EASA Proposed CM-S-001 Issue 01 – Compliance with CS-25 Bird Strike Requirements - Comment Response Document

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
1	*Shanghai Aircraft Airworthiness Certification Center of CAAC*	3.1 (1)	6	I concur with that probabilistic arguments will not be accepted by agency as a means of showing compliance to the bird strike requirements, or as the basis for not complying with these requirements for certain aircraft areas, and all areas of the aircraft prone to bird strike should be considered. So for typical transport airplane, this section does not consider all the areas prone to bird strike. such as fairings between fuselage and wing/empennage, rudder and elevator (just like flaps stiked by bird when deflection)	Add the following to the list: (g) wing (leading edges(including slats), trailing edges (including flaps and spoiler) (n) Fuselage fairings between the fuselage and wing/empennage (o) rudder and elevator (p) the areas after the canopy (after overhead panels)			Partially accepted	(g) Noted / Not accepted - These items are already included in the list, except for spoilers, where the exposure to bird strike in general is considered to be very limited. (n) Accepted, for example if there are critical (for continued flight and landing) systems installed in these area. (o) Not accepted - In general the exposure to bird strike is considered to be very limited for rudder and elevator and these are normally not considered for bird strike compliance. (p) Noted - This item is already included in the list.
2	*Shanghai Aircraft Airworthiness Certification Center of CAAC*	3.1 (1)	6, 7	I concur with that for high lift devices (flaps and slats) the lower speed may be taken, I request clarify how to define the most critical stike trajectory path, stike point and aircraft attitude.				Noted	It is considered very difficult to specify these items upfront in the Certification Memorandum without detailed knowledge of the specific aircraft design features.
3	*Shanghai Aircraft Airworthiness Certification Center of CAAC*	3.1 (1)(l)	6	For externally mounted large antennas, I request clarify how to definite a large antennas, and when showing compliance throught analysis and/or test, how the strike point and aircraft attitude is dertermined?				Noted	EASA is in the process of drafting a separate Certification Memorandum on antenna installations, where these items will be addressed.
4	*Shanghai Aircraft Airworthiness Certification Center of CAAC*	3.1 (2)(b)&(c)	7	I suggest the deletion of operational approved performance (e.g. RVSM), because as noted in the AMC 25.1309, the bird strike is identified as a particular risk, so after bird-strike, it is essential of the airplane continuing safe flight and landing without considering the special performance (e.g. RVSM). It is the impact force induced by the bird strike, and the force induces the accelerations. In order to aviod confusion, I suggest the acceleration replaced by the word direct impact force, and so do other sections, such as in background. I suggest the factors peculiar to high altitude operation should be considered when showing compliance, including the inherent characteristic of the material used, and the effects of temperatures temperature differentials, and absorbed moisture content, because this factors are essential to the effect of bird-strike resistance, especially for composite which has been widely used on empennage, slats, flaps and radome.	**(b) ***on underlying items, systems and equipment;** **(c) ***of the bird-stike induced direct impact force on items, systems and equipment.** **This must be shown by considering the factors peculiar to high altitude operation if demonstrate to be sensitive, including the inherent characteristic of the material used, and the effects of temperatures temperature differentials, and absorbed moisture content.**			Partially accepted	(i) Partially accepted - For operational approved performance, refer to comment no. 21. (ii) Noted - The wording of the Certification Memorandum on impact force / accelerations is however considered as sufficiently clear. (iii) Noted - These issues (high altitude, composites) are considered to be addressed by compliance with CS 25.603 and CS 25.841.
5	*Shanghai Aircraft Airworthiness Certification Center of CAAC*	3.1 (3)(c)	7	Normally, I don't think the radome can withstand the 4lb bird stike without penetration, and I consider the bird energy is absorbed by the forward pressure bulkhead which is behind the radome. In order to demonstrate the satisfactory structural performance of the radome, retention of the radome, it's difficulty to determined the aerodynamic force and it may needs tunnel test, I request more detail about the meaning of satisfactory structural performance.				Partially accepted	Refer to comment no. 22.

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
6	*Shanghai Aircraft Airworthiness Certification Center of CAAC*	3.1 (3)(g)	8	I think the meaning of this section is to consider the secondary effect of bird stike. I request clarify the volume and/or weight of debris, because it 's difficulty of avoiding the release of small debris, such as rivets when bird-stike. Usually the landing gear doors is no need considering, as they are normally installed on the bottom, if release, they should not impact other parts of aircraft (e.g. empennage area, engine). Finally, I suggest consider the impact of engines	***** subsequent release of debris weight equal or more than 4 lb resulting from bird impact should also be addressed, for example for slats, flaps, externally mounted stores and large antennas. This evaluation should include the effect of any debris impacting other parts of the aircraft (e.g. empennage area and engine) and should consider any hazardous asymmetric conditions.*****			Partially accepted	(i) It is acknowledged that if aircraft zones/areas prone to bird strike have been substantiated for impact with a 4 lb bird, they would very likely be able to withstand impact with debris up to that weight (unless size and shape have an effect as well). However, it may be that debris weighing less than 4 lb would strike areas/zones of the aircraft that are normally not impacted by bird strike, and the proposed text would exclude consideration of these events. (ii) Engines will be added to the Certification Memorandum as part of the examples of other parts of the aircraft potentially to be hit by debris.
7	*Shanghai Aircraft Airworthiness Certification Center of CAAC*	2. Background	5, 6	I concur with the in-service events including DC-9, A 310, DHC-8 and A320 are sigificant issue and need special concerns. Does the issuance of this Certification Memorandum mean that the redesign of the top of the captain's panel of the windshield of A320 is necessary, because the type certification basis of A320 includes the CS 25.571, 775 and 631 without sigificant changes of bird strike requirement. And I request more compliance detail of how to consider the shock wave effect and/or effect of bird-strike induce accelerations on items, systems and equipment.				Noted	(i) These events are presented in the Certification Memorandum as examples of lessons learned for consideration on current or future aircraft designs. These events did not result in loss of continued safe flight and landing, and therefore no retroactive action was considered necessary for these aircraft. (ii) Refer to comment no. 54 for the shock wave effects.
8	*Shanghai Aircraft Airworthiness Certification Center of CAAC*	3.1 (3)(f)	8	I suggest the section is modified as right column.	***** it must be substantiated that it not likely to cause spillage of enough fuel constitute a fire hazard or cuase other hazards (e.g. the resulting fuel imbalance of the inability to continue the normal flight) which would preclude continue safe flight and landing.** **A hazardous fuel leak results if bird-strike to a fuel tank surface causes--** **1. A running leak,** **2. A dripping leak, or** **3. A leak that, 15 minutes after wiping dry, results in a wetted airplane surface exceeding 6 inches in length or diameter.** **The leak must be evaluated under maximum fuel head pressure.** **Fuel tank leaks due to bird strike in the vicinity or upstream path of heat sources (landing gears, engine inlet, APU inlet, cabin air inlet) would normally not be considered acceptable. 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.**			Not accepted	The proposed text seems overly descriptive to EASA.
9	*Airbus*		1	Regulatory Requirement(s): CS 25.571(e), CS 25.631, CS25.775 (b) (c) Only structural requirements are listed, which is not in line with the text of this CM where system requirements are recalled in chapter 1.2 and 2.				Accepted	The reference to Regulatory Requirements (front page) will be expanded to include CS 25.1309(b) and CS 25.1323(j).

