

Advanced mechanical parts for experiments in space

Colonize the Earth's orbit, the moon, and eventually new planets, is an ambitious target that forces us to solve extremely challenging problems. In order to find the necessary answers, many experiments run on any environmental conditions and made possible by equally advanced mechanical equipment.

In this challenging scenario, the Pradelli Giancarlo & C had the pleasure to contribute with the production of the mechanical parts of a space incubator: the European Modular Cultivation System (EMCS)¹. This complex equipment designed to run experiments of plant biology in a reduced gravity environment, thanks to its modular design, is suitable for performing many kinds of tests².

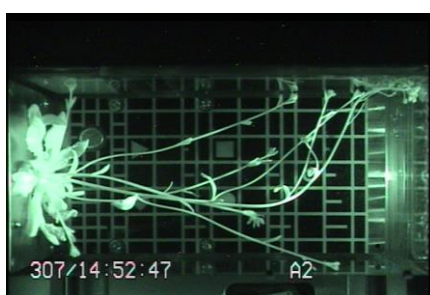
The construction of the mechanical parts began in the first 2000s collaborating with DTM Technologies³. The challenge was to provide the mechanical part capable of running the mission, characterized by strictly controlled tolerances and specific materials suitable for the unique operating conditions.

The Pradelli Company produced all the mechanical parts of the ECMS module by applying its experience in precision mechanical machining and controlling the whole production process, ensuring the high-quality level required.

The ECMS is then assembled, tested, prepared for the mission, later launched with the Space Shuttle Discovery inside the ULF 1.1 mission from the Kennedy Space Center, and finally installed in the Destiny laboratory of the International Space Station⁴.



A phase of the ECMS installation on the ISS, by Thomas Reiter, ESA astronaut.



Over two years, the astronauts carried on several dozens of scientific experiments on the ECMS. The study focused on the effects of space and gravity in the early growing phase of plants under strictly controlled environmental conditions. After the completion of the experiments planned, the module was moved in the ESA's Columbus laboratory, where it is still operational for new tests.

¹ Details about the EMCS: <http://wsn.spaceflight.esa.int/docs/Factsheets/13%20EMCS%20HR%20web.pdf>

² <http://timescale.eu/Pages/EMCS.aspx>

³ <http://www.dtm.it/>

⁴ http://www.esa.int/ESA_Multimedia/Images/2006/07/Installing_EMCS#.XvYtxghdB2U.link

At the end of the ISS mission, the Pradelli Giancarlo & C Company had the great pleasure to know that the ECMS completed all the planned experiments on the ISS with no mechanical problems at all. Such a result is not simple at all to achieve, considering the system complexity and the environmental characteristics, which is indeed not common.

A project of this magnitude requires global collaboration. We at Pradelli proudly remember the contribution we were able to make to the space exploration and research areas, happy to have the chance to apply our know-how to such a challenging project. It meant strictly controlling the machining of each part, ensuring the correspondence to the strict requirements with in-process control points, and final verification of each element.

In the 10 years after the launch, the module run many other experiments and it remembered as a true success⁵ thanks to several Italian contributors. Today, the parts produced are still in space onboard the ESA's Columbus module to study the plant growth in a no-gravity environment⁶.



⁵ <https://www.researchitaly.it/en/success-stories/space-farming-10-years-after-the-launch-into-space-of-the-european-modular-cultivation-system/>

⁶ <https://earth.esa.int/web/eoportal/satellite-missions/i/iss-columbus>