

Discussing Technical Problems: Lithium-ion batteries

Boeing Dreamliner 787: Airline safety

This week saw 50 planes of Boeing's Dreamliner series grounded **amid safety concerns** over the battery. The US and European aviation industries have said planes should remain grounded while **checks are carried out** on their lithium ion batteries. They are worried that the batteries could leak thus **corroding** vital equipment and potentially causing fires. Boeing flights have



This isn't the first time Boeing have come under fire due to technical problems, look at the table of technical issues below. Discuss the potential solutions to these problems and what factors must be considered when implementing them:

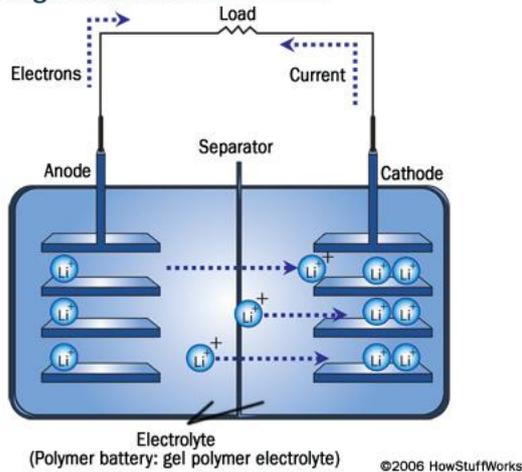
Technical Issue	Problem(s) with and Reason(s) for the technical issue	Solutions for technical issues and things to consider when implementing these.
Parts are outsourced from many countries		
Cracked window in Cockpit		
Exploding Lithium ion battery		

Lithium-ion Battery Safety Concerns

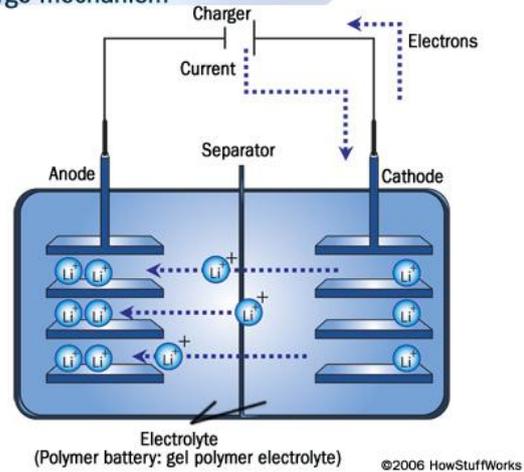
Remember when laptops were bursting into flames in 2006? It was the lithium-ion battery.

Random explosions from overheating weren't a widespread problem, but nevertheless, lithium-ion battery manufacturer Sony, which came out with the first commercialized Li-ion battery in 1991, had to recall more than 6 million computers because of it.

Lithium-ion rechargeable battery
Discharge mechanism



Lithium-ion rechargeable battery
Charge mechanism



Lithium-ion battery packs and cells come in all shapes and sizes, but they're all similar. Check out what the packs and cells look like on the inside.

In the couple of years since then, the Li-ion battery hasn't completely recovered its reputation for safety. Now you can see why putting it inside of a car makes some people a little antsy.

Why is there a chance for explosion? Li-ion batteries work by separating its positive and negative sides by a thin layer, called an **electrolyte**. The electrolyte is **perforated** to allow the lithium ions to pass through from one side of the chamber to the other, thus generating a current. Tiny bits of metal that result from the manufacturing process can potentially get stuck in those perforations, preventing the ions from freely flowing. Pressure and heat can then build up, causing an explosion. Also, allowing the ions to move too quickly can lead to overheating as well.

So how does the all-electric Tesla Roadster manage to pack 6,831 Li-ion batteries under its hood without risking a major blow-up? The Tesla's energy storage system that propels the car is **equipped** with a cooling system, which ensures the batteries don't overheat. It also **regulates** the speed of the flow of ions to keep them from re-charging or **draining** too quickly.

Since car companies and scientists realize the **broad** potential of Li-ion batteries, they have poured time and money into finding ways to reduce any safety hazards. For instance, nanotechnology, the study of atoms and nanostructures, may be able to prevent those dangerous explosions. New nanomaterials, such as nanophosphate, **aren't prone to** shorting out like graphite, the traditional Li-ion electrolyte. And speaking of time and money, before Li-ion batteries make their grand entrance into the consumer automotive world

What needs to be considered before Li-ion batteries come into the automotive world?

Source: <http://auto.howstuffworks.com/fuel-efficiency/vehicles/lithium-ion-battery-car1.htm>

Role A – Airline CEO

You are furious Boeing sold you so many defective airplanes. Tell the others three reasons why. You want Boeing to give you back your money. You will buy airplanes from Airbus instead. You also want compensation – Boeing has damaged the image of your airline.

Role B – Boeing boss

You understand the anger of airlines. However, they are making it a bigger problem than it really is. Tell the others three reasons why. You can't issue refunds. Airlines understand new planes have teething problems. You cannot pay compensation to airlines or passengers.

Role C – Passenger

You missed your own wedding because your flight was canceled. You want Boeing to pay for a new wedding, including all the costs your guests incurred. You are very unhappy with Boeing. Tell the others three reasons why. You want to know why Boeing sold faulty airplanes.

Role D – Aviation safety official

You believe Boeing's Dreamliners are the safest planes in the world. Tell the others three reasons why. All new airplanes have teething problems. Airlines know this, passengers should understand this. Tell Boeing's boss (s)he must compensate all passengers and airlines in full.

Role E – Chairman of the meeting

Your role is to control the meeting. Make sure that a solution is found and that all of the participants in the meeting are satisfied with the outcome. Make sure everyone has a turn to speak and don't allow one individual to dominate the discussion.

Watch the following video on the Boeing 787 Dreamliner and answer the questions below

<https://www.youtube.com/watch?v=wRojKogVlqE>

*the answer are in white – highlight and change colour to reveal the answers

What problems did the Japanese pilots face at the beginning of the report?

What did inspections of the Japanese aircraft find?

Why are Lithium ion batteries particularly dangerous?

What two issues are caused by corrosive fluids being released?

Why were the Lithium Ion designs initially chosen?

The Lithium ion battery



The Boeing 787's lithium battery can self-heat as a result of temperature and pressure changes, which may have caused this battery fire on the Dreamliner.