Habitability Challenges for a Human Settlement on the Moon

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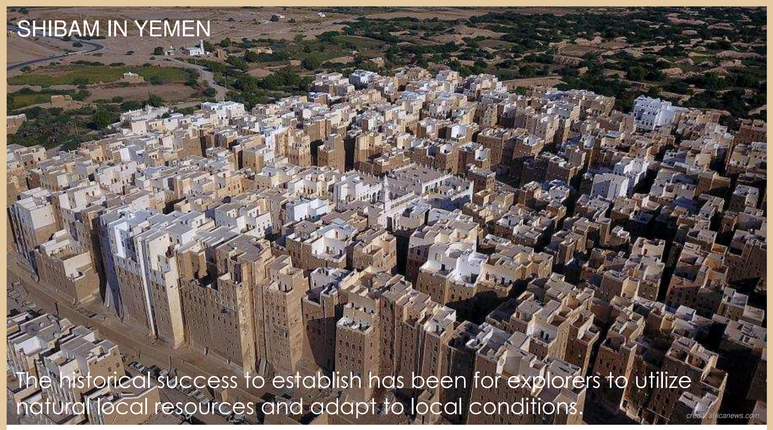
XVII CONGRESSO DI SCIENZE PLANETARIE

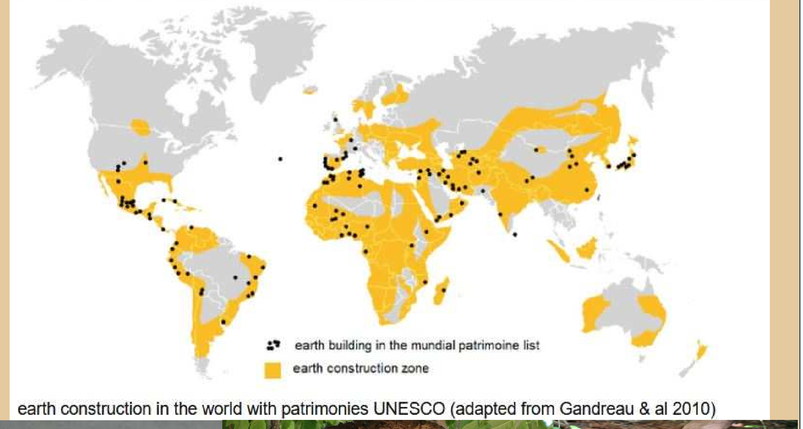
Understanding Earth's Natural Resources

Further research needs to be undertaken on the first steps man has made on Earth to create a shelter, to study them and have solicitations for the first steps that man will take on other planets.

The theme of raw earth like adobe, pise' and torchis are very ancient and spread throughout the Earth. In this presentation we illustrate that we should be building on the Moon and Mars using local resources like we have been for centuries on Earth being inspired by nature.

HOW DO WE BUILD ON EARTH → USING MATERIALS FOUND ON EARTH & ADAPTING TO LOCAL CONDITIONS



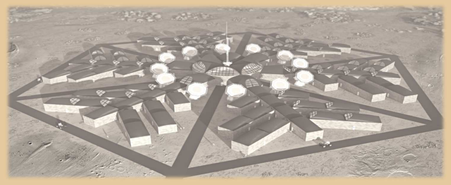


earth construction in the world with patrimonies UNESCO (adapted from Gandreau & al 2010)

Insects and animals build from materials they find locally.
We can learn from their behavior for practical structural concepts

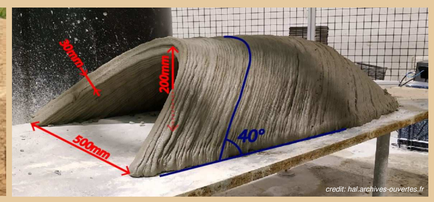
How to Build on the Moon

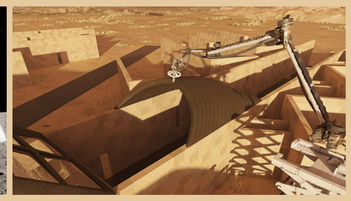
HOW SHALL WE BUILD ON THE MOON → WITH MATERIALS FOUND ON THE MOON & ADAPTING TO LOCAL CONDITIONS



