

**WORKSHOP ON**  
**USING *IN SITU* RESOURCES FOR**  
**CONSTRUCTION OF PLANETARY OUTPOSTS**

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## Preface

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The Workshop on Using *In Situ* Resources for Construction of Planetary Outposts was held in Albuquerque, New Mexico, April 30–May 1, 1998. The principal purpose of the workshop was to examine whether there are any high-priority, near-term applications of *in situ* planetary resources that could lower the cost of constructing human outposts on the Moon and Mars. Inevitably, there is also a great interest in the topic of building human settlements on other worlds. Whereas there is virtually no argument that using indigenous materials will be important for the latter case, no compelling argument has been made for the use of indigenous material for the initial stages of planetary outpost installation.

The workshop examined the potential uses of indigenous materials on the Moon and Mars, other than those uses associated with the production of propellants for space transportation. The use of indigenous propellants has become an accepted requirement for human exploration missions to Mars and in building permanent outposts on the Moon. The papers presented in the workshop concerned the needs for construction, based on analysis of the current NASA Mars Reference Mission and past studies of lunar outposts; the availability of materials on the Moon and Mars; construction techniques that make use of the natural environment; materials production and fabrication techniques based on indigenous materials; and new technologies that could promote the use of indigenous materials in construction.

One of the failings of many previous studies of indigenous planetary resources has been the lack of a demonstrated need; that is, there are many good ideas for how to use the natural materials, but no strong program applications that demand them. In order to advance from concepts into a technology development stage, the applications need to be defined and quantified. It is necessary to show explicitly that each proposed application is cost-effective within the context of the need. This workshop brought together both technologists and mission designers. People interested in planetary construction technology were provided with an update of NASA planning. In turn, they discussed ideas of potential interest to space mission planners. Future workshops should continue to explore the interface between technology innovators and mission designers, expand the database of applications, and promote the consideration of *in situ* resource technology in the human exploration and development of space.

This report contains abstracts of papers submitted to the workshop. In some cases, additional charts and figures have been included with the abstracts. In other cases, an edited version of the presentation made at the workshop has been included. Workshop participants and readers of this report are invited to provide commentary and feedback to the editor, Michael B. Duke, at the Lunar and Planetary Institute ([duke@lpi.jsc.nasa.gov](mailto:duke@lpi.jsc.nasa.gov)).



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