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Exploration of the Moon towards its exploitation

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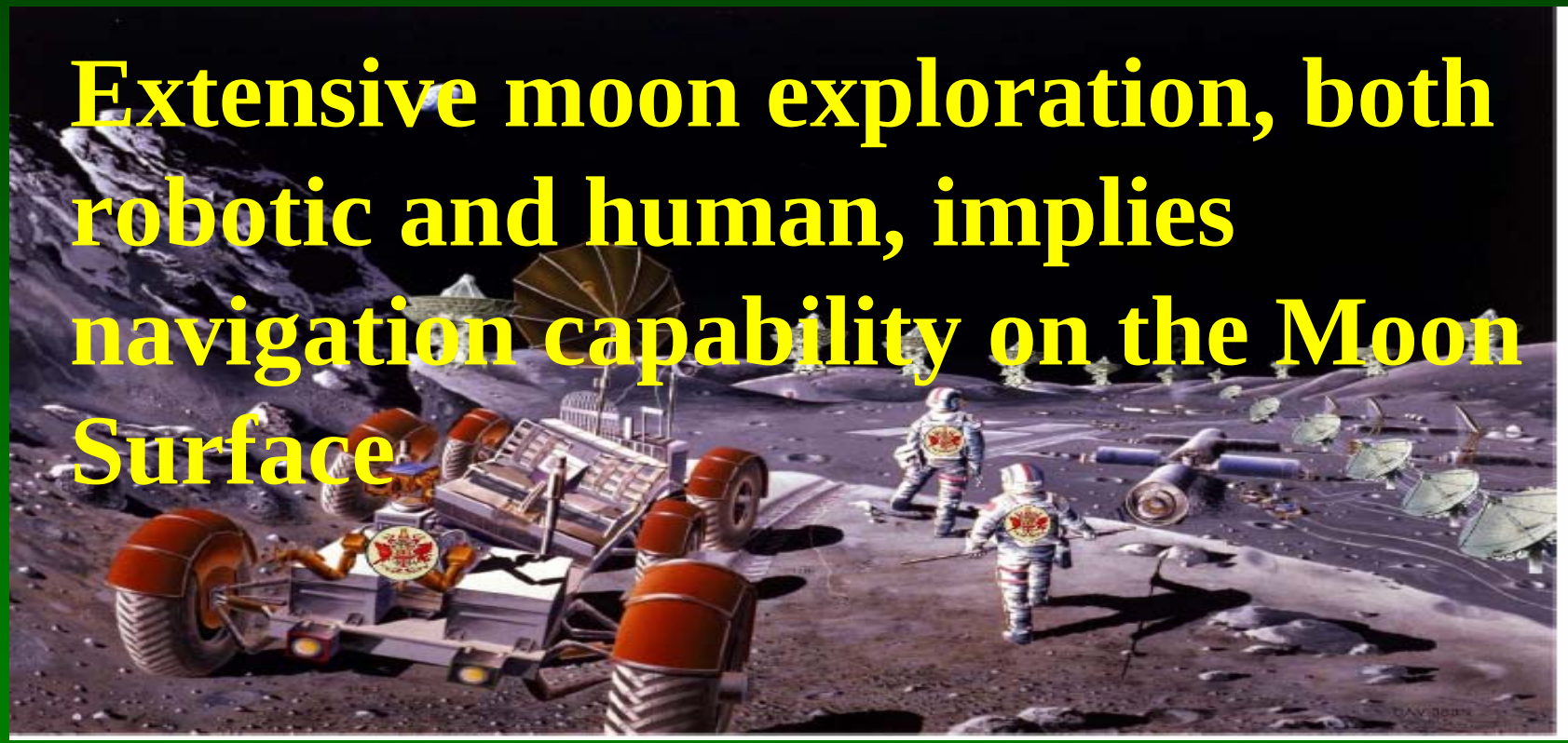
Presentation Structure:

- ***Lunar fixed reference system is a pre-requirement for Navigation on the moon.***
- ***Lunar Selenographic Information system is an important tool for Moon exploitation***
- ***Conclusions***

