2050: An Industrial Lunar Base Concept

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Resume. The discussed concept presents a phase in the industrial development of the base, when it becomes capable of building first experimental space power stations using solar energy to supply power to Earth. At that phase the permanent lunar base turns into a settlement with a population of up to 200.

The technologies that are currently used by the mankind are characterized by power production based on carbon fuels of limited supply, and by 98-99% of all raw materials being eventually turned into waste.

Today, the world scientific community is gradually coming to the conclusion that if the existing structure of the economy continues into the 21st century, this will result in a global environmental disaster, and the only option that can save the mankind and the natural environment from the imminent crises is to develop space power production and to industrialize the near-earth space using lunar resources.

This makes relevant a discussion of various aspects of industrial lunar base construction and operation, and the relevance of such discussion will only grow with time.

In Issue No.3, 1997, of the magazine "Vselennaya i My" ("Universe and us") published in Moscow by the Eurasian Astronomical and Astrogeodesic societies, a team of authors (A.G.Sizentsev, V.V.Shevchenco, V.F.Semenov, G.M.Baidal) presented "A Concept of an Industrial Lunar Base in 2050", which incorporated materials from the Lunar and planetary Physics Department of the Sternberg Astronomical Institute.

The concept presents such a phase in the industrial development of the base, when it becomes capable of building first experimental space power stations using solar energy to supply power to Earth. At that phase the permanent lunar base turns into a settlement with a population of up to 200.

The distinctive feature of this concept is that it selects as a baseline option the preferential placement of the base components on the slopes of craters. This might be called a flexible option as compared with the placement of the base components inside a lava tube.

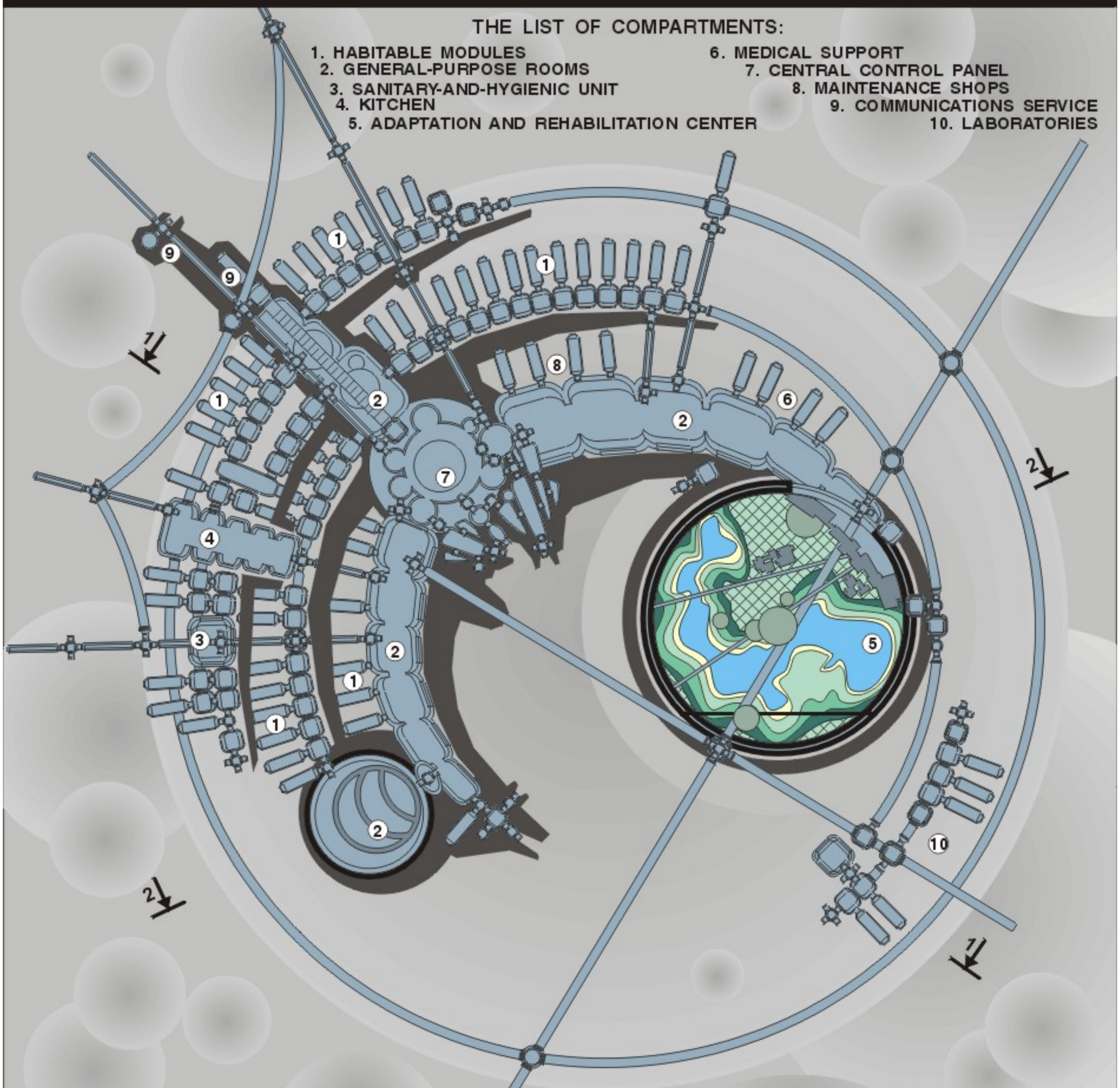
Besides having a flexible layout, as well as being flexible with regard to its selenographic location within marian regions, placing the base components in craters allows to use terrain features for protection against radiation and meteorites that, lower though it may be than inside a lava tube, is still higher than on a plain lunar surface. And, although this entails additional expense, in case of emergency it would be easier to evacuate people from base components located inside a crater than from inside a lava tube. Furthermore, locating the habitation complex inside a crater creates a psychological perception of a fenced-in and therefor more protected habitable space as compared with a layout on a plain surface, while it does not create a feeling of confinement that may be felt inside a lava tube.

