

Zonal Safety Analysis Methodology for Preliminary Aircraft Design

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Objectives

The Zonal Safety Analysis (ZSA) constitutes part of the safety assessment process under Aerospace Recommended Practice (ARP) 4761. Although the ZSA may be performed at any design stage, it would be most cost-effective to do it during preliminary design. However, the ZSA methodology in ARP4761 was found to be more suitable for the detailed design stage. This research aims to develop a methodology to perform ZSA during the preliminary design stage.

Application of ZSA Methodology on Case Study Aircraft

The ZSA methodology for preliminary aircraft design was developed after analysing the methodologies found in ARP4761 and related past year thesis. It was then applied to a case study aircraft - NASA N3-X. The aircraft was partitioned into zones; systems were identified for each zone in the aft fuselage; design and installation guidelines were developed; system external failure modes were derived for each zone and zonal safety inspection was performed. After that, risk assessment was carried out for the safety findings (see Figure 1) using the assessment matrix from ARP5151 and recommendations were proposed to mitigate the risks.

Research Results

The proposed recommendations enhanced the preliminary design of the NASA N3-X aircraft in terms of system and maintenance safety. Lessons were derived from the case study and the ZSA methodology was refined (see Figure 2).

Benefits/Potential Applications

This ZSA methodology will be able to reduce re-design/modification costs by identifying system interference issues early. It can also enable the RSAF to improve its safety analysis processes, in particular for aircraft system modifications/upgrades.

References:

1. SAE International (1996), "ARP4761: Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment", Society of Automotive Engineers, USA.
2. SAE International (2013), "ARP5151: Safety Assessment of General Aviation Airplanes and Rotorcraft in Commercial Service", Society of Automotive Engineers, USA.

