

Consolidated Comments Matrix for AC25.571-1X
Disposition of Public Comments

	Comment	Requested Change	Disposition
1.	<p><u>Commenter: Boeing</u> Paragraph 5n, definition of “<u>Teardown</u>”</p> <p>Issue: Definition for Teardown (paragraph 5n) uses the phrase “destructive process.”</p> <p>Rationale: Not all teardowns are destructive in nature. High-time airplanes may be partially disassembled and refurbished to determine the structural condition. The industry has used the term “teardown and refurbishment” as a means to develop applicable full-scale fatigue test evidence. This concept is prominent in several submittals to ARAC by the AAWG (References [5], [6], [10], and [11]). The ARAC recommendations were accepted, at the time, by both the FAA and JAA representatives that helped develop these reports.</p>	Delete the word “destructive.”	The FAA concurs with the commenter and has revised the definition to acknowledge both destructive and non-destructive inspection methods.
2.	<p><u>Commenter: Boeing</u> Paragraph 5g, definition of “<u>Instructions for Continued Airworthiness</u>”</p> <p>Issue: The definition for Instructions for Airworthiness (ICA) is not complete. The ICA may contain more information than is quoted in this paragraph for structures alone. For instance, the ICA contains Certification Maintenance Requirements for Systems as well.</p> <p>Rationale: For better clarity.</p>	Revise the definition to make it more accurate.	The FAA concurs with the commenter and has revised the definition to include all documentation that sets forth instructions and requirements for maintenance that is essential to the continued airworthiness of an aircraft, engine, or propeller.
3.	<p><u>Commenter: Gulfstream</u></p>	Unless direct evidence is known that an actual limit exists, the	The FAA concurs with the commenter and has revised the AC to refer to “limit

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	<p>Paragraph 5i, Initial Operational Limit</p> <p>The publishing of an Initial Operational Limit (IOL) in the [Airplane Limitations Section (ALS) of the ICA] would not present a burden if applied to all new transport category aircraft. However, the treatment of the IOL appears to place rigid restraints on developing the structural maintenance program.</p> <p>Since many cases of premature cracking appear during in-service operation, a more flexible approach similar to [the] Maintenance Steering Group (MSG-3) maintenance program development process may be more appropriate. This would allow for variations in usage between the different types of operation (Part 91 vs. 121).</p>	<p>philosophy of “Limit of Validity” should be adopted to allow such flexibility.</p>	<p>of validity of the engineering data that supports the structural maintenance program” (LOV) instead of “initial operational limit.”</p>
4.	<p><u>Commenter: Boeing</u></p> <p>Paragraph 7a(3)</p> <p>Issue: The language in this paragraph has changed over the current AC language from a guiding nature to a compulsive one. The term “should” has changed to “must.”</p> <p>Rationale: The prima facie requirement of the regulations is “analysis supported by test evidence.” Additionally, service experience gained from a teardown of an in-service airplane may result in significantly more meaningful information than a single fatigue test.</p>	<p>Change the text to read:</p> <p>(3) Experience with the application of methods of fatigue evaluation indicates that a test background must should exist in order to achieve the design objective. Section 25.571 requires applicants to conduct damage tolerance tests for design information and guidance purposes.</p>	<p>The FAA partially concurs with the commenter and made the following changes:</p> <p>The FAA finds that some form of test evidence must be developed in support of an analysis to achieve the design objective. The test evidence may be coupon testing or full-scale tests.</p> <p>Paragraph 7a(3) is renumbered to 5a(5) and is revised to state that the applicant “should” perform crack-growth and residual-strength testing to produce the data needed to support analyses. It also includes the requirement for full-scale test evidence to support the evaluation of structure susceptible to WFD (as required by the rule).</p>

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5.	<p><u>Commenter: Boeing</u> Paragraph 7a(4)</p> <p>Issue: This is a new paragraph that uses the phrase “analysis and testing.”</p> <p>Rationale: The prima facie requirement of the regulations is “analysis supported by test evidence.” Additionally, service experience gained from a teardown of an in-service airplane may result in significantly more meaningful information than a single fatigue test. Further, most structural tests require analysis to quantify the results</p>	<p>Change the text to read:</p> <p>(4) Replacement times or inspections for fatigue cracking must be established, as necessary. These actions must be based on quantitative evaluations of the fatigue characteristics of the structure. In general, analysis and testing <u>supported by test evidence or service experience</u> will be necessary to generate the information needed. All inspections, modification times, replacement times, and IOLs—based on the damage tolerance, fatigue, and WFD evaluations—must be included in the ALS of the ICA required by § 25.1529.</p>	<p>The FAA concurs with the commenter (although the FAA has not adopted the text proposed by the commenter) and made the following changes:</p> <p>Paragraph 7a(4) is renumbered to 5a(6) and is revised to include a statement regarding the acceptable use of service-experience data.</p>
6.	<p><u>Commenter: Airbus</u> Paragraph 7a(4)</p> <p>The statement of paragraph 7.a.(4) “All inspections, modification times, replacement times, and IOLs (...) must be included in the ALS of the ICA (...)” is not in line with the</p>	<p>The commenter suggests the following:</p> <p>Airbus requests FAA to reconsider the statement below associated to ALS content.</p>	<p>The FAA concurs with the commenter and made the following changes:</p> <p>Paragraph 7a(4) is renumbered to 5a(6) and is revised to specify that all inspections, modification times,</p>

