point to continue to allow them.

d. All the persons carried as supernumeraries will be specially trained and qualified in the escape methods listed above; moreover none of these persons will be "commercial" or fare-paying. Therefore a higher expectation of their capability and familiarity with the exit systems is anticipated.

e. The Boeing 747 installed slides per the Type Certificate meet the existing 25 knot wind requirement; we propose to maintain this capability without change.

f. As an alternative in case this door is found unacceptable as configured, a modification to install supplemental inertial drop reels to provide for evacuation of up to all 19 persons from the upper deck via the right hand door would be proposed. As this mitigation is already approved for up to 19 persons on the upper deck per TCDS A20WE in the case of the 747-200F, we believe this would be acceptable without demonstration of a right hand evacuation demonstration.

3. On the left side of the aircraft,

a. The overhead hatch is outside this regulation and discussed elsewhere, approved for use by up to 8 persons with use of inertial drop reels.

b. The activation of the L1 door entails installation of at least 11 inertia reels on the main deck adjacent to the main deck entry door.

4. We estimate that, if our proposal to use the existing right hand door as is and modify L1 to add at least 11 inertia reels, the proposed new configuration will be in compliance; however we request to be exempted from the "automatically deployed" requirement of 25.809 as the inertial drop reels provide adequate means to escape but do not automatically erect as required.

e. 25.813(b) (25-46) – assist space next to emergency exits

1. We note that Exemption 1870E grants a similar exemption for these regulations; 1870E applies to this aircraft by model; however the new proposed configuration exceeds the limitations of number of persons; nor does 1870E permit access to the main cargo deck in flight.

2. Assist space configurations.

a. The upper deck right hand door exit does not have adequate space to provide the required assist space during an evacuation.

b. Adequate space has been demonstrated to be available in the cockpit for flight crew to assist “crew” in evacuating from the cockpit hatch.

c. Adequate space exists in the vicinity of the L1 door exit to provide assistance during evacuation.

3. The flight crew and the supernumeraries will both be specially trained and benefit from a higher level of aircraft knowledge than the common public on a commercial carrier. Their training will include the safety procedures and evacuation methods to include upper deck slides, evacuation, and the inertial reels/harnesses. As the inhabitants will not be paying passengers but rather be either flight crew or specially trained and qualified “supernumeraries”, we feel that the added benefit of this assist space is more than compensated for by the training. We feel this provides an adequate level of safety in excess of that that would be provided by a crew assist space next to the right hand exit door.

4. We therefore request exemption from this regulation for the upper deck escape door in this configuration; to waive need for an assist space next to the right hand upper deck crew service door.

f. 25.813(e) (25-46) – prohibits installation of interior doors between passenger compartments and exits

1. We have proposed above to use a left hand evacuation route that includes descent through the upper deck smoke barrier, down the stair to the main deck, and out L1.

2. The upper deck smoke barrier is a hard door that opens on the upper deck.

3. We propose to reengineer this smoke barrier/ door and operational procedures to ensure this door is safe for occupant use. Similar to other granted exemptions for doors submitted by BaySys (9741, 9762), These limitations include:

a. Lock the door at the top of the stairs between upper deck and the main cargo deck in the open position during taxi, takeoff and landing. As this door is within visual distance of the crew, no special annunciation is required; however a limitation to ensure flight crew verifies door is in the correct position will be added to the Flight Manual.

b. Re-engineer the door at the top of the stairs to be frangible

c. Add this limitation to the Flight Manual Supplement, that Flight deck crew must verify prior to TTL that the door is locked in the correct position. As this door is so close to the cockpit, additional annunciation is not required.

d. Ensure Protective Breathing Equipment (PBE) as defined in § 25.1439(a) is available that will provide a minimum of 90 seconds of air, in the event of an evacuation event after a landing via L1 if

smoke exists. We propose to install at least 11 PBE units installed on the upper deck.

e. Locate PBE on the upper deck, in close proximity to the doorway that descends to the main deck, for use only in evacuation. The quantity required is the person count plus two.

f. BaySys is prepared to demonstrate by test(s) that:

(i) the upper deck passengers can egress via L1 within the required timeframe (see discussion in paragraph on 25.807 above). As discussed in reference (9) teleconference, evacuation demonstration testing will not be required.

(ii) emergency evacuation within the proscribed time limits is feasible while using PBE devices using the harnesses, and the inertia reels. As discussed in reference (9) teleconference, evacuation demonstration testing will not be required.

(iii) that the door is frangible and may be opened by a fifth percentile female in case of door malfunction, and then egressed by a 95 percentile male;

(iv) that the reengineered smoke barrier/door maintains smoke barrier properties;

Include these measures in the supernumerary and flight crew training.

4. We therefore request exemption from this rule given the mitigating steps listed above.

g. 25.857(e) (25-60) – Class E cargo compartment requirements

1. The central point of this petition is to permit access to the main cargo deck during flight, under specific limitations.

2. This petition envisions no change to the “classification” of the main cargo deck as Class E.

3. This petition proposes specific limitations that, when complied with, allow main cargo deck access during flight phases for specific purposes. A summary is provided:

a. Supernumeraries. These persons will meet the criteria listed above in our paragraph on 25.785.

b. Alerting system. A visual/aural system will be in place to alert Supernumeraries on the main cargo deck when to return to seat and to don oxygen.

c. Smoking is prohibited on the main cargo deck during all phases of flight.

d. Protective Breathing Equipment (PBE) per 25.1439 with protective masks will be stored on the upper deck and required to be carried at all times by Supernumeraries, while on the main cargo deck.

e. Fixed O2 masks. A fixed oxygen source (drop mask) will be available at each upper deck TT&L seat.

f. Smoke barrier. The smoke barrier between the upper deck and main cargo deck must remain in place at all times, except during passage between the areas.

g. Public Address speakers and interphone capabilities per 25.1423 will be available on the main cargo deck.

h. Emergency lighting per 25.812 (foot path and overhead) will be available in the main cargo deck and in the path from upper deck to L1.

i. Exit Signage will be modified to the new configuration.

j. First Aid Kit. Additional first aid kits will be located at the front and rear of the Main Cargo Deck.

k. Additional fire fighting gear (gloves, fire extinguishers) will be stored on the main cargo deck.

l. Appropriate placards and instructions will be posted in the upper deck and main cargo deck.

m. A flight manual supplement will contain these operating limitations.

n. An FAA approved training plan will be submitted for approval as part of the STC project.

