

DISPOSITION OF PUBLIC COMMENTS

Certification of Structural Elements in Flight Control Systems, Policy Statement No. PS-ANM-25-12

Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
Commenter: Airbus			
1	<p>This draft policy provides multiple examples of elements where FAA accept that compliance with the Fatigue and Damage-Tolerance requirements of § 25.571 is sufficient to demonstrate compliance with the single failure systems requirements of §§ 25.671 or 25.1309: Horizontal Stabilizer (cf §1.a.), Main structural elements in landing gear (cf §2.b.(2)), main wing-vertical stabilizer-fuselage (cf §2.b.(3)). This list is not exhaustive as certification experience shows the same approach has been applied to the slat tracks and control surfaces (hinges excluded) for Large Transport aircraft. § 25.629(d)(8) provides one example where such approach is recognized in the rules.</p>	<p>It would be helpful if this policy would clarify, for the “Structural Elements in Systems” those elements where the compliance with the § 25.571 structure requirements would be sufficient to demonstrate compliance with the single failure systems requirements of §§ 25.671 or 25.1309.</p> <p>Airbus proposal is to consider the compliance to § 25.571 as sufficient when all of the following conditions are met:</p> <ol style="list-style-type: none"> 1) Structural elements which are not removable from the aircraft or elements not removed during operation, and for which the risk of disconnection (single failure) due to improper re-installation or maintenance action does not exist, i.e., the so-called “fixed structure” or elements within a LRU. 2) A Fatigue/Damage-Tolerance investigation in accordance with §25.571(a)(b)(c) shows that a complete failure of the element does not occur. 3) The discrete source damage is accounted for. <p>Examples</p> <ul style="list-style-type: none"> - Slat tracks. - Moveable surfaces (hinges excluded) 	<p>We partially agree.</p> <p>We revised the policy to specify elements for which compliance with § 25.571 would be sufficient to demonstrate compliance with the single failure systems requirements of §§ 25.671 or 25.1309. These are control surfaces and the main structural elements in the landing gear.</p> <p>We revised the policy statement to specify that control surfaces are systems, but that § 25.571 is sufficient to address single failures of control surfaces.</p> <p>We do not agree that elements within a line replaceable unit (LRU) should be exempt from the applicable single failure criteria.</p>

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		<ul style="list-style-type: none"> - The fixed structure (fixed to the main box structure) supporting the moveable surfaces hinge points - Landing Gear cylinder (main fitting), drag and side stays and their attachments to the fixed structure. - Elements within LRU (when an acceptable compliance with §25.571 is established). 	
2	<p>The main difference between both sets of requirements concerns the “single failure” issue. Systems components can usually be removed from the aircraft. So, there is a risk of not proper (re)installation and thus of subsequent disconnection. Therefore the single failure requirement is natural to systems design. This is not the case for the main structural components (fuselage, main wing, vertical and horizontal stabilizer), called “fixed structure” in this draft policy paper, which are not normally removed from the aircraft and where such risk does not exist. Similar to “fixed structures,” elements inside a Line Replaceable Unit are not normally removed individually in the airplane, it is the whole LRU that is removed and may be wrongly re-installed.</p>	<p>It would be helpful if this policy would clarify, for the “Structural Elements in Systems” (acc. to diagram on page 4):</p> <p>The compliance with the structure requirements for those elements where the “single failure systems requirement” applies.</p> <p>Airbus proposal: these are elements that are removable from the aircraft and where the risk of disconnection (single failure) exists due to improper re-installation or maintenance action.</p> <p>Examples:</p> <p>1) Structural elements in the flight control systems. For the purpose of compliance with § 25.671, the control system ends where the control system attaches to the “fixed structure” such as the wing, the fuselage or the control surface.</p> <ul style="list-style-type: none"> • Examples of elements to be evaluated under the requirements of § 25.671 are 	<p>We partially agree. We revised the policy to clarify compliance with the structure requirements for those elements where the single failure systems requirement applies.</p> <p>We do not agree with the proposal that only removable items should be subject to the single failure criteria. Improper installation is not the only source of structural failures. We do not want the airplane to be susceptible to catastrophic failure due to a single failure in an element that is not removable.</p> <p>We agree that control surfaces are treated in a similar way as the wing box in that complete failure of these surfaces need not be assumed, since these are built-up structures with multiple load paths within the structure. We have clarified this point in the policy.</p>

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		<p>linkages, hinges, cables, pulleys, quadrants, valves, actuator components, track rollers, flap tracks, bearings, and hydraulic or electrical systems.</p> <p style="padding-left: 40px;">- Control surfaces are treated in a similar way as the wing box or horizontal/vertical stabilizer therefore can be assimilated to “fixed structures.”</p> <p style="padding-left: 40px;">- The single failure requirement is limited to the elements, which may be removed and not properly installed in operation. For example, the torsion boxes of flap tracks on Large Transport aircraft are not subject to single failure due to improper re-installation and therefore can be assimilated to “fixed structures.”</p> <ul style="list-style-type: none"> • Horizontal stabilizer actuator (or screw jack assembly) • Control surface actuators <p>2) Structural elements in Landing Gear System as:</p> <ul style="list-style-type: none"> • Trim or Retraction Actuators, • Wheels and Brakes, • Landing Gear up-lock fitting. • Nose Gear Steering Actuators 	

