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Master Thesis Work

of Choose title Name, Surname

Entwicklung eines entfaltbaren Wiedereintritts- und Rettungssystems für wiederverwendbare Raketen

Development of an Inflatable Re-entry Rescue System for Reusable Rockets

Motivation:

In the space launch market, there is a trend towards reusable rockets, mainly using retropropulsion technology (SpaceX), as well as a trend towards smaller launchers (RFA, Isar Aerospace, HyImpulse, RocketLab). However, retropropulsion comes with disadvantages. An engine or avionics malfunction leads to failure, and the technology is heavy because of landing legs, grid fins and fuel used for re-entry and landing. This reduces rocket payload and means that the technology is not usable for small launchers with low mass margins.

The competing technology inflatable atmospheric decelerators promises to solve those problems. The flight experience so far is limited (NASA HIAD, IRDT). Current concepts also use complex multi-layer structures and gas tanks for inflation.

KLAUS Space Transportation GmbH is a startup company conducting a feasibility study on inflatable decelerators in ESA's Business Incubation Centre Reutlingen. In this Master thesis work, the candidate will determine aerothermodynamic loads for a concept of a simplified, scalable inflatable decelerator for reusable rockets. He / She will conduct a literature review on existing rocket stages and those under development with industrial partners. Based on the rocket stage dimensions, mass and re-entry regime, the candidate will participate in an industrial design study of a suitable decelerator and use the URANUS code for simulation of nonequilibrium re-entry flows. The candidate will further identify suitable ceramic fabric materials and test samples in the plasma wind channel at IRS.

Task description of the Master thesis work:

- Review of existing rocket stages and those under development,
- Participation in an industrial design study of an inflatable decelerator,
- Selection of suitable ceramic fabric,
- Implementation: Test and verification in plasma wind channel,
- Documentation.

Internal Supervisor: G. Herdrich, A.S. Pagan, M. Buntz, C. Kaiser

External Supervisor: Sebastian Klaus

Starting date: 01.09.2021

Submission until: Six months after starting date

Acknowledgement of receipt:
I hereby confirm that I read and understood the task of the master thesis, the juridical regulations as well as the study- and exam regulations.

_____
Date
PD Dr.-Ing. Georg Herdrich
(Responsible Professor)

_____
Date
Signature of the student

Declaration

I, ***Name***, ***First name*** hereby certify that I have written this ***Master thesis*** independently with the support of the supervisor, and I did not use any resources apart from those specified. The thesis, or substantial components of it, has not been submitted as part of graded course work at this or any other educational institution.

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I hereby agree that my ***Master thesis*** with the following title:

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[1] Stated in the DFG recommendations for „Assurance of Good Scientific Practice“ or in the statute of the University of Stuttgart for „Ensuring the Integrity of Scientific Practice and the Handling of Misconduct in Science“