



**ASCenSlon**  
**Advancing Space Access Capabilities - Reusability and Multiple Satellite Injection**

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## **PhD student – Early Stage Researcher (ESR12)** **Reliability and safe disposal**

### **About ASCenSlon**

The purpose of the ASCenSlon project is to develop a programme that focuses on several specific areas of cutting-edge space access research, particularly on launcher systems that are (partially) reusable and capable of injecting multiple payloads into multiple orbits. More than providing design concepts, the network aims to identify and advance critical technologies to prove a feasibility of these concepts. Fields of research and training include propulsion technologies and their reusability; Guidance, Navigation and Control (GNC); aero-thermo-dynamics of re-entry and safe disposal. A variety of technologies will be advanced, including hybrid rocket engines, electric pump feeding and advanced nozzle configurations. Both computational and experimental (cold-flow and hot fire) techniques will ensure an efficient process and reliable results. The reuse of propulsion systems demands an assessment of their durability. It will be conducted by numerical simulations, system analysis with EcosimPro/ESPSS and experimental test runs. The development and integration of wireless sensor networks will allow health monitoring of these critical subsystems. Moreover, novel GNC strategies and processes have to be developed for the whole mission trajectory. This includes solutions for optimised flexibility w.r.t. the orbital insertion conditions as well as dedicated descend trajectories and GNC missionisation for re-entry. The models will cover various recovery concepts and the support of multiple landing sites. This requires an extensive examination of the aero-thermo-dynamics during re-entry as well as of the interactions between stage recovery and propulsion system layout. Ecological and economical sustainability will be addressed as new payload concepts including large constellations increase the demand for safe disposal and space debris mitigation to ensure an open access to space in the future. Furthermore, the utilisation of so called green propellants will be investigated.

The ASCenSlon consortium includes Technische Universität Dresden, German Aerospace Center, SITAEL, Sapienza Università di Roma, ONERA, Université libre de Bruxelles, Hochschule Bremen, Università Di Pisa, Technische Universität Braunschweig, Politecnico di Milano, DEIMOS Space, ArianeGroup, ESA, AVIO, OHB, D-Orbit, SpaceForest and Telematic Solutions.

### **About the host organization**

**Technische Universität Braunschweig (TUBS)** is the oldest university of technology in Germany (founded 1745) and it is ranked among the top engineering universities in Germany. It has about 20,000 students, 2,200 academic staff, 1,500 administrative staff members. The Institute of Space Systems (IRAS) performs various activities in the field of space engineering. Since 1970, a primary subject is the development of advanced computer programmes for the orbital mechanics of satellites and the practical application of this software for space mission planning and satellite re-entries. IRAS has performed pre-warning calculations for the German Government in case of several risk-object re-entries and is participating in the annual re-entry campaigns performed by the Inter Agency Space Debris Coordination Committee (IADC) on behalf of DLR. IRAS has expanded its research to innovative docking mechanisms, GNC algorithms, CubeSat development, reliability assessment of spacecraft and robotics. Thus, the research focusses on AOC of spacecraft, docking and active space debris removal using servicer spacecrafts that enable a controlled re-entry. Innovative docking mechanisms like adhesive bionic materials are used as well as multibody dynamics. These can be validated with a

comprising test environment consisting of an air-bearing table, a robotic arm and several test bodies. This work also benefits from the space debris research that provides risk analyses and failure probabilities for spacecrafts in earth orbit. A further work group for new systems and technologies allows research areas like propulsion systems for small satellites and probes as well as utilization of local research and science of the lunar environment. (<https://www.tu-braunschweig.de/index.html>)

## Task description

### Your PhD project:

The PhD programme is offered by the Department of Mechanical Engineering at TU BS. The ESR will focus on reliability concepts of reusable launcher systems. The work will be based on existing methods of satellite reliability and will incorporate aspects from space situational awareness and from the space debris environment. The candidate can build upon the previous research of the Institute of Space Systems on space debris modelling and end-of-life concepts.

### Problem Definition:

Determining the exact place and time of re-entries is still challenging because different uncertainties need to be considered. In today's launcher development, very conservative methods like combinatorial reliability are applied for reliability calculation. This frequently leads to masses and costs higher than necessary.

### Research Objectives:

- 1) Developing a new reliability model for rocket flight with special focus on re-entry by transferring existing reliability methods to launcher concepts defined
- 2) Implementing a software or software component that can determine re-entry prediction for new rocket concepts based on mission designs investigated
- 3) Considering space situational awareness aspects, such as propagation with uncertainties, the space debris flux, and collision probabilities within the software
- 4) Investigating new concepts that enhance or allow a safe disposal, such as green propellants, passivation, enhanced break-up or advantageous orbits

### Expected Results:

- 1) Sustainable and reliable rocket concepts based on most suitable technology and mission concepts
- 2) Verification of their safe disposal by reliability model and precise trajectory software

### Secondments:

Two secondments are foreseen to:

- 1) ESA Space Debris Office in Germany, for a duration of 4 months, to perform research in SOTA observation, orbit determination & prediction, error estimation and space debris cataloguing
- 2) D-Orbit in Italy, for a period of 6 months, to perform research in investigation of decommissioning / commissioning solutions and constellation deployment strategies

## Profile and requirements

### Essential skills:

- MSc or equivalent in the field of aerospace engineering, mechanical engineering, physics or mathematics
- Applicants must have a solid knowledge of space technology
- Applicants must have a proven knowledge in numerical mathematics, stochastics, and programming (e.g. Matlab, Fortran, C, C++)
- Ability to work highly efficient and self-reliantly in a diverse inter-disciplinary and multi-cultural environment
- Ability to work in a team, as well as independently

