Embedded Reliability in Design Thinking Concept for Aerospace

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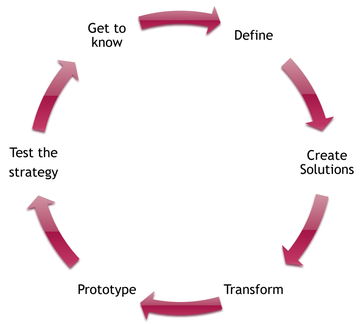
Abstract

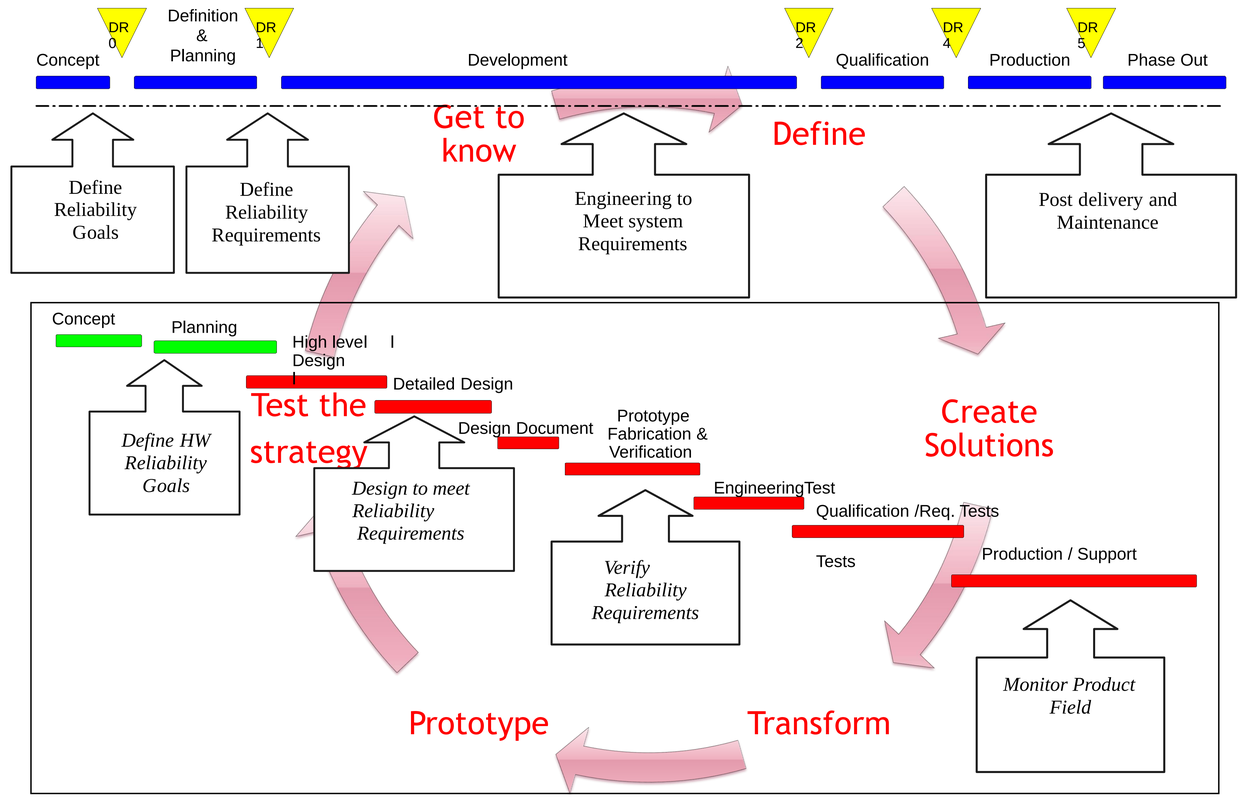
This presentation reports a methodology to implement reliability analysis in Design Thinking (DT) which is an appropriate process for complex problems in Aerospace. This process is extremely useful in tackling problems with lack of clarity in definition resulted from understanding the human needs, re-capture the problem in human-centric ways, creating many ideas in brainstorming sessions, and by adopting a hands-on approach in prototyping and testing. Embedding reliability techniques in the five stages of Design Thinking will empower the Designer to apply the DT Process in order to solve complex problems while meeting the reliability requirements of design. This presentation demonstrates the application and challenges of reliability techniques within DT.

Introduction

Today's engineering systems are complicated. For example, a space shuttle is made up of hundreds of thousands of components. These components functioning together form a system. The reliable performance of the system depends on the reliable performance of its constituent components. Therefore, Design Development Life Cycle (DDLC) with embedded reliability assessments techniques requires a set of tools that enhance the reliability assessment techniques through more efficient processes. The processes create meaningful innovations needed to know Aerospace requirements & standards and to assess them in the design process.



Methods and Materials



Design Thinking

Get to know Aerospace Requirements and Standards	What is design features? Create Design Structure Matrix to assess requirement coverage	Identify monitoring methods and nature of the reliability requirement within the design
Construct a process to bring clarity and focus on feasibilities of Reliability Goals & Requirements	Build a achievement model to assess the requirements coverage	Map monitoring methods to the reliability requirement within the design
Create scientific solution methods for Reliability Goals & Requirements	Apply problem solving methods to tune the solution methods for better results	Design the monitoring methods
Transform the solution ideas to Design Team	Use appropriate training methods to teach Design Team the solution methods	Prototype the monitoring methods
Draw plans for implementation/execution of the process	Try out the reliability verification methods	Demonstrate the monitoring methods

Discussion

In Aerospace industry, Design is a very difficult task due to high standards and rigorous requirements for safety and reliability. Using Design Structure Matrix we depicts the distribution of requirements over DDLC phases associated with reliability assessment processes made up of the following steps:

1- Get to know: the centerpiece of a human-centered design process. In this step, we understand design team, the context of design challenge. It is important to understand the way they do things and why, how they think about Aerospace Requirement and standard, and what is meaningful to them for the design.

2- Define: The Define mode of the design process is all about bringing clarity and focus to the design space. We have a chance, and responsibility, as a design thinker to define the challenge. The goal of the Define mode is to craft a meaningful and actionable problem statement. This should be a guiding statement that focuses on insights and needs of the design team.

3- Create solutions: This is the mode of the design process in which you concentrate on idea generation. The scientific methods should provide both the fuel and also the source material for building prototypes and getting innovative solutions into the hands of the design team.

4- Prototype: This mode is the iterative generation of artifacts intended to address the problem to find the final solution. In the early stages of a design project that problem may be broad. Therefore, we need to construct a general prototype. This prototype get more refined and complex through design stages.

5- Test strategy: This mode is meant to get feedback, about the prototypes from your users and professionals. Testing is another opportunity to understand Aerospace Requirements and Standard.

Future Directions

Due uncertain situations, a fuzzy structured interlock system that engage DDLC phases with DT steps would be another venue of research.

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