



## AIR LINE PILOTS ASSOCIATION, INTERNATIONAL

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Comments Submitted Electronically

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Ground Floor, Room W12-140  
1200 New Jersey Avenue, SE.  
Washington, DC 20590-0001

Subject: Docket No. PHMSA-2009-0095 (HM-224F), Hazardous Materials, Transportation of  
Lithium Batteries

Dear Sir/Madam:

The Air Line Pilots Association, International (ALPA), representing the safety interests of 53,000 professional airline pilots flying passenger and cargo aircraft for 38 airlines in the United States and Canada, appreciates the opportunity to comment on the proposed Department of Transportation's (DOT) Pipeline and Hazardous Materials Safety Administration's (PHMSA) notice of proposed rulemaking (NPRM) concerning the transportation of lithium batteries.

ALPA has long voiced concern that current provisions in the hazardous materials regulations governing the transport of lithium batteries by air are inadequate to protect crewmembers, passengers, cargo and the travelling public. We support most of the proposals in the NPRM, such as adopting the new shipping names, a watt-hour rating in lieu of using equivalent lithium content, changes to design type tests, a mark indicating successful completion of those tests, and allowing an operator to carry lithium batteries in the cabin. We believe that the proposed changes will have a significant, positive impact on the safety of the air transportation system.

We applaud the Department of Transportation for this rulemaking and believe it should be adopted with additional requirements for lithium metal batteries, somewhat revised requirements governing accessibility, and a focus on additional testing. We agree that safety is best served through the early implementation date proposed by the DOT and offer the following detailed comments on its content.

### Revision of Proper Shipping Names

ALPA supports PHMSA's proposal to revise the proper shipping names for lithium batteries (UN 3090), lithium batteries packed with equipment (UN 3091), and lithium batteries contained in equipment (UN 3091) to differentiate between lithium-metal batteries (including lithium alloy batteries) and lithium ion lithium-ion batteries (including lithium polymer batteries). Lithium

metal and lithium ion batteries have significantly different chemistries and fire characteristics, necessitating different emergency response actions.

Additionally, testing by the Federal Aviation Administration (FAA) has demonstrated that lithium metal battery fires are not responsive to Halon, the fire extinguishing agent used aboard aircraft. Accordingly, it is appropriate to apply more stringent transport conditions to lithium metal batteries. In order to properly identify each type of battery, it is necessary to have separate proper shipping names. This proposal would harmonize the proper shipping names in the United States with those adopted at the United Nations (UN) and the International Civil Aviation Organization (ICAO), facilitating global shipments of lithium metal and lithium ion batteries.

#### Watt Hour versus Equivalent Lithium Content

We support the proposal to adopt a watt-hour requirement for lithium ion batteries in lieu of determining equivalent lithium content. The term "equivalent lithium content" is not well understood, nor is it generally used to describe the energy content of a battery. In contrast, both the UN and ICAO have adopted watt-hours to determine the relative strengths of lithium ion batteries, and have adopted proposals that will require all new lithium ion batteries to be marked with the watt-hour rating of the battery.

#### Revision to Design Type Testing Requirements

Effective design type testing of lithium batteries is critical to ensuring that new lithium battery designs will safely withstand exposure to the severe environmental conditions encountered during transportation and use. Testing must be sufficiently rigorous to ensure that batteries can be transported safely, not just directly after production, but also at the end of their useful life.

ALPA agrees with PHMSA that the requirements in the United Nation's Manual of Testing and Criteria should be strengthened and clarified, and supports the changes proposed in this rulemaking. Specifically, ALPA supports revising the criteria for a new design type test from the current change of 0.1 grams or 20% by mass to the anode, the cathode, or electrolyte material to a more restrictive change of 0.1 grams or 5% by mass to the anode, the cathode, or electrolyte material. We also agree that the criteria in the UN Testing Manual are too broad, and support the inclusion of the examples listed in the rulemaking. These proposals will ensure that more new battery types are tested, reducing the likelihood of a short circuit or other dangerous condition in transportation.

ALPA concurs with the inclusion of an internal short circuit test, if a consensus for a reliable test method emerges at the United Nations working group on lithium battery testing. Additionally, ALPA supports the PHMSA proposals to modify the terms "module" and "battery assembly," adopt new definitions of "large batteries" and "small batteries," and to modify the testing protocol for large batteries and battery assemblies.

Because testing is vital to ensure that battery designs are safe for transportation, ALPA further agrees that more steps need to be taken to make certain that batteries have met the requirements of the design type testing. Accordingly, we support the proposed requirement to retain evidence of satisfactory completion of the design type tests. Retention of the testing results will aid in oversight, enforcement and outreach, adding to the safety of the air transportation system.

ALPA further supports the proposal to require a visible marking on the outside case of each cell or battery. A battery may be transported several times by multiple shippers after production and testing. A visible mark would help those shippers determine that the cells and batteries had been properly tested prior to being placed in the transportation system. A mark may also help prevent the transportation of counterfeit batteries, which may be more likely to be involved in an incident due to poor manufacturing, low quality materials and the lack of manufacturing quality control.

#### Elimination of Exceptions for Small Lithium Batteries

ALPA strongly supports the elimination of regulatory exceptions for small lithium batteries. When not properly manufactured, packaged or handled, lithium batteries present a risk in transportation, including in-flight fire and the potential loss of an aircraft and its occupants. Additionally, lithium batteries may ignite when exposed to an external fire or the residual heat from a suppressed cargo fire. ALPA believes that the risk presented in transporting lithium batteries, including lithium batteries packed with or in equipment, is sufficient to justify them being fully regulated within the hazardous materials regulations.

Lithium batteries present an unusual, significant risk in transportation, since nothing more than a damaged package is necessary to start a fire, possibly several hours after the damage occurred. This outcome is very different when compared to other highly regulated substances, where absent an ignition source, a damaged package will only result in a spill. Hazardous materials have been safely transported for decades under Department of Transportation regulations, and ALPA believes that bringing lithium batteries fully into this regulatory scheme will have significant safety benefits, as outlined in the following sections:

#### Labeling

Although classified as a Class 9 material, most lithium battery packages are not currently required to carry the Class 9 label. Requiring this label to appear on lithium battery packages would significantly increase the visibility of lithium battery shipments and clearly communicate the risk these shipments pose to airline acceptance and handling personnel.

Unlike other battery labels or markings in use internationally, the Class 9 label is easily recognizable and does not require an understanding of English. Because all air carrier personnel are trained to recognize that diamond labels represent hazardous materials, it is highly likely that a package bearing a Class 9 label would be handled with care, and not loaded on an aircraft after being damaged. Furthermore, packages bearing hazard



warning labels are normally removed from the general freight stream for non-regulated packages and would be subject to an acceptance check, ensuring more oversight and a lower likelihood of damage to the package. Since damage to a hazardous materials package is all that may be necessary to cause a fire, the increased safety level afforded by a Class 9 label is clearly justified.

ALPA does agree, however, that the ICAO battery handling label should be allowed to appear on a package, in addition to the diamond Class 9 label. While rendered in English and not in the diamond shape most widely recognized as being associated with hazardous materials, affixing the ICAO battery handling label to a package would only improve awareness of lithium battery shipments and improve safety.

#### Packaging

PHMSA proposes to enhance packaging requirements for lithium batteries. Since an external short circuit and damage to the battery are two major causes of lithium battery incidents, ALPA agrees these improved packaging standards are necessary to improve the safety of lithium battery shipments. Specifically, the proposed requirement to transport lithium cells or batteries in inner packagings of combination packagings that completely enclose the cell or battery will significantly reduce the likelihood of short circuits caused by batteries in a shipment coming into contact with each other.

#### Acceptance Check

By eliminating regulatory exceptions for lithium battery shipments, packages containing lithium batteries will be separated from general freight, reducing the possibility of inadvertent damage. They would also be subject to an acceptance check by airline personnel prior to being placed in air transportation, including inspection of the package to detect damaged or improperly prepared packages. These measures would reduce the number of improperly prepared or damaged packages carried aboard aircraft.

#### Pilot Notification

ALPA maintains that providing pilots with written notification of the presence of lithium battery shipments will increase safety and supports the proposal in the NPRM. Under the current regulatory system, pilots would receive written notification when, for example, five pounds of dry ice or flammable paint is loaded onto an aircraft, but would be unaware of a pallet of thousands of lithium batteries loaded adjacent to these shipments. The flight crew is the last link in the hazardous materials safety chain and providing them with a pilot notification form can prevent improperly prepared shipments from being loaded onto an aircraft.

Knowledge of the size, location and the quantity of lithium battery shipments will assist the crew decision making process during an in-flight emergency. This information, when

considered in association with the potential severity of a fire, including the inability of Halon to suppress a lithium metal battery fire, could alter the choice of diversion airports, particularly when a pilot is evaluating those with differing weather conditions or facility capabilities. This awareness may also influence a decision to conduct a water or off-airport landing while the aircraft is still intact.

Providing information concerning lithium battery shipments on the pilot notification form also enables the flight crew to inform air traffic control and emergency response personnel of the size and location of a lithium battery shipment, enhancing their ability to protect the aircraft, its occupants, themselves and the environment. In order to make the best possible decision and receive the highest level of emergency response in such circumstances, the flight crew needs all available information. ALPA believes that requiring the listing of lithium battery shipments on the pilot notification form enhances the information available to the crew and significantly improves safety.

#### Training

Removing regulatory exceptions for most lithium battery shipments will impose training requirements in the hazardous materials regulations on both shippers and air carrier personnel. ALPA supports this required training and believes it may have the single largest impact on reducing the number of lithium battery incidents in air transportation.

Many battery-related incidents have been the result of improperly prepared shipments. Required training would greatly increase compliance with packing requirements and aid air carrier personnel in discovering improperly prepared shipments. In cases where improperly prepared shipments have caused fires aboard aircraft, the non-compliance has generally been the result of an incomplete or improper understanding of the regulations, not a deliberate attempt to avoid them. Training in hazardous materials regulations has been very effective in preventing incidents involving other types of hazardous materials and ALPA believes it would be equally effective in reducing lithium battery incidents.

The Department of Transportation has undertaken a significant outreach effort and public awareness campaign over the past decade to educate shippers and the public about the risks associated with lithium battery shipments and how to properly package them. While laudable, this outreach effort has failed to significantly reduce the number of battery incidents in transportation. With training requirements in place, ALPA believes that the DOT's outreach efforts will be more effective since shippers will be required to develop and provide DOT-approved training programs and maintain records of successful employee completion. We recognize that this training places an additional cost burden on industry, but considering the cost of a single, major, hull-loss accident, we feel it is justified and a necessary component of a safe transportation system.



#### Exceptions for Small Lithium Batteries Installed in Equipment

An exception for small lithium batteries (under 0.3g lithium or 3.7 Wh) packed with or contained in equipment is proposed in the NPRM. While we are unaware of any testing results that can be used to justify such an exception, we agree in general that button cell-sized or smaller batteries represent little risk in transportation when packed with or in equipment. The equipment itself affords a level of protection to the batteries and prevents thousands or hundreds of thousands of these batteries from being packaged together and creating an aggregate hazard. ALPA does, however, have some concern that the limits proposed in the NPRM would provide exceptions for batteries larger than button cells. We therefore propose that the exception language be specifically limited to button cells when packed with or contained in equipment.

#### Lithium Batteries Carried in the Cabin by an Operator

The NPRM references a petition from the Air Transport Association of America (ATA) and the Regional Airline Association (RAA) requesting the ability to carry a limited number of lithium batteries in the cabin in a constant state of readiness. Based on the results of testing done by the DOT, the Civil Aviation Association (CAA) of the United Kingdom and the Norwegian Defense Institute, ALPA and the International Federation of Air Line Pilots Associations (IFALPA) have worked together to develop procedures for flight crews to follow in the event of a lithium battery incident in the cabin. If a lithium battery were to catch fire in the cabin of a passenger aircraft, the fire would be quickly discovered and most likely limited to a single battery or device. With the proper procedures and training, the flight crew should be able to effectively respond to such an incident in the cabin and ensure a safe outcome for the flight.

ALPA therefore agrees that airlines should be permitted to carry lithium batteries in the cabin to power devices such as electronic flight bags, onboard medical monitoring devices, portable oxygen concentrators, personal electronic devices and credit card readers.

#### Exceptions Based on State of Charge

ALPA recognizes that the energy in a lithium ion battery and the intensity of a fire involving that battery is directly related to its state of charge. A lower state of charge reduces the risk posed by a battery in transportation. We are concerned, however, with incorporating state of charge requirements in the hazardous materials regulations, as this provision will be nearly impossible to verify or enforce. While a shipper may be able to accurately determine the state of charge for a laptop battery, it would be nearly impossible for anyone other than the manufacturer to determine the state of charge of smaller batteries. We therefore do not support using state of charge parameters to justify relaxing any regulatory requirement.

Elsewhere in our comments, we have requested that further testing be conducted to determine what constitutes a safe quantity of lithium batteries in a cargo compartment. We believe this testing should be done with batteries fully charged.

#### Packaging and Stowage of Lithium Ion Batteries

ALPA believes it is vitally important to limit the quantity of lithium ion batteries stored in a single location as well as in a single cargo compartment. Because a fire may be the result of an internal short circuit, defective design or counterfeit battery, no amount of packaging or training will prevent every incident. The severity of that incident, however, can be effectively managed by controlling the number of batteries in close proximity to each other.

We are encouraged by testing that has shown that Halon would be effective in suppressing a fire involving lithium ion batteries, but are concerned that a fire involving large quantities of these batteries will eventually overwhelm a Halon suppression system. While a single battery packaged for transport may not represent a major risk for the aircraft, when that battery is packaged with hundreds or even thousands of other lithium ion batteries, the risk is substantially increased. We recognize that the only way to effectively restrict the number of batteries at a single location is to eliminate the exceptions for individual batteries and we applaud the DOT for proposing this important step.

We request that the DOT take additional action by conducting fire-safety research using lithium ion batteries packaged for transport in a Class C cargo compartment. This testing would determine the appropriate quantity of batteries that that can be safely transported in a single compartment without overwhelming an aircraft Halon suppression system. Specifically, the testing should determine how long it would take before a fire involving a single, fully charged lithium battery in either a ULD or bulk loaded would be detected, how quickly that fire would spread to additional lithium batteries in the shipment, and how effective the Halon system would be in suppressing the fire. The testing should also determine how many fully charged batteries simultaneously igniting could be suppressed by a typical Halon system. The results from this testing should be used to determine the maximum quantity of batteries permitted in a single Class C cargo compartment.

Until this testing is complete, ALPA recommends that the DOT impose a conservative limit on the number of batteries permitted in a single cargo compartment. While we do not have the expertise or testing data to propose such a limit, we respectfully suggest that the FAA Technical Center, which conducted the 2006 fire testing of bulk packaged lithium ion batteries, may be able to assist the DOT in determining an interim limit.

We also recognize that lithium ion batteries are currently permitted to be shipped aboard cargo aircraft not equipped with Class C cargo compartments. We therefore request that additional testing be conducted with packaged lithium batteries in both Class D and E



cargo compartments to determine the maximum safe quantity of batteries in these compartments, or be used as a basis to restrict the loading of lithium ion batteries to Class C compartments.

#### Lithium Metal Batteries

ALPA has long expressed concern with the risk posed by lithium metal batteries to air transportation and the more permissive regulatory standards applied to them when carried aboard cargo-only aircraft. Although lithium metal batteries were prohibited for transport aboard passenger aircraft (except when installed with or contained in equipment) by the DOT in 2004, they are permitted to be transported in unlimited quantities and without being fully regulated aboard cargo-only aircraft.

ALPA believes that a single level of safety should exist for both passenger and cargo air operations and has long advocated for substantially improved provisions for the carriage of lithium metal batteries on both of these transport categories. We are encouraged that the NPRM proposes to eliminate most regulatory exceptions for lithium metal batteries, but we believe that the packaging and stowage requirements do not go far enough to ensure an adequate level of safety.

Until adequate packaging can be developed to protect lithium metal batteries from damage, prevent a fire involving a packaged lithium metal battery from spreading to other batteries, and prevent packaged lithium metal batteries from igniting from the heat of an independent fire, the prohibition currently applied to carriage of lithium metal batteries on passenger aircraft should be extended to cargo-only aircraft. ALPA has expressed its position on this issue to DOT on numerous occasions prior to this NPRM response. We also propose that the DOT conduct testing similar to that outlined for lithium ion batteries to determine the type of packaging and the safe number of packaged lithium metal batteries that should be permitted in Class C, Class D and Class E compartments.

