REDAC SAS FY 2016

Fire Research and Safety Portfolio Review

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Fire Safety Program Overview

Why is this Program Necessary?

- **Inherent Fire Risks in Aircraft Design and Operation**
- **Accidents/Incidents**
- **NTSB Recommendations**
- **New Fire Threats--New Technology—New consequences**
- **Proven successes (see Asiana 777 accident)**
- **EPA Restrictions on Effective Fire Safety Technology**
- **Supports AVS Mission Needs:** directly addresses continued operation safety; supports certification of new technologies; provides data for regulatory and policy initiatives to account for technology changes

Fatal Freighter Fire Accidents

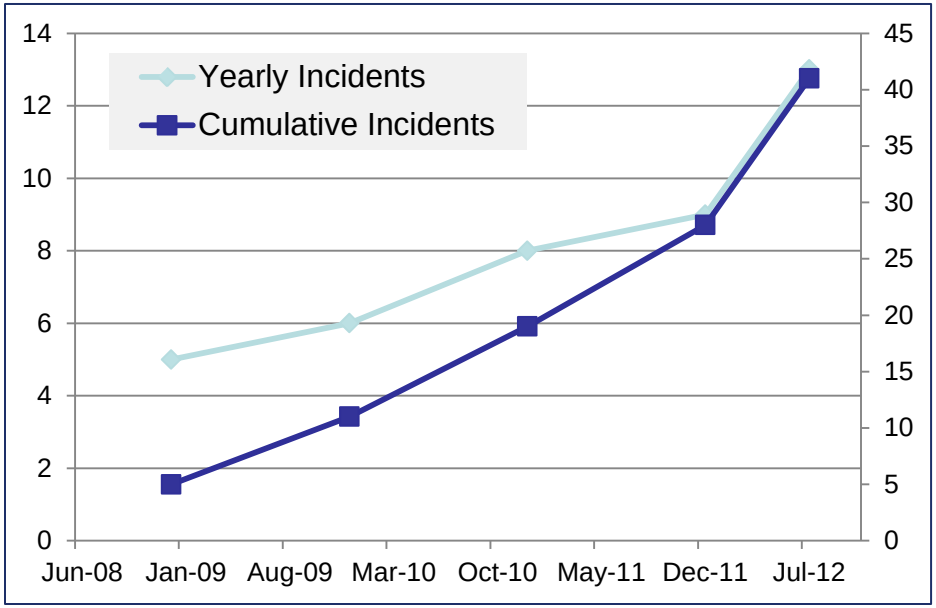
UPS 747-400
Dubai, United Arab Emirates
September 3, 2010

Asiana 747-400
Korea
July 28, 2011

Transported Lithium Battery Fire Incidents

FedEx ULD Lithium Battery Fire
Memphis, Tennessee
August 6, 2004

Transported Lithium Battery Fire Incidents (2008 – 2012)



Future Risk of Cargo Fire Accidents

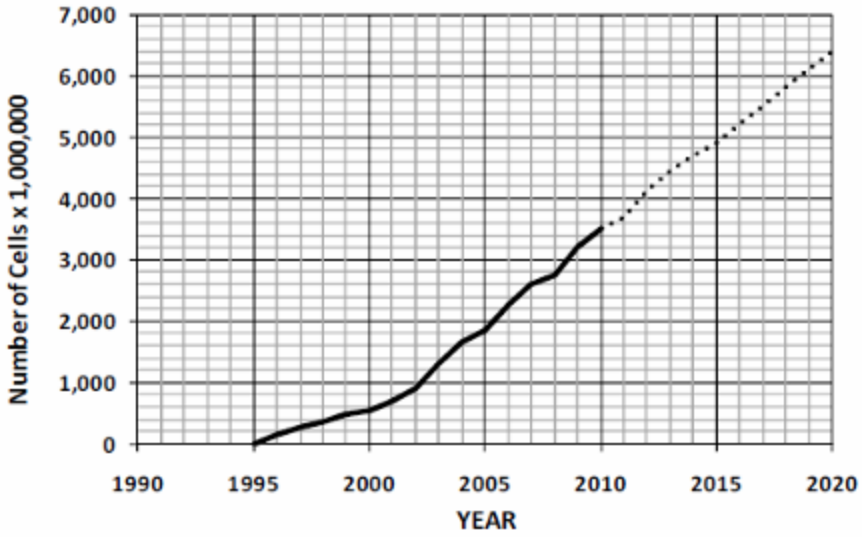


Figure 3 Estimation of the Annual Number of Lithium Ion batteries produced worldwide