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
10	*Airbus*		1	They are intended to provide guidance on a particular subject and, as non-binding material, may provide complementary information or guidance for compliance demonstration with current standards. Certification Memoranda are provided for information purposes only and must not be misconstrued as formally adopted Acceptable Means of Compliance (AMC) or as Guidance Material (GM). Certification Memoranda are not intended to introduce new certification requirements or to modify existing certification requirements and do not constitute any legal obligation. EASA Certification Memoranda are living documents into which either additional criteria or additional is-sues can be incorporated as soon as a need is identified by EASA. The intent of this CM is described by the above text. However the current text itself of this CM is not in line with the intent of CM, where not only non-binding guidance, but more rigid requirements are introduced, sometimes in conflict with existing requirements, policy is established and several substitutions to AMC are noted, in context of usage of such words as "must", "not acceptable", "should not be", "non-preferred approach", etc… (see further detail below). Also the title Certification Policy of paragraph 3 implies a different context than non- binding guidance.				Not accepted	EASA is of the opinion that the content of the Certification Memorandum is in line with CS 25.631 and the explanatory text on the front page of the Certification Memorandum. No new requirements are introduced.
11	*Airbus*		1	EASA Certification Memoranda are living document What is applicability of this CM? Should it be considered by the applicants for the applications after the issue date? Especially if the CM is being updated during a running program it might be difficult to apply.				Noted	The applicability is addressed in paragraph 3.2. of the Certification Memorandum. Once the draft Certification Memorandum has been published, applicants should start to consider its contents and discuss any issues with EASA. Any subsequent changes to the Certification Memorandum should be considered as well.
12	*Airbus*	1.2	4	Table of references Entire 25.1309 does not need to be mentioned, only sub-paragraph 25.1309(b) is relevant for "single failure" requirements.				Accepted	Reference to CS 25.1309(b) will be made in the Certification Memorandum, on page 1 (see also comment no. 9), on page 4 and on page 5.
13	*Airbus*	2	5	The sub-paragraphs (a)&(b) appear 3 times, and sub-paragraphs (c)&(d) appear 2 times.				Noted	No change to the existing text is considered necessary.
14	*Airbus*		5	In the first series of sub-paragraphs (a), (b), (c) the literal wording of CS25 requirements and AMCs have to be used, instead of current text that is reflecting interpretations of referenced CS25 requirements and AMCs in chapter 1.2.				Not accepted	The subject text of the Certification Memorandum paraphrases the essential elements of the applicable Certification Specifications and Acceptable Means of Compliance to make the Certification Memorandum easier to read and provide context. It is not the purpose of Certification Memoranda to repeat verbatim the requirements and the referenced text in CS-25 always takes precedence.

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
15	*Airbus*		5	"The EASA Certification Policy contained in Section 3 of this Certification Memorandum provides an overview of typical aircraft areas/zones prone to bird strike which normally are considered. This overview includes pressurised and non-pressurised area/zones, as well as primary and secondary structure, as the CS-25 bird strike requirements in principle make no distinction between these categories of structure in terms of applicability of these requirements (i.e. all should be considered). The EASA Certification Policy also recognizes that for flaps, slats and landing gears a lower impact speed than Vc has been accepted in the past as more appropriate for these items in the case that the deployment speed is limited due to certain (placard) restrictions." Airbus view is that, in addition to primary structures, only secondary structures whose failure could jeopardize safe flight and landing need to be considered (not all secondary structures). Landing gear doors need to be added.				Accepted	(i) Refer to comment no. 29. (ii) Landing gear doors will be added to the list on page 6.
16	*Airbus*		5	"The EASA Certification Policy further addresses the considerations related to those air-craft areas/zones where non-penetration and no part loss under bird impact conditions can be shown. This would be the preferred certification approach. Bird impact induced deformations and accelerations on structures, systems, equipment and other items must be addressed in this scenario." The wording "must be addressed" is setting obligation and more stringent requirement, which contradicts the intent of this CM and therefore the use of such wording is not appropriate. Current AMC 25.631 states: *"Consideration should be given in the early stages of the design to the installation of items in **essential** services, such as control system components, and items which, if damaged, could cause a hazard, such as electrical equipment. **As far as practicable**, such items should not be installed immediately behind areas liable to be struck by birds."* The wording "Essential" and "as far as practicable" should be considered when demonstrating compliance. Main goal of requirements CS25.631, CS25.571(e) and CS25.775(b) is to demonstrate capacity of a/c for continued safe flight and landing . No criteria of structural strength linked with neither "non-penetration", nor "no part loss" are established in current requirements, only GHL capability for PSE's under 25.571(e). This CM introduced new requirement which contradicts the intent of CM.				Partially accepted	The wording "must be addressed" is changed into "should be addressed" to align better with the intent and purpose of the Certification Memorandum (to provide information/guidance on compliance demonstration). EASA does not agree however, that the subsequent text introduces new, or contradicts existing, requirements or guidance material. Based on the in-service examples provided on page 5 of the Certification Memorandum, only showing no penetration or no part loss under bird strike conditions is not deemed to be sufficient in all cases to ensure continued safe flight and landing.

