

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
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1	FAA	3.3		<p>“... the probability of debris fatally hitting people is in the order of magnitude of 1E-3”.</p> <p>I was just reading a paper published by the AIAA Atmospheric Flight Mechanics Conference and Exhibit, 15-18 August 2005, AIAA 2005-6506, “Modelling of Risk to Aircraft from Space Vehicle Debris” by Steven L. Carbon and Erik W.F. Larson. In the paper they mention that the Space Shuttle Columbia disaster resulted in 75,000 pieces of the debris being recovered, about 1/3 of the orbiter. Easily more than 100,000 pieces of debris were scattered over a wide area. No one was hit by any of the pieces, so it could be concluded that the probability of being hit by the debris from that disaster was demonstrated to be less than 1E-5.</p>	A precise value for “the probability of debris fatally hitting people” as used in CM-21.A-A-001 cannot be provided, but it appears that it is much smaller than 1E-3. Something for you to consider.	Yes	No	Noted	<p><b>EASA Comment:</b></p> <p><i>The order of magnitude herein specified is a result of the methods currently applied by some manufacturers in the framework of CAW PDA event assessment. It is considered sufficiently conservative. Nevertheless, this consideration might be taken into account for the refinement of future calculations.</i></p>
2	Boeing	1.3	3	<p>Abbreviations missing. Add meanings for <i>ELT</i>, <i>DFDR</i>, <i>CVR</i>, <i>GM</i>.</p>	These abbreviations are used in the text of the CM but are not defined in the Abbreviation table. Defining these abbreviations will add clarity to the document.	Yes	No	Agreed	<p><b>EASA Comment:</b></p> <p><i>Abbreviations added</i></p>
3	Boeing	2	4	<p>“2. Background ... The objective of the CM is to provide criteria to help applicants determine whether a PDA is an unsafe condition or not.”</p> <p><b>REQUESTED CHANGE:</b> We request changes to the text as follows: “2. Background ... The objective of the CM is to provide criteria to help applicants/<b>operators</b> determine whether a PDA is an unsafe condition or not.”</p>	The CM needs to distinguish the roles and effects between the applicant and operator. There may be actions done by an operator during maintenance that are inconsistent with the applicants published requirements that can lead to unsafe conditions.	No	Yes	Partially agreed	<p><b>EASA Comment:</b></p> <p><i>The CM is addressed to DA holders and any other party that applies Part 21.A.3B for the determination of an unsafe condition.</i></p> <p><i>See also ID# 36</i></p>

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4	Boeing	3.1	5	<p><i>"3.1 Objective</i> ... <i>It is important to emphasize that, in the context of this document, PDA events are considered as an unintentional loss of parts within the framework of Continued Airworthiness. Although no unsafe condition for the aeroplane exists in some cases of PDA, in general, it is not acceptable to allow failures that result in loss of a part as design criteria for mitigating certain failure cases in Initial Airworthiness, for which this CM does not apply. Loss of parts should be prevented as much as possible."</i></p> <p><b>REQUESTED CHANGE:</b> We request changes to the text as follows: <i>"3.1 Objective</i> ... <i>It is important to emphasize that, in the context of this document, PDA events are considered as an unintentional loss of parts within the framework of Continued Airworthiness. Although no unsafe condition for the aeroplane exists in some cases of PDA, in general, it is not acceptable to allow failures that result in loss of a part as design criteria for mitigating certain failure cases in Initial Airworthiness, for which this CM does not apply. Loss loss of parts should be prevented as much as possible."</i></p>	<p>We believe this statement is inaccurate and should be removed to avoid confusion. There are several cases of part loss as part of initial airworthiness – FBO (fan blade out), Gear separation, blow out panels, etc.</p> <p>Moreover the CM is not to impose new certification requirements, this statement is also contrary to failure cases allowed in the initial airworthiness design criteria.</p>	No	Yes	Partially agreed	<p><b>Text changed:</b></p> <p>‘This CM may be used only to assess PDA events in the framework of Continued Airworthiness. Although some PDA scenarios mentioned in this CM could be acceptable based on the observed rate of parts loss per FH, in general, the loss of parts should be prevented as much as possible.</p> <p>This CM does not contradict certain accepted Initial Airworthiness requirements that address scenarios where parts are assumed to fail and depart from the aeroplane (e.g. fan blade loss, landing gear separation).’</p> <p><b>EASA Comment:</b></p> <p><i>This CM does not impose new certification requirements, on the other hand its aim it is not to be adopted as a means to allow failure cases in Initial Airworthiness that are seen as design criteria. In order to prevent this possible interpretation, this concept has to be kept.</i></p>

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5	Boeing	3.2 Scenario 1 para 2	5	<p><i>"3.2. SCENARIO 1: Damage to the aeroplane itself</i> ... <i>...If the likelihood of compromising the structural integrity of all potentially impacted parts can be demonstrated to be extremely improbable, (i.e. less than 1E-9/FH), the unsafe condition may be discarded..."</i></p> <p><b>REQUESTED CHANGE:</b> We request changes to the text as follows: <i>"3.2. SCENARIO 1: Damage to the aeroplane itself</i> ... <i>...If the likelihood of compromising the structural integrity of all potentially impacted parts can be demonstrated to be extremely improbable, (i.e. less than 1E-9/FH), the unsafe condition <del>may be discarded</del> meets an acceptable level of risk..."</i></p>	Clarification as a showing of the probability should be documented and to discard the hazard would be to completely remove the hazard.	No	Yes	Agreed	<b>EASA comment:</b> <i>Text removed.</i>

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6	Boeing	3.2 Scenario 1, paragraph 3	5	<p><i>"3.2. SCENARIO 1: Damage to the aeroplane itself</i></p> <p><i>... PDA may prevent the safe completion of the flight. The typical scenario is any PSE or essential system being hit by the departed part, with the consequent prevention of its intended function and impairment of the aeroplane safe flight and landing, with potential injuries on occupants and/or flight crew."</i></p> <p><b>REQUESTED CHANGE:</b> We request changes to the text as follows:</p> <p><i>"3.2. SCENARIO 1: Damage to the aeroplane itself</i></p> <p><i>... PDA may prevent the safe completion of the flight. The typical scenario is any PSE or essential system being hit by the departed part, with the consequent prevention of its intended function and impairment of the aeroplane safe flight and landing, with potential injuries <del>on</del> to occupants and/or flight crew."</i></p>	Readability	Yes	No	Noted	<b>EASA Comment:</b> <i>Text removed.</i>

