VISUAL INFORMATION CUBESAT FOR EVA (VICE). *B. B. Strickler[1], S. Singh[2], K. K. Schroeder[3]*
[1]Virginia Polytechnic Institute and State University (strick20@vt.edu), [2]Virginia Polytechnic Institute and State University (simran10@vt.edu), [3]Virginia Polytechnic Institute and State University (kschro1@vt.edu)

Brief Presenter Biography: Ben Strickler and Simran Singh are both undergraduate Aerospace Engineers studying at Virginia Polytechnic Institute and State University in the United States. The pair intend to graduate in the spring of 2020 and hope to pursue careers in the aerospace and entrepreneurship industries. Their research stemmed from a Students for the Exploration and Development of Space (SEDS) competition where their design is competing for a complimentary CubeSat launch courtesy of Astranis and Nanoracks.

Introduction: The possibilities for what go onto a cube satellite (CubeSat) are theoretically infinite. There are always new ideas and technologies to be tested in the space environment as humans move closer and closer to becoming interplanetary and beyond. One such technology is the idea of an external display screen that is openly exposed to the space environment. Students from Virginia Polytechnic Institute & State University (Virginia Tech) are working to develop, test, and launch one of the first, if not the first, external display screen in space on their CubeSat, ContentCube.

Method: ContentCube, illustrated in Fig. 1, is designed to be a 1U (10 x 10 x 10 cm) CubeSat deployed from the ISS using the Nanoracks CubeSat Deployer (NRCSD). Once in Low Earth Orbit (LEO), ContentCube will take a self-portrait of its monitor display using an extendable solar array with attached camera, as seen in Fig. 2. The CubeSat will also be equipped with an active Attitude Determination and Control System (ADCS) with the capability to maintain any orientation, allowing the images taken of ContentCube's display screen to have Earth in the background.

ContentCube will use a combination of the National Aeronautics and Space Administration (NASA) core Flight System (cFS) and the Virginia CubeSat Constellation (VCC) software, used on the most recent CubeSat developed at the Center for Space Science and Engineering Research (Space@VT), to operate its payload and flight boards, respectively. This will additionally allow for the creation of a foundational operating system that can also be used on future satellite missions out of Space@VT.

Various images uplinked from the Virginia Tech Ground Station to the monitor will be photographed by the camera in the space environment. These images will be downlinked to the VT Ground Station and the team will examine the pictures for visual health inspection of the screen. The images will be continuously cycled through the uplink/downlink cycle for the full duration of the CubeSat's lifetime, so researchers can assess the longevity of the display's functionality over the course of twelve to eighteen months.

Anything exposed to the space environment is subjected to numerous competing constraints, including a vacuum environment and use in temperatures ranging from -120℃ to 230℃. After evaluating various limitations, the ContentCube team is conducting trade studies for various display monitors that could prove to be compatible in the space environment. Using lab facilities provided by Space@VT, the team will conduct subsystem requirements-level performance tests to shortlist these monitors for placement on the CubeSat.

Future Applications: External display screens could be used on everything from planetary rovers to extravehicular activity (EVA), and even on extraterrestrial bases and habitats. This same technology could also be applied to astronauts making in-situ measurements on other celestial bodies. Display monitors have the potential to provide detailed visuals for astronauts exploring the space environment and can become a vital part of space exploration in the future.

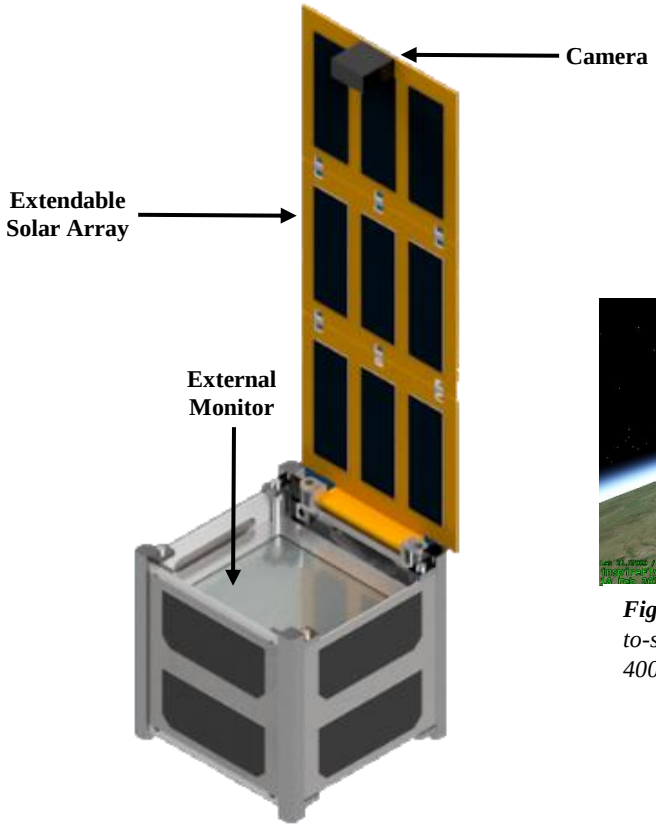

Fig. 1 *Preliminary test CubeSat, ContentCube, will monitor its external display with its camera attached to an extendable solar array*

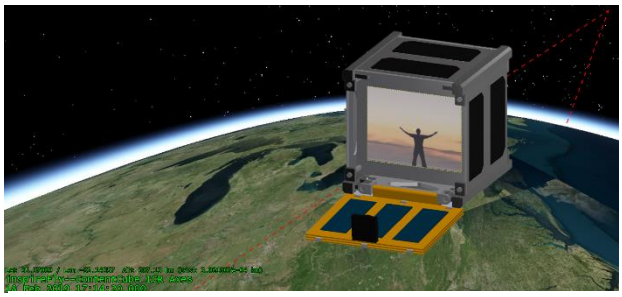

Fig. 2 *ContentCube deploying its solar array, with a to-scale view of the external display showing a test image, 400 km above Earth in LEO*