6 ACCIDENTS OVER NEXT 10 YEARS

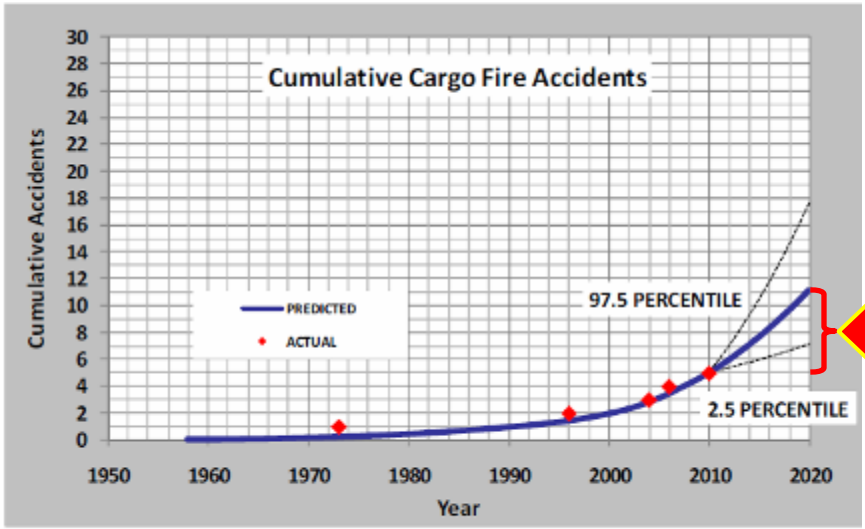


Figure 6 Predicted Number of Freighter Airplane Cargo Fire Accidents through to 2020

Accidents/Incidents in 2013

Standards contributed to survivability

Event suggests more research is needed

Asiana Interior Looking Forward

Ethiopia Exterior and Interior

Unexpected skin damage, based on fire penetration tests

Unexpected fire propagation, based on testing and research

NTSB Most Wanted List

Improve Fire Safety in Transportation

What is the issue?

Fire safety combines many elements, such as design, materials, and fire detection and suppression technologies. NTSB accident investigations have revealed deficiencies in the implementation of fire safety in many modes of transportation.

In 2005, the NTSB found deficiencies in the design, materials, and fire detection capabilities that led to a tragic highway accident near Wilmer, Texas. This motorcoach fire was caused by ignition of a tire and resulted in the death of 23 passengers.

In 1996, near Juneau, Alaska, a fire in the main laundry area of a passenger ship killed 5 and injured 56. In 2000, a fire in the unmanned engine room of a commuter ferry in the Hudson River caused $1.2 million in damages, but all people on board were rescued. In Boston Harbor in 2006, another fire in the unmanned engine room of a commuter ferry resulted in no serious injuries or fatalities, but damages were estimated at $800,000. These accidents were exacerbated by inadequate fire detection.

Three cargo fires accidents in the past seven years have resulted in the deaths of two flight crews and the total loss of three aircraft. The NTSB investigations for all three accidents revealed deficiencies in fire safety strategy used for both fire detection and suppression, and noted the role played by cargo container materials.

UPS DC-8, PHL, 2/8/2006

NTSB Cargo Airplane Fire Protection Recommendations

Letter to Acting Administrator; November 28, 2012

- Require the installation and use of active fire suppression systems in all aircraft cargo compartments or containers, or both, such that fires are not allowed to develop (A-12-70)
- Develop fire detection system performance requirements for the early detection of fires originating within cargo containers and pallets and, once developed, implement the new requirements (A-12-68)
- Ensure the cargo container construction materials meet the same flammability requirements as all other cargo compartment materials in accordance with Title 14 Code of Federal Regulations 25.855 (a-12-69)

Unknown Smoke/Odor Incidents in Passenger Aircraft

- **Large number each year (~900)**
- **Not isolated to one carrier or one aircraft type**
- **Large majority are non fire/smoke sources or low risk sources**
  - Environmental Control System
  - Faulty smoke-fire detection systems
  - Galleys (ovens and coffee)
- **Significant Operations and Cost Impact**
  - Diversions or airbourne turn backs
  - Returns to gate
  - Emergency landings/evacuations at destination airport
- **Dual safety concerns: hidden fire sources and flight deviations**
- **Study underway with initial incident summary provided**

Developing Areas

Full-Scale Fire Test on Magnesium Alloy Seat Structure

- Aircraft structure applications to replace non-combustible metal alloys
- Weight reduction main driver
- Graphite/epoxy composite fuselage and wings (B787 and A350)
- Lithium/Aluminum allows for fuselage structure (Bombardier C-series)
- Magnesium Alloy
  - Seat structure (special conditions in draft)
  - Other cabin applications-inaccessible areas
- Improved Cargo Containers/Covers