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7	Boeing	Section 3.2 paragraph 3	5-6	<p><i>"3.2. SCENARIO 1: Damage to the aeroplane itself</i> ... <i>As per AMC 25.1309, any failure condition, which would result in multiple fatalities, usually with the loss of the aeroplane, are classified as catastrophic (CAT). The safety objective associated with a CAT event is satisfied if the probability of occurrence per FH is less than 1E-9.</i></p> <p><b>REQUESTED CHANGE:</b> We request changes to the text as follows: <i>"3.2. SCENARIO 1: Damage to the aeroplane itself</i> ... <i>As per AMC 25.1309, any failure condition, which would result in multiple fatalities, usually with the loss of the aeroplane, are is classified as catastrophic (CAT). In addition, as per AMC 25.1309, any failure condition which would result in serious or fatal injury to a relatively small number of the occupants other than flight crew, is classified as Hazardous (HAZ). The safety objective associated with a CAT event is satisfied if the probability of occurrence per FH is less than 1E-9. The safety objective associated with a HAZ event is satisfied if the probability of occurrence per FH is less than 1E-7.</i></p>	The intent of our proposed suggestion is to include a personal injury concern for if the fuselage is impacted, resulting in serious or fatal injury to a relatively small number of occupants where the continued safe flight and landing is not compromised.	No	Yes	Agreed	<p><b>Text changed:</b> 'As per AMC 25.1309, any failure condition, which would result in multiple fatalities, usually with the loss of the aeroplane, is classified as catastrophic (CAT). In addition, as per AMC 25.1309, any failure condition which would result in serious or fatal injury to a relatively small number of the occupants other than flight crew, is classified as Hazardous (HAZ). The safety objective associated with a CAT event is satisfied if the probability of occurrence per FH is less than 1E-9. The safety objective associated with a HAZ event is satisfied if the probability of occurrence per FH is less than 1E-7.'</p>

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8	Boeing	3.2 first paragraph	6	<p>"3.2. SCENARIO 1: Damage to the aeroplane itself</p> <p>...</p> <p>...The probability of a PDA impacting the aeroplane(s) depends on the trajectory that the released part will follow and the potential damage that a PDA impacting the aeroplane can cause depends on the force with which it may impact the aeroplane."</p> <p><b>REQUESTED CHANGE:</b> We request changes to the text as follows:</p> <p>"3.2. SCENARIO 1: Damage to the aeroplane itself</p> <p>...</p> <p>...The probability of a PDA impacting the aeroplane(s) depends on the trajectory that the released part will follow, <del>and</del> the potential damage that a PDA impacting the aeroplane can cause <del>depends on</del> and the force with which it may impact the aeroplane."</p>	Sentence is confusing as written. Propose rewording to improve clarity.	Yes	No	<b>Not Agreed</b>	<p><b>EASA comment:</b></p> <p>The current text is considered to be accurate: the probability of an impact depends on the trajectory, and the potential damage depends on the force.</p>
9	Boeing	3.2 second paragraph	6	<p>"3.2. SCENARIO 1: Damage to the aeroplane itself</p> <p>...</p> <p>The combination of part trajectory and impact energy should therefore be considered when assessing side effects of PDA. The following aspects may be taken into account:"</p> <p><b>REQUESTED CHANGE:</b> We request changes to the text as follows:</p> <p>"3.2. SCENARIO 1: Damage to the aeroplane itself</p> <p>...</p> <p>The combination of part trajectory, <b>part orientation</b>, and impact energy should therefore be considered when assessing side effects of PDA. The following aspects may be taken into account:"</p>	Part orientation at impact (edge vs flat, for example) has a significant influence on the nature of the damage	No	Yes	<b>Agreed</b>	<p><b>Text changed:</b></p> <p>'The combination of the trajectory of the part, the orientation of the part, and its impact energy should therefore be considered when assessing side effects of PDA. The following aspects may be taken into account:'</p>



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10	Boeing	3.2A third bullet	6	<p>“3.2. SCENARIO 1: Damage to the aeroplane itself ... A... • Non-lifting high-mass lost parts may not present a risk of hitting the aeroplane if the trajectory is mainly determined by gravity, or if the starting location on the aeroplane is such that the detached part is unlikely to damage the aeroplane.”</p> <p><b>REQUESTED CHANGE:</b> We request changes to the text as follows: “3.2. SCENARIO 1: Damage to the aeroplane itself ... A... • Non-lifting high-mass lost parts may not present a risk of hitting the aeroplane if the trajectory is mainly determined by gravity, or if the starting location on the aeroplane is such that the detached part is unlikely to <del>damage</del> <b>impact</b> the aeroplane.”</p>	We think, the word “damage” should be replaced with “impact”. This bullet is talking about relative position of departing part and the probability of an impact. The word "damage" does not seem applicable in this statement.	Yes	No	Agreed	<p><b>Text changed:</b></p> <p>‘• Non-lifting high-mass lost parts may not present a risk of hitting the aeroplane if the trajectory is mainly determined by gravity, or if the starting location on the aeroplane is such that the detached part is unlikely to impact the aeroplane.’</p>

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11	Boeing	3.2B	6	<p>“3.2. SCENARIO 1: Damage to the aeroplane itself ... B... • An estimation of the impact energy based on an estimation of the maximum relative impact speed and mass of the detached part • Estimation of impact angle and worst orientation of part • Estimation of the worst possible extent of the damage • Statistical analysis or in-service data used to substantiate the likelihood of a certain level of damage”</p> <p><b>REQUESTED CHANGE:</b> We request adding a sentence before or after the bullet list that states:  “Conventional analysis is sufficient in most cases. Detailed dynamic modelling is not a requirement.”</p>	<p>If this combined estimation does not show that the effect on structural integrity or system functionality is acceptable, then engineering judgement <b>or analysis along with a probabilistic assessment</b> should be applied for taking into consideration shape and size, mass distribution of the part, <b>orientation at impact</b>, potential impacted zone and trajectory</p>	No	Yes	<b>Partially Agreed</b>	<p><b>Text changed:</b> ‘The potential damage depends on the energy of the detached part, the impact angle, the geometrical and material properties of the detached part, and on the characteristics of the impacted area itself. Conventional analysis is sufficient in most cases. Detailed dynamic modelling may not be required’</p> <p><b>EASA comment :</b> The requested change has been implemented in a different part of the document.</p>