4. Therefore while the classification of the main deck cargo compartment does not change, we specifically request to access this area in flight under limitations listed above.

h. 25.1447(c)(1) (25-41), Automatic presentation of O2 masks.

While the upper deck will meet this, the main deck cargo area will not meet this requirement for supernumeraries while accessing the main cargo deck.

1. When supernumeraries are seated in their seats or while in the lavatory on the upper deck, self-presenting oxygen masks indicate the need to don an oxygen mask. Since self-presenting oxygen masks are not available to persons entering the Class E compartment, the Decompression & Fire-Smoke alert system (subpara 5.a.3 above) that indicates to compartment occupants the need to immediately don oxygen for either a decompression event or fire/smoke, that they are required to carry while in the main cargo compartment.

2. Supernumeraries will be trained regarding the location and use of the oxygen equipment and the alert conditions requiring their use.

3. While in the class E compartment, supernumeraries are required to carry their oxygen equipment on their person. These oxygen equipment will be stored in a specified location, easily accessible to

supernumeraries, in close proximity to the cargo stair. There will be at least one portable oxygen unit, with a mask connected to it, provided for each supernumerary allowed to enter the main deck Class E cargo compartment during flight; with an additional 2 units to meet the 10% overage requirement of 25.1447.

4. The portable oxygen device will meet the performance standards of §§ 25.1443(a) or (b), or the equipment will be shown to protect the supernumerary from hypoxia at the activity level required to return to his or her seat following a rapid decompression to 40,000 feet cabin altitude. An example of a device that meets this criteria is the AVOX Systems portable O2 cylinder MA-1 p/n 9000A-3 with mask 358, used by USAF and designed for use with masks at altitudes to 43,000 feet by moderately active flight personnel – or up to 45,000 feet in extreme emergency situations of short duration. See AVOX Systems http://www.avoxsys.com/pdf/products/portable-oxygen-systems/MA-1-PN-9000A-3-portable-oxygen-cylinder-and-regulator.pdf

5. As we propose to use the same alert for both decompression and smoke/fire, the portable oxygen device will meet the PBE requirements in §§ 25.1439(b)(1), (2), and (4), and the PBE equipment will be designed to prevent any inward leakage to the inside of the device and prevent any outward leakage causing significant increase in the oxygen content of the local atmosphere (i.e., full face mask type.)

6. The oxygen units will also meet the intent of § 25.1449, which states that there must be a means for the crew to determine whether oxygen is being delivered to the dispensing units. We propose to include in the mandatory supernumerary training, how to make this determination and to provide oxygen flow indication in the oxygen equipment.

7. Class E cargo compartments are usually remote from the flight deck and encompass the entire interior of the airplane. The means of controlling fires that might occur in the cargo compartment is to starve the fires of oxygen. This is accomplished by depressurizing the airplane and maintaining an altitude that will not support combustion. Due to the manner in which fire in the cargo compartment is to be controlled, supernumeraries (persons) on the airplane will have been found physically fit by the operator.

8. In all cases, there must be suitable means of preventing smoke penetration into areas that are occupied. The petitioner's design accounts for this by proposing a barrier, which must comply with the smoke penetration requirements for the flight deck and the supernumerary compartment. This configuration is intended to allow supernumeraries to enter the Class E cargo compartment and hence open the smoke barrier between the cargo compartment and the supernumerary compartment. The smoke barrier will automatically close and remain closed at all times, except during passage. A placard indicating that the smoke barrier is to be secured (i.e., the door or

curtain must be closed) at all times, will be posted in a conspicuous place, either on or next to the smoke barrier.

9. Smoking will not be permitted on the main cargo deck during any phase of flight.

10. Alerting. The alerting scheme has been proposed in subparagraph 5.a.3, above.

11. We therefore request relief from this rule under the limitations listed above, automatic presentation of O2 masks.

6) Public Interest

Safety is the primary concern of the modification. Safety requirements of the original type certification of the aircraft will be complied with, as defined by the aircraft type certificate data sheet A20WE; as modified by limitations and mitigations listed above. There are no adverse effects anticipated from the exemption petition that are not mitigated by our proposals listed above.

The Owner and Operator of the aircraft intends to use the aircraft to transport horses, including race horses, show horses, and bloodstock. These animals are very valuable, many worth over one million dollars each. The animals cannot be properly insured nor cared for during travel unless there are a sufficient number of qualified handlers on board who can access the animals during flight.

Based in a Middle East country, the owner's flight team travels to world class events worldwide using other aircraft currently. The interest of the petitioner is in providing a level of safety for the animals and aircraft that will allow his service to support all international events which involve a large number of race or show horses. The Boeing 747-400F current has provisions for 6 people on the upper deck but no approved means for "supernumerary" with access to the main cargo deck for care of cargo.

For safety reasons, the International Air Transport Association (IATA) recommends that for up to four pallets, one experienced groom be provided for each pallet of horses. For more than four pallets of horses, it is at the discretion of the carrier and the shipper to determine the optimum requirement. The safe transport of large numbers of horses by air therefore requires the carriage of a commensurate number of qualified handlers on the main deck. The Owner/Operator has planned that, with 15 supernumeraries on the aircraft, the horses carried will be adequately cared for in all cases of expected transport.

The carriage of an appropriate number of animal handlers aboard an aircraft to monitor and to attend to the special requirements of live animal cargo, especially race horses and show horses, serves the public interest in raising the level of safety of the livestock, the airplane, the flight crew, and consequently, the public in general.

This exemption, therefore, serves the public interest for safety reasons and also for increased air freight deliveries of these animals internationally.

