

AGENCY

Students shoot for the Moon in ESA's Concurrent Engineering Challenge 2017

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Concurrent Engineering is a method of designing and developing products for the space sector. Contrary to traditional design methods, in concurrent engineering all subsystems are designed simultaneously. As this is so different to conventional approaches, ESA has started holding Concurrent Engineering Workshops to help the next generation of scientists and engineers appreciate the benefits it provides.

The first Concurrent Engineering Challenge was held between 12 and 15 September 2017, and was the fifth event using the ESA Academy's Concurrent Design Facility. Twenty-two university students from 10 different ESA Member and Associate States participated to the challenge which took place at the ESA Academy's Training and Learning Centre at the European Space Security and Education Centre (ESEC) in Belgium. This resulted in a very diverse and multicultural environment for the students to work in and, as one British student from the Delft University of Technology said: "The Concurrent Engineering Challenge was an excellent learning opportunity. I thoroughly enjoyed working with 21 other highly motivated and capable young engineers and scientists from a diverse range of technical and cultural backgrounds, many of whom will remain good friends for years to come. We received outstanding support from ESA engineers who provided very valuable advice for both the concurrent design methodology and for our future paths in the space industry. I strongly recommend this challenge to any student looking to design space systems after their graduation."

The participants were joined remotely by three other student groups participating from Concurrent Design Facilities located at three different European universities: Politecnico di Torino (Italy), University of Strathclyde (United Kingdom), and Technical University of Madrid (Spain). Each group included 15 to 25 university students. In total, 88 university students took part in this challenge!

Each group of students was supported by two system engineers with concurrent engineering experience. The four groups were not competing against each other. Rather, this was a cooperative effort. Although each group produced their own mission proposal, video conferencing was used to share each day's progress, raise any particular difficulties student groups were facing, and receive helpful input from the participants in the other groups. A Spanish student from the ISAE-SUPAERO said: "I can assure you that I will remember the experience in the Concurrent Engineering Challenge for the rest of my life. I have learned a lot of valuable things from experts in the space sector that will be decisive for my future career."

In the afternoon of 11 September the students participating from ESEC met to prepare for the challenge starting the next day. System engineers from ESA's Concurrent Engineering Section gave them an introduction to the concurrent engineering approach and helped them get familiar with the Open Concurrent Design Tool (OCDT). They also learned about the ESA Academy programme and had an exciting visit to the Proba satellite operations room. That evening the students played the EcoDesign board game to learn about the environmental impacts of a space mission. They asked many interesting questions and it was a good opportunity for them to get to know each other.

The Concurrent Engineering Challenge started the next day, which began with the four student groups meeting via video conferencing. They were briefed on their challenge – to design a mission to conduct science on the Moon – and the constraints they had to be operating under.

Each group of students was then divided into teams to cover the mission's different subsystems: configuration, structure, propulsion, mission analysis, attitude & orbit control, power, thermal, optics & sensors, communication & data handling and mechanisms.

Over the following days the four groups performed a first concurrent engineering iteration, working on the different subsystem designs, and making their initial computations and budget. Each group then remotely shared their first design and computations with the others.

During the third day, the students performed a second and final iteration to improve their mission design and to remain below the maximum total mass allowed.

On the last day of the challenge, the four groups froze their results. They then presented their final proposals to the other groups and the ESA experts. The students found it fascinating to see how each design had developed over such short timespans, and how they had taken