- Ability to solve complex problems with adherence of strict deadlines
- Excellent communication skills (both written and verbal) in English to derive the full benefit from the network training
- Proactive attitude
- As secondments and events are foreseen, applicants must be ready to travel
- Applicants must be eligible to enroll on a PhD programme offered by the Department of Mechanical Engineering at TUBS. Therewith, the degree must be approved by TUBS
- Applicants having a degree in a field contrary to aerospace engineering or comparable engineering sciences have to pass additional modules where required. Find more information at <https://www.tu-braunschweig.de/en/fmb/promotion>

Desired skills:

- Experience in laboratory work including the design, conduction and evaluation of experiments
- Project management
- Knowledge of the host institution language is a plus

Applicants can be of any nationality.

Candidates may apply prior to obtaining their master's degree but cannot begin before having received it.

In addition:

*H2020 MSCA Mobility Rule:* researchers must not have resided or carried out their main activity (work, studies, etc.) in the country of the host organization (Germany) for more than 12 months in the 3 years immediately before the recruitment date. Compulsory national service, short stays such as holidays, and time spent as part of a procedure for obtaining refugee status are not taken into account.

Eligible researchers must not have spent more than 12 months in the 3 years immediately prior to the date of selection in the same appointing international organisation.

*H2020 MSCA eligibility criteria:* Early Stage Researchers (ESRs) must, at the date of recruitment by the host organization, be in the first four years (full-time equivalent research experience) of their research careers and have not been awarded a doctoral degree. Full-Time Equivalent Research Experience is measured from the date when the researcher obtained the degree entitling him/her to embark on a doctorate (either in the country in which the degree was obtained or in the country in which the researcher is recruited, even if a doctorate was never started or envisaged).

**Applicants who do not fulfill these requirements CANNOT be considered for the research position.**

## Benefits

- You will be working within our international group of > 30 researchers with experience in a broad range of sciences
- You will get in contact with the other members of this international consortium and will benefit from the joint training platform to develop skills necessary for developing a thorough understanding of space transportation systems
- You will be employed by the host organization for 36 months
- A competitive salary plus allowances. Moreover, funding is available for technical and personal skills training and participation in international research events
- You will benefit from the well-structured training programme offered by the host organization and the consortium
- You will participate in international conferences and secondments to other organisations

within the ASCenSlon network and in outreach activities targeted at a wide audience

Please find additional information in the [Information package for Marie Curie fellows](#).

### Selection procedure

For the selection procedure, the ASCenSlon consortium will appoint a Committee, consisting of at least three members: one main supervisor, two co-supervisors and the project coordinator from University of Dresden. The preliminary selection is made by review of the application documents specified below. The final selection will be made after interviews with the final candidates. The applicants will be informed about rejection or admission to an interview by end of May at the latest. The interviews will take place either in person at the host institution or via video-conference. The timeframe for the interviews is May - June.

### Application

Interested candidates are invited to submit **one single PDF** containing the following documents in this exact order:

- Application form (see end of this document)
- Cover letter
- CV
- Educational and professional certificates (university degree(s) with marks, internships, workshops, languages, etc.)

Moreover, you must submit:

- Short video (max. 30 s.). The video must include: personal introduction, background, motivation to apply to the research position... show us why you are the ideal candidate!

All the application documents must be submitted via email to **ascension@tu-dresden.de**

The email subject must be **"Application for ESR12 position"**.

The email size incl. attachments **must not exceed 30 MB** in total.

You will receive an automatic reply if we have received your email. Please avoid any questions on the status of the selection process. We will inform you as soon as there is an update.

**Candidates whose application is not compliant with the requirements above will not be considered.**

Application deadline: 19 April 2020 at 11:59 PM CET

Expected start date: 1 October 2020

**Applications and enclosures received after the deadline will not be considered.**

More information and other vacant positions can be found at:

- Website: <https://www.ascension-itn.eu/>
- Facebook: <https://www.facebook.com/ascensionitn/>
- LinkedIn: <https://www.linkedin.com/company/ascensionitn/>

### Additional information

We in the ASCenSlon consortium value diversity and we commit to equal treatment of all applicants irrespective of gender, sexuality, health status as well as social, cultural or religious background.

For additional information about the research project and this individual position, please contact:

**ascension@tu-dresden.de**





# ASCenSlon ITN Application Form

Applying for ESR No. 12

Name and surname:

Age:

Nationality:

<b>Country of residency in the last 3 years</b> (if more than one, state also for how long you resided in each country):	
<b>Country where you carried out your main activity</b> (study, work, etc.) <b>in the last 3 years</b> (if more than one, state also the duration of your activities):	
<b>University and course degree:</b>	
<b>Master's degree final mark:</b>	
<b>Final thesis title:</b>	
<b>Thesis supervisor(s):</b>	
<b>Starting and ending year of your university studies (Bachelor and Master):</b>	
<b>Professional experiences carried out in the last 4 years, if any</b> (internships, scholarships, free collaboration, research, work experience and/or internship abroad, participation in Erasmus + or Summer School programmes, etc.):	
<b>Professional experiences relevant to the research position you are applying for</b> (specify up to three experiences in chronological order, starting from the most recent):	
<b>Language skills</b> (language and level):	
<b>Relevant computer skills</b> (software, programming, etc. and specify user level: basic, average, experienced):	
<b>Please specify any relevant professional teamwork experience</b> (and your role within the team):	
<b>State three aspects that would make you the ideal candidate for this position:</b>	