International Maintenance Review Board Policy Board (IMRBPB)

Issue Paper (IP)

IP Number: CIP IND 2018-04 (V1, 2)
Initial Date: 19/NOV/2018
Revision / Date: R01 / 11/MAR/2020
Effective Date (DD/MMM/YYYY):
Retroactivity (Y/N):

Title:	SSI boundary determination and selection guideline
Submitter:	RMPIG

Applies To:	
MSG-3 Vol 1	X
MSG-3 Vol 2	X
IMPS	

Issue:

A consistent approach for SSI boundary determination and selection should be identified.

Problem:

Currently, MSG-3 document structures section does not provide clear guidance for selection and boundary determination of an SSI. Section 2-4-1, subsection (1) contains the definitions of the SSI and explains the difference with PSE and Other Structure but does not provide any guidance on how to set the boundary of an SSI and how to select an SSI.

This could lead to overcomplicated analysis, unnecessary increase of tasks numbers, lower intervals, and access issues.
Some examples of possible problems:

- Example 1: SSI selected based on manufacturing process drawings.
- Example 2: SSI selected for LH/RH identical structure items and increase task numbers.
- Example 3: SSI selected based on worst material and finish protection rating and penalize the whole area with unnecessary low interval.
- Example 4: SSI boundary selected regardless of different accidental damage sources or environmental conditions and may penalize the whole area with unnecessary low interval.
- Example 5: Separate SSI selected for each component within the same assembly with same ratings, access, and zone, creating extra SSIs and tasks.

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Recommendation (including Implementation):

This IP presents in two parts:

Part (A) consists of recommendations for inclusion in the PPH to help MSG-3 analysts to define SSI boundaries and are not required to be implemented into the MSG-3 document.

Part (B) contains recommendations and guidelines for selection of the SSIs and are proposed to add to the MSG-3 document.

Part (A):

To define SSI boundaries in a way to allow efficient analysis, several factors including but not limited to PSE, Zone, Access, Standard Numbering System (SNS), Material properties/surface protection system, Accidental damage sources, Environment, Potential impact of AD(s) on residual strength, Susceptibility to fatigue, Detectability, Density of the area and, in-service experience from similar designs should be considered.

To define SSI boundaries in order to have efficient tasks analysis, the following criteria should be considered by the MSG-3 analysts when breaking down the aircraft structures into the SSIs:

a) PSEs; Special care and attention should be given to the boundary of the PSEs when defining the SSI boundary to make sure no portion of any PSE is overlooked during this process.

b) By zone; when applicable, the SSI boundary should be harmonized with the zone boundary. This will help the possible transfer of applicable tasks from structures to zonal in the future.

c) By access; Structures may be covered by more than one SSI due to different access (e.g. below the floor/above the floor). SSI boundary should to be defined in a way that the structure is accessible from the same access point. In addition, the analyst should consider system installations, wiring and access panels within a zone, to split the area into more than one SSI, if required.

d) ATA iSpec 2200 or S1000D SNS; when selecting an SSI, pay attention to the ATA chapter it will fall within and split the area into to more than one SSI, if required.

e) Identical structures for left and right sides; one SSI should be selected to cover both the left and right sides of the symmetrical structure. Minor differences between the LH and RH could still be covered within one SSI, so long as it does not impact the analysis ratings. If required, separate LH and RH tasks can still be selected to reduce MH requirements per task and facilitate zonal transfer capabilities.

f) Material characteristic, and surface protection system; since the structures ED analysis is a conservative approach by selecting the worst-case scenario, the SSI boundary should be defined in a way that will not penalize the whole area of inspection with a low interval due to one component's material or surface protection system. When beneficial, the part with the lowest material characteristic and/or surface protection ratings may be covered by a separate analysis within the same SSI or in a separate SSI to cover the worst case.

g) Effects of accidental damage sources and environmental conditions; when applicable, the SSI boundary should be defined in a way that will cover all the structure items with the same vulnerability to accidental damage sources and environmental conditions. When required, a new MSG-3 analysis or a separate SSI and dedicated task may be selected to cover the worst-case, preventing penalizing the whole area with a lower interval.

