ASCenSIon
Advancing Space Access Capabilities - Reusability and Multiple Satellite Injection

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PhD student – Early Stage Researcher (ESR5)
Assessment of green propellants for reusable launchers

About ASCenSIon

The purpose of the ASCenSIon 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 ASCenSIon 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

SITAEL (STL) is the largest Italian privately owned Company operating in the Aerospace Sector. SITAEL space activities are vertically integrated to cover the Design, Development and Production of Small Satellites, Advanced Electric and Chemical Propulsion Systems, Earth Observation and Science Payloads, Platform and Payload Avionics from equipment down to complex component level. Leading contractor and preferred partner for many stakeholders in several space missions, SITAEL joins its flexibility and deep knowledge of design with a continuous look to innovation, ensuring the highest quality attention to each project while optimizing costs and development times. ESA/NASA standard certifications have been obtained in order to guarantee highly qualified processes, increasing the quality of offered products and solutions. The Propulsion Division (PD, formerly known as Alta SpA) of the Company will manage ITN activities. Propulsion Division has been deeply involved in design, experimentation, testing, analysis and simulation of electric and chemical rocket propulsion systems for launcher

and spacecraft applications. Existing facilities at SITAEL PD include 15 space vacuum simulators of different sizes and capabilities, ranging up to 6 m in internal diameter. PD workforce counts on 50 researchers and engineers. (www.sitael.com)

Task description

Your PhD project:
The researcher will be in charge of the assessment of the use of liquid and storable green propellants in reusable launchers for both the primary and control (ACS) propulsion. In particular, the research will be focused on the identification and assessment of possible valid substitutes to current propellants mainly in terms of propulsive performance, material compatibility, impacts on the propulsion system design, compliance with the REACH regulation and with the space debris mitigation. To target these tasks, the researcher is asked to work in a broad and international multidisciplinary research network with links to other researchers' activities.
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:
The recent inclusion of hydrazine into the candidate list of SVHC in accordance with the REACH regulation has made the identification and the experimental investigation of green propellants critical for future launchers. Particularly in current upper stages, the primary propulsion is powered by storable toxic propellants or by cryogenic combinations.

Research Objectives:
1) Assessment of green propellants w.r.t. performance characteristics & material compatibility
2) Assessment of liquid green propellant technologies (GPTs) for monopropellant systems for ACS
3) Assessment of liquid GPTs for bipropellant systems for stages

Expected Results:
1) Clear identification of the requirements of the propulsion system for green propellant ACSs and stages
2) Preliminary design of the down selected monopropellant and bipropellant thrusters
3) Ground testing of the selected thrusters

Secondments:
Two secondments are 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 thermo-fluid science, spacecraft systems and space mission design.
- Ability to work highly efficient and self-reliantly in a diverse inter-disciplinary and multicultural 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
- Knowledge of a program language (e.g. C++, Python, etc.) and/or a numerical computing software (e.g. Matlab, Octave, etc.)

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 (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 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 ASCenSIon 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 ASCenSIon 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 ESR5 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 May 2020 at 11:59 PM CET
Expected starting date: 1 October 2020

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

Candidates can apply to more than one position.
More information and other vacant positions can be found at:

- Website (to be published within April): https://www.ascension-itn.eu/
- Facebook: https://www.facebook.com/ascensionitn/
- LinkedIn: https://www.linkedin.com/company/ascensionitn/

Additional information

We in the ASCenSIon 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


TECHNISCHE
UNIVERSITÄT
DRESDEN


SITAEL
AN ANGEL COMPANY

ASCenSIon ITN Application Form

Name and surname: **Applying for ESR No. 5**

Age:

Nationality:

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