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	25.571(a)(3) rule. Per the rule, only those inspections or other procedures must be established, as necessary, to prevent catastrophic failure, and these must be included in the ALS. Therefore, all inspections, modification times, replacement times resulting from the fatigue, damage tolerance, and WFD evaluation are not mandatory to ensure continued airworthiness, and all results should not be included in the ALS.	“All inspections, modification times, replacement times, and IOLs (...) must be included in the ALS of the ICA (...)”	replacement times and LOVs <i>that are necessary to prevent catastrophic failure</i> (based on the damage tolerance, fatigue, and WFD evaluations) must be included in the ALS of the ICA.
7.	<p><u>Commenter: Gulfstream</u> Paragraph 7a(4)</p> <p>This section discusses the requirement to incorporate inspections or part replacements to preclude WFD in the ALS. Gulfstream contends that a separate WFD section in the ALS is not required as the operator only needs to know that the part is life-limited or requires an inspection.</p>	<p>Gulfstream recommends that the following be required for all aircraft regardless of operation:</p> <ul style="list-style-type: none"> • A defined, but flexible, limit on the structural maintenance program. • The incorporation of inspections or part replacements to preclude WFD in the ALS. 	<p>The FAA concurs with the commenter and has made the following changes:</p> <p>Paragraph 7a(4) has been renumbered to 5a(6) and revised to state that all inspection or other actions necessary to preclude structural failure up to a catastrophic failure must be included in the ALS. The text of the final AC has been amended to remove any references to a separate section in the ALS that identifies actions necessary to address WFD.</p>
8.	<p><u>Commenter: Boeing</u> Paragraph 7d</p> <p>Issue: The paragraph uses the phrase “... that serious damage growth is extremely improbable....” This phrase also appears in AC 25.571-1C.</p> <p>Rationale: While some may consider any crack growth as “serious,” the issue here is if the crack growth is significant.</p>	Delete the word “serious” and in its place use the word “significant.”	The FAA concurs with the commenter and has revised the sentence accordingly. Paragraph 7d is now 5d.
9.	<u>Commenter: Boeing</u>	Delete the reference to IOL so that the statement reads as	After completing the full-scale fatigue test, the applicant will establish an LOV

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	<p>Paragraph 8a, Damage Tolerance Evaluation</p> <p>Issue: As written, this paragraph could be misinterpreted relating to the development of the DTA inspection programs and their respective thresholds for inspection.</p> <p>Rationale: The way the proposed text is worded could lead one to believe that there was a requirement to revisit the baseline fatigue program when the airplane reached either DSG (current language) or IOL (proposed language). This paragraph is directly referring to the Damage Tolerance Evaluation and the inspections that result out of the damage tolerance assessment. These inspections have other inspection threshold criteria applied to them. Generally these thresholds are set between 50% and 100% of DSG, but never greater. It seems inappropriate to change this to IOL in this paragraph of the proposed AC. In addition, IOL may not be known for several years after the type certificate is issued, making the means of compliance a “moving target.”</p>	<p>follows:</p> <p>“... to ensure that – should fatigue, corrosion, or accidental damage occur within the IOL of the airplane – the remaining structure...”</p>	<p>for the airplane model. Prior to this, the applicant should have a candidate LOV in mind for compliance. The applicant should consider the candidate LOV when performing the damage tolerance evaluation and after the full-scale fatigue testing is completed the applicant may need to re-evaluate some structure. The FAA finds the new term, LOV, provides additional clarity over the existing term, DSG, or the proposed term, initial operational limit. To operate beyond the LOV, the full-scale fatigue test evidence and the structural maintenance program must be re-evaluated to determine if additional modifications or replacements are required.</p>
10.	<p><u>Commenter: Boeing</u></p> <p>Paragraph 8d</p> <p>Issue: The example given in this paragraph is no longer an appropriate example.</p> <p>Rationale: Following the 1988 accident in Hawaii involving a Boeing Model 737, the industry identified certain failure modes that were being considered as safe detection of damage as inappropriate. One of those was eliminated -- the consideration of a safe decompression due to “flapping” of</p>	<p>The commenter suggests that the example about “flapping” of fuselage skins be replaced with the example of a wing fuel leak.</p>	<p>Paragraph 6d has been amended to delete the phrase, “in a pressurized fuselage an obvious partial failure...” in reference to the flapping skin detection.</p> <p>Although the FAA concurs that the example of a wing fuel leak is relevant, additional examples have not been added as a sufficient number of examples are already provided.</p>

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	fuselage skins. Because of this, SSID programs were changed to eliminate detection of fuselage skin damage by this means.		
11.	<p><u>Commenter: Boeing</u> Paragraph 8g(1)</p> <p>Issue: The determination of general damage locations is incomplete. (Boeing notes that this section has not changed from AC 25.571-1C.). Applicants may have available to them additional information that could be used to develop damage locations based on service experience of other models. Boeing recommends that this be added to the guidance material.</p> <p>Rationale: Any applicable data that is available should be reviewed in the process of determining which structure to analyze. Boeing considers that the information available from service experience is often times more significant than the data derived from analysis supported by test evidence.</p>	<p>The commenter suggests adding the following wording:</p> <p>“The location and modes of damage can be determined by analysis or service experience or by fatigue tests on complete structures or subcomponents ...”</p>	<p>The FAA concurs with the commenter. The paragraph is changed to include a statement regarding the use of service experience, if available, for the evaluation of determining general damage locations.</p>
12.	<p><u>Commenter: Boeing</u> Paragraph 9a, Widespread Fatigue Damage Evaluation</p> <p>Issue: The distinction between MSD, MED and WFD is not appropriately noted.</p> <p>Discussion: The suggested re-wording provides a more accurate description of MSD/MED and the relationship to WFD.</p>	<p>The commenter suggests changing the text to read as follows:</p> <p><i>“a. <u>General.</u> Widespread fatigue damage is a condition that typically occurs later in the life of an airplane, as the result of the simultaneous presence of relatively small fatigue cracks at multiple adjacent locations. The cracks may occur within one</i></p>	<p>The FAA concurs with the commenter and has revised the AC to align with the general discussion on widespread fatigue damage contained in AC 120-104.</p>

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		<p><i>structural element, such as a single rivet line of a lap splice joining two large skin panels (Multiple site damage (MSD)), or in multiple elements such as adjacent frames or stringers (Multiple element damage (MED)). If widespread fatigue damage (WFD) occurs, the MSD or MED cracks have reached a sufficient size and density to interact, and most importantly, have reduced the load carrying capability of the structure to below the certification requirements of 14 CFR §25.571(b). These cracks may be difficult to detect, and therefore, appropriate maintenance actions must be defined to prevent their occurrence, at least up to the limit of validity.</i></p>	
13.	<p><u>Commenter: Boeing</u> Paragraph 9b, Widespread Fatigue Damage Evaluation Issue: The absolute requirement of assuring absence of WFD up to a limit cannot be reasonably assured by the means</p>	<p>Paragraph 6b of current AC 25.571-1C provides a much more concise appraisal of what is possible with two lifetimes of fatigue-test evidence. Boeing</p>	<p>We agree that an absolute requirement of assuring absence from WFD up to a limit is not practical. We find that clarification to the guidance in paragraph 6b of AC 25.571-1C is necessary. Appendix 2</p>