If we turn to current foreign and domestic analogs, we should note that the projects of the first lunar settlements are usually done at the conceptual design level, while the concepts that address later phases in the development of lunar settlements mostly focus on artistic impression without a due study of engineering aspects.

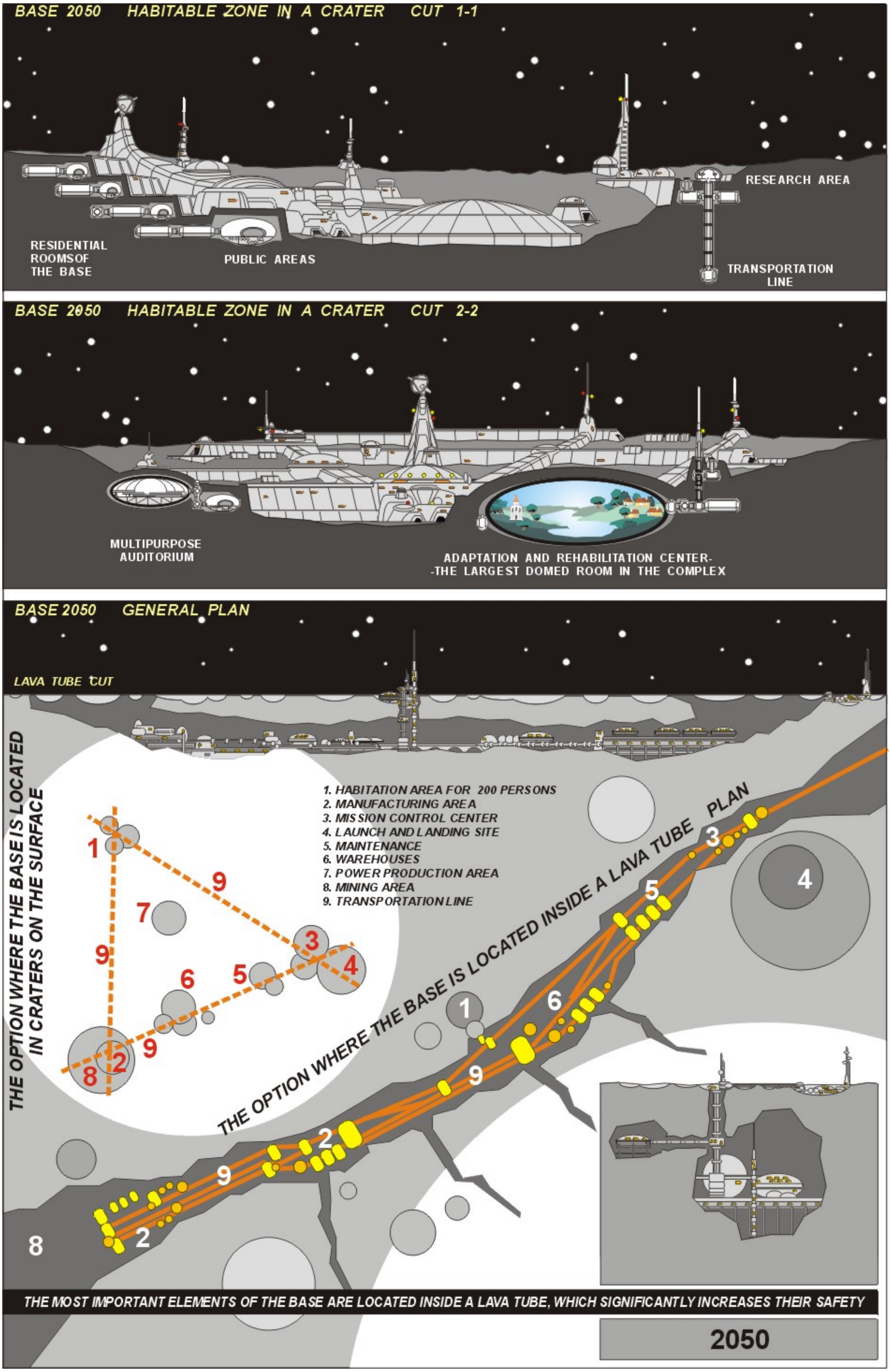
The work that is being presented is an attempt to develop a concept that equally meets engineering, aesthetic and biopsychological requirements.

