

24th IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM (A5)  
Human Exploration of the Moon and Cislunar Space (1)

Author: Mr. Doug Craig  
NASA, United States

Mr. Travis Ashurst  
NASA, United States

Dr. Greg Chavers  
NASA Marshall Space Flight Center, United States

Mrs. Kandyce Goodliff  
NASA, United States

Ms. Erin Mahoney  
Stardog Union, United States

Ms. Allison Taylor  
The Aerospace Corporation, United States

ELEMENT FORMULATION PROCESS FOR THE MOON AND MARS

**Abstract**

NASA's Artemis program is underway with secured contracts and hardware for initial lunar infrastructure elements. The element formulation process—which has resulted in multiple contracts with U.S. industry and agreements with international partners for the lunar-orbiting Gateway—includes early concept maturation, prototyping, modeling and simulation, and human-in-the-loop testing on Earth. As the concepts mature, the process advances to data exchanges and opportunity discussions with industry and international partners, and innovative acquisition approaches that lead to contracts, partnerships, or other agreements, and the establishment of a program office within NASA. NASA's Moon-to-Mars architecture element formulation process is ongoing with a look forward to additional elements on the surface as part of the Artemis Base Camp, including unpressurized and pressurized lunar rovers, a surface habitat, a large cargo lander, as well as a Mars transit habitation module to dock with the Gateway in lunar orbit. Many of these elements are formulated to support multiple human destinations, and as much as is possible, will be designed for both the Moon and Mars. The formulation team is responsible for many of the current lunar elements in work and maturation of the future Mars conceptual elements. . This paper will discuss the element formulation process, with a look at current concepts in formulation, and how many of the individual elements, as well as the human-robotic operational protocols inherently attached to them, will be designed to support human missions to the Moon and Mars.