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	<p>proposed in the AC.</p> <p>Rationale: Even if the applicant follows the means of compliance suggested in AC 25.571-1X to the letter, there are no guarantees that the airplane will be free from WFD up to a limit. One of the purposes of the maintenance inspection programs is, in part, to detect issues that did not reveal themselves during the fatigue test. The FAA has placed significant importance on the value of a single fatigue test to demonstrate freedom from WFD. In reality, the issue is far more complex, and while we agree that a fatigue test provides a high degree of confidence, there are no guarantees... In addition, it is impossible for Boeing, or any other manufacturer for that matter, to control how an airplane will be used once it enters service. In the past, we selected flight profiles for the fatigue design of the airframe that represented what we considered to be conservative estimates of the usage. We have also used analysis based on tests to extend those results to other usages of the airplane</p> <p>We would imagine that these types of discussions would occur between the applicant and the FAA (as suggested in paragraph 6.b. of AC 25.571-1C) in the process of developing the test plan and objectives. This guidance has been removed from the proposed AC and in its place a reiteration of the rule requirements has been inserted. It appears that the proposed AC does not recognize or address the issues and problems related to variations in actual in-service usage of the airplanes by various operators.</p>	<p>suggests that the text from AC 25.571-1C be used instead of the proposed text.</p>	<p>(appendix 1 is now 2) also provides specific guidance on how the full-scale fatigue test should be used for the evaluation of structure susceptible to WFD. It also provides guidance for when a full-scale fatigue test must be performed. We have revised Section 9, which is now Section 7, to describe the process for establishing an LOV and incorporating the LOV in the ALS of the ICA.</p>
14.	<p><u>Commenter: Boeing</u> Paragraph 9c(1) and 9c(2), Widespread Fatigue Damage Evaluation</p>	<p>The proposed AC should reflect the language contained in the proposed regulation in its entirety. Alternatively, these</p>	<p>The FAA concurs with the commenter and has revised those paragraphs accordingly.</p>

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	<p>Issue: These proposed paragraphs describe when fatigue testing is and is not completed. There appears to be a discrepancy, however, between the proposed AC text and the associated proposed regulation. The proposed regulation does specifically require that an operational limit be declared.</p>	<p>paragraphs could be deleted because they provide no further guidance than what is provided in the proposed regulation itself.</p>	<p>Paragraphs 9c(1) and 9c(2) have been renumbered to 7d(1) and 7d(2). Under appendix H to part 25, the ALS must contain a defined limitation; this limit is an airworthiness limitation beyond which the airplane may not be operated. Paragraphs 7d(1) and 7d(2) define this “limitation.”</p>
15.	<p><u>Commenter: Boeing</u> Paragraph 9d, Widespread Fatigue Damage Evaluation</p> <p>Issue: This paragraph describes placing known service issues in the Airworthiness Limitation Section of the ICA: “... maintenance actions may be necessary for an airplane to reach its IOL. For initial certification, these actions should be specified as airworthiness limitation items and incorporated into the ALS of the ICA.”</p> <p>Rationale: The fatigue test may not be complete and the full analysis of the data may not be available for a significant period of time after type certification. For those areas that will require inspection and modification, the service information may take another period of time to develop, incorporate on the production line, and publish as a service bulletin. It is only at this point that the service bulletin can contain the proper effectivity. The notion of adding issues to the ALI could be very challenging: On the one hand the rule says the product must be “free from WFD,” and on the other hand this guidance material appears to allow the TCH to</p>	<p>Boeing requests that the FAA limit this paragraph to delivered airplanes, and require the TCH to embody such changes, as required, to preclude WFD in future deliveries, which is the associated rule requirement.</p>	<p>The FAA concurs with the commenter and has provided clarification on pre-certification and post-certification maintenance actions necessary to support a LOV. This information has been moved to paragraph 7c.</p>

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	produce and deliver a product with a known safety issue.		
16.	<p><u>Commenter: Gulfstream</u> Paragraph 9d in Maintenance Actions</p> <p>The text appears to allow TC holders to provide only service data to prevent WFD if discovered post-certification and states that this “<i>may</i> be mandated by airworthiness directives by the FAA”. This is counter to paragraph 7a(4) which requires an update to the ALS. Gulfstream believes that relying on service information alone challenges the ALS concept. Gulfstream believes that any maintenance action required as a result of fatigue testing or service experience, WFD or otherwise, must be incorporated in the ALS and order M-8040.1, paragraph 158, specifically requires the FAA to issue an AD in this case.</p>	<p>The commenter recommends adding a milestone, after completion of the fatigue test, where all maintenance instructions are reassessed for all new TC programs.</p>	<p>The FAA partially concurs with the commenter and provides the following clarification:</p> <p>The guidance in the proposed AC text for maintenance actions is consistent with the FAA’s practice for addressing any safety concern that are discovered during the certification fatigue test. Any maintenance actions that are needed to address a safety concern must be identified in and mandated by the ALS of the ICA. Maintenance actions that address an unsafe condition for airplanes that are in service must be mandated by an airworthiness directive. Airplanes to be delivered in the future must have maintenance actions identified in and mandated by the ALS.</p> <p>Regarding the commenter’s suggestion for including a milestone after completion of the fatigue tests for reassessment of all maintenance instructions: appendix 2 (appendix 1 is now 2) provides detailed guidance on the full-scale test and post-test actions necessary to support the airplane LOV.</p>
17.	<p><u>Commenter: Boeing</u> Paragraph 9e, Widespread Fatigue Damage Evaluation</p>	<p>The AAWG has been given a task, Reference [9], to examine the means that an operator can</p>	<p>The tasking is done and we are providing the guidance that is different. Section 9e is renumbered to 7e. The text is changed</p>