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
17	*Airbus*	3.1 (1)	6	” Probabilistic arguments (for example the likelihood of impact based on consideration of frontal area, flight phase, aircraft speed and altitude) will not be accepted by EASA as a means of showing compliance to the CS-25 bird strike requirements, or as the basis for not complying with these requirements for certain aircraft areas/zones.” Non acceptance of probabilistic arguments sets a new standard, which contradicts the announced intent and spirit of this CM. It contradicts also to the terminology “prone Bird strike”, as trajectory of bird impact is linked to the aircraft flight phase. Probabilistic arguments should be able to be used in line with the AMC wording “as far as practicable” and under the PRA exercise CS25.1309 risk analysis.				Accepted	The intent of the wording in the Certification Memorandum is to prevent applicants from not considering certain areas/zones prone to bird strike (as listed on page 6 of the Certification Memorandum), because of the perceived low probability of hitting/impacting those areas/zones. The wording of this particular paragraph has been changed to clarify the intent and address this comment.
18	*Airbus*		7	” For high lift devices (flaps and slats) instead of using Vc at sea-level or 0.85 Vc at 8000 ft, the appropriate maximum design speed (as per CS 25.335(e)) may be taken as the basis for bird strike substantiation (to be enlarged by 15% for aeroelastic considerations as per CS 25.629). For landing gears the appropriate maximum operational speed (as per CS 25.1515) may be taken as the basis for bird strike substantiation.” Speed criteria set in this paragraph is misleading. For high lift devices, the bird energy linked to the appropriate maximum design speed is considered, but not enlarged by 15%. Requested in this CM, 15% increased speed margin for flutter justification after bird strike event, sets new more stringent requirement, which contradict AMC 25.571 2.7.2, where “*…no dangerous reduction in freedom from flutter up to speed VC/MC.* “ has to be demonstrated without additional 15% margin. Same comment is applicable for par. 3.1(3)e.				Accepted	The wording "(to be enlarged by 15% for aeroelastic considerations as per CS 25.629)" is removed from the Certification Memorandum. The subject wording has been modified to clarify that the bird impact energy is linked to these speeds. Reference to AMC 25.571 is not helpful in this context. Compliance with CS 25.629(b)(2) and (d)(8) and (d)(9) is expected.
19	*Airbus*	2	7	“Non-critical” or “Critical” effect qualifications are not relevant, the only criteria is continued safe flight and landing.				Accepted	The wording of the subject paragraph in the Certification Memorandum has been changed to address this comment.
20	*Airbus*	2 (a)	7	Substantiation of the non-critical effects of the bird-strike induced deformation of structures on internal structures; It contradicts CS 25.571(e), where no requirement for deformation is set, only static strength under load considered as ultimate load need to be reviewed.				Not accepted	The wording of the Certification Memorandum is considered to complement, but not to contradict, the existing bird strike requirements (including CS 25.571(e)).

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
21	*Airbus*	2 (b)	7	Substantiation of the non-critical effects of the bird-strike induced deformation of structures on underlying items, systems and equipment, or on operational approved performance (e.g. RVSM); and This is not in line with CS25 requirements where *"… realistic scenario, including pilot corrective actions must be established to determine the loads"*…. Pilot is aware of event, measures and corrective actions are taken. In this case the link with operational requirements is not necessary. Not all systems need to be looked at, only the essential systems/ equipment referred to under AMC25.631. Furthermore, the requirement in this paragraph is already covered in 25.1309(b), where it is required that *"… (1) Any catastrophic failure condition… (ii) does not result from a single failure."*				Accepted	RVSM is removed as an example. With the revised wording of this paragraph of the Certification Memorandum (see also comment no. 19) it is clarified that continued safe flight and landing should be substantiated *considering the effects* on operational approved performance. Pilot corrective action is added to the Certification Memorandum as a valid consideration to mitigate the bird strike risk for the remainder of the flight.
22	*Airbus*	3 (c)	7	If the nose/radome area is penetrated, the structural effects of the air flow/dynamic pressure generated in the radome due to the hole imparted by the bird should be evaluated. Satis-factory structural performance of the radome, retention of the radome structure and aircraft sup-porting structure under these circumstances should be demonstrated. This statement sets new requirement for radome by requesting demonstration of structural performance, which is not in line with the loss of radome and the capability to demonstrate continued safe flight and landing. It also contradicts the requirements in CS25.571, where only for PSE structure strength has to be considered and radome is not a PSE.				Partially accepted	The words "…., unless continued safe flight and landing can be substantiated with loss of the nose/radome." have been added to the Certification Memorandum to address this comment. The comment however that a radome is typically not classified as a PSE and should therefore not have to be considered for bird strike is not supported by EASA. The whole aircraft must be considered under CS 25.631.
23	*Airbus*	3 (d)	7	If the pressure vessel is penetrated the effect of rapid decompression should be considered. For example the effects of cabin pressurisation release into the radome area should be considered in addition to static pressure as per item (c) above; This issue is already covered by the requirement CS25.365. No need to highlight the point.				Not accepted	
24	*Airbus*	3 (e)	7	The amount of partial loss to be considered should be subject to a sensitivity / para-metric study to determine the most critical condition; This statement requests for a wide frame of scenario analysis without connection with realistic/rationale ones. The amount of partial loss may be determined by sensitivity study based on most realistic winglet failure scenario, in order to consider the most realistic critical condition.				Accepted	

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
25	*Airbus*	3 (g)	7	The effects on continued safe flight and landing of damage and subsequent release of debris resulting from bird impact should also be addressed, for example for flaps, landing gear doors and large antennas. The effects of such parts loss should not be catastrophic. This statement is not in line with the intent of this CM, by its wording "should be", " should not be", "should consider" it imposes new criteria. Terminology "catastrophic" has defined meaning and not appropriate, where the only criteria is "continued safe flight and landing" per 25.631.				Partially accepted	(i) EASA does not agree that this Certification Memorandum imposes new criteria, as parts departing aircraft has always been an airworthiness concern (in addition to posing a potential threat to persons on the ground). (ii) The wording "not be catastrophic" is replaced by "not prohibit continued safe flight and landing."
26	*Dassault Aviation*	2.	5	"Bird impact induced deformations and accelerations on structures, systems, equipment and other items must be addressed in this scenario." Induced deformation and accelerations is a criterion for systems, equipment and other items if they are critical for safe flight and landing after bird strike. Strictly speaking, it is not a criterion for structures as they can even failed under impact. For structure, the criterion is to withstand the loads required by AMC 25.571 (a) (b) and (e) § 2.7.2.	"Bird impact induced deformations and accelerations on systems, equipment and other items critical for subsequent safe flight and landing must be addressed in this scenario. The static strength of damaged structures must be sufficient to withstand the required by AMC 25.571 (a) (b) and (e) § 2.7.2."		Objection	Not accepted	In the Certification Memorandum reference to these "get home" conditions of AMC 25.571 is already made on page 5 and on page 6.
27	*Dassault Aviation*	2.	5	"(b) In 1984, an A310 ... (c) In 1986, the windshield of a DHC-8 ... (d) In 1989, an A320…" Those incidents seam not have led to catastrophic situations and if safe flight and landing have been assured, they do not constitute true examples of the criticality of bird strike that must be avoided.	To list other examples as (a) which have led to non safe flight or landing (from ATKINS report for instance).	Suggestion		Not accepted	The intent of the Certification Memorandum was not to provide an exhaustive list of all bird strike related incidents and accidents, but merely to provide a number of in-service events that relate to the considerations offered in the Certification Memorandum. It is true that the events mentioned did not in all cases result in a catastrophic failure of the aircraft, but these events can still be considered as useful lessons learned.

