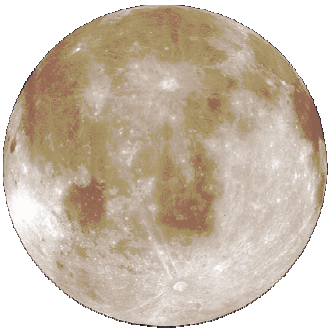
SPACE TECHNOLOGY AND APPLICATIONS INTERNATIONAL FORUM (STAIF-2001)
18th Symposium on Space Nuclear Power Systems

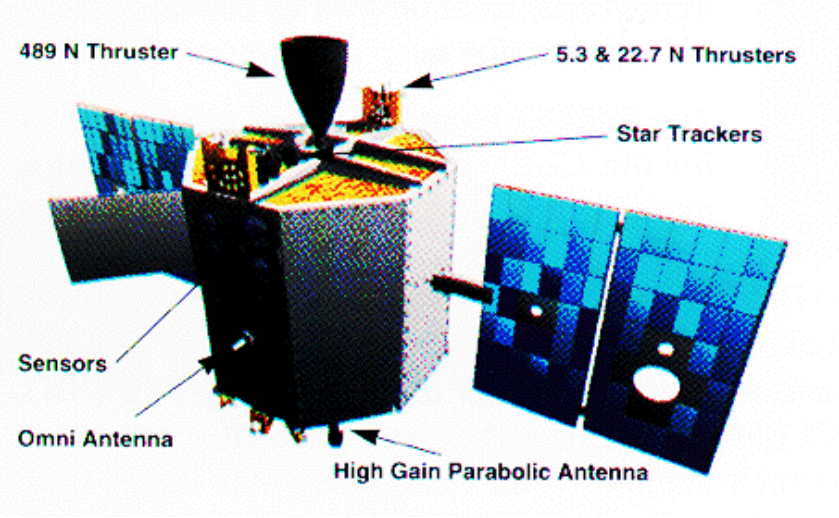
STUDENT SPACE DESIGN COMPETITION
Project Statement

Moonbase for the New Millenium

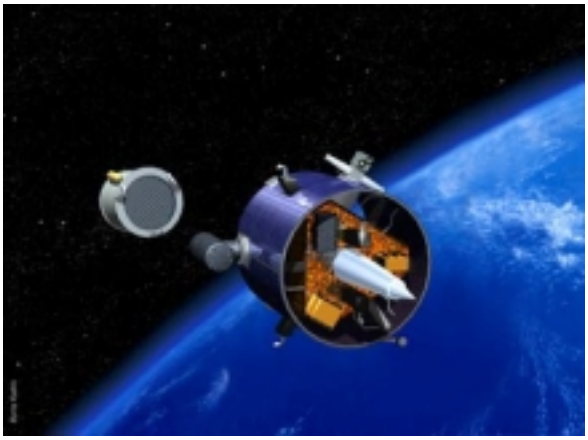


BACKGROUND

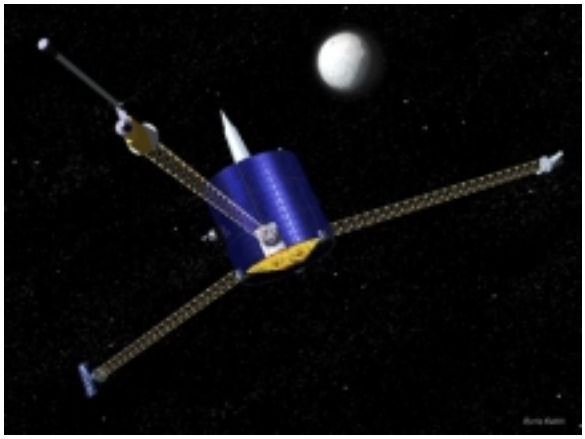
In 1994, the spacecraft *Clementine* relayed data back to Earth that seemed to indicate the presence of water ice in the permanently dark craters of the Moon's poles. In 1998, definitive signals for water ice were received by the neutron spectrometer aboard the *Lunar Prospector*, further supporting the presence of water ice at both poles of the moon.



Clementine



Artist's rendering of the *Lunar Prospector* just after separation from the Trans-Lunar Injection solid rocket motor.



