

## Dangers of Lithium Ion Batteries

In the last article we discussed the dangers of lithium metal batteries. Now we will discuss why lithium ion batteries also pose significant dangers in air transport. While lithium ion batteries do not contain a reactive form of lithium (it is an ionized, salt form), the electrolyte they contain is a very flammable liquid, that when heated, can produce explosive gas mixtures. The Halon fire suppression systems used in today's aircraft are ineffective in preventing these gas mixtures from exploding. Lithium ion batteries are generally rechargeable and power most of the battery powered devices that are so popular today. These include laptops, tablets, phones, cameras, hoverboards, small electric drones, toothbrushes, power tools and many, many other portable electronic devices. Like lithium metal batteries, their popularity stems from very high energy and power to weight ratios.

A battery is made up of one or more individual cells. Each cell is a power producing unit. Much like lithium metal cells, when a lithium ion cell starts to short circuit (from mechanical damage, exposure to high or low temperature, manufacturing defect, external short), heat is generated that can lead to further breakdown of insulating properties within the battery, causing further shorting. This creates more heat, and the cycle repeats, causing thermal runaway. This heat can cause the electrolyte (a fuel like liquid inside the cell) to either vaporize and vent through seals in the cell, or rupture the cell. A short in a single cell can propagate from cell to cell within a battery or between batteries in a shipment until many cells and batteries have vented. The vented gas mixture contains significant amounts of hydrogen gas and hydrocarbons that create an explosive mixture. In a lithium metal battery, the lithium metal will burn causing the gasses to combust immediately, but since there is no lithium metal in a lithium ion battery (it's lithium is in the form of an inert salt) the vented gasses can collect in a void in a package or container. Eventually, enough heat from the short circuiting can be generated to ignite these gasses and cause an explosion.

The explosion itself might not be strong enough to structurally damage an aircraft, but if it occurs in a Class C cargo compartment (all FedEx belly compartments are Class C), it will probably compromise the Halon effectiveness by dislodging blow out panels, rendering the compartment unable to contain the Halon. The fire suppression system of the aircraft is then compromised and there is nothing to prevent the fire from spreading to the rest of the aircraft. It is important to note that FAA tests show that gasses from as few as three to eight cells is enough to disable the fire fighting capability of a B-737 Class C cargo compartment. Since the most common replaceable laptop batteries are either six or nine cell batteries, this means that one single cell shorting in a single laptop battery can lead to the loss of a commercial aircraft.

The FAA has concluded from their own tests that the risk from lithium ion batteries is significant and has publically supported international action to ban lithium ion batteries on passenger aircraft. Unfortunately, they are prevented by statute from acting before ICAO imposes tougher safety standards. Current regulations do not limit the number of lithium ion batteries allowed to be carried on commercial aircraft even though the FAA recognizes this danger. Additionally, Boeing and Airbus have recommended that any airline accepting lithium ion batteries carry out a risk assessment to include at least the type and number carried. This is impossible at FedEx, since many of the batteries we carry are shipped under regulations that don't require a Dangerous Goods Declaration Form, and are not tracked as they transit our system.

Department of Transportation is prohibited by congress from enacting regulations to ensure the safe transport of lithium batteries if they are more restrictive than ICAO standards. ALPA has been working to repeal this onerous limitation on our regulators, and allow them to safely regulate lithium battery transport, but we need member help. Please follow the link below and let your senators and congressmen know that politics should not interfere with flight safety and the DOT should be allowed to do their job to ensure lithium batteries are transported safely.