Cargo Research Area Updates

Presented to: International Aircraft Materials & Systems Forum Meeting

By: Dhaval Dadia

Date: April 16-18, 2024

Federal Aviation Administration

Cargo Research Area Topics

- Disinfectant Study
- HFC Replacement
- Class-E Cargo Compartment
- Halon MPS – Multiple Fuel Fire Scenario

Concern: Spontaneous Combustion of Chemical Disinfectant Cargo

Testing and Outcome

This study will indicate the probability of autoignition of chemical disinfectant and/or Lithium-ion battery cargo on a hot tarmac and the results may affect current FAA/IATA/ICAO hazardous goods regulations.

Phase 1 Test Data will determine:

- Highest internal **temperature and humidity** of a typical cargo stack (rain-wrapped pallet or LD3) and the **duration** those values were sustained.

Data Analyzed

Phase 2 Test Data will determine:

- **How chemicals and/or batteries in cargo respond** to extreme heat and humidity conditions (observed in phase 1)

Test Plan in Progress

Phase 1 Results

- Data was collected every 2 minutes over a period of 30 days
- Test articles were subject to a good mix of wind, rain, and sun
- Ambient data was collected using weather station sensors adjacent to the stacks

MAXIMUMS ACROSS 30-DAY DATA COLLECTION

			Ambient
RWP	MAX SURFACE TEMP	175°F	*94°F / 94% RH*
	MAX AIR TEMP	**168°F**	***96°F / 95% RH***
LD3	MAX SURFACE TEMP	151°F	*98°F / 85% RH*
	MAX AIR TEMP	**121°F**	***98°F / 85% RH***
	MAX INTERNAL HUMIDITY	**95% RH**	

Questions?

- **Contact Information:**

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HFC Replacement Task Group

- Hydrofluorocarbons (HFCs) have been used in refrigerant applications in aircraft
- Kigali Amendment to the Montreal Protocol require a significant reduction of the use of HFCs, in order to address global warming.
  - 85% reduction in HFC total carbon footprint by 2036
- Other industries have replaced HFC refrigerants with refrigerants that are flammable.
- Task group was established to review standards used in other sectors and determine whether the aviation industry can utilize standards used in other sectors.
- Task group has continued to meet virtually since the fall forum meeting.

HFC Replacement Task Group

Task Group on Thursday April 18

Salon Roselius

1:30 PM – 3:00 PM

Class-E Cargo Compartment

- Last task group meeting conducted in June, 2023
- Tasking for industry:
  - If there have been any developments in fire safety enhancement concepts for class-E cargo compartments, contact Dhaval Dadia.

Cargo MPS – Multiple Fuel Fire Scenario

- Addition of a multiple fuel fire scenario to the Cargo MPS
- Test setup, Test Methodology, # of Tests, Acceptance Criteria