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	<p>Issue: The suggested guidance material for ATCs and STCs, and their repairs, appears to be premature.</p> <p>Rationale: With respect to the suggested rewrite of the guidance material, Boeing notes that most tests – fatigue or otherwise – must be interpreted through analysis before those results are, in general, applicable.</p>	<p>incorporate maintenance requirements for WFD into its maintenance program. Boeing suggests that the FAA withhold this guidance until the AAWG has completed the tasking.</p> <p>In addition, we suggest the following rewording of the text to bring it into line with the associated rule requirements.</p> <p style="padding-left: 40px;">“This demonstration should be by a WFD evaluation, which may include <u>analysis supported by</u> fatigue test evidence.” (see appendix 1 of this AC), analysis that correlates to relevant full-scale fatigue test results, or both.”</p>	<p>to state only that freedom from WFD must be demonstrated up to the LOV.</p> <p>Specific guidance on testing, as it relates to repairs, is provided in paragraph 7f and appendix 2 (appendix 1 is now 2).</p>
18.	<p><u>Commenter: Boeing</u> Paragraph 9e(2), Widespread Fatigue Damage Evaluation</p> <p>Issue: The requirement to provide maintenance actions as part of the repair data is not in concert with other long-standing FAA guidance material and practice on repairs.</p> <p>Rationale: For repairs, there are no defined safety issues with releasing an airplane on the basis of static strength, as long as the inspection requirements are provided within one year,</p>	<p>The commenter suggests that the proposed text reference either AC 25.1529-1, or AC 120-XX [AC 120-93], as an acceptable means of compliance that allows a period of one year to develop such data after the airplane returns to service.</p>	<p>The FAA concurs with the commenter and has revised the AC accordingly. It now refers to AC 120-93 for the timing on when the evaluation must be done.</p> <p>For new certification, repairs must be done to meet certification basis.</p> <p>Paragraph 9e (renumbered to 7f) is changed to state only that freedom from</p>

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	<p>based on guidance given in both AC 25.1529-1 and proposed AC 120-XX. These inspection requirements have historically been associated with damage tolerance, but could equally be associated with WFD. The importance of WFD cannot be raised over the importance of Damage Tolerance. It is important that safety is served for both elements. Damage tolerance inspections begin earlier in the life of the airplane, whereas WFD maintenance actions occur later. It is a requirement that damage tolerance analysis be performed in advance of the WFD analysis. The guidance provided herein on repairs would reverse that order and slow the approval of repairs.</p>		<p>WFD must be demonstrated up to the LOV for airplanes certified to Amendment 25-96 or later, as required, to maintain the original certification basis. Specific guidance on testing, as it relates to repairs, is provided in appendix 2 (appendix 1 is now 2).</p> <p>Section 25.571(b) at Amendment 25-45 and later requires the evaluation of damage at multiple sites. However, how we have addressed the fact that the FAA and industry’s understanding of damage at multiple sites has changed over time. A crack at a single site will usually occur before cracks at multiple sites, but both are considered under 25.571(b) – i.e., a DT analysis.</p>
19.	<p><u>Commenter: Boeing</u> Appendix 1</p> <p>“Full-Scale fatigue test evidence” is not clearly defined in the proposed AC. Appendix 1 appears to provide only a narrowly focused explanation involving the fatigue testing of a highly configured article.</p> <p>In the preamble to Amendment 25-96, Reference [8], the FAA dispositioned one of the comments submitted as follows:</p> <p><i>The FAA received several comments about the full-scale fatigue testing of derivative or modified type designs. These commenters point out that full-scale fatigue test data generated during the original certification of an airplane</i></p>	<p>The commenter suggests the AC include the synopsis provided by the AAWG, Reference [6] Section 6, as a definition/ explanation.</p>	<p>Based on this comment, we find clarification is necessary as to what “full-scale fatigue-test evidence” means. To show compliance, an applicant typically must perform a laboratory fatigue test. We changed the words in Amendment 25-96 from “full-scale fatigue testing” to “full-scale fatigue-test evidence” in response to commenters’ concern that applicants would always have to perform a full-scale fatigue test to demonstrate compliance. The change to “full-scale fatigue test evidence” allows the use of previously accomplished fatigue testing for derivative models and type-design</p>

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	<p><i>type, and other data, can sometimes be used to determine when widespread multiple-site fatigue damage will, or will not, occur on the modified designs. These commenters state that additional full-scale fatigue testing would not be necessary in all cases. The FAA concurs with these comments. The working of Sec. 25.571(b) in the final rule has been changed along the lines of one comment that had been jointly developed by the Aerospace Industries Association, the Association Europeenne des Constructeurs de Materiel Aerospatial, and the FAA's Technical Oversight Group for Aging Airplanes. This change uses the words "sufficient full-scale fatigue test evidence" in place of "sufficient full-scale testing"</i></p> <p>The information contained in the AAWG's report, Reference [6], which was developed by the industry and the FAA, provides clear guidance as to what constitutes full-scale fatigue test evidence. Specifically, the AAWG identified seven areas where meaningful data could be obtained:</p> <p><i>"Fatigue Test Evidence consists of reductions of data collected from more than one of the following sources:</i></p> <ul style="list-style-type: none"> • <i>Full Scale Fatigue Test with or without tear down</i> • <i>Full Scale component tests with or without tear down</i> • <i>Tear down and refurbishment of a high time airplane</i> • <i>Less than full scale component tests</i> 		<p>changes when it has been shown by the applicant to be applicable. AC 25.571-1C followed this by providing guidance on when additional fatigue testing is necessary for different certification projects. This acknowledges that there may already be full-scale fatigue-test evidence that an applicant can use to certify a derivative model or a design change to an existing model.</p> <p>The final AC includes guidance in appendix 2 (appendix 1 is now 2) for showing compliance by full-scale fatigue testing. It also includes guidance on when an applicant may or may not have to perform additional fatigue testing. We agree with the commenter that other acceptable data may be available, such as service experience. In such cases, the applicant would include such an approach in its compliance plan.</p>

