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Lithium-Ion Battery Safety in Air Travel: An Asia-Pacific Focus

Lithium-ion batteries, when damaged, overcharged, mishandled, or substandard, can enter a state of thermal runaway — a chemical reaction that generates extreme heat, fire, and even explosion. In the confined environment of an aircraft, such events can be catastrophic.

The rapid rise of lithium-ion battery-powered devices across Asia-Pacific has brought new complexities to aviation safety. From smartphones and laptops to cameras and power banks, these personal electronic devices (or PEDs) are a constant travel companion – but also a potential hazard. Recent survey data from UL Standards & Engagement (ULSE) offers a deeper understanding of how Asia-Pacific travelers across cultures and countries perceive lithium-ion battery safety, and what implications their awareness, behaviors, and beliefs may hold for aviation protocols.

To better understand these issues across the Asia-Pacific region, ULSE conducted a comprehensive survey of 3,478 travelers from 10 countries between Feb. 25 and Mar 20, 2025. The survey revealed near-universal carriage of personal electronic devices among respondents: 88% travel with smartphones, 42% with laptops, and 43% with power banks. With nearly 65% of respondents flying at least once annually, the study provides critical insights for developing targeted battery safety strategies across this rapidly growing aviation market.

While most Asia-Pacific travelers have a general awareness of thermal runaway, specific knowledge about which PEDs are powered by lithium-ion batteries and how to minimize risks remains limited. As a result of these knowledge gaps, nearly a quarter of passengers admit to risky behaviors like storing power banks and spare lithium-ion batteries in checked luggage where timely detection is challenging during flight.

Regional variations in awareness of risks, concerns around safety, and subsequent safety preferences are substantial. Airline travelers in ASEAN demonstrate higher awareness and concern regarding thermal incidents than their regional peers, and, as such, favor airlines with enhanced safety measures even at higher costs. This contrasts with Oceania (i.e., Australia and New Zealand) and East Asia (i.e., Japan and South Korea) travelers who lean toward airlines with standard protections at current fares.

The study's findings offer promising paths forward. Nearly all Asia-Pacific passengers show strong support for battery safety measures, including more safety messages that communicate existing limits on the maximum capacity of power banks allowed on flights, restrictions on in-flight charging as well as limits on the number of PEDs allowed for each passenger. Furthermore, a strong majority are open to additional screening time and higher airline ticket prices for improved protection.

By expanding education and awareness efforts that build on passengers' demonstrated willingness to support enhanced measures, airlines and regulatory bodies can significantly strengthen lithium-ion battery safety across the Asia-Pacific aviation.

More than **one in five** admit to storing spare rechargeable lithium-ion batteries or power banks in checked luggage.

Knowledge Gaps and Risky Behaviors Drive Battery Safety Disconnect

PEDs powered by lithium-ion batteries are becoming ubiquitous – nearly all passengers in the Asia-Pacific region carry at least one onboard – but awareness of their risks remains alarmingly low. This information deficit, compounded by unsafe packing practices, is potentially putting air travelers at risk.

Passenger Awareness Gaps:

While 70% of Asia-Pacific travelers report some awareness of thermal runaway risks, several awareness gaps remain. Only 29% recognize which PEDs are powered by lithium-ion batteries, with 28% admitting to knowing nothing about these batteries at all. Lack of awareness for high-risk products such as power banks and portable chargers (40% aware) and individual rechargeable or spare batteries (28%) is particularly concerning. Additionally, nearly half (44%) of surveyed respondents didn't realize that safety standards for lithium-ion batteries exist.

Regional Disparities in Awareness and Attitudes:

Regional differences in sentiment are noteworthy. ASEAN travelers show overall higher thermal runaway risk awareness (74%) and safety concerns (86%), while awareness (65%) and related concerns (76%) are still evolving for East Asian and Oceania respondents. These differences highlight the need for bespoke education efforts across different markets. ASEAN respondents also demonstrate relatively higher awareness (86%) of battery-related thermal runaway incidents – the highest in the region. Overall 16% of Asia-Pacific consumers recall hearing about aircraft-specific thermal runaway incidents, but the impact on travel attitudes vary considerably by region: ASEAN travelers maintain strong willingness to fly (33% more willing to fly) despite incident awareness, whereas 43% of East Asian respondents say they are less willing, likely impacted by the recent Air Busan power bank battery fire.

