

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

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A HANDS-ON SPACE EDUCATION PROGRAM ON THE DEVELOPMENT, IMPLEMENTATION
AND OPERATION OF PAYLOAD AND SENSORY COMPONENTS FOR THE NANOKHOD
MICROROVER

Abstract

Within the 2021/22 semester, two student teams successfully designed and implemented a micro-sensor suite, on-board computer system and interface software for the Nanokhod Microrover using COTS components. The developments were realised within the framework of the hands-on educational course “Development of an Exploration Rover System”, an interdisciplinary education program on space robotics and rover system development offered by the University of Stuttgart’s Institute of Space Systems (IRS). The innovative course structure allows students not only to learn and experience the challenges of space system development, but also to come up with new, innovative and straight forward ideas of designing and implementing robotic systems for space exploration within a hands-on project work. This year’s project phase of the educational program covered the development of sensory components for the Nanokhod Microrover, a three-kilogram exploration rover system, formerly designed by the company von Hoerner und Sulger (vH&S) for ESA’s BepiColombo Mission. In cooperation with vH&S and IRS a further development of the Nanokhod Microrover towards a Lunar surface exploration mission is anticipated, thus allowing an interdisciplinary link between excellent education and hands-on project work on space system technology

development. To setup a competitive framework, participating students of the education program were divided into two groups regarding their individual emphasis and interests in four major subjects: system engineering & management, mechanics & analytics, electronics, and software. Each team had to fulfil top-level mission requirements as well as a predefined set of constraints regarding cost, time schedule and subsystem interfaces. To successfully reach the goal, the teams need to apply standards in space system development processes, such as the NASA Space Flight Project Life Cycle. For a fulfilment of the mission goal, a successful realisation of the specific development phases A to E are elaborated along a given set of supervised review-milestones. At the end of the semester, the teams presented and operated the realised systems within a one-day event, the "Rover Challenge". To pass all the milestones and successfully reach the goal, students were strongly encouraged to develop and foster a hands-on mentality, thus in particular allowing to develop and train key capabilities. This paper presents the hands-on activities and lessons-learned from this innovative education program, as well as specifically the successfully realised sensor and instrument-suites by the student-teams. Within the session, the functional realisation of the two designed payload cabins, collecting and processing of house-keeping data and gathering environmental information shall be demonstrated.