Other owners/operators may have a similar interest in this solution as there is clear economic benefit to both owners/operators as well as this installation activity and the overall US economy from this modification. Increased economic action is of clear public interest to the United States.

Since the passengers aboard these airplanes will not be revenue paying customers of commercial for hire airlines, but rather employees of the owner operator and specifically trained, there is no degradation to airline passenger safety and therefore no detrimental impact [on] the public at large. Indeed, the supernumeraries are already employees of the Owner/Operator.

The project in question on this Boeing 747-400F is a case of the special market in which BaySys works. Owners and operators require configurations that use interior space in ways not anticipated in the original TCDS configurations which, in this case include access to the main cargo deck during flight in support of animal care. In order to satisfy the customer requirements and maintain our marketing competitiveness, BaySys Technologies, LLC seeks to accommodate this configuration while providing an adequate level of safety for the flight crew and supernumeraries.

BaySys Technologies, LLC is a small and growing company based in Virginia that provides engineering, certification and installation on part 25 aircraft. BaySys is the parent company of a part 145 Repair Station and an FAA Part Manufacturer Authority (PMA) certificate. The company employs over 50 US citizens and provides strong support to the local economy where these employees and facilities are located. Moreover, our facility and operations in the Virginia area key in a project led by the County of Accomack, the State of Virginia and universities teamed with the NASA Wallops Flight Facility in Virginia to create a new Wallops Research Park. The purpose of this new Wallops Research Park is to promote aerospace-related activities and research related educational activities that will promote real and sustainable economic growth in this county; BaySys is privileged to be a partner in these efforts. Our success in an extremely competitive global economy will have a significant positive impact on the local and regional economy.

This project is work for an “offshore” client, improving the United States’ balance of trade.

Granting this exemption will permit conclusion of this project, which will provide a significant income with positive impact on both the local and regional economies. This will aid both in the case of this specific project and in future aircraft in this STC.

Approval of these exemptions will enable this Virginia company working on Transport Category Airplanes to effectively compete in this global market. Stability and improved financial performance of this Virginia company gives greater job stability to workers employed, thereby providing a stabilizing influence to the greater regional and the larger US economy due to the increased consumer spending capacity associated with stable workers. Improved financial performance of Virginia owned and operated corporations and increased

workforce stability translates into continued and improved local, state, and federal tax revenues, which in turn add to the stability of the overall United States economy. Improved financial performance allows Virginia corporations to continue to invest in Research and Development allowing the United States to maintain and improve its competitive position in the global economy.

7) Request to Waive Publication [for] Public Comment

For this petition, BaySys requests that the publication and comment procedures that are required by 14CFR § 11.29 be waived in accordance with §11.87. In our estimation:

- Granting these [exemptions] would not set precedents;
- These exemptions are near identical to previously granted exemptions, and are already recognized by the FAA on similar model aircraft (1870, 8536, 8587)
- The issues are non-controversial;
- Delaying approval will delay the engineering deliverable which will delay the scheduled completion of this project, with resulting schedule backups and additional expense;
- The inherent delaying action caused by publication in the Federal Register may cause delays in modifying the 747-400F and thereby require multiple aircraft to fulfill the project missions.
- Our petitions have been filed in a timely manner, within days of assignment of ACO project number to support of delivery to meet customer schedule requirements. In keeping with our program schedule, we request that review and decision be made as soon as possible.

BaySys Technologies respectfully submits this Petition for Exemption as regards this project ST15315LA-T. We believe that the mitigations we have presented will provide a level of safety adequate to protect all crew and supernumeraries in this aircraft.

***Federal Register* publication**

A summary of the petition was published in the *Federal Register* on January 7, 2013 (78 FR 978). One comment (FAA-2012-0361-0012) was received:

> Your notice indicated that the Permit requested the carriage of 15 non-crewmembers (commonly referred to as supernumeraries) in a compartment behind the flight deck on Boeing Model 747-400F airplanes.
>
> Please keep the rules uniform. If the permit is allowed, the passengers need to have seats with seat belts.

The FAA responds that the petitioner has not requested an exemption from the seats and seat-belt requirements for the subject non-crewmembers. Therefore, the requirements for passenger seats and seat belts do apply to this project, and it is understood that these will

be installed per 14 CFR part 25. Otherwise, the FAA would not certificate the airplane if required seats and related restraints were not installed for all supernumeraries.

The FAA's analysis

Class E cargo compartments are usually remote from the flight deck and encompass the entire interior of the airplane. The means of controlling fires that might occur in the cargo compartment is to starve the fire of oxygen. This is accomplished by depressurizing the airplane and maintaining an altitude that will not support combustion. For this reason, only crewmembers are permitted on board such airplanes.

The certification regulations for transport-category airplanes address airplane occupants as being either "crew" or "passengers." Due to differences in training, physical capabilities, and other factors (such as familiarity with the airplane), the means required by 14 CFR part 25 to address emergency evacuation and emergency equipment for passengers and crewmembers differ. Because supernumeraries are not crewmembers, they must be considered "passengers" by default with respect to part 25. However, supernumeraries do hold a special status because of their training and other factors. The FAA, therefore, has granted certain exemptions to allow the carriage of supernumeraries on cargo airplanes without compliance with all of the part 25 standards for passengers, provided that certain other conditions are met. Those conditions have varied, depending on the airplane design, the nature of the proposals under consideration, and the number and location of persons to be carried.

The FAA has previously granted exemptions for carriage of persons in addition to crew on freighter airplanes and allowed access to the cargo compartment, provided that certain other conditions are met. These conditions have varied depending on the airplane design, the number of persons involved, and the type of cargo permitted to be transported in the main-deck Class E cargo compartment.

