EASA update on rulemaking and research

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IASFPF Meeting
18 October 2023

Your safety is our mission.

Agenda

→ Final Certification Memorandum ref. CM-CS-011 Issue 02 on “Guidance on smoke propagation and smoke penetration tests"

→ PED battery fire on the flight deck

→ EASA research

CM-CS-011

Certification Memorandum

Guidance on smoke propagation and smoke penetration tests

EASA CM No.: CM–CS-011 Issue 02 dated 28 June 2023

Regulatory requirement(s): CS 25.855(h)(2)

1.1. Purpose and scope

The purpose of this Certification Memorandum is to provide specific clarifications and additional guidance regarding the certification testing to be conducted to evaluate the entry of hazardous quantities of smoke into compartments occupied by the crew or passengers as a result of an in-flight fire event in the pressurized areas of the fuselage of a large aeroplane.

CM-CS-011

- Proposed CM-CS-011-001 Issue 1 was published on 25th October 2019. Comment period expired on 18th November 2019.

- EASA received 23 comments from 3 commenters (Airbus, Boeing, Bombardier).

- The CRD and final CM were published on the EASA website on 29 June 2023.

- The content of the CM is the result of a coordination effort with the FAA that started with the objective to propose a policy that could address cases in which both EASA and the FAA accepted test conditions different from those specified in FAA AC 25-9A.

CM-CS-011

- According to CS 25.855(h)(2), flight tests must be conducted to show compliance with the provisions of CS 25.857 concerning the entry of hazardous quantities of smoke into compartments occupied by the crew or passengers.

- CS 25.831(d) requires smoke evacuation to be readily accomplished if the accumulation of hazardous quantities of smoke in the cockpit area is reasonably probable.

- CS-25 explicitly requires the installation of smoke detection systems in Class B, C, E and F cargo compartments, and, for each aeroplane with a passenger capacity of 20 or more, in the lavatories.

- The installation of smoke detection systems in other areas of the pressurized fuselage may be proposed as a means to mitigate the fire risk, based on the outcome of the Zonal Safety Analysis and Particular Risk Analysis conducted to demonstrate compliance with CS 25.1309.

CM-CS-011

CS 25.795(b)(1) specifies that means must be provided to limit entry of smoke, fumes, and noxious gases into the flight deck. According to CS 25.795(b)(2), except for aeroplanes intended to be used solely for the transport of cargo, means must be provided to prevent passenger incapacitation in the cabin resulting from smoke, fumes, and noxious gases.

CS-25 Appendix S (applicable to non-commercially operated aeroplanes and low-occupancy aeroplanes) requires smoke detection systems for isolated compartments, as described in paragraph S25.10(c) and its related AMC material.

EASA issues special conditions that are applicable for the installation of certain cabin compartments (e.g. crew rest compartments, high wall mini-suites, etc.) which include requirements that address smoke detection and the accumulation of hazardous quantities of smoke in occupied areas.

CM-CS-011

→ In certification projects, the definition of the test conditions for the demonstration of compliance with the requirements addressing the accumulation of hazardous quantities of smoke in occupied compartments are extensively discussed.

→ FAA AC 25-9A clarifies that:

'…fires in inaccessible areas (e.g. equipment bays, Class C cargo compartments) should be assumed to be ***continuous****, i.e., capable of continuously generating products of combustion until it can be visually verified that the fire has been extinguished. This is required for the development of fire suppression procedures and to show compliance with the control and containment (as well as continued safe flight and landing) requirements specified in 25.831, 25.869, and 25.1309. The adequacy of the smoke control and containment means should be demonstrated during airplane flight tests'.*

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- Smoke penetration testing is successful only if the compartment is provided with effective **isolation** means (e.g. smoke barriers, airtight liners, means to control ventilation) to prevent smoke penetration into the surrounding areas.

- However, an in-flight fire may originate in other compartments (e.g. equipment bays, cabin stowage compartments, lavatories, crew rest compartments, remote areas of the cabin, etc.) that may not be equipped with the above-mentioned isolation features.

- For these compartments, EASA finds that **smoke propagation** tests may be conducted.

- In addition, some compartments that rely upon a crew member fighting a fire or conducting a post-fire inspection (e.g., Class B cargo compartments) may require smoke propagation testing during the time that the compartment is being accessed by the crew member, and some quantity of smoke may enter the occupied areas due to the opening of the access provisions.

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→ What is a smoke propagation test?

EASA defines as a smoke propagation test any test that is conducted to evaluate the movement of smoke from an area (e.g. a lavatory, avionic compartment, etc.) that cannot be isolated from other occupied areas, or that requires a crew member to enter it to manually fight a fire (e.g., a Class B cargo compartment, crew rest compartment, etc.). The amount of smoke to be generated in smoke propagation tests should be defined taking into account the available fire protection systems and the applicable emergency procedures. If an emergency procedure is implemented to suppress/extinguish a fire, the time interval in which the continuous generation of smoke occurs in the compartment can be assumed to be limited.

