

IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
In Orbit - Postgraduate Space Education (4)

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COMPUTATIONAL DESIGN AND INTERNATIONAL COOPERATION IN SPACE ARCHITECTURE
EDUCATION

Abstract

Space architecture is an interdisciplinary field that involves many different branches of knowledge, like space science, engineering, architecture, industrial design, medicine, psychology, and art, covering all aspects and needs for human space exploration in LEO and other celestial bodies, like the Moon and Mars. For this reason, the educational effort should involve a set of different skills in the various fields in order to design a safe and livable environment for sustaining human's life in space.

Since 2020, the course at Politecnico di Milano "Architecture for Human Space Exploration" for the School of Architecture, Urban Planning, and Construction Engineering is implementing this multi-disciplinarity thanks to external reviewers, that are experts in the Space Architecture domain, and the collaboration, in the actual A.Y. 2021-22, with the Webinar Series at MIT Media Lab "Design Exploration: towards a Moon Architecture".

The Webinar Series, open to all MIT and Harvard students, addressed numerous topics and aspects of designing a lunar settlement with several experts about history of space architecture, crewed missions, habitation systems and habitability requirements, In Situ Resources Utilization, Human Factor Design principles, radiation shielding technologies, sustainability of space exploration, and inspirational talks. The talks gathered space architects, engineers and professionals from NASA JPL, NASA JSC and ESA, astronauts, faculty from different universities (University of Houston - SICSA, UW-Madison, Université Paris-Saclay, SDU, University of Bologna, Politecnico di Milano, MIT Media Lab and MIT AeroAstro) and companies (Trotti Studio, Thales Alenia Space, SOM, ICON). Indeed, the students attending this collaborative classroom had to develop a space architecture project for the Moon or Mars. Therefore, the possibility to actively participate to this Webinar Series resulted extremely effective since students applied the acquired knowledge directly to their Space Architecture projects.

The approach is different in case of short and deeply focused Workshop on computational design applied to Space Architecture on worldwide educational platforms, like the Workshop "Explore Moon Architecture" for Digital Futures and the Workshop "Mars Architecture" for Parametric Architecture. The educational strategy for these Workshops is based on the development of customized computational design tools for generating form-finding, multi-objective and topology optimization processes for space structures. Students learned how to use Grasshopper, an algorithmic modeling software, and several other plugins, like Octopus, Ameba, Karamba 3D, Kangaroo, Weaverbird and others.

In this paper, some Space Architecture projects resulting from these two educational strategies will be briefly presented and discussed.