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3	<p>FAA draft policy states: “Sections 25.571, 25.671, and 25.1309 are among numerous regulations that apply to “Structural Elements in Systems.” We should avoid that a structural element in a system is fully justified from both a structure certification point of view and full system point of view. The set of systems requirements assumes single failure to occur when the compliance to the set of structure requirements assures no failure should occur. If not prevented, the Applicant is applying two contradictory approaches to meet the same objective (e.g., to prevent any foreseeable catastrophic failure) and is doubling the certification workload unnecessarily.</p>	<p>For those “Structural Elements in Systems” where the single failure systems requirement applies, Airbus proposes to limit the compliance to the structural requirements to proof and ultimate tests, and a fatigue test. No need to provide a structural analysis with approved methods and materials data.</p> <p>For those “Structural Elements in Systems” where compliance with § 25.571 is sufficient to demonstrate compliance with the single failure requirements of §§ 25.671 or 25.1309, the compliance to the structure requirements should include appropriate structural analysis, with approved methods and materials data and supporting test evidence.</p>	<p>We do not agree with the commenter. For any structural element for which compliance with § 25.571 or Subpart C strength requirements are necessary, the structural analysis must include approved methods and materials data. Also, the system and structure approaches are complementary, not contradictory. There are multiple events of tab rod failure, flap support linkage failure, and other system element failures despite the application of structures requirements. System safety assessment assures that a single element failure is not a catastrophic failure. No change.</p>
4	<p>Guidance on single failures is unclear.</p>	<p>It would be useful to have examples of applications of the following sentence within the policy: “While single failures must normally be assumed to occur, there are cases where it is obvious that, from a realistic and practical viewpoint, any knowledgeable, experienced person would unequivocally conclude that a failure mode simply would not occur, unless it is associated with a wholly unrelated failure condition that would itself be catastrophic.”</p>	<p>We agree. We added examples to the policy statement. In addition, criteria are added that should be considered when assessing single failures.</p>

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1	<p>Refer to Paragraph 2.b.(3):</p> <p>“Structural Elements Not Subject to § 25.671 or § 25.1309. As noted above, ‘fixed structures,’ such as the main wing, vertical stabilizer, and the fuselage, need not be considered part of a system, and are not subject to the requirements of § 25.671 or § 25.1309. However, to the extent that failure of these elements could occur due to a particular threat, such as rotorburst, decompression, bird strike, etc., the effects of those failures should be taken into account in the system safety assessment.”</p> <p>This paragraph seems to extend the scope of this document to more than just “structural elements in systems.” The subject of this policy should be broadened in order to encompass this paragraph.</p>	<p>#1 “Systems requirements applicable to structural elements.” Otherwise this paragraph would be more appropriate in material specifically related to those mentioned particular threats (rotor burst, decompression, bird strikes, etc.).</p> <p>#2 Furthermore, the “fixed structures” that share a common mode with system failures (potentially contributing to aggravating the event consequences) should be introduced as an additional sub-type of structural element subject to systems requirements in “Summary” and “General” sections of this policy.</p>	<p>We agree that this paragraph is confusing and unnecessary. We have removed this paragraph from the final policy statement.</p>

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No.	Comment	Requested Change	Disposition
Commenter: BOEING			
1	<p>The proposed text states:</p> <p>“In this document, the term ‘element’ is synonymous with ‘component’ or ‘part.’ The term ‘system’ means a combination of elements that are inter-connected to perform one or more functions.”</p> <p>We do not agree that the term “element” will provide clarity to the structural regulations. Terms identified in the current 14 CFR 25.571 and AC 25.571-1C provide clear understanding and categorization of primary and secondary structure. This categorization is used on all structure including systems components, doors, payloads installations, etc. The introduction of a new term to classify structure will potentially lead to confusion, is not aligned with current guidance, and, therefore, is not needed.</p>	<p>We infer Boeing requests that we delete the term “element” from the policy statement.</p>	<p>We do not agree with the commenter. The term “element” is used in § 25.671. The purpose of this policy is to clarify that some of those elements are structural. The term “element” in the policy statement is clear and necessary. No change.</p>
2	<p>The proposed text states:</p> <p>This policy “Identifies <u>some of</u> the Title 14, Code of Federal Regulations (14 CFR) part 25 regulations and guidance that address structural elements in systems.”</p> <p>To be applied correctly and consistently, the policy needs to be clear, so that the applicant need not guess as to each regulation’s applicability to the structural elements in structure.</p>	<p>Boeing requests that the policy be revised to provide applicants with a complete list of regulations that apply to structural elements in systems in order to avoid confusion and maximize the likelihood that the policy will be equitably applied. Corresponding changes then need to be made in the policy so that <u>all</u> of the pertinent regulations are, in fact, listed.</p>	<p>We changed the summary to state this policy addresses appropriate application of §§ 25.571, 25.671 and 25.1309. We do not believe it is necessary to provide an exhaustive list of regulations and their applicability to structural elements in systems. The policy statement addresses the key issues and areas of confusion, namely, compliance with §§ 25.571, 25.671 and 25.1309. No change.</p>

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3	<p>The proposed policy only presents compliance guidance for regulation § 25.571 and to the single failure requirements of regulations §§ 25.671 and 25.1309.</p> <p>Regulations §§ 25.671 and 25.1309 contain requirements concerning multiple failures. Compliance with these requirements typically involves conducting:</p> <ul style="list-style-type: none"> • Numerical-probability analyses (fault tree) to show that catastrophic events are extremely improbable, and • Qualitative and quantitative assessments to show that latent failures have been minimized. <p>These analyses and assessments generally have not included a system’s structural elements. Therefore, new guidance materials in these areas are needed.</p>	<p>We suggest that the policy also provide compliance guidance for the following:</p> <ul style="list-style-type: none"> • Acceptable methods to determine failure rates for structural elements in systems, when those structural elements meet the damage tolerance requirements of regulation § 25.571. • Acceptable methods to meet the “minimize latent failure” requirements of the ARAC recommended changes to AC 25.1309-1A (ref. ARAC working group’s “Arsenal” draft) 	<p>We do not agree. A qualitative assessment can be used to show compliance to §§ 25.1309 and 25.671 if there is no reliable failure rate data. We added a reference to AC 25.1309-1A to remind readers of this fact.</p> <p>Minimization of latent failure was a subject addressed by the ARAC’s Airplane-Level Safety Assessment Working Group. Since it is a subject that encompasses more than flight control systems, we plan to address it outside of this policy statement.</p>