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12	Boeing	First paragraph after 3.2B	6	<p><i>"3.2. SCENARIO 1: Damage to the aeroplane itself</i> ... <i>B...</i> <i>In general the maximum energy of impact of a detached part can be conservatively estimated by considering the maximum estimated relative speed of the part and its mass."</i></p> <p><b>REQUESTED CHANGE:</b> We request adding one more sentence to the text as follows: <i>"3.2. SCENARIO 1: Damage to the aeroplane itself</i> ... <i>B...</i> <i>In general the maximum energy of impact of a detached part can be conservatively estimated by considering the maximum estimated relative speed of the part and its mass. This is clearly a conservative estimation since the relative speed of the part is dependent on the PDA drag coefficient during its travel from departure point to impact point."</i></p>	To allow understanding that the maximum estimated relative speed of the part is dependent on the profile it presents to the airstream.	No	Yes	Partially Agreed	<p><b>Text changed:</b></p> <p>‘In general, the maximum energy of impact of a detached part can be conservatively estimated by considering the maximum estimated relative speed of the part and its mass. This is a conservative estimation since the relative speed of the part is dependent on the drag coefficient of the PDA during its travel from the departure point to the impact point.’</p>

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13	Boeing	Second paragraph after 3.2B	6	<p><i>"3.2. SCENARIO 1: Damage to the aeroplane itself ... B... If this combined estimation does not show that the effect on structural integrity or system functionality is acceptable, then engineering judgement should be applied for taking into consideration shape and size, mass distribution of the part, potential impacted zone and trajectory."</i></p> <p><b>REQUESTED CHANGE:</b> We request changes to the text as follows: <i>"3.2. SCENARIO 1: Damage to the aeroplane itself ... B... If this combined estimation does not show that the effect on structural integrity or system functionality is acceptable, then engineering judgement or analysis along with a probabilistic assessment should be applied for taking into consideration shape and size, mass distribution of the part, orientation at impact, potential impacted zone and trajectory."</i></p>	<p>Part orientation at impact (edge vs flat, for example) has a significant influence on the nature of the damage. Energy should be included as the part's speed is conditional to orientation while in flight.</p> <p>Analysis from Aerodynamics for probable trajectories can be effective and this includes looking at probable orientations when assessing the resulting damage state.</p>	No	Yes	Noted	<p><b>EASA comment:</b> <i>Text removed</i></p>

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14	Boeing	Note after 3.2B	6	<p>"3.2. SCENARIO 1: Damage to the aeroplane itself ... B... Note: Some approval holders may wish to use existing bird strike compliance demonstrations as part of their assessment. As the impact dynamics for a bird versus a part impacting an aircraft are generally different in terms of density, body shape and consistency, a simple comparison of the energy level involved in the PDA event with the one defined in the bird strike requirements is not considered as a sufficient substantiation for assuring the impact will not prevent continued safe flight and landing."</p> <p><b>REQUESTED CHANGE:</b> We request changes to the text as follows: "3.2. SCENARIO 1: Damage to the aeroplane itself ... B... Note: Some approval holders may wish to use existing bird strike compliance demonstrations as part of their assessment. <b>Care must be taken to ensure the specific PDA event under consideration is easily enveloped by existing bird strike data.</b> As the impact dynamics for a bird versus a part impacting an aircraft are generally different in terms of density, body shape and consistency, a simple comparison of the energy level involved in the PDA event with the one defined in the bird strike requirements <del>is not considered</del> as a <b>may not be</b> sufficient substantiation for assuring the impact will not prevent continued safe flight and landing."</p>	There are scenarios where small parts (size and weight) are easily enveloped by the bird strike requirement, and should be given consideration when evaluating relative damage risk. For example, a sandwich panel weighing less than one pound liberates from the airframe, engineering judgment could be used to avoid extensive analysis.	No	Yes	<b>Not agreed</b>	<p><b>Text changed:</b> 'Note: some approval holders may wish to use existing bird strike compliance demonstrations as part of their assessment. As the impact dynamics for a bird versus a part impacting an aeroplane are generally different in terms of their densities, body shapes and consistencies, only a simple comparison of the energy level involved in the PDA event with the one defined in the bird strike requirements is not considered to be a sufficient substantiation for assuring that the impact will not prevent continued safe flight and landing.'</p> <p><b>EASA comment:</b> The Boeing example case (of a frangible sandwich panel weighing less than one pound) may be acceptable, but the assessment already includes more than just weight and impact speed, or energy. In the example case, also the frangibility (the behaviour of a part when impacting the airframe) is considered, which is in line with the intent of this paragraph. If the one pound part had been made of solid metal, the outcome of the assessment would have been different.</p>

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15	Boeing	3.3	7	<p>"3.3. SCENARIO 2: People on ground ...In the context of this CM, serious or fatal injuries of few people on ground is considered being a Hazardous repercussion, even if people on ground are not 'taking the risk' of travelling on the aeroplane..."</p> <p><b>REQUESTED CHANGE:</b> We request changes to the text as follows:</p> <p>"3.3. SCENARIO 2: People on ground ...In the context of this CM, serious or fatal <del>injuries</del> <b>injuries to a person or a small number of people</b> of few people on ground is considered being a Hazardous repercussion, even if people on ground are not 'taking the risk' of travelling on the aeroplane..."</p>	Spelling error correction and clarification	Yes	No	Agreed	<p><b>Text changed:</b></p> <p>'In the context of this CM, serious or fatal injuries to a person or a small number of people on the ground are considered to be events with hazardous consequences, ref. to AMC CS25.1309, extrapolating the severity definitions as per AMC 25.1309 for people on the aeroplane to people who were not travelling on the aeroplane.'</p>
16	Boeing	3.3	7	<p>"3.3. SCENARIO 2: People on ground ...</p> <ul style="list-style-type: none"> <li>The density of population, with reasonable correction factors related to time exposure and shielded arrangements.</li> </ul> <p><b>REQUESTED CHANGE:</b> We request adding a definition of "shielded arrangement"</p>	It is not clear what it is the specific definition of shielded arrangements. This need to be clearly defined in order to avoid confusion or interpretations.	No	Yes	Agreed	<p><b>Text changed:</b></p> <p>'The density of population, with reasonable correction factors related to time exposure and shielding such as being indoors and shielded by, for example, buildings, or being on a means of transportation.</p>