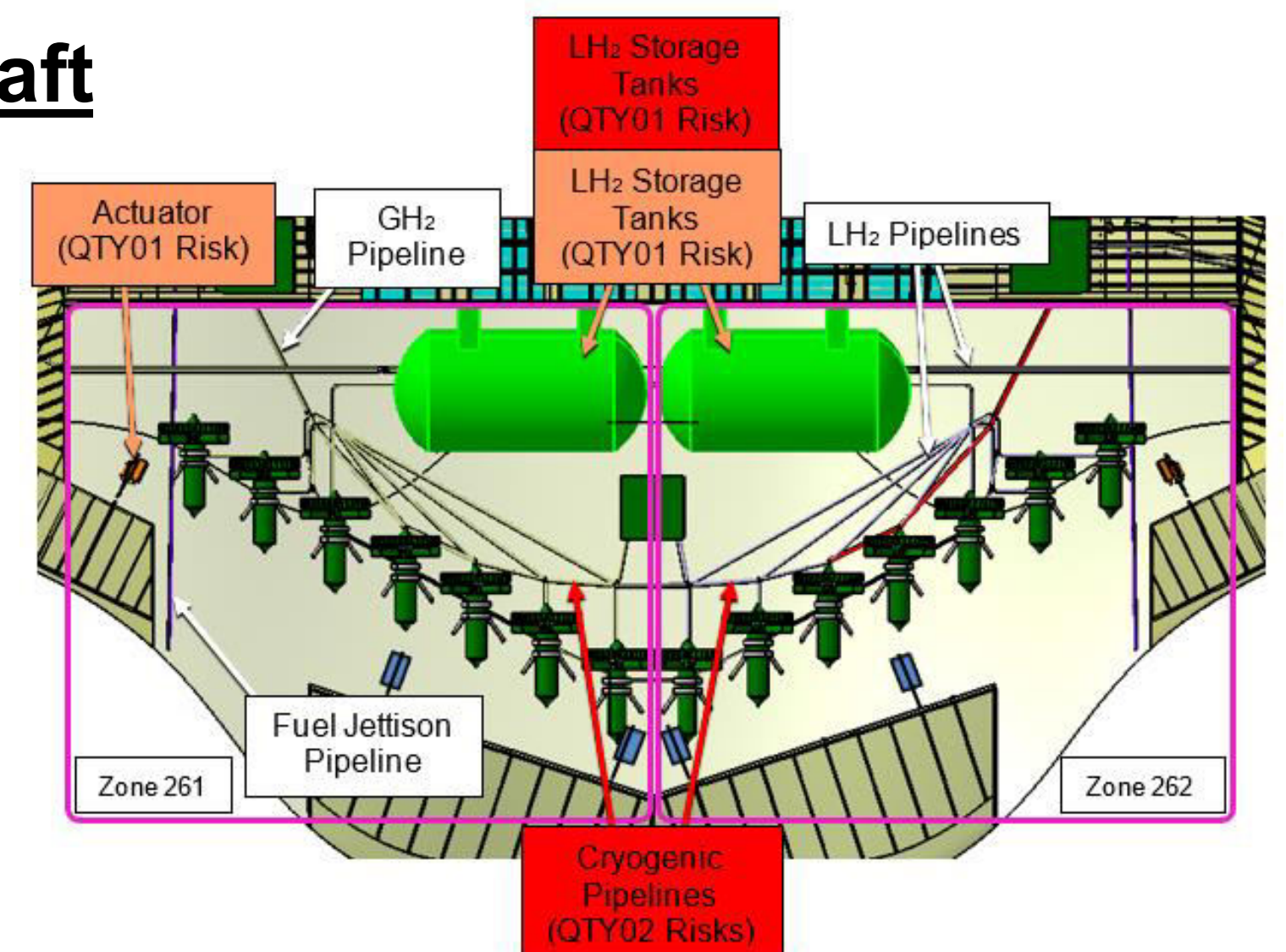


Figure 1: Assessed Risks in Zones 261/262

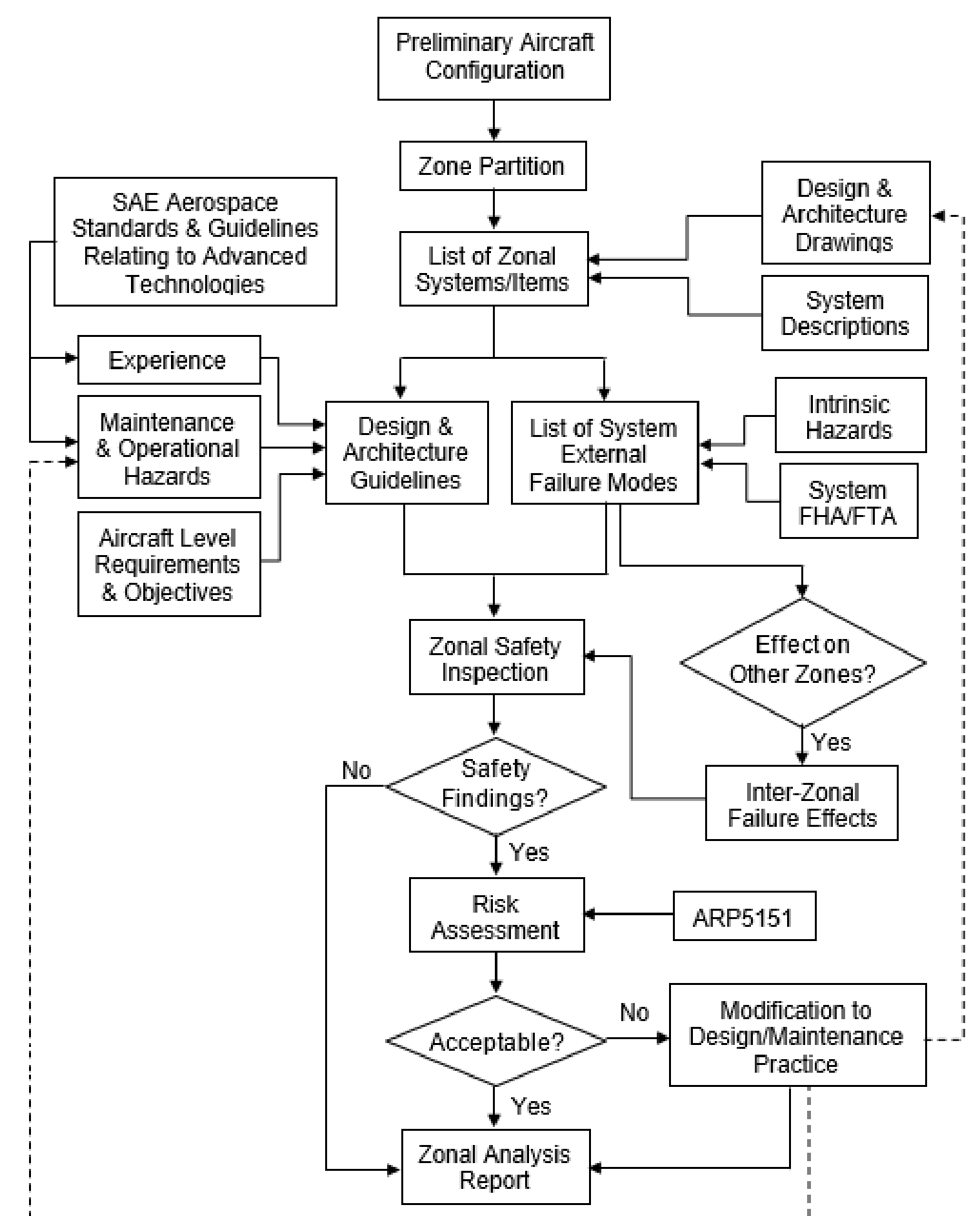


Figure 2: ZSA Methodology for Preliminary Design