Aircraft Cargo Compartment Fire Detection

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Cargo Compartment False Alarms

Compiled from FAA Service Difficulty Reports
Unscheduled Landings Caused by Cargo Compartment False Alarms

- Alarms
- Reported Unscheduled Landings
## Resin Block Formulation

<table>
<thead>
<tr>
<th></th>
<th>Original</th>
<th>Rev.1</th>
<th>Rev. 2</th>
<th></th>
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<td>13.6g</td>
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<tr>
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</tbody>
</table>
False Alarm Source Testing

Arizona Test Dust A2

Compressed Air

Detectors
False Alarm Source Testing

Household Humidifier
Flaming Resin Block

Ventilation air supply ducts
(1 change of cabin air every 4 minutes.)

Ceiling mounted smoke meter

10.3'

9.1'

5'

10'

15'

DC-10 Test Article
Ventilation rate: 1 change of cabin air every 4 minutes.
Cabin vol. ~ 6400 ft³.
Vent air rate. ~1600 ft³/min
Main deck smoke
Multiple resin blocks

Ventilation air supply ducts
(1 change of cabin air every 4 minutes.)

Ceiling mounted smoke meter

DC-10 Test Article
Cabin Volume = 6400 ft³

-Molded resin block
Main deck smoke. Resin blocks 5' aft of smoke meter

%LT/ft

secs

Ceiling Smoke 2 resin blocks (delay)
Ceiling Smoke 2 resin blocks
Ceiling Smoke 3 resin blocks
Main Deck Smoke

No Smoke detector activation

- Smoke. 2 flaming. 5' fwd
- Smoke. 2 flaming. Directly under laser
- Smoke. 3 flaming. Directly under laser
Main Deck Smoke

- Smoke. 2 flaming. 5' fwd
- Smoke. 2 flaming. Directly under laser
- Smoke. 3 flaming. Directly under laser
- Corona 26 psi. Directly under laser
- Corona 20 psi. Directly under laser
DC10 Main Deck Smoke. Corona Smoke Generator

26 psi. ~91%LT/ft. 109 seconds
20 psi. ~86%LT/ft. 177 seconds
Time of first smoke detection
2 flaming resin against sidewall
Corona against sidewall1. 20 psi
Corona against sidewall2. 20 psi
Corona against sidewall3. 20 psi

- 25 seconds. ~92%LT/ft
- 31 seconds. ~89%LT/ft
- 68 seconds. ~89%LT/ft
- 76 seconds. ~78%LT/ft
PRESENT STATUS

• The smoke quantity produced by multiple (2-3) burning resin blocks can accumulate into detectable levels in less than one minute in a well ventilated main deck compartment. The location and ventilation pattern determines if this will occur.

• Typical smoke detectors presently in use respond very differently to liquid particles from smoldering fires or artificial smoke generators than they do to smoke from flaming fires. Smoke obscuration alone is not predictive of detector response time.
Sandia CFD Model Development

• Sub model for heat transfer to the compartment walls and ceiling is under development and will be implemented shortly.

• A series of 15 validation experiments have been conducted in the DC-10 lower lobe cargo compartment. The comparison between the validation experiments and the model predictions will be completed after the heat transfer sub model has been implemented into the code. More validation tests are planned.

• A preliminary list of initial code testers has been compiled. The target date for initial tester evaluation to begin is September 2004.

• Initial discussion have begun on the method for the public release of the code.
Future Work

• Continue with main deck smoke testing.
• Develop “dry ice” false alarm scenario. Test new detectors to false alarm sources.
• Continue testing to support CFD model validation.
• Attempt to identify a “smoke” source with appropriate particle size and optical properties. Combine gas species of interest to the smoke source and recommend settings/generation rates appropriate for detector certification tests in various cargo compartments.
New Project

Evaluate the effect of contaminants (lubricating oil, hydraulic fluid, etc.) introduced into aircraft ventilation systems and the resulting hazards that result in the flight deck and passenger cabin.