



Advancing Space Access Capabilities – Reusability and Multiple Satellite Injection

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

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## **PhD student – Early Stage Researcher (ESR11)** **Design solutions for green expendable upper stages**

### **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, 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**

**Università di Pisa (UniPi)** is an ancient and prestigious academic and research institution with a long-standing tradition in industrial engineering and hard science, such as physics and chemistry. In 2013, the University of Pisa finished with USR (which is also part of the consortium) in first place among the Italian universities, according to the Academic Ranking of World Universities. The administrative staff comprises 1.900 employees. UniPi has 50.000 students and an additional 3.500 doctoral students. UniPi participates with a team of researchers coming from the Aerospace Engineering Division of the Department of Civil and Industrial Engineering (DICI, [www.dici.unipi.it](http://www.dici.unipi.it)). At DICI, major areas of study and research in aerospace engineering include space systems, space mission analysis and design, flight mechanics, fluid dynamics and aerodynamics, aerothermodynamics, chemical and electric rocket propulsion, air-breathing propulsion, structures and materials. To this purpose, the Aerospace Engineering Division runs a broad set of dedicated facilities and specialized laboratories. Research activities are carried out in close collaboration with several intergovernmental organizations, prestigious universities, and aerospace and mechanical companies. ([www.unipi.it](http://www.unipi.it))

## Task description

### Your PhD project:

The researcher will be in charge of the assessment of design solutions for green expendable upper stages. In particular, the research will start with the identification of relevant mission profiles of future launchers and the corresponding requirements for their green expendable upper stages compliant with the space debris mitigation guidelines. Then, after doing the preliminary design of the upper stage with focus on attainable propulsive performance and affordable envelope and mass budgets, the ESR will carry out the detailed design of the propulsion system of the selected upper stage(s) with focus on most critical components.

The ESR will be enrolled in a PhD course at Università di Pisa and will be asked to: attend a list of local and network-wide training activities during the project (e.g. lectures, workshops, seminars, conferences, etc.); attend language courses in English and in Italian; actively disseminate the research results (e.g. publications in peer-reviewed scientific journals and scientific presentations at international conferences); perform two secondments in prestigious institutions to widen the skills on green propulsion.

### Problem Definition:

One ESR is fully dedicated to the green propulsion system design for upper stages due to the complexity of upper stage design aspects including the development of green propulsion systems as well as the adherence to safe disposal requirements and novel GNC solutions for injecting multiple payloads to different orbits.

### Research Objectives:

- 1) Identification of relevant mission profiles of future launchers
- 2) Identification of requirements for green expendable upper stages of future launchers compliant with the space debris mitigation guidelines
- 3) Assessment of liquid green propellant technologies (GPTs) for monopropellant systems for ACS and RCS and bipropellant systems for stages
- 4) Preliminary design of the propulsion system of the upper stage powered by liquid green propellants
- 5) Detailed design of the propulsion system of the upper stage powered by liquid green propellants with focus on most critical components

### Expected Results:

- 1) Definition of the requirements for upper stages of future launchers
- 2) Recommendation of green propellant technologies for future substitution of current upper stage powered by toxic propellants
- 3) Detailed design of the down-selected liquid green propellant technologies for the upper-stage.
- 4) Ground testing of the most critical components of the selected upper stage propulsion system (e.g. monopropellant and bipropellant thrusters and/or their components, tanks, etc.)

### Secondments:

Two secondments are likely foreseen to:

- 1) DLR, for a duration of about 4 months, to work on the development of hypergolic bipropellant combination
- 2) Hochschule Bremen, for a duration of about 4 months, to work on the optimisation of an ethanol injection system

## Profile and requirements

### Essential skills:

- MSc or equivalent in the field of aerospace engineering, chemical engineering, materials engineering, mechanical engineering or physics

- Applicants must have a solid knowledge of math, problem solving, mechanics, fluid dynamics, general chemistry and thermal science. Additionally, it is preferred to have knowledge of design and manufacturing, material science, rocket propulsion, combustion, experimental thermos-fluid science; spacecraft systems and space mission design
- 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 at Università di Pisa (<http://dottorato.unipi.it/index.php/en/ph-d-courses.html>)

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.

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 (Italy) 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 the maximum duration compatible with the ASCenSlon project (most likely 31.5 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

The selected candidate will be appointed a temporary contract, salary will be in line with the funding schemes of MSCA action, and in accordance with Italian rules and regulations within this regard and Country specific requirements, as stated in the Grant Agreement and Guide for Applicants. Monthly salary (living allowance + mobility allowance) will be of approx. 4.000€ (gross amount), allocated following Italian specific contract conditions for MSCA candidates. Family allowance will be granted upon specific conditions.

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 (probably one from University of Dresden, which is coordinating consortium, two from the University of Pisa, and one from industry).

The selection is assessed by qualifications and an interview.

The total rating allowed is 100/100. Academic qualifications and publications will be assigned up to 60 points. The interview will be assigned up to 40 points, with a minimum passing rate of 32/40. The ranking list will be compiled considering both ratings.

The selection Committee will inform the candidates admitted to the oral interview about the interview schedule and venue.

Candidates unable to attend the interview at the University of Pisa, will be allowed to be interviewed via web or conference call upon Selection Committee approval. The Selection committee is appointed to establish the duly examination of the candidates and shall acquire each candidate's copy of an identity card or passport.

In the event of a single candidate and only if already qualified (according to both admission and mobility requirements described above) by the application's deadline, the Committee can assess all the academic qualifications and publications and can approve the candidate without the interview.

In this case, the Committee is appointed to communicate its decision to the Staff Management that will inform the candidate during the two days before the interview date via mail. A similar notice will be published in case the Committee is unable to conform to the date set for the interview.

### Approval and Enrollment in the PhD programme

The scholarship for the PhD degree is subject to academic approval, and the candidate will be enrolled in one of the general PhD programmes at the Department of Civil and Industrial Engineering of University of Pisa. For information about our enrolment requirements and the general planning of the PhD study programme, please see the PhD Guide.

### 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 ESR11 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: 31 March 2021 at 23:59 CET

Expected starting date: 1 May 2021

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

More information about the project and its activities 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

Name and surname:

Applying for ESR No. 11

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>	