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VOIDCUBE: A VERSATILE INTERCONNECTED PLATFORM FOR PAYLOAD SUPPORT

Abstract

VOIDCUBE is a student project born under the aurora in Swedish Lapland, at Luleå University of Technology's (LTU) Space Campus in Kiruna. The main objective is to create an array of modular Cube-Sat units, each containing a spacecraft's subsystem. These cubes can be interlocked in any arrangement, with the connection interfaces allowing for data and power transfer across the entire array.

The aspiration is to develop an integrated platform as a solution to the increasing demand for sustainable accessibility to space. An array of easily manufacturable modular cubes can allow the focusing of resources to be solely on the payloads (i.e. for other student projects) to be connected to this platform, leading to reduced development time and cost. Furthermore, the concept of simple interconnection of different subsystems' modules on a larger scale fractionated satellite provides the possibility to substitute and recycle the singular subsystem, leading to a more sustainable circular space economy.

The project's design phase covered the common structure, housekeeping and operational subsystems

for the modular cubes, with focus especially on the interlocking mechanism. The interfacing between two cubes requires them to be aligned so that a set of protruding pins on each cube is inserted into a series of cavities in the opposing cube's face. A motor subsequently activates a rotating disc which secures the relevant pins and locks the cubes together.

Alongside the pins, the faces comprise electrical connectors transferring data and power between the cubes. They are placed in a rotationally symmetrical layout allowing for connection at every 90 degree orientation. In order to function, the system contains a central computer, a power system to distribute the energy the assembly needs and a communication system for remote operation. Equipping each cube face with a locking interface allows them to be connected in any configuration, maximising the versatility of the platform, where each subsystem is placed in a specialised cube.

Following a successful Critical Design Review, VOIDCUBE is now facing the prototyping and testing phase, in synergy with expertise at LTU and the Swedish Institute of Space Physics (IRF). The planned technology demonstration requires the manufacturing and testing of four 1U cubes: three containing a specialised subsystem (Core Cube, Power Cube, Communications Cube) and one Sensors Cube serving as a payload. This test campaign will moreover serve as proof of concept, showing this approach of using interconnected platforms is viable and scalable for space missions.