SPACE EXPLORATION SYMPOSIUM (A3)
Space Exploration Overview (1)

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ASTEROIDS AND ARTIFICIAL HABITAT — A STAGE OF MANNED SPACE EXPLORATION

Abstract

The report discusses the need for space exploration and deals with the problems that prevent such exploration. As the alternative for the discussed scenarios of space exploration, a scenario is proposed that implies the use of asteroids with artificial environment in them. Apart from internal problems (Earth population growth, resource depletion) in modern society, there is a threat of global natural disasters. Many believe the Earth's biosphere to be something immutable and eternal, and the costs of overcoming the looming global catastrophes are deemed useless. However, many problems of exploration of nearest planets and giant artificial orbital stations can be solved if asteroids (that have orbits with a minimum perihelion distance less than or equal to 1.3 A.U. (near-Earth asteroids, NEA)) are used to create artificial environment. Settlements within an asteroid should have an atmosphere suitable for breathing, and the asteroid should rotate to provide artificial gravity. Beneath the surface of the asteroid it is possible to create habitable zones at any depth providing a reliable passive protection from radiation. Air, water, food and other materials will be produced in closed ecological and technological cycles, i.e. almost indefinitely, on the basis of a unit established in 1972 in the Krasnoyarsk Institute of Biophysics — BIOS-3 — experimental a closed ecological human life-support system. The advantages of small celestial bodies are their relatively small mass and moment of inertia, which make it possible to give such asteroids angular velocity providing Earth-like gravity with the help of the existing technologies. Asteroids also contain structural materials (iron, nickel, rhodium, etc.), semiconductors and consumable materials which can be used for engines in space. In the process of extraction of mineral resources within an asteroid a diversified infrastructure can be created. Shooting slag from the sinking mines in the process of such infrastructure formation it will be possible to impart the necessary angular velocity to the asteroid. It is important that the NEAs crossing the orbits of Venus, Mars and Jupiter can be used as vehicles protected from radiation — a shelter for delivery of manned spacecraft to other planets. Interstellar flights seem impractical because of their long duration. Everything changes when you live in a space colony implying a subsequent change of dozens of generations. If energy and consumables for flight can be replenished from local sources of mineral raw materials within a space colony, humanity will be able to migrate to other stars.