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	<ul style="list-style-type: none"> • <i>Fleet Proven Life Techniques</i> • <i>Evaluation of in-service problems experienced by other airplanes with similar design concepts</i> • <i>Analysis methods which have been parametrically developed to reflect fatigue test and service experience.”</i> 		
20.	<p><u>Commenter: Boeing</u> Appendix 1, paragraph 1a</p> <p>Issue: The objective standard to be cleared initially is the DSG, not the IOL.</p> <p>Discussion: The amount of full-scale fatigue test evidence from a single fatigue test is limited. As previously mentioned, while there is high confidence that WFD will not occur, there are no guarantees that the actual fleet of airplanes will be free from WFD as a result of running that one test. The following figure notionally illustrates the contribution of both the initial fatigue test, and what can be expected from the fleet of airplanes as the fleet ages. Boeing notes that the current regulation requires freedom from WFD up to the DSG, and that is good and sufficient for the purposes of certification. If there is a desire to operate beyond DSG, the requirements of Subpart I should be in effect.</p>	Change IOL to DSG.	<p>The FAA changed the rule; the IOL terminology is replaced with limit of validity (LOV) throughout the document in response to comments to the NPRM. The FAA determined that the LOV, based on the data known at the time (best data available), must be included in the airplane’s ALS as an airworthiness limitation to prevent airplanes from being flown beyond the LOV. 14 CFR part 26 includes requirements to extend the LOV should any person provide further data to support such an extension.</p> <p>Appendix 1 is now changed to 2.</p>
21.	<p><u>Commenter: Boeing</u> Appendix 1, paragraphs 1b and 1c</p> <p>Issue: The reason for the testing is not clearly explained. The description of the test article and test loadings is very precise and provides no means to objectively determine compliance.</p>	The reason for the test is to provide information relative to freedom from WFD. This reason needs to be added to paragraphs 1b and 1c to provide the basis for the configuration and the	<p>The FAA concurs. Appendix 2, paragraph 1a, is revised to include a description of the purpose of the full-scale fatigue test.</p> <p>Appendix 1 is now changed to 2.</p>

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		loading proposed by the applicant.	
22.	<p><u>Commenter: Boeing</u> Appendix 1, paragraph b(1)</p> <p>Issue: It appears that a basic step in the process is missing, in that the applicant should declare what areas are being tested. The proposed text seems to relate more to the entire airframe.</p> <p>Rationale: The fact that the test is for determination of WFD, should guide a number of different decisions about the test article, the means of testing, and the number of load cycles to be applied.</p>	<p>Revise the proposed text to state that the applicant should declare the areas of the test article being evaluated for freedom from WFD. The applicant should demonstrate why the test is representative of the area and the loading it will experience in the testing as opposed to service.</p>	<p>The FAA partially concurs with the commenter and has made the following changes:</p> <p>The FAA has added Step 3, evaluation of WFD susceptible structure, in paragraph 7c(2) of the final AC. We have also revised the discussion on Test Duration to address duration for showing freedom from WFD for WFD susceptible structure.</p> <p>Based on the 16 examples presented in proposed AC 120-104, WFD may be a global issue that affects the entire airplane. The guidance in AC 120-104 and this final AC was written based on past experience with metal airplanes. We have determined that the test article and loading to show freedom from WFD should be no different from what companies have done in the past to show that the fatigue characteristics of the entire airplane are understood.</p> <p>We recognize that, for future designs that include composites for primary structure, this might not be the case. For these designs, an applicant should refer to AC</p>

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			20-107B for guidance.
23.	<p><u>Commenter: Boeing</u> Appendix 1, paragraph b(3)(ii)</p> <p>Issue: In Appendix 1b(1), the guidance instructs the applicant to test a typical airframe. In paragraph b.(3)(ii), the guidance states that the applicant should install and test both repairs and type design changes, and then extend the testing to show freedom from WFD.</p> <p>Rationale: It is expected that the fatigue test will be complete within one or two years of type certification. It is doubtful if any type-design changes would be developed in that period of time. A type-design change by virtue of the certification process would be required to be free from WFD and the means to provide that data would be subject of discussions between the applicant and the FAA.</p>	<p>While it may be advantageous to install some typical SRM repairs on the airframe at the start of the test, the installation of type design changes and SRM repairs on the changes does not seem appropriate. It is not possible to predict all the repairs that might be required in advance of completion of the fatigue test and it is certainly known to a lesser extent what design changes might be required. In addition, incorporation of repairs or type design changes in a given area may preclude a valid fatigue test of the unrepaired structure. Boeing recommends that the provision for type design changes and repairs be removed.</p>	<p>The FAA partially concurs with the commenter and has made the following changes:</p> <p>The FAA has revised the noted appendix (appendix 1 is now 2) by moving the guidance in paragraph c of the proposed AC to paragraph b. The revision first discusses when full-scale fatigue testing should be performed and then provides guidance on the details of that testing. We have not changed the guidance related to whether major repairs require full-scale fatigue testing. The guidance states that, in general, new major repairs would not necessitate full-scale fatigue testing. If a test is needed, it is not the intent of the FAA to have that repair (or design change) be tested on the fatigue-test article that is used for the original certification project.</p>
24.	<p><u>Commenter: Boeing</u> Appendix 1, paragraph b(4)(i)</p> <p>Issue: The guidance contained in this paragraph suggests the application of static loads to demonstrate freedom from WFD.</p> <p>Rationale: Reconfiguring a fatigue test to a static loads test in order to cover all of the loading requirements of § 25.571(b) is a significant effort. There are also substantial technical issues regarding how one condition may interact</p>	<p>Remove the noted provision.</p>	<p>Appendix 2 (appendix 1 is now 2), paragraph 3e (renumbered), has been revised to state that a residual-strength assessment is required at the end of the full-scale fatigue test. This may be accomplished by residual-strength tests [3e(1)] or teardown inspections [3e(2)].</p> <p>Performing a static test with the applied residual-strength loads at the end of the</p>

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	with another condition. This process, while interesting, would be highly impractical.		fatigue test provides a viable method for determining whether MSD or MED has advanced to the state of WFD. This method would be an alternative to a teardown inspection of the airplane.
25.	<p><u>Commenter: Airbus</u> Appendix 1, paragraph b(4)(i)</p> <p>In Appendix 1, Paragraph b.(4)(i), FAA describes tear-down activities and static load test in the same section. These 2 different exercises, which are not necessarily alternatives to each other, should not be described at the same level.</p>	Review noted appendix for clarification.	The FAA partially concurs and has revised the final AC to discuss teardown inspections separately from static-load tests. Although the FAA agrees that these two exercises are not necessarily equal to each other, we find that accomplishment of either at the end of the full-scale fatigue test may be used to assess the residual strength of the test article.
26.	<p><u>Commenter: Boeing</u> Appendix 1, paragraph b(4)(ii)(A)</p> <p>Issue: This proposed guidance states that the applicant may establish an IOL that is less than the originally proposed IOL. Boeing considers this an unacceptable alternative.</p> <p>Discussion: If an airplane is sold and advertised to have a 50,000 flight DSG, there are significant financial issues if the DSG is then reduced. It is hard to imagine that this situation would exist, based on how airplanes are designed today. If an issue developed during the test, that issue would be resolved by a change to the type design and inspections/replacements for in-service airplanes</p>	Remove this provision. It is also noted that IOL should be changed to DSG.	The FAA has determined that, from a safety and technical perspective, this is an acceptable option. The option of reducing the LOV is only one of three options for addressing cracking that could lead to WFD. This option was included to allow the applicant time to develop a corrective action, such as a design change and/or maintenance actions. Subsequent to developing any corrective action, the LOV could be extended if the data supports such an extension.
27.	<p><u>Commenter: Boeing</u></p>	Revise text in both paragraphs as	The FAA concurs with the commenter.