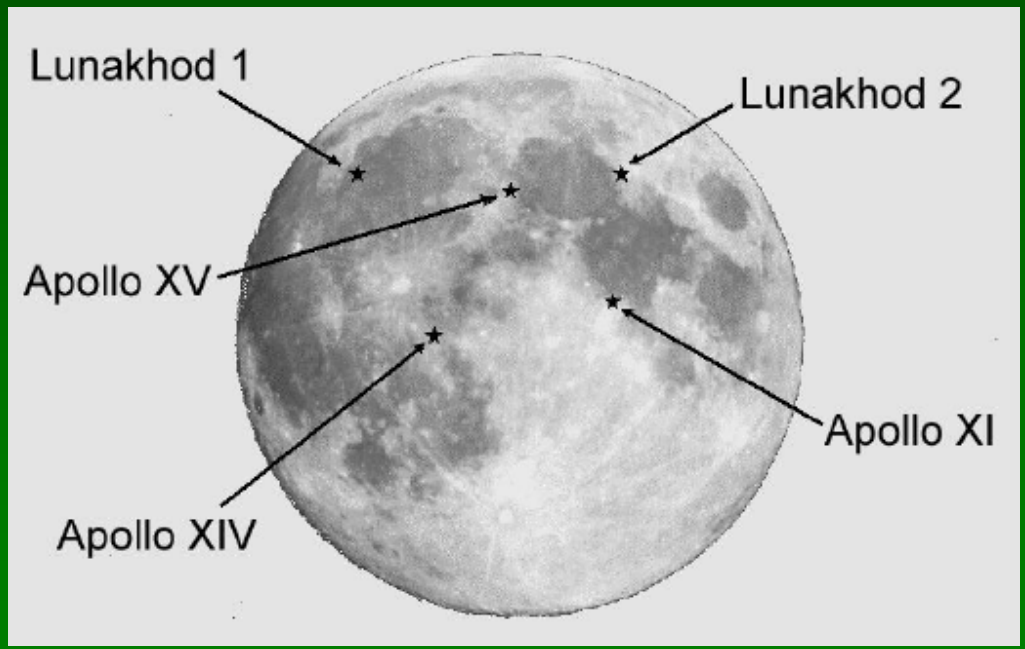
Extensive moon exploration, both robotic and human, implies navigation capability on the Moon Surface



To achieve Navigation Capability a Moon centered Reference system is needed

Space Geodesy and in particular Lunar Laser Ranging technique is a privileged tool for establishing and maintaining a Lunar fixed reference system connected with the Earth fixed one. Accuracy at the 1 m level are achievable according to the current results

Current distribution on the moon surface of Lunar retroreflector are not enough



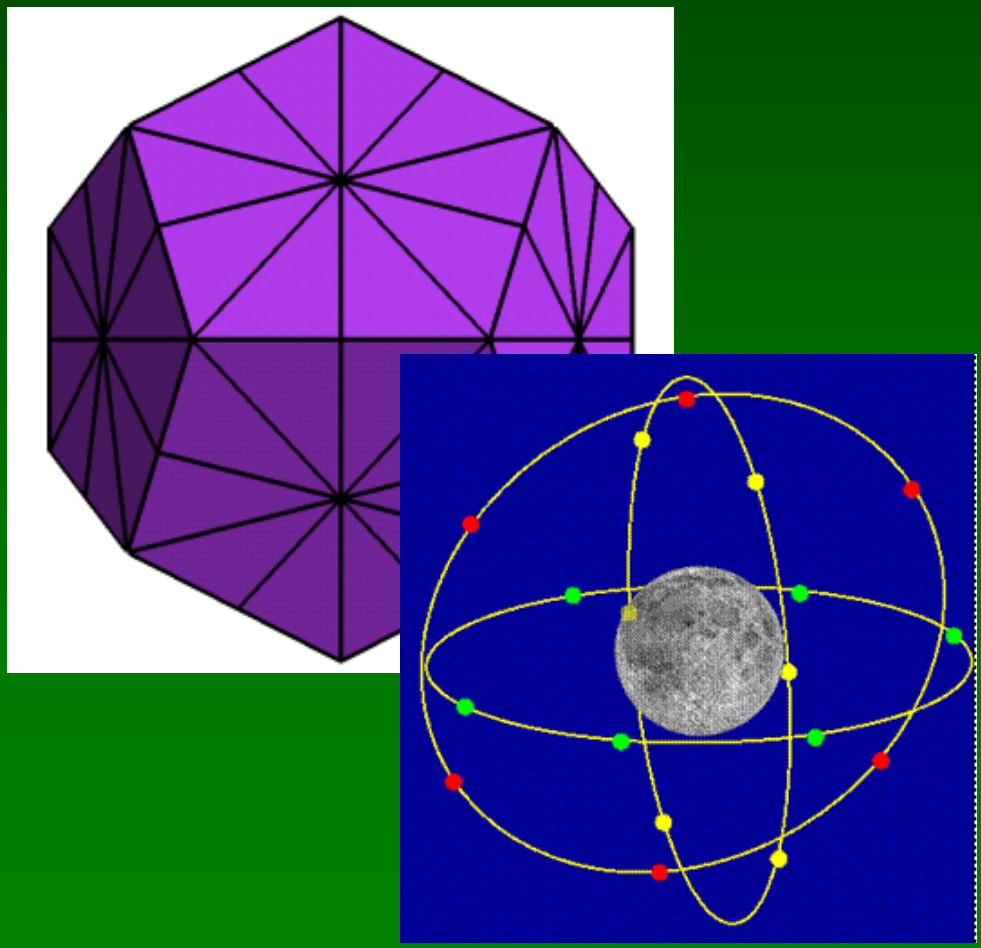
Only four retroreflector are currently available and tracked by ground Lunar Laser Ranging stations. Lunakhod 1 is no more available