Humans have been using local available resources on Earth to build shelters for millennia

Development of the Moon will become a mission of transporting know how rather than mass, identifying and developing a common dominant, a standard for habitats for assuring connection and interoperability.
It is necessary to bring together various technologies and interdisciplinary competencies of the nascent field of space architecture.





Learning from our ancient past of building in extreme environments with limited resources. The Nubian vault is a construction system where bricks are laid inclined with respect to the vertical plane.
This eliminates the carpentry of wood used to support the vault.

Even with the inclined plane, the 3d printing extrusion allows the vault to hold up during the construction phase with a material that has not yet dried.

In the future there may be a printer that moves along the vault itself with rails included in each printed layer, allowing the development of large vaults without having the need for a 3d printing crane to surround the object.

Necessary Elements to Advance The Lunar Mission

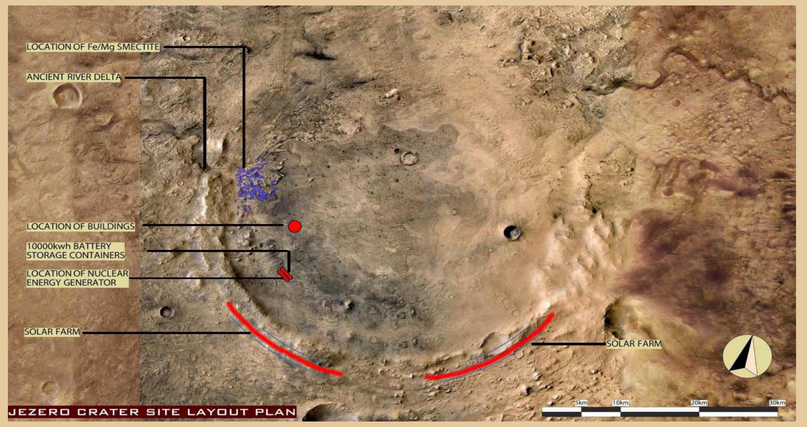
COMMUNICATIONS INTERNAL UTILITY ROADS, LANDING PADS & ACCESS DUST ISSUE	**SHIELDING** RADIATION, METEORITES, EXHAUST PLUME PROTECTION	**INSULATION** TEMPERATURE DIFFERENTIALS OF 250 DEGREES	**BLAST PROTECTION** HANGARS OF EQUIPMENT/MAINTENANCE, LIGHTING, 5G, POWER, PROCESSING PLANTS	**INFRASTRUCTURES** BURIAL	**CONSTRUCTIVE ELEMENTS**

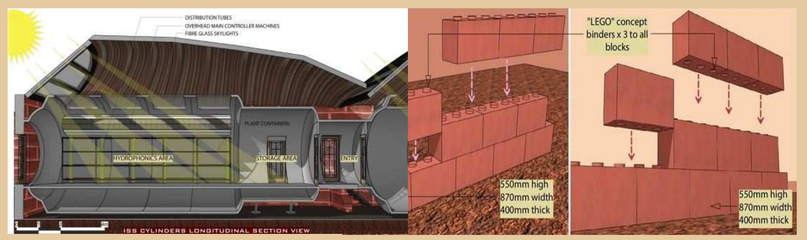
Challenges to Advance the Lunar Mission

WATER	FOOD	POWER

Case Study: Mars Base "Sprout"

Mars Base "Sprout" an International Award Winning Architectural Competition Entry for a Martian Base Sponsored by Nasa & Esa.
Base Location Jezero Crater





Internal ISS pressurized cylinders for crop cultivation shielded by 3d printed basalt Nubian vaulted roofs supported by regolith block walls