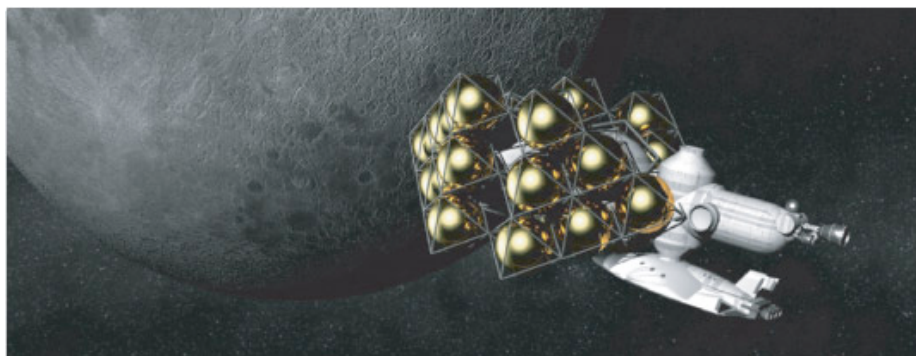




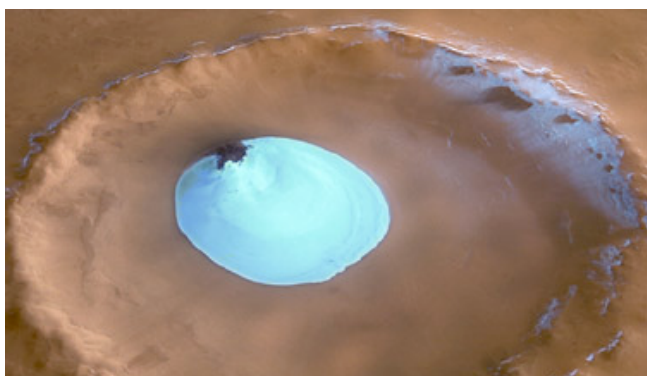
STEP 2

PERMANENCE AND SETTLEMENT



Lunar module - Image O.Boisard

Flights to Mars are regular, on what is now called the "new road of silk". The improvement of propulsion systems reduces appreciably the duration of the flight, and new crews of explorers are sent to Mars every three months. Comfort onboard improves too. Inhabited zones, slowly rotating, reproduce artificial gravity facilitating everyday life, and exempting from the difficult period of adaptation during the return in a natural field of gravity. The member crews know that, in case of necessity, the Earth will be able to send them within in a few days or a few weeks, using solar sails, little containers not exceeding five hundred grams with medicines, security equipment... and postcards.



Frozen lake on Mars. Photo: ESA/Mars Express

The Martian environment is the object of an intensive research. A question always focuses the interest of exo-biologists: **does life exist, in a form or another, in the depth of the planet?** Unlike the Earth, Mars has neither an ozone layer absorbing ultraviolet rays from the sunlight, nor a magnetic field protecting from the dangerous ionized particles of the solar wind. The surface of the planet is thus naturally aseptized, and, if life exists, it must be refuged under the ground, where remains the water from former oceans disappeared a few billions years ago. Similar researches are conducted in other parts of the solar system: an automatic probe land on Europa, one of Jupiter's satellites, where a drilling machine dig into its superficial layer of ice to reach the liquid ocean. These conditions are extreme, but life has been already observed on Earth even in the most inhospitable abysses of oceans ...

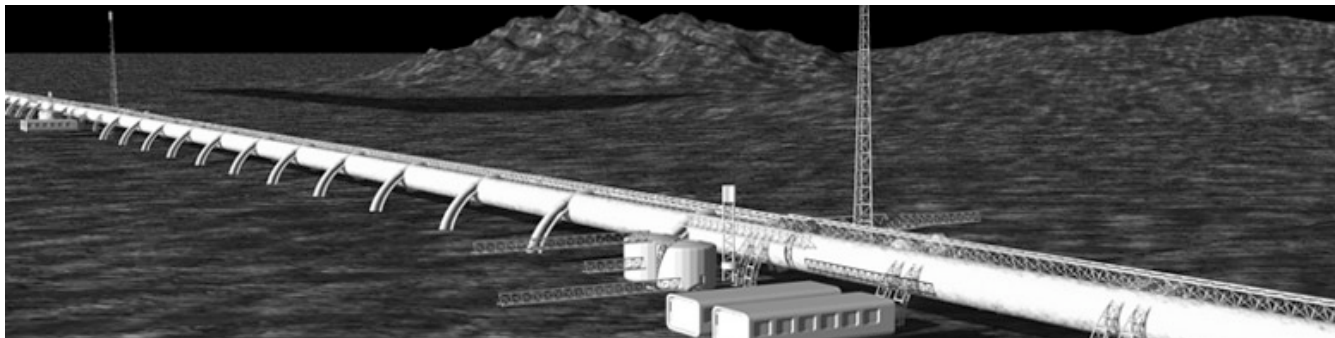
The first richness of Mars are landscapes. In the glaciers of the north polar cap, the sides of the Olympus Mons volcano, the dunes fields of Utopia Planitia, inhabited complexes are developed. Near the hydroponic greenhouses providing to "Martians" a sufficient food supply - although moderately tasty – automatic factories distillate oxygen and hydrogen from the environment. From a long runway, sailplanes - equipped with auxiliary rocket engines – take off for exploration flights all around the small planet, whose surface does not exceed the size of the whole terrestrial continents. During a perilous expedition on the sides of the canyon Valles Marineris, the entrance of a cave is discovered : in the main room rises a forest of stalactites and stalagmites...

