Paper ID: 78230
oral
student

51st IAF STUDENT CONFERENCE (E2)
Student Team Competition (3-GTS.4)

Author: Mr. Philip Bergmann
Julius Maximilians Universität Würzburg, Germany, philip.bergmann@stud-mail.uni-wuerzburg.de

Mr. Clemens Riegler
Julius Maximilians Universität Würzburg, Germany, clemens.riegler@uni-wuerzburg.de
Ms. Zuri Klaschka
Julius Maximilians Universität Würzburg, Germany, zuri.klaschka@wuespace.de
Mr. Tobias Herbst
Julius Maximilians Universität Würzburg, Germany, tobias.b.herbst@stud-mail.uni-wuerzburg.de
Mr. Jan Markus Wolf
Julius Maximilians Universität Würzburg, Germany, jan.wolf@stud-mail.uni-wuerzburg.de
Mr. Maximilian Reigl
Julius Maximilians Universität Würzburg, Germany, maximilian.reigl@stud-mail.uni-wuerzburg.de
Mr. Niels Koch
Julius Maximilians Universität Würzburg, Germany, niels.koch@stud-mail.uni-wuerzburg.de
Ms. Sarah Menninger
Julius Maximilians Universität Würzburg, Germany, sarah.menninger@uni-wuerzburg.de
Mr. Jan von Pichowski
Julius Maximilians Universität Würzburg, Germany, janvonpichowski@gmail.com
Mr. Cedric Boes
Julius Maximilians Universität Würzburg, Germany, cedric.boes@stud-mail.uni-wuerzburg.de
Mr. Bence Barthó
Julius Maximilians Universität Würzburg, Germany, bence.bartho@stud-mail.uni-wuerzburg.de
Mr. Frederik Dunschen
Julius Maximilians Universität Würzburg, Germany, frederik.dunschen@wuespace.de
Ms. Johanna Mehringer
Julius Maximilians Universität Würzburg, Germany, johanna.mehringer@stud-mail.uni-wuerzburg.de
Mr. Ludwig Richter
Julius Maximilians Universität Würzburg, Germany, ludwig.richter@stud-mail.uni-wuerzburg.de
Mr. Lennart Werner
Julius Maximilians Universität Würzburg, Germany, lennart.werner@stud-mail.uni-wuerzburg.de

DAEDALUS 2: AUTOROTATION ENTRY, DESCENT AND LANDING EXPERIMENT ON REXUS29

Abstract

In recent years, interplanetary exploration has gained significant momentum, leading to a focus on the development of launch vehicles. However, the critical technology of Entry Descent and Landing (EDL) mechanisms has not received the same level of attention and remains less mature and capable. To address this gap, we took advantage of the REXUS program to develop a pioneering EDL mechanism and challenge the current state of the art in this field.

Through our research, we discovered that autorotation offers a viable alternative to conventional landing vehicles, especially compared to parachutes. Our approach provides significant advantages, including

steerability, controllability, and the possibility of a soft landing. To validate our concept and specific implementation, we conducted a sounding rocket experiment on REXUS 29, and compared the results to previous missions and simulations. We also discuss the different subsystems, including relevant design decisions and constraints that drove the individual system designs, such as software, mechanics, electronics, and control systems. An emphasis will also be on the organization and setup of the team entirely made up and executed by students.

To minimize the possibility of error and maximize understanding of this relatively new technology, we verified the design iterations through testing. In this paper, we discuss the results of these tests and the major insights we gained. This includes a full flight and possible failure analysis of the autorotation system. Additionally, we present the flight on REXUS itself, including the most important outcomes, and focus on the comparison to other decelerators like parachutes. Ultimately, future works and possibilities for improvements are outlined.

The research presented in this paper highlights the need for continued exploration and development of EDL mechanisms for future interplanetary missions. By demonstrating the potential of autorotation as a viable alternative to conventional landing systems, we hope to inspire further research in this area and contribute to the advancement of space exploration technology.