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→ When is it acceptable to run a smoke propagation test?

No.	Compartment	Smoke Propagation Test
1	Equipment Bays (e.g. Avionics)	Yes
2	Class B Cargo or Baggage Compartment	Yes*
3	Class C Cargo or Baggage Compartment	No
4	Class E Cargo Compartment	No
5	Class F Cargo or Baggage Compartment (with built-in fire extinguishing system)	No
6	Class F Cargo or Baggage Compartment (without built-in fire extinguishing system)	Yes*
7	Lavatories	Yes
8	Crew Rest Compartments (with built-in fire extinguishing system)	No
9	Crew Rest Compartment (without built-in fire extinguishing system)	Yes*
10	Galley Areas	Yes
11	Assessment of migration of smoke between decks of double-deck passenger aeroplanes	Yes
12	High wall mini-suites	Yes*

→ YES = smoke propagation testing may be performed as a substitute for smoke penetration testing

→ YES* = the main scope of the smoke propagation test is to evaluate the accumulation of hazardous quantities of smoke, flames or extinguishing agents in compartments occupied by the crew or passengers when the access provisions of the compartment in which the fire is located are used.

→ NO = smoke propagation testing is not appropriate

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- In a smoke propagation test, the affected compartment does not necessarily need to be smoke-filled as is required in a smoke penetration test, although a larger amount of smoke should be generated than that used in a smoke detection test.

- The smoke propagation test conditions should be discussed and agreed with EASA.

- EASA expects applicants to submit dedicated test plans that define and justify the following:
  - the smoke generator type/model;
  - the smoke generation method (e.g. paraffin oil);
  - the worst-case location for the smoke generator;
  - the amount of smoke; and
  - the smoke emission time.

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- Applicants should specify the settings of the smoke generator (e.g. the fuel flow rate, orifice pressure ratio, etc.) that will be used during compliance test demonstrations. The locations of the smoke generator should be selected taking into account the likely areas in which a fire may originate, the design of the ventilation system and the design of the smoke detection system, if installed.

- The amount of smoke and the emission time should be established considering the applicable emergency procedures. In compartments in which the fire-fighting procedure cannot be implemented, smoke should be generated continuously for an amount of time that is sufficient to reach a steady state, i.e. sufficient to produce evidence that no accumulation of hazardous quantities of smoke would occur in the occupied areas.

- If fire-fighting procedures can be implemented, then the smoke emission can be limited in time. For example, if manual fire-fighting is possible in a compartment that is equipped with a smoke detection system, the smoke emission time can be determined by considering the maximum smoke detection time plus the time needed for crew members to react to the smoke alarm and start the fire-fighting procedure, plus a delay to take into account the time needed to extinguish the fire.

CM-CS-011

- The pass/fail criteria specified in Chapter 11, paragraph e. (4) of FAA AC 25-9A for smoke penetration tests should also be considered as a reference for smoke propagation tests.

- As smoke propagation tests are conducted in compartments that are not designed to be smoke-tight (e.g. crew rest compartments) or that are designed to contain smoke but rely on firefighting by a crew member (e.g. Class B cargo compartments), it is acceptable for smoke to enter the occupied areas (e.g., during the time the access door is opened) if it is demonstrated that smoke does not accumulate or create a hazardous condition when the smoke and fire procedures are used.

- Any accumulation of smoke in an occupied area would not be acceptable. Clarification in CRD (EASA response to comment #11):

  EASA recognizes that during a smoke propagation test, transient periods may exist where smoke can enter occupied areas. In these transient periods smoke may accumulate but should eventually dissipate or the conditions should stabilize. During the entire duration of the smoke propagation test, it should be determined that the smoke distribution in the compartment under evaluation does not create any hazardous condition for the occupants.

- Any smoke entering an occupied compartment when the access door is opened must dissipate within five minutes after the access door is closed.

PED battery fire on the flight deck

PED fire on the flight deck

- **Continuing Airworthiness (CAW) activities:**
  - In May 2018 EASA issued a Continuing Airworthiness Review Item (ref. CARI 25-09) to request TCHs to assess the hazard associated to a lithium battery fire on the flight deck
  - The CARI identifies a minimum set of measures necessary to address the hazard
- **Initial Airworthiness (IAW) activities:**
  - In December 2021 EASA published proposed special conditions to address the safety concern highlighted in the CARI for new design certification project
  - On 26 April 2022 EASA published the final Special Condition SC-G25.1585-01 Issue 2 and the related CRD
- **SIB addressed to operators:**
  - On 12 October 2022 EASA published SIB 2022-08 including recommendations based on the special conditions
  - The SIB was shared with other Aviation Authorities before pubblication

PED fire on the flight deck

Potential Risks due to devices containing Lithium batteries located on the flight deck

→ Personal electronic devices (PED) carried by passengers and crew contain as well lithium batteries. Additionally, passengers and crew may carry spare lithium batteries and powerbanks. Lithium batteries and PEDs commonly found in the flight deck are electronic flight bags (EFB) and those carried by the flight crew for personal convenience.