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
28	*Dassault Aviation*	3.1 (1)	6	"(1) Probabilistic arguments (for example the likelihood of impact based on consideration of frontal area, flight phase, aircraft speed and altitude) will not be accepted by EASA as a means …" To be noticed that in ATKINS report for AESA, no bird impact has been reported above 19700 ft (AN-124 fatal accident). This fact could be used to avoid bird strike analysis above this altitude in particular in conjunction with flight above 41000ft. So DA propose to maintain the possibility to use probabilistic argument above 20000 ft where no bird strike has been encountered. To be added that based on probabilistic arguments, elements that are either displaced or opened not permanently (as A/B, elevators, rudders or ailerons...) or for emergency (as RAT, scoops...) have not to be considered. Furthermore, DA think that probabilistic arguments can help to avoid a too huge amount of unnecessary analyses to be made and to concentrate them on true critical scenarii. Outside certification process but for continued airworthiness, DA want to underline the fact a probabilistic approach can be used to cover a concession in the interim of its correction or for a A/C NTO in the interim of its repair.	"(1) Probabilistic arguments (for example the likelihood of impact based on consideration of frontal area, flight phase, aircraft speed and altitude will not be accepted by EASA as a mean of showing compliance to the CS-25 bird strike requirements, or as the basis for not complying with these requirements for certain aircraft areas/zones. Nevertheless, it is admitted that: - no bird strike has to be considered above 20000 ft (cf. ATKINS statistics); - elements not permanently displaced or opened (as control surfaces or emergency equipment as RAT or scoops) have not to be considered due to the low probability they could be impacted when displaced or opened; - use of probabilistic arguments based upon on an engineering judgment is allowed in order concentrate the analyses performed on true critical scenarii; - for continued airworthiness, in the interim of a concession treatment or for a No Technical Objection flight, probabilistic arguments can be used."		Objection/ Substantive	Partially accepted	(i) EASA does not believe that an altitude threshold can be established with reasonable accuracy beyond which no bird strike will occur. EASA acknowledges that the probability of a bird strike decreases with altitude, but believes that some measure of protection is appropriate throughout the certified envelope. (ii) EASA agrees that typically control surfaces and Ram Air Turbines (RAT) are not considered for compliance with the bird strike requirements based on limited exposure. The wording of the Certification Memorandum has been changed to reflect this comment. (iii) EASA is of the opinion that probabilistic analyses in general have merit and are acceptable in the frame of continued airworthiness and assessing time scales for corrective measures.
29	*Dassault Aviation*	3.1 (1)	6	"All areas/zones of the aircraft prone to bird strike should be considered, either pressurized or non-pressurized, either primary or secondary structure." To be noticed that secondary structure have not to be considered except if they participate to protect systems or equipment or other items critical for safe flight and landing.	"All areas/zones of the aircraft prone to bird strike should be considered, either pressurized or non-pressurized, either primary structural elements or secondary structural elements, if these last ones contribute to protect systems or equipment or other items critical for subsequent safe flight and landing and / or if they fail they could impede subsequent safe flight and landing."		Objection	Partially accepted	The wording of this paragraph of the Certification Memorandum has been changed to address this comment.
30	*Dassault Aviation*	3.1	7	"For high lift devices (flaps and slats) instead of using Vc at sea-level or 0.85 Vc at 8000 ft, the appropriate maximum design speed (as per CS 25.335(e)) may be taken as the basis for bird strike substantiation (to be enlarged by 15% for aeroelastic considerations as per CS 25.629)." As flaps (and slats) are extended at VFE, DA propose to use VFE instead of VF for bird strike analysis on flaps and slats. Furthermore, the aeroelastic envelope has to be written clearly.	"For high lift devices (flaps and slats) instead of using Vc at sea-level or 0.85 Vc at 8000 ft, the appropriate maximum design speed (as per CS 25.1511, i.e. VFE) may be taken as the basis for bird strike substantiation. For at the time of incident" and "following the incident", the aeroelastic stability envelope of CS 25.629 is then (1.15 VFE/MFE)."	Suggestion		Not accepted	(i) Structural airworthiness requirements are normally based on structural design speeds, such as the design cruise speed Vc (and not the maximum operational manoeuring speed Vmo) in CS 25.631. Reference to CS 25.335(e) for the design flap speed Vf seems therefore more appropriate than reference to the operational extended falp speed Vfe. (ii) For the comment on the aeroelastic envelope, refer to comment no. 18.