Types of operations

The FAA has previously granted exemptions for in-flight access of the Class E cargo compartment by supernumeraries, provided that certain other conditions are met. These conditions have varied, depending on the airplane design, the number of persons involved, and the type of cargo permitted to be transported in the main-deck Class E cargo compartment. We have been reviewing the operational need for access into the Class E cargo compartment in-flight, and the number of persons needed in the cargo compartment for the type of operation. We have divided the access into the cargo compartment into three different types of operations:

- Carriage of live animals requiring care/attention during flight, and associated material only, no other cargo. The petitioner has identified this as operational type A.
- Cargo only, which does not require care/attention during flight, and no live animal(s) requiring care/attention during flight. The petitioner has identified this as operational type B.
- Carriage of cargo requiring care/attention during flight, and other cargo. The petitioner has identified this as operational type C.

Each of these three types of operation are discussed as follows:

Operational type A

We do not agree with the proposal to have one alert used for fire/smoke and decompression. Alerts are discussed in more detail below. We will require two different alerts for these conditions. Also, the one change and one correction discussed in operational type B, below, applies to this type of operation. Other than these three items we agree with the proposal. All large animals being shipped by air need supernumeraries on board for their care/attention during flight because the carriage of large animals implies a potential risk due to the brute force they are capable of, which can endanger flight safety. Horses are routinely shipped by air and are one of the large animals that require care/attention during flight because of the brute-force issue. Also, these horses that are shipped by air are high-value animals, and the owners and insurance policies require in-flight care/attention. We understand that the industry standard for the air transport of horses recommends one supernumerary (groom/handler) for every three or four horses. We agree that this recommendation is appropriate to ensure safety of flight.

Considering the size of the 747-400F airplane, the main deck cargo compartment could contain several dozen horses. As a result of the large number of horses or other large animals, a large number of supernumeraries (groom/handler) would be needed. We have granted exemptions in the past for larger numbers of supernumeraries with in-flight access into the main-deck Class E cargo compartment under certain conditions. These conditions have included limiting the permitted cargo to the large, live animals and associated cargo only. We have considered that live animals are less flammable cargo than other cargo, therefore, we have allowed more in-flight access to the cargo compartment. The petitioner has requested a maximum of 15 supernumeraries be allowed to have in-flight access to the main-deck Class E cargo compartment for the care/attention of live animals. We accept the proposal for the number of supernumeraries.

For this operational type A, the petitioner has requested that the maximum number of persons on the upper deck be 19, including the crewmembers. This number of persons on the upper deck is greater than what has been accepted by the FAA for this exit configuration on the upper deck.

The petitioner has proposed that the exit and manually deployed/automatically inflating escape slide on the right-hand side of the airplane be accepted for 19 persons. The exit is the standard exit provided on 747-400F airplanes. The escape slide is a standard option that is delivered with the airplane. We accept this proposal.

On the left side of the airplane, the only exit on the upper deck is the overhead hatch. For the overhead hatch, the assist means that has been accepted on other airplanes of this model has been inertia reels and harnesses for a maximum number of 8 persons. The reason for the limitation to 8 persons is the combination of the size of the overhead hatch and the number of persons with the inertia reels exiting the hatch. The petitioner has proposed to use the main-deck entry door as an emergency exit. They have proposed to modify the existing main-deck entry door by installing at least 11 inertia reels adjacent to the door. This modification includes the door-operating markings on the inside of the airplane; interior illumination system; assist means; attachment point for a liferaft mooring line; and exterior markings. In addition, the petitioner has proposed to modify

the stairway installed between the main deck and the upper deck. The modified stairway would be designed to meet similar requirements as those identified in special conditions 25-430-SC, which are for a stairway between two passenger decks on the 747-8 airplane. The petitioner's position contains the proposed special conditions for the stairway. The main-deck entry door for this airplane is located inside the Class E cargo compartment. To address additional concerns with the need to evacuate through a cargo compartment that may have smoke and fire, the petitioner has proposed to supply a second type of portable protective breathing equipment (PBE), as defined in § 25.1439(a), that would provide a minimum of 90 seconds of air that could be used if the class E cargo compartment contains fire/smoke. The petitioner has proposed PBE to be used in the event that evacuation is required out the left side of the airplane in combination with fire/smoke in the main-deck cargo compartment, as part of their petition for exemption. We accept this proposal.

Operational type B

For this type of operation, no in-flight access to the main deck Class E cargo compartment is requested. This type of operation and airplane configuration is the same as that defined in Exemption No. 1870E. We accept the proposal and propose to grant the exemption with the same limitation as identified in Exemption No. 1870E with one minor change and one correction. Since the Exemption No. 1870E was issued, the FAA has been requiring a harness for each inertia reel installed on the airplane, whereas before we only required the harness for the supernumeraries. Exemption No. 1870E incorrectly identifies the crew service door on the left side of the upper deck as a Type I exit. This exit is the size of a Type I exit, however, this exit is not floor level. This exit has a step-up from the floor to the exit, which is not allowed for Type I exits. The crew service door does qualify for a Type III exit rating. This change and correction are applicable to all types of operations.

Operational type C

For this type of operation, the petitioner requests in-flight access to the main-deck Class E cargo compartment by a maximum of three persons. We do not agree with the proposal to have one alert used for fire/smoke and decompression. Alerts are discussed in more detail below. We will require two different alerts for these conditions. Also, the one change and one correction discussed above in operational type B applies to this type of operation. Other than these three items we agree with the proposal. The petitioner proposed to modify the stairway to meet some additional requirements for operational types C and A. The FAA has approved the stairway installed by Boeing, which comes standard with the airplane, to be acceptable for accessing the cargo compartment in-flight by a maximum of three supernumeraries. Therefore, the FAA will not require these modification to the stairway for operational type C.

Cargo-compartment alerts for operational types A and C

The FAA has determined that three separate, distinct alerts are required in the cargo compartment. One distinct alert each is for decompression; smoke and fire; and turbulence. In the past, the FAA has accepted a single alert to address both decompression and smoke/fire events because the action required of the supernumeraries was the same for both events. That action required supernumeraries to don oxygen

masks, start the flow of oxygen, then evacuate the cargo compartment. The FAA now determines that the time required to don an oxygen mask and start oxygen flow, in the event of a smoke/fire event, is best spent first evacuating the cargo compartment. Therefore, the FAA now requires all new certification programs to provide three distinct, separate alerts for these three events.