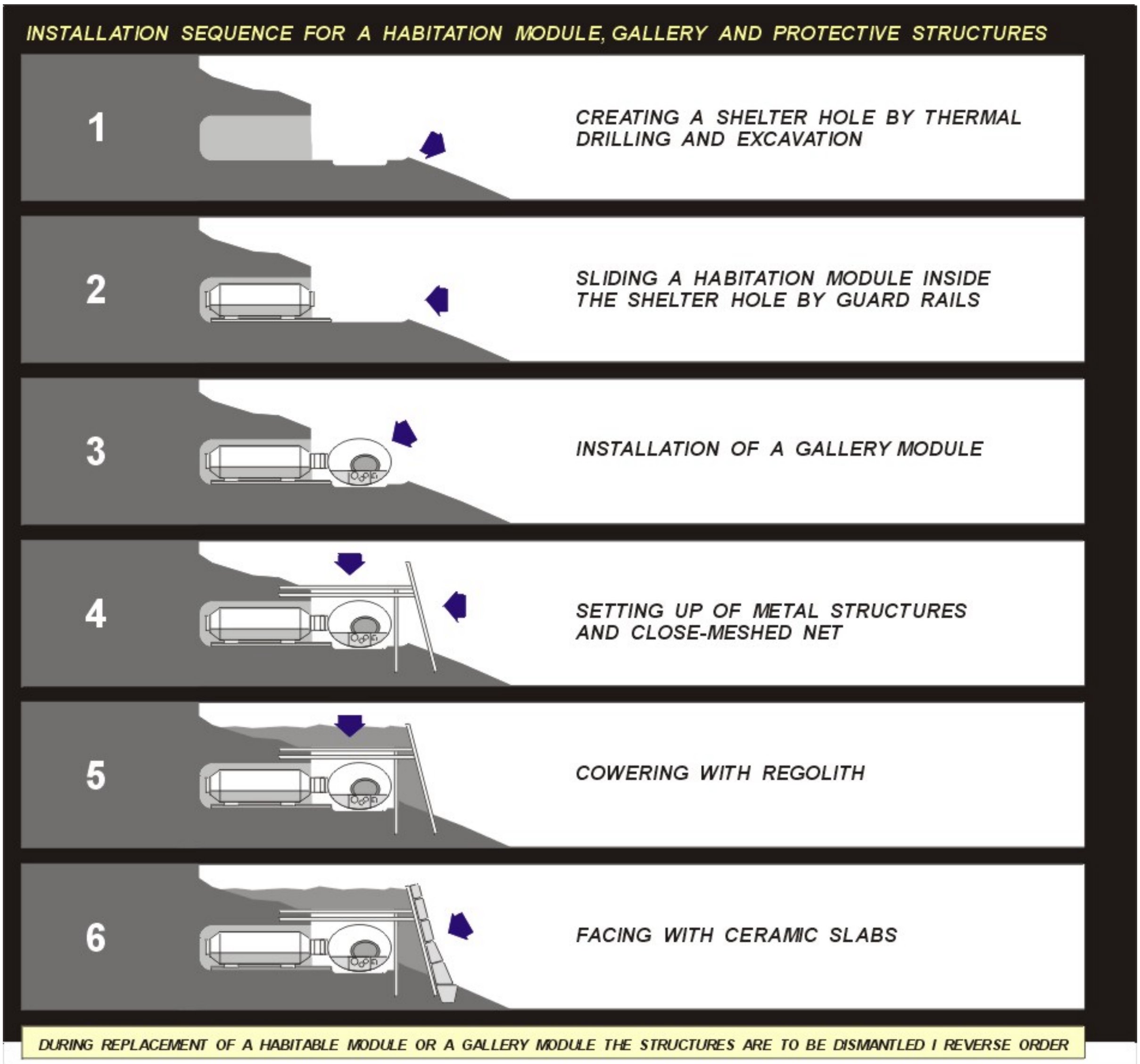
Here we present the most important illustrations from the graphic part of this work.