→ The increasing number of lithium batteries contained in equipment carried by the flight crew on commercial transport aircraft results in a higher risk of in-flight lithium battery fires.

→ Typical location may be in the storage boxes available or on mounting brackets when provided. On certain aircraft design, the flight deck storage boxes may be located in close proximity to built-in oxygen lines routed in the flight deck, the oxygen mask storage box or other critical system components.

PED fire on the flight deck

CARI 25-09 : Potential Risks due to devices containing Lithium batteries located on the flight deck

→ In case of a battery/cell thermal runaway, the flight deck would become potentially affected by generation of heat, smoke and flames, as well as by explosions. Additionally, a battery fire affecting critical aircraft systems (e.g. flight controls and oxygen lines) may be catastrophic.

→ The use of PED's in the flight deck is regulated by operational requirements. However, the Agency believes that the safety risks associated to PED fires relate for some aspects to the design.

→ The purpose of CARI 25-09 is to investigate if potential unsafe conditions associated to lithium battery fires in the flight deck may exist on any specific transport aircraft type that would require corrective actions as a second step.

PED fire on the flight deck

CARI 25-09 : Potential Risks due to devices containing Lithium batteries located on the flight deck

The Type Certificate Holder (TCH) is requested to:

→ 1) Perform a hazard assessment of a representative lithium battery fire in the flight deck.

→ 2) If in case of lithium battery thermal runaway the storage boxes or mounting brackets cannot keep their physical integrity, or the thermal runaway effects may may be critical f or the surrounding systems, the TCH is requested to define how to handle such event.

→ 3) Define the procedure associated to a PED fire in the flight deck.

→ 4) Define the safety equipment (e.g. fire gloves) necessary to relocate an overheated PED to the location specified for fire fighting and subsequent storage.

→ 5) Define the necessary safety makings.

Special Condition SC-G25.1585-01

Special Condition

Mitigation of flight deck fires originating from lithium batteries

that are not part of the aircraft design

1) The emergency procedures to be followed in case of lithium battery fire on the flight deck must be specified considering the different threats (i.e. heat, smoke, fire and explosion) associated to a potential lithium battery thermal runaway event.

2) Adequate training must be specified for the flight- and cabin crew addressing such emergency procedures.

3) The emergency equipment required to effectively follow the procedures established to meet above SC 1) must be suitable for lithium battery fires and must be located either in the flight deck or in its close proximity so that it can be timely retrieved by the flight crew or the cabin crew, as applicable.

4) The design of each stowage compartment and each mounting bracket on the flight deck, must be evaluated by means of a fire hazard assessment supported by test evidence to determine its suitability to place or stow PEDs, power banks and spare batteries.

5) Placards must be installed to allow the identification of stowage locations and mounting brackets inside the flight deck that are determined to be suitable for PED stowage according to above SC 4).

Special Condition SC-G25.1585-01

Means of Compliance

The associated Means of Compliance is published for awareness only and is not subject to public consultation.

MOC to SC 1
The emergency procedures required to meet special condition 1) should be included in the AFM and should be developed considering the following guidance:

a. Personal Electronic Devices (PEDs) powered by lithium batteries are commonly transported on the flight deck of Large Aeroplanes, e.g. electronic flight bags (EFB) or devices carried by the flight crew for personal convenience (mobile phones, tablets, laptop computers, e-cigarettes,etc.). In addition to PEDs, also power banks or spare batteries may be transported on the flight deck by flight crew members.
b. A possible means of compliance with special condition 1) consists in prohibiting the carriage on the flight deck of lithium batteries that are not part of the aircraft type design and that have a capacity exceeding 2 Wh.
c. The lithium battery may be in a PED on a mounting bracket or may be in the personal belongings of the flight crew - both cases need to be addressed.
d. A lithium battery fire on the flight deck could be potentially catastrophic and therefore the emergency procedures should involve either the removal of the PED, power bank or spare battery from the flight deck or placing it in a safe stowage that is readily on the flight deck.
e. The need to use liquids to cool the battery as part of the fire-fighting procedure.
f. The likelihood that cabin crew members can actively participate to the fire-fighting procedure should be evaluated.
g. The procedure should make clear whether it is required for the aircraft to land as soon as possible.

