

# An Origami-Inspired Deployable VHF Antenna for Space Applications

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## Abstract

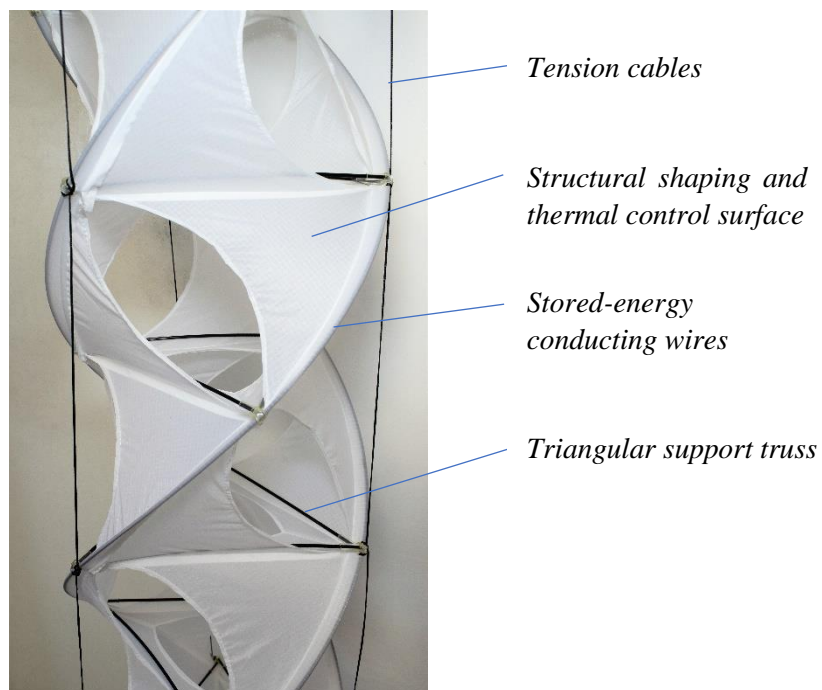
In the context of unfurlable space structures, an ongoing challenge is to maximise the stowage efficiency of large deployable structures, as volume available for payloads onboard launchers is highly limited and payload mass incurs a high cost penalty – around £20,000 per kilogram to reach orbit. In this paper, a high stowage efficiency, helical trifilar antenna for VHF telecommunications is profiled. The deployable antenna uses origami folding techniques, a passive stored-energy deployment system and a tensegrity tensioning structure. The antenna is designed to provide very high stowage efficiency, with the ability to stow from a deployed length of 2.7 m to a height of 10 cm (Figure 1).

The antenna has a prismatic structure, maintained by a triangular support truss, while the stored-energy copper-beryllium conductors form a triple helix which imparts the required radiofrequency capability. The shaping surface, inspired by kite design, provides additional structural integrity to the antenna and acts as a thermal control surface (Figure 2). The folding pattern of the shaping surface is inspired by origami techniques, with details of the folding patterns set out in the full paper.

The antenna is designed for dual downlink and uplink in the VHF band, with a maximum gain of 6dBi. In the full paper, more detail is given on radiofrequency performance, as well as its structural, thermal, and functional capabilities with specific reference of designing such motion structures for the demanding and unique environment of space.



**Figure 1:** Breadboard prototype of the origami-inspired deployable VHF antenna, stowed (left) and deployed (right).



**Figure 2:** Detail of the deployable trifilar antenna components.