

Development of a FMECA Framework for VLEO Satellite Mission Operations

The collaborative research center (CRC) "Advancing Technologies of Very Low Altitude Satellites (ATLAS)" at the University of Stuttgart, funded by the German Research Foundation (DFG), addresses the fundamental scientific and engineering challenges of rendering Very Low Earth Orbit (VLEO) accessible and extending satellite lifetime by an order of magnitude. As part of this research project, the fundamentals of VLEO satellite operations are being investigated by drawing on expertise gained from operating satellites at the University of Stuttgart.

The aim of this thesis is to develop a structured approach for assessing and improving the operational reliability of VLEO satellite missions. Satellites operating in VLEO face unique environmental and operational challenges compared to conventional LEO missions. Increased atmospheric drag, less ground communication windows, and frequent orbit adjustments heighten the risk of anomalies during operations. While some faults are handled by onboard systems, other failures require manual intervention or operational adjustments by mission control. To ensure mission robustness under these conditions, potential operational failures and their consequences must be systematically analyzed. This thesis aims to develop an Operational Failure Modes, Effects, and Criticality Analysis (FMECA) framework for VLEO missions to identify, assess, and mitigate critical failure scenarios relevant to satellite operations.

Your tasks

- Familiarization with VLEO satellite operations and their respective challenges
- Research on existing FMECA methodologies (ECSS) in space operations
- Identification of potential operational failure modes for VLEO missions
- Development of an FMECA framework for different mission phases
- Evaluation of failure criticality and likelihood
- Derivation of mitigation strategies for operational concepts and response procedures
- Documentation

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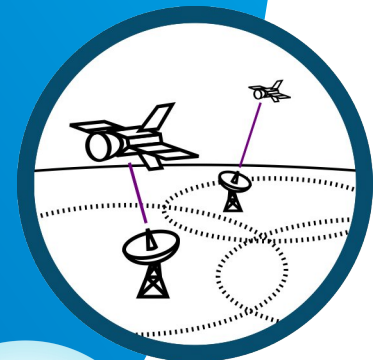
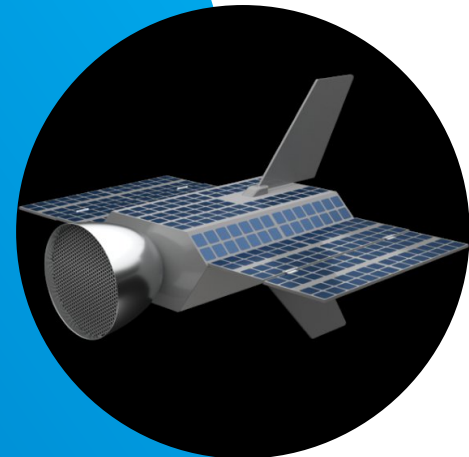
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