Special Condition SC-G25.1585-01

MOC to SC 4

The hazard assessment required by SC 4) should cover all the consequences of a thermal runaway event, such as for example:

a. Smoke and toxic gases released from the battery, taking into account the effects of the implementation of the applicable flight deck smoke evacuation procedure.
b. The need to remove the battery from the flight deck, if applicable.
c. The consequences of the use of liquids to cool the battery as part of the fire-fighting procedure.
d. The impact of the battery fire on the physical integrity of stowage boxes or mounting brackets.
e. The potential for corrosive leakage from the battery.

The hazard assessment should be performed considering a representative lithium battery fire in terms of heat, smoke and toxic gases generation. In absence of any other justification, it should be assumed that in a thermal runaway of a representative PED battery temperatures as high as 760° C could be reached and that the event could have a duration of at least 2 minutes. The setup and procedure of any test conducted to support the demonstration of compliance with SC 4 should be agreed with EASA.The proximity of critical systems (e.g. oxygen systems, wire bundles, other batteries, etc.) that could be affected by direct flame impingement or heat transfer should be taken into account. Mounting brackets should be shown to withstand the PED overheat/ fire until the PED can be safely removed from the mounting bracket.

A possible means of compliance with special condition 4) consists in prohibiting the carriage on the flight deck of lithium batteries that are not part of the aircraft type design and that have a capacity exceeding 2 Wh.

EASA SIB 2022-08

Recommendation(s):

EASA recommends the large aeroplane operators to:

- Ensure that no PEDs, spare batteries or power banks are transported on the flight deck, unless, when not in use, they can be placed or stowed in flight deck stowage compartments that have been specifically designated to stow PEDs, power banks and spare batteries by the relevant design approval holder.
- Implement Service Bulletins published by TC holders to address the lithium battery fire events on the flight deck.
- For EFBs, ensure that the battery fire scenario is addressed in the risk assessment performed to authorize their use on the flight deck. In such risk assessment no credit should be given to existing EASA approvals of mounting brackets installations, as regards to withstanding the effects of a lithium battery thermal runaway, unless there is the evidence that EASA Special Condition SC-G25.1585-01 was part of the certification basis considered for the related projects.

CARI 25-09 : data review status

- Several non-EU TCHs have not provided any data
- Review of the data received from EU TCHs almost finalized
- Level of priority established based on the size of the in-service fleet
- Objective of the review of the available data is to identify any unsafe condition and implement appropriate corrective actions
- Target (considering the workload of EASA specialists and TC holders reaction times): end of Q2 2024

CARI 25-09 : main findings

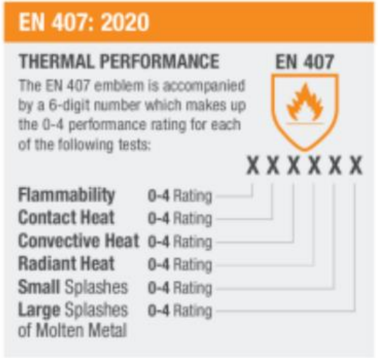
- Unambiguous information on safe stowage locations available on the flight deck should be provided to operators (through placards and training material).
- Donning fire gloves is essential to safely relocate PEDs:
  - Not always available on the flight deck or in its proximity
  - Minimum performance standard for fire gloves should be specified
- Use of fire containment bags: not acceptable for fire fighting but may be used as stowage facilities (in the cabin and on the flight deck), if adequate performance is demonstrated.
- A strategy needs to be defined to address Continuing Airworthiness of EFB mounts installations

Fire Gloves (1/3)

→ EU TC holders typically install fire gloves that meet EN 407:2020 with rating [4342XX]

EN 407:2020 establishes thermal performance levels, testing and classification for protective gloves and other hand protective equipment for professional, consumer or domestic use against heat and/or fire.

This standard is comprised of six separate thermal tests—burning behavior, contact heat, convective heat, radiant heat, small splashes of molten metal, and large splashes of molten metal. Each test is rated from 0 to 4, with 4 offering the greatest degree of protection. A zero (0) rating means no rating was earned.



Fire Gloves (2/3)

→ UL 5800 (Battery Fire Containment Products):

13.2 Gloves shall be required to be packaged with the containment product. Gloves shall comply with either the structural fire fighting glove requirements of NFPA 1971 or the Type B welding glove requirements of EN 12477.

