Vermont Technical College CubeSat Lab is developing the flight software for the Lunar IceCube, a 6U (10cm x 20cm x 30cm, 14kg) CubeSat that is manifested on the Space Launch System (SLS) EM-1 flight to the Moon in 2018. This is a self-propelled CubeSat with an iodine ion drive that will be used to go from the SLS drop off point into orbit around the Moon. Lunar IceCube will then survey the Moon for water ice, vapor and other volatiles with its IR spectrometer. The rest of the team for Lunar IceCube is Morehead State University (the PI), Catholic University & NASA JPL (Science PI), Goddard Space Flight Center (IR spectrometer and navigation), Busek (iodine ion engine) and NASA JPL (Iris 2 X-band data and navigation radio and the Deep Space Network, which we will use). Previous CubeSat missions have almost all been programmed in the very error prone C language. We will be using SPARK/Ada, the most reliable software system available. Ada has been used for many NASA missions (Cassini, Space Shuttle, ISS, Chandra, EOS, Terra, GOES, CloudSat, QuikSCAT, Oersted and many others), virtually all European Space Agency missions and well as launch vehicles Ariane IV & V, Atlas V, Delta II & IV (used for the first Orion test). Ada is also used in all commercial airline avionics and air traffic control systems. SPARK, a set of static analysis tools which greatly increases the reliability of Ada was used in our Vermont Lunar CubeSat, the first spacecraft of any kind to use SPARK. SPARK is used in the Airbus engine control system and the new UK air traffic control system.

We have shown the reliability of SPARK in our Vermont Lunar CubeSat. This CubeSat operated from launch, November, 2013 for two years and two days until reentry on November 21, 2015. We were the first satellite launched from a University in New England, and the only successful satellite from a university in the entire Northeast United States. Of the 12 CubeSats on the ELaNa IV launch, ours was the only one fully successful. Eight were never heard from, two had partial contact for a week and one operated for four months. We believe software errors are the most likely cause of the failures. SPARK/Ada has 1% of the C error rate. We are developing CubedOS (http://cubesatlab.org/CubedOS.jsp) as a basis for Lunar IceCube and other CubeSat flight control software.