

Flight Deck Smoke Penetration Testing



Federal Aviation
Administration



Presented to: International Aircraft Systems Fire
Protection Working Group. Koeln, Germany

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Background

Testing was requested by the FAA Transport Airplane Directorate.

Objective is to determine if current flight deck smoke penetration certification testing is adequate.

Tests will be conducted in both the forward and aft cargo compartments and the main deck of the 747SP aircraft.

Test conditions will include smoke penetration tests using only pack1, pack2, and pack 3.

Additional tests will be conducted under the above conditions but with varied areas of cargo liner removed for the below floor tests.

Test Article



Aft Cargo



Flight Deck



Upper Deck



Front Cabin

Instrumentation

Laser Diode Smoke Meters

- (2) installed in Flight Deck
- (1) Portable



Portable Gas Analyzer Trailer

- 3 Sample systems
 - CO
 - CO₂
 - O₂
 - Halon 1211
 - Halon 1301



Cabin Exchange Rate Tests

Measured CO2 decay rates to determine on ground ventilation rate of main passenger deck and forward and aft cargo compartments.

747SP ECS Setup:

APU Duct Pressure: 29 psi

Pack 1

Air Flow: 1800 cfm

ACM Outlet Temp: 38° F

Comp Discharge Temp: 344° F

Pack 2

Air Flow: 2700 cfm

ACM Outlet Temp: 43° F

Comp Discharge Temp : 330° F

All zone mix valves set to 25% open

Aft Cargo Heat: On

Cabin Exchange Fan Placement



Mid & Aft Cabin (Looking Forward)

Cabin Exchange Fan Placement



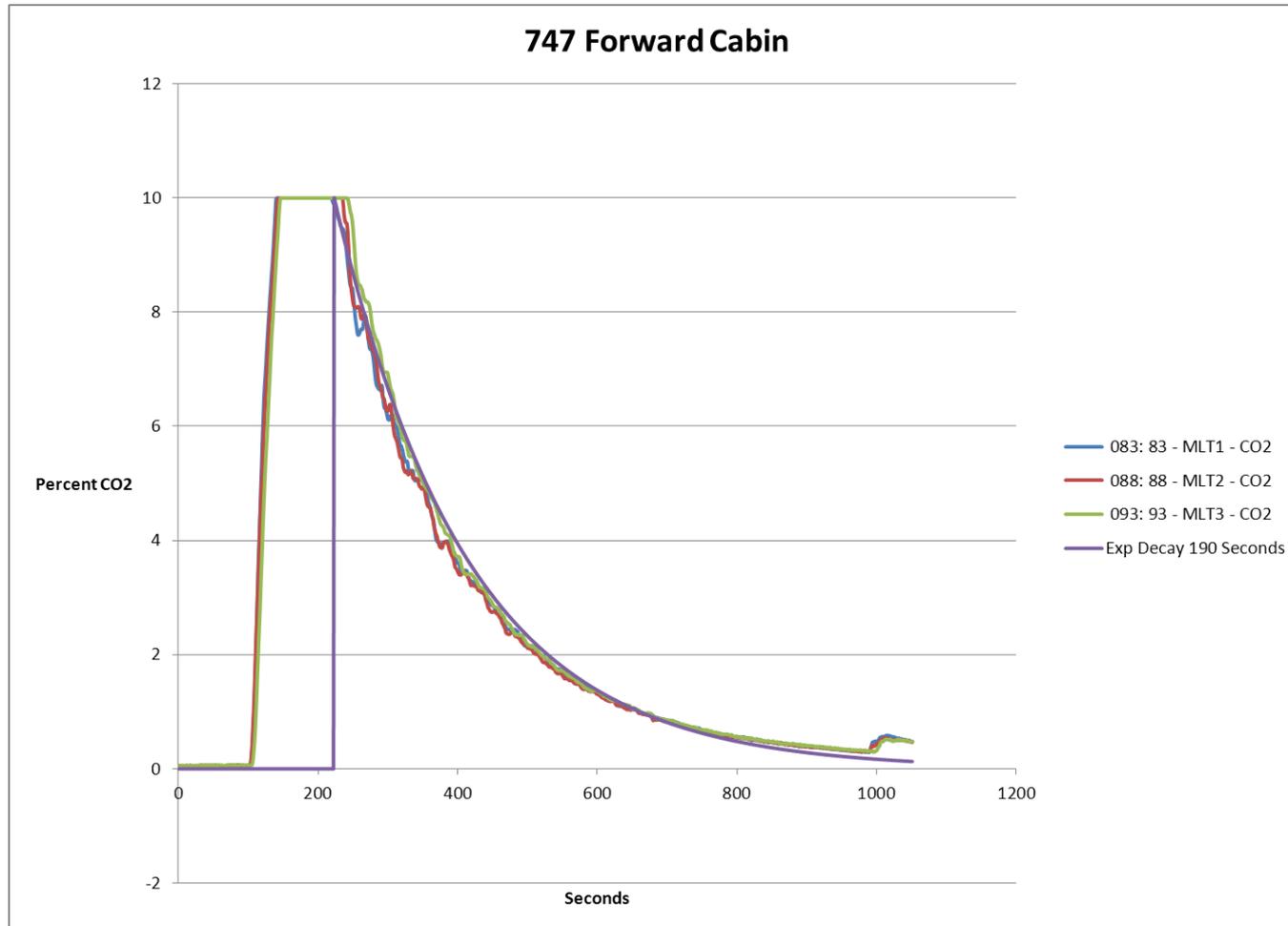
Mid & Aft Cabin (Looking Aft)