AVS Mission Support

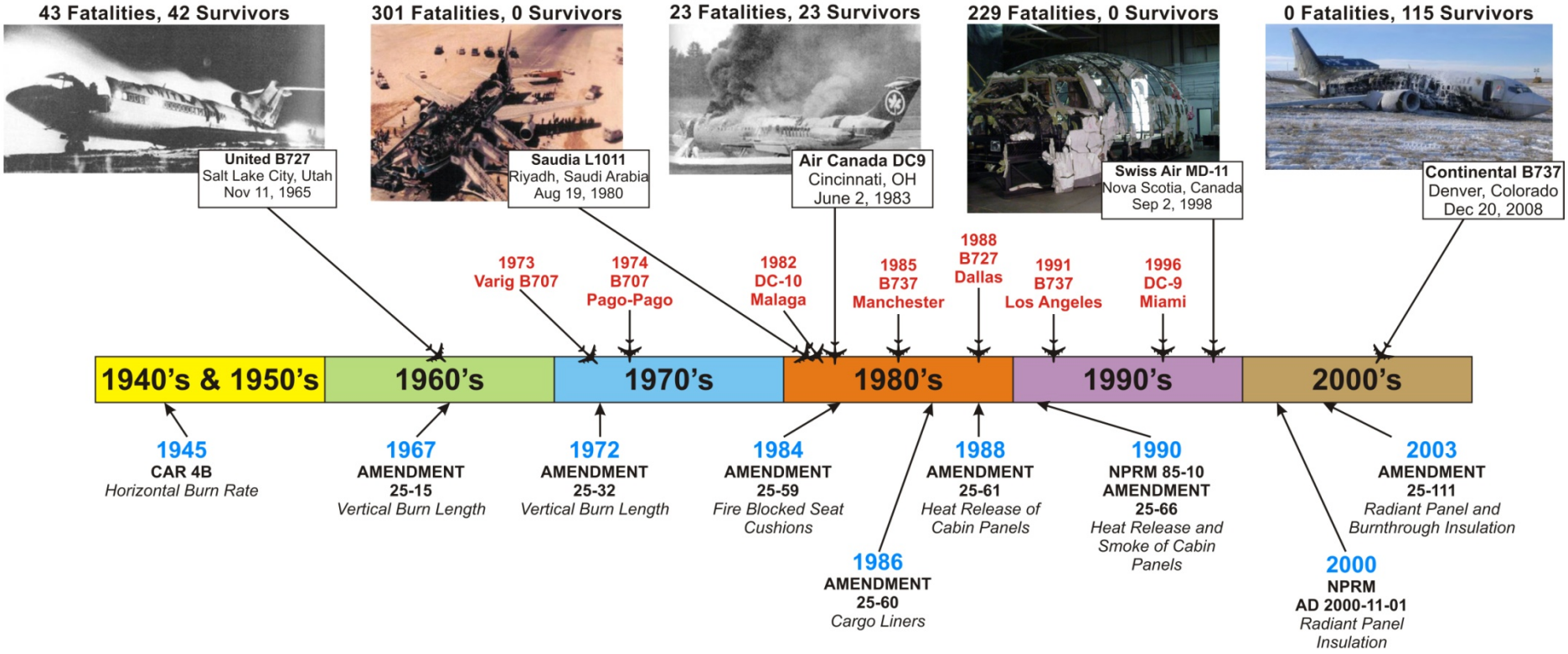
- **Continued Operational Safety**
  - Risk of freighter fire accidents
  - Increasing threat of lithium battery cargo- and installed
  - Fuel cells: Installed as well as PAX PED's
  - Unknown smoke/odor incidents
  - Fire safety training videos (maintenance, lithium battery cargo handling)
- **Standards and Policy**
  - Halon replacement minimum performance standards (MPS)
  - Halon replacement ARC
  - Advisory Circulars (cargo liner/installation fire tests, seat cushion fire tests)
  - Refined and new test methods based on threat scenario and part/material usage
  - Complete revamping of material flammability regulations (FAR 25/Appendix F)
- **Certification**
  - Special conditions (e.g., composite fuselage flammability, magnesium alloy seat structures,)
  - New material applications (e.g., lithium aluminum fuselage structure)
  - Fuel Cell Power sources (Hydrogen)

Fire Safety Program Overview

What is this Program?

- **Purpose**
  - Improve fire safety in transport aircraft
    - Prevent accidents caused by in-flight fire (accident prevention)
    - Improve postcrash fire survivability (accident mitigation)
  - Develop fire safety technology standards and criteria for AVS implementation
    - Flammability test methods and criteria for interior **materials**
    - Fire protection **systems** (detectors, suppression/extinguishing agents, integrated systems)
    - **Hazardous materials** safety (e.g., lithium batteries)
- **Benefits**
  - Reduced loss of life and injuries due to aircraft fires
  - Reduced hull/property losses due to aircraft fires
  - Enables FAA to meet its responsibility as a regulatory agency to ensure the highest level of aviation safety

Evolution of Improved FAA Flammability Test Standards for Aircraft Interior Materials



