



## Ensuring Batteries are “Safe2Fly” - Combining Aviation Safety and Battery Science -

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***“The basic premise of the Safe2Fly program combines aviation safety with battery science”***

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***“This concept is a comprehensive end-to-end plan to address gaps in battery transportation safety”***

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***“In today's environment, battery manufacturers run the gamut from producing well-manufactured batteries to poorly manufactured or counterfeit batteries that pose real risk”***

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***“The concept of utilizing a Third party to help ensure safety is not new to aviation”***

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Operation Safe2Fly is aggressively promoting safer methods for transporting batteries on aircraft. Our role has resulted in developing significant risk mitigation strategies. The most important initiative under development is called “Safe2Fly” which advocates a comprehensive end-to-end program to address gaps in the battery transportation supply chain. Developing this program involved combining our knowledge of aviation safety and risk with Underwriters Laboratories (UL) understanding of battery science and product safety. The purpose of this article is to highlight UL as an independent Third party that is actively involved in battery safety, describe the practical workings of the Safe2Fly program and provide a series of questions and answers related to developing such a program.

### **Safety Standards and UL**

Innovation brings the promise to better our lives, but with it often come new risks and complexities that can threaten product safety, security and sustainability. UL applies science to help solve these complex challenges and makes the safe adoption of innovation possible. The mission of UL is to enable safe, secure, sustainable working and living environments for all. For more than 120 years, UL's science and expertise in the development of safety standards has helped innovation fulfill its' promise, so that products once deemed dangerous can be made safer. A recent example comes from examining the hoverboard debacle. The hoverboard literally became the “hottest gift” in 2015 as the number of house fires surged. This led to a ban on transportation by U.S. airlines and involvement from the U.S. Consumer Products Safety Commission (CPSC). As a result, UL was asked to develop the national safety standard for both the US and Canada and on November 21, 2016 UL published UL 2272, “The safety Standard for Electrical Systems for E-Mobility Devices”. This multi-national standard contains the consensus requirements for the evaluation of the electrical drive train system along with the battery and charger system. Today, hoverboards that meet UL's standard are marked with a holographic UL label and provide indication you have purchased a UL evaluated, tested and certified product. Equally important, unsafe counterfeit hoverboards are kept away from consumers by UL's active involvement in partnership with U.S. Customs and Border Protection and Royal Canadian Mounted Police to seize counterfeit products and prosecute those individuals and companies responsible. This type of proven track record for improving safety led IPA to begin a dialogue with UL about the hazards of transporting batteries on aircraft. What followed was the collaborative development of a safety program concept called “Safe2Fly”.

# Operation Safe2Fly



## Battery Science

This involves a review of battery chemistry and testing cells to failure. Failure testing allows the direct measurement of the potential hazard it represents to aviation and consumers. Compiling this data and understanding failure is the key first step in the program.



## Design, Manufacture and Certification

On site manufacturing inspections help ensure standards are being followed and that modifications have not been made to compromise safety.



## Database

A central repository of knowledge allows an air carrier or government agency to quickly evaluate a product for transportation. A database for large-scale retailers already exists and it needs to be enhanced.



## Safety Management System Risk Assessment

Not all batteries are created equal and some pose a much greater risk than others, and it is this measurement of hazard that drives this data-driven assessment. This is knowledge an airline can use to conduct a factual SMS risk assessment of products offered for transport.

# 3rd Party Review & Risk Assessment Overview



## Packaging

There are packaging standards that must be followed to mitigate hazards. In addition, new packaging standards under development (e.g. SAE G-27) can be incorporated.



## Labeling

Unique product labeling that is not easily duplicated and can be entered into a database is a key component for both developing an accurate Safety Management System (SMS) risk assessment and more easily identifying counterfeit products.



## Aviation Transportation

At this point in the process, a product or shipment can be accepted, rejected or identified as counterfeit and the appropriate action taken.

OR



## Counterfeit Detection and Prosecution

Products identified as counterfeit can be identified and removed from the supply chain and criminal prosecution can be pursued for copyright or trademark infringement.

# Operation Safe2Fly - Questions and Answers

## **Is the Safe2Fly program really necessary?**

The issue of Lithium batteries causing hazards in the air transportation system is significant. Battery production is increasing along with demand. Reputable battery manufacturers are being penalized by sub-par manufacturers and counterfeit producers. The Safe2Fly process combines battery science and aviation safety to mitigate the risks associated with transporting batteries. In the end, quality manufacturers, airlines and consumers are all rewarded from a Third party validation process.

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## **Why is a Third party necessary?**

“Trust but Verify” - These three words attributed to former President Regan would have a significant and positive impact on aviation safety. The Safe2Fly process requires an independent Third party to validate many aspects of this program, including testing, certification, standards, manufacturing surveillance, data validation and others. In today's environment, battery manufacturers run the gamut from producing well-manufactured batteries to poorly manufactured or counterfeit batteries that pose real risk. Even more concerning is that some well-manufactured medical device batteries (e.g. pacemaker batteries) which pose low risk are banned from air transportation while thousands of hazardous and untested batteries are legally transported by air every day.

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## **What do you mean by a First, Second or Third Party?**

These are terms used to identify

organizations that make claims about a product performance and safety. The First Party is the originator of the claimed information. A Second Party is associated with the First Party, but may or may not have validated these claims. A Third Party is an independent and impartial organization that can verify and/or validate claims made by the First or Second Party through systematic evaluation, authentication, surveillance and testing methods. These methods are published and open to scrutiny by the experts in the industry.

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## **Is a Third party process used elsewhere in aviation safety?**

The concept of utilizing a Third party to help ensure safety is not new. The U.S. Department of Transportation uses a 3rd party process for the transportation of certain hazardous products.

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## **Why do batteries need to be tested, aren't manufacturing standards in place?**

To-date, UL has developed 19 battery-safety standards with multiple test requirements. The fact is that all of these standards are voluntary and not required for a product to enter the marketplace. An example is hoverboards and the eventual development of UL 2272 as requested by the CPSC.

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## **Why is failure and hazard assessment important?**

You cannot conduct an accurate SMS fact-based risk assessment unless you understand the hazard. From Wikipedia: “Quantitative risk assessment requires calculations of

two components of risk (R); the magnitude of the potential loss (L), and the probability (p) that the loss will occur.” Testing a cell to failure allows you to determine a “breaking point” so an accurate understanding of the product risk can be developed. Batteries are a complex arrangement of one or more cells. Cells contain multiple ingredients (metals, chemicals, plastics, additives) that constitute an “electrochemical couple”. Cells allow the storage and release of energy as we charge and discharge the cell hundreds or thousands of cycles. There are factors that can affect this delicate “recharging and use” process that can lead to unexpected failure (these include shock, vibration, overcharge, over discharge, poor quality manufacturing, poor design and so on). Abrupt discharge of this stored energy is often called internal short circuit (ISC) leading to thermal runaway. Internal or external short circuit can result in temperatures exceeding 7001000oC leading to cell rupture, arcing, ignition and fire. Propagation to adjacent cells (or surrounding materials) can occur leading to an ever-greater hazard.

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## **Do any manufacturers have their battery designs and facilities inspected?**

They may or may not. Manufacturers may choose to use an independent Third party certification body to demonstrate conformity of their battery products. As an example, UL conducts over 500,000 factory visits per year and the UL Mark appears on over 22 billion products annually.