Cabin Exchange Fan Placement



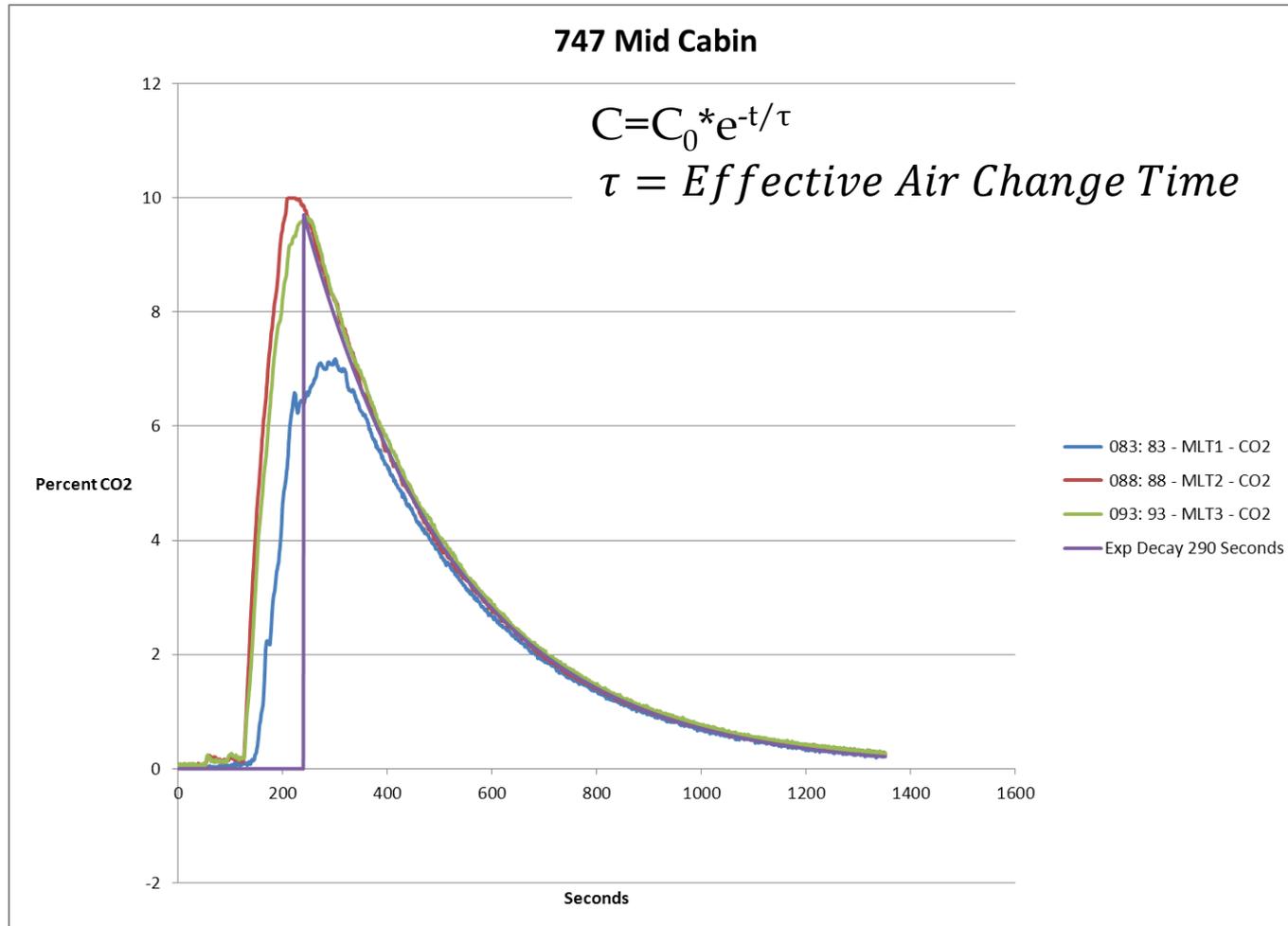
Forward Cabin (Looking Aft)

