SAE INTERNATIONAL

AEROSPACE INFORMATION REPORT

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Lithium Battery Powered Portable Electronic Devices

RATIONALE

This SAE Aerospace Information Report (AIR) is prepared to bring attention to what is considered a potential shortcoming of current standards related to the usage of lithium-ion (Li-Ion) battery powered portable devices in conjunction with flight operations of business and commercial aircraft. There are well understood risks associated with the use of these commercial products, which are not currently covered by aerospace standards and regulations, and it is the opinion of this committee that potential users need interim guidance concerning the risks associated with potential li-ion battery failures in these devices.

1. SCOPE

This SAE Aerospace Information Report (AIR) is intended to cover any type of portable electronic device, powered by a rechargeable lithium battery that has application in operating the aircraft. This includes devices such as laptop computers, electronic tablets, and electronic book-reading devices, used as Electronic Flight Bags (EFBs), and similar applications.

1.1 Purpose

This AIR is prepared to bring attention to what is considered a potential shortcoming of current standards related to the usage of lithium-ion (Li-Ion) battery powered portable devices onboard aircraft. While work has been completed by other groups to develop standards for permanently installed, rechargeable lithium batteries, there is currently no aerospace standard for lithium battery powered portable electronic devices that are intended to be used in conjunction with flight operations.

2. REFERENCES

There are no referenced publications specified herein.

3. CURRENT PRACTICE

In recent years, there has been rapid growth in the introduction of portable electronic devices, the majority of which are powered by rechargeable, lithium batteries. The reason is very simple. Rechargeable lithium batteries offer higher energy densities in substantially smaller packages, thus satisfying the growing power needs of electronics devices.

Products powered by a rechargeable lithium battery permeate the lives of nearly everyone in one way or another. The range of products runs from the indispensable, cell phone and laptop computer, to a variety of life sustaining and health monitoring medical devices, and everything in between.

Unfortunately, some of these devices have experienced dramatic failures of the battery systems, giving rise to concerns about the safety of lithium-ion battery technology. Investigations into the causes of these failures have uncovered issues with mismatched battery packs and charging devices, usually obtained from unauthorized third party vendors, and manufacturing defects related to foreign object contamination of the cells.

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Additional problems have come to light as a result of air transport related incidents, such as the February 2006 UPS in-flight fire that terminated in Philadelphia, the Jet Blue incident in February of 2007, out of JFK, and the loss of a UPS 747 and its crew in Dubai in 2011. Most of the issues recorded by the FAA, resulted from mishandling, improper packaging, or in some cases, undetected manufacturing defects in the battery packs themselves, and a number are not limited to lithium-ion batteries. Attached below is a link to the events recorded by the FAA in recent years.

http://www.faa.gov/about/office_org/headquarters_offices/ash/ash_programs/hazmat/aircarrier_info/media/Battery_incident_chart.pdf

Not surprisingly, aerospace engineers are interested in utilizing this promising battery technology to meet the ever increasing power demands onboard aircraft. To aide in these endeavors, standards are being developed to guide in selecting the appropriate chemistry and for specifying battery systems that will meet the stringent requirements of the aviation application. One of the first of these standards, RTCA DO-311, was developed specifically for permanently installed rechargeable lithium battery systems. The requirements of this document were meant to cover a wide range of battery systems typically installed as main-ship batteries, emergency lighting batteries, avionics back-up batteries, satellite communication and surveillance system batteries and the like. However, this standard leaves one very significant gap in the intended qualification coverage, the qualification of battery systems powering portable electronic devices used in conjunction with flight operations onboard aircraft.

Statistically speaking, portable devices utilizing rechargeable lithium batteries are safe, as experienced by most users in their day-to day application of these devices. However, portable devices are subject to unintended abuse from being dropped or exposed to unfavorable environmental conditions, such as being left in a car trunk during the summer. It is also a recognized fact that one of the greatest risks for rechargeable lithium batteries is the potential for a thermal runaway of the battery pack (typically occurring during recharge).

With the growing proliferation of portable electronic devices, it is no surprise that some of these have found their way into aviation related applications. Most notably, there are now many models of Electronic Flight Bags (EFBs) developed from commercially available laptop computers. Some of these devices have been approved and in use for a number of years, and have become invaluable tools for flight crews. EFBs are classified as Class 1, Class 2, or Class 3 devices. Class 1 and 2 devices are considered portable and are not required to meet specific aviation related performance qualification testing. Class 1 and Class 2 devices fall under the purview of the FAA Flight Standards Service group. Class 3 devices are those that are installed in the aircraft, and are certified as part of the original Type Certificate or via a Secondary Type Certificate. The FAA defines these devices as follows:

EFB Class 1 and Class 2 systems are considered portable electronic devices and do not require a TSOA or aircraft certification design approval (e.g., STC). EFB Class 1 and 2 systems require operational approval (suitability for use) from the PI/AEG.

The rationale for the classifying EFB Class 1 and 2 systems as portable is that the software applications are limited to operational applications that have traditionally been supported by paper products. Because existing flight crew flight bags (filled with paper) have been considered “portable,” the electronic versions are also considered “portable.” These types of applications have been traditionally approved by the Flight Standards Service and have not required Aircraft Certification oversight.

EFB Class 3 systems enable additional software applications that have traditionally had the oversight of the Aircraft Certification Service. The EFB Class 3 system is a powerful tool because it allows both operationally approved (Type A and B software applications) and Aircraft Certification design-approved software to reside on the same platform with partitioning.

The realization that the manufacturers of these EFBs have now switched from nickel-cadmium batteries to lithium-ion has given rise to safety concerns. The battery systems powering these devices vary widely in manufacturing and component qualification standards, and to date, few if any of these have been qualified to aviation environmental conditions. This lack of standardization and configuration management leads to serious concerns over the proposed use of these or similar devices on the flight deck of commercial aircraft. With the added potential for users of these devices to bypass built-in safety devices, by substituting unapproved chargers or battery packs, the possibility of a serious safety event on the flight deck is dramatically increased.