	Requirement for minimum performance level		
Protective properties	Standard	Type A	Type B
Resistance to abrasion	EN 388	2	1
Cut resistance	EN 388	1	1
Tear resistance	EN 388	2	1
Puncture resistance	EN 388	2	1
Limited flame spread	EN 407	3	2
Contact heat	EN 407	1	1
Convective heat	EN 407	1	-
Small splashes of molten metal	EN 407	3	2
Flexibility	EN 420	1 (smallest diameter 11 mm)	4 (smallest diameter 6.5 mm)

Fire Gloves (3/3)

→ EN 12477 Type B gloves are required to meet EN 407 Level 1 for resistance to Contact Heat, EU TC holders install gloves that meet EN 407 Level 3

Resistance to Contact Heat

Samples of the glove's palm material are placed on four plates ranging in temperature from 100 - 500°C. Time is measured to determine how long it takes the temperature of opposite side of the material to increase by 10°C from an initial temperature of about 25°C. A minimum time of at least 15 seconds is required to pass each level.

Level	Temperature After 15 Seconds
1	100 °C
2	250 °C
3	350 °C
4	500 °C

Fire containment bags

- → FCBs may be used as stowage means on the flight deck.
- → Fire containment should be demonstrated against a standard test method (e.g. UL5800).
- → Relocation of the bag to another compartment (e.g. a lavatory) is essential to address smoke released by the PED during the thermal runaway event
- → As of today, FCBs have not passed the fire containment tests requested by EASA (performed using UL5800 as a reference).
- → Fire containment performance significantly depends on the strict application of the instructions for closure of the bag.

EFB Mounts (1/2)

- EFB mounts installations are not approved only by TC holders:
  - CARI 25-09 is addressed to TC holders
  - SIB 2022-08 clarifies that the scope of the STCs granted by EASA does not address PED battery fire events unless Special Condition SC-G25.1585-01 is included in the project certification basis
- Strategy to address CAW of EFB mounts:
  - a new CARI, equivalent to CARI 25-09, should be created and sent to the approval holders of design changes that install EFB mounts.

EFB Mounts (2/2)

- 83 STCs held by 39 Design Organizations
- None of these Design Organizations has received CARI 25-09
- Cases have been detected in which EFB mount installations have been incorrectly approved by DOAs as a minor change.

STC Holders	all TC Holders (Large Aeroplanes only)
ACS-NAI Ltd.	Airbus
AERO VODOCHODY AEROSPACE A.S.	Airbus Canada
AIRBUS TRANSPORT INTERNATIONAL SNC	Airbus D&S
ALAMO ENGINEERING GmbH	Antonov
AVIONICS INTEGRATION & ENGINEERINGCORPORATION AG (AIEC)	ATR
AVIONICS SUPPORT GROUP, Inc.	BAE Systems
B/E AEROSPACE, Inc.	Beriev
BBJ DESIGN SERVICES LIMITED	Boeing
BJAC BUSINESS JET AIRCRAFTCOMPLETIONS	Bombardier
BOMBARDIER AEROSPACE	COMAC
BOMBARDIER INC.	Dassault Aviation
BOURNEMOUTH AVIATION (CONSULTANTS)Ltd.	De Havilland
CHIPPEWA AEROSPACE, Inc.	Deutsche Aircraft GmbH
DELTA ENGINEERING CORPORATION	Embraer
DUNCAN AVIATION, INC.	Fokker Services
ELECTRONIC CABLE SPECIALISTS, Inc.	Gulfstream Aerospace
EMBRAER GPX Ltda. (PC 722)	IPTN
FIELD AVIATION EAST, LTD.	Irkut
FOKKER SERVICES B.V.	Israel Aircraft Industries
HAWKER BEECHCRAFT Ltd.	Learjet
HOLLINGSEAD INTERNATIONAL	Leonardo
ICELANDAIR EHF	Lockheed
INNOTECH AVIATIONA DIVISION OF IMP GROUP LTD.	MHI RJ corp
JET AVIATION ST. LOUIS, Inc.	SAAB
KELOWNA FLIGHTCRAFT Ltd.	Tupolev
LUFTHANSA TECHNIK AG	Viking Air
MID-CANADA MOD CENTER	
NAVAERO AVIONICS AB	
PENTASTAR AVIATION, L.L.C.	
PMV ENGINEERING	
ROSEMOUNT AEROSPACE, Inc.	
RUAG AEROSPACE SERVICES GmbH	
SABENA TECHNICS BGC	
SCANDINAVIAN AVIONICS DESIGN ApS	
SOCIETE AIR FRANCE S.A.	
TENENCIA Ltd.	
U.S. TECHNICAL CONSULTANTS, INC.	

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Next steps

- → EASA will approach TC Holders with the objective to achieve the implementation the SC in the certification basis of already certified aircraft models

- → Make progress in the definition of a standard for FCBs addressing PEDs handling and battery fire containment: on-going EASA research project LOKI-PED

- → EASA should define minimum performance standards for fire gloves

- → EFB mounts:
  - → EASA is developing a new CARI that will be sent to design approval holders (including DOAs that incorrectly approved mounts installation as minor changes…)
  - → revision of the MOC to SC-G25.1585-01

European Union Aviation Safety Agency

EASA Research

EASA research

LOKI-PED

Research Project details

Contracting Authority: EASA

Project Leader: Fraunhofer Gesellschaft

€ 800,000

08/2022 › 07/2025

This project will be funded from the European Union's Horizon Europe research and innovation programme.