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4	<p>BCA disagrees with combining current regulations using this proposed policy as written. With the exception of a few generalized examples, the proposed policy does not provide the applicant any understanding as to how to combine certain regulations.</p> <p>Although the text states explicitly that “ ... the general policy stated in this document does not constitute a new regulation,” we see evidence throughout that, in effect, the policy would establish new certification requirements.</p>	<p>We recommend that the policy be revised to include detailed guidance, and new requirements imposed on the applicant should be promulgated via the rulemaking process.</p>	<p>We do not agree that the policy would establish new certification requirements. Sections 25.571, 25.671, and 25.1309 exist today. Structural elements in flight control systems are not exempt from the requirements of § 25.671. This policy reinforces this applicability, as it has been misunderstood in the past. Detailed guidance in the subject areas exists in the advisory circulars listed in the policy statement. No change.</p>
5	<p>The proposed text states: “In some past cases, applicants have classified certain structural elements as being in one of two mutually exclusive categories, either ‘structures’ or ‘systems.’ ... For the most part, this approach has not presented a safety concern because the objective of each set of requirements is the same: to avoid any foreseeable catastrophic failure condition.”</p> <p>This language conflicts with existing guidance material for §25.1309. As written, it could be interpreted that all catastrophic failure conditions must be eliminated. However, catastrophic failure conditions are required to be avoided only to the extent that they are extremely improbable, not eliminated. The requested change below is based on AC 25.1309-1A.</p>	<p>We recommend changing the last portion of the text to read as follows:</p> <p>“ ... to avoid any reduce the probability of foreseeable catastrophic failure conditions to a level that they are not anticipated to occur during the operational life of all airplanes of a particular type. ... ”</p>	<p>The referenced text provided a general objective of the requirements. However, it was deemed unnecessary and has been deleted from the policy statement.</p>

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6	<p>The proposed text states: “In some past cases, applicants have classified certain structural elements as being in one of two mutually exclusive categories, either ‘structures’ or ‘systems.’ ... However, the FAA has determined that there is no regulatory basis for this categorization, and that, for some structural elements, both sets of requirements apply.”</p> <p>The policy states that, for some elements, both sets of regulations apply, but it does not specify the actual structure or exact regulations. This lack of clarity is likely to result in confusion and numerous/unnecessary certification plans and Issue Papers. Further, the statement suggests that the policy is thereby imposing requirements beyond the current regulations. We consider AC 25.571-1C sufficient to classify and certify structure, including structure in systems.</p>	Boeing requests clearer understanding of the suggestion that certain regulations need to be combined, and the specific regulations that actually apply to this situation.	We have clarified the policy statement and deleted the referenced text.

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7	<p>The proposed text states: “Each of the structures and systems regulations specified in part 25 stands on its own and should be applied independently and to the extent specified in that regulation. In some cases, this will result in application of both types of requirements to the same elements of a system.”</p> <p>This instruction for how to categorize and certify is far too general and without any real guidance on the 33 applicable regulations listed. The instructions are too general and could have far-reaching, unintended consequences, particularly since the effect of certifying structure and systems suggests the need for combining certain regulations with others.</p> <p>AC 25.571-1C provides clear definitions for classification of all structure, and it extends to structure that resides in systems.</p>	<p>We request that the FAA make the instructions more explicit so that both the applicant and the FAA specialist will have a clear and unambiguous understanding of how compliance is to be demonstrated.</p>	<p>We have clarified the policy statement and deleted the referenced text.</p>

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8	<p>The proposed policy uses very generalized examples, and does not provide the applicant any help with defining the actual components involved or determining which sections of the regulations to combine to address those components. We do not find it useful to create a new, oversimplified model for categories of structure, structures in systems, and non-structure.</p> <p>This lack of clarity for classification of structure will without doubt result in confusion and numerous/unnecessary certification plans and Issue Papers. Further, the lack of specificity creates untenable opportunities for “picking and choosing” structures merely on which to impose this policy’s requirements, and potentially ignoring others where there may indeed be a safety issue of concern.</p> <p>Boeing considers AC 25.571 sufficient to classify and certify all structure, even those structures that are common to systems.</p>	<p>We request that the FAA point to the AC 25.571 guidance in lieu of imposing new requirements via this policy statement.</p>	<p>We have clarified the policy statement and provided additional examples. We do not agree that the policy imposes new requirements.</p>

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9	<p>The proposed text states: "... Examples of structural elements subject to both structures and systems requirements are the horizontal stabilizer actuator—or jackscrew assembly; high lift actuation; control surface actuators; the landing gear; and any structural elements that transmit or react control surface or system loads. Other examples of elements covered by these regulations are provided in AC 25.571-1C, AC 25-14, AC 25.629-1A, and in the regulations themselves."</p> <p>Showing non-structural components to be in compliance with the structural regulations addressed by this proposed policy would be highly impractical and would not contribute significantly to safety.</p>	<p>To provide more clarity, we recommend expanding the proposed language to clarify that the above mentioned assemblies may include non-structural elements including dust covers, valve hardware, hydraulic plugs, etc.</p>	<p>We do not consider these items (dust covers, valve hardware, hydraulic plugs) to be structural elements subject to § 25.571. No change.</p>
10	<p>The proposed text states: "... the structural elements of certain mechanical systems should be considered 'principal structural elements' and evaluated in accordance with § 25.571. As is true for aircraft structure, if it is impractical to perform a damage tolerance evaluation, a safe-life evaluation may be used. An example would be dual tab control rods. In demonstrating compliance, the safe-life approach specified in § 25.571(c) could be used as it may be impractical to develop a reliable inspection program as specified in § 25.571(b). Regardless of whether a damage tolerance or safe-life method is used, the</p>	<p>Remove the referenced sections from the policy memo.</p>	<p>We agree. We have removed the referenced text.</p>

