Educational Satellite (EduSat):
Morehead and University of Rome Prepare to Launch Satellite from Russia

Morehead State's Space Science Center and Kentucky Space are collaborating with the University of Rome Sapienza Aerospace Engineering School on a series of student-driven educational satellite projects. The goal is to develop, build, and fly a series of 4 satellites that are designed, built, and operated by university students. These satellites (EduSat, UNISAT-5, UNISAT-6, and UNISAT-7) will be built in Rome and in Morehead, integrated at the University of Rome, launched on Russian Dnepr rockets from Russia and Kazakhstan, and controlled from Morehead by students using the big dish antenna and by Italian students using satellite ground assets in Europe.

The first in the series of these missions is the Educational Satellite (EduSat). EduSat is an innovative Microsatellite weighing about 24 pounds and about the size of a small microwave oven, that will be launched in July 2011 from Yasny Russia on a Dnepr Rocket. EduSat began as a collaboration between the University of Rome and the Italian Space Agency and now includes the Morehead State University Space Science Center and Kentucky Space. During its first 30 days on orbit, EduSat will test an orbital deployer designed to release femto-class satellites. While the femtosats will not be released on the first mission, the deployment system that will ultimately deploy them will be tested.

A follow-on mission in 2012 (UNISAT-5) will deploy four femto-class satellites (with masses of under one pound each), two of which were developed by Morehead State University students and faculty. The femtosatellites (invented by Morehead Professor Bob Twiggs), called PocketQub™s, will be ejected from the UNISAT-5 "mothership" at apogee. Morehead State University has built two of the PocketQub™s in house, with the others built by university students in the US and Europe. These femtosats will be among the smallest satellites ever launched. Each will have Earth and Space monitoring sensors and test micro/nano technology for space applications. The EduSat mission is a precursor mission that will lead the way to flying the PocketQubs by flight-testing the orbital deployer that will launch the PocketQubs from the larger satellite.

The orbital deployers—called the MRFODs—Morehead –Roma Femtosatellite Orbital Deployers—were designed and built by undergraduate students in the Morehead State University space science program. The orbital deployer was conceived to provide a reliable and adaptable deployment system for the recently developed PocketQub standard as well as other femto-class satellite form factors. To accelerate prototyping of the MRFODs, the 3D printer at the Space Science Center was used. 3-D printing is an additive manufacturing, rapid prototyping technology that greatly facilitates the engineering design process. Printed prototype models provide a quick turnaround time and a cost effective alternative to developing prototypes from traditional materials and with costly machinging processes. The 3D printed models have been invaluable in development and testing; including: functionality and fit-checks. Using this technique, the MRFOD systems were conceived, designed, prototyped, tested, and flight models were produced in under

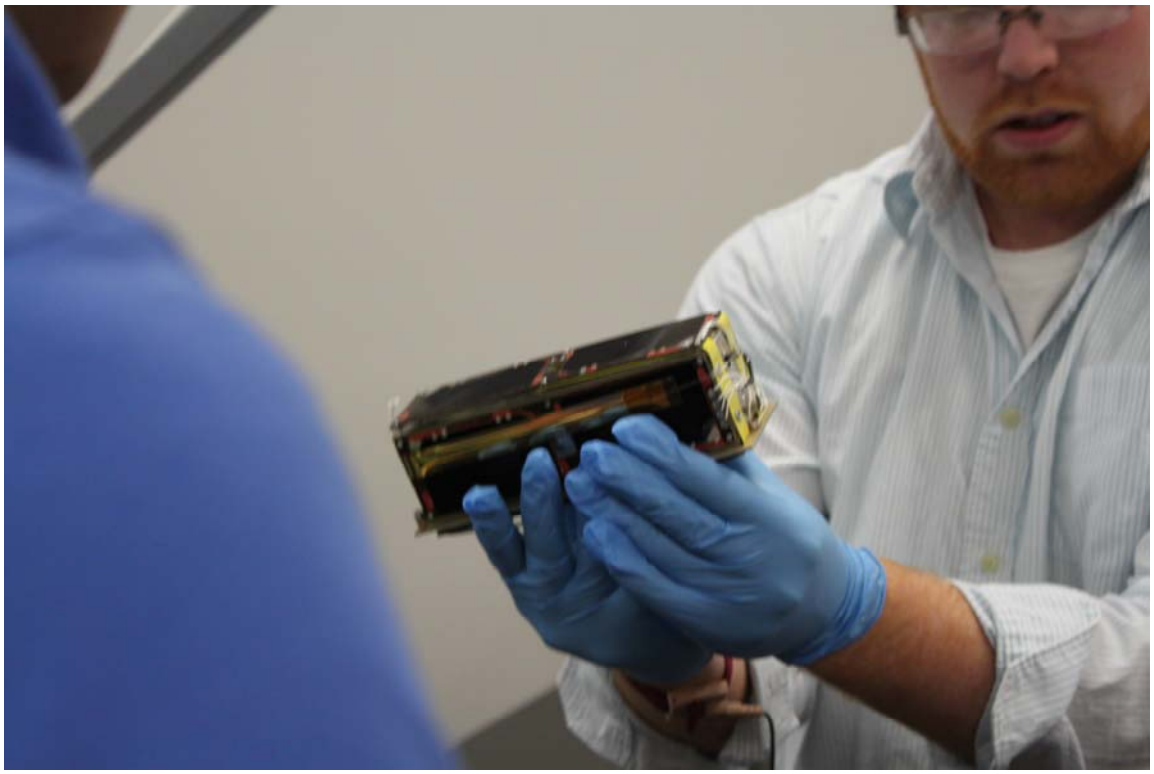
9 months. Using traditional manufacturing processes for prototyping the engineering models would have taken significantly longer and would have cost several times as much to produce.