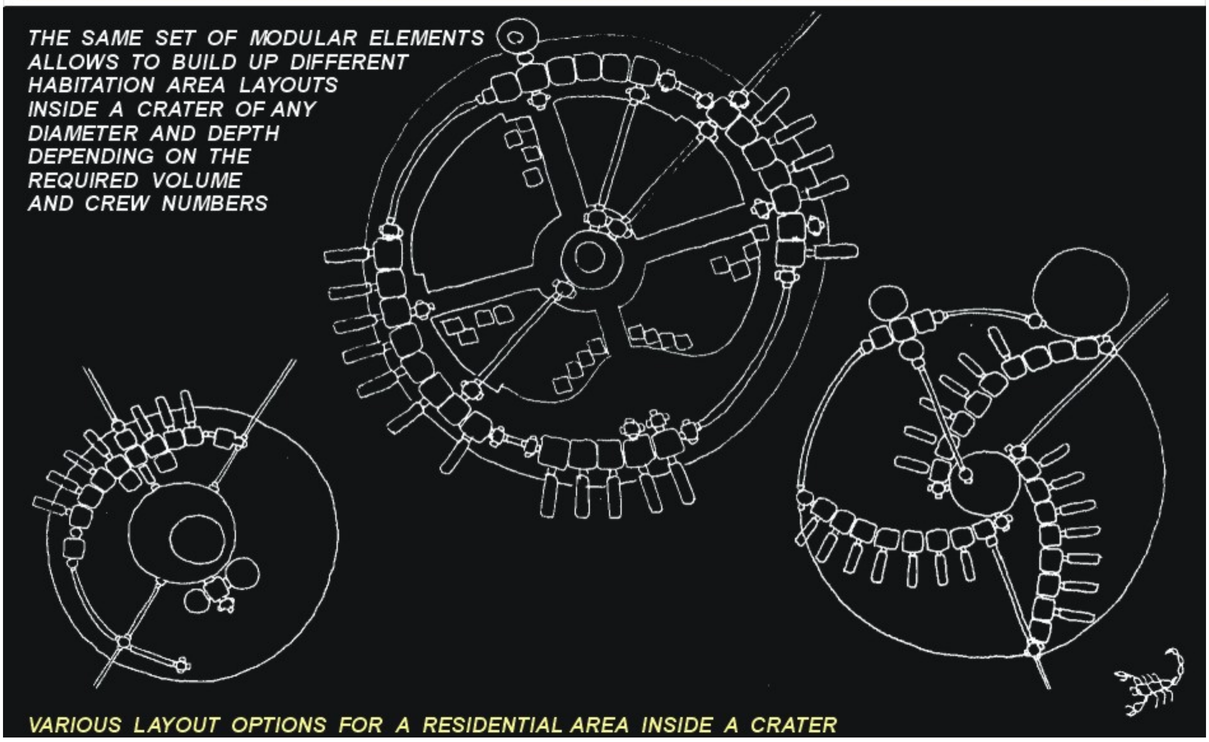
BASE 2050 HABITABLE ZONE IN A CRATER GENERAL VIEW