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	<p>Appendix 1, paragraphs b(4)(ii)(B) and b(4)(ii)(C)</p> <p>Issue: See comments on section 9e, above, and the following suggested change to the text.</p> <p>Rationale: As previously commented, a test without analysis is not appropriate.</p>	<p>follows:</p> <p><i>“The applicant must substantiate the maintenance actions by further fatigue test evidence, analyses, or both analysis supported by fatigue test evidence.”</i></p>	<p>To be consistent with § 25.571(b), we have determined that the identified paragraphs require clarification. We have revised the final AC to align with the rule. The applicant must substantiate the maintenance actions by analysis supported by test evidence and (if available) service experience.</p>
28.	<p><u>Commenter: Boeing</u></p> <p>Appendix 1, paragraph c(2)(ii)(A)</p> <p>Issue: The following statement appears in this proposed paragraph:</p> <p style="padding-left: 40px;">“The applicant should also show that the operating stress levels for the affected structure are relatively the same (e.g., within 1 or 2 percent) as for the original certification project.”</p> <p>Rationale: The guidance provided here in determining the need for a fatigue test is less than the normal error one would expect from comparing two NASA Structural Analysis Program (NASTRAN) results from two different versions of the computer code. Most design changes will result in a situation where direct comparisons of stress levels are not possible. There may be additional considerations beyond the design change itself, such as a change in utilization, that might offset any stress increase or decrease. Further, the proposed AC does not indicate what stress (net section, far field, etc.) or loading condition should be considered in the comparison. Simply put, this guidance could drive all design changes to require test. In addition, Boeing notes that there are FAA-approved techniques that allow the direct</p>	<p>Remove this guidance.</p>	<p>Although we agree with the commenter, the applicant should still account for differences in usage and stress levels as part of the certification data. As a result, we have revised this final AC as follows: In the evaluation, the applicant should address any difference in operational usage and stress levels between the original certification project and the derivative model, and account for them.</p>

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	comparison of expected lives from the similar designs when operated at a different referenced stress states.		
29.	<p><u>Commenter: Boeing</u> Appendix 1, paragraph c(2)(ii)(B)</p> <p>Issue: This paragraph contains proposed criteria to define when fatigue testing is required of derivatives where no previous requirements exist.</p> <p>The relationship between the design and the need to test is missing from this guidance. The issue that needs to be addressed is if the design change to the derivative model affects the widespread fatigue characteristics established by the original full-scale fatigue test evidence. This should be added.</p> <p>Rationale: The decision on what tests are to be performed on a derivative model is a complex consideration, extending far beyond the changes being incorporated. The proposed AC establishes criteria that only extend to the changes being made and stress levels involved. This approach could lead to every derivative model requiring a fatigue test, with no exceptions. In fact, could also lead to more fatigue tests being accomplished than proof or ultimate load tests.</p>	<p>The commenter suggests that the following issues be considered in place of the ones proposed in the AC:</p> <p>Along with the five criteria above, we consider that the language contained in Appendix 1, paragraph c.(3) to be closer to industry practice today</p> <ol style="list-style-type: none"> 1. Does the design change have an adverse effect on the WFD characteristics of a detail or details? 2. Does the design detail add additional details that might be susceptible to WFD? 3. Does the design change alter the previously established load paths or design concepts? 4. Are there other considerations, such as changes in flight profiles, which might 	<p>The FAA partially concurs with the commenter. The FAA determined that the commenter’s five criteria are already implicitly included in the criteria provided in this AC. The examples provided in proposed paragraph c(2)(ii)(B) are provided to help identify derivatives that would need to be tested. The FAA has since determined that the criteria contained in the AC are sufficient without examples, and has removed the examples in the referenced paragraph.</p> <p>Appendix 2 (appendix 1 is now 2) of the AC was developed to provide guidance on the amount of fatigue testing required, if any, and the details of the testing for various certification projects. The testing, whether new or previously accomplished, provides data to support showing the airplane free from WFD up to the LOV.</p>

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		<p>affect the WFD characteristics?</p> <p>5. Is the substantiating full-scale fatigue test evidence deemed adequate by the applicant?</p>	
30.	<p><u>Commenter: Boeing</u> Appendix 1, paragraph c(4)</p> <p>Issue: The AC suggests that the applicant can use guidelines developed by the TCH to make the determination of maintenance actions to support the IOL. Boeing considers that the guidance provided could severely limit the ability of third party STC holders to provide services, and could have other negative effects in the industry.</p> <p>Discussion: The reason for a fatigue test on the structural changes by the STC is that the WFD characteristics of the structure cannot be reliably determined by existing full-scale fatigue test evidence. STC projects can involve something as simple as a small antenna installation, to something significantly larger, such as an installation of an upper deck cargo door. The criteria offered by the proposed AC would require testing of either of these examples based on one or more of the factors presented, specifically by the statement:</p> <p style="padding-left: 40px;">“For example, the applicant should perform full-scale fatigue testing when an STC <i>affects the magnitude and distribution of stress in the underlying structure</i>” [emphasis added]</p> <p>Boeing recommends that the applicant present to the FAA its plan for mitigating the threat to WFD, and in that plan,</p>	<p>The decision to test or not to test should be left to a discussion between the applicant and the FAA, and be a reasoned discussion based on the factors discussed below. The reference to “guidelines developed by the type certificate holder” should be removed. (See comments to Appendix 2, below, concerning the availability of such guidelines.)</p>	<p>The FAA partially concurs with the commenter and has removed the guidelines and revised the AC to clarify the full-scale fatigue-test requirements when it is necessary to perform such a test.</p>

