

22nd IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND  
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EXPLORATION AND DEVELOPMENT (IP)

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UNIQUE AND NOVEL INFLATABLE TOWER (UNIT) AS CRITICAL INFRASTRUCTURE ON THE  
MOON**Abstract**

This paper presents the research and design process for developing an inflatable tower – the UNIT (Unique and Novel Inflatable Tower) – in response to the NASA Big Ideas Challenge 2024. The challenge was to develop a novel inflatable structure that presented a solution for future space exploration. University of Houston and Embry Riddle Aeronautical University proposed a tower that aims to revolutionize lunar exploration, through the development of innovative, efficient, and cost-effective inflatable structures that enhance the sustainability of lunar infrastructure. UNIT represents a pivotal advancement in lunar exploration infrastructure. Designed as an inflatable tower, it serves as a key component to a larger communication network intended to address the issues of power, illumination, and communication latency. The concept of the tower is to allow for rapid deployment as well as segmented inflation for scalability and flexibility. It supports deployments of equipment that will be necessary for permanent settlement, including solar panels for emergency and network power, a communication antenna and illumination device. The tower supports future operations for Artemis mission’s LUNANET; UNIT can seamlessly integrate into the large-scale communication system. The design of UNIT involves a core load integrated with a rigid structural element at the tower’s base. This is coupled with a pulley system, ranging the length of the tower, which stabilizes the structure throughout the deployment process. The tower starts by deploying from the base and then moves up the tower in sections. There is a toroidal tank that sits at the base of the tower that distributes the stored air evenly allowing for consistent pressure, ensuring full stability and structural integrity. The tower will be built using materials best for inflation integrated with various 3D printed parts. Should the tower make it to the prototyping stage the design, structure and

inflation will all be evaluated through a series of verification tests such as pressure test, shake table test and stabilization test. UNIT is a versatile infrastructure element for lunar exploration and a significant step towards creating a sustainable human presence on the Moon. By learning from its applications on the Moon, the tower is a steppingstone for the future Mars. The team hopes that the tower will successfully be deployed and operated for any necessary operations. In the ever-changing landscape, this tower can be utilized in many ways to help create a long-lasting human presence on the Moon and Mars no matter the goal.