On the Moon, other inhabited stations are constructed for hundreds of astronauts. Here too, exploration remains a major activity. But another one, more pragmatic, mobilizes increasing resources: industrial exploitation of the lunar resources. The middle term objective is clearly to develop out of the Earth a profitable economic activity.



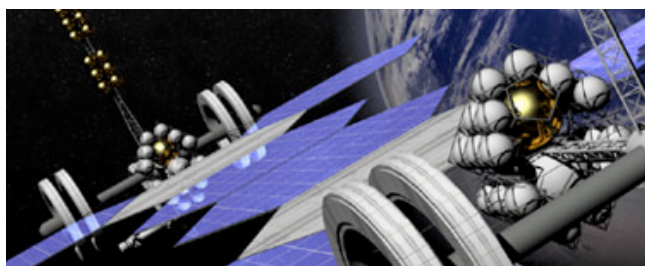
NASA

One of the most spectacular achievements is the "electromagnetic catapult", satellizing loads of ores thanks to fast little railcar driven in a ten kilometers long railway. For the first time, electric power is used to send payloads in space. This energy is produced by a nuclear power station. Another option was solar energy, but the lunar night is long and this solution posed too many problems of energy storage. One day, two solar stations could be used, built on opposite sides of the Moon, connected by a high voltage line. Or an orbital Solar Power Station, whose first prototype is tested near the Earth, could send to the Moon thanks to a microwave beam, the solar energy drawn in space.



Lunar catapult - Image O.Boisard

The question is raised concerning the utility of the International Space Station (ISS), still orbiting 400 kilometers above of the Earth. Is a permanent human presence necessary in low orbit? Automatic satellites can perfectly do the majority of the tasks, sometimes tiresome for astronauts who undoubtedly have more important things to do higher in the sky, for example in ensuring the weekly rotation of the space "buses" in the regular Earth-Moon space line.



Space station - Image O.Boisard

The use of the ISS is entirely reconsidered: it becomes a transit station, connecting space planes in direction of the Earth, and "buses" in direction of the Moon. Few modules, dedicated to space tourism, are exploited by private companies: the extraordinary spectacle of the Earth is a good reason to spend a "space week end" in orbit, and astonishing projects are already being studied, for customers in search of new sensations: a tennis court will be built in weightlessness (the rules of the game being a bit modified ...); in the panoramic dome of a swimming pool, it will be possible, for the first time, to swim above the ocean; later, a giant stadium will host sporting competitions of a new kind...

A second international space station is constructed on the Lagrange point L5. Tens of astronauts, scientists - and maybe a few militaries -, are living in this new station, much larger than the first ISS. A giant wheel reproduces artificial gravity, and provides excellent living conditions in inhabited zones. The factories and research laboratories are anchored, independently, a few kilometers away : the quality of micro-gravity on these uninhabited platforms is much better than in the former ISS, where many vibrations, due to human activity, disturbed the experiments. After a difficult beginning, technologies of "micro-gravity" are finally developing, and the first products "made-in-space" are sent to the Earth.

In space industry, standardized modular equipments, conceived as pieces of meccano, answer to any functions, in any possible environments, and any configuration: habitation modules designed for space, lunar, and Martian stations; scientific modules; solar panels; containers of freight; tanks of liquid hydrogen and oxygen; atmospheric production unities... Responding to the needs of a mission, new machines are rapidly conceived thanks to the catalogue of these many resources. The most sophisticated equipments are still manufactured on Earth, but some of them – for instance heavy metallic frames - are forged on the Moon, then sent in space at a very low cost via the electromagnetic catapult.



NASA



Photo Hubble

Automatic probes pursue their exploration of all the "map" of the solar system. For the security of astronauts, a surveying satellite is orbiting near the Sun : in case of solar flare, the detection system will warn all the men in space, on the Moon, and on Mars, and give them time to join a shelters which will protect them during the few tens of minutes of the storm.

All over the solar system, hyperinstruments based on constellations of satellites are used by searchers in fundamental physics to scan elementary particles and test, "in situ", the validity of theories about the nature of matter, time, and gravitation. Others turn to the deep sky, the galaxies, and echoes of the Big-bang.

Only a few tens of light-years away, a telluric exo-planet - i.e. comparable with the Earth, but in an other solar system - is finally photographed. The spectral analysis of its atmosphere reveals traces of oxygen... New territories?

MAJOR FACTS :

- Regular space lines are opened between the Earth, the Moon, and Mars,
- A permanent station is settled on Mars; the crew can be renewed every 3 to 6 months,
- Space tourism has its own installations in low orbits,
- A permanent station is built on the Moon, using an electromagnetic catapult,
- A new ISS is anchored on the Lagrange point L5,
- The first products "made-in-space" are sent to the Earth,
- A telluric exo-planet is photographed by a hypertelescope.

STEP 2 : PERMANENCE AND SETTLEMENT



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