Open Issues to be addressed

Trans lunar face reference system materialization is not possible through Lunar Laser Ranging and different approach has to be developed.

•The design and density of the needed network of Laser retro-reflector on the moon for establishing and maintaining a moon fixed reference system suitable to allow positioning and navigation on a long range scale has to be addressed.

Possible design of the materialization network



Moon gravity field resolute and accurate recovery is needed for the establishment of a reliable selenocentric reference system

Exploration of the Moon for its exploitation (1 of 2)

Exploration and deeper knowledge of the Moon is driven from the will to establish there permanent human settlement.

Human presence on the Moon is justified not only by science but include also the development of applications to address security and economy for the future of humanity.

Exploration of the Moon for its exploitation (2 of 2)

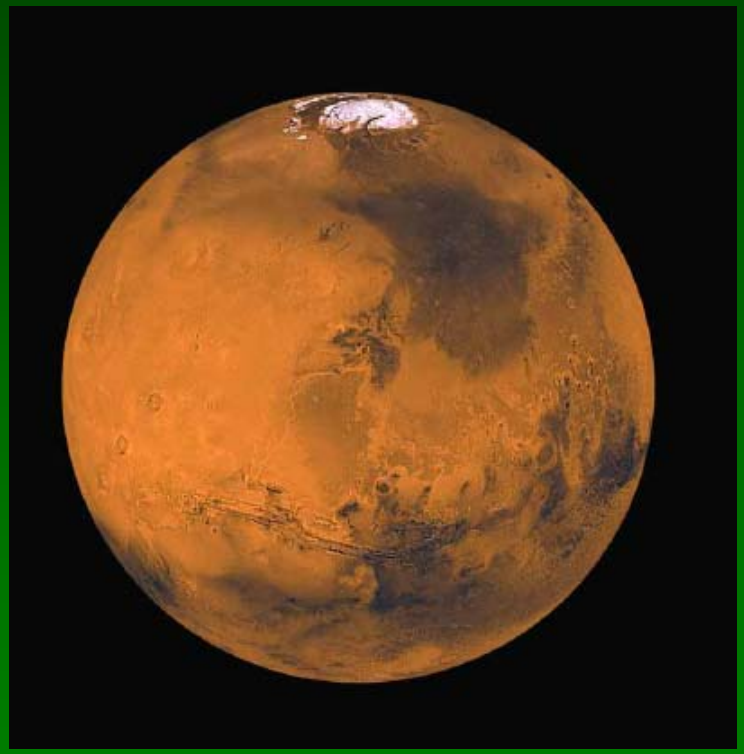
Just some example, on the moon surface it is possible to activate:

- Solar power production;
- Realization of produts requiring low gravity conditions;
- Extraction of mineral resources
- Continuous Observation of the Neighborhood of the Earth against dangerous asteroids crossing the Earth orbit.

Needed Activities on the Moon driven from applications

- Mapping Lunar resources.
- Realizing large permanent settlement suitable to host industrial activities.
- Establishment of large Solar power arrays.
- Robotic and human mining activity

