

66th International Astronautical Congress 2015

SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND
DEVELOPMENT (D3)

Novel Concepts and Technologies to Enable Future Building Blocks in Space Exploration and
Development (3)

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SEMI-ANDROGYNOUS MULTIFUNCTIONAL INTERFACE FOR EXPANDABLE SPACE
STRUCTURES

Abstract

In the last years, the significant cut in the cost of development and access to space due to the employment of miniature satellites is creating a new market, dedicated to commercial low risk application, low budget scientific missions and educational purposes. However, these applications are limited by important technical constraints, e.g. short operational life, small payload size and mass, and reduced on-board available resources. For these reasons, miniature spacecraft are still unattractive for complex and high performance missions. One possible solution to overcome such limitations is to make small satellites cooperate together, in formation flight or in assembled configuration. Furthermore, there is a growing interest on modular space systems that could be composed, re-configured, assembled or extended in orbit, and small satellites could be used in this context as building blocks for expandable space structures. To this aim, there is the need to develop standardized multifunctional interfaces that could be used to build up complex space assets made of interconnected microsatellites. In this framework, this paper presents a docking system with the capability of transfer thermo-mechanical loads and fuel, as well as transmit power and data between modules. From the mechanical point of view, a semi-androgynous shape-shifting mechanism is employed, merging the advantages of both androgynous and gender-mate geometries used in existing docking mechanisms: the connection is realized actuating one interface, that changes the port in a “drogue” configuration, able to wrap around a twin one, close and capture it creating a solid joint. The realization of a suitable pre-load allows to form a watertight seal, giving the refueling interface the ability to transfer fluids; data transmission is performed by an off-the-shelf Near-Field-Communication (NFC) system; the same technology is evaluated for power transmission, as well as more standard connectors.