

EXPLORATION PLANNING IN THE CONTEXT OF HUMAN EXPLORATION AND DEVELOPMENT OF THE MOON; Michael B. Duke and Donald A. Morrison, Johnson Space Center, Houston, TX 77058

It is widely believed that the next step beyond low Earth orbit in attaining the United States' stated goal of "Expanding human presence beyond the Earth" should be to reestablish a lunar capability, building on the Apollo program, and preparing the way for eventual human missions to Mars. The Moon offers important questions in planetary and Earth science, can provide a unique platform for making astronomical observations of high resolution and sensitivity, and can be in the development path for unlocking resources of the inner solar system to support space activities and return benefits to Earth. NASA's Office of Exploration has undertaken the planning of future lunar exploration missions, with the assistance of the Solar System Exploration Division in matters dealing with the quality of scientific data and the manner in which it will be made available to the scientific community. The initial elements of the proposed program include the Lunar Scout missions, which consist of two small identical spacecraft in polar orbit around the Moon, which can accomplish most of the objectives associated with previous proposals for Lunar Polar Orbiters (Lunar Observers). These missions would be followed by "Artemis" landers, capable of emplacing up to 200 Kg payloads anywhere on the Moon. In addition, the exploration program must incorporate data obtained from other missions, including the Galileo lunar flybys, the Clementine high orbital observations, and Japanese penetrator missions. In the past year, a rather detailed plan for a "First Lunar Outpost (FLO)" which would place 4 astronauts on the lunar surface for 45 days has been developed as a possible initial step of a renewed human exploration program. In the coming year, the FLO concept will be reviewed and evolved to become more highly integrated with planning for the initial human exploration of Mars, which could come perhaps 5 years after the reestablishment of lunar capability. Both programs could benefit from the common development of systems and subsystems, where that is sensible from a performance perspective.

The environment for obtaining approval for new space missions has changed dramatically in the past few years. Human exploration missions are particularly in question, because they tend to require new space transportation systems (eg. heavy lift launch vehicles, space habitats), greater investments in power and life support, and have significant operations costs. Like the Space Station Freedom, which is viewed as a long term operational facility, a lunar outpost could be associated with continued costs that would make it difficult for new programs to start in a period of severe budget restrictions. The "cheaper, faster, better" slogan adopted by NASA's recent management is a movement to address that concern. It is relatively clear how such direction can be implemented with robotic missions, which can be terminated when their initial objectives have been accomplished. It is less clear how to apply such an approach to human missions. The Office of Exploration's strategy is designed to develop a new exploration management culture by focusing first on robotic missions, doing them quickly, inexpensively and well, and applying the management techniques developed in the process to the human missions.

In the long run, however, it will be up to the communities involved to demonstrate that the development of a lunar program is a sound investment. The lunar and planetary science community is in the position of being able both to contribute to and benefit highly from a renewed and vigorous lunar exploration program.