EASA European Union Aviation Safety Agency	**Consultation paper** **Equivalent Safety Finding**	Doc. No. : ESF-D25.855-02 Issue : 1 Date : 3 March 2022 Proposed ☒ Final ☐ Deadline for comments: 24 MAR 2022

SUBJECT : **Cargo Compartment – Inadvertent operation of smoke/fire detection**

REQUIREMENTS incl. Amdt. : **CS 25.855(i) Amdt. 27**[1]

ASSOCIATED IM/MoC[2] : Yes☐ / No ☒

ADVISORY MATERIAL : --

INTRODUCTORY NOTE:

The following Equivalent Safety Finding (ESF) 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:

A request for an Equivalent Safety Finding (ESF) to CS 25.855(i) at Amdt. 18 was submitted to EASA for a large aeroplane with a main deck class E cargo compartment.

CS 25.855(i) at Amdt. 18 states the following:

Quote
During the above tests, it must be shown that no inadvertent operation of smoke or fire detectors in any compartment would occur as a result of fire contained in any other compartment, either during or after extinguishment, unless the extinguishing system floods each such compartment simultaneously.
Unquote

The related validation project modifies an A321-200 from a passenger to a freighter configuration. The converted freighter has a main deck Class E cargo compartment and retains the lower lobe Class C cargo compartments, forward and aft.

While conducting smoke penetration certification flight testing related to the main deck Class E cargo compartment, an inadvertent smoke detection in the aft lower lobe cargo compartment occurred during the descent-to-landing phase. Inadvertent detection from that compartment had occurred previously during engineering flight tests and efforts were made to mitigate smoke migration and eventual penetration into the aft lower lobe cargo compartment. These efforts were not fully successful. Prior to certification testing, the

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[1] The text of CS 25.855 has not changed between Amdt. 18 (used in the individual project that triggered this consultation) and the latest Amdt. 27 effective at the date of publication.

[2] 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.

applicant presented a detailed analysis of the inadvertent smoke detections and mitigation attempts to the FAA who is the primary certification authority for this project.

The FAA Policy and Innovation Division made an evaluation on the establishment of an equivalent level of safety (ELOS) finding for the Airbus Model A321 aeroplane for inadvertent smoke detection in the aft lower deck class C cargo compartment during descent. As a result, the ELOS Memo #ST13086SE-T-ES-1 has been issued by FAA.

Considering all the above, the following Equivalent Safety Finding is proposed:

Equivalent Safety Finding to CS 25.855(i) at Amdt. 27

Inadvertent operation of smoke detectors

1. Applicability
This ESF is applicable to the Airbus A321-200.

1.1 Affected CS
CS 25.855(i) at Amendment 27

2. Equivalent Safety Finding
In lieu of direct compliance with CS 25.855(i), and provided that the below compensating factors are complied with, it is acceptable that the smoke detection system alarm of the lower deck aft class C cargo compartment be inadvertently activated following the application of the main deck class E cargo compartment fire suppression procedure, due to smoke migration from the class E cargo compartment to the class C cargo compartment, during the emergency descent at altitudes below 12,500 ft.

EASA considers that the design of the main deck class E cargo compartment meets the main intent of CS 25.855(i) because no smoke is detected in the lower deck aft class C cargo compartment as long as the flight crew depressurises the aeroplane and maintains the safe altitude of 22,000 ft in accordance with the AFM fire suppression procedure.
The smoke may migrate and be detected in the lower deck aft class C cargo compartment only during the emergency descent to land, below 12,500 feet. At that time the initial fire suppression procedure would have already been completed, and in case of an additional fire alarm in the class C lower deck aft cargo compartment, the flight crew could perform the fire suppression procedure with an acceptable additional workload.

3. Compensating Factors
a) Inadvertent smoke migration and detection in the lower deck forward and aft class C cargo compartments must not occur while depressurising the aeroplane and maintaining a safe altitude of 22,000 ft in compliance with the AFM cargo fire suppression procedure for the main deck class E cargo compartment.
b) Smoke from a cargo fire in the main deck class E cargo compartment must not result in an inadvertent smoke migration and detection in the lower deck forward class C cargo compartment.
c) Smoke migration from the main deck class E cargo compartment may only activate the smoke detectors in the lower deck aft class C cargo compartment during the emergency descent-to-landing phase. It must be shown that any smoke detection in the lower deck aft class C cargo compartment that may be encountered during flight testing occurs below 12,500 feet.
d) In case of a fire alarm in the lower deck aft class C cargo compartment, the flight crew must be able to initiate the active fire suppression system in that cargo compartment affording additional protection at the pilot's discretion. This must be independent from a potential previous application of the fire fighting procedure in the main deck class E cargo compartment. Assuming that the aeroplane will land as soon as possible, the cargo fire protection system must provide acceptable protection until the aeroplane is on the ground.

e) The applicant shall demonstrate that the probability of having two independent cargo fires (one on the main deck followed by one in a lower deck cargo compartment) during the same flight is extremely improbable.

f) The AFM shall specify that in the event of a fire in the main deck class E cargo compartment:
   i. The flight crew must land the aeroplane at the nearest suitable runway once the class E cargo compartment fire suppression procedures have been completed.
   ii. The flight crew must maintain the safe cabin altitude of 22,000 ft as long as possible until they can initiate an emergency descent to the nearest suitable runway for landing.

g) An acceptable functional ground or flight test, as appropriate, shall be performed to demonstrate that, when smoke is detected in the main deck class E cargo compartment, and following the correct application of the associated fire suppression procedure by the flight crew, ventilating airflow shuts off to the main deck class E cargo compartment and lower deck aft class C cargo compartments.