Passengers Packing Habits Present Potential Safety Risks:

While regulations permit smaller lithium-ion-powered PEDs such as smartphone, laptops in checked luggage (when completely switched off and protected from damage), lithium-ion batteries intended for use as a power source such as spare batteries or power banks are not permitted. A quarter (24%) of passengers, however, admit to storing spare rechargeable lithium-ion batteries in checked luggage and 22% admit the same for power banks. That said, vast majority (80%) of Asia-Pacific travelers recall seeing battery safety signage during their journey and appear to comply with safety rules, and encouragingly, half (49%) of respondents across the Asia-Pacific region recognize their personal responsibility for minimizing battery risks. This points to the potential for behavior change through education efforts that explains the "why" behind safety rules.

Nine in ten feel visual demos, info about emergency procedures, and simple dos and don’ts are the best way to communicate battery safety information to passengers.

Passengers Offer Suggestions for High Impact Safety Communication

While passengers trust airline professionals to manage lithium-ion battery emergencies, many still worry about the risk of thermal runaway onboard. Nearly two in five lack confidence in their ability to identify unsafe lithium-ion batteries and have recommendations to improve education in this space.

Passengers Trust Cabin Crew but Not Other Travelers:

The survey reveals an interesting tension in passenger perception of airline professionals and their fellow travelers. Three-quarters (75%) of Asia-Pacific passengers trust that cabin crew has been adequately trained and are confident they can identify and handle lithium-ion battery fires in the aircraft cabin. Moreover, 73% are comfortable with how staff have handled incidents thus far. Despite this high trust in professionals, 35% are skeptical about fellow passengers complying with battery rules, and 38% feel they cannot identify unsafe lithium-ion batteries on their own.

Strong Preference for Battery Safety Guidance Before Arriving at the Airport:

Asia-Pacific travelers prefer receiving battery safety information early in their journey, with nearly half (48%) wanting it before reaching the airport (i.e., during booking, online check-in, or before arriving at the airport). In terms of delivery method preferences, passengers in ASEAN countries (20%) and East Asia (23%) most prefer in-person briefings, while Oceania passengers prefer email (23%). Overall, current communication effectiveness varies by touchpoint, with check-in/bag drop areas (87% of Asia-Pacific travelers rate it as effective), security lines (85%), and on-board announcements (84%) rated highest.

Clear, Concise, and Consistent Messaging Resonates with Safety Aware Travelers:

The findings suggest safety messaging should capitalize on travelers' existing awareness with clear, action-oriented content tailored to regional preferences. Three in five (60%) travelers have heard at least a fair amount about airline safety rules regarding lithium-ion batteries, and 72% feel comfortable with current battery-related announcements. Building on this existing awareness, the data shows that emergency procedures information (91% effective), visual demonstrations (90%) and straightforward do's and don'ts (90%) are most effective, while technical information (79%) is least effective.

51% would prefer an airline with enhanced lithium-ion battery safety measures even if that means higher fares.

Strong Support for Battery Safety Measures, Even if They Increase Screening Time and Ticket Prices

Passengers believe the airline industry is managing lithium-ion battery safety well but acknowledge that more needs to be done. Nearly all endorse additional messaging and mandatory battery screening at security, with most willing to accept slightly longer wait times and higher ticket prices if it means reducing the risk of thermal runaway incidents.

Passengers Generally Believe Battery Safety is Well-Managed:

Two-thirds (66%) feel airlines are doing enough to ensure lithium-ion battery safety on flights, and most feel highly comfortable with current measures, particularly security screening (78%) and emergency procedures (73%). Additionally, 76% of passengers indicate that an airline's battery safety measures will likely influence their future booking decisions, with that figure rising to 85% in the ASEAN region. Notably, 68% of passengers say they would consider switching airlines for improved lithium-ion battery safety, again this figure rises to 78% for ASEAN travelers.

Strong Support for Airline Battery Safety Measures:

Nearly all back additional battery safety messages (93%) that communicate limits on the maximum capacity of power banks allowed on airplanes (86%), restrictions on in-flight charging (84%) as well as limits on the number of PEDs allowed for each passenger (82%). The strongest support for these measures is among ASEAN passengers (91% average) vs. overall Asia-Pacific passengers (87%). While respondents indicate strong support for these measures, they also point to key catalysts for maximizing passenger acceptance and compliance, including a clear explanation of the safety benefits (cited by 59%) and minimal impact on boarding time from enforcing safety measures (42%).

Majority Open to Longer Screening Times and Higher Ticket Prices for Enhanced Battery Safety:

An overwhelming 89% are open to additional screening time – although 69% prefer this extra time be limited to just 10 minutes. Additionally, 69% would pay more for a typical domestic flight to support extra battery safety protocols, with passengers in ASEAN region (77%) showing the most willingness to pay extra. A majority (51%) would also prefer an airline with enhanced safety at higher fares (e.g., fire-resistant device containment bags at every seat and ticket prices that are 5% to 10% higher) than an airline with regular measures at current fares. Preferences for airlines with enhanced measures rises to 60% among ASEAN respondents.