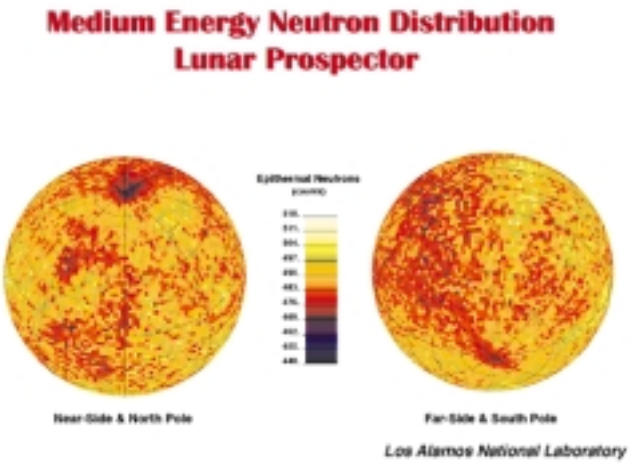
Artist's rendering of the *Lunar Prospector* in an operational configuration

The discovery of water ice on the moon is exciting because water is a valuable resource that could make colonization of the moon and exploration of the solar system much easier. Water can be processed to make breathable air or rocket fuel. Being able to make these things on the moon, rather than transporting them from Earth, could significantly reduce the cost and difficulty of establishing an outpost on the moon.

A lunar outpost could be used as a staging area for the exploration of the rest of the solar system as well as a research center for studying the effects of long term extra-terrestrial habitation on the human body. Both of these could be critical components of a manned mission to Mars. The lunar outpost could also support a lunar-based observatory which would be able to study the far cosmos in much greater detail than those based on Earth. Such an observatory could be a key piece in the search for Earth-like planets around other stars.

OBJECTIVE

The objective of this contest is to design a manned lunar outpost located at the north pole of the Moon that can be used as a base for scientific study and solar system exploration.



Neutron distribution data returned by *Lunar Prospector*. The darker areas indicate the presence of hydrogen, a component of water ice.

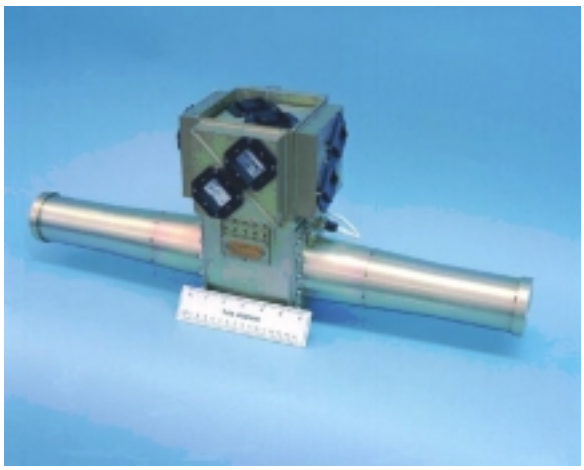


Image of the neutron spectrometer carried onboard the *Lunar Prospector*.

MISSION REQUIRMENTS

The design should satisfy the following mission requirements:

1. The lunar outpost will be located at the north pole of the moon, near a source of water ice.
2. The lunar outpost should provide long-term residence for up to ten people.
3. Items to be considered in the design include, but are not limited to:
   - Living areas and laboratory space
   - Source(s) of electric power and heat
   - Maintenance of a breathable atmosphere
   - Supplies of food and water
   - Waste handling
   - Internal and external communications
   - Potential missions for the lunar outpost
4. Spacecraft are needed to transport personnel and cargo between the Earth and the outpost. Spacecraft design(s) should include provisions for launch, transit and landing, as needed.

ASSUMPTIONS

1. Significant sources of water ice exist at the lunar poles as indicated by *Clementine* and *Lunar Propector*.
2. The actual lunar conditions are consistent with the impetus for the outpost and the current best scientific understanding of the Moon.

SUGGESTED REFERENCES

A variety of reference materials are available both inside and outside your school library. Additional references include:

1. The Space Design Competition web page (**http://www-chne.unm.edu/isnps/sdc**).

2. The University of New Mexico Centennial Science-Engineering Library (CSEL) on campus at the University in Albuquerque. The UNM CSEL may be accessed for books and periodical titles and abstracts through the University web page: **http://www.unm.edu.** Select Libraries, followed by Centennial Science and Engineering and LIBROS (follow instructions to access general references).

3. The National Aeronautics and Space Administration (NASA) web page is another source of information: **http://www.nasa.gov**.

4. The Jet Propulsion Laboratory (JPL) web page (**http://www.jpl.nase.gov**) is also a source of information.

5. Titles of useful information may also be accessed through the American Institute of Aeronautics and Astronautics web site: **http://www.aiaa.org** selecting Publications, followed by technical papers to get to "AIAA Meetings Papers Searchable Citation Database 1992 to Present." Do a search on "Space Sciences" (note: enclose the phrase with " to get a phrase search, otherwise the search will be on the separate words 'space' and 'science,' and may take some time)