



# National Transportation Safety Board

Washington, DC 20594

## Safety Recommendation

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**Date:** December 1, 2014

**In reply refer to:** A-14-113 through -127

The Honorable Michael P. Huerta  
Administrator  
Federal Aviation Administration  
Washington, DC 20590

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On November 21, 2014, the National Transportation Safety Board (NTSB) adopted its report concerning the January 7, 2013, incident, in which a Japan Airlines Boeing 787-8, JA8297, was parked at a gate at General Edward Lawrence Logan International Airport, Boston, Massachusetts, when maintenance personnel observed smoke coming from the lid of the auxiliary power unit battery case, as well as a fire with two distinct flames at the electrical connector on the front of the case. No passengers or crewmembers were aboard the airplane at the time, and none of the maintenance or cleaning personnel aboard the airplane was injured.<sup>1</sup> Additional information about this incident and the resulting recommendations may be found in the report of the investigation, which can be accessed at our website, <http://www.nts.gov>, under report number AIR-14/01.

As a result of this investigation, we classified previously issued Safety Recommendations A-14-32 through -36 and issued 18 new recommendations, including 2 to The Boeing Company, 1 to GS Yuasa Corporation, and the following 15 recommendations to the Federal Aviation Administration (FAA):

### A-14-113

Develop or revise processes to establish more effective oversight of production approval holders and their suppliers (including subtier suppliers) to ensure that they adhere to established manufacturing industry standards.

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<sup>1</sup> *Auxiliary Power Unit Battery Fire, Japan Airlines Boeing 787-8, JA829J, Boston, Massachusetts, January 7, 2013, Aircraft Incident Report NTSB/AIR-14/01 (Washington, DC: NTSB, 2014), which can be accessed at the NTSB's website.*

A-14-114

Work with aviation industry experts to develop or modify design safety standards for large-format lithium-ion batteries to require that sources of excessive heating, including electrical contact resistance from components and connections, be identified, minimized, and documented as part of the design. The standards should include measures for identifying and minimizing potential sources of heating that consider the range of operating temperatures and the most extreme electrical currents that the battery could be expected to experience during repeated charge and discharge cycles.

A-14-115

Work with aviation industry experts to develop or modify existing safety standards related to the design of permanently installed lithium-ion batteries to require monitoring of individual cell temperature and voltage and recording of exceedances to prevent internal cell damage during operations under the most extreme operating temperatures and currents.

A-14-116

Once the guidance requested in Safety Recommendation A-14-115 has been issued, require type certification applicants to demonstrate that the battery monitoring system maintains each individual cell within safe temperature limits at the most extreme battery operating temperatures and the heaviest electrical current loads approved for operation.

A-14-117

Work with lithium-ion industry experts to (1) conduct research into battery monitoring system technologies that could improve the recognition of conditions leading to thermal runaway, (2) develop active mitigation of such conditions to minimize damage, and (3) update design and safety standards accordingly.

A-14-118

Work with industry experts to develop appropriate test methods for determining the initial point of self-heating in a lithium-ion cell to establish objective margins of thermal safety for future battery designs.

A-14-119

Provide your certification engineers with written guidance and training to ensure that (1) assumptions, data sources, and analytical techniques are fully identified and justified in applicants' safety assessments for designs incorporating new technology and (2) an appropriate level of conservatism is included in the analysis or design, consistent with the intent of Advisory Circular 25.1309 (Arsenal draft).

A-14-120

During annual recurrent training for engineering designees, discuss the need for applicants to identify, validate, and justify key assumptions and supporting engineering rationale used in safety assessments addressing new technology.

A-14-121

Develop written guidance for your certification engineers and engineering designees about the use of traceability principles to verify that the methods of compliance proposed by type certification applicants for special conditions involving new technology are correct and complete.

A-14-122

Once the guidance requested in Safety Recommendation A-14-121 has been issued, provide training to your certification engineers and engineering designees on the subjects discussed in the guidance.

A-14-123

Require applicants to discuss key assumptions related to safety-significant failure conditions, their validation, and their traceability to requirements and proposed methods of compliance during certification planning meetings for type designs involving special conditions.

A-14-124

Require Boeing 787 operators to incorporate guidance about the enhanced airborne flight recorder stale data issue in their maintenance manuals to prevent stale data from being used for maintenance activities or flight recorder maintenance.

A-14-125

Evaluate whether the recording of stale data by the Boeing 787 enhanced airborne flight recorder, including whether the data are specifically identified as stale, impacts the certification of the recording system regarding the ranges, accuracies, and sampling intervals specified in 14 *Code of Federal Regulations* Part 121 Appendix M, and take appropriate measures to correct any problems found.

A-14-126

Require Boeing to improve the quality of (1) the enhanced airborne flight recorder radio/hot microphone channels by using the maximum available dynamic range of the individual channels and (2) the cockpit area microphone airborne recordings by increasing the crew conversation signals over the ambient background noise.

A-14-127

Either remove the current exception to European Organization for Civil Aviation Equipment ED-112A, “Minimum Operational Performance Specification for Crash Protected Airborne Recording Systems,” chapter I-6 in Technical Standard Order 123B, “Cockpit Voice Recorder Equipment,” or provide installers and certifiers with specific guidance to determine whether a cockpit voice recorder installation would be acceptable.

In addition, we classified the following previously issued recommendations to the FAA:

A-14-32

Develop abuse tests that subject a single cell within a permanently installed, rechargeable lithium-ion battery to thermal runaway and demonstrate that the battery installation mitigates all hazardous effects of propagation to other cells and the release of electrolyte, fire, or explosive debris outside the battery case. The tests should replicate the battery installation on the aircraft and be conducted under conditions that produce the most severe outcome.

A-14-33

After Safety Recommendation A-14-32 has been completed, require aircraft manufacturers to perform the tests and demonstrate acceptable performance as part of the certification of any new aircraft design that incorporates a permanently installed, rechargeable lithium-ion battery.

A-14-34

Work with lithium-ion battery technology experts from government and test standards organizations, including US national laboratories, to develop guidance on acceptable methods to induce thermal runaway that most reliably simulate cell internal short-circuiting hazards at the cell, battery, and aircraft levels.

A-14-35

Review the methods of compliance used to certify permanently installed, rechargeable lithium-ion batteries on in-service aircraft and require additional testing, if needed, to ensure that the battery design and installation adequately protects against all adverse effects of a cell thermal runaway.

A-14-36

Develop a policy to establish, when practicable, a panel of independent technical experts to advise on methods of compliance and best practices for certifying the safety of new technology to be used on new or existing aircraft. The panel should be established as early as possible in the certification program to ensure that the

most current research and information related to the technology could be incorporated during the program.

These safety recommendations are now classified “Open—Acceptable Response.”

Acting Chairman HART and Members SUMWALT, ROSEKIND, and WEENER concurred in these recommendations.

The NTSB is vitally interested in these recommendations because they are designed to prevent accidents and save lives. We would appreciate receiving a response from you within 90 days detailing the actions you have taken or intend to take to implement them. When replying, please refer to the safety recommendations by number. We encourage you to submit your response electronically to [correspondence@ntsb.gov](mailto:correspondence@ntsb.gov).

[Original Signed]

By: Christopher A. Hart,  
Acting Chairman