At Frauenhofer Gesellschaft

Project manager: Simon Holz, simon.holz@emi.fraunhofer.de

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Consortium members

Airbus

At EASA

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LOKI-PED Project

(https://loki-ped.de)

About LOKI-PED

The LOKI-PED project, funded by EASA and named after the nordic god of fire, aims to assess the risks associated with lithium batteries in portable electronic devices in case of fire and smoke in cockpit and cabin. Therefore, the Fraunhofer Institutes for Highspeed-Dynamics, Ernst-Mach-Institut, EMI and Building Physics IBP team up with AIRBUS (Airbus Operations GmbH and Airbus SAS). With this consortium, the latest numerical and risk assessment methods, advanced test facilities for battery abuse, cabin fire testing and cabin in flight conditions will be employed to make the inflight use of PEDs safer.


Smartphone battery after Thermal Runaway. © Adobe Stock


Burning Laptop. © Adobe Stock

Expected outcome

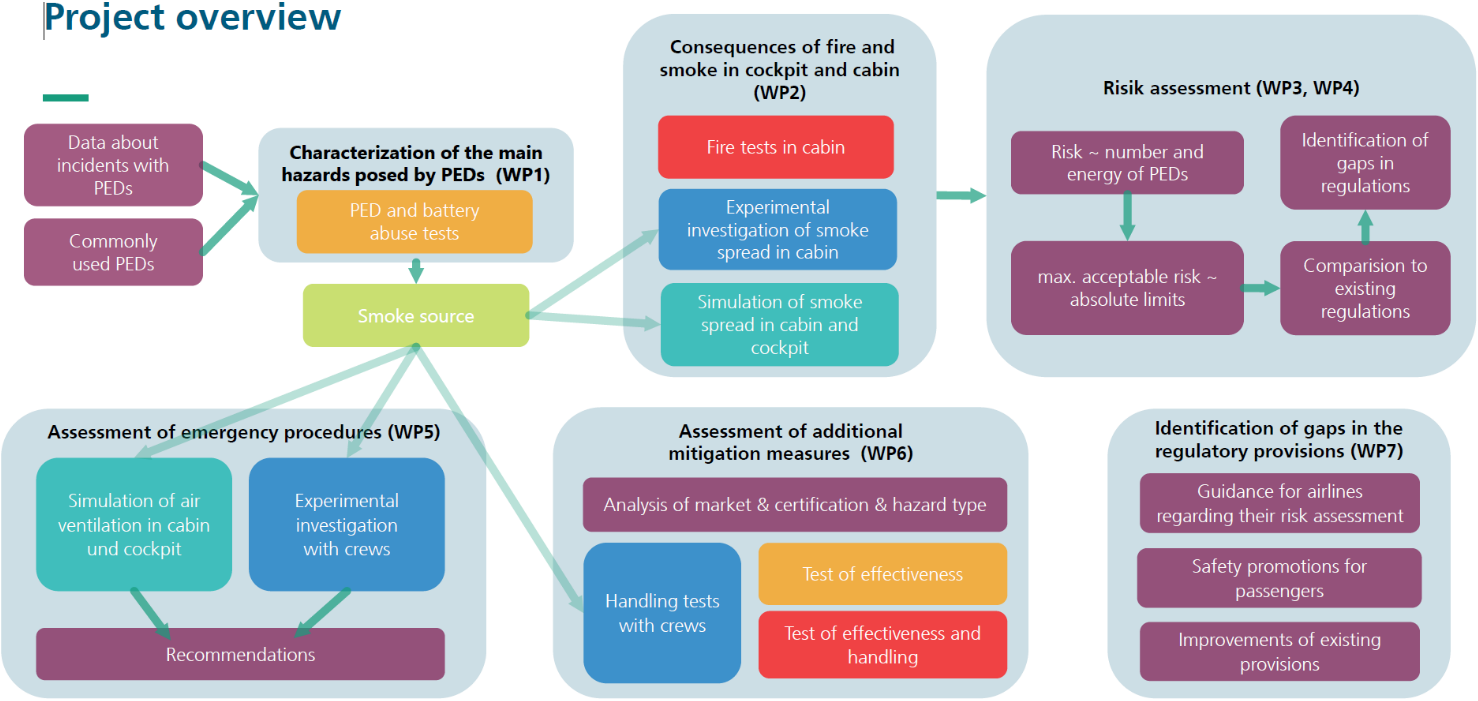
(https://loki-ped.de)