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17	Boeing	Section 3.3 paragraphs 5 and 6	7	<p>"3.3. SCENARIO 2: People on ground ...</p> <p>Following the different methods, the result is that the probability of debris fatally hitting people is in the order of magnitude of 1E-3 and, therefore, in order to meet a target of 1E-7 occurrences-per-FH the probability of losing a part per FH would need to be less than 1E-4.</p> <p>Data retrieved from several large aeroplane manufacturers have been analysed. These data show a rate of loss of parts in the range of 1E-6/FH, resulting in an overall risk to people on the ground substantially lower than the proposed objective."</p> <p><b>REQUESTED CHANGE:</b> We request changes to the text as follows:</p> <p>"3.3. SCENARIO 2: People on ground ...</p> <p>Following the different methods, the result is that the probability of <del>debris</del> fatally hitting people is in the order of magnitude of 1E-3 and, therefore, in order to meet a target of 1E-7 occurrences-per-FH the probability of losing a <b>single</b> part per FH would need to be less than 1E-4.</p> <p>Data retrieved from several large aeroplane manufacturers have been analysed. These data show a rate of loss of <b>a single</b> parts in the range of 1E-6/FH, resulting in an overall risk to people on the ground substantially lower than the proposed objective</p>	Our suggestion should clarify the rate is for an individual part.	No	Yes	Agreed	<p><b>Text changed:</b></p> <p>'Following the different methods, the result is that the probability of fatally hitting people is in the order of magnitude of 1E-3 and, therefore, in order to meet a target of 1E-7 occurrences-per-FH the probability of losing a single part per FH would need to be less than 1E-4.</p> <p>Data retrieved from several large aeroplane manufacturers have been analysed. These data show a rate of loss of parts that is between 1E-6/FH and 1E-5/FH, resulting in an overall risk to people on the ground that is substantially lower than the proposed objective.'</p>

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18	Boeing	Last paragraph of Section 3.3	8	<p><i>"3.3. SCENARIO 2: People on ground ...</i></p> <p><i>A reassessment by the DA holder of a specific PDA case is expected when parts being lost with a probability per FH an order of magnitude above the rates currently observed in the field."</i></p> <p><b>REQUESTED CHANGE:</b> We request this paragraph be deleted.</p>	This paragraph is not necessary as it conflicts directly with the paragraphs which state the risk that a PDA causes an accident of another aeroplane is generally considered negligible.	No	Yes	<b>Not agreed</b>	<p><b>Text changed:</b></p> <p>‘A reassessment by the DA holder of a specific PDA case for a potential unsafe condition is expected when the loss of a specific part has a probability rate per FH that is significantly higher than the average probability rate, which is between 1E-6/FH and 1E-5/FH, as currently observed in the field.’</p> <p><b>EASA comment:</b></p> <p><i>The conclusion that the risk of PDA causing an accident on another aeroplane (or fatally injuring people on the ground) is deemed within acceptable limits is obtained by taking assumptions. In particular, assumptions are made on the rate of occurrence of PDA. The currently observed rate of PDA is in the order of 1E-6 to 1E-5 per FH. If, for a specific part, there were an increase in the order of magnitude of the rate of the part being lost, a reassessment of the situation for this specific part would be needed in order to confirm that the conclusions were not changed.</i></p>



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19	Boeing	3.4	8	<p>"3.4. SCENARIO 3: Damage to other aeroplanes/parts on the runway ...</p> <p>Moreover, requirement CS 25.734 was introduced at Amendment 14 to reduce the risk to an agreed and acceptable level in cases of damaging effects on systems or structures due to wheel or tyre failures that are caused by a FOD."</p> <p><b>REQUESTED CHANGE:</b> We request clarification to this sentence</p>	It should be made clear that this helps mitigate the risk to following aircraft due to FOD on the runway	Yes	No	Partially Agreed	<p><b>Text changed:</b></p> <p>'In terms of actions to address the threat from runway debris, in 2013, EASA published NPA 2013/02 that considered the need for new certification standards for protection of large aeroplanes against certain categories of threats, i.e. tyre and wheel failure, small engine debris and runway debris.</p> <p>The Working Group involved in the preparation of the NPA reviewed existing threat models, outcomes of studies and in-service occurrences. With specific reference to runway debris (which may include PDA), the most frequent risk identified was damage to tyres and engines, the consequences of which were considered in the NPA to be adequately addressed by the proposed requirements to consider tyre, wheel and engine debris threats; subsequently introduced under CS 25.734 in CS-25 Amdt 14. Of the other risks presented to aeroplanes by runway debris, no events were identified that caused injury. The working group considered that the protection afforded against tyre and wheel debris by the proposed requirements would also indirectly provide robustness and protection against runway debris thrown up by contact with the tyres. However, notwithstanding the potential safety benefits of the proposed threat models for wheel and tyre debris and engine debris, the NPA also recommended that airports improve FOD prevention as a complement to their current disposition of ICAO Annex 14.</p> <p>As a result, in order to support the current satisfactory safety record and although the above assessments indicate an unsafe condition will not usually result from runway debris consisting of PDA, it is recommended that DA holders pay particular attention to preventing occurrences of PDA when the parts are prone to loss in the take-off and landing phases and of a nature that could cause tyre or engine damage.'</p>

