



## **DANGEROUS GOODS PANEL (DGP)**

### **TWENTY-NINTH MEETING**

**Montréal, 13 to 17 November 2023**

**Agenda Item 4: Managing safety risks posed by the carriage of lithium batteries by air (Ref: Job Card DGP.003.04)**

### **INFORMATION ON THE STATUS OF THE RESEARCH PROJECTS (EASA)**

(Presented by L. Calleja Barcena)

#### **SUMMARY**

The European Union Aviation Safety Agency (EASA) has been working on research related to lithium batteries in the last few years. The presentation provided in the appendix contains the most relevant information and updates of this work.

The DGP is invited to consider this information and continue to follow up on the progress of the projects, noticing the potential impact that their outcome may have on the transport of lithium batteries and, thus, on the work of the panel.

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**APPENDIX**

**THE EUROPEAN UNION AVIATION SAFETY AGENCY (EASA) RESEARCH UPDATE**

# EASA Research update

Lia Calleja Barcena

Dangerous Goods Expert (& Cabin Crew Safety)  
FS2.1 Air Operations Standards

# Fire risks caused by portable electronic devices on board aircraft - SABATAIR

PROJECT RES.0016

# SABATAIR – main results

Final report/deliverables published Q4-2022: <https://sabatair.vito.be/en/reports>

- Tests to improve and validate SAE-G27 packaging standard.

- Assessed & proposed additional mitigating measures to prevent involvement of batteries in an external cargo fire.
- Guidance to operators to perform RA to transport of LB as cargo.



Figure 19: Impact on Cells after the test with fire suppression.



Figure 23: Impact on Cells after the test with Fire Suppression and a Fire Containment Cover.



# Safe air transport of PEDs in checked-in baggage

PROJECT Air PED

# AirPED – Information

<https://www.easa.europa.eu/en/research-projects/fire-risks-caused-peds-board-aircraft>

- Project funded by the Horizon 2020 Work Programme Societal Challenge 4 'Smart, green and integrated transport'
- Budget: 600.000 €
- Consortium of: Vito (PM Kiehm Trad), Airbus (Technical Lead Konstantin Kallergis) and DLR (Deutsches Zentrum für Luft und Raumfahrt)
- PM: SM, Emmanuel Isambert, Technical lead: CT, Thomas Manthey and Enzo Canari
- Timeline: kick off September 2021, deadline Q2 2023 (delayed to **Q2 2024**)
- Scope: LB fire in cargo compartments (PEDs checked baggage/LB bulk shipments)



# AirPED – Information

- Objectives:
  - 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
  - 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**)

# AIRPED - project status

Task 1 — Evaluate the baseline performances of the selected fire test chamber against FAA MPS standard tests—**COMPLETED** pending finalization of unsuppressed fire test scenarios  
Task 2 — Develop the test plan and protocols for scenarios involving PED or lithium batteries fires in checked luggage

Task 3 — Performance of fire tests

← Task 2 and Task 3 - **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 **Q1 2024**

Task 4 — Assessment of test results and aircraft fire protection effectiveness

Task 5 — Project conclusions, recommendations and presentation to aviation stakeholders  
← Task 4 and Task 5 to be completed in **Q2 2024**

Final report and project deliverables due by the end of **Q2 2024**

# PED — lithium batteries fire/smoke risks in cabin - LOKI-PED

PROJECT RES.0044

# LOKI-PED - Information

<https://www.easa.europa.eu/en/research-projects/LOKI-ped-lithium-batteries-firesmoke-risks-cabin>

- Project funded from the EU Horizon Europe Research and innovation programme
- Budget: 800.000 €
- Timelines: 08/2022 – 07/2025

- Project leader: Fraunhofer Gesellschaft (project manager Simon Holz, technical lead: Victor Norrefeldt). Consortium members are Fraunhofer Institutes for Highspeed-Dynamics, Ernst-Mach-Institut, EMI, and Building Physics IBP team with AIRBUS (Airbus Operations GmbH and Airbus SAS).