#### Accessibility and Class C Cargo Compartment Requirements

Because a flight crew may not be able to expeditiously land an aircraft following the outbreak of an on-board fire, the pilots must have the means to suppress an in-flight fire involving any properly declared commodity. We are concerned that the NPRM proposes to allow lithium batteries to be transported in accessible locations as an alternative to placing the batteries in a cargo compartment with a suitable fire suppression system. By requiring lithium ion batteries to be accessible, they would be placed together with other highly regulated and flammable substances, increasing the potential for igniting or increasing the severity of an onboard fire.

Accessibility provides a very basic means of fire suppression, requiring one crewmember to leave the cockpit and enter the cargo compartment with a hand held fire extinguisher.



While preferable to having no ability to attempt to extinguish an on board fire, the likelihood of a crew member being successful in extinguishing a cargo fire using the accessibility provisions is unfortunately relatively small. Therefore, we therefore do not support permitting lithium ion batteries to be placed at an accessible cargo position as an alternative to stowing the batteries in a Class C cargo compartment.

ALPA believes that lithium ion batteries should be required to be stowed in a Class C cargo compartment. Although not required, an increasing number of large, transport category cargo aircraft are equipped with Class C cargo compartments. It should be noted that large volumes of freight are also carried in transport category passenger aircraft which are required to be equipped with Class C cargo compartments. It is ALPA's position that, if a Class C compartment does not exist on an aircraft, shipments of these batteries should not be permitted on board unless additional testing determines that they can be safely transported in either Class D or Class E cargo compartments.

If the DOT does not agree that lithium ion batteries can only be safely transported in Class C cargo compartments, we acknowledge that accessibility provides an improved level of safety over an inaccessible cargo compartment with no fire suppression agent. In this case, we propose requiring lithium ion batteries to be stowed in a Class C compartment when available, or in severely restricted quantities and proper packaging at an accessible location otherwise. This would allow a very basic level of fire suppression, as well as enable the flight crew to inspect the package before flight and further remove it from the general cargo stream.

We do not agree that the accessibility provisions should be applied to lithium metal batteries. If a fire were to occur, it is likely that a crewmember would attempt to extinguish the fire using a hand-held Halon fire extinguisher. Because FAA testing has shown that Halon is ineffective in suppressing a lithium metal battery fire, the result would be an uncontrollable fire located adjacent to other potentially highly flammable substances. ALPA contends that lithium metal batteries should only be transported in packaging sufficient to protect them from damage, to prevent a fire involving a single battery from spreading, and to protect the battery from an external independent fire or high heat source. These packages should then only be transported in limited quantities and in cargo compartments capable of extinguishing any resultant fire.

#### Compliance Date

ALPA remains concerned that the provisions of the current hazardous materials regulations do not adequately ensure the safe transportation of lithium batteries, and we have previously requested an emergency prohibition of lithium battery shipments until the deficiencies have been addressed. We believe that the provisions outlined in this NPRM, once enacted, will have a significant positive impact on safety and may preclude the need for a prohibition.

We also point out that many of the provisions proposed have already been adopted internationally, easing compliance for shippers already familiar with the ICAO Technical Instructions. In those cases where the proposed regulations exceed the requirements in the Technical Instructions, the proposals are generally consistent with the requirements for shipping other Class 9 hazardous materials. The final rule's specified compliance time is critically important to protect passengers and crewmembers from a potential accident or incident and should be required at the earliest possible date. We therefore support the proposed compliance date of no later than 75 days after publication of the final rule.

#### Cost/Benefit Analysis

Undoubtedly, the NPRM will have a financial impact on battery manufacturers and those involved in the shipping of batteries and the electronic devices that they power. We note, however, that the DOT proposes to include lithium batteries in an existing regulatory system that has been used safely for decades to transport other types of hazardous materials. Costs associated with hazardous materials packaging, labeling, pilot-notification and training are incurred every day when thousands of commodities, such as flammable paint, air bags and dry ice are shipped by air. If even one major hull loss accident or the loss of one life can be prevented through the provisions proposed in this NPRM, the costs will have been well justified. Since the NPRM's provisions are the same as those applicable to dozens of other commodities, ALPA believes it reasonable and fair that the battery industry bear the costs of shipping their products safely.

#### Summary of ALPA Recommendations

To ensure the safety of flight when shipments of lithium batteries are transported on passenger and cargo-only aircraft, ALPA recommends that PHMSA:

1. Adopt new, proper shipping names for lithium metal batteries (including lithium alloy) and lithium ion batteries (including lithium polymer), as proposed.
2. Adopt a new watt-hour description in place of equivalent lithium content for lithium ion batteries, as proposed.
3. Adopt changes to design type tests, including a requirement for an internal short circuit test (if a reliable one can be developed), as proposed.
4. Adopt the requirement to retain evidence of satisfactory completion of design type tests, as proposed.
5. Adopt the requirement to mark batteries that have successfully passed the design type tests required by the hazardous materials regulations, as proposed.



6. Eliminate regulatory exceptions for most lithium battery shipments, as proposed. This will result in lithium battery shipments being prepared and shipped as fully regulated Class 9 hazardous materials, including requirements for packaging, labeling, an acceptance check, pilot notification and training.
7. Limit the proposed exception to button cell batteries when packed with or contained in equipment.
8. Allow the ICAO lithium battery handling label in addition to a Class 9 label, as proposed.
9. Adopt a requirement to completely enclose a lithium cell or battery in an inner packaging, as proposed.
10. Adopt provisions to permit an operator to carry lithium batteries and lithium battery powered equipment in the cabin, as proposed.
11. Adopt a new requirement to transport batteries at a reduced state of charge to improve the margin of safety for lithium battery shipments, but do not use state of charge to justify relaxing any regulatory requirement.
12. Conduct new testing on fully charged lithium ion and lithium metal batteries packaged for transport to determine the safe quantity of batteries that may be carried in Class C, Class D, and Class E cargo compartments.
13. Until testing is complete, adopt a conservative limit for the number of lithium batteries permitted in a single cargo compartment.
14. Extend the current prohibition of lithium metal batteries aboard passenger aircraft to cargo-only aircraft until adequate packaging can be developed to protect the batteries from damage, external fire or high heat source, and to prevent a fire involving a single lithium metal battery from spreading.
15. Do not adopt accessibility requirements for lithium ion batteries in lieu of transportation in a Class C cargo compartment.
16. Do not adopt accessibility requirements for lithium metal batteries.
17. Adopt the compliance date of 75-days following the publication of a final rule, as proposed.

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Conclusion

ALPA recommends that the NPRM be adopted with the inclusion of the changes articulated in our response. We applaud the PHMSA and the Department of Transportation for this rulemaking and agree that it will significantly enhance the safety of transporting lithium battery shipments, particularly via air transportation. If we can offer further clarification or assistance, please contact me directly at [mark.rogers@ALPA.org](mailto:mark.rogers@ALPA.org) or ALPA Senior Staff Engineer Rick Kessel (703/689-4202, [rick.kessel@ALPA.org](mailto:rick.kessel@ALPA.org)).

Thank you for providing ALPA the opportunity to comment on this important NPRM.

Sincerely,



Mark Rogers,  
Director, Dangerous Goods Programs

MMR:rk





## AIR LINE PILOTS ASSOCIATION, INTERNATIONAL

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### Recommendations Regarding the Shipment of Lithium Batteries by Air

December 17, 2008

The Air Line Pilots Association, International (ALPA) has a vested interest in regulations governing shipping hazardous materials aboard passenger and cargo-only aircraft. A topic of particular concern to us is the transport by air of lithium-ion and lithium-metal batteries. Over the past eight years, ALPA has urged the Department of Transportation's Pipeline and Hazardous Materials Administration (PHMSA) to:

- (1) Bring bulk shipments of lithium-ion and lithium-metal batteries into the full scope of the dangerous goods regulations, and
- (2) Extend the prohibition of bulk shipments of lithium-metal batteries from passenger to cargo-only aircraft until adequate packaging standards can be developed to sufficiently protect the batteries.

#### The Issue

The degree of risk and incident history associated with lithium batteries justifies their inclusion into regulations of dangerous goods shipped by air, to include: packaging requirements, acceptance checks, package testing, labeling, quantity limitations and pilot notification. These measures are critically important as batteries are one of a few commodities in which damage to a shipment is the only thing necessary to start a fire. Undamaged lithium batteries may also self ignite and burn in the presence of a high-heat source. Experience has shown that a fire could emerge hours after battery damage has occurred.

Unlike other regulated dangerous goods such as dry ice and flammable paint, lithium-ion batteries are exempted (or follow different criteria) from the majority of the dangerous goods regulations, including requirements for dangerous goods labels, an acceptance check by an airline, and notification to the pilot in command or Notice to Captain (NOTOC). It is inappropriate to provide significant regulatory relief for the transport of lithium batteries as cargo, especially in large quantities, considering that less hazardous items such as flammable paint and five pounds of dry ice are fully covered under the dangerous goods regulations.

#### Background

There are two types of lithium batteries used in today's electronic devices; *lithium-ion*, which are typically rechargeable and *lithium-metal*, which are not normally rechargeable. Lithium-ion batteries are typically used to power devices such as laptop computers, cell phones and MP-3 players. Lithium-metal batteries typically power devices such as watches, flashlights and digital cameras.

While the vast majority of lithium batteries are transported safely, when they are damaged, defective, or subjected to an external or internal short circuit, they have the potential to burn violently, emitting flames, sparks and large quantities of smoke. There have been several recent

lithium-ion fires, including a March 2008 in-flight fire on a Chicago-to-Tokyo flight and a June 2007 fire in the passenger terminal in Los Angeles. Fortunately, in both cases, the fires were successfully extinguished before substantial damage to property or loss of life could occur. The extent of the problem is further evidenced by the growing number of events listed in the battery incident list maintained by the Federal Aviation Administration (FAA).

Following a fire involving lithium-metal batteries in Los Angeles in 1999, the FAA Technical Center undertook a study of lithium-metal batteries and their response to an external fire source (DOT/FAA/AR-04/26). Among the findings published in June 2004, the FAA concluded that a fire involving one lithium-metal battery would spread to all batteries in a shipment, that the fire would burn violently at a temperature above the melting point of aluminum, that the heat from a suppressed cargo fire (approximately 400 deg. F) would be enough to ignite the batteries, and that ignition and fire would be accompanied by a pressure pulse that could cause the cargo compartment lining of an aircraft to fail. Especially significant was the finding that the traditional aircraft fire suppression agent, Halon 1301, would have no effect on the lithium-metal battery-initiated fire. In effect, damage to a single battery in a shipment of hundreds of thousands could lead to an uncontrollable fire.

After publication of the FAA report, the DOT issued immediate rule-making that banned the bulk shipment of lithium-metal batteries on passenger aircraft, leaving unchanged the provisions for shipment by cargo-only aircraft. This double standard is unacceptable. Because ALPA has long insisted on *One Level of Safety* for both passenger and all-cargo aircraft, we continue to advocate that PHMSA extend the ban on lithium-metal batteries to cargo-only aircraft until adequate packaging can be developed to protect lithium-metal batteries and the aircraft upon which they are transported.

On January 1, 2009, the vast majority of lithium-metal and lithium-ion batteries will be permitted to be shipped internationally on aircraft under packaging instructions 965-970 of the International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air, providing that certain size, testing, packaging and marking requirements are met. These requirements, however, do not include dangerous goods labels or notification to the flight crew. Because this carriage standard is of significant importance to the well-being of our membership, ALPA will work through ICAO and the United Nations Committee of Experts on the Transport of Dangerous Goods (UNCOE) to improve the safety of international hazmat air transport including batteries. Clearly, a strong US PHMSA law is important to that end.

#### **Justification for Change**

Improved packaging, better testing, a dangerous goods label that would be easily recognizable to ground handlers and emergency responders, an acceptance check to verify that the regulations have been complied with, and notification to the pilot in command that lithium-ion batteries were being carried in accordance with the HMR would greatly improve air safety.



While lithium-ion batteries can be safely transported once fully incorporated into the dangerous goods regulations, the characteristics of lithium-metal batteries make them unsuitable for transport in bulk quantities aboard passenger or cargo aircraft. In short, there is no safety justification for allowing bulk shipments of lithium-metal batteries to continue to travel on cargo-only aircraft when there is no adequate fire-suppression agent currently available. Accordingly, until adequate HMR regulations packaging standards can be developed to protect all occupants of an aircraft in case a shipment of lithium-metal batteries is exposed to fire of any origin, and to protect the batteries from external damage, we urge PHMSA to ban bulk shipments of lithium-metal batteries on both passenger and cargo aircraft.

On December 4, 2007 the NTSB held a public meeting and issued a report (NTSB/AAR-07/07) of their investigation into the in-flight cargo fire on a UPS cargo-only aircraft on February 7, 2006. A synopsis of the executive summary and list of conclusions from that report is provided as Attachment A. In their report, the NTSB substantiated ALPA's concerns concerning the carriage of lithium batteries by air.

As part of that report, on December 17, 2007 the NTSB issued a letter (Attachment B) to PHMSA with their recommendations A-07-104 through -109. Although the content of the letter epitomizes ALPA's positions, Recommendations A-07-104 and A-07-109 speak directly to our concerns. In A-07-104, the NTSB recommends that PHMSA *"require aircraft operators to implement measures to reduce the risk of primary lithium batteries becoming involved in fires on cargo-only aircraft, such as transporting such batteries in fire resistant containers and/or in restricted quantities at any single location on the aircraft."* This recommendation is consistent with the ALPA position to ban bulk shipments until adequate packaging is developed.

Additionally, in Recommendation A-07-109, PHMSA is urged to *"Eliminate regulatory exemptions for the packaging, marking, and labeling of cargo shipments of small secondary lithium batteries (no more than 8 grams equivalent lithium content) until the analysis of the failures and the implementation of risk-based requirements asked for in Safety Recommendation A-07-108 are completed."*

#### **ALPA Recommendations**

1. Remove regulatory exemptions for the transport of cargo shipments of lithium-ion batteries; these batteries should be shipped in complete accordance with the dangerous goods regulations, including packaging requirements, labeling, testing, flight crew notification and quantity limitations.
2. Ban bulk shipments of lithium-metal batteries on passenger and cargo aircraft until adequate packaging standards can be developed to protect these batteries from a fire from any source.
3. Incorporate NTSB recommendations concerning lithium batteries into the Hazardous Materials Regulations (HMR).





PRESIDENT'S DEPARTMENT  
**AIR LINE PILOTS ASSOCIATION, INTERNATIONAL**

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September 22, 2010

The Honorable Ray LaHood  
Secretary of Transportation  
US Department of Transportation  
1200 New Jersey Avenue, SE  
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Dear Secretary LaHood:

I am writing to express the concerns of nearly 53,000 pilot members of the Air Line Pilots Association, International who fly for 38 airlines in the U.S. and Canada regarding the ongoing, substantial risk to aviation safety as posed by lithium batteries carried as cargo. By letter dated August 20, 2009, we called on the Pipeline and Hazardous Materials Safety Administration (PHMSA) to issue a temporary prohibition on the carriage of all lithium batteries as cargo on passenger and all-cargo airplanes, with such a prohibition to remain in place until a rulemaking was issued and fully implemented. PHMSA replied to our correspondence in a positive fashion approximately one month later stating that the agency planned to issue a notice of proposed rulemaking to "comprehensively address the safe transportation of lithium cells and batteries in cargo."

True to its expressed intentions, PHMSA, in consultation with the FAA, published a Notice of Proposed Rulemaking (NPRM) concerning the transport of lithium batteries on January 11, 2010. The proposed rulemaking was received very positively by our membership and our comments of March 12, 2010 expressed this viewpoint.

There has been no further publicly available information on this rulemaking since that time, despite the fact that the U.S. House of Representatives' Transportation & Infrastructure Committee approved legislation this summer which essentially endorsed PHMSA's proposed rule. In fact, Congressmen James Oberstar and Jerry Costello communicated their strong support of the NPRM to the DOT in this regard.

Since we wrote to PHMSA last August, the FAA has posted information on its Dangerous Goods website regarding five (5) additional lithium battery related incidents. As is widely known, a wide body all-cargo aircraft carrying a large quantity of lithium batteries recently crashed in the Middle East and caused loss of life and damage to property on the ground. Some who are knowledgeable of the accident sequence have publicly raised the possibility that this accident may have been attributable to a fire resulting from its large cargo of these batteries.

In our view, the government has had sufficient time to publish a rule to safeguard aviation and persons and property on the ground from the risk of lithium batteries. We respectfully urge the DOT to expeditiously take all necessary actions to help ensure that these devices are regulated



and recognized for what they have always been – dangerous goods – and that they be packaged, marked and transported accordingly.

