SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
On Track - Undergraduate Space Education (3)

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HOW CAN A GROUP OF 3RD YEAR UNIVERSITY STUDENTS DESIGN A REAL NANO-SATELLITE? A CASE STUDY AT DELFT UNIVERSITY OF TECHNOLOGY

Abstract

A unique didactic element of the Aerospace Engineering Faculty at Delft University of Technology is the Design Synthesis Exercise (DSE): as a completion of their B.Sc. study cycle, groups of 10 students work full-time on a single project for 10 weeks. This ensures that sufficient design content is present in the study program, giving the students a practical possibility to apply and integrate the analysis techniques learned during other fundamental courses.

Every DSE project covers a complete design process, from initial definition and analysis of requirements to a final Phase A design of the system, through an iterative set of trade-offs where non-optimal decisions are corrected to meet the requirements. It culminates in a final symposium where the groups present their work and compete for a best-design award. The goal is not only to improve the design skills of students, but also to let them make a first concrete experience of teamwork, communication, decision making and project management. Multi-disciplinarity and integration of different aerospace engineering subjects are two key aspects of these projects. Faculty teachers supervise the students, provide support for those subjects where they lack sufficient background preparation, and act as customers for their work. The general idea is that fresh design teams, with limited but adequate supervision, are able to produce unconventional, innovative but still credible designs.

The Space Systems Engineering chair at Delft University of Technology is actively involved in the design, assembly, integration and launch of nano-satellites, mainly for educational purposes. Since students play a relevant role in this activity it is crucial to educate them, already during their B.Sc. studies, on the challenges, difficulties and multi-disciplinary aspects of small satellite design.

The authors will act as supervisors of two DSE projects on the design of nano-satellites based on the requirements and constraints of QB50, an international mission incorporating a network of 50 CubeSats in Low-Earth orbit for lower thermosphere and re-entry research.

The paper will describe the evolution of this design exercise from its beginning to the final symposium presentation, the challenges faced by the students and by the supervisors and the ways how they have been addressed. The lessons learned from this didactic experience will be discussed, together with its outcomes and potential benefits for the Faculty and the students. Details will be provided on the criteria used for the final assessment, as well as on the feedback evaluation received from the students.