Further discussion

Considering the size of the 747-400F airplane, the main-deck cargo compartment could contain several dozen horses. As a result of the large number of horses or other large animals, a large number of supernumeraries (groom/handler) would be needed. We have granted exemptions in the past for larger numbers of supernumeraries with in-flight access into the main-deck Class E cargo compartment under certain conditions. These conditions have included limiting the permitted cargo to the large, live animals and associated cargo only. We have considered that live animals are less flammable cargo than other cargo, therefore, we have allowed more in-flight access to the cargo compartment. The petitioner has requested a maximum of 15 supernumeraries be allowed to have in-flight access to the main-deck Class E cargo compartment for the care/attention of live animals. We accept the proposal for the number of supernumeraries.

Handholds

The requirement of § 25.785(d) Amendment 25-64 for handholds is to ensure that occupants have a means to steady themselves in moderately rough air while traversing the main aisles of typical passenger airplanes. On the proposed airplane, we concur with the petitioner that it is not necessary to provide dedicated handholds in the cargo compartment because it is impractical, provided a flightcrew-operated aural or visual signal, which is recognized in accessible areas in the Class E cargo compartment, is installed to indicate, during turbulence, that persons must return to their seats.

Type and number of exits

Sections 25.807(c)(1) and (c)(5) require, for passenger capacity of 10 to 19, a minimum of a Type III exit on each side of the fuselage. The Model 747-400F is equipped on the right side with a Type III crew-service door. On the upper deck, no similar capability is provided for the left side of the airplane. However, an overhead hatch to the left of the centerline is located in the cockpit, which does comply with the flightcrew emergency-exit requirements of § 25.805. The FAA has accepted this overhead hatch in similar exemptions with the appropriate limitations and equipment installations for a maximum of 8 persons (six supernumeraries and two flightcrew) on the airplane. This exit configuration would cover operational types B and C, and we accept this configuration with the appropriate limitations and equipment installations for a maximum of 8 persons (six supernumeraries and two flightcrew) on the airplane.

However, this exit configuration is not acceptable for operational type A. For this operational type, additional evacuation capability is needed for the left side of the airplane. The petitioner has proposed to modify the existing main-deck entry door by installing at least 11 inertia reels adjacent to the door. This modification includes the door-operating markings on the inside of the airplane; interior illumination system; assist means; attachment point for a liferaft mooring line; and exterior markings. As an additional compensating feature, the petitioner has proposed that the stairway between

the upper deck and the main deck be modified to comply with similar conditions as those requirements found in special conditions 25-430-SC, for the stairway for the 747-8 passenger airplane. A complete list of the petitioner's proposed conditions for the stairway is found in the petition. The petitioner proposed to limit the cargo for this operational type to live animals and associated cargo. The associated cargo excludes from carriage hazardous material the carriage of which is governed by regulations in 49 CFR part 175; ignition sources (open flame, articles producing sparks, hot surfaces); lithium batteries; explosives; radioactive materials; flammable liquid fuel; oxidizers; plutonium; and dry ice. This exit configuration would cover operational type A, and the FAA accepts this configuration with the appropriate limitations and equipment installations for a maximum of 19 persons (15 supernumeraries and 4 flightcrew) on the airplane.

Assist means

Section 25.809(f)(1) requires that a self-supporting slide or equivalent must be provided to assist the occupants in descending to the ground for each passenger emergency exit located more than 6 feet from the ground. The Model 747-400F crew-service door has an inflatable escape slide that is self-supporting with the landing gear extended. The overhead hatch is equipped with eight inertia reels and eight harnesses not envisioned by this requirement, but are considered by the FAA to be adequate for use by flightcrew and "crew" in accordance with the requirements of § 25.809(f)(2).

Section 25.809(f)(1)(i) requires that the assist means must be automatically deployed. The escape slide installed at the crew-service door is manually deployed and so are the installed inertia reels. The FAA has granted exemptions to the requirement on 747 freighter airplanes with and without supernumeraries for many years. We agree with the petitioner's proposal.

Section 25.809(f)(1)(ii) requires that the assist means must be automatically erected within 10 seconds after deployment is begun. The escape slide installed at the crew-service door meets this requirement. The inertia reels do not erect, but have been found acceptable for this type of installation.

Section 25.809(f)(1)(iii) requires that the assist means must be of such length after full deployment that the lower end is self-supporting on the ground and provides safe evacuation of occupants to the ground after collapse of one or more legs of the landing gear. The escape slide for the crew service door is not self-supporting on the ground in all cases of gear collapse, and the inertia reels are too short to reach the ground in all cases of gear collapse. However, the inertia reels have been demonstrated to be effective at providing safe evacuation of occupants exiting from the overhead hatch to the ground. The inertia reels installed near the overhead hatch located in the cockpit have been demonstrated to be effective at providing safe evacuation out the crew-service door, after the escape slide has been deployed and inflated, to address the conditions when the escape slide is not self-supporting on the ground. However, additional inertia reels and harnesses need to be installed in the airplane to have one inertia reel and harness for each of the proposed 19 occupants. The FAA notes that the petitioner is proposing to add these items to address this concern.

For operational type A, the petitioner has proposed to install at least 11 inertia reels adjacent to the main-deck entry door. The inertia reels are too short to reach the ground in all cases of gear collapse. However, the inertia reels have been demonstrated to be effective at providing safe evacuation of occupants to the ground for the exits on the upper deck. These are the same part-number inertia reels we have determined to be acceptable for use at the main-deck entry door. The harnesses that would be used for this exit are the same as those installed on the upper deck adjacent to the crew-service door, and would be donned before the evacuees entered the cargo compartment. We accept this proposal.

Section 25.809(f)(1)(iv) requires certain performance capabilities in 25-knot wind conditions. The crew-service-door escape slide is certified to meet this requirement.