Recommendations

Based on the insights from this survey, ULSE recommends the following actions to enhance lithium-ion battery safety for Asia-Pacific airline passengers:

1 Implement regionally tailored safety education programs across multiple touchpoints.

- Focus on early journey education, as nearly half of Asia-Pacific travelers prefer receiving safety information before reaching the airport.
- Deploy prominent, easily comprehensible signage and demonstrations at high-impact locations like check-in counters and security lines, with content adapted to regional languages and cultural contexts.
- Integrate safety information into pre-flight touchpoints (e.g., booking platforms, airline websites, mobile apps), using visual demonstrations and straightforward guidance based on regional communication preferences.

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2 Lead with clear, concise and consistent messaging.

- Create clear messaging about the benefits of enhanced safety measures, as this drives passenger acceptance and compliance across all regions.
- Display additional safety messages that clearly outline existing rules around the maximum allowable capacity of power banks on flights, restrictions on in-flight charging as well as limits on the number of PEDs allowed for each passenger.

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3 Foster industry-wide collaboration to strengthen device standards and protocols.

- Promote adoption of consumer product safety standards that help reduce the risk of battery-related fires, especially for high-energy devices like power banks.
- Standardize storage and handling protocols across airlines while enforcing prohibitions on placing high-risk products such as spare lithium-ion batteries or power banks in checked baggage.
- Encourage knowledge-sharing between aviation stakeholders to harmonize safety measures and ensure new battery technologies are safely integrated into passenger experiences.
- Support the use of mitigation solutions such as fire containment devices that meet safety standards to help manage thermal incidents in transit.

Standards for Li-Ion Battery Safety in Aviation and Personal Electronic Devices

UL Standards & Engagement has more than 80 standards that reduce the risks associated with lithium-ion batteries and the devices that rely on them. ULSE safety standards are consensus-based with balanced representation from multiple countries that represent different interest categories and industries.

A few examples of standards to protect consumers include the following:

UL 1642, Lithium Batteries – Covers rechargeable and non-rechargeable lithium batteries, and is referenced by a number of ULSE standards for products that use lithium-ion batteries as power sources. In order to comply with its requirements, the casing of a lithium battery must have the strength and rigidity necessary to resist the abuses to which it may be subjected, without resulting in a risk of fire.

- **Electrical tests:** These include a short-circuit test, in which a battery is short-circuited by connecting the positive and negative output port terminals, an abnormal charging test, and a forced-discharge test.
- **Mechanical tests:** These include a crush test, in which a battery is crushed between two flat surfaces; a round bar crush test, in which a battery is crushed under the force of a round steel bar; an impact test, in which a weight is dropped onto a battery; a shock test, in which a battery is subjected to sudden, jarring mechanical shock; and a vibration test.
- **Environmental tests:** These include heating, temperature cycling, and low-pressure (altitude simulation) tests.

UL 2054, Household and Commercial Batteries – This standard is intended to reduce the risk of fire or explosion from rechargeable and non-rechargeable batteries used as power sources in products. In order to comply with its requirements, the casing of a cell or single cell battery, or the enclosure of a battery pack must have the strength and rigidity required to resist the possible abuses that it is exposed to during its intended use.

- **Electrical tests:** These include short-circuit, abnormal charging, abusive overcharge, forced discharge, limited power source, battery pack component temperature, and battery pack surface temperature tests.
- **Mechanical tests:** These include crush, impact, shock, and vibration tests.
- **Additional tests:** These include drop impact, heating, and temperature cycling tests.

UL 2056, Power Banks – Covers power banks, also known as portable USB chargers, which incorporate primary or secondary batteries for mobile powering of low-voltage electronic devices. It features construction, performance, and testing requirements to help reduce the risk of fire or explosion of power banks. In order to comply, its enclosure must have the strength and rigidity to resist reasonably foreseeable abuses that it is exposed to during use.

- Lithium cells must comply with either UL 1642, Lithium Batteries, or UL 62133-2 / CSA C22.2 No. 62133-2, Secondary Cells and Batteries Containing Alkaline or Other Non-Acid Electrolytes, which are intended to reduce the risk of fire or explosion when lithium batteries are used in a product.
- **Electrical tests:** These include a short-circuit of output port test, as well as abnormal charging, and abusive overcharging of the battery tests.
- **Enclosure tests:** These include a steady uniform force test, in which a power bank is pressed between two flat surfaces, as well as a drop impact test, and a flexing force test, in which the power bank is pressed against metal rods — similar to what would happen if it were lodged in the reclining mechanism of an airplane seat.