- Provide experimental test evidence for the establishment of limits (power output and quantity) for the transport of PEDs, and study the effects of an increase/decrease in the risks involved.
- Develop new and improve existing emergency procedures to cope with lithium batteries and PEDs transported in the cabin, thus rendering it a safer environment for both passengers and aircrew.
- Reduce the occurrences of safety events caused by lithium batteries and PEDs carried by passengers and aircrew by better understanding the causes, consequences and patterns of lithium-battery thermal runaways in flight.
- Reduce the consequences of fire and smoke events by determining cabin and cockpit tolerances, identifying the consequences of failures in the aircraft systems, and identifying solutions both at aircraft and lithium-battery level.
- Support operators in assessing the risks associated with the transport of lithium batteries and PEDs in the cabin and identify the need for safety promotion for passengers.

LOKI-PED

(https://loki-ped.de)

Project overview



EASA

LOKI-PED

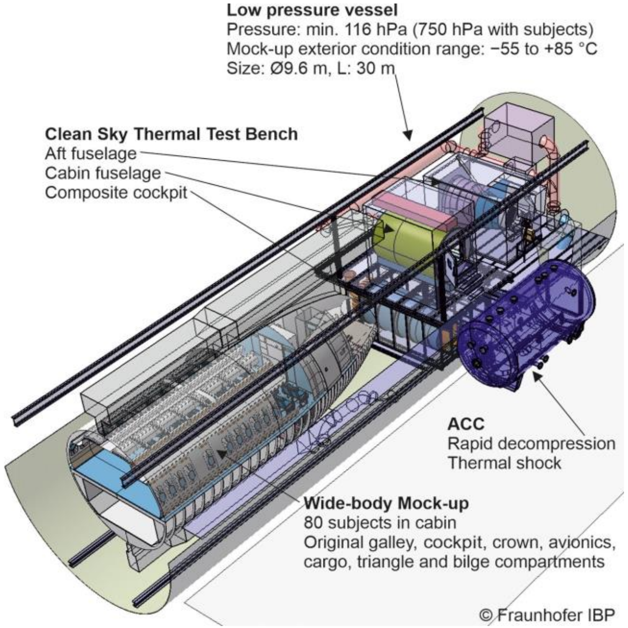
(https://loki-ped.de)

TASKS AND TIME TABLE

2023	2024	2025
WP1 Characterization of the main hazards posed by lithium batteries and PEDs carried by passengers and aircrew in the cabin	**WP2** Evaluation of the consequences of fire and smoke **WP3** Assessment of the limits related to the number of batteries and the battery power / energy **WP4** Comparison of the risk scenarios with the limits established by the applicable regulations	**WP5** Assessment of the cabin emergency procedures **WP6** Assessment of additional mitigation measures **WP7** Identification of gaps in the regulatory provisions

LOKI-PED
(https://loki-ped.de)

Flight Test Facility - the Fraunhofer IBP flight lab



The flight lab, which is the only one of its kind in the world, houses a low-pressure chamber containing the front segment of a wide-body aircraft with the original cabin, crown, galley, cockpit, avionics and cargo area. In this demonstrator, we study all aspects of the interior climat from comfort and hygiene in the passenger cabin and personnel areas galley and cockpit, to the distribution of environmentally-friendly fire-extinguishing agents in the cargo area, right through to analyzing the formation of condensation on the aircraft structure and even replicating

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LOKI-PED

(https://loki-ped.de)

Participate

Within the LOKI-PED project workshops with different stakeholders will enable the participation of airlines as well as manufacturers of additional mitigation measures among others.

We will conduct workshops with airline crews at the Flight Test Facility of the Fraunhofer IBP in Holzkirchen. Thereby, we want to analyse and improve existing procedures dealing with the thermal runaway of the Lithium-Ion-Batteries in Portable Electronic Devices. Furthermore, existing mitigation measures will be tested and assessed in a real cabin environment regarding their handling and effectiveness. Therefore, we welcome airlines sending crew members and safety experts to work together with the LOKI-PED consortium on safer handling of PEDs under thermal runaway.

We are looking for manufacturers of additional mitigation measures against PEDs under thermal runaway. We will assess the handling and effectiveness of these measures at the Battery Test Facility of Fraunhofer EMI and an A320 mockup as well as the Flight Test Facility of Fraunhofer IBP.

Fraunhofer EMI

Fraunhofer IBP

AIRBUS

EASA

European Union Aviation Safety Agency

Loki-PED - Request for participation

Focus of tests

PEDs

- Laptops and laptop batteries
- Tablets
- Smartphones
- Power tool batteries

Additional mitigation measures

- Bags (some with filters)
- Sprays
- Personal Protective Equipment
  - Gloves
  - Blankets
  - Masks
  - Goggles

Disclaimer: Please note, these products are shown for illustration purpose only.
This does not imply a judgment of their capabilities nor a recommendation for usage.

