

**Disposition of Public Comments  
AC 25.795-7X  
Survivability of Systems**

Comment	Requested Change	Disposition
<b>Transport Canada</b>		
Common issues addressed in AC 25.795-6X on the LRBL and in this AC.	Recommend combining the two ACs into one to ensure that common areas of concern are not lost.	It is true that there are certain aspects of the two subjects that overlap. However, the majority of the guidance is specific to one subject or the other. To avoid an oversight, we have revised this AC to highlight the LRBL and its possible influence on system design.
<b>Boeing</b>		
Change title of AC to focus on explosive devices	Recommend changing the title of this AC to:  <i>“Subject: Survivability of Systems from Explosive and/or Incendiary Devices”</i>	While the impetus of the rule is to address security threats, discussion of <i>Survivability of Systems</i> has always been in terms of “an event,” including explosive or incendiary devices but not limited to them. So the general title is appropriate.
<b>Paragraph 1.</b> Need to revise to make it clear (1) that this item is limited to critical systems to ensure that the separation requirement is not applied where it is impractical, as defined in paragraph 6.a(4) of this AC, and (2) that this requirement applies to an explosive device.	Recommend revising this sentence to read as follows:  <i>“1. ...Section 25.795(c)(2) requires that <u>critical redundant airplane systems necessary for continued safe flight and landing must be physically separated, except where impractical, by certain minimum distances to protect them from an explosive device.</u></i>	This paragraph already contains the qualifier “ <i>necessary for continued safe flight and landing</i> ” and adding the word “ <i>critical</i> ” to that could be confusing. However, we have added the phrase, “except where impracticable” to match the rule language. With respect to the last suggested change, see the discussion below regarding the term “ <i>any event.</i> ”

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	<b>Airbus</b>	
<p><b>Paragraph 1</b> should state that no structural damage is considered when assessing compliance with the system survivability rule.</p>	<p>Recommend including language similar to that in the preamble of the rule, stating that only the functionality of the relevant systems is considered and not any structural ramifications of an explosive device.</p>	<p>In general, we agree. We have added a statement along the lines suggested to paragraph 5., as part of the overall discussion of the requirement and the method of compliance.</p>
<p>From the rule and proposed AC, as some functional redundancy could be ensured today within the same equipment unit, does this requirement impose physical segregation of functional redundancy (which would lead to increased complexity of the interface)? Or is this requirement for segregation limited to functional redundancy embedded in redundant equipment units?</p>	<p>Question whether functional redundancy within a component is subject to the separation requirement. However, commenter does not propose specific changes to the AC.</p>	<p>The requirement is applicable to redundant systems necessary for continued safe flight and landing. The extent to which a piece of equipment can have functional redundancy and satisfy the existing requirements for protection against single failures would dictate the effect of this requirement.</p> <p>Many pieces of equipment have functional redundancy as a matter of design practice, but this feature is not a secondary (or backup) system. It enables higher reliability of a given system. If the functional redundancy necessary to meet the current rules is embedded in the same piece of equipment, then the philosophy of § 25.795(c)(2) applies.</p> <p>Assuming that this occurs in a portion of the airplane affected by the rule, then the</p>

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		“impracticable” provision of the rule would likely apply, and protection would be the approach.
<b>Airbus and Boeing</b>		
Specify locations in the airplane where and when the ½ sphere is applied and where other approaches are permissible.	Request a more detailed and specific discussion of where the sphere is required to be applied and where it is not. Both commenters recommend stating that the sphere need only be applied for ½ diameter beyond the cargo compartment liners.	<p>This matter was also discussed in the preamble to the final rule. However the intent of the requirement as well as the recommended language from ARAC has always applied to the fuselage in general. This includes areas beyond the cabin or cargo linings, but only the ½ sphere beyond the structural bulkheads and the separation between the flightdeck and passenger cabin.</p> <p>Since the affected systems are almost exclusively in those areas, the maximum separation distance is most effective in those areas. In the preamble to the NPRM, there is mention of the cargo liners, which was intended to apply to the <i>fore and aft ends</i> of the cargo compartment. While this language may not have been so clear, the rule language is quite clear, and the AC reflects the rule language.</p>

