Data-Centric Framework for Digital Twin Development of an Aircraft System

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1. RESEARCH MOTIVATION

- With the rapid digitalisation in commercial aircraft industries, emergence of Digital Twin (DT) is significant as it can fulfil the urgent need of data-driven optimisations in existing products, operations and services.
- Considering the complexity of the systems and multidisciplinary data in an aircraft, development and implementation of DT is challenging.
- The research is intended to develop a data-centric framework to enable the creation of a fully representative DT for aircraft system.

2. AIM & OBJECTIVES

To develop a data-centric framework to enable the creation of Digital Twin (DT) for aircraft system.

Objectives:
- Understand the current practices and state-of-the-art in managing DT.
- Clarify the concept of DT within the scope of the commercial aircraft industry.
- Identify the key phases and data elements for DT in the commercial aircraft industry.
- Develop a Framework to optimise data management for DT for an aircraft system.
- Validate the framework with real-life case studies and expert opinions.

3. METHODOLOGY

- Literature:
  - Problem statement foundation
  - Existing literature & gap analysis
  - DT application: data-centric challenges & missing opportunities

- Conceptualisation:
  - Engage stakeholders
  - Accessing the current state
  - Knowledge development

- Framework:
  - Requirement identification
  - Digital twin engine development
  - Integration

- Test & Validate:
  - Feeding digital twin engine with real datasets
  - Expert validation
  - Framework improvement
  - Boundary definition

4. FRAMEWORK

- Minimum Data Structure for DT
  - ISO 13374-1:2003

- DT Ontology Model

- USE CASE

- Landing Gear

5. NOVELTY & CONCLUSION

- Data modelling for DT can bridge the gap of multidisciplinary data and present IM infrastructure.
- A minimum data structure is essential for highly scalable DT data modelling.

Conclusion

- Semantics is a significant element for DT data management.
- Metadata is as important as real data for DT.

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