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RE-CONFIGURABLE BUILDING SYSTEM FOR SPACECRAFT INTERIORS, EQUIPMENT SUPPORT, AND HUMAN ACCOMMODATIONS

Abstract

The requirement to mount or install a significant amount of support, computer, and science equipment in today's spacecraft has resulted in interior configurations that are limiting and non-adaptable. During short duration missions in smaller spacecraft this has been less of a problem but with the potential for longer duration future missions outside earth orbit, to the Moon and Mars for example, this issue could become more problematic.

During the design of the International Space Station (ISS) the requirement for a standardized system to mount equipment resulted in the International Standard Payload Rack (ISPR) system. The development of the ISPR was an effort to aid in integration and interchangeability of payload hardware. This rack system has worked relatively well as a first generation solution but further evolution is needed.

This paper will discuss the design concept for a standardized system of high-performance re-configurable building components or elements that could be utilized on spacecraft for interior build-out, equipment mounting and support, as well as human accommodation.

Adaptability is one of the primary benefits of this system. The ability to re-configure interior spaces and equipment racks as needs evolve or change can be very beneficial. It is impossible to pre-determine all the needs a complex mission in an extreme environment may have. By utilizing a system that can be changed, users could re-configure the components to accommodate emergencies, unforeseen needs, or varying human occupancy requirements. Other Benefits of this system would include but are not limited to:

- Ability to re-configure: As the mission changes or evolves, so could the interior build-out.
- Better Space Utilization: The ability for a space to quickly change functions.
- Accessibility for Repairs: Easily disassembled to access systems.
- Easily Transported: The system could be disassembled and packed into a small footprint if needed.
- Lower Cost: By avoiding custom solutions and utilizing a standard set of components costs would be reduced.

In conclusion, the fundamental concept of this paper is to explore a new architectural approach to spacecraft interior build-out. One which replaces the current, non-flexible, ridged approach, with one that is more adaptable, flexible and non-ridged.

This systems design must be rooted in the engineering and physical requirements for human spaceflight and extreme environments, however, by using an architectural design approach, rather than a pure engineering approach to solving the problem, valuable new insight and designs would be realized.