Until appropriate regulations are published *and* fully implemented, we believe that a temporary ban on the carriage of lithium batteries is not only appropriate, it is still much needed. Accordingly, we also renew the call that we made more than one year ago to place a temporary prohibition on the carriage of lithium batteries as cargo on passenger and all-cargo aircraft, to remain in place until the agency has published and implemented a final rulemaking that ensures they can be shipped safely.

Thank you for your consideration of this urgent request. We look forward to your reply.

Sincerely,

  
John Prater, President

**STATEMENT OF**

**FIRST OFFICER MARK ROGERS**

**AIR LINE PILOTS ASSOCIATION, INTERNATIONAL**

**BEFORE THE**

**SUBCOMMITTEE ON RAILROADS, PIPELINES, AND HAZARDOUS MATERIALS**

**COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE**

**UNITED STATES HOUSE OF REPRESENTATIVES**

**BALTIMORE, MD**

**NOVEMBER 16, 2009**

**"REAUTHORIZATION OF THE DEPARTMENT OF TRANSPORTATION'S  
HAZARDOUS MATERIALS SAFETY PROGRAM"**

**Air Line Pilots Association, International  
1625 Massachusetts Avenue, NW  
Washington, DC 20036  
(202) 797-4033**

**STATEMENT OF FIRST OFFICER MARK ROGERS  
AIR LINE PILOTS ASSOCIATION, INTERNATIONAL (ALPA)  
BEFORE THE  
SUBCOMMITTEE ON RAILROADS, PIPELINES, AND HAZARDOUS MATERIALS  
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE  
U.S. HOUSE OF REPRESENTATIVES  
ON  
“REAUTHORIZATION OF THE DEPARTMENT OF TRANSPORTATION’S  
HAZARDOUS MATERIALS SAFETY PROGRAM”**

**NOVEMBER 16, 2009**

Good afternoon Chairwoman Brown, Ranking Member Shuster, and distinguished members of the Subcommittee. I am Mark Rogers, a commercial airline pilot and director of the dangerous goods program for the Air Line Pilots Association, International (ALPA). ALPA represents more than 53,000 pilots who fly for 36 passenger and all-cargo airlines in the United States and Canada. On behalf of our members, I thank you for this opportunity to testify regarding immediate safety deficiencies related to the carriage of lithium batteries as cargo on passenger and all-cargo aircraft.

ALPA has long advocated for improved transport requirements for lithium-ion and lithium-metal batteries and we are pleased that your version of the HAZMAT Reauthorization bill mandates strict new requirements. By letter dated November 4, 2009, ALPA president, Captain John Prater, urged Chairman Oberstar to support the positions contained within the bill and requested that its language not be weakened. We believe that the actions we have recommended for incorporation into the reauthorization bill will greatly enhance the overall safety of the air-cargo transportation system.

On May 14, 2009, I appeared before this committee and cited numerous incidents wherein lithium batteries, carried either in the cabin of passenger aircraft or shipped as air-cargo, malfunctioned and resulted in fires. On that occasion, I presented a video of a fire spontaneously igniting in a laptop computer’s lithium battery, demonstrating that once a single cell in a lithium battery ignites, the generated heat can cause surrounding cells to ignite as well.

Since then, six (6) more fires involving lithium batteries have been reported to the FAA. I reiterate that ALPA is not advocating for enhanced restrictions on the types of items individuals may personally carry on board aircraft. Our attention and concern remains focused on lithium batteries transported as air cargo. If these commodity shipments either initiate or become involved in a fire, they pose a significant risk to the safety and well-being of an aircraft and its occupants.

While it is true that a fire involving a limited number of lithium-ion batteries may be controlled by the active fire suppression system on an aircraft, FAA testing has shown that lithium-metal batteries are unresponsive to Halon, the traditional extinguishing agent used aboard aircraft.

Unfortunately, lithium-ion and lithium-metal batteries remain exempt from many of the Federal hazardous material regulations, such as the requirement to place a dangerous goods label on the



package, the requirement to notify the pilot in command of their presence, the requirement for airline personnel to perform an acceptance check of the package, or any of the cargo compartment quantity limitations normally applied to hazardous materials. Under existing regulations, a flight crew would not be made aware of a pallet containing thousands of lithium batteries, yet a five-pound package of flammable paint or dry ice would be subject to the full scope of the dangerous goods provisions. These exceptions are clearly inappropriate for any commodity having a significant history of fire incidents aboard aircraft, as do lithium batteries.

The full regulation of lithium batteries as dangerous goods would have a significantly positive impact on the safety of the air cargo supply chain. Improved packaging standards would help prevent damage to shipped batteries. Dangerous goods labels would ensure worldwide recognition that shipments have the potential to cause an incident if mishandled. An acceptance check would provide an opportunity to detect package damage or non-compliance with the regulations. Pilot notification would increase the awareness of flight crewmembers and allow them to communicate hazard information to emergency responders in the event of an incident.

Because of the inability of aircraft fire suppression systems to extinguish a fire involving lithium metal batteries, the current ban on bulk shipments of these items on passenger aircraft should be extended to all-cargo aircraft until adequate packaging materials can be developed which will protect these batteries both from damage and from external heat sources. ALPA has long been an advocate of one level of safety and security for cargo and passenger aircraft, and we find it particularly troubling that a commodity which is completely prohibited from shipment on passenger aircraft may be transported, nearly unregulated, on all-cargo aircraft.

We recognize that the risk associated with a single battery in a shipped package is low. We caution, however, against providing exceptions to the dangerous goods regulations for shipping small batteries based on this logic, as there is nothing to prevent hundreds or even thousands of these items from being consolidated in a single shipment. It is only through full regulation of the shipment of small batteries that the quantity of batteries stored at a single location in an aircraft or in a single cargo compartment can be addressed. In the absence of such regulations, the batteries are handled as general freight and airline employees are often unaware of the total quantity of batteries offered for shipment or the risk that they pose to the aircraft.

The Pipeline and Hazardous Materials Safety Administration (PHMSA) has testified before this Committee that pending, draft rulemaking will improve lithium battery safety in air transportation. However, despite National Transportation Safety Board (NTSB) recommendations, ALPA's urging and FAA encouragement, PHMSA has not published any significant lithium battery rulemaking since 2003 and even then the resulting final rule did not take effect until 2007.

Given that FAA has received six reports of fires related to lithium batteries since we last testified, it is clear that we cannot afford to wait several years or longer for the NPRM process to bring about the implementation and enforcement of improved lithium battery regulations. Every day we delay, people and property are being exposed to the potential danger of an in-flight fire that neither the aircraft's fire suppression system nor the flight crew can extinguish. Expedient approval of the legislation before this Committee is necessary to ensure the safety of lives and property involved in air cargo operations.

An objection has been raised that if these needed regulatory improvements are made via the legislative process, the U.S. will not be in harmonization with the international aviation community. In fact, those with a financial interest in the outcome of this debate – the airlines, battery and electronic equipment manufacturers – have been allied against harmonization which would result in safety improvements. Due to their objections, the Dangerous Goods Panel of the International Civil Aviation Organization (ICAO) has failed to act decisively on this issue at two separate panel meetings over two years. As a consequence, shipments of lithium batteries continue to be excepted under ICAO rules with no change possible for at least two more years.

At a recent meeting of the ICAO Dangerous Goods Panel we made the follow recommendations which the airlines, and battery and electronic equipment manufacturers opposed:

1. Eliminate exceptions for lithium batteries shipped as cargo aboard aircraft. Although lithium batteries have been involved in dozens of fires aboard aircraft, the Technical Instructions provide relief from the packaging, testing, labeling, training, acceptance check and pilot notification requirements of fully regulated dangerous goods.
2. Restrict the quantity of lithium-ion batteries at a single location on the aircraft. While ICAO limits the quantity of lithium-ion batteries per package, an unlimited number of packages are allowed on both passenger and cargo aircraft, increasing the risk that a fire involving these batteries will overwhelm a cargo fire suppression system.
3. Prohibit cargo quantities of lithium-metal batteries on all aircraft. Following a fire in 1999, the U.S. Federal Aviation Administration (FAA) determined that a fire involving a single lithium-metal battery would spread to an entire shipment, and that the aircraft fire suppression agent Halon would have no effect the fire. PHMSA banned bulk shipments of lithium-metal batteries on passenger aircraft in 2004. We proposed to extend this ban to both passenger and cargo aircraft worldwide.
4. Require the full regulation of lithium batteries, thereby alerting the acceptance and loading personnel to the presence of lithium battery shipments at cargo acceptance points.

Because the international community has failed to take needed remedial action, ALPA believes this Committee should act now to protect the public, flight crewmembers and other individuals directly involved in the air-cargo transportation system. The U.S. continues to be regarded as the world's leader in regulating the safe carriage of hazardous materials in air transportation. We submit that passage of this proposed legislation will enhance that status within the ICAO community. By pointing to this legislation, U.S. representatives will be positioned to propose their adoption on a worldwide basis. It should be noted that whether enhanced regulations governing the handling of lithium batteries are adopted via legislation or NPRM, they will differ from existing ICAO rules. Consequently, for a time, there will be a lack of harmonization with ICAO practices, regardless of the way the rules are adopted.

Compliance with provisions in the Department of Transportation's hazardous materials regulations will ensure that each shipment by air cargo of lithium batteries is subjected to the following conditions:

- A. Design testing of each battery according to the UN Manual of Tests and Criteria
- B. Each cell or battery must be protected from short circuit



- C. Packaging in strong outer UN Specification Packaging
- D. A dangerous goods transport document must be provided
- E. The package must be marked with a Class 9 Dangerous Goods Label
- F. An acceptance check is required to be performed by the operator
- G. A pilot notification form must be provided to the pilot in command
- H. Training must be provided to persons preparing batteries for shipment

ALPA believes it is critical that the total quantity of lithium-ion batteries stored at any single location or in a single cargo compartment must be limited. While the risk of a fire initiating in a single battery can never be completely eliminated, by limiting the number of batteries stored at a single location, the severity of a fire can be reduced. A conservative approach to the number of batteries permissible at a single location must be adopted until testing is performed to determine the quantity of batteries that can be successfully extinguished using aircraft fire suppression systems.

In conclusion, I want to express ALPA's appreciation for this Committee's interest in the safe transport of lithium batteries as cargo on passenger and all-cargo aircraft and for the leadership which you have provided by ensuring that PHMSA promulgates regulations mandating the safe transportation of lithium batteries. The language that you have added to the HAZMAT reauthorization bill will greatly enhance the overall safety of air cargo operations and protect lives and property whenever lithium batteries are moved through the air transportation system.

Thank you for the opportunity to testify today. I would be pleased to address any questions that you may have.





STATEMENT OF  
FIRST OFFICER MARK ROGERS  
DIRECTOR, DANGEROUS GOODS PROGRAMS  
AIR LINE PILOTS ASSOCIATION, INTERNATIONAL  
BEFORE THE  
SUBCOMMITTEE ON RAILROADS, PIPELINES,  
AND HAZARDOUS MATERIALS  
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE  
UNITED STATES HOUSE OF REPRESENTATIVES  
WASHINGTON, DC

May 14, 2009

REAUTHORIZATION OF THE DEPARTMENT OF TRANSPORTATION'S  
HAZARDOUS MATERIALS SAFETY PROGRAM

Air Line Pilots Association, International  
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STATEMENT OF  
FIRST OFFICER MARK ROGERS  
DIRECTOR, DANGEROUS GOODS PROGRAMS  
AIR LINE PILOTS ASSOCIATION, INTERNATIONAL  
BEFORE THE  
SUBCOMMITTEE ON RAILROADS, PIPELINES, AND HAZARDOUS MATERIALS  
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE  
UNITED STATES HOUSE OF REPRESENTATIVES  
WASHINGTON, DC  
May 14, 2009

**Carriage of Lithium Batteries as Cargo  
on Passenger and Cargo Aircraft**

Good afternoon, Chairwoman Brown, Ranking Member Shuster, and members of the Subcommittee. I am Mark Rogers, a commercial airline pilot and Director of the Dangerous Goods Programs of the Air Line Pilots Association, International (ALPA). ALPA represents more than 54,000 pilots who fly for 36 passenger and all-cargo airlines in the United States and Canada. On behalf of our members, I want to thank you for the opportunity to provide our safety perspective on the carriage of lithium batteries as cargo on passenger and cargo aircraft.

ALPA has a vested interest in regulations governing shipments of hazardous materials aboard passenger and cargo-only aircraft. A topic of particular concern to us is the transport by air of lithium-ion and lithium-metal batteries. Over the past eight years, ALPA has urged the Department of Transportation's Pipeline and Hazardous Materials Administration (PHMSA) to:

- (1) Bring bulk shipments of lithium-metal (primary) and lithium-ion (secondary) batteries into the full scope of the dangerous goods regulations, and
- (2) Extend the prohibition of bulk shipments of lithium-metal batteries from passenger to cargo-only aircraft until adequate packaging standards can be developed to sufficiently protect the batteries.

**The Issue**

The degree of risk and well-documented history of incidents associated with lithium batteries justifies their inclusion in regulations pertaining to dangerous goods shipped by air, to include: packaging requirements, acceptance checks, package testing, labeling, quantity limitations and pilot notification. These measures are critically important as batteries are one of a few commodities in which damage to a shipment is the only thing necessary to start a fire. Experience has shown that a fire can emerge hours after battery damage has occurred. Undamaged lithium batteries may also self ignite and burn in the presence of a high-heat source.

Unlike other regulated dangerous goods such as dry ice and flammable paint, lithium-ion batteries are exempted (or follow different criteria) from the majority of the dangerous goods



regulations, including requirements for dangerous goods labels, an acceptance check by an airline, and notification to the pilot in command, or Notice to Captain (NOTOC). It is inappropriate to provide significant regulatory relief for the transport of lithium batteries as cargo, especially in large quantities, considering that less hazardous items such as flammable paint and five pounds of dry ice are fully covered under the dangerous goods regulations.

## Background

There are two types of lithium batteries used in today's electronic devices; *lithium-ion*, which are typically rechargeable and *lithium-metal*, which are not normally rechargeable. Lithium-ion batteries are typically used to power devices such as laptop computers, cell phones and MP-3 players. Lithium-metal batteries typically power devices such as watches, flashlights and digital cameras.

While the vast majority of lithium batteries are transported safely, when they are damaged, defective, or subjected to an external or internal short circuit, they have the potential to burn violently, emitting flames, sparks and large quantities of smoke. There have been several recent lithium-ion fires, including a March 2008 in-flight fire on a Chicago-to-Tokyo flight and a June 2007 fire in a passenger terminal at the Los Angeles airport. Fortunately, in both cases, the fires were successfully extinguished before substantial damage to property or loss of life could occur. The extent of the problem is further evidenced by the growing number of events listed in the battery incident list maintained by the Federal Aviation Administration (FAA).

Following a fire involving lithium-metal batteries in Los Angeles in 1999, the FAA Technical Center undertook a study of lithium-metal batteries and their response to an external fire source (DOT/FAA/AR-04/26). Among the findings published in June 2004, the FAA concluded that a fire involving one lithium-metal battery would spread to all batteries in a shipment, that the fire would burn violently at a temperature above the melting point of aluminum, that the heat from a suppressed cargo fire (approximately 400 deg. F) would be enough to ignite the batteries, and that ignition and fire would be accompanied by a pressure pulse that could cause the cargo compartment lining of an aircraft to fail. Especially significant was the finding that the traditional aircraft fire suppression agent, Halon 1301, would have no effect on a lithium-metal battery-initiated fire. In effect, damage to a single battery in a shipment of hundreds or thousands could lead to an uncontrollable fire.

After publication of the FAA report, the DOT issued immediate rule-making that banned the bulk shipment of lithium-metal batteries on passenger aircraft, leaving unchanged the provisions for shipment by cargo-only aircraft. Because ALPA has long insisted on *One Level of Safety* for both passenger and all-cargo aircraft, we continue to advocate that PHMSA extend the ban on lithium-metal batteries to cargo-only aircraft until adequate packaging can be developed to protect lithium-metal batteries and the aircraft upon which they are transported.

On January 1, 2009, the vast majority of lithium-metal and lithium-ion batteries were permitted to be shipped internationally on aircraft under packaging instructions 965-970 of the International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air, providing that certain size, testing, packaging and marking

requirements are met. These requirements, however, do not include dangerous goods labels or notification to the flight crew. Because this carriage standard is of significant importance to the well-being of our membership, ALPA is working through ICAO and the United Nations Committee of Experts on the Transport of Dangerous Goods (UNCOE) to improve the safety of international air transport of hazmat including batteries. Clearly, a strong US PHMSA law is important to that end.

