THE ARISTARCHUS PLATEAU: THE NEXT STEP IN HUMAN EXPLORATION OF THE MOON. C. A. Peterson[1,2], G. A. Smith[1,2], B. R. Hawke[1], [1]Hawaii Institute of Geophysics and Planetology, University of Hawaii, Honolulu, HI 96822, [2]The Apollo Society, Honolulu, HI.

Introduction: NASA's Vision for Space Exploration includes the goal of returning humans to the Moon after an absence of more than thirty years. NASA intends to "use lunar exploration activities to further science, and to develop and test new approaches, technologies, and systems, including use of lunar and other space resources, to support sustained human space exploration to Mars and other destinations" [1]. Many Americans have little idea of what such an endeavor would entail.

The teaching of abstract ideas is often simplified and made more effective by the use of concrete examples. One way to educate students and the general public about what NASA will try to accomplish on the Moon is to model a future lunar base. The Aristarchus plateau has long been considered as a possible location for a lunar base [e.g., 2]. We have chosen it as a site for our model because it incorporates many features that can be used to illustrate the range of activities that must be undertaken in order to fulfill NASA's objectives.

The Aristarchus Plateau: The Aristarchus plateau is located in the northwestern portion of the lunar nearside. It is marked by the very bright 40-km wide crater Aristarchus and surrounded by the dark lavas of Oceanus Procellarum. The albedo contrast makes Aristarchus crater one of the most recognizable features on the Moon. It can be spotted with the unaided eye near full Moon, and it is easily visible in binoculars. No special location or equipment are required to allow someone to see the Aristarchus plateau, so it is easy to think of it as a real place rather than just a hypothetical concept.

The plateau is covered in fine-grained pyroclastic ash [3,4]. This resource has multiple potential uses for lunar explorers and settlers [5]. First, the material is unconsolidated and would be relatively easy to move around. These attributes make it a convenient source of shielding material to protect the residents of a lunar habitat from solar and cosmic radiation. A trough could be dug and a habitation module placed in it and then covered with a few meters of pyroclastic ash.

A second important attribute of the ash is that it collects solar wind particles. Because the material is so fine grained, it has a large surface area to volume ratio. Overturn of the material by the constant rain of micrometeoroids onto the airless Moon exposes new ash particle surfaces to the solar wind, some of which adheres to the ash particles. These solar wind gases can be driven off the ash particles simply by moderate heating, and if this is done in an enclosed space, the gases can be collected.

The dominant solar wind gas is hydrogen. The hydrogen, in turn, can be used to extract oxygen from the FeO-bearing pyroclastic ash. Thus, water can be derived from materials local to the Aristarchus plateau.

Water for consumption is, of course, essential to human and other life, but that is not its only potential use at a lunar base. Photovoltaic panels could be used to produce electricity to power a lunar base, but power storage during the two-week lunar night could be problematic. By breaking the water down into hydrogen and oxygen during the day, then recombining them into water to produce power at night, the inhabitants of a lunar settlement could use water as a store of energy.

Water is also a good radiation shielding material and could be stored in a manner that would supplement the shielding provided by the pyroclastic ash. This would provide an additional supply of water in case of an emergency.

The Aristarchus plateau region is also a desirable place to pursue lunar science. The pyroclastic ash was deposited during ancient eruptions from the "Cobra Head" volcanic vent on the plateau. The glassy nature of the ash makes it more difficult to characterize from remote spectral measurements than are most other materials on the lunar surface. Knowledge of the precise composition of the ash and how that composition varies among deposits emplaced at different times would further our understanding of the geologic history of the Moon.

Other features of this volcanic region are equally interesting from a geologic perspective. The Cobra Head lies at the top of Schroter's Valley, the longest sinuous rille on the Moon. Elsewhere in the region are many collapsed lava tubes. Some of these may have intact sections that could be sealed and used as habitat as the lunar settlement expands [6].

Of course, there are many other activities that could be pursued at Aristarchus that don't depend on conditions unique to that location. Because transport of materials from Earth to the Moon will remain very expensive for the foreseeable future, it will be important for lunar settlers to reduce their need for resupply from Earth as much as possible. Food production and waste recycling are two activities that would be important for settlers to engage in at a fairly early stage.

The Moon's lack of atmosphere, quiet seismic environment, and slow rotation (which allows for long integration times) make the Moon a very good site for astr onomy (and perhaps monitoring of Earth, as well.) Even a small telescope could easily gather data that would be difficult or impossible to obtain from the surface of the Earth.

Presentation:

Poster. We will present a poster that incorporates the ideas outlined above. A preliminary version of the poster has been used in presentations to many schoolchildren on Oahu. It has proved to be a useful and flexible tool for engaging students in discussion of topics that appeal to them. The poster has been requested and supplied electronically for use by schoolchildren off island.

We will present a newer version of the poster that is better suited for electronic distribution. As a printed medium, it presents images and text that convey information about the resources on the Artistarchus plateau and the infrastructure and activities that might be found at a lunar base there.

However, for electronic distribution, there are better options than simply transferring a single large file. Through hyperlinks in the poster file, and also independently of the poster file, we will provide the same information in a format suitable for printing on 8 1/2 by 11 inch paper. This will make the material much more useful for those who are unable to print out a copy of the full-size poster. This will also allow us to include additional information (that couldn't fit on a single poster) and links to outside sources of information.

Virtual Lunar Base. Our group is also working on a Virtual Lunar Base located on the Aristarchus plateau. This uses game software to create a simulation of the lunar environment at Aristarchus. Users can move around and explore the region and the facilities there. We have demonstrated a preliminary version, and users often find it a fascinating activity. We are working to include more features. When the Virtual Lunar Base is further developed, we will include a link to it from the Aristarchus poster site.

References:

[1] The Vision for Space Exploration (2004) *NP-2004-01-334-HQ*. [2] Coombs C.R. *et al.* (1998) *Space 98, Proc. Conf. Am. Soc. Civil Eng.*, 608-615. [3] Gaddis L.R. *et al.* (1985) *Icarus, 61*, 461-489. [4] Zisk S.H. *et al.* (1977) *The Moon, 17*, 59-99. [5] Hawke B.R. *et al.* (1990) *Proc. 20th LPSC*, 249-258. [6] Coombs C.R. and Hawke B. R. (1992) *NASA Conf. Pub. 3166, Vol. 1*, 219-229