The PocketQub is a new satellite standard that was proposed in 2009 by Professor Robert Twiggs for a satellite even smaller than the CubeSat. PocketQubs are 5 cm cubes and can literally fit in a pocket. The PocketQub™ leverages the CubeSat standard and also leverages the revolution in the miniaturization of electronics. PocketQub™s will ultimately have a wide range of applications including: Network Nodes, Sensor Systems, Satellite Constellations, Inexpensive, Redundant, Spatially Organized Earth Remote Sensing Platforms.

Students of the Space Science Center (SSC) at Morehead State University served as the principle engineers in the development of two of the first PocketQubs (Eagle-1 and Eagle-2) and the Morehead-Rome FemtoSat Orbital Deployers (FOD) designed to deploy the femtosats from Edusat (the mother ship). Eagle-1 and 2 will test deployable de-orbit systems and establish flight heritage for femtosat systems including power systems and transceivers. The primary payloads on EduSat are environmental sensors dedicated to secondary education research. The EduSat-FOD mission's successful launch and operation will potentially usher in a new frontier in micro-miniaturization of technologies for the small satellite industry.

The series of space missions are educational and research space mission involving the University of Rome Sapienza, Kentucky Space and Morehead State University. The on-going project has two main purposes: designing, building, and launching a student-built satellite and testing prototype technologies including extremely small space systems in the space environment. Students at the University of Rome and Morehead have had the responsibility of designing the satellite's mechanical systems, electronics systems, software systems, and will operate the satellites on orbit. The missions provide excellent opportunities for students to engage in research and at the same time push the envelope of micro-nano technologies for space applications.

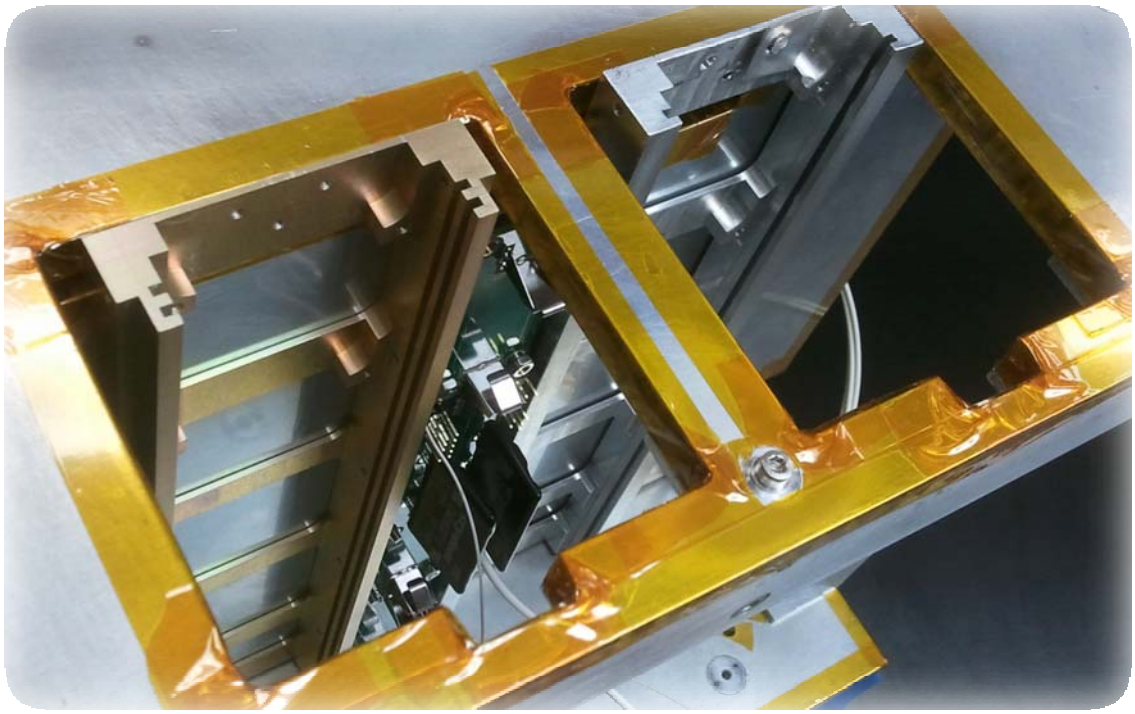
Dr. Malphrus, Director of the Space Science Program, Kevin Brown, Assistant Professor of Space Science, and two undergraduate students—Nathan Fite and Tyler Rose will travel to Italy for the integration activities and Dr. Malphrus and Kevin Brown will travel to Russia for the launch. A group of students including Clay Graves, Jonathan Fitzpatrick, Ben Cahall, Caleb Grimes, and Margaret Powell will serve as the ground operations team for launch and early operations of the satellite from the MSU Mission Operations Center.