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20	Boeing	Section 4 paragraph 1	8	<p>"4. Conclusion In case of PDA events, given the usual observed rates of parts loss per FH, the risk of damages to third parties does not need specific assessment. The DA holder should reassess any PDA scenario, in which the assumptions made that support this conclusion may be invalidated. In addition, the DA holders are expected to present yearly to EASA that the rate of PDA remains in the range of 1E-6/FH per aeroplane type."</p> <p><b>REQUESTED CHANGE:</b> We request changes to the text as follows:</p> <p><i>In case of PDA events, given the usual current observed rates of parts loss per FH, the risk of damages to third parties persons on the ground or other aeroplanes does not need specific assessment. However, if the assumptions made that supports the conclusion that damages to persons on the ground or other aeroplanes are invalidated, the DA holder should reassess damages to persons on the ground or other aeroplanes PDA scenarios. any PDA scenario, in which the assumptions made that support this conclusion may be invalidated. In addition, the DA holders are expected to present yearly to EASA that the rate of PDA remains in the range of 1E-6/FH per aeroplane type."</i></p>	<p>Boeing do not agree with the last sentence implies a reporting requirement provided by a Certification Memorandum. There is not a regulatory requirement that mandates this type of reporting. The CM does not provide any additional information on the source of this expectation. This sentence is not consistent with the text provided on the cover page of this CM, "...Certification memoranda are provided for information purposes only ... are not intended to introduce new certification requirements..."</p> <p>We also believe the paragraph could be better structured to provide a clear message and a consistent use of previous terminology.</p>	No	Yes	Partially Agreed	<p><b>Text changed:</b></p> <p>'In PDA events, given the current observed rates of loss of parts per FH, the risk of injuries to persons on the ground or damage to other aeroplanes is considered to be 'acceptable' (AMC 21.A.3B(b)) under the assumptions taken for this analysis, and does not constitute an unsafe condition as per 21.A.3B(b). No specific assessment is expected unless a specific part shows a rate of loss per FH that is significantly higher than the average PDA rate that is currently observed in the field. In this latter case, the DA holder is expected to reassess the situation and to report if it is considered to be potentially unsafe (i.e. if the rate of loss per FH of this individual part is such that the conclusions of this CM, in terms of the existence or not of a potential unsafe condition, are invalidated).'</p> <p><b>EASA comment:</b></p> <p><i>If individual parts are lost too often (i.e. the rate of loss is significantly higher than the average), the assumptions need to be reassessed and the case reported as potentially unsafe, if it were the case, but no report will be requested to be presented.</i></p>
21	GE Aviation	1.3	3, 4	<p>It would be useful to include in the list of abbreviations all abbreviations that are used in the document. Several are missing including CVR, DFDR, ELT, &amp; GM.</p>	<p>Include in the list of abbreviations all abbreviations that are used in the document.</p>	Yes	No	Agreed	See NR #2

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22	GE Aviation	3.2	5	Second paragraph, third sentence: “the unsafe condition may be discarded” does not seem appropriate.	Change to “an acceptable level of risk is met”. Alternately, as a minimum, change “discarded” to “disregarded”.	Yes	No	Agreed	<b>Text changed :</b> ‘In order to conclude that a potential unsafe condition, based on the hazard, is not unsafe based on the level of risk, it has to be shown, for both effects, that they meet the proper associated safety objectives.’
23	GE Aviation	3.2	5	Third paragraph, first sentence: “with potential injuries on occupants” is stated incorrectly.	Change to “with potential injuries to occupants”.	Yes	No	Agreed	See NR#6
24	GE Aviation	4	8	First paragraph, third sentence: “per aeroplane type” is open to various interpretations.	Suggested rewording: “the rate of all PDA by a DA holder remains in the range of 1E-6/FH for each major aeroplane model”.	Yes	No	Not Agreed	See ID#20
25	GE Aviation			This CM is silent on parts departing the engine flowpath through the exhaust.	It would be helpful if the CM specifically stated that parts or fragments exiting through the engine exhaust are not required to be reported annually or have collective rates calculated since these parts are small and numbers will be unknown for any given engine flowpath event.	Yes	No	Noted	<b>EASA comment:</b> <i>In the final version, there will be a better explanation about the PDA cases reportable by DA holders. Related to engines, a distinction is explained within the CM regarding the departing velocity of PDA. ‘This CM covers the cases of parts that become detached from the aeroplane with no or low initial relative speed to the aeroplane.’</i> <u>Cases, such as those of high energy rotating parts that depart from the engine and from the engine exhaust, fall outside the perimeter of this CM.</u>
26	Embraer S.A.	3.1	5	On Section 3.1, the CM proposal states “it is not acceptable to allow failures that result in loss of a part as design criteria for mitigating certain failure cases”. Although this statement is reasonable for big parts detachment, the application of this statement for any part is not reasonable. For example, for small access panels it is not reasonable to provide a failsafe structure, such as increasing the number of hinges or number of latches. A criteria should be defined to allow non-fail structure based on the PDA weight and location on the aeroplane.	The expression "certain failure cases" should be clarified and better defined on Section 3.1 of this proposed CM-21.A-A-001 Issue 01.	Yes	No	Not agreed	See ID#4

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27	ATR/DASSAULT AIRBUS	3.2	6	The combination of part trajectory and impact energy should therefore be considered when assessing side effects of PDA. The following aspects may be taken into account: ..... If this combined estimation does not show that the effect on structural integrity or system functionality is acceptable, then engineering judgement should be applied for taking into consideration shape and size, mass distribution of the part, potential impacted zone and trajectory.	If this <b>engineering judgement</b> does not show that the effect on structural integrity or system functionality is acceptable, then <b>combined estimation</b> should be applied for taking into consideration shape and size, mass distribution of the part, potential impacted zone and trajectory.  The combination of part trajectory and impact energy should therefore be considered when assessing side effects of PDA. The following aspects may be taken into account: ..... Industry thinks that for most of the cases, engineering judgement may prevent undue calculation, but of course need to be shared with EASA specialist.	No	Substantive	<b>Partially agreed</b>	<b>EASA comment:</b> See ID#13
28	ATR/DASSAULT AIRBUS	3.3	7	Data retrieved from several large aeroplane manufacturers have been analysed. These data show a rate of loss of parts in the range of 1E-6/FH,	Data retrieved from several large aeroplane manufacturers have been analysed. These data show a rate of loss of parts in the range of <b>1E-5/FH</b> ,  Industry reminds that current figures are between 10-6 and 10-5	No	Substantive	<b>Partially agreed</b>	<b>Text changed:</b> 'between 1E-6/FH and 1E-5/FH,'
29	ATR/DASSAULT AIRBUS	3.4	8	As mentioned in Scenario #2, EASA has retrieved information on the parts lost from some European manufacturers, obtaining a rate of detached part in the range of 1E-6/FH.	As mentioned in Scenario #2, EASA has retrieved information on the parts lost from some European manufacturers, obtaining a rate of detached part in the range of <b>1E-5/FH</b> .  Industry reminds that current figures are between 10-6 and 10-5	No	Substantive	<b>Partially agreed</b>	<b>Text changed:</b> 'between 1E-6/FH and 1E-5/FH,'