Assist space

Section 25.813(b), regarding specific assist space requirements for passenger evacuations, has not been addressed in the 747-400F design at any of the proposed exits. However, the FAA has granted exemptions from this requirement for freighter airplanes with supernumeraries based on the additional training that is required to be provided to the supernumeraries and the required pre-flight briefings. Also, the airplane contains adequate space for the flight crew to demonstrate the use of the inertia reels and harnesses and how to evacuate out the airplane with this equipment.

Doors between passenger compartments

The requirement of § 25.813(e), at Amendment 25-46, states that no door should be installed between passenger compartments. The guidance for this requirement at this amendment level makes a distinction between compartments/rooms that are not occupiable for taxi, takeoff, and landing (TT&L), and compartments/rooms that are occupiable for TT&L. The guidance does allow doors between passenger compartments and compartments/rooms that are not occupiable for TT&L. In the proposed design, the Class E cargo compartment is not occupiable for TT&L. For operational type A, the main-deck exit must be used due to the number of occupants allowed on the upper deck. In this case, the door is between a passenger compartment and the exit, and at this amendment level of the regulation, that is acceptable. However, for operational type A, the requirement of § 25.813(f) does apply, and the door must be latched open for TT&L during this type of operation. Therefore, an exemption from the requirement for § 25.813(e), Amendment 25-46, is not needed for this proposed configuration. However, for evacuation, operational type A has a conflict between having the smoke barrier closed for smoke penetration and having the smoke barrier door open during TT&L. In consideration of these two issues, the FAA has determined that the following provides an acceptable level of safety:

The smoke barrier must be latched opened for operational type A TT&L unless fire/smoke has been detected in the main-deck cargo compartment. If fire/smoke has been detected in the main-deck cargo compartment, the door may be closed if directed by the pilot in charge.

Smoke penetration

In all cases, the airplane must contain suitable means of preventing smoke penetration into areas that are occupied. The petitioner's design accounts for this by providing a barrier, which must comply with the smoke-penetration requirements for the flight deck and the supernumerary compartment. However, the petitioner has indicated that configurations may be approved that will allow supernumeraries to enter the Class E cargo compartment and hence open the smoke barrier between the cargo compartment and the supernumerary compartment. To provide an appropriate level of safety, the petitioner must install a placard indicating that the smoke barrier is to be secured (i.e., the door or curtain must be closed) except when entering or exiting the cargo compartment. The placard must be located in a conspicuous place, either on or next to the smoke barrier. However, for evacuation, operational type A has a conflict between having the smoke barrier closed for smoke penetration and having the smoke barrier door open during TT&L. In consideration of these two issues, the FAA has have determined that the following provides an acceptable level of safety:

The smoke barrier must be latched opened for operational type A TT&L unless fire/smoke has been detected in the main-deck cargo compartment. If fire/smoke has been detected in the main-deck cargo compartment, the door may be closed if directed by the pilot in charge.

Another concern, associated with the supernumeraries that have access to the cargo compartment in-flight, is the amount of smoke, in the event of smoke/fire, that would enter into the supernumerary compartment and flight deck as a result of the smoke barrier being open during supernumerary evacuation out of the cargo compartment. This smoke/fire issue must be considered when demonstrating compliance with § 25.855.

If access into the Class E cargo compartment is allowed, an aural or visual annunciation operated by the flightcrew, and recognized in the Class E cargo compartment, must be installed to indicate that persons must return to their seats and secure the smoke barrier (i.e., close the door or curtain) during a fire in the Class E cargo compartment. Appropriate procedures and limitations would need to be established to ensure that the flightcrew signals the supernumeraries to return to their seats and secure the smoke barrier at the onset of a fire. The pre-flight briefing would need to explain this annunciation to the supernumeraries.

The petitioner proposed that the supernumeraries inside the Class E cargo compartment immediately don their oxygen masks, initiate oxygen flow to them, then immediately return to their seats in the event of smoke being detected inside the Class E cargo compartment. We disagree with this procedure because during the onset of a fire, donning the oxygen mask and initiating oxygen flow requires valuable time that is better spent on exiting the Class E cargo compartment. Use of portable oxygen equipment following annunciation of a smoke event should be at the discretion of the supernumeraries, depending on where the source of smoke is in relation to each supernumerary and the exit. Therefore, in the event of smoke being detected inside the Class E cargo compartment, the supernumeraries inside the Class E cargo compartment must be directed to immediately return to their seats and secure the smoke barrier. As necessary, the supernumeraries should don their oxygen mask and initiate the flow of oxygen.

Due to the way that fire in the cargo compartment is to be controlled, it is necessary to limit persons on board the airplane to those who the airplane operator has found to be physically fit, and who have been briefed on the use of the emergency equipment. This limitation on the occupants is consistent with previous approvals and is included in this approval.

Immediately available oxygen

The petitioner indicates that configurations may be approved that will allow the supernumeraries to enter the Class E cargo compartment to tend to animals or hazardous cargo. To provide an acceptable level of safety to the "immediately available" requirement of § 25.1447(c)(1), each supernumerary, while in the Class E cargo compartment, must carry on their person a portable oxygen bottle with a mask connected to it.

Section 25.1447(c)(1) also requires automatic presentation of the oxygen-dispensing units. For seated passengers in typical passenger airplanes, the automatic presentation of masks throughout the cabin indicates the need to don an oxygen mask. However, supernumeraries in the Class E cargo compartment will not have this indication. To provide an acceptable level of safety, an aural, automatically activated decompression signal must be present and immediately recognizable throughout the accessible areas in the Class E cargo compartment, if there is only one aural alert that a supernumerary may hear or is expected to respond to. If there are two or more alerts that a supernumerary may hear or is expected to respond to, there must be an automatic visual alert in addition to the automatic aural alert. Operation of this signal must be automatic, with flightcrew manual activation as a backup.