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<b>Boeing</b>		
<p>Do not require consideration of system combinations.</p>	<p>The consideration of combinations of systems that can be rendered inoperative is new and was not discussed in ARAC. Therefore, it should not be mentioned in the AC.</p>	<p>This comment is also addressed in the preamble to the rule. The goal of the requirement is to maximize the capability for continued safe flight and landing, and in that regard the specific combination of systems subject to common failure from a single event can have a major influence. If the systems are truly redundant, then there is no additional effort to address this provision. If, however, there is limited function or marginal redundancy, the risk can be reduced if the combinations of systems are considered in the design phase.</p>
<b>Boeing and Embraer</b>		
<p><b>In paragraph 4.,</b> the term “any event” should be made clearer or replaced by specific reference to explosive and incendiary devices.</p>	<p>Boeing recommends that the AC focus only on security threats and not refer to “any event.”</p> <p>Embraer, on the other hand, suggests that the AC be clearer regarding protection against any event where systems separation would be valuable.</p>	<p>This item was referred to ARAC to make sure the approach would be harmonized, standardized, and feasible. The recommended approach is that the sphere derived in the rule should be able to pass between any two redundant systems to satisfy the requirement. This is now noted in paragraph 6.a.(3).</p>

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<b>Boeing</b>		
<p><b>Paragraph 5.</b> states that the design should be good for a single event on a flight.</p>	<p>Recommend adding a sentence at the end of paragraph 5 as follows:</p> <p><i>“Design should be good for a single event on a flight.”</i></p>	<p>The intent of the requirement is certainly not to make the airplane invulnerable to multiple events; so, in practice, the intent of the suggested addition is correct. However, the requirement is not to show that the design is “good” for an event so much as to separate or protect the flight-critical systems to improve the level of safety of the airplane in the face of an event. The method of compliance specifically avoids addressing what the event is or what other effects it might produce. The requirement is simply to address the system architecture in a way that makes it less vulnerable. Adding this sentence would beg the question of showing that the design is good for an event in the first place. Thus we have not changed the AC.</p>
<b>Airbus</b>		
<p>Make clear that other measures are required if system separation is “impracticable.”</p>	<p>Propose alternative rule language to better explain the requirement for system protection when separation is not practicable.</p>	<p>We have incorporated this language into the rule and have changed the language in the AC to match it.</p>

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<p><b>Paragraph 6.</b> Specify how distance is measured (e.g., is it from the edge or from the center of a system?).</p>	<p>Request that a specific definition of how to measure the separation distance be included in the AC.</p>	<p>This item was referred to ARAC to make sure the approach would be harmonized, standardized, and feasible. The recommended approach is that the sphere derived in the rule should be able to pass between any two redundant systems to satisfy the requirement. This is now noted in paragraph 6.a.(3).</p>
<b>Transport Canada</b>		
<p>Paragraph 6.a. mentions fuel tanks but does not address other fuel system components.</p>	<p>Recommend that this paragraph address other fuel system components as well as auxiliary fuel tanks sometimes installed on the main deck of executive airplanes.</p>	<p>We agree that fuel system components that are redundant are included in the assessment. However, main deck fuel tanks are not redundant in the sense that the effects of an explosion on a fuel tank can be significantly more severe than just the loss of fuel. So having a second tank may be moot. Nonetheless, an installation where the tank forms cabin boundaries effectively limits the area of consideration, as with bulkheads.</p>
<p><b>Paragraph 6.a.(2)</b> <math>H_o</math> in 14 CFR §25.365(e) has a specific meaning and a maximum value, which may not be applicable in this particular analysis.</p>	<p>This section should be revised to define what <math>H_o</math> means. The section should either define <math>H_o</math> or delete this variable from the equation.</p>	<p>As the requirements apply to applicants for part 25 type certificates and all of part 25 applies, the definition of <math>H_o</math> is already given in the rule. However, to avoid having to cross reference, we have</p>