BASE 2050 HABITABLE ZONE IN A CRATER PLAN


BASE 2050 HABITABLE ZONE IN A CRATER CUT 1-1
RESEARCH AREA
RESIDENTIAL ROOMSOF THE BASE
PUBLIC AREAS
TRANSPORTATION LINE
BASE 2050 HABITABLE ZONE IN A CRATER CUT 2-2
MULTIPURPOSE AUDITORIUM
ADAPTATION AND REHABILITATION CENTER- -THE LARGEST DOMED ROOM IN THE COMPLEX
BASE 2050 GENERAL PLAN
LAVA TUBE CUT
THE OPTION WHERE THE BASE IS LOCATED IN CRATERS ON THE SURFACE
1. HABITATION AREA FOR 200 PERSONS
2. MANUFACTURING AREA
3. MISSION CONTROL CENTER
4. LAUNCH AND LANDING SITE
5. MAINTENANCE
6. WAREHOUSES
7. POWER PRODUCTION AREA
8. MINING AREA
9. TRANSPORTATION LINE
THE OPTION WHERE THE BASE IS LOCATED INSIDE A LAVA TUBE PLAN
THE MOST IMPORTANT ELEMENTS OF THE BASE ARE LOCATED INSIDE A LAVA TUBE, WHICH SIGNIFICANTLY INCREASES THEIR SAFETY
2050


INSTALLATION SEQUENCE FOR A HABITATION MODULE, GALLERY AND PROTECTIVE STRUCTURES
1
CREATING A SHELTER HOLE BY THERMAL DRILLING AND EXCAVATION
2
SLIDING A HABITATION MODULE INSIDE THE SHELTER HOLE BY GUARD RAILS
3
INSTALLATION OF A GALLERY MODULE
4
SETTING UP OF METAL STRUCTURES AND CLOSE-MESHED NET
5
COWERING WITH REGOLITH
6
FACING WITH CERAMIC SLABS
DURING REPLACEMENT OF A HABITABLE MODULE OR A GALLERY MODULE THE STRUCTURES ARE TO BE DISMANTLED I REVERSE ORDER


THE SAME SET OF MODULAR ELEMENTS ALLOWS TO BUILD UP DIFFERENT HABITATION AREA LAYOUTS INSIDE A CRATER OF ANY DIAMETER AND DEPTH DEPENDING ON THE REQUIRED VOLUME AND CREW NUMBERS
VARIOUS LAYOUT OPTIONS FOR A RESIDENTIAL AREA INSIDE A CRATER