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
31	*Dassault Aviation*	3.1	7	To precise that A/C angles-of-attack to consider at the instant of bird strike are 1g flight mean values corresponding to fatigue missions. To indicate also that the bird impact studies are to be studied: - at max (VC at z=0 ; 0.85 VC at 8000 ft) for all A/C elements prone to be struck; - at VFE for flaps and slats at their maximal extension; - and at VLE on L/G and frontal L/G doors if any as it corresponds to the most probable critical scenarii.	To add at the end of (1): "Angles-of-attack to consider at the instant of bird strike are the mean values at 1g straight level flight corresponding to A/C typical fatigue missions. Furthermore, bird strike analyzed scenarii can be limited to concerned element zones critical in term of impacting normal energy i.e. in a practical application bird impact effects are to be studied: - for all A/C elements prone to be struck at max of (VC at z=0 ; 0.85 VC at 8000 ft); - for flaps and slats at their maximal extension at VFE; - on L/G and frontal L/G doors if any at VLE."		Substantive	Not accepted	(i) Not only the aircraft attitude at 1g steady level flight should be assessed for the bird strike conditions, but also other attitudes reasonably attainable (at Vc / sea level or 0.85 Vc / 8000 ft) should be investigated. (ii) Impact speeds related to flaps, slats and landing gear (doors) are already addressed in the Certification Memorandum (page 7).
32	*Dassault Aviation*	3.1 (2)	7	"(a) Substantiation of the non-critical effects of the bird-strike induced deformation of structures on internal structures;" The structure is a group that cannot be considered as divided in external and internal ones working separately. After bird impact damages the structure has to be demonstrated capable to withstand the loads corresponding to subsequent safe flight and landing.	"(a) Substantiation of the non-critical effects of the bird-strike induced deformation even failure on structure static strength capability to withstand the at the time" and "following the incident" loads (cf. AMC 25.571 (a), (b) and (e) § 2.7.2);"		Objection	Partially accepted	The wording "internal structures" has been changed to "internal structural items, such as instrument panels or avionics racks" to clarify the intent.
33	*Dassault Aviation*	3.1 (2)	7	"(b) Substantiation of the non-critical effects of the bird-strike induced deformation of structures on underlying items, systems and equipment, or on operational approved performance (e.g. RVSM); and ..." To precise that this applies on critical items, systems and equipment. Suggestion to keep the same denomination as previously used i.e. "systems, equipment and other items...". To notice that in case of bird strike operational performance is reduced, in particular RVSM, the Flight Manual has to precise measures to be taken by the pilot.	"(b) Substantiation of the non-critical effects of the bird-strike induced deformation of structures on underlying systems or equipment or other items critical for subsequent safe flight and landing, or on operational approved performance in that case specific Flight Manual orders are to be defined (e.g. RVSM); and ..."	Suggestion	Objection	Partially accepted	Refer to comment no 21.
34	*Dassault Aviation*	3.1 (2)	7	"(c) Substantiation of the non-critical effects of the bird-strike induced accelerations on items, systems and equipment." To precise that this applies on critical systems, equipment and other items in the vicinity of the impact.	"(c) Substantiation of the non-critical effects of the bird-strike induced accelerations on systems or equipment or other items critical for subsequent safe flight and landing in the vicinity of bird impact, i.e. at a distance that it is reasonably judged that induced accelerations will be sufficiently damped"		Objection	Noted	EASA agrees with the comment, but sees no need to change the text of the Certification Memorandum as it is normal engineering practice to determine which items could be affected by the bird-strike induced accelerations.

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
35	*Dassault Aviation*	3.1 (3)	7	"(3) If contrary to item (2) above it can not be shown that under the conditions of CS 25.631 bird penetration or part loss does not occur in (some of) the aircraft areas/zones identified as prone to bird strike, the following should also be demonstrated for those areas/zones: …(c) If the nose/radome area is penetrated, the structural effects of the air flow/dynamic pressure generated in the radome due to the hole imparted by the bird should be evaluated. Satisfactory structural performance of the radome, retention of the radome structure and aircraft supporting structure under these circumstances should be demonstrated. These considerations would also apply to large antenna or external radome installations;" To underline that the two sentences "(3) If ... it can not be shown that ... bird penetration or part loss does not occur" and " (c) If the nose/radome area is penetrated, the structural effects ... should be evaluated. Satisfactory structural performance of the radome, retention of the radome structure ... should be demonstrated." are somewhat contradictory. In fact, if it is demonstrated that the loss of radome has no catastrophic consequence, this request is not necessary (cf. (3) (g)).	"(3) If contrary to item (2) above it can not be shown that under the conditions of CS 25.631 bird penetration or part loss does not occur in (some of) the aircraft areas/zones identified as prone to bird strike, the following should also be demonstrated for those areas/zones: …(c) If the nose/radome area is penetrated, the structural effects of the air flow/dynamic pressure generated in the radome due to the hole imparted by the bird should be evaluated. Satisfactory structural performance of the radome, retention of the radome structure and aircraft supporting structure under these circumstances should be demonstrated, unless no catastrophic situation results from their loss as specified in § (3) (g). These considerations would also apply to large antenna or external radome installations;"		Objection	Partially accepted	Refer to comment no. 22.
36	*Dassault Aviation*	3.1 (3)	7	"(d) If the pressure vessel is penetrated the effect of rapid decompression should be considered. For example the effects of cabin pressurization release into the radome area should be considered in addition to static pressure as per item (c) above;" Static pressure to be replaced by dynamic one.	"(d) If the pressure vessel is penetrated the effect of rapid decompression should be considered. For example the effects of cabin pressurisation release into the radome area should be considered in addition to dynamic pressure as per item (c) above;"		Objection	Accepted	The text of the Certification Memorandum has been changed accordingly.
37	*Dassault Aviation*	3.1 (3)	7	"(e) For winglets, freedom from flutter within the fail-safe envelope (as per CS 25.629) should be substantiated with complete loss or partial loss of the winglet due to bird strike." To be noticed that this could apply also to large antennas mounted on lifting surfaces. Bird strike belongs to discrete source damage of CS 25.571 (e). AMC 25.571 (a)(b) and (e) § 2.7.2. b. ask for freedom from aeroelastic instability to be demonstrated up to VC/MC "following the incident", even if VC/MC is questionable as the speed is reduced following the incident. In fact, in that case the aeroelastic stability envelope could be reduced to (1.15 VR/MR; VRD/MRD) where VRD/MRD is the dive speed reached from VR/MR. This last comment is to be taken into account in a future revision of AMC.	"(e) For winglets and large antennas mounted on lifting surfaces, freedom from flutter within the discrete source envelope (as per CS 25.629 at the time of incident" and AMC 25.571 (a) (b) and (e) § 2.7.2. b. "following the incident") should be substantiated with complete loss or partial loss of the element due to bird strike."	Suggestion		Partially accepted	The sizing condition for flutter will be the CS 25.629 (b)(2) stability envelope so the current wording of the Certification Memorandum is retained. Further consideration of the relevance of the period following the incident and clarification of the relationship of the AMC 25.571 with CS 25.629 will be addressed in a future revision of CS-25.
38	*Dassault Aviation*	3.2	8	"This Certification Memorandum affects applicants who need to show compliance with CS-25 bird strike requirements." To change the wording to underline the fact that this memorandum is a non binding document.	"This Certification Memorandum recommendations have to be considered by the applicants who need to show compliance with CS-25 bird strike requirements."	Suggestion		Not accepted	The purpose of this section (3.2) is to define those who are affected by the Certification Memorandum, not whether the text is binding or not (this is sufficiently addressed by the statements on the front page of the Certification Memorandum).