h) Potential impact of AD on residual strength may be used to define the SSI boundary.

i) Susceptibility to fatigue; For non-PSE SSIs, the boundary may be determined in accordance with the potential fatigue influence identified by the manufacturer stress engineering.

j) Assemblies; When there is an assembly with multiple structure items which have the same material, surface protection ratings, same AD/ED exposure, same access, same ATA chapter, and same zone, it is highly recommended that all the assembly structure items be covered within a single SSI and not multiple SSIs for each component. If assemblies are selected to be SSI, all relevant load bearing elements need to be included and analyzed, this may include bearings, bushings, bolts, fasteners, retainers etc. based on the amount of load carried by this element and the effect of failure. Attention should be given to different point of interactions (i.e.; the possibility of the Galvanic corrosion, fatigue .. etc.)

k) Detectability: Establish the SSI boundaries based on the ability to detect accidental damage or environmental deteriorations to have efficient inspection task level (i.e.; GVI, DET, SDI)

l) Density of the area: Establish the SSI boundaries based on the density and restrictions of the area for inspection.

m) In-service experience from similar designs: Analyst should always consider any in-service data when establishing the SSI boundary and split the SSI if required.

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Part (B):

- Section 2-4-4; 1. Procedure, sub section “a”
  Add the following text to the end of the paragraph:

a. The structural maintenance analysis is to be applied to all aircraft structure which is divided into zones or areas (P1) and structural items (P2) by the manufacturer. The manufacturer partitions the aircraft into Structures and Sub-structures per ATA iSpec 2200 or S1000D Standard Numbering Systems. This process continues until all structure items have been identified. The manufacturer identifies the structure items to which the SSI selection questions will be applied.
Consideration should be given to define the highest manageable SSI boundary level. i.e., one which is high enough to avoid unnecessary analysis, but low enough to be properly analyzed.

- Section 2-4-4; 1. Procedure, sub section “b”
  Add the following steps to the end of the paragraph:

b. The manufacturer categorizes each item as structurally significant (SSI) or Other Structure, on the basis of the consequences to aircraft safety of item failure or malfunction as per the following steps (D1).

Step 1.
The question for SSI selection may be formulated as in example below

- Does structure item contribute significantly to carrying FLIGHT loads?
- Does structure item contribute significantly to carrying GROUND loads?
- Does structure item contribute significantly to carrying PRESSURE loads?
- Does structure item contribute significantly to carrying CONTROL loads?
- Could failure or detachment of the structure item in flight or through secondary damage, compromise continued safe flight and landing?

Step 2.
For those structure items for which at least one of the above questions is answered with a "YES," (and though the failure of the item could affect the structural integrity necessary for the SAFETY of the aircraft) MSG-3 analysis is required.

For those structure items for which all questions in step 1 are answered with a "NO", Structural MSG-3 analysis is not required, and further SSI selection analysis is not necessary.

Step 3.
The resulting identification of structure items per Step 2 is now considered as the "Candidate SSI List," and is presented by the manufacturer to the ISC. The ISC, in turn, reviews and approves this list for subsequent distribution to the Working Group.

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Step 4.
The Working Group will review the Candidate SSI List and, through application of MSG-3 analysis, validate the selected SSIs or (if required) propose modification of the SSI list to the ISC. The primary aim of the Working Group review is to verify that no structural significant item has been overlooked, and that the right level for the analysis has been chosen.
During SSI analyses, changes to this are likely to be necessary. Therefore, the SSI list must be a living document and should be referenced in the PPH.

- Delete sub section “c” as it is described in detail in section “a”

~~c. The same procedure is repeated until all structural items have been categorized.~~

- Add the followings to the Annex 1. References:

[S1000D] *International specification for the procurement and production of technical publications. It is an XML specification for preparing, managing, and using equipment maintenance and operations information. (http://s1000d.org)*

NOTE: The original CIP proposal was submitted by Bell

IMRBPB Position:	
Date:	
Position:	
Recommendation for Implementation:	

Status of the Issue Paper:	X	Active
	X	Incorporated in MSG-3 / IMPS (with details)
	X	Archived