### **Justification for Change**

Air safety would be greatly enhanced by improved packaging, better testing, a dangerous goods label that would be easily recognizable to ground handlers and emergency responders, an acceptance check to verify that the regulations have been complied with, and notification to the pilot in command that lithium-ion batteries were being carried in accordance with the hazardous materials regulations (HMR).

While lithium-ion batteries can be safely transported once fully incorporated into the dangerous goods regulations, the characteristics of lithium-metal batteries make them unsuitable for transport in bulk quantities aboard passenger or cargo aircraft. In short, there is no safety justification for allowing bulk shipments of lithium-metal batteries to continue to travel on cargo-only aircraft when there is no adequate fire-suppression agent currently available. Accordingly, until adequate HMR packaging standards can be developed to protect all occupants of an aircraft in case a shipment of lithium-metal batteries is exposed to fire of any origin, and to protect the batteries from external damage, we urge PHMSA to ban bulk shipments of lithium-metal batteries on both passenger and cargo aircraft.

On December 4, 2007 the NTSB held a public meeting and issued a report (NTSB/AAR-07/07) of its investigation into the in-flight cargo fire on a UPS cargo-only aircraft on February 7, 2006. A synopsis of the executive summary and list of conclusions from that report is provided as Attachment A. In its report, the NTSB substantiated ALPA's concerns concerning the carriage of lithium batteries by air.

As part of that report, on December 17, 2007 the NTSB issued a letter (Attachment B) to PHMSA with its recommendations A-07-104 through -109. Although the content of the letter epitomizes ALPA's position on this matter, NTSB Recommendations A-07-104 and A-07-109 speak directly to our concerns. In A-07-104, the NTSB recommends that PHMSA *"require aircraft operators to implement measures to reduce the risk of primary lithium batteries becoming involved in fires on cargo-only aircraft, such as transporting such batteries in fire resistant containers and/or in restricted quantities at any single location on the aircraft."* This recommendation is consistent with the ALPA position to ban bulk shipments until adequate packaging is developed.

Additionally, in NTSB Recommendation A-07-109, PHMSA is urged to *"Eliminate regulatory exemptions for the packaging, marking, and labeling of cargo shipments of small secondary lithium batteries (no more than 8 grams equivalent lithium content) until the analysis of the failures and the implementation of risk-based requirements asked for in Safety Recommendation A-07-108 are completed."*



## Recommendations

The full regulation of lithium metal and lithium ion batteries will significantly increase the safety of these commodities when shipped aboard aircraft. Class 9 requirements will result in packages that are tested and certified, resulting in a higher quality packaging which will limit the possibility of fire following damage. The Class 9 label on the package will make the shipment more visible to ground crews loading the aircraft, raising their awareness of the potential danger if the shipment is mishandled or damaged. The Class 9 label is recognizable and easily identifiable, and does not rely on text or understanding of the English language. Inclusion in Class 9 will also result in an acceptance check being performed by the operator, which would limit the potential of an improper or damaged package being placed into transport. Although not currently required, major cargo carriers may also choose to remove Class 9 shipments of lithium batteries from the general cargo stream at major sort facilities. Pilot notification of Class 9 shipments of lithium batteries will enable flight crews to communicate hazard information to first responders in the event of an incident.

The testing proposed by ALPA would allow a data-driven approach to be used to determine the appropriate types of packages and quantities for both lithium metal and lithium ion batteries aboard passenger and cargo aircraft. For both lithium metal and lithium ion batteries, it must be shown that the aircraft Halon fire suppression system is sufficient to suppress a fire in a cargo compartment containing lithium batteries until the aircraft has an opportunity to land (as long as 3 hours in Extended Twin Engine Operations (ETOPS)). This ability must be demonstrated both for fires originating with the batteries and for fires from another source in a cargo compartment containing lithium batteries.

We recommend that DOT amend the regulations addressing the safe transport of lithium metal (primary) and lithium ion (secondary) batteries aboard aircraft to accomplish the following:

1. Remove regulatory exemptions for the transport of cargo shipments of lithium-ion batteries; these batteries should be shipped in complete accordance with the dangerous goods regulations, including packaging requirements, labeling, testing, flight crew notification and quantity limitations.
2. Ban bulk shipments of lithium-metal batteries on passenger and cargo aircraft until adequate packaging standards can be developed to protect these batteries from a fire from any source.
3. Incorporate NTSB recommendations concerning lithium batteries into the Hazardous Materials Regulations (HMR).

The regulations should contain the following provisions and be enacted as soon as practicable:

- Regulate lithium metal and lithium ion batteries as Class 9 material, including requiring package testing, labeling, and pilot notification.



- Create very limited exceptions to Class 9 requirements for button cell batteries and batteries installed in equipment, so long as other regulatory provisions limit the danger posed by these batteries.
- Adopt regulatory measures to limit the total quantity of lithium batteries in a package and in a cargo compartment. Specifically, the provision granting relief from the limit of 55 net pounds of dangerous goods per inaccessible cargo compartment for Class 9 materials should not be applied to lithium metal or lithium ion batteries.
- Prohibit the transport of lithium ion batteries in non-Class C compartments (cargo compartments not protected by Halon suppression systems). Non-Class C cargo compartments include the main deck cargo compartment of freighter aircraft and those under-floor cargo compartments on freighter aircraft that have not been converted from Class D to Class C.
- Extend the current ban on cargo shipments of lithium metal batteries on passenger aircraft to cargo aircraft until adequate packaging standards are adopted. Lithium metal batteries packed in or with equipment would continue to be permitted for both passenger and cargo aircraft.

Furthermore, ALPA recommends that the DOT/FAA conduct the following testing and amend the regulations as appropriate:

- Evaluate the effectiveness of metal inner and/or outer packagings for lithium metal batteries. Testing should determine if the residual heat from a Halon suppressed cargo fire would be sufficient to cause auto-ignition of the batteries in metal packagings.
- Determine the effectiveness of metal packagings in preventing the spread of a fire from one package to an adjoining package of lithium metal batteries.
- Determine the effectiveness of an aircraft Halon fire suppression system in suppressing a fire involving the maximum quantity of lithium metal batteries in metal packagings permitted in a cargo compartment.
- Evaluate the effectiveness of an aircraft Halon suppression system on a fire involving the maximum permitted quantity of lithium ion batteries in completed packagings.
- Evaluate the effectiveness of fire resistant packagings, pallets, and/or ULDs in preventing the spread of fire initiated within the package, and in preventing the ignition of batteries following a fire from an outside source.

In conclusion, I want to express ALPA's appreciation for this Committee's interest in the safe transport of lithium batteries as cargo on passenger and all-cargo aircraft. Our recommended actions for incorporation into the PHMSA reauthorization bill will greatly enhance the overall safety of moving these batteries through the transportation system. Thank you for the opportunity to testify today. I would be pleased to address any questions that you may have.

###

**NATIONAL TRANSPORTATION SAFETY BOARD**  
**Public Meeting of December 4, 2007**  
**(Information subject to editing)**  
**Aviation Accident Report**  
**In-Flight Cargo Fire, United Parcel Service Company Flight 1307,**  
**McDonnell Douglas DC-8-71F, N748UP**  
**Philadelphia, Pennsylvania, February 7, 2006**  
**NTSB/AAR-07/07**

This is a synopsis from the Safety Board's report and does not include the Board's rationale for the conclusions, probable cause, and safety recommendations. Safety Board staff is currently making final revisions to the report from which the attached conclusions and safety recommendations have been extracted. The final report and pertinent safety recommendation letters will be distributed to recommendation recipients as soon as possible. The attached information is subject to further review and editing.

## EXECUTIVE SUMMARY

On February 7, 2006, about 2359 eastern standard time, United Parcel Service Company flight 1307, a McDonnell Douglas DC-8-71F, N748UP, landed at its destination airport, Philadelphia International Airport, Philadelphia, Pennsylvania, after a cargo smoke indication in the cockpit. The captain, first officer, and flight engineer evacuated from the airplane after landing. The flight crewmembers sustained minor injuries, and the airplane and most of the cargo were destroyed by fire after landing. The scheduled cargo flight was operating under the provisions of 14 *Code of Federal Regulations* Part 121 on an instrument flight rules flight plan. Night visual conditions prevailed at the time of the accident.

## CONCLUSIONS

1. The flight crewmembers were properly certificated and qualified under Federal regulations. No evidence indicated any preexisting medical or physical condition that might have adversely affected the flight crew's performance during the accident flight.
2. No evidence was found indicating that fatigue degraded the performance of any of the flight crewmembers on the day of the accident.
3. Examinations of the recovered components revealed no evidence of any preexisting powerplant, structural, or system failures.
4. The flight crew's continued descent to Philadelphia International Airport was not inappropriate given that there was no evidence of abnormalities other than the odor, and that no cockpit alerts had been activated.
5. The increased airflow that resulted from the Fumes Evacuation checklist actions diluted the smoke and inhibited its detection by either the smoke detection system or flight crewmembers and provided the fire with additional oxygen.
6. The aviation industry initiative on smoke, fire, and fumes provides specific guidance on when and how flight crews should respond to evidence of a fire in the absence of cockpit smoke and/or fire warning.



7. The fire on board the accident airplane initiated as a smoldering fire.
8. The fire was detected by the airplane's smoke and fire detection system after the fire breached a cargo container, at which time, it proceeded to spread, and the growth of the fire after landing was fed by air entering through open doors and burnthrough holes.
9. The exact origin and cause of the in-flight fire on board the airplane could not be determined due to the destruction of potentially helpful evidence; however, available evidence suggests that the fire most likely originated in container 12, 13, or 14.
10. The current certification test standards and guidance for smoke or fire detection systems on board many aircraft are not adequate because they do not account for the effects of cargo containers on airflow around the detection sensors and on the containment of smoke from a fire inside a container.
11. The threat from cargo fires could be mitigated by the installation of fire suppression systems.
12. Flight crews on cargo-only aircraft remain at risk from in-flight fires involving both primary and secondary lithium batteries.
13. The emergency response for this accident was timely.
14. Some aircraft rescue and firefighting personnel are not adequately trained on the use of the high-reach extendable turret with skin-penetrating nozzle, reducing the effectiveness of the device in fighting interior aircraft fires.
15. Philadelphia International Airport aircraft rescue and firefighting personnel were not familiar with the accident airplane's main cargo door, which adversely affected their ability to access the airplane's interior to fight the fire.
16. The availability of accurate and complete airplane diagrams would improve aircraft rescue and firefighting personnel's knowledge and familiarity with fleet configurations and would facilitate emergency response operations.
17. A floor level emergency exit and when appropriate equipped with an evacuation slide would enable more efficient emergency egress for airplane occupants than cockpit window exits, and the associated, instructional placarding of such an exit would assist emergency responders with locating and operating the exit door and accessing the interior of the airplane.
18. United Parcel Service Company (UPS) guidance on hazardous materials information retrieval and dissemination was inadequate, which resulted in UPS personnel not providing emergency responders with detailed information about the hazardous materials on board the airplane in a timely manner.
19. The requirements of 49 *Code of Federal Regulations* 175.33(d) are not adequate because they do not require operators to provide hazardous materials information to emergency responders immediately upon notification of an accident.
20. Testing and incident data indicate that lithium batteries can pose a fire hazard.



21. Because many incidents involving lithium batteries are exempt from reporting requirements, the data regarding such incidents are incomplete, which has prevented a thorough assessment of the causes of these failures and the risks associated with transporting lithium batteries.
22. An in-depth analysis of the causes of secondary and primary lithium battery failures would improve the safe transportation of these batteries.
23. The Pipeline and Hazardous Materials Safety Administration's August 2007 final rule regarding the transportation of lithium batteries did not establish sufficient levels of safety for air transportation of small secondary lithium batteries (no more than 8 grams equivalent lithium content).

## PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this accident was an in-flight cargo fire that initiated from an unknown source, which was most likely located within cargo container 12, 13, or 14. Contributing to the loss of the aircraft were inadequate certification test requirements for smoke and fire detection systems and the lack of an on-board fire suppression system.

## SAFETY RECOMMENDATIONS

As a result of its investigation, the National Transportation Safety Board makes the following safety recommendations:

### To the Federal Aviation Administration:

1. Provide clear guidance to the operators of passenger and cargo aircraft operating under 14 *Code of Federal Regulation* Parts 125, 139 and 91K on flight crew procedures for responding to evidence of a fire in the absence of a cockpit alert based on the guidance developed by the 2004 smoke, fire, and fumes industry initiative.
2. Ensure that the performance requirements for smoke and fire detection systems on cargo airplanes account for the effects of cargo containers on airflow around the detection sensors and on the containment of smoke from a fire inside a container, and establish standardized methods of demonstrating compliance with those requirements.
3. Require that fire suppression systems be installed in the cargo compartments of all cargo airplanes operating under 14 *Code of Federal Regulations* Part 121.
4. Provide guidance to aircraft rescue and firefighting personnel on the best training methods to obtain and maintain proficiency with the high-reach extendable turret with skin-penetrating nozzle.
5. Require airport inspectors to ensure that Part 139 airports with cargo operations include cargo aircraft in their aircraft rescue and firefighting aircraft familiarization training programs.
6. Require cargo operators to designate at least one floor level door when appropriate equipped with an emergency slide as a required emergency exit.
7. Require all emergency exits on cargo aircraft that are operable from the outside to have a 2-inch contrasting colored band outlining the exit.

**To the Pipeline and Hazardous Materials Safety Administration:**

8. Require aircraft operators to implement measures to reduce the risk of primary lithium batteries becoming involved in fires on cargo-only aircraft, such as transporting such batteries in fire resistant containers and/or in restricted quantities at any single location on the aircraft.
9. Until fire suppression systems are required on cargo-only aircraft, as asked for in Safety Recommendation [3], require that cargo shipments of secondary batteries, including those contained in or packed with equipment, be transported in crew-accessible locations where portable fire suppression systems can be used.
10. Require aircraft operators that transport hazardous materials to immediately provide consolidated and specific information about hazardous materials on board an aircraft, including proper shipping name, hazard class, quantity, number of packages, and location, to on-scene emergency responders upon notification of an accident or incident.
11. Require commercial cargo and passenger operators to report to the Pipeline and Hazardous Materials Safety Administration all incidents involving primary and secondary lithium batteries, including those contained in or packed with equipment, that occur either on board or during loading or unloading operations and retain the failed items for evaluation purposes.
12. Analyze the causes of all thermal failures and fires involving secondary and primary lithium batteries and, based on this analysis, take appropriate action to mitigate any risks determined to be posed by transporting lithium batteries, including those contained in or packed with equipment, on board cargo and passenger aircraft as cargo; checked baggage; or carry-on items.
13. Eliminate regulatory exemptions for the packaging, marking, and labeling of cargo shipments of small secondary lithium batteries (no more than 8 grams equivalent lithium content) until the analysis of the failures and the implementation of risk-based requirements asked for in Safety Recommendation [12] are completed.

**To the Cargo Airline Association:**

14. Work with its member airlines and other groups, such as the Air Transport Association, major aircraft manufacturers, and the Aircraft Rescue and Firefighting (ARFF) Working Group, to develop and disseminate accurate and complete airplane Emergency Response diagrams for ARFF personnel at airports with cargo operations.

**PREVIOUSLY ISSUED SAFETY RECOMMENDATION RESULTING FROM THIS ACCIDENT INVESTIGATION**

15. Safety Recommendation A-06-65 was issued on September 25, 2006, and is classified "Open - Acceptable Response."

**PREVIOUSLY ISSUED SAFETY RECOMMENDATION CLASSIFIED IN THIS REPORT**

16. Safety Recommendations A-99-80, -82, and -85 (previously classified "Open-Acceptable Response") are classified "Closed-Acceptable Action."

NTSB Home | Publications



Washington, D.C. 20591  
Safety Recommendations

DATE: December 17, 2007

TO: Director, Office of Safety and Health

FROM: [Illegible]  
SUBJECT: [Illegible]

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## National Transportation Safety Board

Washington, D.C. 20594

### Safety Recommendation

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Date: December 17, 2007

The Honorable Krista L. Edwards  
Acting Administrator  
Pipeline and Hazardous Materials Safety Administration  
U.S. Department of Transportation  
1200 New Jersey Avenue, S.E.  
East Building, 2nd Floor, PH  
Washington, D.C. 20590

In reply refer to: A-07-104 through -109

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On February 7, 2006, about 2359 eastern standard time,<sup>1</sup> United Parcel Service Company (UPS) flight 1307, a McDonnell Douglas DC-8-71F,<sup>2</sup> N748UP, landed at its destination airport, Philadelphia International Airport (PHL), Philadelphia, Pennsylvania, after a cargo smoke indication in the cockpit. The captain, first officer, and flight engineer evacuated the airplane after landing. The flight crewmembers sustained minor injuries, and the airplane and most of the cargo were destroyed by fire after landing. The scheduled cargo flight was operating under the provisions of 14 *Code of Federal Regulations* (CFR) Part 121 on an instrument flight rules flight plan. Night visual conditions prevailed at the time of the accident.<sup>3</sup>

The National Transportation Safety Board determined that the probable cause of this accident was an in-flight cargo fire that initiated from an unknown source, which was most likely located within cargo container 12, 13, or 14. Contributing to the loss of the aircraft were the inadequate certification test requirements for smoke and fire detection systems and the lack of an on board fire suppression system.

