



**NTSB** National Transportation Safety Board

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*Office of Marine Safety*

# **Lessons Learned: Case Studies of Recent In-flight Battery-related Incidents**

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# Overview

- Battery incident statistics
- Case study and related incidents
- Future considerations



# Battery Fires

- Since February 2007, 37 battery-related incidents\*
  - Four incidents since abstracts were submitted
- Location of incidents
  - Passenger cabin
  - Baggage compartment
  - Cargo compartments (cargo-only)

\* FAA Battery and Battery-Powered Devices Aviation Incidents database

# Battery Fires

- Battery types
  - Lithium (primary)
  - Lithium-ion (secondary)
  - Nickel-Cadmium (NiCad)
  - Others (high energy density)
- Causation of incident
  - Short circuit (internal and external)
  - In-use situations
  - Noncompliance



# Battery Fires Case Study

- Jet Blue Flight 721
- Other incidents

# Flight 721-Accident Overview

- Fire discovered in-flight after takeoff from JFK
- Passengers reported smoke coming from overhead bin
- Upon opening overhead bin, flight attendant noticed smoke coming from a bag



# Flight 721-Crew Response

- Attendant sprayed Halon extinguisher into bin
- Smoldering continued after extinguisher was discharged
- Attendant used bottled water on bag
- Removed bag from overhead bin and stored it in lavatory
- Captain declared an emergency and returned to JFK

# Flight 721-Probable Cause

- Contents of the bag
  - Two 14-volt rechargeable batteries with unprotected contacts
  - Various Li-metal batteries-AA and 9-volt





# Flight 721-Probable Cause

- Debris found inside bag determined to be remains of Li-metal 9-volt battery
- Cause determined to be thermal runaway and failure of 9-volt battery



# Other Battery Incidents

- Flashlight found on fire in overhead bin of passenger aircraft
- Air purifying unit “exploded” in terminal
- Battery pack within burned package found during unloading
- “e-Cigarettes” found after crew alerted to a fire by warning light
- Flashlight overheated in crew carry-on



# Conclusion

- Out of the 34 aircraft-related incidents
  - Passenger-9
  - Baggage-6
  - Cargo-19
- Lithium/Lithium-ion batteries most prevalent type; however all types of high energy density batteries contributed to events
- Poor handling/packaging most prevalent cause

# Future Considerations

- NTSB Battery Recommendations
  - Four open recommendations
- New technologies
  - More energy density/smaller package
  - Unidentified failure mechanisms
- Continued Education
  - New rules
  - Passengers and shippers





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