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
39	*Embraer*	2.	5	No incident description among those mentioned raises the concern on debris resulting from bird impact. The reason for including debris into the analysis should be clear, either from field experience or from foreseen trend of increased size or sensitivity to debris. From what is presented, it is not clear that benefits will exceed the costs of considering debris impact. The AC 25.365(e) (Pressurized Compartment Loads) states that "the risk of impact on the main structure from non critical structures, such as fairings, detached from the aircraft due to decompression need not be considered."	The proposed text changes the approach in use for CS 25.365(e) and the reasons should be understood.	Suggestion		Not accepted	Parts departing aircraft have always been an airworthiness concern (in addition to posing a potential threat to persons on the ground) and this issue is attracting increased awareness from regulators and general public. Notwithstanding the words contained in AMC 25.365(e), which are under review and may be subject to future rulemaking activities, EASA is of the opinion the text of the Certification Memorandum is appropriate for this subject.
40	*Embraer*	2.	6	Radome static strength to withstand pressurization loads after bird impact should not be a must.		Suggestion		Not accepted	Refer to comment no. 22.
41	*Embraer*	3.1 (1)	6	In 3.1(1) "Probabilistic arguments [...] will not be accepted by EASA [...] All areas/zones of the aircraft prone to bird strike should be considered [...]". Thus, the list that follows in the proposed AMC is the definition of "prone to bird strike".	Landing gear doors should be included as they are included in 3.1(3).(g).	Suggestion		Accepted	Landing gear doors are added to page 6 of the Certification Memorandum.
42	*Embraer*	3.1 (1)	7	In paragraph 3.1.(1), the sentence about landing gear speeds references the “operational speeds” of CS 25.1515. Because this could be misinterpreted to mean only the landing gear operating speed limit (Vlo) of 25.1515(a), and not the frequently more critical landing gear extended speed limit (Vle).	Embraer recommends that the word “operational” be deleted.	Suggestion		Accepted	The word "operational" is removed from the subject sentence.
43	*Embraer*	3.1.2 (b)	7	Paragraph 2b outlines the preferred certification approach of showing that no loss of operational approved performance would occur in the event of a bird strike in a critical location, and it gives RVSM approval as an example. Embraer notes that a bird strike on a pitot probe or a total air temperature probe will result in the loss of RVSM compliant altimetry. Because RVSM is an example of an operational performance standard that is practically impossible to be maintained after a critical bird strike (and therefore would default to the “no catastrophic failure” standard of paragraph (3)(a)).	Embraer recommends that RVSM be removed as an example.	Suggestion		Accepted	Refer to comment no. 22.
44	*Embraer*	3.1.3 (d)	7	Item 3.1.(3).(d) requires decompression loads to be evaluated for a bird impact hole. This would affect CS 25.365(e) by adding a new condition to the requirement itself.	Additionally, if this condition is kept, the size of the hole due to bird should be specified.	Suggestion		Not accepted	(i) The wording of CS 25.365(e)(3) "the maximum opening caused by aeroplane or equipment failures not shown to be extremely improbable" is considered to cover this case as well. (ii) The actual size of the hole may vary depending on the design features of the aircraft and exact guidance can not be given here.

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
45	*Embraer*	3.1.3 (e)	7	Paragraph 3.1.(3).(e) calls for a flutter analysis for complete or partial winglet loss, and for the partial loss to be assumed to occur at obvious break points (splices, joints). In addition, the CM calls for a sensitivity analysis to determine the critical point along the winglet for flutter. The CM appears to be calling for two different requirements; either at the obvious breaking points, or at the most critical point along the span of the winglet regardless of underlying structure.	It would be helpful to clarify this point.	Suggestion		Accepted	Refer to comment no. 24.
46	*Embraer*	3.1.3 (e)	7	Regarding item 3.1.(3).(e), clarify the criteria of partial loss of the winglet to be shown freedom from flutter (stiffness, mass or a combination of both).		Suggestion		Not accepted	Any parameter influencing flutter behaviour, including stiffness and mass, should be considered; which is already part of the normal compliance practices related to CS 25.629.
47	*Boeing Commercial Airplanes*	3rd "box" from top of page	1	The Notification states that it is intended to "provide guidance… as non-binding material… provided for information purposes only… not intended to introduce new certification requirements or to modify existing certification requirements and do not constitute any legal obligation". It is not clear why this information should not more properly be proposed (and vetted) as formally adopted guidance material such as an Acceptable Means of Compliance (AMC), or how it differs from other types of Guidance Material.	Add more explanation of how CMs differ from AMCs and EASA "Policy Statements," and how EASA plans to implement CM guidance.	Yes		Not accepted	The statements on the front page of the Certification Memorandum are considered sufficiently clear in this respect.
48	*Boeing Commercial Airplanes*	3.1	6	It should be clarified that effects on systems and avionics components during a non-penetrating birdstrike should be evaluated as a part of the CS 25.1309 evaluation. Systems and avionics have not typically demonstrated compliance to CS 25.571, 25.631, or 25.775 on recent certification programs. This has caused confusion when determining the dividing line between structures versus systems showings of compliance.	Identify the specific regulations in the first sentence of 3.1., as follows: ***"When showing compliance with the CS-25 bird strike requirements, several disciplines are involved, such as Structures (25.571, 25.631, 25.775), Systems (25.1309), and Flight Test."***		Yes	Noted	The subject of bird strike is indeed a multi-disciplinary one, where the dividing line may not always be clearly defined (and may vary from company to company). On the one hand it is acknowledged that Systems and Avionics typically do not get involved in the compliance demonstration to CS 25.571 or CS 25.775, but on the other hand the evaluation of bird-strike induced accelerations may involve more then just compliance with CS 25.1309. There is a risk of compartmentalising the tasks too much, therefore EASA is reluctant to make any change to the Certification Memorandum to address this comment.
49	*Boeing Commercial Airplanes*	3.1	6	Paragraph 3.1 also states "Probabilistic arguments (for example, the likelihood of impact based on consideration of frontal area, flight phase, aircraft speed and altitude) will not be accepted by EASA….." Configuration or geometric considerations are valid for assessment. These considerations are not (and should not be considered) probabilistic, but relevant to actual aircraft operation and geometry.	Clarify this section by adding a statement such as: ***"Relevant considerations, such as airplane configuration/geometric and operational characteristics, will be accepted in making assessments as appropriate."***		Yes	Partially accepted	The subject paragraph (page 6) of the Certification Memorandum has been changed to clarify the intent.