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	<p>discuss the following factors:</p> <ol style="list-style-type: none"> 1. Does the STC have an adverse effect on the WFD characteristics of an existing detail or details? 2. Does the STC add additional details that might be susceptible to WFD? 3. Does the STC alter the previously established load paths or design concepts? 4. Are there other considerations, such as changes in flight profiles, which might affect the WFD characteristics of the modified airplane, including a proposed reduction in LOV? 5. Is there any substantiating full-scale fatigue test evidence that would be deemed adequate by the applicant? 		
31.	<p><u>Commenter: Boeing</u> Appendix 1, paragraph c(5)</p> <p>Issue: Whether or not a repair needs to be evaluated for WFD is dependent on some of the factors presented in the proposed AC, and other factors as well.</p> <p>Discussion: The extent of a repair should determine if it is susceptible to WFD. Generally speaking, a repair affecting less than two frame/stringer bays does not have a sufficient number of repetitive details to be of WFD concern. It is expected that the TCH will provide some guidelines on this in the respective model-specific guideline documents</p>	<p>The first step in this process is to determine if a repair even needs an assessment for WFD. Boeing suggests that there be a reference to appendix 2 for determination of repairs that require a WFD evaluation.</p>	<p>The FAA concurs with the commenter and has made the following changes:</p> <p>Appendix 2 (appendix 1 is now 2), paragraph 4e, is revised to provide clarification. Although AAWG provided a simplified approach, that approach could be presented as a means of compliance. No industry-accepted standard criteria are established for determining the susceptibility of a repair to WFD, and therefore the FAA has not provided specific criteria for assessment. Each applicant may develop and propose</p>

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			<p>their own criteria.</p> <p>The FAA has removed from appendix 3 (appendix 2 is now 3) the requirements that applicants develop guidelines for others to evaluate repairs, alterations, and modification for WFD.</p>
32.	<p><u>Commenter: Gulfstream</u> Appendix 2, Guidelines To Prevent Widespread Fatigue Damage</p> <p>The repairs and alterations identified in the discussion and draft AC120-YY, “Widespread Fatigue Damage on Metallic Structure” (Appendix H) are too complex to provide general guidelines to ensure adequate durability. Gulfstream has performed several modifications on the order of those listed and these were large engineering efforts. In many cases, the changes may involve several modifications at once; e.g. addition of cargo door and associated change in mission profile. A set of guidelines to address these items will have to be so general that it would be useless in actual practice, but would require significant resources for a manufacturer to develop. In addition, the manufacturer would have no control over how the guidelines are used and exposes the OEM to potential liability if they are applied incorrectly. Persons desiring to modify aircraft should be encouraged to consult with the appropriate OEM to obtain the necessary data for large projects.</p>	<p>Gulfstream recommends that general guidelines for performing the repairs, and modifications of concern be provided in an AC through the ARAC process.</p>	<p>The FAA concurs with the commenter and has made the following changes:</p> <p>The FAA has revised the AC to remove the requirements in appendix 3 (appendix 2 is now 3) to have applicants develop guidelines for others to evaluate repairs, alterations, and modification for WFD.</p>
33.	<p><u>Commenter: Boeing</u> Appendix 2, paragraph b</p> <p>Issue: The FAA has set specific expectations in Appendix 2</p>	<p>Boeing requests that the guidelines be limited to procedures that persons can employ to determine the correct</p>	<p>The FAA concurs with the commenter and has made the following changes:</p> <p>As stated above, the FAA has removed</p>

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	<p>concerning the contents of TCH Guideline Documents for operators and other affected persons to use in evaluating repairs, alterations, and modifications, other than those contained in TCH published information. Those expectations would require the TCH to provide intellectual property and other material for use by a third party. The proper application of this data by the third party would be suspect.</p> <p>Rationale: The proposed AC states that the FAA-approved guidelines must enable operators and other persons to:</p> <ol style="list-style-type: none"> 1. Identify structure susceptible to WFD, 2. Perform a WFD assessment, including the development of ISP, SMP, inspection intervals, and methods; and 3. Publish service related information such as ISPs, SMPs, inspection methods, and repair/replacement instructions <p>Boeing finds that the presentation of this material in the proposed AC confusing, considering the related rule requirements. It should be noted that the AC text departs from the requirements of the NPRM, which requires the establishment of an operational limit and provision of guidance in determining structure that is susceptible to WFD. No other requirements are specified either in proposed §25.571 or §25.1529, Appendix H.</p> <p>We would like to emphasize that the methods and means that Boeing uses to design, manufacture, and maintain its airplanes have been developed over the last 90 years. These techniques are built on more than just first engineering</p>	<p>source of valid information for a given situation, not methodology and data to develop parameters like ISPs, SMPs, inspection intervals, and methods, as suggested by paragraph b.</p>	<p>the requirements to have applicants develop guidelines for others to evaluate repairs, alterations, and modification for WFD. Additionally, the FAA has removed the guidance for developing guidelines, which was contained in appendix 3 of the proposed AC.</p>

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	<p>principles. In fact, all are based on empirically derived service experience from designs used by Boeing for many years, and are considered to be intellectual property (IP). These methods and techniques have limited use outside of Boeing and we, in fact, consider them unsuitable for independent use by third parties not familiar with overall Boeing design philosophies and practices. These empirically based methodologies cannot be easily adjusted to consider other design philosophies or unique material use. In addition, the tools and methods require a depth of knowledge of statistical inference of structural performance data to develop appropriate WFD mitigation actions. Their use would certainly be suspect for the analysis of any third party STC holder, leading to potential liability issues that cannot be quantified. quality control system.</p> <p>The FAA should further consider how an ACO would be in a position to approve data developed outside the TCH using methodology developed from the TCH, given that the data were not developed under a common To summarize, Boeing objects to any requirements that mandate the publication of TCH proprietary methods, tools, and data for the determination of WFD maintenance actions for susceptible structure for use by third parties. It is Boeing’s position that use of these proprietary methodologies by third parties will produce anecdotal results that are not reliable and could lead to significant unquantifiable liability concerns.</p> <p>Boeing supports the development of guidelines to identify structure that is prone to development of WFD, and making available the process and procedures by which a person can access valid data for the finding compliance with the rule. Beyond this, Boeing requests that the FAA establish the necessary prerequisites for DAHs to meet in finding</p>		