#### Suppression of Secondary and Primary Lithium Battery-Related Fires

A number of secondary lithium batteries, which are described in more detail below, were found loose and in laptop computers and cell phones in the accident debris. No primary batteries were found in the accident debris.

There are basically two types of lithium batteries: secondary (rechargeable) and primary (nonrechargeable). Secondary lithium batteries, which are commonly used in items such as

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<sup>1</sup> Unless otherwise indicated, all times are eastern standard time based on a 24-hour clock.

<sup>2</sup> McDonnell Douglas is now owned by the Boeing Commercial Airplane Group.

<sup>3</sup> For more information, see *In-Flight Cargo Fire, United Parcel Service Company Flight 1307, McDonnell Douglas DC-8-71F, N748UP, Philadelphia, Pennsylvania, February 7, 2007*, Aircraft Accident Report NTSB/AAR-07/07 (Washington, DC: NTSB, 2007).

cameras, cell phones, and laptop computers, contain lithium ions (charged molecules) in a flammable liquid electrolyte. Halon suppression systems (the only fire suppression systems certified for aviation) are effective in extinguishing fires involving secondary lithium batteries.

Primary batteries, which are commonly used in items such as watches and pocket calculators, contain metallic lithium that is sealed in a metal casing. The metallic lithium will burn when exposed to air if the metal casing is damaged, compromised, or exposed to sustained heating. Primary lithium battery flammability tests conducted by the Federal Aviation Administration (FAA) have shown that Halon suppression systems are not effective in extinguishing fires involving primary lithium batteries. Both primary and secondary lithium batteries are regulated as hazardous materials for the purposes of transportation.

Currently, the Safety Board is unaware of any fire suppression system that is effective on primary lithium battery fires. Therefore, although the installation of fire suppression systems in all cargo compartments on cargo-only aircraft, as recommended by the Board,<sup>4</sup> would reduce the risks from a fire involving most cargo items, including secondary lithium batteries, this action would essentially have no effect on a primary lithium battery fire. Further, until such time that fire suppression systems are installed on cargo-only aircraft, secondary lithium batteries will continue to typically be transported in compartments without fire suppression systems.

Therefore, the Safety Board concludes that flight crews on cargo-only aircraft remain at risk from in-flight fires involving both primary and secondary lithium batteries. The Safety Board believes that the Pipeline and Hazardous Materials Safety Administration (PHMSA) should require aircraft operators to implement measures to reduce the risk of primary lithium batteries becoming involved in fires on cargo-only aircraft, such as transporting such batteries in fire resistant containers and/or in restricted quantities at any single location on the aircraft. The Safety Board further believes that, until fire suppression systems are required on cargo-only aircraft, as asked for in Safety Recommendation A-07-99, PHMSA should require that cargo shipments of secondary lithium batteries, including those contained in or packed with equipment, be transported in crew-accessible locations where portable fire suppression systems can be used.

#### **Retrieval and Dissemination of Hazardous Materials Information**

The captain and first officer were not able to find the notice to captain (NOTOC), which contained information on the hazardous materials on board the airplane, during the evacuation because of the smoke in the cockpit and because they did not know that the flight engineer had moved it. Aircraft rescue and firefighting (ARFF) personnel who entered the cockpit after the evacuation were also unable to locate the NOTOC. When asked for the hazardous materials information, the UPS ramp supervisor stated that he could only provide the locations of the hazardous materials, not their identity, and that the NOTOC on board the airplane was the only source he was aware of that contained this information. About 40 minutes after the airplane landed, ARFF personnel reentered the airplane without knowing whether any potential safety hazards existed, found the NOTOC, and provided it to the incident commander.

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<sup>4</sup> As a result of this accident, the Safety Board also issued Safety Recommendation A-07-99, which asked the FAA to require that fire suppression systems be installed in the cargo compartments of all cargo airplanes operating under 14 CFR Part 121.



According to UPS management, in the event of an emergency, airport ground personnel were supposed to contact the UPS Flight Control Group in Louisville, Kentucky, to obtain specific information related to hazardous materials on board UPS flights from the Hazardous Materials Information System (HMIS). However, UPS ground personnel at PHL did not contact the UPS Flight Control Group on the day of the accident. Although UPS' HMIS was on line at PHL, UPS ground personnel were only authorized to access information about the quantity and locations of hazardous materials, not their identity. According to Flight Control personnel, once they heard about the accident, they retrieved the hazardous materials information for the flight from the HMIS; however, Flight Control did not provide this information to PHL Airport Operations or UPS ground or ARFF personnel. Additionally, both Airport Operations and ARFF personnel requested the hazardous information from UPS ground personnel at PHL; however, UPS ground personnel did not have access to the electronic system containing the desired information and did not contact UPS Flight Control in Louisville to obtain a copy of it.

Although emergency responders eventually located the NOTOC on the airplane and ARFF efforts were not significantly delayed, UPS personnel's failure to quickly access specific hazardous materials information and provide it to ARFF personnel could have potentially created a safety hazard. The Safety Board concludes that UPS guidance on hazardous materials information retrieval and dissemination was inadequate, which resulted in UPS personnel not providing emergency responders with detailed information about the hazardous materials on board the airplane in a timely manner.

Since the accident, UPS has revised its operations manuals to clarify personnel reporting responsibilities and the role and capabilities of Flight Control, promoting a more proactive approach to emergency response and hazardous materials communication. However, although these changes are an improvement and should result in hazardous materials information being provided in a timelier manner, the Safety Board is concerned that other operators might not have adequate guidance on hazardous materials information dissemination. The Board has previously addressed the importance of providing detailed hazardous materials information to emergency responders in a timely manner in its investigation of the in-flight fire and emergency landing in Newburgh, New York.<sup>5</sup> The investigation revealed that emergency responders did not receive specific information concerning the identity of hazardous materials, their quantities, or the number of packages on the airplane during the firefighting phase of the emergency. Although the unavailability of such information did not affect firefighting efforts, the overall importance of the timeliness in which emergency responders receive specific information about hazardous materials and the potential implications of unawareness were emphasized in the Board's report.

In the Newburgh report, the Safety Board noted that shipping documents are inherently at risk of destruction by fire and that flight crewmembers would most likely be unable to retrieve such paperwork because of the dangers of on-board fire, leaving it to the operator to provide the information to emergency responders. At the time of the Newburgh accident, Federal regulations did not adequately address the need for hazardous materials information on file with an air carrier to be quickly retrievable in a format useful to emergency responders. As a result, the

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<sup>5</sup> National Transportation Safety Board, *In-Flight Fire/Emergency Landing, Newburgh, New York, Federal Express Flight 1406, Douglas DC-10-10, N68055, September 5, 1996, Aircraft Accident Report NTSB/AAR-98/03* (Washington, DC: NTSB, 1998).



Board issued Safety Recommendation A-98-80 to the Research and Special Programs Administration (RSPA),<sup>6</sup> proposing that it require air carriers to have a means to quickly retrieve and provide consolidated, specific hazardous materials information to emergency responders, 24 hours per day.

In response, on March 25, 2003, RSPA published a final rule, which revised 49 CFR 175.33 to mandate that air carriers have a copy of the NOTOC at the departure and intended arrival airports and, upon request, make the information available to emergency responders. In an August 18, 2003, letter, the Safety Board stated that it was pleased that RSPA had made it a requirement that hazardous materials information be made available immediately upon request but that it was disappointed that the revision did not address the need for providing such information in a consolidated format. Consequently, the Board classified Safety Recommendation A-98-80 "Closed—Unacceptable Action."

Because 49 CFR 175.33(d) requires air carriers to make a copy of the NOTOC information available to emergency responders "upon request," the regulatory requirement suggests that the voluntary transfer of hazardous materials information, without a formal request, is optional for the carrier. In contrast, the International Civil Aviation Organization (ICAO) document, "Technical Instructions for the Safe Transport of Dangerous Goods by Air," provides the following guidance on the transfer of hazardous materials information between aircraft operators and emergency personnel:

In the event of an aircraft accident or serious incident, the operator of an aircraft carrying dangerous goods as cargo must provide information, without delay, to emergency services responding to the accident or serious incident about the dangerous goods on board, as shown on the copy of the information to the pilot-in-command.

The ICAO document promotes a proactive approach to the transfer of hazardous materials information during an emergency, which improves the likelihood that this information will get to emergency responders in a timely manner. In the case of this accident, UPS Flight Control personnel's actions satisfied the intent of the requirements as they are written. Flight Control had the on-board hazardous materials information readily available; however, they stated that they did not volunteer the information because they did not receive a request for it, therefore, they were not obligated to volunteer it, as stipulated by the regulations.

The Safety Board concludes that the requirements of 49 CFR 175.33(d) are not adequate because they do not require operators to provide hazardous materials information to emergency responders immediately upon notification of an accident. Therefore, the Safety Board believes that PHMSA should require aircraft operators that transport hazardous materials to immediately provide consolidated and specific information about hazardous materials on board an aircraft, including proper shipping name, hazard class, quantity, number of packages, and location, to on-scene emergency responders upon notification of an accident or incident.

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<sup>6</sup> RSPA no longer exists, and PHMSA has assumed its responsibilities.

### **Air Transport of Lithium Batteries**

As noted, although it could not be determined whether lithium batteries played a role in the UPS cargo fire, public hearing testimony and the continued occurrence of incidents involving these batteries on board airplanes suggest the need for greater attention to the risks posed by transporting these batteries on commercial aircraft. A review of FAA and Consumer Product Safety Commission (CPSC) records shows that the number of both secondary and primary lithium battery-related incidents, many of which involved laptop computer fires that resulted from either internal or external short-circuiting of the secondary lithium batteries, has increased consistently over the years.<sup>7</sup> Since February 2006, the CPSC has recalled more than 9 million laptops containing secondary lithium batteries and has issued additional recalls for other products containing secondary lithium batteries. During the Safety Board's public hearing, the CPSC predicted that more incidents and recalls would occur if the deficiencies were not addressed. Further, the increasing popularity of portable electronic devices suggests that lithium battery-related incidents, particularly those involving secondary lithium batteries, will continue to increase. The Safety Board concludes that testing and incident data indicate that lithium batteries can pose a fire hazard.

In response to recent secondary lithium battery-related incidents and issues addressed during the Safety Board's public hearing, the FAA, Air Line Pilots Administration, and PHMSA all issued safety alerts or advisories in 2007, which addressed smoke and fire hazards, recommended crew actions in the event of a battery fire, the availability of guidance for the safe transport of batteries and battery-powered devices on board aircraft, and proper packing and handling procedures for these batteries.

On August 9, 2007, PHMSA issued new requirements that tightened the safety standards governing the air transportation of both primary and secondary lithium batteries. The final rule prohibits the transport of primary lithium batteries and cells as cargo on passenger-carrying aircraft. Additionally, spare lithium batteries can only be transported as carry-on items. Further, the exemptions for medium primary and secondary lithium batteries were eliminated, and new marking paperwork requirements were added for those batteries transported as cargo by air or vessel. Under this rule, on the basis of the FAA's initial testing of the fire risks posed by secondary lithium batteries and PHMSA's elimination of many of the exemptions for primary and secondary lithium batteries, greater shipments of lithium batteries will be transported by air as declared hazardous materials that will be required to comply with enhanced packaging and identification standards.

The issuance of the safety alerts and advisories and the new, more stringent requirements demonstrate the growing awareness and concern within the Department of Transportation and the airline industry over the air transportation of primary and secondary lithium batteries and electronic equipment containing such batteries. These initiatives will also heighten awareness about the common risks associated with both primary and secondary lithium batteries. Although the Safety Board is encouraged by these efforts, other concerns still remain.

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<sup>7</sup> Incidents involving small secondary battery-related incidents are not required to be reported, and the reporting level might have increased, in part, as a result of greater awareness of the hazards associated with these batteries.



The FAA currently maintains records of aviation incidents involving batteries and battery-powered devices, including those involving primary and secondary lithium batteries. The records likely do not provide a complete listing because many of the incidents involved lithium batteries that were exempted from incident reporting requirements. As a result, many operators have most likely not reported similar incidents. In addition, although the PHMSA's August 2007 final rule includes a marking and paperwork requirement for small secondary and primary cells and batteries, the new requirement only applies to packages containing 24 or more cells or 12 or more batteries and does not include batteries packed with or contained in equipment. As a result, shipments of batteries and electronic equipment with fewer than 24 cells or 12 batteries, such as laptop computers, are still exempt from reporting requirements, and, therefore, incidents involving such shipments are likely to remain largely unreported.

Consequently, the Safety Board concludes that, because many incidents involving lithium batteries are exempt from reporting requirements, the data regarding such incidents are incomplete, which has prevented a thorough assessment of the causes of these failures and the risks associated with transporting lithium batteries. Therefore, the Safety Board believes that the PHMSA should require commercial cargo and passenger operators to report to the PHMSA all incidents involving primary and secondary lithium batteries, including those contained in or packed with equipment, that occur either on board or during loading or unloading operations and retain the failed items for evaluation purposes. The Safety Board also remains concerned that the causes of secondary lithium battery failures are not well understood or documented. This may be due, in part, to the fact that proper evaluation of failed lithium batteries is not always performed and that, in many cases, these batteries are disposed of before the incident is reported, precluding an accurate analysis of the failures. Regarding primary lithium batteries, although it is understood that physical damage and exposure to heat and fire are major concerns, the impact of clustering several thousand primary batteries on a single pallet or in a single cargo container has not been considered or evaluated. Given that Halon is not an effective suppressant for a primary lithium battery fire, the risk of battery involvement in any type of fire needs to be determined.

Analyzing future secondary and primary lithium battery-related incidents should help determine the causes of the failures and, in turn, allow the most appropriate transportation requirements to be established. Therefore, the Safety Board concludes that an in-depth analysis of the causes of secondary and primary lithium battery failures would improve the safe transportation of these batteries. Therefore, the Safety Board believes that PHMSA should analyze the causes of all thermal failures and fires involving secondary and primary lithium batteries and, based on this analysis, take appropriate action to mitigate any risks determined to be posed by transporting secondary and primary lithium batteries, including those contained in or packed with equipment, on board cargo and passenger aircraft as cargo; checked baggage; or carry-on items.

The Safety Board is also concerned about the remaining exemptions for small secondary lithium batteries, such as those used to power laptop computers, cameras, cell phones, and other personal electronic devices, which are allowed to be shipped on passenger and cargo aircraft even though these types of batteries have been involved in at least nine aviation incidents. Cargo shipments of small secondary lithium batteries should be subject to the same packaging and identification requirements that apply to medium and large secondary lithium batteries to



increase general awareness of the risks of these batteries and to alert package handlers to exercise greater care when loading and unloading packages containing lithium batteries.

Until the causes of the failures of secondary lithium batteries are understood and effectively addressed, the prudent course of action is to eliminate these exceptions, particularly with respect to packaging and identification. Therefore, the Safety Board concludes that PHMSA's August 2007 final rule regarding the transportation of lithium batteries did not establish sufficient levels of safety for air transportation of small secondary lithium batteries (no more than 8 grams (g) equivalent lithium content). Therefore, the Safety Board believes that PHMSA should eliminate regulatory exemptions for the packaging, marking, and labeling of cargo shipments of small secondary lithium batteries (no more than 8 g equivalent lithium content) until the analysis of the failures and the implementation of risk-based requirements asked for in Safety Recommendation A-07-108 are completed.