Cabin Exchange Rate Results



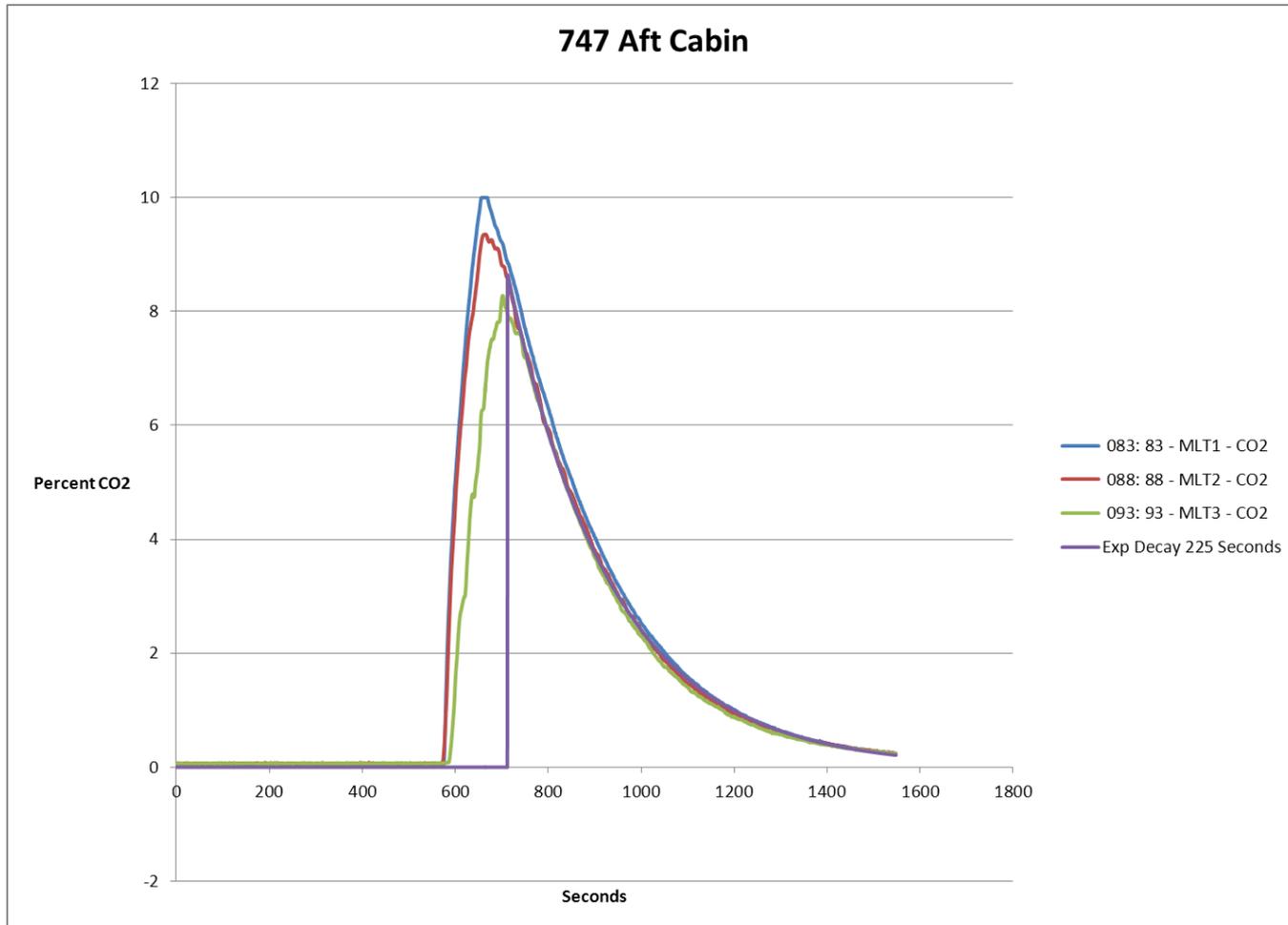
1 Air Exchange every 3.2 minutes

Cabin Exchange Rate Results



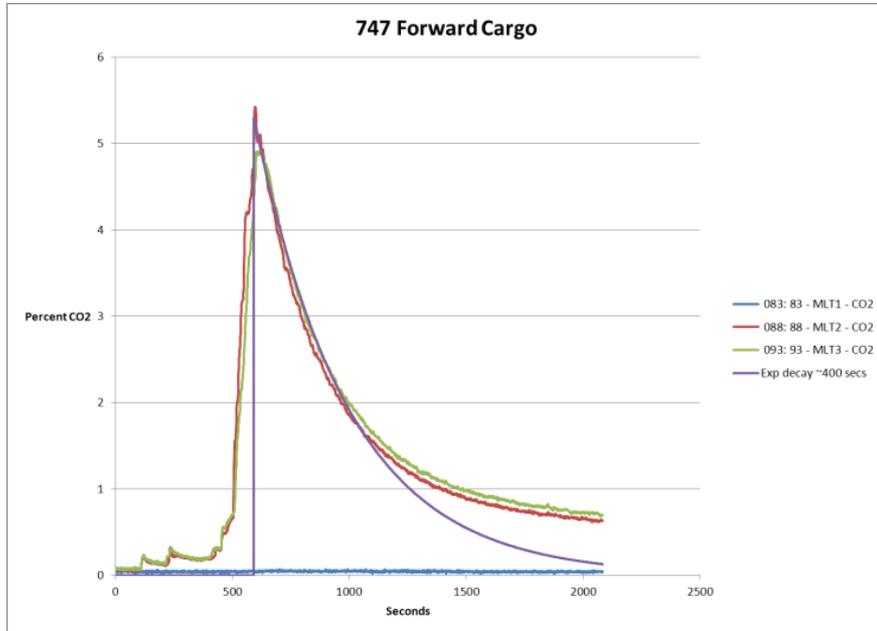
1 Air Exchange every 4.8 minutes

Cabin Exchange Rate Results

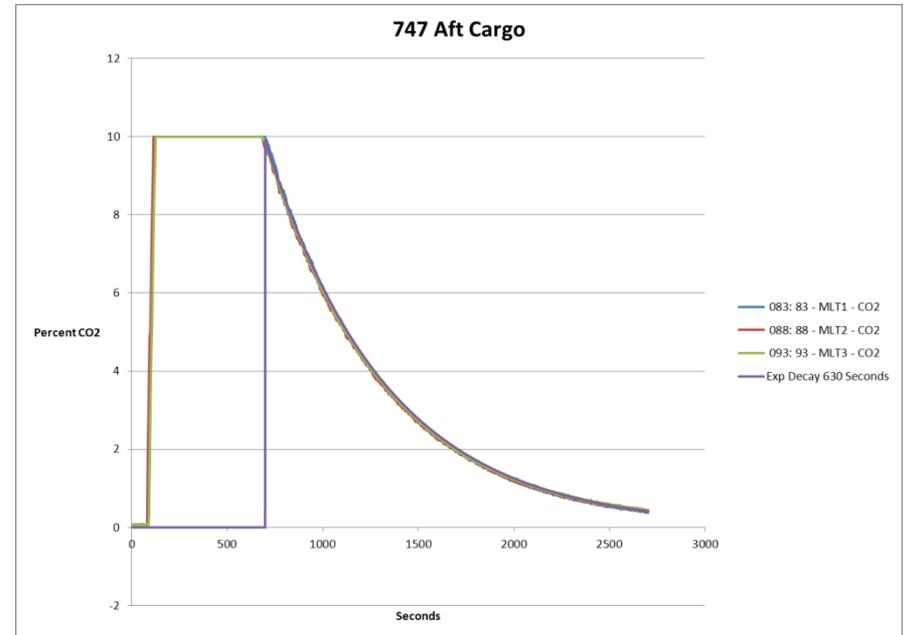


1 Air Exchange every 3.8 minutes

Cargo Exchange Rate Results



1 Air Exchange every 6.6 minutes



1 Air Exchange every 10.5 minutes

Planned Work

Perform interim smoke penetration testing on Fire Safety's 727 freighter main cargo deck.

- Recently, lithium primary battery testing revealed smoke penetrating the flight deck.
- Temperature rate of rise is very high with lithium primaries.
- Study the 727 smoke penetration scenarios before reconfiguring the 747SP for testing.

CO₂ results will be discussed with Boeing and Transport Airplane Directorate to compare to inflight ventilation rates and 747 freighter reconfiguration profile.