

Project ID + Title 40c – Definition of an optimized operational envelope for the Delfi-PQ micro-propulsion demonstrator	Type Analysis
Supervisor(s) A. Cervone	
General Background <p>A dual micro-resistojet demonstrator payload is currently being developed at TU Delft for in-flight validation on board the Delfi-PQ satellite. This payload is intended for demonstration, on the same flight, of two different types of micro-resistojet: the VLM (Vaporizing Liquid Micro-resistojet) and the LPM (Low Pressure Micro-resistojet).</p> <p>One of the most important aspects to be considered in the design of this demonstrator payload is its “operational envelope”; in other words, the full description of the conditions in which it is expected to work while in orbit. This envelope includes, as a minimum: expected amount of propellant (total and per burn), pressure and temperature levels throughout time, duration of thrusting per burn, input power. In a previous project conducted for the Micropropulsion course, a student generated an analytical model to evaluate the effectiveness of an envelope of given characteristics, and used it to select the preferable operational envelope among a few candidate options. In this project, you are required to further advance this model in order to perform a full optimization of the operational envelope, among all possible ones compliant to the design requirements.</p>	
Required Input (<i>to be provided by the supervisor</i>) <ul style="list-style-type: none"> • Current requirements + design of the complete micro-resistojet demonstrator payload • Deliverables of the previous Micropropulsion project on the operational envelope of the Delfi-PQ micro-propulsion demonstrator 	
Tasks <ul style="list-style-type: none"> • Based on the given input and information, study in detail the analytical model proposed by the previous student to characterize the operational envelope (and the way how a preferable envelope has been selected by the student based on this model) • Eventually propose modifications to the previous analytical model (if needed), to make it suitable to perform a full optimization of the operational envelope • Define an adequate optimization strategy (and target criteria) for the operational envelope and, based on it, select a fully optimized operational envelope for the Delfi-PQ micro-propulsion demonstrator 	
Research Questions RQ1 – How can the analytical model, previously proposed by a student for a project within the Micropropulsion course, be further improved in order to allow for a full optimization of the operational envelope of the Delfi-PQ micro-propulsion demonstrator? RQ2 – What is the optimum operational envelope for the Delfi-PQ micro-propulsion demonstrator, and based on which optimization strategy and criteria?	
Final Deliverables <ul style="list-style-type: none"> • Final report describing in detail the outcomes of all project tasks (including analysis and discussion of the results, if applicable) • Optimized operational envelope of the Delfi-PQ micro-propulsion demonstrator payload, according to the analysis performed 	

Grading criteria + rubrics

	<i>Fail</i>	<i>6 (sufficient)</i>	<i>7 (satisfactory)</i>	<i>8 (good)</i>	<i>9 (very good)</i>	<i>10 (excellent)</i>
Understanding & Application of Theory (30%)	Does not understand and can not apply theory to the given project.	Partially understands and applies, only with effort, theory to the given project.	Understands theory and can apply it only after having been shown how to do it.	Understands theory and has independently applied it to the given project.	Has independently collected new theory from additional sources and applied it to the given project.	Has independently developed a new piece of theory and applied it to the given project.
Critical Attitude (20%)	Has no critical attitude towards own results.	Has limited critical attitude towards own results.	Has sufficient critical attitude towards own results.	Has well balanced critical attitude towards own results.	Has validated own results by comparing them to other independent sources.	A complete and thorough validation of the whole methodology, process and results has been carried out.
Report and Deliverables (30%)	One or more of the deliverables is missing or has very poor quality.	The report, although fulfilling all basic requirements, is unclear and poorly expressed. Deliverables can not be used for future work.	The report is reasonably expressed and mostly clear. Some of the deliverables can be used for future work.	The report is clear and free of scientific errors. All deliverables can be used for future work.	The report is very good and can be potentially used for future publications. Some deliverables will represent a fundamental input to future work.	The report or part of it will certainly be published. All deliverables will represent a fundamental input to future work.
Creativity and Initiative (10%)	No initiative at all and no attempts to give an original contribution to the project.	Some individual initiative from the student, but still no original contributions to the project.	At least one original contribution to the project, not directly initiated or thought by the supervisors.	More than one original contribution to the project, not directly initiated or thought by the supervisors.	More than one original contribution to the project, not directly initiated or thought by the supervisors, including some improvements in the methodology initially proposed by the supervisors.	Was able to constructively reshape the project with a number of original contributions and an innovative methodology.
Project Management & Planning (10%)	Wasted all the available resources and was not able to conclude the project.	Concluded the project very close to the maximum 3 months allocated to it, with no real reasons for this delay.	Concluded the project in more than 50% additional time than the nominal expected effort (84 hours), requiring significantly more supervision time and resources than expected.	Took slightly more than the nominal expected effort (84 hours) to conclude the project, requiring more supervision time and resources than expected.	Concluded the project within the nominal expected effort (84 hours), but still requiring more supervision time and resources than expected.	Concluded the project within the nominal expected effort (84 hours), and didn't require more supervision time and resources than expected.