Therefore, the National Transportation Safety Board makes the following recommendations to the Pipeline and Hazardous Materials Safety Administration:

Require aircraft operators to implement measures to reduce the risk of primary lithium batteries becoming involved in fires on cargo-only aircraft, such as transporting such batteries in fire resistant containers and/or in restricted quantities at any single location on the aircraft. (A-07-104)

Until fire suppression systems are required on cargo-only aircraft, as asked for in Safety Recommendation A-07-99, require that cargo shipments of secondary lithium batteries, including those contained in or packed with equipment, be transported in crew-accessible locations where portable fire suppression systems can be used. (A-07-105)

Require aircraft operators that transport hazardous materials to immediately provide consolidated and specific information about hazardous materials on board an aircraft, including proper shipping name, hazard class, quantity, number of packages, and location, to on-scene emergency responders upon notification of an accident or incident. (A-07-106)

Require commercial cargo and passenger operators to report to the Pipeline and Hazardous Materials Safety Administration all incidents involving primary and secondary lithium batteries, including those contained in or packed with equipment, that occur either on board or during loading or unloading operations and retain the failed items for evaluation purposes. (A-07-107)

Analyze the causes of all thermal failures and fires involving secondary and primary lithium batteries and, based on this analysis, take appropriate action to mitigate any risks determined to be posed by transporting secondary and primary lithium batteries, including those contained in or packed with equipment, on board cargo and passenger aircraft as cargo; checked baggage; or carry-on items. (A-07-108)

Eliminate regulatory exemptions for the packaging, marking, and labeling of cargo shipments of small secondary lithium batteries (no more than 8 grams equivalent lithium content) until the analysis of the failures and the implementation of risk-based requirements asked for in Safety Recommendation A-07-108 are completed. (A-07-109)

The Safety Board also issued recommendations to the Federal Aviation Administration and the Cargo Airline Association.

In your response to the recommendations in this letter, please refer to Safety Recommendations A-07-104 through -109. If you need additional information, you may call (202) 314-6649.

Chairman ROSENKER, Vice Chairman SUMWALT, and Members HERSMAN, HIGGINS, and CHEALANDER concurred with these recommendations.

*[Original Signed]*

By: Mark V. Rosenker  
Chairman





# BATTERIES & BATTERY-POWERED DEVICES

## Aviation Incidents Involving Smoke, Fire, Extreme Heat or Explosion

As of August 3, 2010, **113** air incidents involving batteries have been recorded since March 20, 1991

Note: These are recent cargo and baggage incidents that the FAA is aware of. This should not be considered as a complete listing of all such incidents. The incident summaries included here are intended to be brief and objective. They do not represent all information the FAA has collected, nor do they include all investigative or enforcement actions taken.

DATE/ SOURCE	TYPE OF BATTERY	DEVICE (if applicable)	AIRCRAFT TYPE (Passenger or Cargo)	INCIDENT SUMMARY
24-JUNE-2010 DOT5800.1 Form	Non-spillable, rechargeable, lead-acid batteries	Power supply for device	Cargo	Initial report from United Parcel Service indicated a worker at the Salt Lake City, UT facility noticed a leaking package offered for air shipment to Edmonton, Canada. Subsequent inspection indicated the package was radiating heat. It contained a battery that was arching because unprotected terminals were in contact.
6-MAY-2010 DOT5800.1 Form and airport responders	Report indicates 2 loose CR123 lithium batteries	N/A	Passenger	Initial report from Delta Airlines and incident response personnel indicated that while placing a checked bag on a cart at the Seattle-Tacoma International airport, a baggage handler heard a "pop" and saw a flame and then smoke coming from the bag. Airport police and others responded to the incident. The terminal was evacuated. At the conclusion of the response, reports and eyewitness accounts obtained indicated the baggage remnants included the CR 123 lithium batteries.
20-APRIL- 2010 DOT5800.1 Form	Lithium-ion batteries	Curling Iron	Passenger	Initial report from American Airlines indicated that a lithium-ion battery powered curling in checked baggage may have switched to the on position in the bag room at Narita Airport, Japan after a flight. The incident caused the associated spare lithium-ion batteries in proximity to the curling iron to go into a thermal runaway condition. As a result, the bag and some contents were scorched.

9-FEB-2010 Report from Air Carrier	Lithium metal w/liquid cathode battery	N/A	Cargo	Initial report from United Parcel Service Airline indicated that, subsequent to air transport from Hong Kong, during the local ground portion of the delivery, the truck driver heard a loud pop. First responders were called to the scene. One of the batteries in one of the packages in the shipment ruptured, discharged soot and dislodged other batteries in the package.
9-SEPT-2009 Report from Air Carrier	Lithium-ion battery	Personal Electronic Device	Passenger	Initial report from American Airlines indicated that one of its company-owned batteries available for on-board use by passengers was dropped in-flight and caught fire.
25-AUG-2009 Report from Air Carrier	Initial report indicates Lithium-ion battery	GPS tracking device	Cargo	Initial report from Federal Express indicated that a burning and smoking package was discovered at the Medford, MA facility. The package was in route to Seattle, WA. An unsuccessful attempt was made to extinguish the fire by cutting open the package and applying a fire extinguisher. The Fire Department had to be called. Subsequent inspection revealed that two of the devices heated and caused the surrounding packaging to ignite.
15-AUG-2009 Report from Air Carrier	Lithium-ion battery	N/A	Cargo	Initial report from United Parcel Service Airline indicated that a smoldering package was noticed at its Taiwan Hub. The package was transported from Macau, China. Inspection of other packages in the same consignment indicated that similar batteries were offered without terminal protection.
14-AUG-2009 Report from Air Carrier	Lithium metal batteries	e-cigarettes	Cargo	Initial report from Federal Express indicated that upon landing at Minneapolis-St. Paul Airport the crew was alerted to a fire by a warning light associated with a forward compartment. Upon subsequent inspection of the relevant Unit Load Device, numerous packages were discovered with smoke and fire damage.
8-AUG-2009 Report from Air Carrier	Non-spillable lead-acid batteries	N/A	Cargo	Initial report from United Parcel Service Airline indicated that a package that had earlier been offered for air transport was noticed as "hot to the touch" at its Louisville, KY Hub. Upon inspection it contained two batteries, one of which appeared to be short-circuited.

15-JULY-2009 Report from Air Carrier – DOT 5800.1 Form	Lithium-ion cell phone batteries	Transported "loose" in packages without out cell phones	Cargo	Initial report from United Parcel Service Airline indicated that one of several related packages transported from Romulus, MI was discovered to be emitting smoke and smoldering in Santo Domingo, Dominican Republic. Upon inspection, package contained numerous loose lithium-ion batteries with " no protection of the contact points " Package documentation indicated, "used batteries – non haz".
23-JUN-2009 Report from Air Carrier – DOT 5800.1 Form	Battery Wet Filled with Acid – Sealed Rechargeable Battery	N/A	Cargo	Initial report from United Parcel Service Airline indicated that a smoking package was discovered on the ramp prior to loading at Windsor Locks, CT airport. Upon inspection, the battery was observed to have burned through the shipping box.
18-JUN-2009 Report from Air Carrier	Lithium-ion	Bicycle Power Device	Cargo	Initial report from United Parcel Service Airline indicated that a burned package was discovered in Honolulu inside a Unit Load Device as it was being unloaded. The package was originally loaded in Philadelphia and was subsequently transported on UPS flight # 2967 from Ontario, California. DOT Form 5800.1 report to follow.
11-JUN-2009 Report from Air Carrier	18V Nickel Cadmium	Hand held Cordless Power Drill Battery	Passenger	Initial report from Southwest Airlines indicated that a checked bag was observed to be "smoking" on the airport ramp at the Manchester-Boston Regional Airport prior to loading. The bag contained a spare drill battery. A screw inside the bag had connected with the exposed battery terminals apparently causing the incident.
15-JAN-2009 DOT 5800.1 report from Air Carrier	Batteries, Wet, Non- Spillable, Electric Storage	N/A	Cargo	Initial report from Fed Ex indicated that, while at the Pittsburgh airport, a package made of "rice paper" fell exposing three batteries. The battery terminals came in contact with each other and began to arc. As a result sparks were observed shooting from the package. The package was marked as non-spillable batteries as required by 49 CFR 173.159(d)(2) and ICAO TI USG-V08.
13-DEC-2008 DOT 5800.1 report from Air Carrier	Batteries, Wet, Non- Spillable, Electric Storage	20, 12 volt batteries connected in one package resting on "shelves"	Cargo	Initial report from Fed Ex indicated that, while at the Memphis hub, the package fell and the unprotected terminals came in contact with metal "shelves" inside the package. This caused the batteries to arc. As a result, the battery assembly caught fire several times. The package was marked as being in compliance with ICAO TI USG-V11.



07-SEP-2008 Report from UK CAA	Gel type lead acid	Wheelchair	Passenger	Initial report indicated that a battery-powered wheelchair burst into flames as it was being unloaded from a passenger aircraft in Manchester, England.
08-AUG-2008	Lithium ion/Type CF623/11.1-volt	Dell laptop computer	Passenger	While in flight, a passenger on American Airlines flight 1539 from Washington National to Dallas Ft Worth, noticed his Dell laptop was smoking. The passenger removed the battery pack and gave it to a flight attendant. The flight attendant placed the battery in a coffee pot in the aft gallery and poured water and Sprite on it. Dell has been advised of the incident.
06-AUG-2008 Air carrier report	Lithium ion	Electrical equipment	Cargo	UPS Airline reports that a package containing LED lamps powered by excepted lithium ion batteries was transported on UPS#0213 on 04-AUG from Louisville, KY to Cologne, Germany. It was subsequently observed smoking in a UPS ground sort facility in Copenhagen, Denmark.
04-APR-2008	Battery Wet, Non- Spillable, UN2800		Cargo	A package was offered to UPS by EnerSys Inc. in Warrensburg, MO, destined for Espoo, Finland. During the handling process in Copenhagen, Denmark, the package of Non-spillable sealed lead acid batteries erupted into flame while being loaded on a truck. The local fire brigade and bomb squad responded and have possession of the package. It was determined that the terminals consisted of bolts screwed into energized sockets.
18-MAR-2008 United Airlines (UALA) Pilots' internet forum	"CR123A" Lithium metal	Flashlight	Passenger	In Denver, a UALA employee had two flashlights that contained CR123A Lithium batteries. Flashlight used for inspection of aircraft started to dim. Flashlight was turned off and placed in storage compartment in cockpit of 757. A banging noise described like gunshots originated from the flashlight. Cap on the on/off switch blown off and became projectile. Employees hand and fingers burned when he touched the flashlight to move it to the rear of the cockpit. Mechanic responded and safely removed the flashlight.

04-MAR-2008	Lithium ion/polymer/3.7V 1000mAH	Personal binocular video control unit	Passenger	An i-Theater Video Display Unit used for viewing entertainment systems was charged at home prior to United flight from Chicago to Tokyo. Control unit was in use for 2.5 hrs. during the flight. Control unit began to generate heat, caused the plastic case to swell and emitted 10" plume of sparks and debris. United Captain doused unit with water. Small area of carpet damage to aircraft and no injuries to passengers or crew.
29-FEB-2008 TSA report	"C" Cells	Make-shift power unit	Passenger	The make-shift power unit for a passenger's laptop computer began to smoke during pre-board security screening at Terminal 7 of the Los Angeles International Airport.
14-FEB-2008	Under investigation	Flashlight	Passenger	Approximately two-thirds of the 389 passengers had boarded a Northwest Airlines Tokyo-Hong Kong flight, when a passenger's carry-on bag caught fire in an overhead bin. Flight attendants put out the fire with two fire extinguishers. One passenger suffered a minor burn when he tried to put out the fire by hand. Early indications are that a battery in a small flashlight inside the bag caught fire.
27-DEC-2007 Air carrier incident report	Lithium metal (lithium manganese dioxide)  <i>House of Batteries</i> prototype, 15-volt, (Five <i>Ultralife</i> 3-volt D cells connected in series). The battery contained 16.65 grams of lithium (3.3 grams per cell).	SSCOR medical suction pump	Cargo	Shipment was submitted to UPS for "2 <sup>nd</sup> day Air" service. After pick-up and ground transportation, the package "spontaneously combusted" on the conveyor at a UPS package sort facility in Cerritos, Calif. An employee put out the fire with a facility fire extinguisher.
15-DEC-2007 Air carrier incident report	Lithium ion/polymer for radio controlled model helicopter	Packed with radio controlled helicopter kit	Cargo flight	A package containing an R/C helicopter kit with lithium polymer batteries was being sent from Hong Kong to the Netherlands. It was discovered emitting smoke at the FedEx sort center in Frankfurt, Germany. The package was brought outside the building and the fire was extinguished.

11-DEC-2007 Air carrier report	Lithium ion/polymer for radio controlled model planes: FlightPower F3A, 5350 mAh, 18.5 V		Cargo flight	A package of lithium polymer batteries for remote control aircraft was being transported by UPS from Argentina to San Marino via Cologne, Germany. At the UPS hub in Cologne, a customs inspector cut into the box with a knife, accidentally cutting into a battery which then caught fire. The battery had a soft plastic exterior without a hard metal shell. A fire alarm was triggered and 400-500 people were evacuated from the facility for 35 minutes. The transport section of the accompanying MSDS stated the batteries were "non-regulated".
30-SEP-07 Air carrier report	Lithium-ion Xiamen Powerlong 3.7v, 4000 mAh and 5200 mAh		Cargo flight	After flying from Hong Kong, a Korea-bound box was emitting smoke upon offload at the FedEx Hub at Subic Bay, Philippines. No flames were seen. The box was removed from the sort. The outer-most box was an overpack containing three inner fiberboard boxes. It's believed each of the inner boxes contained 120 lithium-ion batteries. The fire was contained to one inner box.
08-AUG-2007 Report from German transport officials	Lithium polymer (ion) Arkai 11.1 Volt		Cargo flight	The batteries traveled from Hong Kong to Frankfurt on a FedEx flight. During customs inspection, one of the 440 batteries in the package started to burn.
14-June-2007 Police report. FAA agent statement.	Lithium CR123A (probable lithium metal)	Ecoquest "Fresh Air Buddy" personal air purifier	Passenger flight	While walking in the Long Beach, CA, airport terminal prior to flight, a passenger's personal air filter worn around her neck exploded in a streak of fire. The battery was ejected at high speed across the terminal and melted the carpet where it came to rest. Passenger was uninjured but suffered scorches/burns on her clothing. A non-rechargeable lithium metal battery may have been put into a recharger before inserting it into the air purifier.
5-June-2007 Airline report. Video from witness also posted to the internet. DOT incident report # 2007070001	Lithium ion	Dell laptop computer	Passenger flight	While waiting in the airport gate area, a passenger plugged his laptop computer into an electrical outlet on a column in the seating area. At some point the computer began smoking. Airline agent suggested the passenger unplug or shutoff the computer but passenger did not. The computer eventually burst into flames. Fire extinguishers were used to suppress—but not quickly extinguish—the fire.



15-May -2007 (report date)  NASA ASRS Report # AB 2007: 26/9-1 5/15/07 730630	Lithium-ion battery pack for <i>Sony PSP</i>	No indication that battery was in or attached to Sony PSP device	Passenger flight	Ramp worker removed checked bag that was on fire when loading passenger aircraft. Fire department determined that the fire was caused by a battery-pack for a Sony PSP handheld video game.  <i>Note: This information comes from an anonymous report via the NASA ASRS. Airline, location, persons involved and exact date are unknown.</i>
22-MAR-2007  FAA report	Two <i>Nexergy Promark</i> 15- volt, 78 AH, alkaline battery packs (30 cells each)		Cargo flight	A battery pack caught fire at the FedEx facility in Forest Park, GA. Apparently, a soldering error during manufacture contributed to a short circuit of the battery. The manufacturer has redesigned the battery and external packaging.
19-MAR-2007  Air carrier report	"CR123" lithium metal  <i>Reportedly; battery fragments were disposed of by crew</i>	Possibly a camera  <i>No passenger took responsibility for the battery</i>	Passenger flight	1 ½ hours into a passenger flight from Buenos Aires to Miami a small explosion occurred in the Business Class section of the aircraft. There were sparks then a flash and smoke. Flight attendants, then the Captain, responded. Battery fragments were the only evidence found. It is suspected that the battery dropped into a seat and arced against a metal seat frame causing it to explode. The ruptured battery splattered debris on overhead bins. A fragment hit a passenger in the head burning her hair near her earlobe. Seven flight attendants were affected by smoke/fume inhalation. All refused medical treatment in Miami. One aircraft seat bottom and four seat covers were damaged and replaced.
9-MAR-2007  Air carrier reports	Lithium ion	Laptop computer and power converter.	Passenger flight	Passenger flight from Toronto to Dallas/Ft. Worth diverted to St. Louis after strong electrical burning smell in the cabin. Source was laptop being used by a passenger while plugged in to aircraft power port via power converter. Power converter reportedly heated up. Aircraft power port and laptop reportedly in normal working condition afterwards.
1-MAR-2007  Australia CASA report	Lithium metal (non- rechargeable)  Twenty-four <i>Surefire</i> SF123A batteries		Passenger flight	US mail package from eBay internet vendor containing the batteries was transported on a passenger flight from LAX to Sydney and caught fire at the Sydney Mail Gateway Facility.

