ALLIED PILOTS ASSOCIATION

Lithium-Ion Batteries in Commercial Aviation

Electronic devices and the batteries that power them are *everywhere*. Though we enjoy and benefit from the use of such items as mobile phones, laptops, and motorized wheelchairs, they do come with a certain level of risk particular to commercial aviation. Lithium batteries are a concern on commercial aircraft (passenger and cargo) due to their tendency to overheat, which can lead to a phenomenon called "thermal runaway." This occurs when an overheated battery generates enough heat to trigger adjacent cells, causing a chain reaction that may lead to fire or explosion. These fires can be difficult to extinguish, particularly at high altitudes, in a small space, with limited firefighting resources. The FAA has reported a 71% increase in incidents involving lithium batteries from 2019 to 2023.[1]

Commercial aircraft carry lithium batteries both in the cabin contained within passenger and crew electronics, and in the cargo bays, where they are often shipped in large quantities. If not properly handled or packaged, faulty or damaged batteries can pose a severe risk in-flight, where even a small fire could jeopardize passenger safety and aircraft integrity.

In addition to accidental thermal runaway, there is recent evidence that certain state and non-state actors are experimenting with targeted thermal runaways in otherwise benign/routine packages to threaten commercial aviation, particularly between Western Europe and North America. To mitigate this risk, strict regulations have been implemented regarding the transport and usage of lithium batteries, and airlines are advised to follow stringent packaging, handling, and quantity limitations.

The transportation of lithium batteries on commercial aircraft is governed by a combination of international guidelines and national regulations, primarily aimed at mitigating fire risks associated with these energy-dense power sources. The International Civil Aviation Organization (ICAO) sets global standards for the safe transport of dangerous goods, including lithium batteries. These standards are detailed in the ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air. The International Air Transport Association (IATA) further refines these guidelines in its Dangerous Goods Regulations (DGR), which are widely adopted by airlines worldwide. Key provisions include:

- **Passenger Aircraft Restrictions**: Transporting lithium-ion cells and batteries as cargo on passenger aircraft is prohibited. However, lithium-ion batteries packed with or contained in equipment are permitted, subject to specific conditions.
- **State of Charge Limitation**: Lithium-ion cells and batteries shipped by cargo-only aircraft must not exceed a 30% state of charge when not packed with or contained in equipment.

[1] Here is one vignette of lithium battery risk on aircraft, with scientific diagrams and actual pictures of a cargo fire aftermath: https://ops.group/blog/dangerous-goods-the-bad-ones/

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- **Packaging and Labeling Requirements**: Strict guidelines are in place for packaging, labeling, and documentation to ensure safe handling and transport.

In the United States, the Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) and the Federal Aviation Administration (FAA) enforce very similar regulations concerning lithium batteries on aircraft:

- The transportation of lithium-ion cells and batteries as cargo on passenger aircraft is prohibited, and lithium-ion cells and batteries shipped on cargo-only aircraft are limited to no more than a 30% state of charge when not packed with or contained in equipment.
- Passengers are allowed to carry personal electronic devices containing lithium batteries in carry-on baggage. Spare (uninstalled) lithium batteries must also be carried in carry-on baggage, with terminals protected against short circuits. Damaged, defective, or recalled batteries are prohibited from being transported by air.

Lithium batteries are regulated as a hazardous material under the US Department of Transportation (DOT) Hazardous Materials Regulations (HMR; 49 CFR, Parts 170-180). There are various additional codes and regulations regarding lithium batteries and rechargeable consumer products, such as UN 38.3 Manual of Test and Criteria, and 42 USC Sections 14322 and 18741 to name a few. There are also pending bills in Congress, most recently the “Setting Consumer Standards for Lithium-Ion Batteries Act” (H.R. 1797, and its companion bill, S.1008). There are multiple other bills mentioning risk factors from lithium batteries, which exemplifies part of the problem: A multitude of conflicting/overlapping regulations, instructions, and published guidance for the handling of lithium batteries on commercial aircraft lends itself to a lack of standardization across airlines, and among various nations.

The Allied Pilots Association supports a single, stringent international standard governing the air transport and carriage of lithium-ion batteries that will ensure the safety of our passengers, crew, and aircraft.

For questions or additional information please email GAC-Chairman@alliedpilots.org