Federal Aviation Administration

Memorandum

Date: January 28, 2011

To: Manager, Seattle Aircraft Certification Office, ANM-100S

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Susan Letcher

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for the Boeing Model 747-400 Special Freighter for Inadvertent Detection of Smoke in Lower Lobe Class C Cargo Compartment (Project Number AT8167SE-T)

ELOS Memo #: AT8167SE-T-ES-1

Reg. Ref.: §§ 21.21(b)(1), 25.855, 25.857, 25.1309, and 25.1585

The purpose of this memorandum is to inform the certificate management aircraft certification office of an evaluation made by the Transport Airplane Directorate (TAD) on the establishment of an equivalent level of safety (ELOS) finding for Boeing Model 747-400 Special Freighter (SF).

Background

Title 14, Code of Federal Regulations (14 CFR) 25.857(c)(1) requires that a Class C cargo compartment must include a smoke detector system. Section 25.855(i) requires that, during flight testing, smoke/fire detectors in one cargo compartment must not alarm due to smoke in another cargo compartment unless the cargo compartment fire extinguishing system simultaneously floods both compartments. While Boeing was conducting 747-400SF smoke penetration flight testing related to the main deck Class E cargo compartment, smoke migrated into both the forward and aft lower lobe Class C cargo compartments and caused inadvertent smoke detection warnings from those compartments. Subsequent attempts to prevent smoke from migrating from the main deck into the lower lobe cargo compartments were not fully successful, and Boeing proposed an airplane design change to inhibit lower lobe smoke detection warning following smoke detection in the main deck and initiation of main deck fire procedures. This would ensure compliance with the § 25.855(i) requirement to preclude inadvertent smoke detection in other cargo compartments, but this would prevent full

compliance with § 25.857(c)(1) requirement for a smoke detector system for those portions of the flight during which the lower lobe cargo compartment smoke detectors are inhibited and therefore unavailable. Boeing requested an ELOS for § 25.857(c)(1) to inhibit the lower lobe smoke detectors while the airplane is in the Class E main deck firefighting mode.

Applicable regulation(s)

§§ 25.855, 25.857, 25.1309, and 25.1585

Regulation(s) requiring an ELOS finding

§ 25.857(c)(1)

Description of compensating design features or alternative standards which allow the granting of the ELOS (including design changes, limitations or equipment need for equivalency)

The FAA reviewed the Boeing Model 747-400 Special Freighter and determined that an ELOS can be granted for § 25.857(c)(1) to allow inhibiting the lower lobe smoke detectors while the airplane is in the main deck Class E cargo compartment firefighting mode, provided the following conditions are met:

- The occurrence of a main deck fire combined with a false lower lobe cargo fire warning is considered a major hazard. The fire protection system must be shown to be acceptable via a systems safety analysis.

- Any time during the flight that the lower lobe Class C cargo compartment smoke detection system is inhibited, the ventilating airflow is shut off in both the main deck and the lower lobe cargo compartments.

- The airplane flight manual (AFM) must specify that in the event of a fire in the main deck Class E cargo compartment, the flight crew should land the airplane at the nearest suitable airport after following Class E cargo compartment fire fighting procedures.

- An acceptable functional or flight test, as appropriate, must be performed to demonstrate that:

    - When smoke is detected in the main deck Class E cargo compartment, ventilating airflow shuts off to the main deck and lower lobe cargo compartments.

    - The system properly inhibits the forward and aft lower lobe Class C cargo fire warnings when the main deck Class E cargo compartment firefighting procedures are initiated.

Explanation of how design features or alternative standards provide an equivalent level of safety to the level of safety intended by the regulation

The FAA considered the overall cargo compartment fire protection system design, and determined that the compensating design features allow granting of an ELOS for § 25.857(c)(1) based on the following:

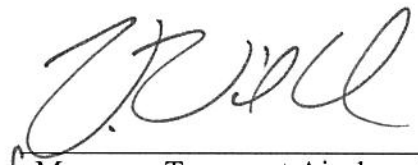
- The FAA acknowledges that cargo compartment fires are rare events, and that the probability of having two independent cargo fires (one on the main deck followed by one in a lower lobe cargo compartment) during the same flight is sufficiently remote as to not require certification for such an occurrence.

- During any time that the smoke detector system is inhibited, the 747-400SF ventilation airflow is shut off in the main deck and lower cargo compartments. During this time, the main deck firefighting procedure would depressurize the airplane, which would also be effective in controlling a fire in the lower lobe cargo compartments.

FAA approval and documentation of the ELOS finding

The FAA approved the aforementioned ELOS finding in project Issue Paper ES-1. This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The TAD has assigned a unique ELOS memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS memorandum number should be listed in the type certificate data sheet under the certification basis section. An example of an appropriate statement is provided below.

Equivalent Level of Safety Findings have been made for the following regulation(s):
§ 25.857(c)(1) (documented in TAD ELOS Memo AT8167SE-T-ES-1)



MARCH 17, 2011

Manager, Transport Airplane Directorate,
Aircraft Certification Service

Date

ELOS Originated by Seattle ACO:	Project Engineer Susan Letcher	Routing Symbol ANM-150S