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	<p>evaluation should be based on fatigue testing and not based solely on analysis.”</p> <p>This intended clarification of §25.571 and AC 25.571-1C is inappropriate and unnecessary. This section of the proposed policy could lead to new FAA definitions of primary structural elements (PSE) outside the definition provided in AC 25.571-1C.</p>		
11	<p>The proposed policy references a paragraph from AC 25.571 that includes: “In certain specific instances, however, damage-tolerant design might be more realistically assessed by a probabilistic evaluation employing methods such as risk analysis.”</p>	<p>This intended clarification of § 25.571 and AC 25.571-1C is inappropriate and unnecessary. Further, this proposed policy appears to introduce risk-based approach in a much broader way than was intended or is applied via AC 25.571-1C.</p>	<p>AC 25.571-1D is quoted directly, so there is no change from current guidance. We added a statement that risk assessment should only be used where considered appropriate.</p>
12	<p>We are concerned with the FAA’s approach in attempting to combine single failures that would otherwise be prevented by § 25.571 damage tolerance inspection programs. The FAA’s argument for a single failure is not consistent with the long-established and substantiated intent of either § 25.571 or § 25.1309. The § 25.571 inspection programs have a good track record of providing damage detection. This proposed policy, however, appears to be declaring these inspection programs inadequate.</p>	<p>None identified.</p>	<p>We refer the commenter to the Alaska Airlines Flight 261 accident in which a McDonnell Douglas MD-83 crashed into the Pacific Ocean on January 31, 2000.</p> <p>http://accidents-ll.faa.gov/ll_main.cfm?TabID=1&LLID=23&LLTypeID=12</p> <p>This proposed policy does not suggest that damage-tolerance-based inspection programs are inadequate for their purpose; however, system structural design needs to be tolerant of single failures as required by § 25.671.</p>

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13	The policy makes references to ARAC committee activity that are not consistent with the records for that committee. Our records show that the ARAC committee recommended that the structures and systems regulations be kept separate.	Correct the references to ARAC committee findings.	In the policy, we state that the FAA does not accept the ARAC recommendation that single failure of a simply-loaded static element can be assumed to be prevented if this element is shown to meet the damage tolerance requirements of § 25.571. In all other areas, this policy is consistent with ARAC recommendations. In addition, the policy does not combine systems and structures regulations. No change.
14	The proposed text states: “When assessing structural elements in systems, single failures must be considered in accordance with §§ 25.671 and 25.1309. As noted in the referenced advisory and regulatory material, the single failure requirement does apply to certain structural elements that in the past may have been evaluated only as ‘structure.’ Examples are control surfaces, flap tracks, hinges, and attachment fittings.”	We request that the text be revised to clarify the expected treatment of control surfaces. As currently written, the text could be interpreted to require that the system safety assessment include a failure-modes-and-effects analysis that evaluates the single failure of each individual component of the control surface structure. We do not think this is the FAA’s intent.	We agree. We have clarified the treatment of control surfaces.

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15	<p>The proposed text states: “For the main structural elements in landing gear, the FAA does accept that compliance with the fatigue (safe-life) requirement of § 25.571(c) is sufficient to demonstrate compliance with the single failure requirement of § 25.1309.”</p> <p>While we agree with the specific example provided for landing gear, we find that the proposed policy lacks enough information to provide the applicant any guidance for other structure that may qualify for compliance with § 25.571(c).</p>	<p>Provide guidance for other structure that may qualify for compliance with § 25.571(c).</p>	<p>AC 25.571-1D provides adequate guidance. No change.</p>
16	<p>Our understanding of the policy leads us to believe that it will impose additional burdens on applicants, as it not only interprets the regulations in a different way than has been established, but adds to the duties of those affected in order to comply with the current regulations.</p>	<p>We request that FAA re-consider the effect of this proposed policy.</p>	<p>We have reconsidered and clarified the policy.</p>

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1		Page 1, Definition of Key Terms: A definition of “Structural Element in a System” should be added, given the intent of the policy is to clarify the applicability of regulations to these items.	We do not agree that a more specific definition for structural element in a system is needed. The term element is defined and examples are provided for structural elements in systems. No change.
2		Page 2, Relevant past practice: It should be emphasized that while the mutually-exclusive categorization of components as either “system” or “structural” is not supported by the regulations, there is critical value in assigning (non-mutually-exclusive) attributes to components for analytical purposes. The AC does not exclude this interpretation, but this should be made clearer. We suggest replacing the last sentence of the first paragraph with “However, the FAA has determined that there is no regulatory basis for <i>mutually-exclusive</i> categorization, and that, for some structural elements, both sets of requirements apply.”	We determined that the referenced text was unnecessary and confusing, so it was removed.
3		Page 3, Applicability of Requirements, General: The existing text reads <i>Applicants should not categorize the structural elements in systems as being either “structures” or “systems,” and then apply the regulations based on that categorization. Each of the structures and systems regulations specified in part 25 stands on its own and should be applied independently and to the extent specified in that regulation. In some</i>	We determined that the referenced text was unnecessary and confusing, so it was removed.

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		<p><i>cases, this will result in application of both types of requirements to the same elements of a system.</i></p> <p>For the reasons given in comment 2, this should be replaced with the following text:</p> <p><i>The applicant should determine (categorize) the structural elements which act as both structure and as part of a system and apply both sets of requirements to them, i.e. related to the structure (subparts B, D) and to the system (§ 25.671, §25.1309) in order to demonstrate the aircraft's safety and show compliance to all relevant requirements.</i></p> <p><i>For the following categories: "structure" and "system", the existing methods, procedures and methodology still apply independently.</i></p>	
4		<p>Page 5, 2.a, Compliance with 25.571</p> <p>The FAA guidance (MOC) for the following question should be specified:</p> <p>Would compliance with Damage Tolerance requirements cover the case of incorrect assembly or installation?</p>	<p>The answer is no to the question, "Would compliance with Damage Tolerance requirements cover the case of incorrect assembly or installation?" We do not believe additional guidance on this question is needed beyond the policy and AC 25.571-1D. No change.</p>