Supernumeraries must be trained in the location and use of the oxygen equipment, and the signals for its use. The oxygen units must be sized adequately for continuous and uninterrupted use during worst-case flight duration following decompression, or of sufficient duration to allow the supernumeraries to return to their seats. The portable oxygen equipment must meet the requirements in § 25.1443(a) or (b), or the equipment must be shown to protect the supernumerary from hypoxia at an activity level required to return to their seat following a rapid decompression to 25,000 feet cabin altitude. Additionally, the portable oxygen equipment must:

- meet § 25.1439(b)(1), (2), and (4), and
- be designed to prevent any inward leakage to the inside of the mask, and
- prevent any outward leakage causing significant increase in the oxygen content of the local atmosphere

Configurations may be approved for carrying cargo that does not require supernumerary access to the Class E cargo compartment. For these configurations, an aural decompression signal is not required to be recognizable in the Class E compartment if an Airplane Flight Manual (AFM) limitation is established to prohibit supernumeraries from being in the Class E cargo compartment during flight.

Incapacitated persons in the cargo compartment

Another concern is the removal of an incapacitated person from the cargo compartment. This concern is increased because the access means to the main-deck cargo compartment is a ladder. BaySys Technologies should develop some procedures for the removal of an incapacitated person from the cargo compartment and provide these to the operator of the airplane. This condition does not need to be combined with any other failure condition (i.e., only normal flight condition needs to be considered).

Protective breathing equipment for evacuation using the main-deck entry door

Operational type A has one condition where the evacuation is the result of smoke/fire in the main deck cargo compartment. To address some of the concern with the evacuees needing to evacuate through a cargo compartment that could be filled with smoke/fire, the petitioner has proposed to supply at least 11 portable PBE units as defined in § 25.1439(a).

The FAA considers the petitioner's proposal for the exemption to be in the public interest for the following reasons:

- The FAA has granted several exemptions for the carriage of supernumeraries on freighter airplanes;
- These supernumeraries are seen as a benefit to airplane safety and efficient operations of air cargo; and
- A significant disruption of air commerce could occur if the petition were not granted.

The FAA's decision

In consideration of the foregoing, I find that a partial grant of exemption is in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. §§ 40113 and 44701, delegated to me by the Administrator, BaySys Technologies is hereby granted a partial exemption from 14 CFR 25.785(d), 25.807(c)(1), 25.807(c)(5), 25.809(f)(1), 25.813(b), 25.857(e), and 25.1447(c)(1) to the extent necessary to allow type certification of Boeing Model 747-400F series airplanes with provisions for the carriage of supernumeraries. The following limitations apply and limitation numbers 1-7, 13, and 15 must be documented in the limitations section of the airplane flight manual:

1. A maximum of 15 supernumeraries may occupy the area just aft of the flight deck. The total maximum occupancy of the airplane is limited to 8 or 19 persons, including the flight crew, depending on the operational type. See item 4 below.
2. The supernumeraries are limited to the categories specified in 14 CFR 121.583(a)(1) through 121.583(a)(7).
3. Supernumeraries are prohibited from being in the cargo area during taxi, takeoff and landing. The pre-flight briefing must inform supernumeraries of this requirement.
4. Access into the cargo compartment in-flight is divided into three different operational types:

- Carriage of live animals requiring care/attention during flight and associated material only, no other cargo. The petitioner has identified this as operation A. The maximum number of supernumeraries is 15 and the total airplane occupancy is 19. Access to the Class E cargo compartment by a maximum of 15 supernumeraries is permitted during climb, cruise, and approach.

- Cargo only, which does not require care/attention during flight, and no live animals requiring care/attention during flight. The petitioner has identified this as operational type B. The maximum number of supernumeraries is 6 and the total airplane occupancy is 8. No access is allowed into the Class E cargo compartment during any airplane operation.

- Carriage of cargo requiring care/attention during flight, and other cargo. The petitioner has identified this as operational type C. The maximum number of supernumeraries is 6 and the total airplane occupancy is 8. Access to the Class E cargo compartment by a maximum of 3 supernumeraries is permitted during climb, cruise, and approach.

5. Prior to each flight, a flightcrew member must brief each supernumerary on the use of exits and emergency equipment, including evacuation instructions to inspect the ground to determine whether a safe landing can be achieved before using an assist means.

6. The operator must determine that each supernumerary is physically able and trained to accomplish the necessary emergency procedures.

7. Each supernumerary must be provided with a portable oxygen unit with a mask attached to it that they must carry whenever they are in the Class E cargo compartment. The supernumeraries must be trained in the use of the oxygen equipment. The supernumeraries must also be trained in making the determination whether oxygen is being delivered to the masks. The equipment must provide oxygen-flow indication. The oxygen units must be sized adequately for continuous and uninterrupted use during worst-case flight duration following decompression, or must be of sufficient duration to allow the supernumeraries to return to their seats where oxygen for the remainder of the decompression is readily accessible. The portable oxygen equipment must meet the requirements in 14 CFR 25.1443(a) or (b), or the equipment must be shown to protect the supernumeraries from hypoxia at an activity level required to return to their seats following a rapid decompression to 25,000 feet cabin altitude. Additionally, the portable oxygen equipment must:

   - meet § 25.1439(b)(1), (2), and (4), and

   - be designed to prevent any inward leakage to the inside of the mask, and

   - prevent any outward leakage causing significant increase in the oxygen content of the local atmosphere.

8. An aural, automatically activated decompression alert must be present and immediately recognizable in accessible areas of the Class E cargo compartment to notify supernumeraries when to don oxygen masks. If there are two or more alerts that a supernumerary may hear or is expected to respond to, there must be an automatic visual alert in addition to the automatic aural alert. The pre-flight briefing must include training in the sound of the alert, the meaning of the alert, and the response to the alert (i.e., procedures for donning the masks and activating the flow of oxygen).

9. A flightcrew-operated aural or visual alert, which is recognized in accessible areas in the Class E cargo compartment, must be installed. This aural or visual alert is to indicate that, during turbulence, persons must return to their seats. Appropriate procedures and limitations must be established to ensure that the flightcrew signals the supernumeraries to return to their seats at the onset of turbulence and prior to landing. The pre-flight briefing must explain this signal to the supernumeraries.