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
50	*Boeing Commercial Airplanes*	3.1 (1)	6	Paragraph 3.1.(1) states: "(1) Probabilistic arguments (for example, the likelihood of impact based on consideration of frontal area, flight phase, aircraft speed and altitude) will not be accepted by EASA….." This requirement is overly prescriptive, and does not reflect operational and environmental reality. Multiple analyses have shown that the majority of bird strikes occur near the ground and that the likelihood of a bird strike decreases exponentially with altitude, for example: (1) Bird population trends and their impact on Aviation safety 1999-2008, EASA 2009 concludes "...most of the occurrences (95%) occur below 2500ft amsl and around 70% occur below 200ft;" and (2) Height Distribution of Birds Recorded by Collisions with Civil Aircraft, Richard A. Dolbeer, University of Nebraska, 2006, "...74% of all strikes and 66% of strikes causing substantial damage occur at 500 feet." Not accepting a probabilistic argument for operation at low altitude including climb and descent is valid, however a probabilistic approach for flight phase, aircraft speed or altitude may be appropriate for cruise, high altitude and high speed, where the likelihood of a bird strike is very low.	Probabilistic arguments for flight operations should be considered on a case-by-case basis.		Yes	Partially accepted	Note that the text of this paragraph the Certification Memorandum has been changed in reply to comment no. 49.
51	*Boeing Commercial Airplanes*	3.1 (1)	7	The parenthetical note at the end of the sentence addressing the appropriate speed to apply during a birdstrike misleads one to think that an additional 15% high speed case is to be added (" ... to be enlarged by 15% for aeroelastic considerations as per CS 25.629"). This is really a separate requirement and should be stated as such.	We suggest the text be clarified as follows: ***"For high lift devices (flaps and slats), instead of using Vc at sea-level or 0.85 Vc at 8000 ft, the appropriate maximum design speed [as per CS 25.335(e)] may be taken as the basis for bird strike substantiation. Separately, for aeroelastic considerations per CS 25.629, increase the high lift devices bird strike design speed by 15%. For landing gears, the appropriate maximum operational speed (as per CS 25.1515) may be taken as the basis for bird strike substantiation. "***		Yes	Not accepted	Refer to comment no. 18.
52	*Boeing Commercial Airplanes*	3.1 (1)	7	**Comment in favor:** The ability to use actual design parameters (maximum design speed and maximum operational speed) is a useful clarification and represents a more realistic design requirement.		Yes		Noted	EASA is glad to receive some supporting comments as well.

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
53	*Boeing Commercial Airplanes*	3.1 (2)(b)	7	The proposed guidance would seem to require that aerosmoothness requirements around avionics equipment be maintained after a birdstrike (as RVSM relies on this aerosmoothness). This would be impractical to achieve. Dents due to birdstrike would be detectable during walkaround pre-flight inspections and would be addressed by allowable damage requirements specified in the SRM. The text should be clarified to indicate that the purpose is to ensure continued safe flight and landing for the remainder of the flight after a bird strike and not to require that structure around the avionics be made to be dent-free after a birdstrike. Additionally, airplane systems are designed to detect and alert flight crews to differences in airspeed and altitude measurements with corresponding procedures and non-normal checklists. This supports continued safe flight and landing (CSFL) following a bird strike	We suggest the text be clarified as follows: ***"Substantiation of the non-critical effects of the bird-strike induced deformation of structures on underlying items, systems and equipment, or on operational approved performance (e.g. RVSM) through the remainder of a flight following a bird strike; and..."***	Yes		Partially accepted	Refer to comment no. 21.
54	*Boeing Commercial Airplanes*	3.1 (2)(c)	7	Equipment shock design and test requirements defined in an internal Boeing document, *"Equipment Vibration Test Requirements,"* have not been derived from bird strike tests for any aircraft model, as no such tests have ever been performed with all the requisite secondary structure, equipment installations, and relavent bird impact locations. They are, instead, selected from industry standard operational shock tests in RTCA/D0-160 and Mil-STD 810, based on engineering judgement and supported by our successful fleet experience. Normally, a qualitative analysis is performed and no data are provided for substantiation. While Boeing has bird shock requirements for the LRUs listed in an internal "Equipment Vibration Requirement" document, the vibration level was taken from a MIL spec for crash load and not from any bird strike test data. This proposed CM appears to require a test for shock -- a new requirement that possibly future airplane programs would have to step up to.	Rewrite this section to state that acceptable substantiation methods include qualitative analysis supported by equipment qualification testing based on industry standard shock tests, such as RTCA/D0-160 for crash safety.		Yes	Not accepted	EASA is reluctant to prescribe any detailed acceptable means of compliance for this particular issue. Previous compliance by applicants has ranged from performing full-scale bird impact test on fully equipped forward fuselage sections (including cockpit) to the more qualitative analysis (supported by service experience) described in the comment. A case by case assessment of the aircraft and systems installed would be needed to define the necessary level and amount of substantiation required.
55	*Boeing Commercial Airplanes*	3.1 (3)	7	The proposed text states: *"(3) If contrary to item (2) above it can not be shown that under the conditions of CS 25.631 bird penetration or part loss does not occur in (some of) the aircraft areas/zones identified as prone to bird strike, the following should also be demonstrated for those areas/zones: ..."* *EDITORIAL COMMENT:* As written, the text is confusing.	Reword this requirement (if retained) to remove the multiple negatives (i.e., "*If contrary...can not be shown...does not occur…*").	Yes		Accepted	The subject sentence has been rewritten to remove the multiple negatives, whilst maintaining the same intent.