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5		<p>Page 5, 2.b (1), Assessment of Single Failures:</p> <p>The FAA guidance (MOC) for the following question should be specified:</p> <p>Would positive indication be required for installation of the single load path “structural elements in system”?</p>	<p>We infer the commenter is referring to § 25.1309(c) regarding warning information. The level of alerting required by that regulation depends upon the effect of a given failure. Sufficient guidance is available in AC 25.1309-1A. No change.</p>
6		<p>Page 5, 2.b (1), Assessment of Single Failures:</p> <p>The last two paragraphs of this subsection read:</p> <p><i>While single failures must normally be assumed to occur, there are cases where it is obvious that, “from a realistic and practical viewpoint, any knowledgeable, experienced person would unequivocally conclude that a failure mode simply would not occur, unless it is associated with a wholly unrelated failure condition that would itself be catastrophic.” Once identified and accepted, such cases need not be considered.</i></p> <p><i>A joint industry-authority working group recommended, and the FAA agreed, that this guidance is also applicable for compliance with the single failure requirement of 25.671.</i></p> <p>The process for identifying and accepting this finding is still vague. It should be more clearly specified if it is acceptable for FAA to use a Damage Tolerance 25.571 (a) & (b), as a Mean of Compliance (MOC) for 25.671 (c)(1) For example,</p>	<p>We added more guidance on the single failure criteria to the policy. We recognize that EASA allows credit for damage tolerance items, but the FAA does not share that criteria—the FAA criteria are described in the policy.</p>

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Commenter: BOMBARDIER			
		<p>AMC 25.671 (c)(1) states:</p> <p><i>[W]here a single component is used on the basis that its failure is extremely improbable, it should comply with CS 25.571 (a) & (b).</i></p> <p>In other words to show that failure of single component is extremely improbable EASA allows to take credit that the component is a damage tolerance item.</p>	
7		<p>Page 5 (2 (b) (2)) 1st paragraph</p> <p>If indeed valid, a stronger argument should be presented to argue the FAA position that</p> <p><i>Upon further review, the FAA determined that meeting the damage tolerance requirement of § 25.571 by itself is not sufficient to justify the assumption that a single failure will not occur.</i></p> <p>The referenced text in AC 25.1309-1A sect 7g argues that ‘service experience’ and ‘flight crew and ground crew checks’ would be insufficient to prevent a catastrophic failure.</p> <p>However, qualifying a single load path structural element to the damage tolerance requirements of 25.571 (a) & (b) offers much more than this, i.e. mandatory inspections by qualified inspectors in amenable work conditions. The inspection requirements would be substantiated by a minimum of 2 lives of testing with induced damage during part of that test.</p>	<p>The FAA has already made this determination, separately from the development of this policy statement. We have been providing this position for the past several years to each applicant wishing to use the ARAC-recommended AC 25.1309-Arsenal version via a finding of equivalent level of safety. We do not believe this determination needs to be revisited.</p>

DISPOSITION OF PUBLIC COMMENTS

Certification of Structural Elements in Flight Control Systems, Policy Statement No. PS-ANM-25-12

Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
	Commenter: BOMBARDIER		
		We would propose that the FAA’s original proposed AC position regarding ‘single structural elements’ (but specifically for sub paragraphs (a) & (b)) be retained. This would then be in harmony with the EASA regulations ref: CS25 AMC 25.1309 4b.	
8		<p>Page 8, 1.b, Interaction of Systems and Structures Special Conditions:</p> <p style="text-align: center;"><i>The special conditions address these failure conditions by specifying factors of safety based on the reliability of the system functions.</i></p> <p>This phrase is poorly phrased and misuses the terms “function” and “reliability” which have specific definitions in a 25.1309 context.</p> <p>We suggest changing the sentence to:</p> <p style="text-align: center;"><i>The special conditions address these failure conditions by specifying the factors of safety necessary to achieve a level of system reliability appropriate to the criticality of the function performed by the system.</i></p>	We have deleted the referenced material.
9		<p>Page 8, 2.c, page 9, 3.c, AC 25-14, High Lift and Drag Devices: This AC has been superseded by AC 25-22 and thus cannot be considered Current Guidance. These references should be updated and the explanatory text changed as necessary.</p>	We have corrected the references.

DISPOSITION OF PUBLIC COMMENTS

Certification of Structural Elements in Flight Control Systems, Policy Statement No. PS-ANM-25-12

Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
Commenter: CESSNA			
1	AC 25.1309-1A states in section 3, Applicability “Because § 25.1309(b) and (c) is a regulation of general applicability, it may not be used to replace or alter any allowed design practices or specific requirements of Part 25, and each requirement of § 25.1309(b) and (c) applies only if other applicable sections of Part 25 do not provide a specific system requirement that has a similar purpose.” Yet the policy memo infers that the requirements of § 25.571 and § 25.671 are inadequate and both require the additional support of the processes used to show compliance to § 25.1309. Cessna Engineering does not agree with this inference.	None specified.	The policy statement does not infer that the requirements of § 25.571 and § 25.671 are inadequate. No change.
2	Cessna Engineering believes that it will add cost without a commensurate increase in safety to the aircraft, crew or passengers. Industry does not keep a statistical database for the probability of failure of each of the structural elements that would be required to support a system safety analysis of structure and therefore Cessna Engineering would be unable to complete this subjective analysis without a level of effort that would be impractical.	None specified.	The policy simply reiterates and clarifies guidance for current requirements and does not introduce new requirements. We consider failure analyses involving structural elements to be normal industry practice. These analyses may be based on statistical probability or may be qualitative, and may also rely on damage tolerance and fatigue analyses. No change.