<p>26-Feb-07</p> <p>FAA case # 2007NE700130</p>	<p>Two 12-volt batteries</p>		<p>Passenger flight</p>	<p>During checked baggage screening, TSA personnel discovered two 12-volt batteries in a passenger's tool box, reportedly for a business demo. The battery terminals were exposed. Upon examination, one of the terminals touched the ETD table and sparked causing the screener to drop the battery. The battery landed with both terminals down and started smoking. TSA determined the batteries were not "hazmat" and the airline agreed to transport the batteries as long as the terminals were protected.</p>
<p>10-FEB-2007</p> <p>Air carrier reports</p>	<p><i>Energizer</i> lithium metal 9-volt, <i>Energizer</i> lithium metal AA, and <i>IDXNP-L50S</i> lithium ion batteries were all present.</p> <p>One <i>Energizer</i> lithium metal 9-volt was destroyed in the fire and seems most likely to be source of the fire.</p>	<p>Packed with professional audio/video equipment</p>	<p>Passenger flight</p>	<p>While still climbing after takeoff from JFK, smoke began pouring from an overhead bin in the passenger cabin. Passengers alerted the flight attendants who responded. A flight attendant opened the bin and saw thick black smoke and flames in the rear of the bin. As the plane returned to the airport for an emergency landing flight attendants were able to put out the fire, discharging two Halon fire extinguishers. Water was applied to some cloth embers that continued to burn after the Halon was used.</p> <p>Cockpit crew smelled some light smoke in the cockpit and donned O2 masks for approx. 20 seconds until the smoke dissipated.</p> <p>Source of fire, bag with audio-video equip was secured in a lavatory. Aircraft landed and taxied to the gate. One passenger complained of chest pains and needed assistance in exiting the aircraft.</p> <p>The fire apparently was caused by loose batteries that were packed in a bag with other audio-video equipment.</p>

<p>15-Dec-2006</p> <p>Media reports and airport operations incident report.</p>	<p>One Lithium metal CR123A (probable)</p> <p><i>Passenger also purchased Lithium-ion rechargeable CR123A battery and charger for the device</i></p>	<p>"Fresh Air Buddy" personal air filter</p>	<p>Passenger flight</p>	<p>On a Houston-Portland passenger flight, a personal air filter, being worn on a strap around a passenger's neck, started a fire in the cabin. The device started making hissing sounds and then emitted bright sparks/flash and a clap/bang sound. The passenger removed the device and it fell between two seat cushions where it continued to burn and smoke. Passengers dumped water on the device and then flight attendants put out the fire with a Halon fire extinguisher. The aircraft diverted to Colorado Springs. The passenger wearing the device suffered a superficial burn to his chest. Dozens of passengers were examined by EMT personnel, mainly for complaints related to inhalation of smoke and/or Halon fumes. Five or six passengers were taken to the hospital. The two fire-resistant aircraft seat cushions were replaced due to having holes burned in them.</p> <p>The airline flight attendant accidentally disposed of the battery, so a determination of what type of lithium battery (primary vs. secondary) could not be made. NTSB took possession of the device and sent to their lab for analysis. Lab analysis of the damaged device was inconclusive in determining what caused the malfunction.</p>
<p>14-Dec-2006</p> <p>Report from air carrier</p>	<p>Counterfeit CR123A, lithium metal</p>	<p>Flashlight "Superfire WF-501B"</p>	<p>Cargo flight</p>	<p>During a UPS cargo flight from Sydney, Australia to Guangzhou, China, at 38,000 ft., the crew heard a loud bang. A crewmember found that his flashlight in a bag next to his seat was warm and had a strong odor coming from it. The flashlight was opened and there was soot/residue from burning. One of the two batteries (now determined to be counterfeit) was damaged. Earlier the crewmember had dropped the flashlight about 6 inches into his bag and heard a thump.</p>
<p>25-Nov-2006</p> <p>FAA agent summary</p>	<p>Nonspillable lead acid, 12-volt, VRLA industrial (Marathon M12V155FTX)</p>		<p>Cargo flight</p>	<p>A pallet of eight batteries was being shipped from Canada to Brazil. At the FedEx Memphis sort center, one of the batteries fell from the wooden skid and cracked open its housing, causing some burning/scorching.</p>



11-Nov-2006 Notification by US Customs and CPSC FAA case # 2007WP700045	Lithium ion cell phone batteries		Cargo flight	After being shipped by air from China to the US, some batteries were selected for inspection by US Customs. While on the desk of an import specialist, the battery started emitting sparking flames and smoke.
15-Sep-2006 FAA Case # 2006GL700427	Silver oxide button cells, various sizes		Cargo flight	During off-loading at their Plymouth, MN facility, DHL/Airborne personnel discovered two boxes that were warm to the touch. The boxes were opened and found to contain hundreds and hundreds of button cell batteries loosely packed together in a plastic bag liner. Batteries were being shipped by a small business battery recycler that stated they thought all batteries were discharged. Tests showed many still had positive voltage.
15-Sep-2006 United Airlines report	Lithium-ion laptop battery	IBM Laptop computer	Passenger flight	Approximately 15 minutes prior to departure of a LAX-LHR transatlantic flight, the laptop computer of a passenger began to smoke. The relief pilot and purser assisted the passenger in removing the laptop from the airplane. The laptop was placed on the floor of the gate area where it continued to smoke from the battery pack area and a small flame appeared. A customer service representative discharged a fire extinguisher on the fire. The battery pack continued to smoke for an additional couple minutes with white smoke and a strong odor. The Fire Department responded and discarded the burnt battery pack. The passenger stated the laptop was an IBM that belonged to his company and had been in his possession the entire time, having original parts and never having been serviced. The passenger was reportedly not using aircraft power to operate the computer. The airplane remained in service and departed on time without the incident passenger.
17-Jul-2006 Fedex Notification to FAA	<i>EaglePicher-Kokam</i> Lithium ion/polymer (used for remote control models), 122 batteries of various sizes		Cargo flight	The unlabeled/marked package was discovered to have caught fire while being held in bond for customs clearance in Korea. Package had traveled to Korea in FedEx system from Vienna via Paris and Subic Bay.

<p>15-July-2006</p> <p>UPS report to FAA</p> <p>FAA case # 2006SO700328</p>	<p>Two <i>North Star</i> 12-volt nonspillable, 70 Ah, model NSB70</p>		<p>Cargo flight</p>	<p>A package caught fire while being unloaded from a ULD at the UPS sort facility in Louisville. Airport fire personnel responded and inside the box they found two 12-volt nonspillable batteries. The terminals were not protected and the batteries were not secured to prevent movement inside the box. The inner packaging consisted of Styrofoam peanuts and paper. The statement from the fire personnel indicated the terminals on one battery came in contact with the other, arced, then caused a fire.</p>
<p>??-July-2006</p> <p>UK CAA report to FAA</p>	<p>Unknown</p>	<p>Photographic flash gun</p>	<p>Passenger flight</p>	<p>Upon arriving at home after a flight, a British Airways passenger found that his battery-powered photographic flash unit in his baggage had burnt holes in some of his clothing. Plastic housing on flash unit had also melted.</p>
<p>02-June-2006</p> <p>China CAA report</p>	<p>Lithium ion / polymer, 7.4-volt; 10000 mAh</p>		<p>Passenger flight</p>	<p>An Air China passenger flight from Guangzhou to Chengdu diverted takeoff due to a lithium battery fire in the cargo hold. While taxiing for departure the fire alarm for the lower deck cargo compartment activated. The Captain immediately released the fire extinguisher and the aircraft stopped taxiing. Passengers were evacuated. A burnt package containing lithium polymer batteries was discovered in the cargo hold up against the ceiling of the compartment on top of the other packages. Burn marks were visible on the ceiling. Shipment was declared as electric parts; there was no indication of lithium batteries or Dangerous Goods. No UN test report was available for the batteries. Eleven other boxes were in the shipment.</p>

<p>15-May-2006</p> <p>Lufthansa DG Occurrence Report # 0001/06</p> <p>DOT incident report # 2006060033</p>	<p>Lithium-ion</p> <p>(VGP-BPL2/VGP-BPS2 or equivalent)</p>	<p>Laptop with spare battery</p>	<p>Passenger flight</p>	<p>Shortly before flight departure, a burning smell was detected in the first-class cabin of a Lufthansa ORD-MUC flight. Maintenance personnel were called to check and found it was coming from hand luggage inside an overhead luggage bin above seat 2A. The flight attendants evacuated the passengers in first class and first 2 rows of coach class. Crew used extinguishers to prevent setting off what was seen as the beginning of a slow fire. Maintenance immediately brought the bag outside the aircraft onto the ramp where it started to catch fire. Fire dept was called to assist. Fire was eventually put out after reigniting once. Fire apparently started from the extra battery pack for a laptop which was purchased on eBay. Flight departed 1 hour 18 minutes late.</p>
<p>29-Mar-2006</p> <p>DOT Incident report # 2006040159</p>	<p>Lead Calcium</p>		<p>Cargo flight</p>	<p>Air package shipped from Puerto Rico to Georgia containing a battery was discovered smoking while out for Fedex delivery to final destination. The package was removed and extinguished. Consignee accepted the package.</p>
<p>03-MAR-2006</p> <p>FedEx incident report</p>	<p>Lithium ion button cells, mfr. by <i>Living</i></p>		<p>Cargo flight</p>	<p>US-bound package was noticed to be smoking at outbound FedEx station in Shenzhen, China. Upon inspection, the package of lithium ion batteries was discovered to be on fire.</p>
<p>28-FEB-2006</p> <p>FAA case # 2006NM700106</p>	<p>Two NiCad cordless drill batteries</p>		<p>Passenger flight</p>	<p>Employee had power tools in baggage. TSA observed smoke emitting from suitcase on baggage belt and pulled it off the belt. Fire dept. was notified and extinguished the fire. Bag contained two NiCad cordless drill batteries. One battery had melted. Company of traveling employee paid \$15,000 civil penalty.</p>
<p>23-FEB-2006</p> <p>FAA Special Agent statement and UK CAA message</p>	<p>Nickel Metal Hydride (NiMH)</p>		<p>Cargo flight</p>	<p>During cargo sort operations in Memphis, FedEx personnel discovered a smoking fiberboard box. Four boxes contained 250 Nickel metal hydride batteries. Four of the batteries had short circuited. The non-spec fiberboard boxes apparently lost their structural integrity due to the weight of the batteries which were packaged loosely without proper short circuit protection. The batteries were being shipped from London to St. Louis. The UK fined the shipper a total of £2800.</p>



4-OCT-2005 UK CAA report	Dry cell / rechargeable	Portable drill	unknown	After being unloaded from a domestic flight in England, a package caught fire due to the activation of a portable drill inside. DHL driver suffered smoke inhalation and was treated at a hospital.
14-SEP-2005 FAA Agent report	Eight large heavy-duty industrial 12-volt batteries (Specs: 1350 CCA, 245 Amp Hrs @ 20 Hrs)	Batteries in metal racks for solar panels	Cargo flight	During loading of outbound FedEx flight in Portland, ME, a package fell off the forklift and landed upside down. Sparks and a small fire were seen immediately. The cardboard outer packaging was removed exposing eight large batteries connected to each other inside a metal frame on a wooden pallet. Terminals were all exposed. Visible burn marks were on two of the batteries as well as on the crossbar of the metal frame. No package marking or labels indicated batteries. Documentation indicated the shipment contained solar panels and school supplies.
18-JUL-2005 FAA case # 2005NM700175	Two Ryobi 14.4-volt NiCad rechargeable batteries		Passenger flight	TSA officer observed smoke coming from baggage. United and TSA personnel discovered 2 Ryobi 14.4-volt NiCad power tool batteries. One battery has short circuited. Company of the employee carrying batteries paid \$10,000 civil penalty.
29-JUN-2005 FAA case # 2005WP700218 DOT Incident report # 2005080470	Lithium Ion	Battery-pack	Cargo flight	At UPS in Ontario, Calif., during unloading of a ULD from Shanghai, it was discovered that a fire had taken place inside the ULD. A package containing a lithium-ion battery pack was identified as the source of the fire. Upon discovery, the burnt package and its contents were cool to the touch and there was no smoldering evident.
18-MAY-2005	18 D-cell batteries	Marine buoy	Cargo flight	A FedEx employee in Fredericksburg, VA, was injured when a package that he was loading into a ULD exploded. The package contained a marine buoy powered by a battery-pack containing 18 D-cell batteries. Apparently some of the batteries had deteriorated causing gas to build up in a sealed container. Static electricity generated by sliding the box may have been the ignition source.

<p>25-MAR-2005</p> <p>TSA report to FAA ANE</p> <p>FAA case # 2005NE700152</p>	<p>Twenty-four 9-volt <i>Energizer Industrial</i> batteries</p>	<p>None</p>	<p>Passenger flight</p>	<p>TSA screeners discovered smoldering batteries in a passenger's checked baggage. They discovered 24 9-volt batteries, most of them packed loosely inside a cardboard box in the baggage. Only nine of the batteries had their terminals protected (with plastic caps or electrical tape). There were other loose metal objects in the box that apparently came in contact with the terminals; one metal object was visibly charred. At least one of the batteries was still hot to the touch.</p> <p>Passenger paid \$1500 fine.</p>
<p>11-FEB-2005</p> <p>FAA incident summary</p> <p>DOT incident report # 2005030047</p>	<p>Lithium battery, solid cathode, manufactured by <i>Eagle Picher</i> of Surrey, BC, Canada.</p>	<p>None</p>	<p>Cargo flight</p>	<p>An undeclared package containing 18 lithium batteries caught fire while being unloaded from a conveyor belt at the FedEx facility in White Bear Lake, MN. FedEx cargo handlers report hearing a "pop" sound and then seeing the box "lifted" off the conveyor belt by the force. The shipment had flown from Los Angeles to Minneapolis and was to be trucked to Clear Lake, WI. Only one battery caught fire.</p>
<p>29-OCT-2004</p> <p>Greensboro FSDO briefing paper and media accounts</p>	<p><i>Ultralife</i> 9-volt lithium (traditional 9-volt form: rectangular with two terminals on top)</p>	<p>Camera equipment</p>	<p>Passenger flight</p>	<p>Shortly after departure, the battery exploded in the hand of a cameraman traveling on the VP campaign plane of Sen. Edwards (the cameraman reportedly was in the process of changing batteries). It spewed shrapnel and ignited a fire in the seat which was extinguished by flight attendants and others. The flight crew declared an emergency and returned to Raleigh-Durham airport without further incident.</p>
<p>14-SEP-2004</p> <p>FAA field agent initial report</p>	<p>Two 12-volt, nonspillable, sealed rechargeable lead-acid batteries</p>		<p>Cargo flight</p>	<p>One of the batteries was packaged so that its terminals were able to come into contact with metallic sensor tape that was packed with it. This resulted in a short circuit and fire discovered at the Greenville-Spartanburg FedEx facility after the flight.</p>

04-SEP-2004 FAA incident summary statement	Dry, Alkaline, C-cell, (four)	Diving flashlight	Passenger flight	Diving flashlight exploded at LAX as it was removed from checked baggage by TSA personnel during the CTX screening process. Minor injuries to nine people. The incident occurred prior to the baggage being loaded on the passenger aircraft. A 1996 NIOSH report indicates that exploding flashlights are not uncommon—particularly among airtight flashlights with old, damaged, or improperly installed batteries. One of these batteries (Exp. Date: MAR 2005) may have been improperly installed according to the FAA summary.
07-AUG-2004 FAA incident summary statement, DOT Incident Report #2004081622	Lithium-ion	Lithium-ion batteries assembled together in a plastic case	Cargo flight	Prototype lithium batteries shipped under a competent authority approval from California to Europe apparently started a fire in a ULD during the loading process at the FedEx Memphis hub. The ULD had just been loaded for a transatlantic flight (Memphis-Paris). The ULD and many other packages in it were damaged/destroyed by fire. Shipment apparently was in violation of the DOT approval allowing the prototype battery to be shipped.
28-APR-2004 DOT Incident report #2004050033	Dry batteries		Cargo flight	While unloading a container in Dothan, AL, a FedEx ground handler smelled burning plastic. The package was located and opened. Several dry batteries inside had wires attached. Plastic bag inner packaging was melted and inside of box showed burn marks.
18-APR-2004 FAA incident summary	Ni-Cad, 18-volt, rechargeable	DeWalt cordless power drill	Passenger flight	A power drill with battery attached was activated in checked baggage. Drill generated heat, setting fire to the bag and other bags on the luggage cart while waiting to be loaded on to the passenger aircraft.
01-APR-2004 Transport Canada	CR123 lithium batteries	Flashlight	Passenger flight	A flight attendant lent a passenger a flashlight which was recently purchased in Beijing. The passenger dropped the flashlight while it was on. Later the passenger put the flashlight in a seatback pocket. A few minutes later, the flashlight began to emit smoke and noxious fumes. The flashlight became so hot it could only be handled with oven mitts.
02-NOV-2003	Ni-Cad, Ni-Metal Hydride, and/or Lithium (according to label on computer)	Notebook computer – Toshiba Satellite model # 815-S129	Passenger flight	At security screening, a passenger's bag contained a computer bearing a warning label on the bottom near the battery compartment: "Warning: Hot base may cause burn. Avoid prolonged contact with bare skin." Battery compartment was hot. Screener had passenger turn off computer.



