

**SUBJECT:** **Mitigation of flight deck fires originating from lithium batteries that are not part of the aircraft design**

**REQUIREMENTS incl. Amdt.:** CS 25.831, CS 25.851, 25.853, 25.855, 25.857, 25.863, 25.1309, 25.1360, 25.1453(a)(2), 25.1453(b)(1), 25.1501, 25.1541, 25.1581, 25.1585 at Amdt. 27

**ASSOCIATED IM/MoC<sup>1</sup>:** Yes  / No

**ADVISORY MATERIAL:**

**Reference Documents:** FAA report DOT/FAA/TC-16/37 "Summary of FAA Studies Related to the Hazards Produced by Lithium Cells in Thermal Runaway in Aircraft Cargo Compartments"

#### INTRODUCTORY NOTE:

The following Special Condition (SC) has been classified as important and as such shall be subject to public consultation in accordance with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.) which states:

"2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency."

#### IDENTIFICATION OF ISSUE:

In recent years, EASA has made significant efforts to address the threat associated to thermal runaways of rechargeable and non-rechargeable lithium batteries that are certified as part of the aircraft design.

Nonetheless, a significant amount of **lithium batteries** not included in the **design** configuration of the certified aircraft, are brought on board by crew members, passengers, or as part of the cargo.

**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.).** Transportation of PEDs on Large Aeroplanes is addressed in the EASA Air Ops rules. EFBs are considered as controlled PEDs (C-PEDs). A 'Controlled portable electronic device (C-PED)' is a PED subject to administrative control by the operator that uses it. This includes tracking the allocation of the devices to specific aircraft or persons and ensuring that no unauthorised changes are made to the hardware, software, or databases. **In addition to PEDs, also power banks or spare batteries may be transported on the flight deck by flight crew members.**

<sup>1</sup> In case of SC, the associated Interpretative Material and/or Means of Compliance may be published for awareness only and they are not subject to public consultation.

Lithium batteries, including **the ones that power PEDs**, can go into thermal runaway. A thermal runaway may result in the release of heat, smoke, flames and in some cases in explosion. FAA report DOT/FAA/TC-16/37 shows how a lithium cell in thermal runaway may experience a rapid and uncontrolled temperature rise, with peaks that may exceed 760° C.

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

Typical locations for PEDs on the flight deck may be the available stowage compartments or mounting brackets. PEDs lithium batteries may be connected to a power supply unit available on the flight deck, or even to a power bank.

On certain aircraft, the flight deck storage boxes may be located in close proximity to critical systems, such as **flight control and** oxygen lines routed 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.

While CS 25.1585(a)(3) already request that *“Operating procedures must be furnished for –*

*...*

*(3) Emergency procedures for foreseeable but unusual situations in which immediate and precise action by the crew may be expected to substantially reduce the risk of catastrophe”,* the existing specifications included in CS-25 do not explicitly address the battery fire risk described above.

EASA has acknowledged that the use of PEDs on the flight deck is a common practice and, to address the risk of PED battery fire on the flight deck, has developed the special conditions and the related means of compliance that are detailed below.

EASA is aware that future evolution of the design of PEDs may have an impact on the risk associated to their use/stowage on the flight deck. This may result in the need to reconsider and update the content of these special conditions and the associated means of compliance.

Considering all the above, the following Special Condition is proposed:

**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).

## 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.

### MOC to SC 3

The emergency procedures that address special condition 1) should foresee the use of emergency equipment (e.g. specific gloves) necessary to move an overheated PED to a defined location on the flight deck or in the passenger cabin. The designated stowage location of such equipment should be within easy reach of each flight crew member.

### 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.

#### **MOC to SC 5**

Based on the outcome of the hazard assessment required by special condition 4), it should be determined whether to mark the stowage compartments that are not suitable for the storage of PED, power banks and spare batteries, or, alternatively, to identify the stowage compartments that have been established to be suitable for PED stowage to that purpose. Text such as “Not suitable for equipment containing lithium battery” or “Suitable for equipment containing lithium battery” should be used for the marking, or any other equivalent text found acceptable by EASA.