- PM: SM, Simone Schwerdorf, Technical lead: FS, Lia Calleja Barcena

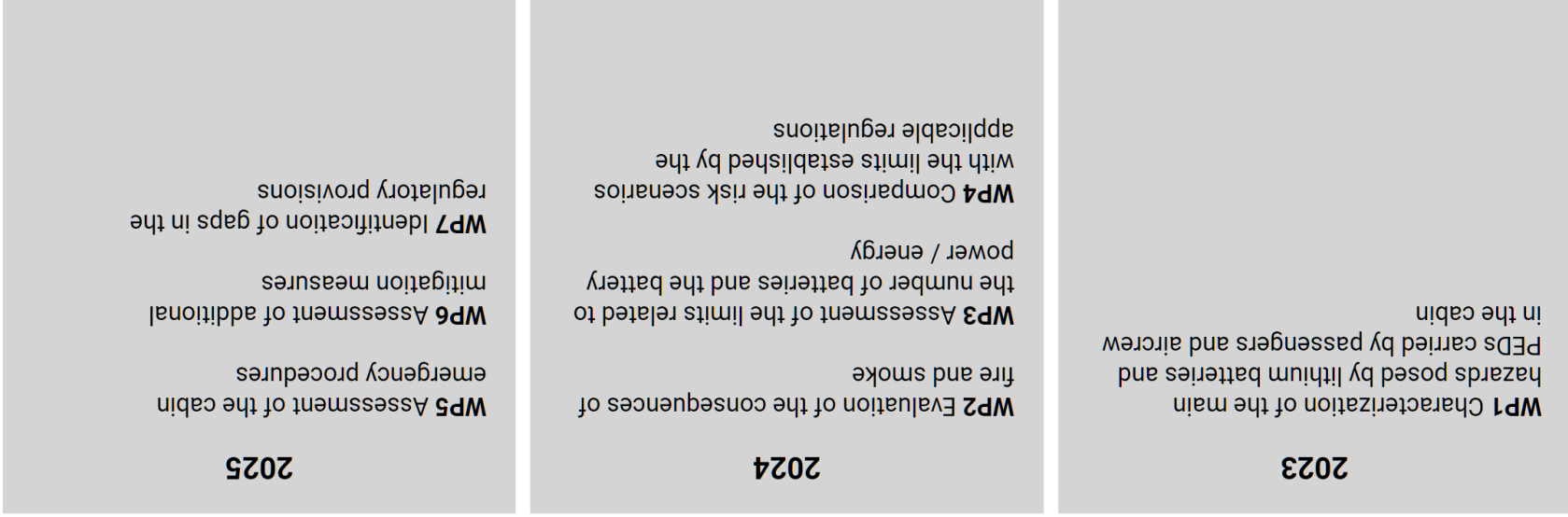
- Objective: use the latest numerical and RA methods, advanced test facilities for battery abuse, cabin fire testing and cabin in flight conditions to make the inflight use of PEDs safer.

# LOKI-PED - Objectives

- Fully characterise the hazards related to the carriage of lithium batteries and PEDs by passengers in the aircraft cabin.
- Determine the extent of the consequences of fire and smoke caused by an event on the safe conduct of the flight.
- Assess the limits related to battery design (energy content and power output) and number of PEDs on board to maintain acceptable risk level(s).
- Compare the scenarios assessed with the limits established by the applicable regulations to identify potential gaps and needs for change.
- Assess and evaluate current emergency procedures and identify potential improvements.
- Establish whether additional mitigating measures in relation to the hazard would need to be applied, determining whether the use of certain solutions may minimise or increase the risks and consequences and justifying whether manufacturing or testing standards should be developed by the appropriate entities.
- Identify gaps in the applicable provisions, as well as any need for improvement.
- Identify whether there is a need for guidance for operators for performing their risk assessment and/or safety promotion for passengers.

# LOKI-PED - Information and timetable

<https://loki-ped.de/>



Facilities: <https://www.ibp.fraunhofer.de/en/expertise/energy-efficiency-and-indoor-climate/vehicle-climate-control-systems/flightlab-flight-test-facility.html>

