

Feasibility study for a next generation cold gas thruster for CubeSat propulsion systems

The purpose of the work is to contribute to a study and trade-off analysis for materials for a new thruster unit design for GomSpace's next-generation propulsion systems. The results from the analysis will be used for evaluating the general improvements on the thermal performance of these thruster units in particular.

The purpose of the project work is to make thermal & fluidic simulations of propellant (gaseous butane) flow through a thruster nozzle and the impact of heat loss from the propellant as it passes through the thruster unit for a given set of materials under consideration for the next thruster unit developments at GomSpace. The study builds on a master's thesis project carried out in spring 2021 where suitable materials were determined. The results from this analysis will be used for further evaluating about how the different materials would suit their application in the cold-gas propulsion system from the viewpoint of thermal properties.

The task in this project will be to set up the model of a thruster unit for performing simulations in COMSOL or equivalent numerical simulation program (here content from the aforementioned thesis project can be re-used) and set up a way to simulate flow of gaseous butane through the thruster. The students shall then run simulations to compare how different materials perform in simulations where butane flows through the thruster and heat is lost to the material as a result of its thermal properties. If time allows, a second round of simulations can be made where the thruster models are given heaters to compensate for the heat loss and how that might affect heat gain into the butane as it flows through instead.

Note! GomSpace will provide a geometrical starting point for making the model in COMSOL (or equivalent software), but computers with this software installed and available for the students shall be provided by the university (as has been the arrangement in the past). GomSpace will not give company laptops to the student for this task.

The work to be done, in summary:

- Prepare a project plan and schedule a regular series of follow-up sessions.
- Learn the software to be used (COMSOL or equivalent).
- Set up the model of the thruster in the software (older content can be re-used for this) and add to the model a modelled behaviour of the propellant flowing through.
- Simulate the heat loss from the propellant as it flows through the thruster for one given material.
- Simulate the above for three other candidate materials.
- If time allows: Repeat the two above steps with a thruster heater added into the model.
- At the end of the project: Write and present a report to the Propulsion department at GomSpace.