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		repeated the definition in the AC.
<b>Airbus and Boeing</b>		
<p><b>Paragraph 6.a.(3).</b> There are multiple locations in an airplane where threats will be in conflict with each other. The added statement clarifies that the more probable event should take precedence.</p>	<p>Other regulations, specifically §§ 25.729(f) and 25.903(d), can create conflicts with the requirements of § 25.795(c)(2).</p> <p>Suggest adding the following:</p> <p><i>“When a conflict exists for multiple airplane threats in a given area, critical systems should be separated for the most likely airplane threat.”</i></p>	<p>This subject was referred to ARAC and is also discussed in the preamble to the rule. Essentially, there is no conflict evident; should one arise, the rule contains a provision pertaining to impracticability that can be used to resolve the conflict.</p>
<b>Boeing</b>		
<p><b>Paragraph 6.a.(4)(c).</b> Space restriction may preclude locating flight-critical systems away from cargo and passenger compartments.</p>	<p>Suggest the following text in lieu of the current paragraph:</p> <p><i>“Flight critical redundant systems should be separated to the greatest extent possible within equipment centers.”</i></p>	<p>We agree with the comment, although the original proposed language and this suggestion are not mutually exclusive. Both separation within the compartment and locating the vulnerable, critical systems away from potential source of an event are good practices. Accordingly, we have modified the AC to include both approaches.</p>

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<p><b>Paragraph 6.a. (5).</b> Remove the statement "...we encourage greater separation where it is practicable." The statement is vague and could be open to various interpretations. The AC needs to be very clear about an acceptable compliance method so that there is standard application of the intent of this item.</p>	<p>Recommend that the paragraph read as follows:</p> <p><i>"6.a.(5) Figure 1 shows the regions where the designer must separate critical systems. Compliance should be shown by design and analysis for each affected zone and flight-critical system. The sphere diameter represents the minimum acceptable separation; however, we encourage greater separation where it is practicable."</i></p>	<p>The statement in the AC doesn't impose a requirement or conflict with the requirements of the rule. It is simply a statement that the FAA encourages maximum separation where practicable. The AC is clear about what the rule requires; however, we have revised the AC to state explicitly that greater separation is not mandatory.</p>
<b>Transport Canada</b>		
<p><b>Paragraph 6.b. (1)</b> discusses shielding for redundant system pairs and says only that one of the two should be shielded.</p>	<p>Recommend specifying that—when the two systems are not 100% redundant—the system providing either the primary function <u>or</u> the most functionality should be shielded.</p>	<p>The intent was to address truly redundant systems where either provides the same function. However, we agree that this might not be clear and have modified the AC to address the case where the two systems are not 100% redundant.</p>
<b>Boeing and Bombardier</b>		
<p><b>Paragraph 6.b. (3).</b> Consideration of 6" displacements for system attachments is not reasonable.</p>	<p>Both commenters interpret this section as requiring a 12" diameter sphere of free space around the particular system and suggest that such a requirement is not reasonable. They recommend deleting the text discussing the 6" displacement. They</p>	<p>In keeping with the approach taken for cargo fire protection systems, we have revised the AC to exclude displacements that would take the system outside the fuselage contour.</p>

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	<p>also note that frangible attachments create problems during the service life of the airplane.</p>	<p>Contrary to the commenters' concern, this section does not require free space surrounding the system within which it can deflect. The intent is to have flexibility in the attachment methods so that relative displacements do not render the system inoperative.</p> <p>As with cargo fire protection systems, the intent is to have a simple method of compliance that does not require having detailed knowledge or making assumptions about a particular device or event. As always, applicants may propose alternative methods if they have them.</p> <p>Finally, if the systems are separated, there is no need to address deflections. So the actual situation should be limited to a few areas on the airplane where shielding or frangible attachments are used to avoid failure of the system elements.</p>

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<b>Boeing</b>		
<p><b>Paragraphs 6.a.(5) and 6.b.(3)</b> Consideration of 6" displacements for system attachments is written as something that "must" be accomplished.</p>	<p>The word "must" implies a <u>requirement</u>, which is inappropriate in advisory material.</p>	<p>In paragraph 6.a(5), the word "must" simply reflects the rule language so it is appropriate. In the context of paragraph 6.(b)(3), however, we agree that it is more appropriate to use "should: and have revised the AC accordingly.</p>
<p><b>Paragraph 6.b.(4)</b> should include a reference to Paragraph 6.b.(2) because it is not practicable to protect against <u>all</u> threats. A deterministic process needs to be allowed to address significant threats.</p>	<p>Proposes the following change:  <i>"6.b.(4) The designer should provide shielding to protect the systems against ballistic threats <u>described in paragraph 6.b.(2), and...."</u></i></p>	<p>The main point of this paragraph is to advise that protection against the pressure wave is likely to be counter productive. There is no intent to address all ballistic threats, and, as noted, paragraph 6.b.(2) already provides a way to assess ballistic protection. However, there is no harm including the reference and we have modified the AC accordingly.</p>