# Tests and facilities

**PED and battery abuse**



**Battery Test Center, Fraunhofer EMI**

**Cabin fire**



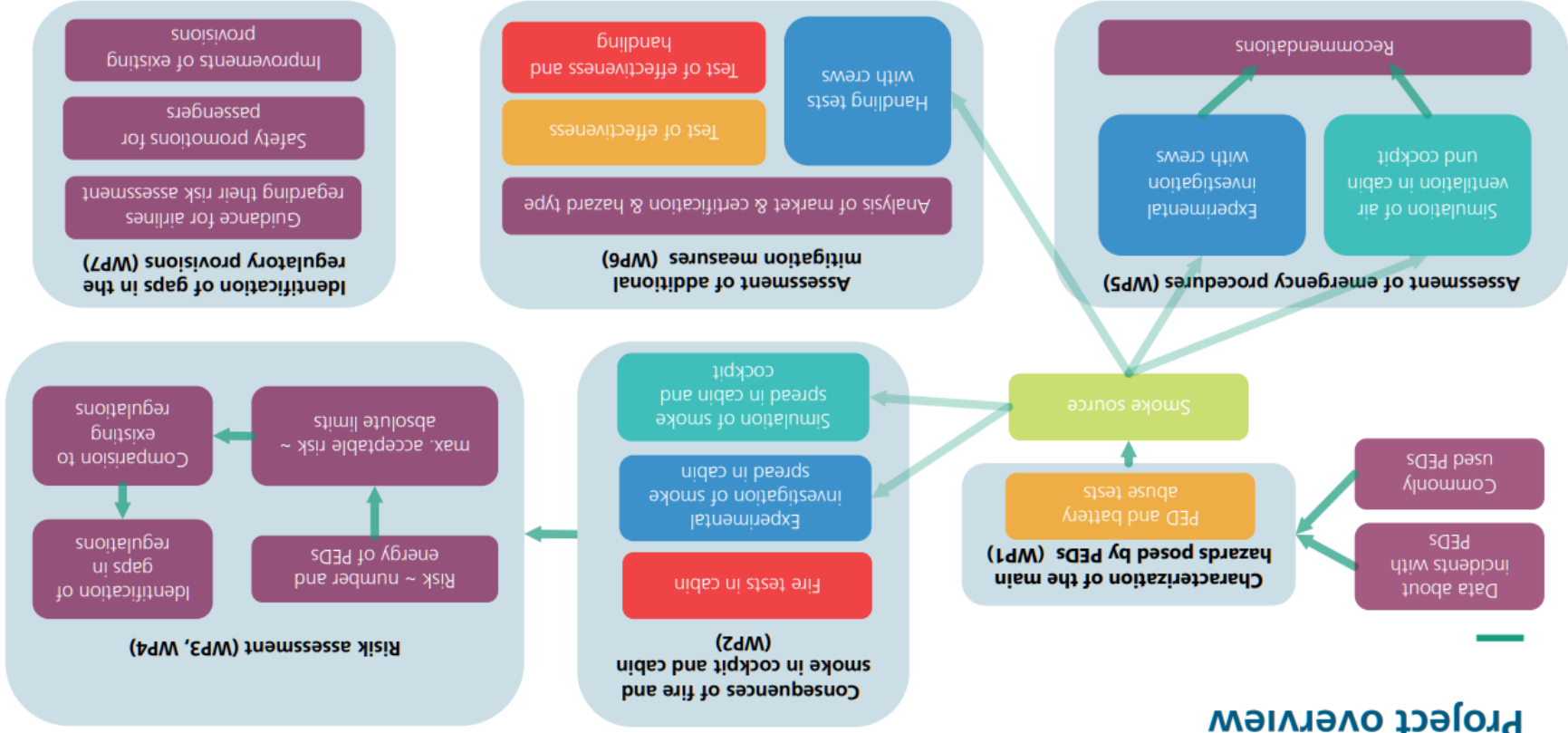
**A320 Mockup, Fraunhofer EMI & IBP**

**Smoke spread**



**Flight Test Facility, Fraunhofer IBP**

# Project overview



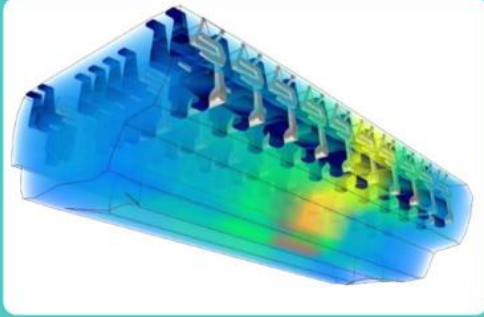


# Tests - WP

	<b>Battery test center</b> 08/2023 & 06/2024 	<b>A320 mockup</b> 06/2024 & 09/2024 	<b>Flight Test Facility</b> 06/2024 & 03/2025 
<b>WP 1</b>	<b>TR and source characterization</b> Realization: PEDs and batteries are triggered by heating		
<b>WP 2</b>		<b>TR and source characterization in cabin environment</b> <i>Scenarios:</i> on floor, on/in/under seat/pocket, in overhead storage <i>Realization:</i> PEDs triggered by heating. Realistic air flow pattern and geometry including aircraft seats.	<b>Smoke spread in cabin</b> as reference for simulations
<b>WP 5</b>			<b>Influence of air ventilation</b> on smoke spread <b>Where to place the PED</b> during/after TR w/o bag, gloves
<b>WP 6</b>	<b>Containment capability of bags</b> <i>Worst case scenario:</i> laptop / power tool (100Wh) is stored in bag after TR (only one cell affected) with ongoing propagation. <i>Realization:</i> trigger TR of laptop/power tool in bag <i>Diagnostics:</i> <ul style="list-style-type: none"> <li>- gas volume (source)</li> <li>- gas composition (toxicity)</li> <li>- temperature on bag (handling)</li> </ul>	<b>Handling of fire and heat emitted from PEDs</b> <i>Worst case scenario:</i> laptop / power tool (100Wh) in TR on seat, in seat-back pocket, in overhead storage <i>Realization:</i> PEDs triggered by heating. Person in PSE will handle the PEDs with bags and sprays.	<b>Handling of smoke</b> emitted from PEDs by crew in real cabin with bags, sprays and personal protective equipment like gloves, blankets, masks and goggles

# Numerical simulations

Smoke spread

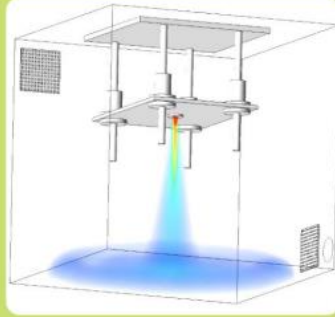


Zonal simulations

**Objective:** Efficient assessment of effects on smoke spread like ventilation control and enabling the assessment of any aircraft type

Velocity Propagating Zonal Model, Fraunhofer IBP

Smoke source definition



Computational Fluid Dynamics (CFD) simulations

**Objective:** Transfer of experimental results to FTf and simulations

OpenFOAM & Ansys Fluent, Fraunhofer EMI

# Status of the project and work – Q3.2023

WP.1, focused on PED testing and analysis of results:

- Setting up a source model
- Plan WP.2 (smoke spread) and WP.6 (add. mit. measures)
- Setup and validation of lab facilities, acquiring the necessary products (batteries, PEDs and sensors for smoke characterization)
- Information provided by Project leader:
