**Option for SDC Requirement in a Subpart D Design and Construction Regulation**

# 25.6XX - Structural Damage Capability (SDC)

- **Philosophy**

This design philosophy results in the manufacturer providing a generalized structural capability in the presence of damage so that even if the structure "fails" partially, there will still be enough structure remaining to be "safe". To a large extent this philosophy ignores the details of the way damage can develop, but simply assumes a certain part of the structure will fail and requires that the rest of the structure can sustain the appropriate residual strength loads.

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Structure evaluated according to the damage-tolerance requirements of paragraph 25.571(b) must be designed to assure a level of structural damage capability (SDC) in accordance with this section.

(a) It must be shown by analysis or test evidence, that the remaining structure is able to withstand the loads (considered as static ultimate loads) specified in paragraphs 25.571(b)(1) to (b)(5 ) in the presence of damage equivalent to:

(1) The failure of any single element , or

(2) Partial failure between damage containment features that significantly retard or arrest damage.

(b ) If the damage would be obvious or detectable during normal pre-flight inspections of the airplane, then the load levels specified in (a) may be reduced to the levels specified in paragraph 25.571(e).

(c ) Typical (average) values of material properties that account for the quantifiable effects of environment and other parameters may be used in these residual-strength assessments.

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Comment: Landing gear and landing gear support structure has a long history of using single load path structure. Where practical, this structure is designed damage tolerant rather than safe life. An example being some aluminum gear support fittings. The safety of these designs has been demonstrated by many decades of good service experience. This safety record, in combination with the existing 14 CFR 25.721 requirements for capability to safely land most airplanes with any combination of gear not extended, leads to the conclusion that additional SDC requirements are not needed for the landing loads of 25.571 (b)(6).

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Comment: We removed the term “complete” as a descriptor for failure because for composites, large visual impact damage and stiffener/facesheet disbonds could be considered as incomplete failures. Furthermore, for certain compression critical structure, if we “completely” remove the structural element, we cannot show any capability. Lastly, we considered adding terms such as fatigue failure (for metallics) and accidental/environmental damage (for composites), but decided to strike them because unforeseen damage encompasses all failure scenarios.

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Comment: For some of our damage scenarios for composites we use the 70% limit criteria consistent with the definition in AC 25.571. We generally do this when the damage is large, and arbitrarily defined, i.e. we cannot identify a driving mechanism (fatigue/damage propagation) that would allow it to manifest itself and persist for any significant period of time.

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Comment: Text of (c) is taken from AC 25.571-1D. Included in this 25.6XX paragraph as this is one difference from the pre-Amendment 45 fail-safe requirements.

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General comment: We did consider mentioning Single Load Path Structure (SLPS) in this 25.6XX proposal and making a cross reference to the 25.571 inspection requirements for SLPS. However, it was felt that the provisions of 25.6XX(a)(2) allow for SLPS and integrated structure. Furthermore, we did not want to muddle inspection requirements with SDC, which should be purely a design-driven requirement.

## Benefits of this Potential 25.6XX Regulation

- Subpart D – Design and Construction regulation
  - Not directly linked to maintenance
  - Not an overly prescriptive regulation
  - Allows for compliance flexibility in guidance material
- Addresses built-up and integral metallic and composite structure
- Allows for compliance by analysis or test evidence
- Complements DTA requirements of 25.571 and its guidance material
- Provides coverage for unforeseen damage scenarios which is a major goal of SDC requirements

## Drawbacks of this Potential 25.6XX Regulation

- Some may believe that not having a link to maintenance inspection/threshold is a drawback
- Certain existing single load path structure may not be compliant with this proposal
- Usage of vague terms such as “partial failure” and “significantly retard or arrest”
- Required level of SDC remains variable
- This is an additional rule whereas some may argue that the existing regulations are sufficient or that SDC can be addressed with minor changes to 25.571
- May need to change 25.571 and/or its guidance as well