

IAF SPACE SYSTEMS SYMPOSIUM (D1)  
Innovative and Visionary Space Systems (1)

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SCENARIOS FOR AFFORDING AND ACHIEVING HUMAN MARS EXPLORATION: SCENARIOS  
FROM THE FIFTH COMMUNITY WORKSHOP**Abstract**

For the past several years, scenarios for human exploration of Mars have been developed by multiple organizations in the U.S.: aerospace industry, academia, and NASA. The majority of these scenarios have concentrated on realistic affordability and sustainability with the goal of a human landing in the 2030s.

To debate and publicize these studies, Explore Mars, Inc. and the American Astronautical Society initiated in 2013 the first in a series of five community workshops. These workshops featured broad participation by professional communities involved in human exploration. Formal reports from the workshops are found at <https://www.exploremars.org/affording-mars>. We present here the results from our most recent workshop, the fifth, which was held in Washington, D.C., in December 2017.

The primary goal of this workshop (aka, AM V) was to develop technologically achievable and plausibly affordable scenarios for human exploration of Mars that for three distinctly different “end states” and to identify common architectural threads within them. This would allow the participants to compare the features of the scenarios, identifying elements in common and debate the reality of each. The end states were chosen to represent three widely discussed options for human missions: (1) an Apollo-like series of short stays, (2) a “beachhead”-type scenario, analogous to current exploration of Antarctica, and (3) sustained human occupation.

Approximately 60 “mission architects” participated in the workshop, which included extensive pre- and post-workshop activities. After plenary discussion, participants self-organized around the three unique scenarios. Each team was charged with identifying major elements of each scenario, developing a time line, identifying major milestones and decision points, developing justification for each decision and element of the scenario, and producing a cost estimate. An essential process of the workshop was that each scenario was reviewed and critiqued in plenary by all participants. This invaluable activity, which we do not believe has been attempted elsewhere, allowed the creators of each scenario to iterate toward improved design before the workshop ended, iteration which continued for a subsequent two months. This community engagement allowed the three teams to take advantage of expertise very rarely brought together in one place. Finally, the three architectures were analyzed to identify decision points in common, as well as architectural decisions that were unique. Both provide valuable insight, with the common architectural decisions providing the initial basis for a broad amalgam of human Mars mission scenarios subsequently presented publicly and to space exploration stakeholders.