International Maintenance Review Board Policy Board (IMRBPB)

Issue Paper (IP)

IP Number: IP 198
Initial Date (DD/MMM/YYYY): 28/May/2021
Revision / Date (DD/MMM/YYYY): Rev. 0 / 28/May/2021
Effective Date (DD/MMM/YYYY): 27/Jul/2021
Retroactivity (Y/N): N

Title:	Freeze-Thaw cycle effect
Submitter:	RMPIG

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

Issue:

Water ingress in combination with Freeze-thaw cycles could result in adverse effects such as delamination or disbonding on composite structures depending on the operational conditions and environment

Problem:

While water ingress is an issue resulting disbond and delamination on helicopter composite parts, freeze/thaw cycles are significantly more severe in the fixed wing world (especially transport aircraft), as the temperature at their flight altitude can easily reach -40°C (-40°F), regardless of the temperature on ground. Therefore, they can get a freeze/thaw cycle every flight, unless it is already freezing on ground. Should they perform 2-3 flights per day for the whole year, this comes out to be 730-1095 freeze/thaw cycles per year.

On the other hand, if aircraft stay on ground (or "near" ground), you will get significantly less cycles. According to MIL Handbook 310 (global climatic data for developing military products), you could expect freeze-thaw cycles 337 days annually in regions of high elevations in the tropics (tropical mountains). However, this is an extreme case (even for US DOD). Elsewhere, a much lower number of days annually would be expected.

Helicopters do not fly as high as transport aircraft. On a cloudless day, you could expect a decrease of 3°C (5.4°F) per 1,000 feet elevation (as opposed to 1.83°C (3.3°F) per 1,000 ft for a clouded day).

On a 20°C (38°F) day on ground, you would need to fly at 7,000 feet to get below freezing on a cloudless day.

Recommendation (including Implementation):

Section 2-3-9; Supplemental analyses for Rotors / Drive systems:
Section 3. Accidental Damage (AD), part (c):
Amend as follows:

c. The timely detection of damage based on the relative rate of growth after damage is sustained and visibility of the MSI for inspection. ~~Assessments should take into account damage growth associated with non-chemical interaction with an environment, such as disbond or delamination growth associated with a freeze/thaw cycle.~~

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Based on the type of operation and environmental conditions defined in the program's PPH, assessments should take into account non-chemical causes such as disbonding and/or delamination resulting from water ingress in combination with freeze/thaw cycles.

Section 2-4-5; Rating Systems for Structural Significant Items:
Section 1. Rating Accidental Damage, part (c):
Amend as follows:

c. Timely detection of damage based on the relative rate of growth after damage is sustained and visibility of the SSI for inspection. ~~Assessments should take into account damage growth associated with non-chemical interaction with an environment, such as disbond or delamination growth associated with a freeze/thaw cycle.~~
Based on the type of operation and environmental conditions defined in the program's PPH, assessments should take into account non-chemical causes such as disbonding and/or delamination resulting from water ingress in combination with freeze/thaw cycles.

NOTE: The original CIP proposal was submitted by Bell.

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IMRBPB Position:	
Date:	28 May 2021
Position:	Agreed, closed in 2021 meeting as IP198
Recommendation for Implementation:	As per effective date

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