

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

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INTEGRATION OF SMALL SATELLITES DESIGN PROCESS INTO THE SPECIALIST'S DEGREE
EDUCATIONAL PROGRAM

Abstract

CubeSat standard satellites, which were proposed in 1999 at Stanford University (USA), are now designed at various universities around the world. In reality, such projects are carried out by a small group of advanced students and produced in a single batch, and hence there is only a minimal educational effect from such practical endeavors. At the same time, modern specialists of satellite-based technologies should have advanced skills in spacecraft design. Small dimensions and volumes impose significant restrictions on the spacecraft configuration. This problem requires a designer of cyberphysical system to be qualified according to the new demands specified by the fourth industrial revolution. In the report we propose a new concept of end-to-end education of specialists in design of small satellites as cyberphysical systems. For integration of the design process of such satellites into the specialist degree educational program, a group of students with individual education plan is created on a task-specific chair. A student's task during the time of education will be to develop the engineering specification and manufacture a pico- or a nanosatellite. Of course, this task cannot be fulfilled on a stand-alone basis. This is why undergraduate students (first- and second-year students) only take part in spacecraft manufacture, but starting from the senior year of education, they start working, in the framework of term projects and home assignments, on creating the design data package for his or her own satellite. Fifth-year students begin to build their own satellites. Under this approach, students are taught in their common group and study such special courses that will be necessary for spacecraft design. As a result, continuous accumulation of experience and practical results is achieved and at least one small satellite is built per year. The results of integration of small satellites design process into the design specialist's degree educational program are demonstrated on an example of design and production processes of the Baumanets, Baumanets-2 microsattelites, the Parus- BMSTU nanosatellite of class CubeSat 1U and the Yarilo nanosatellite of class CubeSat 3U. The authors propose a systematic approach to the integration of the design phase of small spacecrafts into the design specialist's degree educational program (the specialist degree), which enables students to acquire professional engineering skills by from their involvement in the full production cycle of a spacecraft, with due account of the project conceptual design, design planning, manufacture, ground tests and operation of a spacecraft.