

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

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SPACE HAUC: AN UNDERGRADUATE CUBESAT MISSION TO DEMONSTRATE HIGH
BANDWIDTH COMMUNICATION USING A X-BAND PHASED-ARRAY SYSTEM

Abstract

We describe the present status, upcoming plans and lessons learned from SPACE HAUC (Science Program Around Communication Engineering with High Achieving Undergraduate Cadres). It was selected through the NASA Undergraduate Student Instrumentation Program (USIP), that is designed to provide hands-on training in spaceflight missions to multidisciplinary teams of undergraduate students with a goal of developing future space explorers.

SPACE HAUC will demonstrate high rate data transmission (up to 100 Mbps) which is essential for imaging applications that dominate nanosatellite missions. It operates in the X-band (7.2 - 8.3 GHz) and uses a 16 element (4 X 4) patch antenna array. The phased array will create a 25 deg (FWHM) beam and will also demonstrate beam steering over 45 deg with less than 5 deg error.

The X-Band communication system consists of a Commercial off-the-self (COTS) transceiver and student-designed patch antenna array, RF front-end for signal processing and a beam steering system. The entire communication module occupies a 0.5 U volume and weighs less than 1 kg with a receiver sensitivity of -115 dBm.

The undergraduate students formed various teams for the project execution including project management, engineering, and software. Along the way, over one hundred students from various colleges and departments within the university involved in SPACE HAUC gained experience with hands on management and engineering designs and processes. In addition they learned real-world lessons of a spaceflight mission involving a state-of-the-art technology demonstration. Additionally, as an institution, we created an aerospace engineering minor as the first step towards a comprehensive aerospace engineering program.

SPACE HAUC is scheduled for flight in 2020. If successful, it will introduce an important new communication tool to the CubeSat community. The collaborators and generous supporters of SPACE HAUC include the Massachusetts Space Grant Consortium, MIT Haystack Observatory, UMass Lowell's Immersive Scholars program, BAE Systems, GOMspace and UMass Lowell's Submillimeter-Wave Technology Laboratory. SPACE HAUC was supported by the NASA USIP program.