

AGENCY

Student satellite components bombarded with heavy-ions during intense tests

15/06/2021 1108 VIEWS 26 LIKES

ESA / Education / CubeSats - Fly Your Satellite!

ESA Academy's Fly Your Satellite! programme gives university students the life-changing experience of designing, building, and even launching their own nano-satellites into orbit.

The third cycle began in March 2020, and includes the SpaceDot team from the University of Thessaloniki (AUTH) in Greece, who are developing their ACubeSat project. For the past few months, the team has been preparing for the heavy-ion radiation test, supported by engineers from ESA's Radiation Hardness Assurance and Component Analysis section (TEC-QEC), to test critical components of their on-board computer.

— Preparing the test setup

ACubeSat is a 3-unit CubeSat mission designed to study the effects of microgravity and radiation on the gene expression of a strain of yeast cells. This will advance lab-on-a-chip technology for use in small satellite missions, as well as helping scientists to better understand the impact being in space has on DNA – critical knowledge for future human endeavours in Earth orbit and beyond.

However, space is a challenging environment for spacecraft. Once the protection of Earth's atmosphere is left behind, charged particles can penetrate electronics and potentially cause mission-ending levels of damage. While still on Earth, engineers study how components will behave when hit by those particles, ascertaining how prone they are to malfunction, and exactly what happens when they fail.

With this aim in mind, two university students from the SpaceDot team spent 17 – 21 May 2021 at the Cyclotron Resource Centre at UCLouvain, Belgium, for a heavy-ion radiation test at the Heavy Ion Facility (HIF). The team is developing their own on-board computer subsystem to be the brains of ACubeSat; as a critical subsystem, it is essential to at least test all critical components to ensure that they will function well, and predictably, when exposed to radiation in space.

The SpaceDot team was closely supported by ESA's (TEC-QEC) engineers for the preparation, execution as well as for offering the beam slot. They helped the students to define the objectives of the test, design the set-up, and carry out the testing at the facility. The ESA engineers also performed delidding of the components at ESTEC. Delidding is a process in which a component's protective casing is partially removed to fully reveal the die, allowing heavy-ions to penetrate the active regions.

Months of preparation culminated in a week of intense work at UCLouvain. The team, alongside an ESA engineer, worked around the clock to expose more than 12 components to the necessary radiation conditions. COVID guidelines were adhered to by all in attendance, which added an extra, but necessary, level of complexity.

— A delidded component

— ACubeSat team ready to start the test

For this reason the outcome of all this hard work was globally a successful test campaign! The SpaceDot team now have a better understanding of the components that will be used in

ACubeSat's on-board computer. The heavy ion test was a valuable learning experience for the students, who are now close to completing their Critical Design Review. They will then proceed to the next phase of the Fly Your Satellite! programme: Build Your Satellite! This unique hands-on experience resulted in the team learning not only how to better prepare for a heavy-ion test campaign, but also how to work under time pressure and long hours, which may be useful to better prepare for subsequent FYS tests.