EASA	COMMENT RESPONSE DOCUMENT
	Tyre Debris vs. Fuel Leakage for CFRP Fuel Tank **Applicable to Airbus A350** **SC C-05 – Issue 1**

Commenter 1 : CAA-UK

Comment # 1 –

1- Tyre Debris Impacts to Fuel Tanks

(c) Fuel leaks caused by impact from tyre debris larger than that specified in paragraph (b)(1), from any portion of a fuel tank or fuel system located within the tyre debris impact area (see also Interpretative Material (IM) indicated here below), may not result in hazardous quantities of fuel entering any of the following areas of the airplane:

(1) Engine inlet

(2) APU inlet, or

(3) Cabin air inlet.

This must be shown by test or analysis, or a combination of both, for each approved engine forward thrust condition and each approved reverse thrust condition.

Comment:
[Differences in condition [c] between this Airbus A350 Special Condition and a Special Condition previously applied on the B787; Condition [c] should be removed](*)

(*) : rewording from the initial comment.

Justification:
Accepting that a fuel leak may not be hazardous because it could be argued that it missed the engine/APU intakes and cabin air inlet is not a precedent that should be established. There are likely to be more ignition sources eg exhausts, hot brakes, which are not included in the

list. A weak argument that fuel leaks are acceptable and not hazardous will create future problems in establishing safe fuel tank designs. Fuel leaks are generally accepted to be hazardous (and may be catastrophic) and the intent of the requirement here should be to show no leak - throwing larger and larger (yet undefined) tyre pieces at the wing and then accepting that a leak is not hazardous is not an approach that should be followed. If there is a need to establish larger tyre debris pieces than currently required, then this should be justified and properly defined.
Given Concorde, Paris and B737, Manchester, we have some difficulty in accepting the concept of 'non-hazardous fuel leaks', which is why we suggest that condition (c) is unacceptable and why in part this section of the FAA SC was not carried through to the B787 [SC].

EASA response:
The comment is partially agreed.
The contents of the Special Condition [c], as well as some text similar to Special Condition paragraphs [a] and [b], have been incorporated in AMC 25.734 proposed by NPA 2013-02:

Quote
Create a new AMC 25.734 as follows:
AMC 25.734
Protection against wheel and tyre failures
…

Model 1 — Tyre Debris Threat Model

Threats occurring when the tyre is in contact with the ground release tyre debris.
Two tyre debris sizes are considered.
These debris are assumed to be released from the tread area of the tyre and projected towards the aircraft within the zones of vulnerability identified in figure 1:

- ***(i) a 'large debris' with dimensions WSG × WSG and a thickness of the full tread plus outermost ply (i.e. the re-enforcement or protector ply). The angle of vulnerability θ is 15°.***
- ***(ii) a 'small debris' consisting of 1 per cent of the total tyre mass, with an impact load distributed over an area equal to 1.5 per cent of the total tread area. The angle of vulnerability θ is 30°.***

The debris have a speed equivalent to the minimum tyre speed rating certified for the aircraft (the additional velocity component due to the release of carcass pressure need not be taken into account).
…

Protection of the structure and pass-fail criteria on effects of penetration

1) The large tyre debris size as defined in (i) above is assumed to penetrate and open the fuel tank or fuel system structure located in the zone of vulnerability defined in (i). It is used to define the opening size of the structural damage. A fuel leakage is assumed to occur whenever either the fuel tank structure or any structural element of fuel system components is struck by this large debris or when fuel tank deformation or rupture has been induced (for example, through propagation of pressure waves or

cracking sufficient to allow a hazardous fuel leak). It need not be used as a sizing case for structural design.

The fuel leakage should not result in:

a) hazardous quantities of fuel entering the following areas of the aeroplane:
- ***1. an engine air intake,***
- ***2. an APU air intake, or***
- ***3. a cabin air intake;***

b) fuel coming into contact with an ignition source.

This should be shown by test or analysis, or a combination of both, for each engine forward thrust condition and each approved reverse thrust condition.
Alternatively, it is acceptable to demonstrate that the large tyre debris as defined in (i) above will not cause damage sufficient to allow a hazardous fuel leak.

2) The small tyre debris as defined in (ii) should not create damage sufficient to allow a hazardous fuel leak in the zone of vulnerability defined in (ii).

A hazardous fuel leak results if debris impact to a fuel tank surface (or resulting pressure wave) causes:
a) a running leak,
b) a dripping leak, or
c) a leak that, 15 minutes after wiping dry, results in a wetted aeroplane surface exceeding 6 inches in length or diameter.

The leak should be evaluated under maximum fuel pressure (1 g on ground with full fuel volume, and also considering any applicable fuel tank pressurisation).
Unquote

Even though the contents of A350 Special Condition [c] have not been included in the Special Condition previously applied on the B787, the Rulemaking Task 25.028 leading to NPA 2013-02 was already in planning at the time when the A350 Special Condition has been drafted and proposed to Airbus. In addition, Airbus accepted to demonstrate compliance to the subject paragraph at the time of the closure of the associated Certification Review Item. Therefore, EASA does not agree to remove the paragraph [c] from the Special Condition used for A350.

EASA agrees to the comment that "There are likely to be more ignition sources eg exhausts, hot brakes, which are not included in the list" defined in Special Condition [c]. This deficiency of the Special Condition used for A350 will not create future problems in establishing safe fuel tank designs, because it has been addressed by the additional paragraph 1)b) proposed to be introduced in the new AMC 25.734 by the NPA 2013-02 (see text in the above extracted from NPA 2013-02 highlighted in yellow).

Considering that the NPA was not yet released and not even drafted at the time when the application of the Special Condition has been negotiated between Airbus and EASA, EASA does not consider to amend the A350 Special Condition [c] by the text included in paragraph 1)b) of the proposed new AMC 25.734, because it would constitute an undue burden for Airbus.

Comment # 2 –

1- Tyre Debris Impacts to Fuel Tanks

(c) Fuel leaks caused by impact from tyre debris larger than that specified in paragraph (b)(1), from any portion of a fuel tank or fuel system located within the tyre debris impact area (see also Interpretative Material (IM) indicated here below), may not result in hazardous quantities of fuel entering any of the following areas of the airplane:

(1) Engine inlet

(2) APU inlet, or

(3) Cabin air inlet.

This must be shown by test or analysis, or a combination of both, for each approved engine forward thrust condition and each approved reverse thrust condition.

Comment:
Paragraph [c] of this Special Condition appears to be identified with a composite wing, whereas it could be equally applicable to a metallic wing

Justification:
The issue of non-hazardous fuel leaks is equally applicable to a metallic structure as to a composite structure.

EASA response:
The comment is agreed. EASA NPA 2013-02 included the contents of paragraph [c] of this Special Condition in the proposed AMC

25.734. The NPA does not limit the applicability of the proposed new CS 25.734 and amended CS 25.963 (e) (including the associated AMCs) to composite wings. Therefore, it is intended to apply the changes proposed in this NPA equally to composite and metallic wings.