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Position

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Fire Protection of Cargo Compartments

Please note: This paper supersedes 16POS02 - Fire Protection of Cargo Compartments

BACKGROUND

On 11 May 1996, a McDonnell Douglas DC-9 operated by ValuJet Airlines, Inc. as Flight 592 crashed into the Everglades approximately ten minutes after take-off from Miami International Airport. The accident occurred as Flight 592 was attempting to return to Miami and was the result of an uncontrolled fire in the aeroplane's forward Class D cargo compartment.

At the time of the ValuJet accident, five cargo compartment classifications were available in the United States: Classes A, B, C, D, and E. Lower lobe cargo compartments on large passenger aeroplanes, which would be inaccessible in flight and used mostly for passenger baggage, could be Class C or Class D compartments. As mentioned above, the ValuJet fire occurred in a Class D compartment.

The fire protection approaches for Classes C and D differ. Class C relies on active fire control through fire detection and suppression systems, whereas Class D relied on passive control through oxygen starvation. Class C requirements are essentially unchanged since the accident. Following the accident, the U.S. Federal Aviation Administration (FAA) modified their certification rules to remove the Class D classification. In addition, operators of aeroplanes with Class D compartments were required under operational Regulations to upgrade these compartments to the Class C Standard.

Class C fire protection relies on detecting the fire early and suppressing it for the duration of the flight. The fire suppression system releases an extinguishing agent like Halon into the compartment at a concentration level that inhibits combustion. The fire-resistant liner helps prevent leakage of the extinguishing agent so that an effective concentration can be maintained and protects adjacent structure and systems. Ventilation to the compartment following fire detection is also limited to maintain extinguishing agent concentrations.

Class D fire protection relied on passive oxygen starvation, i.e., the compartment being small and sealed enough so that a fire would quickly expend available oxygen and extinguish or remain so small that it would not threaten the aeroplane. This was accomplished by limiting the size of and ventilation to the compartment. Class D compartments did not require fire detection or suppression systems, so fires occurring therein were expected to stay at a non-threatening level for the duration of the flight. As part of the lessons learned after the ValuJet accident, the FAA removed the Class D cargo compartment classification.

Class E fire protection relies on oxygen starvation by aircraft depressurization. Class E compartments are main deck compartments on all-cargo aircraft. There are cargo compartment liner requirements, but they are not as rigorous as Class C requirements, except where protection of critical structure and systems is concerned. Where not protecting non-critical aircraft systems and structure, there is often no separate cargo liner installed since the existing insulation or wall material can satisfy existing liner requirements.

Tests by the FAA have shown that the suppression can be adequate as long as the aircraft maintains sufficiently high cabin altitude (approximately FL 180), but significant hazards present themselves during descent for landing. This is primarily due to the build-up of flammable gasses and vapours in the oxygen poor environment at high altitude, but when the oxygen concentration increases during descent, the fuel air mixture can cause flashover, resulting in the likely loss of the aircraft.

Class F compartments were originally envisioned to replace Class B compartments but are now considered by some to enhance fire protection when used in Class C, D, or E compartments. For example, if a shipment is deemed unsuitable for a Class E compartment due to flammability, a special Class F compartment might be deemed appropriate for transport if located inside a Class E compartment due to special fire containment capabilities of the Class F compartment. Some examples are fire containment covers, fire resistant containers, and main deck (Class E) fire suppression systems.

ICAO PROVISIONS

ICAO Annex 8 does not define or specify Classes of cargo compartments, but does specify (Part IIIB, para. 4.2 g) that each *cargo compartment not accessible to a crew member should be equipped with a built-in fire detection system and a built-in fire suppression system*. But the Annex does not include two other components found in Class C compartments: means to exclude hazardous quantities of smoke, flames, or extinguishing agent from any occupied compartment, and means to control ventilation.

Most importantly, the above Standard is included in Part IIIB of the Annex which only applies to *aeroplanes over 5 700 kg for which application for certification was submitted on or after 2 March 2004*. Consequently, there are aeroplanes currently in commercial air transport that have Class D cargo compartments. These aeroplanes do not have an equivalent level of safety as aeroplanes with Class C cargo compartments.

POSITION

IFALPA believes the following cargo compartment fire protection requirements should be applied to all aircraft engaged in commercial air transport:

1. Each cargo compartment should have an approved means of fire suppression so that any fire remains suppressed for enough time for the crew to land safely at a suitable aerodrome.

2. There should be a separate, approved smoke detector or fire detector system for each cargo compartment that provides a warning at the pilot station in time for the crew to land safely at a suitable aerodrome.

3. Requirements for Class E compartment cargo liners should provide equivalent protection to those of a Class C compartment.

4. Current Class D cargo compartments should be upgraded to at least a Class C standard.

5. All cargo compartments, regardless of size, should be lined with insulating material capable of containing the maximum fire intensity associated with the cargo being carried during all operating conditions.

6. Class F compartments should be tested to demonstrate the capability of suppressing any fire likely to occur given the type of cargo to be transported in the compartments.

7. Each cargo compartment should have a means to prevent hazardous quantities of smoke, flames, or suppressing agent, from entering any compartment occupied by the crew or passengers.

8. Each cargo compartment should have a means to control ventilation and drafts within the compartment so that the suppressing agent used can control any fire that may start within the compartment.

9. When cargo is placed within a Unit Load Device (ULD) in a cargo compartment, there should be a means to detect a fire within the ULD. Extinguishing systems should be designed to extinguish a fire within a ULD before it spreads to other cargo.

10. There should be a means for the flight crew to monitor the affected compartment's condition following activation of the fire extinguishing system.

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