

# LUNAR INDUSTRY & RESEARCH BASE CONCEPT

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## Abstract

The current paper presents the goals of Moon exploration, Yuzhnoye SDO's concept of a Lunar Industry & Research Base, phases and terms of its development, as well as a conclusion of the project's feasibility.

## 1. Introduction

The experience of Moon exploration started almost along with the beginning of space age, but peculiarity of the tasks to be resolved with the direct human participation in expedition as well as a high cost of projects have pushed away the idea of further expansion for several decades.

Currently, all main space industry players, such as Europe, USA, Russia, China, etc., are looking back again at the idea of Moon exploration building there a manned lunar base. Alongside with other world spacefaring nations, Yuzhnoye State Design Office with its long-time development experience, technological and intellectual potential, organized its own conceptual work on development of the Lunar Industry & Research Base.

## 2. Moon exploration goals

Besides the fact that the Moon is the closest available object for humanity to colonize it, the Moon and its reach resources are the key to reducing costs for interplanetary missions. Lunar resources will allow producing rocket propellant, constructional materials, and necessary resources for crew life support and base on the whole – all this will provide a stimulus in development of space activities of mankind in the near and outer space. Lunar industry & research base is a platform for testing of space equipment and technologies necessary for lunar exploration and interplanetary manned missions, and a springboard to the development of next manned bases on Mars and its moons, as well as to exploration of asteroids, etc.

The Moon will become the first place in the Solar system where people will get the experience of living in space without support from the Earth.

## 3. Yuzhnoye SDO's Lunar Industry & Research Base concept

In the frames of conceptual project "Lunar Industrial & Research Base" were formed its appearance, preliminary configuration and infrastructure at different stages of operation, trajectory and flight scheme to the Moon, as well as terms of the project's realization, and main technical characteristics of the systems under development (such as space transportation system for crew and cargo delivery to lunar surface and return to Earth, standardized designs of lunar modules, lunar surface vehicles).

Table 1: Phases of lunar base development

Phases of lunar base development	Terms of lunar base development, years
Phase #1 – Preparation	~ 10
Phase #2 – Minimal configuration base	~ 2
Phase #3 – Base expansion	~ 10
Phase #4 – Transition to production	~ 20
Phase #5 – Permanent base	

The main phases of lunar base development are:

**Phase #1 Preparation:** establishment of international cooperation, Moon exploration by means of unmanned spacecraft, development of Earth-Moon-Earth space transportation system, lunar base infrastructure components, and take-off/landing pad.

**Phase #2 Minimal configuration base:** delivery of first lunar base modules and power plant;

minimal configuration lunar base assembly, systems check-out and testing.



Figure 1: Development phase #2.

**Phase #3 Base expansion:** building up of lunar base infrastructure, lunar surface exploration, selection and preparation of territories for production base and lunar observatory.

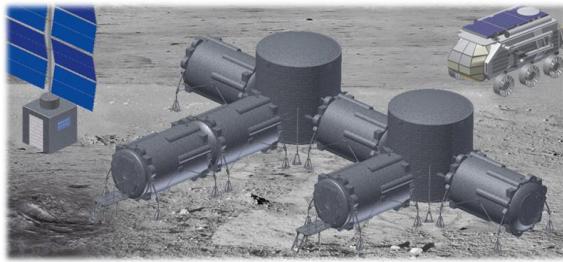


Figure 2: Development phase #3.

**Phase #4 Transition to production:** development of closed-cycle life-support system, production base and lunar observatory.

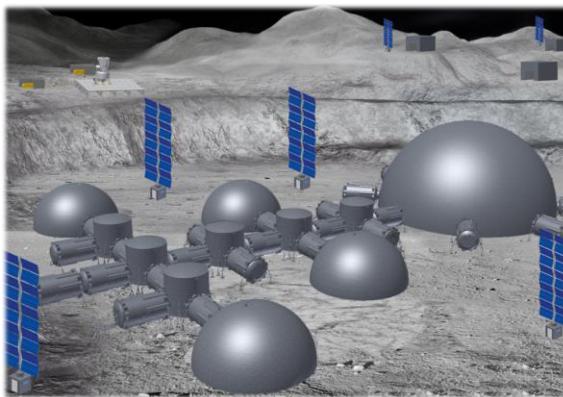


Figure 3: Development phase #4 and #5.

**Phase #5 Permanent base:** human constant presence and life activity on the Moon, development of space tourism center.

#### 4. Summary and Conclusions

The "Lunar Industrial & Research Base" project's preliminary risk assessment has shown a high value of its overall risk due to the lack of reliable information about the Moon, technical risks, long-term development of its elements, very high financial costs and dependence on state support.

This points to the fact that it is reasonable to create such a global project in cooperation with other countries. International cooperation will expand the capabilities of any nation, reduce risks and increase the success probability of automated or manned space missions. It is necessary to create and bring into operation practical mechanisms for long-term space exploration on a global scale. One of the ways to do this is to create a multinational agency which would include both state enterprises and private companies.

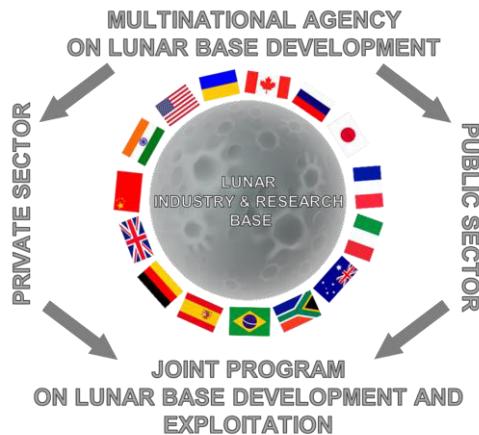


Figure 4: International cooperation model on lunar base development.

By finding a common language in space research, the countries will be able to effectively divide the efforts to achieve common goals, and leaning on their own potential and coordinating the joint efforts, they will come to global cooperation and partnership. Such an international cooperation directed towards a single global goal will help to reduce conflicts, increase global security, and lead to establishment of the peace.