10. A flightcrew-activated aural or visual signal, which is recognized in the Class E cargo compartment, must be installed. This aural or visual signal is to indicate that, in the event of fire or smoke in the Class E cargo compartment, persons must return to their seats and ensure that the smoke barrier is secured (i.e., the door or curtain is closed). Appropriate procedures and limitations must be established to ensure that, at the onset of a fire or smoke event, the flightcrew signals the supernumeraries to return to their seats and secure the smoke barrier. The pre-flight briefing must explain these signals to the supernumeraries.

11. A placard located in the supernumerary area, in a conspicuous location either on or adjacent to the smoke barrier, must indicate the following:

    For operational type B

    - no access to the Class E cargo compartment is allowed during any airplane operation
    - the smoke barrier must be secured (i.e., the door or curtain must be closed) except for ground operations

    The pre-flight briefing must inform supernumeraries of these requirements.

    For operational type C

    - access to the Class E cargo compartment is limited to the care and handling of cargo requiring care/attention during flight
    - access to the Class E cargo compartment is limited to a maximum of three supernumeraries
    - the smoke barrier must be secured (i.e., the door or curtain must be closed) except when entering or leaving the cargo compartment
    - a portable oxygen bottle (with mask attached) must be carried at all times when accessing the cargo compartment

- smoking is not allowed within the cargo compartment

The pre-flight briefing must inform supernumeraries of these requirements.

For operational type A

- access to the Class E cargo compartment is limited to the care and handling of animals and cargo only
- access to the Class E cargo compartment is limited to a maximum of 15 for the carriage of live animals and associated material
- the smoke barrier must be secured (i.e., the door or curtain must be closed) except when entering or leaving the cargo compartment during cruise. The smoke barrier must be latched opened for TT&L for operational type A unless fire/smoke has been detected in the main-deck cargo compartment. If fire/smoke has been detected in the main-deck cargo compartment, the door may be closed if directed by the pilot in charge
- a portable oxygen bottle (with mask attached) must be carried at all times when accessing the cargo compartment
- smoking is not allowed within the cargo compartment
- the compartment must not be entered in case of fire/smoke being detected inside the Class E cargo compartment except during evacuation

The pre-flight briefing must inform supernumeraries of these requirements.

12. Alerting requirements

    - must be distinctive and effective
    - visual alerts must be visible from all occupant locations and orientations, during all expected operational conditions, including a rapid decompression where moisture in the air may condense
    - aural alerts must be loud enough to be heard during all expected operational conditions, including a rapid decompression where the ambient noise level will increase

13. A minimum of 8 inertia reels and harnesses must be installed on the flight deck for operational types B and C. In addition to the minimum 8 inertia reels and harnesses installed on the flight deck, a minimum of 11 inertia reels and harnesses must be installed at a location that can be used for exiting the crew-service door when the installed escape slide is not self-supporting on the ground. No flight-deck door may be installed between the supernumerary compartment and flight deck that would prevent access to the overhead hatch and 8 inertia reels and harnesses.

14. Additional requirements for a stairway between the upper deck and the main deck for operational type A only:

    a. The stairway must be essentially straight.

b. The stairway must have essentially rectangular treads.

c. With the airplane in level attitude and in each attitude resulting from the collapse of one or more legs of the landing gear, the stairway must have entrance, exit, and gradient characteristics that allow the upper-deck supernumeraries to evacuate and exit the airplane through the L1 main-deck exit. This must be shown by demonstration, tests, analysis, or any combination thereof.

d. The stairway must accommodate the carriage of an incapacitated occupant from the upper deck to the main deck. The crewmember procedures for such carriage must be established and included in the AFM.

e. The stairway must be located to provide occupants an adequate descent rate under probable emergency conditions, including a condition in which an occupant falls or is incapacitated while on the stairway.

f. The stairway must be designed and located to minimize damage to its structure during an emergency landing or ditching.

g. General illumination must be provided so that, when measured along the center lines of each tread and landing, the illumination is not less than 0.05 foot-candle. This is in lieu of compliance with § 25.812(c), at Amendment 25-116.

h. Means must be provided to assist supernumeraries in locating the stairway in dense smoke conditions as part of compliance with § 25.811(c), at Amendment 25-88.

i. An emergency-exit sign meeting § 25.812(b)(1)(i), at Amendment 25-116, must be provided in the upper deck near the stairway, visible to supernumeraries on the upper deck as required by § 25.811(d)(1), at Amendment 25-88.

j. Floor-proximity lighting, required by § 25.812(e), at Amendment 25-120, must be provided along the stairs.

k. The stairway must have a handrail on at least one side to allow occupants to steady themselves during foreseeable conditions, including, but not limited to, gear collapse on the ground and moderate turbulence in flight. The handrail(s) must be constructed with no obstruction on them that causes the user to release their grip or hinder the continuous movement of the hands along the handrail. Handrail(s) must be terminated in a manner that will neither interfere with occupants walking by nor create a hazard (such as catching clothing). The petitioner must demonstrate that the design can accommodate the stature of a fifth-percentile female and a ninety-fifth-percentile male.

l. The public-address system must be intelligible in the stairway during all flight phases.

m. “No smoking” and “return to seat” signs must be installed and visible in the stairway both going up and down, and at the stairway entrances.

n. During any flight operation where more than 8 persons are on the flight, the stair must remain installed between upper and main decks during the entire flight.

15. The existing main-deck entry door must be modified to function as an emergency exit by installing at least 11 inertia reels adjacent to the door. This modification includes the door-operating markings on the inside of the airplane; interior illumination system; assist means; attachment point for a liferaft mooring line; and exterior markings.

16. A minimum of 11 portable PBE units, as defined in § 25.1439(a), and which will provide a minimum 90-second breathing supply, must be installed such that they are readily accessible to the supernumeraries to aid in evacuation in the event of smoke. The supernumeraries must be trained in the use of the PBE.

Note: The briefings and associated procedures in limitations 8, 9 and 10, to alert the supernumeraries in the Class E cargo compartment, are not required if an AFM limitation is established to prohibit supernumerary access to the Class E cargo compartment during flight.

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/s/ K. C. Yanamura

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