

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

Author: Mr. Kevin Cowan

Delft University of Technology (TU Delft), The Netherlands, k.j.cowan@tudelft.nl

Dr. Angelo Cervone

Delft University of Technology (TU Delft), The Netherlands, a.cervone@tudelft.nl

Mr. Jasper Bouwmeester

Delft University of Technology (TU Delft), The Netherlands, jasper.bouwmeester@tudelft.nl

Dr. D. M. Stam

The Netherlands, d.m.stam@tudelft.nl

Dr. Ernst Schrama

Delft University of Technology (TU Delft), The Netherlands, e.j.o.schrama@tudelft.nl

Prof. Ramon Hanssen

Delft University of Technology (TU Delft), The Netherlands, r.f.hanssen@tudelft.nl

Dr. Chris Verhoeven

Delft University of Technology (TU Delft), The Netherlands, c.j.m.verhoeven@tudelft.nl

Dr. JM (Hans) Kuiper

Delft University of Technology (TU Delft), The Netherlands, j.m.kuiper@tudelft.nl

MULTIDISCIPLINARY SPACE EDUCATION IN A BLENDED LEARNING ENVIRONMENT: THE  
NEW SPACEFLIGHT MINOR AT DELFT UNIVERSITY OF TECHNOLOGY

**Abstract**

Driven by wide interest among Delft University of Technology students to acquire focussed knowledge on space engineering, missions and planetary exploration, a new Spaceflight minor was developed for the minor program of the university. With this program, TU Delft affords its students an opportunity to dedicate the first semester of their 3rd BSc year to a set of courses chosen among the numerous options offered by this, or another, university. Students are not only allowed but encouraged to explore topics and study fields outside their main BSc track.

The Spaceflight minor is designed as a multidisciplinary, thematic program, in which the students gain insight in the demand for space applications, mission analysis, system requirements and sizing. This multidisciplinary setup is facilitated by the recently established TU Delft Space Institute (DSI), of which all the faculties involved in the minor are members. The minor and the DSI provide a unique opportunity to strengthen space education and research across TU Delft.

The minor covers two quarters over twenty weeks and includes six courses. Offered in the first quarter are: Introduction to Spaceflight (for students without Aerospace Engineering background) or Electronic Circuits (for the other students); Space Exploration, with basics and examples of planetary and astronomical exploration and an introduction to space law; Earth Observation, covering basics of remote sensing of the Earth. The second quarter includes: Spacecraft Technology, providing an overview of the technology of spacecraft subsystems with emphasis on small satellites; Satellite Tracking Communication, on telecommunications, ground station operations and telemetry analysis from a theoretical and practical point of view; Spaceflight Assignment, the final project in which students produce real, small-scale space deliverables, and reflect on the process and results of development and analysis in the complex space engineering and scientific environment. In total, 15 lecturers from three TU Delft faculties and one from

Leiden University contributed to the minor. Many of the courses employ innovative education techniques, such as flipped classrooms and videos produced by the lecturers. Some courses are simultaneously offered to campus students and external participants in a full online format.

The first edition of the minor, delivered from September 2015 to January 2016 to 50 students from various TU Delft faculties, can be considered a success with excellent feedback from participants. The paper elaborates on the minor design and learning objectives, showing how multidisciplinary, innovative education can be effectively implemented for students with different academic backgrounds.