

HUMAN SPACEFLIGHT SYMPOSIUM (B3)
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TECHNICAL AND PROGRAMMATIC PROSPECTS FOR HUMAN SPACE EXPLORATION 2015-2030

Abstract

The US Congress 2010 Authorization Act for NASA required that the US National Academies conduct a review of the goals, core capabilities and direction of human space flight. The National Academies Committee on Human Space Flight was commissioned by NASA to conduct this review. As part of the Committee's efforts, a Technical Panel with diverse expertise in human space exploration, space technology, cost-estimation, and program management was created to examine technical and programmatic challenges facing US human spaceflight activities in the immediate and mid-term future. Both the Committee and the Panel were tasked to conduct the review in the context of the broader international framework of human exploration of space. The technical panel was further tasked to consider the implications of the recent expansion of commercial space endeavors explicitly addressing exploration and human commercial exploitation of space, and the role of such commercial entities in augmenting the NASA program of record. The Panel invited and received extensive briefings from NASA, commercial entities, and international partners, and it reviewed previous US and international studies of human spaceflight as part of its deliberations.

This paper presents the major findings of the Technical Panel, including:

- a) the potential domain of human exploration, given currently foreseeable technology development over the study period and the currently understood limits of human physiology;
- b) an assessment of the critical technology developments that are required to effect human exploration beyond low Earth orbit (LEO);
- c) a review of the fiscal, programmatic, and operational challenges associated with such a program;
- d) the importance of the International Space Station in enabling humanity's advance beyond LEO;
- e) the implications of international collaboration in conducting operations beyond LEO; and
- f) a set of pathway principles that should govern development of a beyond-LEO program of exploration to maximize its cost-effectiveness and probability of success.

The Panel employed data- and model-driven independent cost estimates, as well as a novel "sub-system counting" approach in order to consistently characterize the relative difficulty and risk of a set of alternative exploration pathways spanning the feasible near-term set of destinations for human space exploration. This approach provides a particularly well-supported set of cost profiles and timetables for human exploration programs to a variety of potential human space exploration targets.