Loki-PED - Request for participation

- Participation: workshops with airline crews at the Flight Test Facility of the Fraunhofer IBP in Holzkirchen will be conducted.
- We want to analyse and improve existing procedures dealing with the thermal runaway of the Lithium-Ion-Batteries in PEDs.
- Existing mitigation measures will be tested and assessed in a real cabin environment regarding their handling and effectiveness.
- We welcome airlines sending crew members and safety experts to work together with the LOKI-PED consortium on safer handling of PEDs under thermal runaway.
- We are also looking for manufacturers of additional mitigation measures against PEDs under thermal runaway.
- The handling and effectiveness will be tested at the Battery Test Facility of Fraunhofer EMI and Fraunhofer IBP in Germany.

EASA research

AirPED

Research project EASA.2020.HVP.12
based on the Horizon 2020 Work Programme Societal Challenge 4
'Smart, green and integrated transport'

- → Lithium battery fires in cargo compartments:
  - → PEDs in checked baggage
  - → Bulk shipment of lithium batteries
- → Budget: 600.000 €
- → Project started in September 2021
- → Report to be published in ~~Q1 2024~~ Q2 2024

vito

AIRBUS

DLR Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center

New EASA research project: AIRPED

Objectives:

- To evaluate the effectiveness of cargo fire suppression systems (Halon-based and Halon-free) in case of thermal runaway events originating from battery-powered devices in checked baggage

- To generate data to support the revision of the MPS for Aircraft Cargo Compartment Halon Replacement Fire Suppression Systems : validation of the definition of a new cargo fire test scenario involving lithium batteries

- To perform additional tests with the same setup as Task 4 of the Sabatair project (external fire scenario, with FCCs protecting the batteries/cells)

New EASA research project: AIRPED

TASK 2 – DEVELOP THE TEST PLAN AND PROTOCOLS

TASK 3 – PERFORMANCE OF FIRE TESTS

Test Scenario
Unsuppressed Surface Burning
Unsuppressed Bulk Load
Unsuppressed Containerized
Unsuppressed Multiple Fire Test

Test Scenario
Surface burning & Halon 1301
Bulk Load & Halon 1301
Containerized & Halon 1301
Multiple Fire Test & Halon 1301
Multiple Fire Test & Halon replacement agent
Surface Burning & Halon replacement agent
Bulk Load & Halon replacement agent
Containerized & Halon replacement agent

Test Scenario
Calibration of baggage
Compartment floor
Compartment ceiling
ULD container
Involvement of a bulk shipment of cells/batteries in an external fire event

Halon replacement MPS

SCENARIO 6: Halon Replacement

→ Show that a candidate replacement agent can pass the cargo MPS (see reference 5) tests25, including the Multiple Fuel Fire scenario.

Test Scenario
Surface burning & Halon 1301
Bulk Load & Halon 1301
Containerized & Halon 1301
Multiple Fire Test & Halon 1301
Multiple Fire Test & Halon replacement agent
Surface Burning & Halon replacement agent
Bulk Load & Halon replacement agent
Containerized & Halon replacement agent

EASA

New EASA research project: AIRPED

TASK 4 – ASSESSMENT OF TEST RESULTS AND AIRCRAFT FIRE PROTECTION EFFECTIVENESS

TASK 5 – PROJECT CONCLUSIONS, RECOMMENDATIONS AND PRESENTATION TO AVIATION STAKEHOLDERS

- The objective of Task 4 and Task is the assessment of the effectiveness of a state-of-the-art fire protection means of a Class C cargo compartment in suppressing a fire involving lithium batteries. This assessment will be done based on test data from the different test scenarios carried in the previous tasks and will include:
  - the evaluation of the level of performance of the tested aircraft fire protection systems in the tested cargo fire scenarios
  - recommendations for improvements of the MPS test protocols, with particular reference to the definition of the new Multiple Fuel Fire scenario involving lithium batteries.
- The final project report will also identify recommendations and further work on open issues that were not deeply investigated during this project.

AIRPED: project status

- Task 1 is completed (pending finalization of unsuppressed fire test scenarios)
- Task 2 and Task 3 are on-going. Activities performed:
  - unsuppressed fire test scenarios (except for Multiple Fuel Fire scenario)
  - Halon 1301 fire suppression system calibration tests
- All Fire test scenarios to be run by the end of ~~Q4 2023~~ Q1 2024
- Task 4 and Task 5 to be completed in ~~Q1 2024~~ Q2 2024
- Final report and project deliverables due by the end of ~~Q1 2024~~ Q2 2024

Any Questions ?

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