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	compliance with this proposed rule.		
34.	<p><u>Commenter: Boeing</u> Appendix 3, paragraph a</p> <p>Issue: The proposed AC should provide guidance on when fatigue testing is necessary</p> <p>Rationale: All of the examples presented <u>could</u> affect the WFD characteristics of the airplane, but they also might not affect it. The revised wording provides for a discussion between the applicant and the FAA in establishing the need for a test. Full-scale fatigue test has not been historically required for any of the 10 items listed in proposed paragraph a. and do not appear to be justified, based on fleet service experience. The economic consequences of imposing a full-scale fatigue test requirement for any and all of these items is severe and has not been accounted for in the economic impact analysis of the related rulemaking.</p>	<p>Reword the first sentence of paragraph a to read:</p> <p style="padding-left: 40px;">“The following are examples of types of alterations that <i>could affect structure that is sensitive to the development of WFD. Alterations that are shown to affect WFD prone structure would usually require full-scale fatigue testing or analysis supported by service experience or full-scale fatigue test evidence.</i>”</p>	<p>The FAA concurs with the commenter and has made the following changes:</p> <p>The FAA has changed the format of appendix 2 (appendix 1 is now 2) to supplement the existing guidance. In this format, the appendix first provides a discussion of when full-scale fatigue testing should be performed, and then provides guidance on the details of that testing. We have not changed guidance related to whether major repairs require full-scale fatigue testing.</p> <p>We have revised the appendix guidance by adding that a test may not be required if an applicant can show that the alteration is not susceptible to WFD or that there is sufficient test data available for the applicant to use. In addition, we deleted paragraph b in appendix 4 (appendix 3 is now 4) and its corresponding text in appendix 2 because we determined that is not necessary.</p>
35.	<p><u>Commenter: Gulfstream</u> Appendix 3, Examples of Alterations Typically Requiring A Fatigue Test:</p> <p>Gulfstream recommends that consideration be given to allow</p>	<p>Provide guidance on the use of existing test data through analysis of an alteration.</p>	<p>The FAA concurs with the commenter. The guidance in appendix 2 (appendix 1 is now 2), paragraph d(4), has been changed to include a reference to appendix 4 (appendix 3 is now 4) for</p>

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	for cases where analysis can be used to show that the modification is covered by an existing fatigue test.		examples of types of alterations for which the applicant should do full-scale fatigue tests, unless the applicant can show that fatigue testing is not required (e.g., alteration is not susceptible to WFD or sufficient test data already exists).
36.	<p><u>Commenter: UPS</u> Appendix 3</p> <p>We believe that the best place to determine the need for full scale fatigue testing is at the initial compliance plan discussion with the FAA upon STC application for the alteration.</p> <p>UPS is very concerned about the new Appendix 3 - 'Examples of Alterations' that is included in the proposed AC 25.571-1X. The material in both Appendix 1 and Appendix 3 appear to highly biased to the OEM. For example, in appendix 3, any airline proposed alteration that affects more than three fuselage frames would require full scale fatigue testing. However, an OEM wishing to add a fuselage plug to an airframe would not be required to perform full scale fatigue testing. We do not understand why an antenna installation affecting three stringers would be considered more critical than a 120" fuselage plug.</p>	Delete appendix 3 from the proposed AC.	The FAA has determined that guidance is necessary for determining when fatigue testing is necessary and therefore retains appendix 3. We have determined that data may be available that allows the applicant to show that fatigue testing is not necessary. The guidance in appendix 2 (appendix 1 is now 2) is revised to include a reference to appendix 4 (appendix 3 is now 4) for examples of types of alterations for which the applicant should do full-scale fatigue tests.
37.	<p><u>Commenter: UPS</u> General Comment:</p> <p>It appears that the AC was revised in anticipation of the WFD rulemaking being implemented in the currently proposed form. There are several acronyms and definitions that were recently introduced in the WFD proposed rule. Based on the</p>	UPS recommends that the proposed draft AC be withdrawn until the issues relating to the WFD rule are resolved.	The FAA has revised the AC to align with the final rule.

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	<p>volume of comments currently in the docket, it appears likely that there will be significant changes to the proposed WFD rule.</p>		
<p>38.</p>	<p><u>Commenter: Boeing</u> General Comment:</p> <p>Applicants and others impacted would benefit greatly if the relationships between the recent aging aircraft proposed rules and the associated proposed ACs (of which this is one) were clearly explained in the documents themselves. Without these interrelations clearly defined, an applicant could have great difficulty knowing what requirements must be met. Some examples follow:</p> <ol style="list-style-type: none"> 1. Current AC 25.571-1C and proposed AC 25.571-1X discuss the definition of “Principle Structural Elements (PSE),” AC 120-XX discusses the definition of “Fatigue Critical Structure.” In other areas the FAA discusses “structure susceptible to WFD.” The details seem left to the reader to understand if these items are the same or different, and then to figure out when in the process each of these data elements are required for new certification. This can be quite confusing to anyone not familiar with the subjects 2. For new certification programs, both the proposed § 25.571 and § 25.1807 [now § 26.21] rules have differing requirements that “must be met.” The related proposed ACs 25.571-1X and AC 120-104 have differing means of compliance. 	<p>Refer to examples in the Comment column.</p>	<p>The FAA concurs with the commenter and has made the following changes:</p> <p>The basic requirement for both rules is the same, to show freedom from WFD up to the LOV. The process for accomplishing this is different for new airplanes than it is for existing airplanes. Section 26.21 contains the requirements for existing airplanes and guidance for that rule is in AC 120-104. 14 CFR 25.571 contains the requirements for new airplanes and guidance for that rule is in AC 25.571-1X.</p> <p>The FAA added appendix 5 to clarify the relationship of the terms PSE, FCS, and WFD susceptible structure.</p>

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	<p>It is difficult to discern the relationship between the certification rules contained in proposed 14 CFR § 25.571 and the requirements contained in proposed Subpart I of Part 25. It appears that an airplane certified to proposed § 25.571 has equal but differing requirements to be met under Subpart I for WFD. The associated ACs contained no guidance to clarify which requirements were preeminent. Clarification of the requirements seems appropriate</p>		