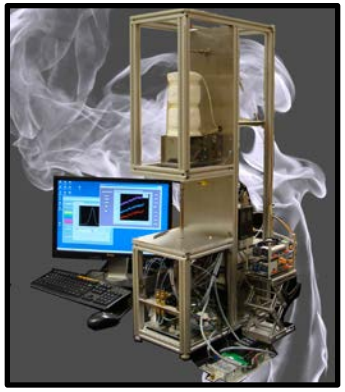
Fire Safety Program Capabilities

- **People**
  - Fire Safety Branch personnel are recognized world-wide for their expertise in aircraft fire safety R&D
  - FAA Fire Safety Program is mainly conducted in-house
  - Advanced research in fire science and enabling technologies
- **Facilities**
  - FAA operates the most extensive civil aircraft fire test facilities in the world
    - Full-scale tests
    - Medium scale tests
    - Laboratory tests
- **Partnerships**
  - Industry participation and input is provided through 2 international working groups chaired by FAA (material fire tests, systems fire protection)
  - Cooperative research with foreign regulatory authorities through Cabin Safety Research Technical Group
  - Fire Safety R&D will support other agencies (domestic, international) when beneficial to FAA

In-House Fire Test Facilities

Aircraft Components Fire Test Facility

Fire Science Laboratory



Aircraft Fire Test Pad

Airflow Induction Test Facility

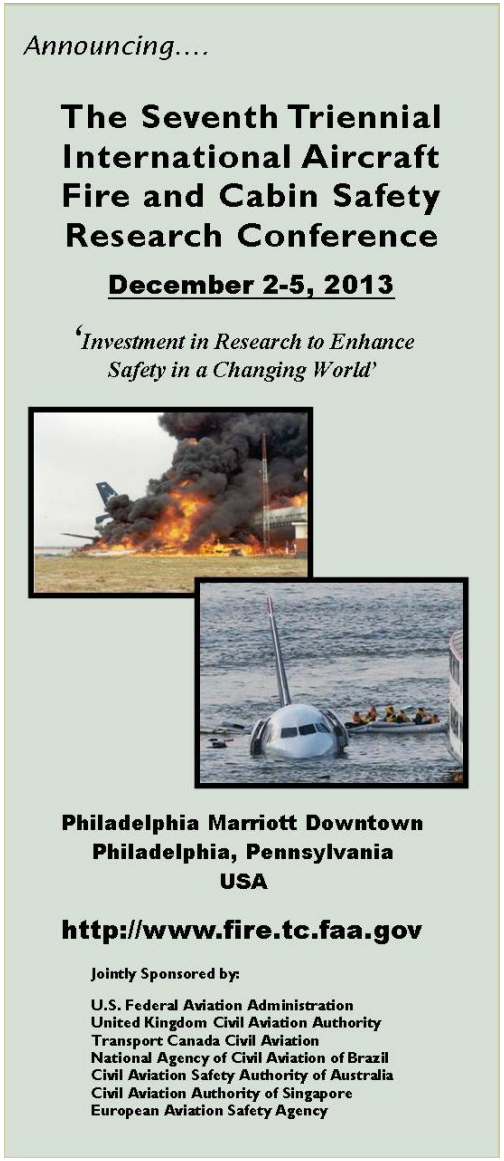
Materials Fire Test Facility

Full-Scale Fire Test Facility

Engine Nacelle Fire Simulator

Worldwide Interest

- 7th Triennial Fire and Cabin Safety Research Conference Dec. 2-5, 2013
- 563 Attendees
- Keynote Addresses from FAA Deputy Administrator, NTSB Board Member
- Over 20 countries represented



Fire Research and Safety (FCS-16-01)

Research Requirement

- Improve passive and active methods of fire protection in aircraft to prevent and mitigate accidents
- Transfer large-scale fire tests to repeatable/reproducible material flammability test methods for both in-flight and post-crash fires
- Consider the need for fire suppression systems to protect against hidden in-flight fires
- Address the hazards of high energy storage devices (lithium batteries and fuel cells)
- Sponsor: Jeff Gardlin, ANM-115; Performer: Dick Hill, ANG-E21

Outcome & Implementation Plan

- Outcome: Prevent accidents caused by in-flight fires
- Revamped material flammability regulations (Planned NPRM FY-14)
- Key decision point on viability and merit of integrated fire protection system in FY-18

Outputs

- Generalized flammability test method for hidden materials
- Large-scale fire tests on magnesium alloy ducting
- Prototype sensor that discriminates between fire and non-fire events
- Initial design of an on-board fire detection and extinguishment system for cabin attic space
- Fire characteristics of large-format lithium cells and batteries
- Initial design of a system to protect against a fuel cell APU leaking hydrogen gas
- Fire spread capability added to CFD hidden fire model

Contract Funding ($K)

FY12	FY13	FY14	FY15	FY16
$	$	$	$	$