

29th IAA SYMPOSIUM ON SPACE AND SOCIETY (E5)  
Interactive Presentations - 29th IAA SYMPOSIUM ON SPACE AND SOCIETY (IP)

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## SHAPE MORPHING CREW QUARTER

### Abstract

Due to launch mass limitations, spatial resources in human spaceflight are scarce. Therefore, most careful design and efficient use of the limited habitable volume is vital to the success of long duration spaceflight missions, as it affects productivity, crew cohesion and the psychological health of the crew. In this paper we present research approaches and results for the viability, usefulness and practicality of a crew quarter that ‘reacts’ to predetermined signals (social cues/stressors) by actuators inducing structural adjustment with the aim to improve efficiency and quality of limited habitable space. The hull of the crew quarter acts like a muscle: extending and retracting to adapt to the users requirements. Based on the concept of fluid-driven origami-inspired artificial muscles the adaptability is brought on by the composition of the structure: an origami structure serving as a compressible skeleton and a fluid medium (water) are embedded in a flexible membrane (skin), powered by pressure difference. Thus, an increase in perceived spaciousness, flexibility and adaptability of space habitats equipped with such crew quarters should be achieved. Additionally, the water that is embedded in the membrane will enhance radiation protection inside the crew quarter.

The proposed design shows how a shape morphing crew quarter could enhance habitability by responding to the environment and the residents’ needs, promoting psychological redefinition of areas and increasing radiation protection.