DISPOSITION OF PUBLIC COMMENTS

Certification of Structural Elements in Flight Control Systems, Policy Statement No. PS-ANM-25-12

Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
Commenter: CESSNA			
3	<p>The proposed Policy Statement also discusses the possibility of substituting a safe-life compliance for damage tolerance of parts other than the landing gear. However, existing FAA policy states that this may only be used for landing gear: Policy Number: PS-ANM100-1988-00040 - The only structure considered impracticable to design to the damage tolerant criteria of 25.571 is the airplane landing gear.</p> <p>For some parts (trim tab actuators and hinges for instance) it has been acceptable to show damage tolerance capability through cyclic testing with certain elements completely disconnected or through analysis in cases where the stresses are exceptionally low. This is another example of a conflict between this policy memo and previously published guidance.</p>	None specified.	We agree. The conflicting text, which allowed safe-life compliance for parts other than the landing gear, has been removed.

DISPOSITION OF PUBLIC COMMENTS

Certification of Structural Elements in Flight Control Systems, Policy Statement No. PS-ANM-25-12

Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
Commenter: CESSNA			
4	<p>The FAA has stated in the policy memo “in some cases, both sets of requirements apply.” This conclusion is not supported and is open to interpretation. During a recent FAA/Industry working group, some members of industry asserted that a part 25 airframe that is limited to 20,000 hours should not be held to the same fatigue standards as one with 100,000 or more hours. Some members of the FAA did not support this position.</p>	<p>Cessna Engineering suggests that the FAA:</p> <ol style="list-style-type: none"> 1. Develop a consistent set of cases or a flowchart where both sets of requirements need to be addressed, obtain concurrence from FAA legal and publish them in an AC. This will ensure that applicants have a level playing field from ACO to ACO. This flow chart should take into account the lifetime of the airframe. 2. Show that addressing both sets of requirements; even though it conflicts with AC 25.1309-1A and other published guidance material, is supportable by a cost benefits analysis. Provide or ask industry to provide a cost benefits analysis. While some applicants may argue that the use of the analysis used to show compliance § 25.1309 may result in a manpower savings to show compliance to § 25.571 and § 25.671, we disagree. Our concern is that if this goes forward, the FAA will issue specific findings against § 25.571 and § 25.671 because they are now tied to § 25.1309. 3. Address the concerns from industry from the past two efforts to release AC 25.1309-1B. Once the AC is agreed to and released, we see these issues going away. 	<p>The policy has been clarified, and there is no conflict with existing guidance material. No cost benefits analyses are necessary because the policy does not introduce new rules.</p>

DISPOSITION OF PUBLIC COMMENTS

Certification of Structural Elements in Flight Control Systems, Policy Statement No. PS-ANM-25-12

Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
Commenter: CESSNA			
5	It would appear that the FAA has some concerns about the way applicants are showing compliance to § 25.571 and § 25.671. It would also appear that the FAA’s concerns would be addressed if the applicants used the processes connected to § 25.1309, in some cases. Cessna Engineering is concerned that this could be interpreted as an effort by the FAA to withhold delegation on § 25.571 and § 25.671 by tying those rules to § 25.1309, and if this is successful with § 25.571 and § 25.671, other rules will follow (i.e., § 25.981).	None specified.	The FAA’s concerns about the way applicants are showing compliance to § 25.571 and § 25.671 are expressed in the policy statement under Relevant Past Practice. We have no intention to use the policy to withhold delegation on § 25.571 and § 25.671. No change.
6	Historically, an agreement is reached at the beginning of each program to determine the division between systems and structures. This position is negotiated between the Cessna certification specialists and the ACO counterparts considering the nature and complexity of the individual systems.	Allow current practice in which Applicant and certifying office agree on division between systems and structures.	We agree that close coordination with the cognizant ACO is necessary for all certification activities. However, this policy statement should be used by both parties to guide the discussion regarding certification of structural elements in systems. No change.

DISPOSITION OF PUBLIC COMMENTS

Certification of Structural Elements in Flight Control Systems, Policy Statement No. PS-ANM-25-12

Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
Commenter: CESSNA			
7	<p>Cessna has accepted the recent extension of the systems/structure boundary to include the horizontal stabilizer trim actuator jackscrew and load path, due to the complexity and criticality of this component.</p> <p>Consider the example of a spoiler system. Current Cessna approach for this installation is to limit the extent of the system to the actuator and the attaching bolts. The FAA is proposing an extension of the “systems” definition to include “any structural elements that transmit or react control surface or system loads.” The FAA policy could be interpreted to extend the definition of systems to the entire spoiler system. If so, there would be additional effort required to show compliance for failures that can result in Hazardous or Catastrophic effects.</p> <p>Cessna aircraft are currently designed to preclude single failures of system or structure resulting in Catastrophic effects, so the “single failure” requirement is not a concern. However, a spoiler system could be designed in which a single panel spoiler disconnect is Hazardous over some portion of the flight envelope. In the FAA proposal, single structural failures would have to be analyzed to determine that the probability meets the requirement for Hazardous.</p>	None specified.	<p>The commenter refers to a “recent extension of the systems/structure boundary to include the horizontal stabilizer trim actuator jackscrew and load path.” In fact, there was no such extension by regulatory action. However, following the AS261 accident, there was recognition by industry and authorities that past compliance findings were not sufficient. This policy statement was developed in large part to address and formalize this recognition. No change.</p> <p>The commenter says that the FAA is proposing an extension of the “systems” definition to include “any structural elements that transmit or react control surface or system loads,” and that this could be interpreted to extend the definition of systems to the entire spoiler system, for example. We do not believe this is a change to the existing systems definition.</p> <p>As defined in this policy statement and in the latest version of AC 25.1309-1 being considered, the term “system” means a combination of components, parts, and elements that is interconnected to perform one or more functions. The spoiler system meets this definition. Therefore, this system, including any structural elements within the system, is subject to §§ 25.671 and 25.1309.</p>