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
56	*Boeing Commercial Airplanes*	3.1 (3)(b)	7	Potentially, no current or proposed transport category airplanes would meet this requirement for 4-lb. birds. Any guidance or requirement for "no penetration" is an escalation of the regulations, and the essence of the requirement is to retain the ability for CSFL. Trajectory analyses are indeed difficult to perform and validate. The manufacturer should be free to utilize any means to protect critical systems or mitigate damage to critical systems, and forward pressure bulkheads may be strengthened for this purpose. Despite these mitigations, there are areas where a bird can penetrate and cause injury to the crew.	Revise this requirement.		Yes	Not accepted	There is a large number of aircraft certificated by JAA/EASA that have actually demonstrated that birds (under the conditions specified in CS 25.631) will not enter the flight deck area. Sometimes local structure had to be reinforced to achieve this. As explained in the Certification Memorandum, EASA is very concerned about potential injury (or worse) to the flight crew, and therefore the Certification Memorandum strongly encourages applicants to prevent bird penetration into the flight deck area.
57	*Boeing Commercial Airplanes*	3.1 (3)(c)	7	The text states: *"(c) If the nose/radome area is penetrated, the structural effects of the air flow/dynamic pressure generated in the radome due to the hole imparted by the bird should be evaluated. Satisfactory structural performance of the radome, retention of the radome structure and aircraft supporting structure under these circumstances should be demonstrated. These considerations would also apply to large antenna or external radome installations;"* We have several comments on this text: **Comment 1.** There is no requirement to for non-penetration or retention of a radome following a bird strike, unless it leads to loss of ability for CSFL. Service experience resulting in penetration or loss of radome has not resulted in loss of CSFL. The accident cited was unique and involved an An-124 aircraft with ram air effects between the nose and the front bulkhead resulting in failure of an upward opening freight door.				Partially accepted	Refer to comment no. 22.
58	*Boeing Commercial Airplanes*	3.1 (3)(c)	7	**Comment 2.** Normally the air flow/dynamic pressure generated in the radome due to a bird strike is not calculated, nor required to be calculated.				Partially accepted	Refer to comment no. 22.
59	*Boeing Commercial Airplanes*	3.1 (3)(c)	7	**Comment 3.** Requiring the nose radome sustain or prevent birdstrike penetrations would be new for some models and seems like a questionable requirement for many designs.				Partially accepted	Refer to comment no. 22.
60	*Boeing Commercial Airplanes*	3.1 (3)(c)	7	**Comment 4.** The proposed guidance would seem to require substantiation that secondary structure (the nose radome) be retained if penetrated by a bird.	We suggest that the second sentence be revised to state: ***"....Satisfactory structural performance of the radome, retention of the radome structure and aircraft supporting structure under these circumstances should be demonstrated if continued safe flight and landing would be precluded by loss of the radome...."***		Yes	Partially accepted	Refer to comment no. 22.
61	*Boeing Commercial Airplanes*	3.1 (3)(d)	7	The effects of cabin pressurization release into the radome area due to a bird strike are normally not calculated, nor are required to be calculated.		Yes		Not accepted	This would only be necessary if the front pressure bulkhead would be penetrated under the bird impact conditions of CS 25.631, in which case EASA believes all relevant aspects and consequences should be considered, including pressurisation into the nose/radome area.

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
62	*Boeing Commercial Airplanes*	3.1 (3)(f)	8	This paragraph states *"... Fuel tank leaks due to bird strike in the vicinity or upstream path of heat sources (landing gears, engines) would normally not be considered acceptable."* As written, this guidance appears to be an escalation in requirements and is not based on any cited service history. Boeing maintains that a bird strike to fuel system components in the front spar is not catastrophic because this area is classified as a flammable leakage zone, where fuel can be present, and systems are designed to preclude ignition. The 4-lb. bird requirement ensures no fuel leak through the front spar. Further, CS 25.863 already requires addressing flammable fluid leaks.			Yes	Not accepted	Notwithstanding compliance with CS 25.863, fuel leakage near potential heat sources like engines and landing gears is not considered acceptable to EASA.
63	*Boeing Commercial Airplanes*	3.1 (3)(g)	8	The text states: *"(g) The effects on continued safe flight and landing of damage and subsequent release of debris resulting from bird impact should also be addressed, for example for flaps, landing gear doors and large antennas. The effects of such parts loss should not be catastrophic. This evaluation should include the effect of any debris impacting other parts of the aircraft (e.g. empennage area) and should consider any hazardous asymmetric conditions. Probabilistic arguments (for example the likelihood of debris impacting other parts of the aircraft based on past service experience) will not be accepted as the basis for ensuring continued safe flight and landing."* We have several comments on the effects of this proposed text: <u>Comment 1.</u> This proposed requirement may have a significant burden that is not substantiated by service history.				Not accepted	Refer to comment no. 39.
64	*Boeing Commercial Airplanes*	3.1 (3)(g)	8	<u>Comment 2</u>. The prohibition of allowing probabilistic arguments in determining the likelihood of debris impacting other parts of the airplane based on service experience seems extreme.				Accepted	The wording of the subject paragraph of the Certification Memorandum has been revised by removing the sentence about probabilistic arguments / analysis, and replacing it by a sentence allowing the use of multiple attachment points, engineering judgement and service experience (as noted in comment no. 65) to address this issue.
65	*Boeing Commercial Airplanes*	3.1 (3)(g)	8	<u>Comment 3.</u> It is not rational to exclude probabilistic considerations in considering the likelihood of debris impacting other parts of the aircraft. Service experience and engineering judgment have generally been used to define likely trajectories to be considered and this has resulted in safe designs in the past. For example, service experience combined with engineering judgment would lead to a conclusion that it is extremely improbable for a departing underwing fairing door hinged on the body centerline to impact the tip of the fin on most airplane designs. In addition, many regulations require probabilistic safety analysis for compliance and EASA has not established why use of probability is not safe for this particular analysis.				Accepted	Refer to comment no. 64.

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
NR	Author	Section, table, figure	Page						
66	*Boeing Commercial Airplanes*	3.1 (3)(g)	8	Comment 4. Collateral damage from a bird strike and debris release should be assessed on a case by case basis. [Boeing has considered collateral damage on a case-by-case basis (for a broadband antenna for instance).] Design features, such as multiple attachment points on high lift movable surfaces, serve to minimize the release of large debris, and service history supports this approach.	Remove the sentence beginning "*Probabilistic arguments….*"		Yes	Accepted	Refer to comment no. 64.