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30	ATR/DASSAULT/ AIRBUS	3.3	7	The conclusion is that the likelihood of fatally injuring people on the ground due to a PDA event is conservatively estimated to be close to the objective set in CS 25.1309 for system failures with catastrophic effect, i.e. 1E-9/FH and can therefore be considered acceptable.	The conclusion is that the likelihood of fatally injuring people on the ground due to a PDA event is conservatively estimated to be close to the objective set in CS 25.1309 for system failures with catastrophic effect, i.e. 1E-9/FH and can therefore be considered acceptable <b>regarding the objective to impact people on ground of 10-7.</b>  Industry reminds the safety objectives are 10-7 (HAZ).	No	Substantive	<b>Agreed</b>	<b>Text changed:</b>  'The conclusion is that the likelihood of fatally injuring people on the ground due to a PDA event is conservatively estimated to be close to the objective set in CS 25.1309 for system failures with a catastrophic effect, i.e. 1E-9/FH, and can therefore be considered to be acceptable regarding the probability objective of 1E-7/FH for impacting people on the ground. '

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31	ATR/DASSAULT AIRBUS	4	9	<p>....the DA holders are expected to present yearly to EASA that the rate of PDA remains in the range of 1E-6/FH per aeroplane type.</p>	<p>Industry reminds that the risk for PDA is linked to:</p> <ul style="list-style-type: none"> <li>- Damage on Aeroplane itself</li> <li>- People on Ground</li> <li>- Damage on other aeroplane/parts on the runway.</li> </ul> <p>Considering people on ground, assessment done is the following:</p> <p>Following the different methods, the result is that the probability of debris fatally hitting people is in the order of magnitude of 1E-3 and, therefore, in order to meet a target of 1E-7 occurrences-per-FH the probability of losing a part per FH would need to be less than 1E-4.</p> <p>Data retrieved from several large aeroplane manufacturers have been analysed. These data show a rate of loss of parts in the range of 1E-6/FH, resulting in an overall risk to people on the ground substantially lower than the proposed objective.</p> <p>This target covering people on ground scenario only.</p> <p>Industry considers that the real target would 10-4 and not 10-6.</p> <p>Industry does not oppose to present the figures yearly as proposed but challenge the target of 10-6 that represents a ratio of 100 versus the safety objective acceptable.</p>	No	Substantive	Noted	See ID#20



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32	SNA			The Certification Memorandum specifies that data retrieved from multiple large aeroplanes manufacturer show that the rate for loss of parts is in the range of 1E-6/FH. For the DOA organizations which are not holders of a Type-Certificate approval, it may remain unclear what is considered to be a PDA. Is there a threshold (shape, size, mass) to consider a part as PDA? For example, are small parts like fasteners, piece of sealing, stickers etc. taken into account to determine the rate for loss of parts?				<b>Noted</b>	<p><b>EASA comment:</b></p> <p>There are no existing specific criteria to define a PDA. Any part lost from an aeroplane, during any phase, could be a PDA, since it could lead to an unsafe condition per AMC 21.A.3B(b). The intent of the CM is to define whether an unsafe condition can effectively occur. All the cited variables (shape, size, mass) definitely play a role, but there is no threshold that could be used for discriminating all the possible cases.</p> <p>In addition, DOA organisations (either TCH either non-TCH) hold an approval under which they are responsible for the Continued Airworthiness of the designs for which they hold an EASA approval.</p>
33	SNA	Scenario 3		<p>In scenario 3, a reassessment is required if parts are being lost and are determined to be most likely lost on runways. Safran Nacelles proposes that only a PDA of significant size/mass and that may cause damage to the engine or structure of another aeroplane or rotorcraft (whatever its size) should require such reassessment. Therefore, we propose the following modified text in § 3.4:</p> <p><i>“A reassessment by the DA holder of a specific PDA case is expected when parts that can reasonably be expected to cause damage to another aircraft are being lost with a probability per FH an order of magnitude above the rates currently observed in the field or when the part is specifically determined to be most likely to be lost on runways.</i></p>				<b>Noted</b>	<p><b>EASA comment:</b></p> <p>The comment is considered to be already implicit in the assessment required by the CM. Engineering judgement can automatically discard parts that are not expected to cause any damage to another aircraft.</p>

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34	SNA			Similarly, in § 4, the rule of rate of PDA that should remain in the range of 1E-6/FH seems too severe for very small PDA that do not represent a threat for other aircraft if lost on the runway. Therefore, we propose the following modified text : <i>"In case of PDA events, given the usual observed rates of parts loss per FH, the risk of damages to third parties does not need specific assessment. The DA holder should reassess any PDA scenario, in which the assumptions made that support this conclusion may be invalidated. In addition, the DA holders are expected to present yearly to EASA that the rate of PDA that can reasonably be expected to cause damage to another aircraft remains in the range of 1E-6/FH per aeroplane type.</i>				Noted	Same as ID#33.
35	SNA			Is the obligation to communicate to EASA the PDA rate also applicable to DA holders which are not TCH? Safran Nacelles as OEM & minor change and repairs DOA holder only has partial information to build any reliable data.				Noted	<b>EASA comment:</b>  <i>There is no obligation, as this CM has to be intended as a guideline. PDAs can be reportable by DOAs that are not the TCHs.</i>
36	Gulfstream	Section 2	4	The objective of the CM is to provide criteria to help applicants determine whether a PDA is an unsafe condition or not." This statement is ambiguous due to the use of the expression "a PDA". The statement could be interpreted to refer to the risk of PDA events in general, or to the risk of a specific actual PDA occurrence (hypothetical or real).	From the subsequent content of the CM, it is understood EASA intends the criteria to be applied to each potential PDA scenario identified for a type design, therefore alternative wording is proposed: "The objective of the CM is to provide criteria to help applicants determine whether each potential PDA identified for an aircraft model is an unsafe condition or not."	Yes	No	Partially Agreed	<b>Text changed:</b>  'The objective of the CM is to provide criteria to determine whether each potential PDA identified for an aeroplane model is an unsafe condition or not.'

