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FIELD RESEARCH IN THE EXTRATERRESTRIAL ENVIRONMENT : IMPLICATIONS FOR PLANETARY SCIENTISTS. Thomas M. Ciesla; Outer Space Environments, Spring, Texas 77388

Research programs often mature to a point where there is no substitute for in-situ observation and testing. The eventual placement of a Lunar or Martian base camp will allow planetary scientists the opportunity to perform a variety of field experiments to test current theory and rapidly extend our knowledge of extraterrestrial environments [8]. As exciting as this potential of field exploration is, there are a number of serious implications for the planetary scientist requiring analysis during the years preceeding colonization. For this discussion, two categories are established: the physical environment and the cosmopolitical environment.

· THE PHYSICAL ENVIRONMENT ·

The physical environment describes both the natural and the man made, each presenting the planetary scientist a special set of problems. Early Lunar bases, consisting of pressurized modules sent from Earth, will mimic early Antarctic outposts with limited volume, power, adaptability and crew size. With a host of operational issues to resolve such as life support, excavation techniques and power generation [3], the work of the planetary scientist may not command primary importance. Due to the limited crew size and space allocation [6], competition will be high for what will be frustratingly few research positions at the Lunar base. The extended travel times, costs and logistics problems of a Martian outpost will make research positions there available to a select few who also possess other flight operational skills. The development of a selection system considering not only the research proposal but the ability of the individual to function in the psycho/social atmosphere of the colony, must be in place as the colony begins construction.

The natural environment of the Moon and Mars will impose limitations to the scientist that at present are unavoidable. The radiation environment on the surface of these bodies is a life threatening factor requiring special precautions. To adhere to the 5 REM/yr exposure limit for Earth-based radiation workers, limited surface excursions in enclosed vehicles must be imposed, with even shorter time allotments for extravehicular activities [1]. In the early years of the colony, long trecks across the surface will not be advised due to unpredictable solar flare activity, when exposure limits are greatly exceeded [7]. For these longer excursions a network of sheilded shelters must be constructed along the way, or a system devised for quickly retreiving scientists from these trips.

· THE COSMOPOLITICAL ENVIRONMENT ·

As the size and sophistication of the colony increases and the question of survival is no longer all-consuming, the cosmopolitical environment (which includes beaurecratic systems for policy,goverment and funding) will begin to impose additional limitations to the scientist. Increasing numbers of researchers moving into the field will necessitate establishment of protocols for protecting the natural environment and prevent costly duplication of effort. To coordinate this activity a central agency must be established for the sole purpose of scientific mission support.

Implications of Field Research

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The success of the National Science Foundation in management of the U.S. Antarctic Program could well serve as a prototype for space colony research activities, which eventually will include all scientific disciplines. In the initial colony, the severe environment of the Moon, the complexities of logistics and resupply and the early emphasis on geological research to understand the Moon itself [2] create a scenario very similar to early work in Antarctica.

· CONCLUSION ·

To say field research in the extraterrestrial environment is dangerous is stating the obvious; severe environment research always contains that element. What is unique is that the danger is omnipresent with total dependence on technology. In addition, the deadliest factor, the unseen radiation, limits the field geologist or geophysict in what they love most - exploring.

To say field research in the extraterrestrial environment will be costly is also stating the obvious; remote locations are always expensive to access and maintain a permanent presence in. The degree of expense, however will be unique to space research, with an estimated labor cost of $60,000/HR. for the space station as an example [4].

Though colonization remains decades away, there is much prepatory work that can be undertaken now to effectively handle the economic and cosmopolitical issues that are sure to arise. Dialogue begun in these development years while the colonies are still on the drawing boards will aloow inputs from the scientific community to be incorporated into the design baseline. At an estimated cost of 90 billion dollars for the Lunar base [5], these early inputs should prevent costly subsequent modifications to an existing facility. For those planetary scientists with expertise that is transferable to direct space colony isssues (i.e. excavation procedures and equipment design, closed life support technology), this early involvemnt may ensure an early crew assignment based on facility construction needs. Ultimately, it will not be the physical hardships of the extraterrestrial environment, but rather the organizational infrastructure of exploration that may prove most frustrating to the planetary scientist.

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