30 Minute Test

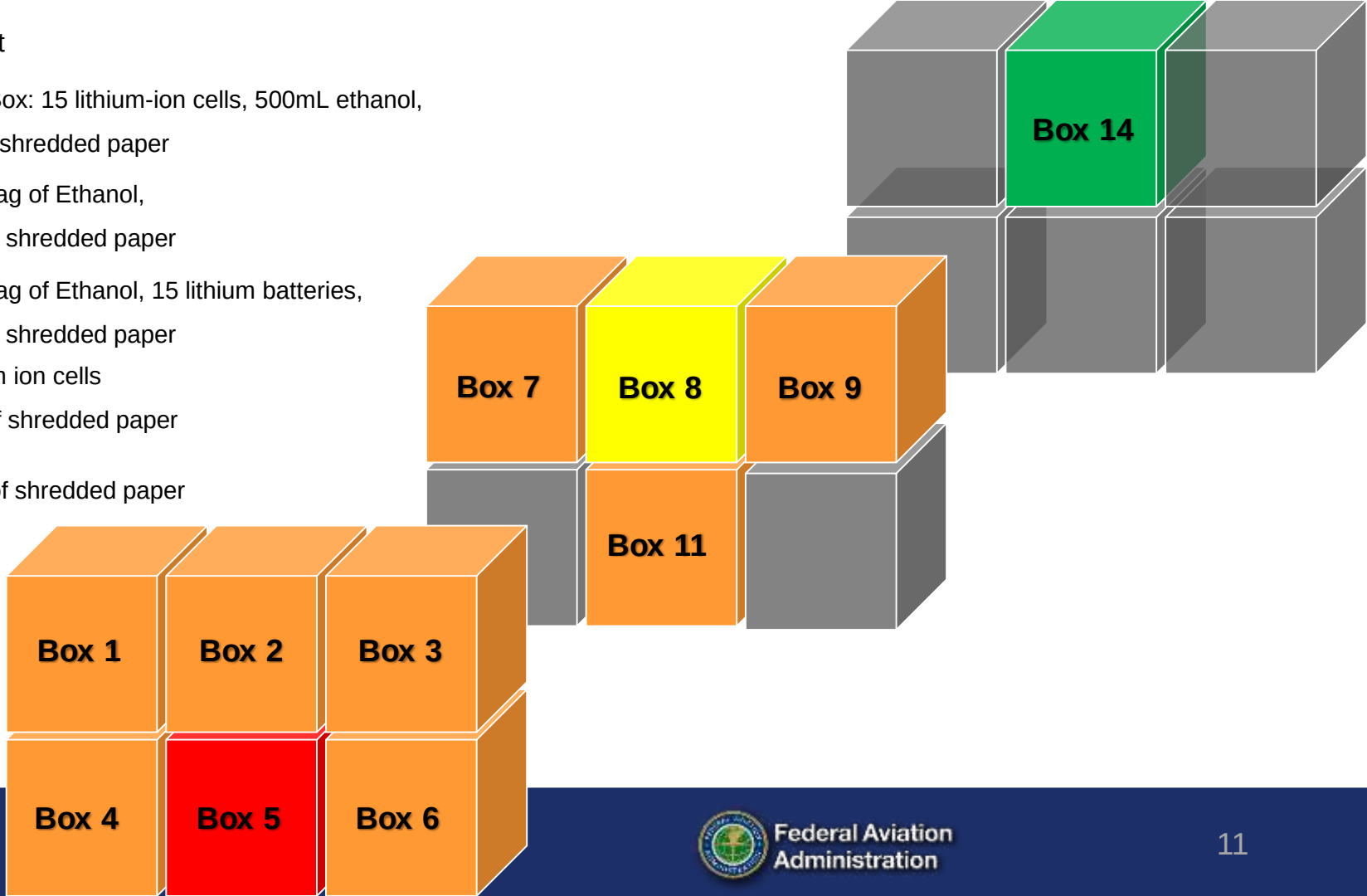
Ignition Box: 15 lithium-ion cells, 500mL ethanol,
2.5lbs of shredded paper

½ Gal. Bag of Ethanol,
2.5 lbs of shredded paper

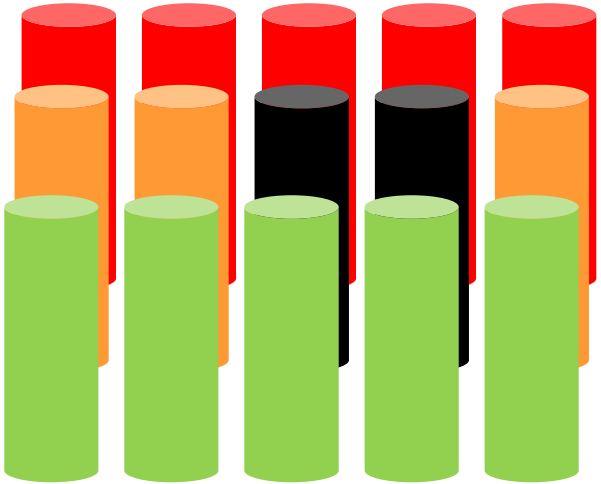
½ Gal. Bag of Ethanol, 15 lithium batteries,
2.5 lbs of shredded paper

15 lithium ion cells
2.5 lbs of shredded paper

2.5 lbs. of shredded paper



Cargo Halon Replacement MPS



100% SOC

60% SOC

30% SOC

60% SOC with Film Heater

Heat 2 cells to ensure propagation

MFFS – Test Methodology

- Fire initiated with initiating thermal runaway in lithium-ion cells in Box 5
- Fire suppression agent is initiated 1 minute after a ceiling thermocouple reaches 200°F.
- For the 180-minute version of the test, thermal runaway is initiated in the lithium cells in Box14 60 minutes from the start of the fire suppression agent.

MFFS - # of Tests

- 5 tests of the multiple fuel fire scenario are to be conducted
- 3 of the 5 tests will be conducted for 30 minutes after the start of the fire suppression agent.
- 2 of the 5 tests will be conducted for 180 minutes after the start of the fire suppression agent.

MFFS – Acceptance Criteria

- The acceptance criteria for the multiple fuel fire scenario will be established based on the performance of Halon 1301
- The peak temperature and time-temperature integral will be calculated in a manner similar to the other fire scenarios.
  - The peak temperature and time-temperature integral will not exceed the highest value of the 5 tests + standard deviation of the 5 tests as performed with Halon 1301

Cargo MPS Task Group

Task Group on Thursday April 18

Salon Roselius

8:30 AM – 12:00 PM

Questions?