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37	Gulfstream	Section 3	5	<p>“EASA Certification Policy”</p> <p>This section mixes EASA's research and analytical findings on the subject of PDA with policy on what EASA considers acceptable methods of determining the risk of PDA within a certification program.</p> <p>It is highly recommended that this content be separated, such that the research and analysis that forms the basis of the policy is separate from the policy itself - which is directive.</p>	Research and analysis findings could be moved to the 2. Background section, or a new separate	Yes	No	<b>Not agreed</b>	<p><b>EASA comment:</b></p> <p><i>The data provided in terms of research and analysis are used here as substantiation material. This section is deemed to be in the right location.</i></p>
38	Gulfstream	Section 3.1	5	<p>“The objective of this CM is to provide guidance, limited to large aeroplanes, for evaluating whether an unsafe condition exists in case of PDA events that can be applied by European large aeroplane(s) DA holders.”</p> <p>This phrase has similar ambiguity to the statement in Section 2.0. Also, the last phrase ("that can be applied by European large aeroplane(s) DA holders") relates to the substantive "guidance" but that relationship is not clear due to the grammatical structure of the sentence.</p>	<p>The following alternative wording is proposed:</p> <p>"The objective of this CM is to provide guidance, limited to large aeroplanes and that can be applied by European large aeroplane(s) DA holders, for evaluating whether each potential PDA event identified for an aircraft model is or is not an unsafe condition."</p>	Yes	No	<b>Agreed</b>	<p><b>Text changed:</b></p> <p>‘The objective of this CM is to provide guidance, limited to large aeroplanes, for evaluating whether each potential PDA event identified for an aeroplane model is, or is not, an unsafe condition.’</p>

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39	Gulfstream	Section 3.1	5	<p>In reference to, 3.1. Objective: This section needs clearer definition on the scope of intended application of the policy.</p> <p>The background section contains a list of examples ("doors, access panels, fairings, engine cowlings, fasteners, etc."), however objective criteria are necessary to define whether an item needs to be considered a potential PDA.</p>	<p>The following text is recommended to be added after the first paragraph of Section 3.1:</p> <p>"The potential risk associated to PDA should be analysed for all parts that could potentially depart the aircraft in foreseeable conditions. The following types of parts do not need to be considered as potential PDA:</p> <ul style="list-style-type: none"> <li>* Primary structures</li> <li>* Static (non-moving) structures attached with non-removable fasteners to primary structures or to other static structures; where these structures have been sized for normal and abnormal loads including any loads that may be generated by failure conditions not shown to be extremely improbable (i.e. less than 1E-9/FH)</li> <li>* Static (non-moving) structures attached with removable fasteners to primary structures or to other static structures; where these structures have been sized for normal and abnormal loads and shown to be retained under those conditions with any single removable fastener missing</li> <li>* Passive structures (movable structures that are not part of a power operated system and are not moved in flight) attached with hinges, stops, latches, or locks to primary structures or static structures; where these structures have been sized for normal and abnormal loads and shown to be retained under those conditions with any single latching or locking device disengaged or removed"</li> </ul> <p>* Parts that could only depart the aircraft as a result of conditions shown to be extremely improbable</p>	Yes		<b>Not agreed</b>	<p><b>EASA comment:</b></p> <p><i>The proposed list is too specific, and not in line with the CM philosophy that any part (including the ones on the proposed list) could potentially depart from an aeroplane. Therefore the exclusion of these parts is not deemed to be correct.</i></p>

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40	Gulfstream	Section 3.1	5	<p>“It is important to emphasize that, in the context of this document, PDA events are considered as an unintentional loss of parts within the framework of Continued Airworthiness. Although no unsafe condition for the aeroplane exists in some cases of PDA, in general, it is not acceptable to allow failures that result in loss of a part as design criteria for mitigating certain failure cases in Initial Airworthiness, for which this CM does not apply. Loss of parts should be prevented as much as possible.”</p> <p>This paragraph creates an undesirable discrepancy between acceptable standards for Continued Airworthiness and initial type certification of an aircraft model.</p> <p>While it is understood that there are situations where risk-based criteria may find a condition acceptable in service that is not acceptable for initial certification, in this case the CM addresses the actual observed effects of PDA and the conclusions should be equally valid for Continued Airworthiness and for Type Certification. It is understood that EASA does not consider it acceptable to deliberately design the aircraft to shed parts in flight under certain conditions. It is also understood that EASA intends for a "minimization of risks" design standard to be applied, similar to what is done in other cases where the risk cannot be entirely eliminated by practical means.</p>	<p>With these considerations, the following alternate wording is proposed:</p> <p>"The policy in this document may be used to assess PDA as part of Initial Airworthiness and Continued Airworthiness. It is important to emphasize that it is not acceptable to deliberately design parts to be released in flight as mitigation for a foreseeable condition. The design standard for PDA should be the minimization of risks, where practical means to prevent PDA are considered and applied."</p>	Yes	No	Not agreed	See ID#4

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41	Gulfstream	Section 3.2	5	<p>“In case of PDA an unsafe condition can be generated by”</p> <p>The following proposed text change introduces the probability aspect that is recommended to be removed in the subsequent paragraphs of this section.</p>	<p>Recommended text:</p> <p>"As per AMC 25.1309, any failure condition, which would result in multiple fatalities, usually with the loss of the aeroplane, are classified as catastrophic (CAT). The safety objective associated with a CAT event is satisfied if the probability of occurrence per FH is less than 1E-9 (extremely improbable). In cases where part detachment cannot be shown to be extremely improbable, an unsafe condition can be generated by (...)"</p>	Yes	No	Noted	<p><b>Text changed:</b></p> <p>‘In the case of a PDA, an unsafe condition can be generated by a direct effect of the detached part on the aeroplane, i.e. the loss of the function that this part provides; or by an indirect effect, i.e. an impact on other zones of the aeroplane.’</p>
42	Gulfstream	Section 3.2	5	<p>“If the likelihood of compromising the structural integrity of all potentially impacted parts can be demonstrated to be extremely improbable, (i.e. less than 1E-9/FH), the unsafe condition may be discarded.”</p> <p>Comment: Probabilistic assessment can be performed to determine the likelihood that a PDA scenario will occur (i.e. with what frequency is the part anticipated to detach from the aircraft), however there are no defined and accepted probabilistic methods to determine "likelihood of compromising structural integrity of all potentially impacted parts" once a PDA has occurred.</p>	<p>This text is recommended to be removed:</p> <p><del>“If the likelihood of compromising the structural integrity of all potentially impacted parts can be demonstrated to be extremely improbable, (i.e. less than 1E-9/FH), the unsafe condition may be discarded.”</del></p>	Yes	No	Agreed	<p><b>EASA comment:</b></p> <p>Text removed.</p>