25-OCT-2003 FAA incident summary	<i>PowerSonic</i> Nonspillable, Lead Acid gel-cell, 12-volt, 35 AMP hours	Powered hand truck	Passenger flight	Powered hand truck shipped as cargo accidentally switched on. Motor and battery generated heat and smoke in cargo compartment of the pax aircraft forcing it to return to gate.
01-AUG-2003 FAA # 2003NE700110	<i>Sanyo</i> six nickel metal hydride battery pack		Cargo flight	Battery pack self-ignited and burned while in transit at the UPS facility in Brewer, Maine. Medical instrument vendor had sent a replacement battery pack to the shipper with written instructions to return the battery pack they were using which had been recalled because of potential problems with it overheating after charging.
09-JUN-2003	Ni-Cad, 18-volt, rechargeable	Battery for DeWalt cordless drill – unattached	Passenger flight	As part of routine baggage screening it was noticed that the battery, packed loosely in a toolbox, was hot. The unattached drill battery with unprotected terminals had come in contact with metal objects in the toolbox.
04-JUN-2003 DOT Incident report # 2003060805	Non-spillable batteries	None	Cargo flight	Package burst into flames at FedEx sort facility. Terminals not protected from short circuit, arced and started fire.
16 FEB-2003 Civil Aviation Safety Authority of Australia	Non-spillable, sealed, lead-acid	Wheelchair	Passenger flight	Upon unloading Virgin Blue flight # DJ621 from Launceston to Melbourne, Australia staff noticed the arching wheelchair battery. A pre-existing fault in an attached electrical cord appeared to be a contributing factor, but it was not possible to prove exactly what caused the short circuit.
12-AUG-2002 DOT Incident report #2002090134	Lithium battery (excepted)	Samsung mini computer (palm pilot)	Cargo flight	Burning odor detected by handlers at the Los Angeles FedEx inbound package sort center. Battery apparently short-circuited causing the bubble wrap in the package to burn and melt onto the unit.
12-APR-2002 DOT Incident report #2002050519	Lithium batteries	None	Cargo flight	Lithium batteries shipped under exception by Abbott Labs did not have terminals protected from short circuit. Started fire inside package at FedEx Indy sort facility.
25-MAR-2002	<i>Hawker Cyclon</i> , sealed lead, rechargeable, nonspillable batteries	<i>Cyclon</i> batteries contained in larger battery: <i>Lucent/Hawker</i> , sealed lead, rechargeable, 45-volt, 2.5-Amp Hour	Cargo flight	After the initial flight, the package containing the battery/batteries caught fire at the FedEx sort facility in Memphis.

09-MAY-2001 DOT Incident report #2001061356	Wet acid batteries, nonspillable, two 6-pound batteries		Cargo flight	Shipment was being unloaded from of inbound aircraft when handlers noticed fumes and smoke. Package was located and had a burn hole on its side. Batteries apparently short-circuited.
26-FEB-2001	Wet nonspillable battery	Portable welder	Cargo flight	After air transport and in route to final destination, UPS truck driver observed smoke coming from the trailer. Package had been undeclared.
03-NOV-2000 FAA EIR # 2001NM710044 DOT incident report # 2000110896	<i>Hawker</i> lithium sulphur dioxide batteries	None	Cargo flight	While in route by road to the FedEx Cargo facility in Portland, OR, a lithium battery shorted and ruptured, burning its packaging. The shorted battery had long flexible protruding positive and negative terminals. Two FedEx drivers were treated at a hospital after inhaling fumes from the incident.
25-OCT-2000 DOT Incident report #20010043	<i>Hawker Cyclon</i> , 2-volt, nonspillable	None	Cargo flight	Eleven batteries (approx. D-size), with positive and negative terminals on the same end were packed loosely in a box. They shorted and caught their packaging on fire. Discovered at FedEx cargo sort center in Ft. Worth after first flight.
07-SEP-2000 DOT Incident report #2000091202	Rechargeable sealed lead acid battery	None	Cargo flight	Handlers at Fedex outbound center in Raleigh, NC, noticed the package had an odor. Package was opened. Discovered slight smoke and two battery wires that had melted.
23-JUL-2000 DOT Incident report	Nonspillable wet batteries	None	Cargo flight	One package discovered leaking; another displayed evidence of electrical shorting. Outer packaging marked "Batteries, wet, nonspillable"
21-JUL-2000	Four AA or AAA batteries	None	Passenger flight	During unloading of checked baggage off flight from Miami to Ecuador, handlers discovered a bag containing several battery-powered gifts destroyed by fire started by pack of small batteries. Bag also contained broken bottle of cologne.
06-JUL-2000 DOT Incident report	20 nonspillable lead acid batteries	Cables attached to terminals; related power supply equipment	Cargo flight	Ramp personnel handling the shipment noticed that several of the batteries were sparking or arcing while being moved and that the terminals on the batteries were not sealed properly. Subsequently discovered that some of the cables normally interconnecting batteries still attached to terminals. Also, related equipment, switching panel and controller placed directly on top of batteries. Outer package marked "12-volt BAT-0048 Sealed, no maintenance rechargeable battery for UPS applications."

11-FEB-2000 ANM EIR# 2000NM- 710146 DOT Incident report # 200002135	Two <i>PowerSonic</i> , sealed rechargeable, lead acid batteries, 12-volt, 7 Amp Hr.		Cargo flight	Ramp workers noticed a burning smell emanating from a box after aircraft unloaded. Employees opened box and discovered two sealed lead acid batteries packed together without protection from short circuiting. Terminals of both batteries were partially melted and scorch marked. Battery cases were significantly warped and cases bubbled.
26-JAN-2000 DOT Incident Report #2000021369	Eight nonspillable wet batteries	None	Cargo flight	Package broke open in cargo facility. Two batteries shorting when discovered. Little post on battery described as practically burned off. Paper packing material had black scorched spots. Terminals not protected against short circuits.
17-DEC-1999 DOT Incident Report # 2000010495	Four auto-sized batteries	Uninterruptible power source (UPS)	Passenger flight	Four automotive-size batteries inside the metal cabinet, wired in sequence by battery cables. Appears batteries not adequately secured within cabinet, shifted during handling and appear to have shorted out against the metal cabinet, causing burning. Outer container, a fiberboard box on a skid, showed signs of burning.
12-SEP-1999 DOT Incident report	Nonspillable battery (non-regulated or undeclared)	None	Cargo flight	Box found smoking during sort process. Battery had its posts bent inside the box. Posts allegedly came into contact with the metal slide in the sort, allowing the arc to occur and resulting in fire.
12-SEP-1999 DOT Incident report # 19990913126	Nonspillable batteries (undeclared)	None	Cargo flight	During unloading of FedEx ULD in Denver, box discovered allegedly emitting smoke. Report indicates box containing 2 rechargeable, lead-acid batteries caught on fire.
31-AUG-1999 DOT Incident Report # 1999091333 and FAA 1999EA- 610653	Nonspillable battery (undeclared)	None	Cargo flight	During outbound package sort, battery apparently initiated and caught fire. There were holes burned completely through the fiberboard box closures.



24-AUG-1999  Taiwan Aviation safety Council report # ASC-AAR- 00-11-001 Accident Investigation Report	12v motorcycle battery		Passenger flight	UNI Air passenger flight from Taipei to Hualien. Upon landing there was explosion then smoke and fire in the forward part of the passenger cabin. Investigators found that a motorcycle battery and container of gasoline had been brought into the passenger cabin. It is believed the gasoline leaked from its unmarked plastic bottle onto the battery causing a short circuit and fire. The aircraft was destroyed by fire. 14 passengers suffered critical injuries, 14 passengers suffered minor injuries.
24-JUL-1999  DOT Incident Report # #1999081536	12-volt battery	Connected to a phone jack	Passenger flight	America West ramp agents noticed smoke coming from a piece of luggage that was on the belt loader (transferring from inbound flight to outbound flight). Bag was removed and firefighters called. There was visible melting and charring of a wire connected to the negative terminal of the battery.
07-JUN-1999  DOT Incident Report	"Non-regulated" batteries. Actual type unknown.	None	Cargo flight	Package noticed during FedEx operation in Greensboro, NC to have burning smell. Inner batteries apparently arced causing batteries to burn inside the package. Incident report stated batteries had not been packaged correctly.
JUN-1999  NASA ASRS Report	Camcorder battery	Possibly Camcorder	Passenger flight	During ground maintenance delay, flight attendant noticed burning smell. Passengers deplaned. Overhead bin opened to reveal smoke from a passenger bag. Upon opening, cloth items discovered to be smoldering, and a camcorder battery in the bag was extremely hot.
04-JUN-1999  FAA AEU and FAA AEA msgs	Dry cell batteries	None	Cargo flight	U.S. cargo air carrier transported shipment containing batteries and gas cartridges to foreign destination. Fire broke out as cargo being offloaded and smoking pallet discovered. Examination of the pallet revealed steel rods placed on top of the dry batteries loosely piled on the pallet.
28-APR-1999  AWP report/ NTSB Rec. A-99-85	Primary Lithium batteries, Sanyo CR2 (excepted)	None	Passenger flight	120,000 lithium batteries were being shipped on two pallets. After being unloaded from a passenger flight from Japan, a cargo employee at LAX mishandled one of the two pallets causing lithium batteries to dislodge from their packaging. The pallet later caught on fire along with the second pallet which it was placed next to. Initial attempts to extinguish the blaze using water/chemical fire extinguishers failed.

10-OCT-1998 FAA AAL Special Agent statement	Unknown	336 laptop computers	Cargo flight	Fire warning diverted cargo aircraft. Captain/flight engineer inspected cargo area. Both noted heat rising between pallets on jet flat, as well as strange odor and lung irritation. Fire fighters sprayed pallet with retardant. No further evidence of heat exposure or fire.
03-OCT-1998 DOT Incident Report # 1998100548	Nickel cadmium batteries	None	Cargo flight	Two batteries somehow arced and short-circuited. This malfunction started a fire inside the box. The fire self-extinguished.
07-JUL-1998 Rapid City SD Incident Report 98-002106	9-volt battery	Baby Monitor Remote	Passenger flight	Fire damaged bag discovered during unloading. Carrier employee noted fire odor and checked bag felt warm. Fire appeared to have been caused by a short in the monitor remote, possibly because of close proximity to luggage frame.
19-MAY-1998 DOT Incident Report # 1998071744	Wet acid battery		Cargo flight	Sort center employee smelled unusual odor coming from container during unloading. A 70-lb package singled out and opened by emergency responder. Fanny pack burned and corroded, hot and smelled of fumes.
19-MAY-1998 FAA #EA19980082	Unspecified batteries	Uninterruptible power supply (UPS) units (2)	Cargo at IAC warehouse	One of the UPS units exploded during offloading of a truck.
12-MAR-1998	Wet batteries	Engines		Ramp agent at Miami Int'l airport noticed flames and smoke coming from one of the pallets during unloading after a flight from the Netherlands. One of the engine batteries was not protected and had come into contact with a steel cable causing the cable to spark and burn.
25-NOV-1997 FAA ASW investigation  FAA press release 9/9/98	Nonspillable wet electric storage batteries	None	Intended as cargo on passenger aircraft	Courier company dispatched driver to pick up package consignment consisting of global positioning system-based survey equipment. Package self-ignited, smoked and burst into flames. An entire CO2 chemical extinguisher could not extinguish the fire, so firefighters applied dry chemical extinguisher. The FAA, NASA and the city arson bureau analyzed the fire and determined that it was caused by cables placed directly on top of battery.

13-NOV-1997 FAA ASO Investigation # 98S0730067	Nontoxic wet batteries	UPS	Cargo flight	During cargo sort operation, this shipment was discovered burning. The device consisted of a battery with associated circuitry. A subsequent failure analysis report revealed that the burning initiated in a printed circuit board, with the battery acting as the source of energy.
15-MAY-1997 FAA AEA security summary BUF-97-017	Dry cell batteries	None	Cargo flight	As cargo being offloaded from aircraft, ramp employee noticed open, empty box in cargo bin. Then the employee noted four batteries on floor, which sparked as she attempted to pick them up.
28-JAN-1997 FAA AEA # 97EA710078	Nontoxic batteries (16)	Battery backup cabinet (UPS?)	Passenger flight	16 nontoxic batteries were part of an extended battery cabinet used as backup power for computers. The air cargo package ignited while being delivered after transport aboard a passenger aircraft.
26-SEP-1996 DOT Incident report #1996110343	Lithium batteries	None	Cargo flight	Eight lithium batteries were connected in a series and packed with bubble wrap inside a plastic express envelope. There were exposed connections on one end and loose wires on the other end. The batteries were not secured from movement within the package and a short-circuit resulted causing the packaging to burn. Burnt package discovered at Airborne sort center after first flight and prior to trans-Pacific cargo flight.
09-JUN-1996 DOT Incident Report # 960700024	Nickel cadmium battery	Power pack belt, lamp	Passenger flight	One of three passenger checked bags discovered smoldering and burning in air carrier baggage make-up area. During bag handling, power pack belt had button pushed into "on" position, causing high intensity lamp in bag to power up. Heat from lamp set bag on fire.
19-MAR-1996 DOT Incident Report # 960401424	Hawker Cyclon, sealed-lead rechargeable batteries. (1000)	None	Cargo flight	Fiberboard box top came unsealed. Box contained rechargeable batteries. Terminals on loose batteries connected, causing them to arc, catching the box on fire and igniting surrounding freight. This box was one of ten pieces in the shipment. Other boxes were located and loose batteries repacked prior to movement to hazmat area. Each box contained two layers of 50 batteries each. Inner packaging consisted of batteries separated by cardboard dividers with layer of styrofoam sheeting across the top. Packaging tape on outer box failed.



20-FEB-1996 FAA ASO investigation FAA press release 3/3/98	Lawn-mower batteries (declared)	Lawnmower	Cargo flight	Shipment consisting of 106 boxes (each containing a battery-powered lawn mower) was offered for transport to various destinations. Air carrier employees discovered smoke coming from one box. Lawn mower battery had become dislodged and shorted out, causing the mower's wires, plastic housing and battery to burn/melt. Subsequent recall of all boxes revealed that more than 50 of the batteries had short-circuited and several had burned enough to char the boxes in which they were being shipped.
07-FEB-1996 DOT Incident Report # 19960300554	Wet acid batteries (undeclared)	None	Cargo flight	Package failure caused battery terminals to come into contact with metal slide, resulting in short circuit and sparks/fire. Heat generated melted the batteries.
18-NOV-1995 DOT Incident Report #1995120471	Wet cell battery	Removed from electric wheelchair	Passenger flight	Wet cell batteries were removed from passenger's wheelchair and packaged separately by airline staff. Battery cables were left attached to battery causing a short-circuit during air transportation. This melted the plastic bag inner packaging. Overheated battery then boiled over, releasing acid which was mostly absorbed by the absorbent packaging material but reached the outer fiberboard box packaging.
08-MAY-1994 UK CAA DG Occurrence Report Database (G. Leach)	<i>Duracell</i> lithium batteries (excepted from ICAO regulation by SP A45)	None	Intended to go as cargo on passenger aircraft	Consignment of lithium batteries found emitting smoke in ULD during truck transport to LHR. Fire damage. Batteries were smaller in diameter than a dime and about 5 mm high. They had been tossed loosely into a box. Positive and negative terminals had "tails" which were prone to short circuiting. The shipper was prosecuted by the UK CAA for failure to comply with Special Provision A45 of the ICAO Technical Instructions and fined £1200 with £300 costs.
20-MAR-1991 DOT Incident Report # 910404294	Nonspillable battery	None	Cargo flight	During air transportation, a package containing a nonspillable battery was discovered smoking in the upper deck cargo area. Aircraft rerouted for emergency landing.