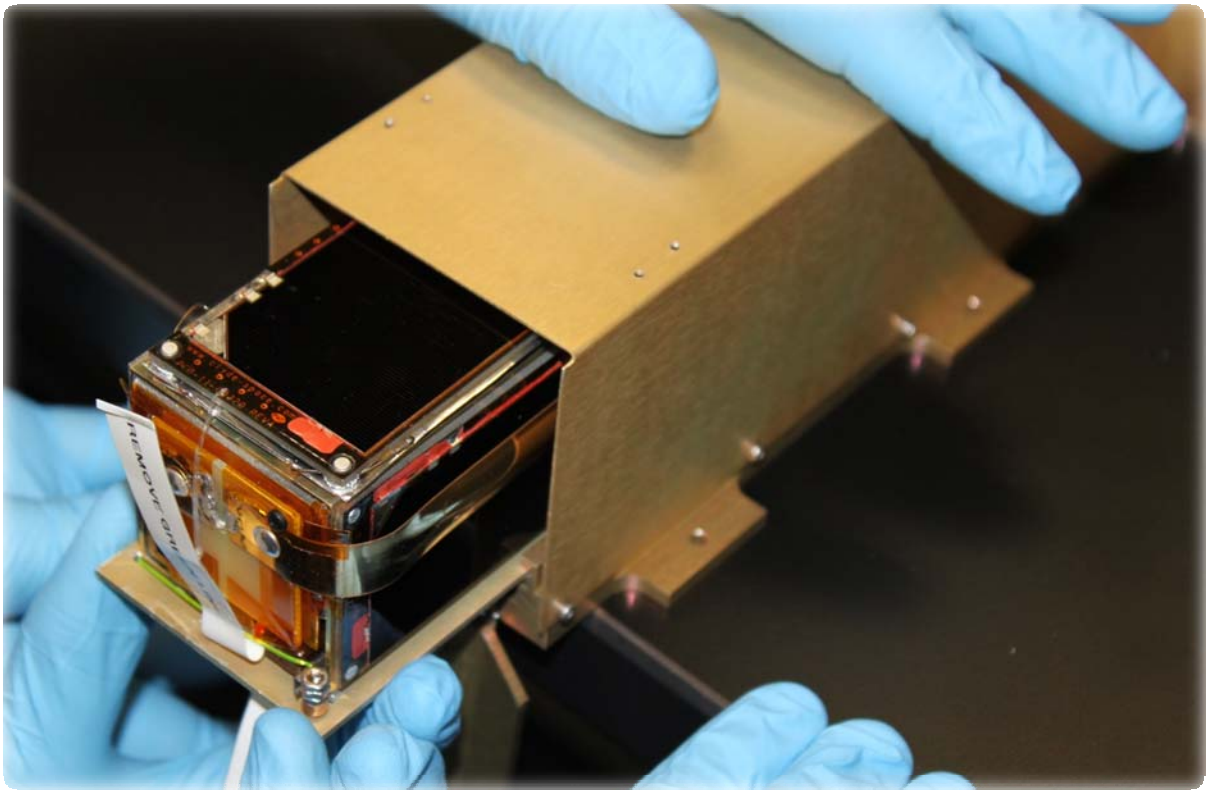
Undergraduate Space Science Student Nathan Fite holding a PocketQub Satellite

Dr. Malphrus examining one of the Morehead-Rome Femtosat Orbital Deployers (MRFODs) that are installed in the EduSat microsatellite and will ultimately eject femtosatellites developed by students at Morehead State University and the University of Rome

Tyler Rose, a Space Science Student, Prepares One FOD Unit for Vibration Testing



Interior View of MRFOD Deployment Rails & Electronics Package



Fit Check of a PocketQub Satellite in the MRFOD System