UL 5840, Standard for Electrical Systems of Battery Powered Aviation Ground Support Equipment – Covers the electrical systems of lithium-ion battery-powered ground support equipment (GSE) used in aviation environments, such as baggage tractors, belt loaders, and airport service vehicles. These systems encompass their batteries, charging systems, components, and controls.

- These requirements do not cover the aircraft themselves or consumables, emissions, or the physiological effects of substances used during equipment operation.
- Battery cells must comply with at least one of the following: UL 1642, CSA E62133 / UL 62133, or UL 2054, Household and Commercial Batteries.
- **Tests:** Include normal charge and discharge, overcharge, short circuit, mechanical shock and vibration, environmental exposure (such as water spray and temperature extremes), and system-level fault simulation..

UL 5800, Battery Fire Containment Products – Battery fire containment products are typically insulated bags or hard cases, large enough to hold a laptop computer, which are designed to suppress the flames and smoke from lithium-ion battery fires. The standard provides testing methodology to ensure containment products perform as intended in an emergency, and it also requires clear instructions and cautionary markings on the outside of the product, to facilitate ease of use by trained personnel.

- **Test method:** Lithium-ion cells are placed inside a containment product and intentionally driven into thermal runaway. The containment product is placed on a softwood surface and covered with white tissue paper and a single layer of cheesecloth. Temperature and smoke release rate measurements are recorded throughout testing. In order to conform to UL 5800, a containment product must contain all flames, visible smoke, and shrapnel from the thermal runaway event, surfaces must not exceed specified temperatures.

Methodology

The results are taken from a ULSE Insights survey fielded in 10 countries, for a total of n=3,478 responses collected from adults 18 years of age and older who have ever traveled on an airplane. Responses were collected between February 25 and March 20, 2025. At 95% confidence level for aggregate results (and assuming estimated proportion of 0.5), the margin of error is +/- 1.66%. Sampling error is larger for subgroups of the data.

The country total samples were as follows:

East Asia	
Japan	n=558
South Korea	n=407

ASEAN	
Indonesia	n=459
Thailand	n=424
Malaysia	n=316
Vietnam	n=309
Philippines	n=203
Singapore	n=202

Oceania	
Australia	n=400
New Zealand	n=200

All studies were designed and formulated by UL Standards & Engagement. Surveys were administered online by BV Insights. As a member of the Insights Association and ESOMAR (the European Society for Opinion and Marketing Research), BV Insights adheres to industry ethics and best practices, including maintaining the anonymity of respondents.

As with any survey, sampling error is only one source of possible error. While non-sampling error cannot be accurately calculated, precautionary steps were taken in all phases of the survey design, collection, and processing of the data to minimize its influence.

Note: All numbers are percentages unless otherwise noted.
Figures may not total 100% due to rounding.

Understanding Thermal Runaway Risks in Aviation:

Asia-Pacific Passenger Perspective

70% have some awareness of thermal runaway

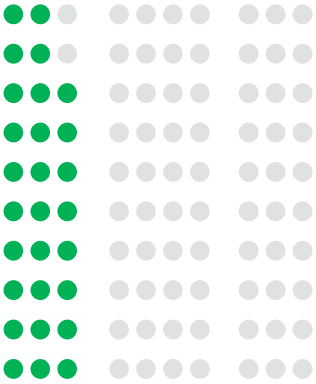
82% have heard of a thermal runaway incident in the past 12 months – **45%** involving PEDs

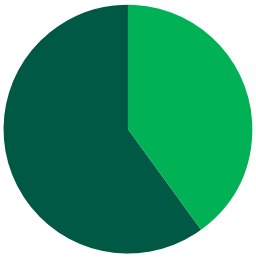
28%
are unsure or do not know what lithium-ion batteries are

ASEAN
24%

Oceania
34%

East Asia
33%





44% don't realize that safety standards for lithium-ion batteries exist

98%
bring at least one rechargeable device containing lithium-ion batteries when traveling on an airplane.

93% support additional battery safety messages from airlines

86% support limits on the maximum capacity of power banks allowed onboard

89% are open to additional screening time – although **69%** prefer this extra time be limited to just 10 minutes

51% would prefer an airline with enhanced lithium-ion battery safety measures even if it means higher fares

(e.g., fire-resistant device containment bags at every seat and ticket prices that are 5% to 10% higher)