DISPOSITION OF PUBLIC COMMENTS

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Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
	Commenter: CESSNA		
	<p>In addition, the single failure of structural elements would also have to be combined with other failures to ensure that the probability of a Catastrophic event due to the combination is extremely improbable. Compliance with 25.1309 and 25.671 requires the creation of a fault tree analysis for these failure scenarios. The fault tree conducted for 25.1309 analysis of a spoiler surface disconnect (for example) would then have to include the machined fittings. This would result in a significant increase in effort, with no foreseeable benefit.</p>		<p>There is no regulatory basis for the exclusion of certain elements of the system just because they are structural in nature.</p> <p>The commenter says that under the FAA proposal, single structural failures would have to be analyzed to determine that the probability meets the requirement for Hazardous under § 25.1309. We agree. This is our interpretation of the current requirement. We have revised the policy to capture this point.</p> <p>The commenter says that, in addition, the single failure of structural elements would also have to be combined with other failures to ensure that the probability of a Catastrophic event due to the combination is extremely improbable. We agree. As stated above, there is no regulatory basis for the exclusion of certain elements of the system just because they are structural in nature. We have revised the policy to capture this point.</p>

DISPOSITION OF PUBLIC COMMENTS

Certification of Structural Elements in Flight Control Systems, Policy Statement No. PS-ANM-25-12

Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
Commenter: DASSAULT			
1	After internal Dassault review involving structure, flight controls, systems, and system safety specialists, Dassault's position is that we have no adverse comment against the subject Memo. We concluded that our engineering approach has been for long compliant with the directions given by the Memo.	None.	None.

DISPOSITION OF PUBLIC COMMENTS

Certification of Structural Elements in Flight Control Systems, Policy Statement No. PS-ANM-25-12

Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
Commenter: EASA			
1	EASA supports the intent of this Policy Statement to provide additional guidance for certification of structural elements in systems; especially the general applicability of requirements as written in the policy chapter 1.a.: <i>“Applicants should not categorize the structural elements in systems as being either “structures” or “systems,” and then apply the regulations based on that categorization. Each of the structures and systems regulations specified in part 25 stands on its own and should be applied independently and to the extent specified in that regulation.”</i>	None.	None.
2	<p>It is suggested to further clarify the scope and intent of the Memo.</p> <p>a) Although the title of the Memo refers to systems in general, most of the text actually relates to (flight) control systems and landing gears.</p> <p>b) Paragraphs 25.901 and 25.933 are referenced in the header of the Memo but these requirements are not discussed in more detail. It is also noted that the EASA AMC 25.933 (paragraph 8.c) does not seem to be in line with the draft Memo.</p> <p>c) AC 25.783-1A also addresses the issue of single failures of structural elements in (door) systems.</p>	<p>(1) Based on EASA comments (a) and (b): to remove reference to 25.901 and 25.933 from the draft Memo.</p> <p>(2) Based on EASA comment (c): please refer to the attached document with proposed changes highlighted in red.</p>	<p>We have removed reference to §§ 25.901 and 25.933 from the policy statement.</p> <p>The second requested change includes the addition of several references to doors and § 25.783. However, since the subject of the policy has been limited to “structural elements in flight control systems,” this would exclude doors and their related systems. No change.</p>

DISPOSITION OF PUBLIC COMMENTS

Certification of Structural Elements in Flight Control Systems, Policy Statement No. PS-ANM-25-12

Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
Commenter: EASA			
3	<p>Paragraph 2.a. of the draft Memo states that <i>“As is true for aircraft structure, if it is impractical to perform a damage tolerance evaluation, a safe-life evaluation may be used. An example would be dual tab control rods. In demonstrating compliance, the safe-life approach specified in § 25.571(c) could be used as it may be impractical to develop a reliable inspection program as specified in § 25.571(b).”</i> EASA suggests FAA removes these sentences from the draft Memo because:</p> <p>a) Current FAA and EASA policy is basically to accept landing gears as safe- life items as they are the only structures for which damage tolerance is currently considered impractical. More discussion appears to be required for other PSEs.</p> <p>b) EASA AMC 25.671 (c)(1) states that <i>“However, where a single component is used on the basis that its failure is extremely improbable, it should comply with CS 25.571(a) and (b).”</i> For such cases compliance to 25.571(c) only is not acceptable for EASA. If a damage tolerance evaluation is not possible, the design should be changed to be fail-safe. The draft Memo seems to relax the current regulation of § 25.671 and it seems to be in conflict with the Effect of Policy: <i>“The general policy stated in this document does not constitute a new regulation.”</i></p>	<p>To remove these three sentences (in paragraph 2.a) from the draft Memo.</p>	<p>We agree. We have removed the referenced sentences.</p>

DISPOSITION OF PUBLIC COMMENTS

Certification of Structural Elements in Flight Control Systems, Policy Statement No. PS-ANM-25-12

Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
	Commenter: EASA		
	<p>c) These words do not seem to be fully in line with FAA Policy PS-ANM100-1981-00046 (which promotes a fail-safe approach).</p> <p>d) EASA understands the principal focus of the draft Memo to be on identifying structural elements in systems, and not the compliance demonstration with 25.571 and interpretation of “impractical” in relation to damage tolerance. EASA is concerned that the example used of safe-life for dual rods may be confusing.</p>		
4	<p>Paragraph 2.b.(1) of the draft Memo states that <i>“While single failures must normally be assumed to occur, there are cases where it is obvious that, from a realistic and practical viewpoint, any knowledgeable, experienced person would unequivocally conclude that a failure mode simply would not occur, unless it is associated with a wholly unrelated failure condition that would itself be catastrophic.”</i> Once identified and accepted, such cases need not be considered.” EASA suggests that further detail is required to enhance this guidance. Some examples would be helpful to identify failure modes which could be accepted as simply not occurring.</p>	<p>To further detail this guidance (in paragraph 2.b.(1)) and to add examples to the draft Memo.</p>	<p>We have provided guidance as suggested.</p>

DISPOSITION OF PUBLIC COMMENTS

Certification of Structural Elements in Flight Control Systems, Policy Statement No. PS-ANM-25-12

Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
Commenter: EASA			
5	Paragraph 2.b.(1) of the draft Memo states that “A joint industry-authority working group recommended, and the FAA agreed, that this guidance is also applicable for compliance with the single failure requirement of § 25.671.” EASA disagrees and suggests that FAA removes this sentence from the draft Memo because it seems to relax the current regulation of § 25.671 and it seems to be in conflict with the Effect of Policy: “The general policy stated in this document does not constitute a new regulation.”	To remove this sentence (in paragraph 2.b.(1)) from the draft Memo.	We have removed the sentence from the policy. However, the FAA does not distinguish between the single failure requirement in § 25.671 and the single failure requirement in § 25.1309.
6	It is suggested that the development of an inspection program should be further clarified in the draft Memo in relation to the single failures considered under 25.671/25.1309. From a systems point of view it is expected that inspections shall be put in place to detect these single failures (as CMR’s). From a structural point of view, it should be demonstrated that there is enough fatigue life (determined by either crack growth or safe life) in the remaining load path(s) (taking into account redistribution of loads as well) to support these inspections as well.	To add to the draft Memo the FAA’s expectations for the inspection program to be put in place in relation to single failures considered under 25.671/25.1309.	We do not agree that the policy should contain guidance on inspection programs. Inspections used to meet §§ 25.1309 and 25.671, as well as § 25.571, should be established based on current guidance and practice, and relevant industry documents. No change.
7	It is noted that FAA Policy PS-ANM100-1981-00046 also addresses some of the items discussed in the draft Memo.	To add FAA Policy PS-ANM100-1981-00046 to the list of references (page 2) and to attachment 1 (section 3).	The referenced policy was superseded by Policy Statement PS-ANM100-1984-00039, which is referenced and discussed in the proposed policy statement.

DISPOSITION OF PUBLIC COMMENTS

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Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
Commenter: EASA			
8	<p>EASA has identified inconsistencies between the referenced guidance material (ACs, PSs) and the regulations.</p> <p>For example:</p> <p>AC 25-14 states that <i>“The design should incorporate features that would provide a high probability of detection of any damage, before the damage causes loss of the surface from the airplane.”</i> AC 25-14 asks for features to detect damage before the damage causes the loss of the surface, whereas PS-ANM100-1984-00053 would accept missing slat/flap surface if the airplane still has adequate stall margins, controllability and maneuverability. None of these guidance materials includes the investigation of the effect of the surface loss on the airplane (for example: possible impact of a slat/flap surface on the horizontal or vertical stabilizer), which is required by 25.1309. It is suggested that this subject should be addressed in the Memo.</p> <p>Furthermore, it is quite difficult to clearly identify the FAA policy due to the number and the content of the referenced guidance material.</p> <p>A cross-check of the referenced guidance material may lead to further comments.</p> <p>EASA suggests taking into account the following possibility: Perhaps the various AC and policy material could be withdrawn and incorporated into</p>	<p>To address the identified inconsistency and to add guidance for this subject to the draft Memo.</p> <p>Additional cross-check of the referenced guidance material and to provide further guidance for any identified inconsistency.</p>	<p>The subject of control surfaces departing the airplane is outside the scope of this policy statement. We do not wish to add more guidance to this policy on that particular subject.</p> <p>The commenter also suggests withdrawing all current and relevant policy memos and replacing with a single memo. We recognize the need to consolidate policy statements in the long term; however, we are postponing that effort for a future activity. No change.</p>

DISPOSITION OF PUBLIC COMMENTS

Certification of Structural Elements in Flight Control Systems, Policy Statement No. PS-ANM-25-12

Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
	Commenter: EASA		
	this Policy Statement. This would allow a single policy to be applied rather than using this Policy Statement in addition to current material.		
9	AC 25-14 was cancelled and incorporated in its entirety into AC 25-22. In the draft Memo it is referred to AC 25-14 at various places. To avoid any reference to a cancelled AC, it is proposed to change the references to AC 25-22.	To change references AC 25-14 to AC 25-22.	We have corrected the references.

DISPOSITION OF PUBLIC COMMENTS

Certification of Structural Elements in Flight Control Systems, Policy Statement No. PS-ANM-25-12

Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
Commenter: Tom Knott, DER			
1	This draft Policy Statement is well written, understandable, and necessary. It will go a long ways towards standardized findings of compliance, and help with a regulation number-based authorization system for designees being developed in a separate FAA effort.	None.	None.
2		Include “aspects” in the key definitions. A “component” such as an autopilot servo has structural, mechanical systems, and electrical systems aspects. This would also provide more clarity to the Figure on page 4, which at least to me is very understandable.	We believe the definitions are adequately stated in the policy. No change.
3		The last sentence in paragraph 3.b. on page 9, “But this does not exclude structural elements in systems from the requirements of § 25.1309” is consistent with the Figure on page 4 and the overall intent of the document, but could provide troublesome for repairs and alterations. For instance, an autopilot servo could be installed with alternative hardware, which has structural aspects but does not affect the system function or system safety. Right now, this could be handled with a statement on the (structural) 8110-3, but further explanation in the Policy memo would clarify.	This policy does not change the applicability of § 25.1309. If a structural component does not affect system function or system safety, then compliance with § 25.1309 need not be addressed. We do not believe that additional guidance is needed in this area. No change.

DISPOSITION OF PUBLIC COMMENTS

Certification of Structural Elements in Flight Control Systems, Policy Statement No. PS-ANM-25-12

Prepared by Todd Martin, ANM-115

No.	Comment	Requested Change	Disposition
Commenter: NTSB			
1	The NTSB recognizes the benefits of this proposed policy statement and fully supports its adoption. However, the NTSB notes that the proposed statement does not provide guidance on structural failures and the human-airplane system, as identified in Safety Recommendation A-06-37, and encourages the FAA to continue its work in this area.	None.	This policy statement will address structural failures as identified in Safety Recommendation A-06-37. Guidance that addresses the “human-airplane system” will be addressed separately.