  - IATA World Operations Safety Conference
  - Press release in Fraunhofer Research News (12/2023-  
<https://www.fraunhofer.de/en/press/newsletterpress/research-news.html>)

# Status of the project and work – Q4.2023

WP.1, focused on analysis of data gathered at the thermal runaway tests and definition of a source model (preliminary results from PED abuse tests for source model definition)

→ Preparation of the A320 mockup for the fire tests

→ Preparing workshops (<https://LOKI-ped.de/participate/>):

→ Safety Management (airlines, trainers, safety managers and CC)

→ Additional Mitigation Measures (manufacturers)

→ List of items to be included in PED incident reports (to be discussed with EASA and shared via the IATA Safety Connect program)

# Upcoming deliverables Q4.2023

- Performance of tests to determine the risks posed by lithium batteries and PEDs including smoke characterization.
- Collecting data on potential patterns (thermal runaway evolution). Description of the patterns corresponding to each representative situation.
- Impact of future developments, pattern sensitivity analysis with specific products (including changes in size and number of batteries analyzed).
- Hazards related to the carriage of PEDs and lithium batteries in the cabin.

# Detection LB using screening equipment

PROJECT RES.0054 (ref. tbc)

# Detection of LB using Security Screening Equipment

- <https://www.easa.europa.eu/en/research-projects/detection-lithium-batteries-using-security-screening-equipment>
- Project funded from the EU Horizon Europe research and innovation programme.
- Budget: 350.000 €
- Timeline: 12/2022 – 06/2024
- Project leader: Rapiscan Systems Limited in a consortium with CAA International (project manager Sarah Fox, from the UK CAA and Technical Lead Eric Chevalier, from Rapiscan Systems)
- Project managed at EASA by SM (Simone Schwerdorf), technical lead Adam Borkowski.

# Detection of LB using Security Screening Equipment

← Objectives:

← Evaluate the feasibility of the detection of lithium batteries transported as checked baggage using the security screening equipment and processes in operation at airports.

← Assessment of impact on airport and screening operations.

← Steps: Development of the algorithm, testing of performance, Aerodrome Trial, and reporting and recommendations.

← Status:

← Introductory Webinar on October 14

← Test plan for the development and trial of LB detection algorithm presented.

← Preparations for on-site trials on-going





# Any Questions ?

[easa.europa.eu/connect](https://easa.europa.eu/connect)



**Your safety is our mission.**

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