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43	Gulfstream	Section 3.2	5,6	<p>“As per AMC 25.1309, any failure condition, which would result in multiple fatalities, usually with the loss of the aeroplane, are classified as catastrophic (CAT). The safety objective associated with a CAT event is satisfied if the probability of occurrence per FH is less than 1E-9. There are other cases for which the severity of the event can be different. These should be analysed on a case-by-case basis. The probability of a PDA impacting the aeroplane(s) depends on the trajectory that the released part will follow and the potential damage that a PDA impacting the aeroplane can cause depends on the force with which it may impact the aeroplane.”</p> <p>While this text is factually correct, probabilistic assessment would not be the appropriate method to address cases where PDA has been determined to be a foreseeable occurrence and the effects need to be determined.</p>	The recommended approach in this case is that if a part can plausibly detach, it should be assumed to detach and each potential impact location assessed for impact effects.	Yes	No	Noted	<p><b>EASA comment:</b></p> <p><i>The sentence coming after the paragraph isolated by the commenter expresses the difficulties in predicting such trajectories “[...] The trajectories cannot be easily predicted, whereas the impact energy may be conservatively estimated”. From this perspective the CM presents in ‘point A.’ the qualitative guidelines to be used in assessing the consequences of an impact. If no numerical values can be furnished for predicting the trajectory, the case has to be considered in the light of engineering judgement and the starting point is the assumption of the detachment of the part, and the related possible impact locations.</i></p>
44	Gulfstream	Section 3.2	6	<p>“Based on service experience typical PDA includes servicing doors or panels, lights, fairings, etc.”</p> <p>This text may be removed if the objective scope definition proposed in Section 3.1 is adopted.</p>	<p>This text is recommended to be removed.</p> <p><del>“Based on service experience typical PDA includes servicing doors or panels, lights, fairings, etc.”</del></p>	Yes	No	Not Agreed	<p><b>EASA comment:</b></p> <p>See #ID 39</p>
45	Gulfstream	Section 3.2	6	<p>“Although predicting the exact trajectories of detached parts is not generally possible. However, some acceptable assumptions are that:”</p>	Delete “Although”, grammatical error.	Yes	No	Agreed	
46	Gulfstream	Section 3.2	6	<p>“, or if the starting location on the aeroplane is such that the detached part is unlikely to damage the aeroplane”</p> <p>This clause does not have an objective criteria.</p>	<p>It is recommended that the text include the basis on which a part may be considered “unlikely to damage the airplane” or that this clause be removed.</p>	Yes	No	Partially agreed	<p><b>Text change:</b></p> <p>‘or if the starting location on the aeroplane is such that the detached part is unlikely to impact the aeroplane’</p> <p><b>EASA comment:</b></p> <p><i>The basis for considering the likelihood of impacting parts of the aeroplane that might compromise its continuous safe flight and landing is left to engineering judgement. In addition, designs that are currently in use are different from each other, so therefore it is not easy to draw up one single criterion.</i></p>

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47	Gulfstream	Section 3.2	6	"In any case the results of a search into historical data back to 1990, available at the Agency, show that all occurrences involving PDA have always been completed with uneventful landings and without serious or fatal injuries for the occupants."	Recommend adding: "Applicants may make reference to this service history when assessing the PDA risk of conventionally designed and located items on conventionally configured aircraft."	Yes	No	Partially agreed	<b>EASA comment:</b>  <i>This research has been done with information provided by TCH, operators' etc. that are stored within the EASA database and were available at the time of writing of this CM. DA holders may directly use the CM conclusions as a reference.</i>
48	Gulfstream	Section 3.4	8	" , except for parts which are exclusively operated during the take-off or landing runs, for example thrust reverser system. For these kind of parts the probability of loss cannot be reduced by any exposure time." Comment: Parts that are exclusively operated during takeoff and landing also have equally limited exposure time.	If these parts' failure rates are expressed per flight hour, it is equally appropriate to apply the limited exposure time when calculating the probability of occurrence. For parts with failure rates expressed per cycle, it would not be appropriate to apply an exposure time since the failure rate already accounts for the limited exposure.	No	Yes	Agreed	<b>EASA comment:</b> <i>Text removed.</i>
49	Gulfstream	Section 4	8	"In addition, the DA holders are expected to present yearly to EASA that the rate of PDA remains in the range of 1E-6/FH per aeroplane type." It should be noted that accuracy in OEM reporting relies on reporting of PDA incidents by the operator to the OEM. OEMs should not be required to report this data where the operators are not in turn required to report such occurrences.	Recommend this to be modified such that DA holders be requested to report when occurrence rates are exceeded in a year instead of requiring report of non-exceedance. The Continued Operational Safety process is the venue for such reports. Please clarify if the requirement is applicable to EASA DOAs only.	No	Yes	Agreed	<b>EASA comment:</b> <i>See ID#20 and ID#31</i>
50	TCCA	Section 3 title	5	The heading suggests the content is certification related rather than Continued Airworthiness. Should certification aspects and continued airworthiness be dealt with in separate documents?	Revise title to reflect the intended usage of this policy document. This document could complement existing GM rather than being a dedicated CM.			Not agreed	<b>EASA comment:</b>  <i>This is a standard document used by EASA when creating additional guidelines to the regulations. In this case, they are guidelines to Part 21.</i>

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51	TCCA	Scenario 2	7	The author states: “ The conclusion is that the risk of....is intrinsically considered “acceptable”. This statement could be improved by adding “from a quantitative and numerical analysis point of view and for the purpose of evaluating the need for mandatory corrective action.				Partially Agreed	<b>EASA comment:</b>  <i>The text was already slightly modified, and the commented part will figure currently as follows:</i>  'The conclusion is that the likelihood of fatally injuring people on the ground due to a PDA event is conservatively estimated to be close to the objective set in CS 25.1309 for system failures with a catastrophic effect, i.e. 1E-9/FH, and can therefore be considered to be acceptable regarding the probability objective of 1E-7/FH for impacting people on the ground. Furthermore, this is supported by the absence of any in-service events of people who were fatally injured as a consequence of PDA.  As a result, no unsafe condition has been identified for people on the ground from a quantitative point of view, or for the purpose of evaluating the need for mandatory corrective action.'
52	TCCA	General		TCCA supports the idea of harmonized guidance material for PDA continued airworthiness evaluation.				Noted	<b>EASA comment:</b>  <i>Thanks for your support and your comment is highly appreciated.</i>

\* Please complete this column using the word “yes” or “no”  
\*\* Please complete this column using the word “yes” or “no”