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

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SUSTAINABLE SPACE ACTIVITIES (SUSPACT): A NOVEL APPROACH TO IMPLEMENT SUSTAINABILITY IN SPACE EDUCATION COMBINING THEORY AND PRACTICE

Abstract

The increasing use of space, particularly for commercial purposes, has heightened the necessity for sustainable space activities in view of the fragile LEO environment. Alongside the threat space debris poses to future missions it is further inevitable to carefully consider the negative impact of space industry on the terrestrial environment – especially in the face of climate change. In light of these developments, it is crucial to address sustainability as early as possible in the career of an aerospace engineer or related professions to shape a prospective space workforce with a future-oriented mindset. For this reason, a new course entitled Sustainable Space Activities (SuSpAct) was introduced at TU Berlin in 2023. Its innovative approach is presented in this work to provide a possible roadmap on how to implement sustainability in space education. The concept focuses on a close connection between theory and practice and comprises three complementary elements: a lecture series, a seminar, and hands-on components. Lectures cover a variety of sustainable space topics like space debris, green propulsion, and planetary protection. The content is further deepened in a subsequent seminar through discussion and active student participation, as well as applied in various workshops. This combination facilitates an engaging curriculum, adaptable to the ongoing changes within the space sector. For the pilot semester, two workshops with different focuses were developed: In the first one, students plan a satellite image acquisition of a target on Earth with a sustainable purpose, which is then carried out by one of TU Berlin's satellites. In a second workshop, students are introduced to ESA's DRAMA tool, used for various simulations regarding lifetime estimation, damage and re-entry risk assessment. The course addresses not only undergraduate and graduate students in aerospace engineering, but also students in related fields such as computer science or natural sciences to bring an interdisciplinary view into the seminar.

This work provides a detailed overview of the covered topics, workshop contents, and seminar structure. Subsequent evaluation of the teaching approach identifies areas for improvement, which can be addressed by applying the lessons learned to iterations of the lecture course. It is demonstrated that sustainability topics can be merged into an independent course to enrich an existing space curriculum. The result is a foundation that can serve as a model for other academic institutions and may support its portability.