Technische Universität Braunschweig

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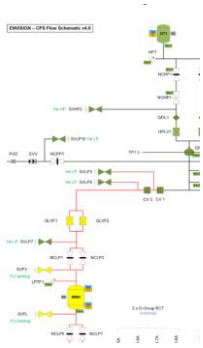
Institut für Raumfahrtsysteme

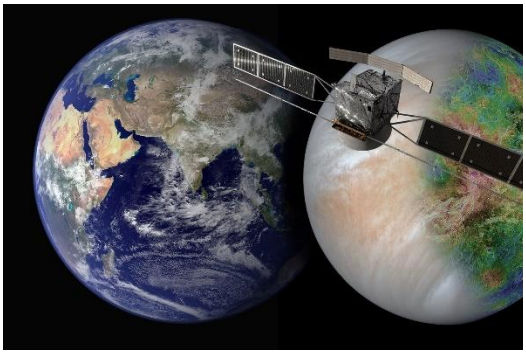
Master Thesis

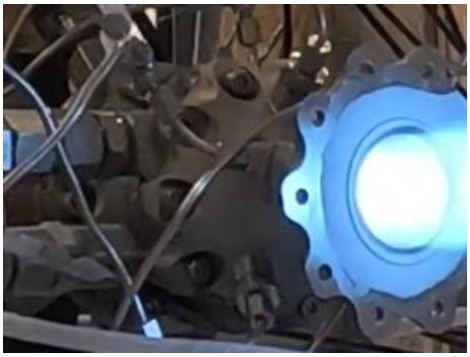
Preliminary Design of a Cryogenic Propulsion System for a Mission to Venus

Envision will be ESA's next Venus orbiter, providing a holistic view of the planet from its inner core to upper atmosphere to determine how and why Venus and Earth evolved so differently. EnVision is the fifth Medium-class mission in the European Space Agency's Cosmic Vision plan and is as such representative for an entire class of missions. The EnVision spacecraft is currently in the design phase and scheduled for launch in the early 30s. It will be using a classical propulsion system based on highly toxic storable propellants, powering both the high-thrust apogee engine, as well as smaller Reaction Control Thrusters.

However, new developments in the field of cryogenic in-space propulsion have advanced enough to envision a similar mission to be fuelled by Methane and Oxygen bipropellant systems. These propulsion systems are not only non-toxic, but also provide higher performance. Your task will be to assess how such a spacecraft could be implemented using cryogenic propellants and evaluate the expected influence on payload mass. Maybe the next medium-class ESA mission could be based on your design!







Your Tasks

- Summarize and prioritize EnVision propulsion system requirements
- Establish database of cryogenic propulsion system components, performances and masses
- Design a complete propulsion system architecture around cryogenics
- Optimize the spacecraft architecture based on existing design tools (optional)
- Implement the mission in an orbital simulation framework (optional)
- Summarize and document results

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