Exploitation of the Moon 1/2

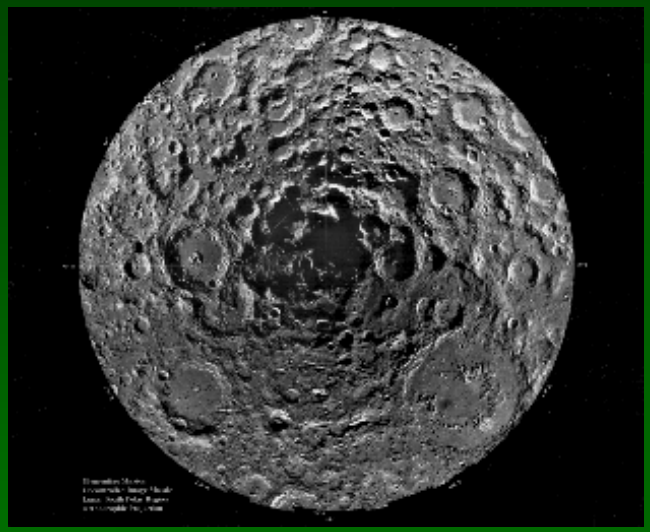


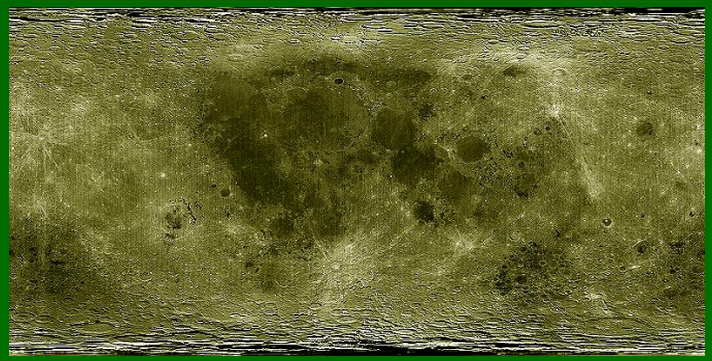
As well as Navigation capability implies reference system establishment, applications on the Moon implies instruments to make exploitation as efficient as possible.

One of such instruments is the realization of:

The Selenographic Information System for the Moon

Exploitation of the Moon 2/2





Basic information based on satellite observation and measurements are needed to populate the SIS system. Topographic mapping provided by Clementine Mission.

As well as

Resource mapping provided by Lunar Prospector Mission are good starting point but inadeguate for long term needs

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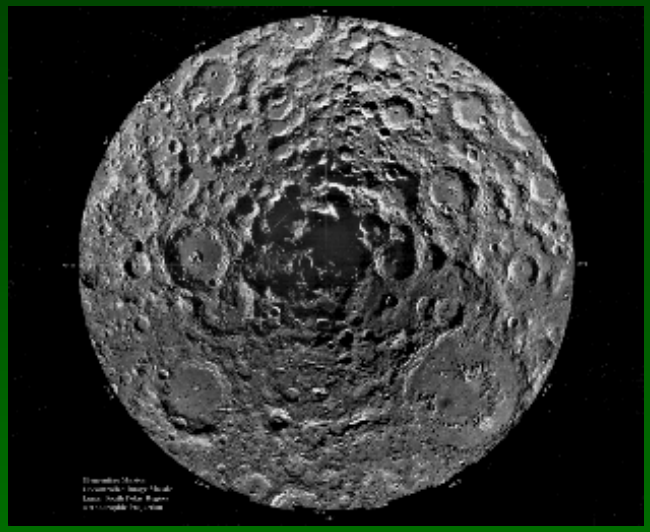

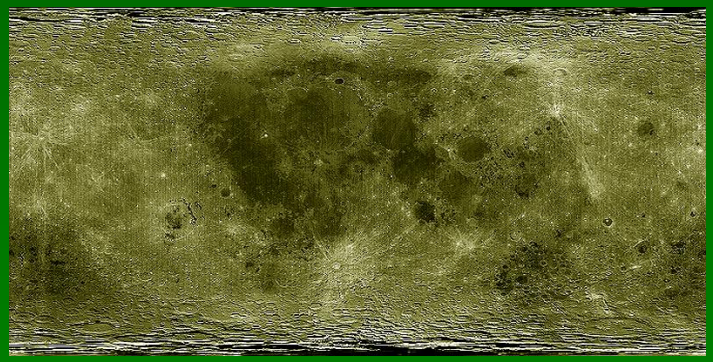

New mission for mapping moon surface and its resources

The running SELENE mission and next Missions Chandrayaan, Lunar Reconaissance Orbiter together with the many planned new missions will make available in the next future basic data and information for the implementation of the SIS for Moon exploitation

Conclusions

To make exploration of the Moon for its exploitation feasible the establishment of a selenocentric reference system is a prerequirement in order to support navigation on the Moon surface.

The establishment of such a system and its materialization is, a tipical Geodetic or well Selenodesic problem and could be addressed through space geodesy technique like Lunar Laser Ranging and Gravity field recovery.

The new reference system shall be the basis for mapping the Moon surface and its resources. These are mandatory steps to:

"Consider the Moon as the Earth's Seventh Continent the colonisation of which would lead to enlargement of the ecumen"