

CONCEPT OF DEVELOPMENT AND APPLICATION OF MULTI-LAYER SYSTEM OF THE EARTH PROTECTION AGAINST ASTEROID HAZARD

R.N. Smirnov

Russian Research Institute of Space Instrument Engineering, Russia

Analysis of different approaches to creation of the system of protection of the Earth against asteroid hazard shows, that the solution of this problem is possible only on the basis of multi-layered protection system development, using the means, deployed in the space. Such system is capable to guarantee the most high level of reliability for solution of considered problem, and also possibility of realization of the ways of hazardous cosmic objects neutralization on account of their deflection into the safe for the Earth orbits, that is rather difficult at utilization of only Earth-based means. Proposed multi-layered system consists of four layers. The first one is located in vicinities of the Sun libration points, the second layer in vicinities of libration points of the Earth-Moon system and on the Moon, the third layer in near-earth space up to stationary orbit and the fourth layer on the Earth. It is proposed to include in the composition of all four layers the means of long-distance detection and determination of trajectory of hazardous space objects movement, impacting them with the purpose of movement parameters alteration or destruction, and also means of their functioning maintenance and control over purposeful application. On the first stage means of long-distance detection and acquisition of preliminary targeting data are developed on the basis of special space vehicles, the other tasks are accomplished on the basis of creation of special multi-purpose space centers of asteroids interceptors deployment, on which it is also purposeful to lay the performance of other tasks, for example science and navigation related. The possible variant of such center shape is represented in Figure 1. On the first stage these stations are located in vicinities of libration points L_1 , L_4 , L_5 and L_3 of the Earth-Moon system.

Such location of the station will optimize the system from the standpoint of required power consumption and guaranteeing of sufficient delivery time for the means of asteroid impacting to impacted object. In this case it was assumed, that discrepancy angle for trajectories of specified above objects should not exceed 15° . It follows from unusually high velocities of asteroids movements, which in general may reach 70 kilometers per second.

Deployment of cosmic interceptor basing centers besides traditional means of transportation-technical maintenance will require development of the vehicles of inter-orbit transportation on small thrust, for example of "Bars" type, developed in Russia.

The interception means of the third and the fourth layers are proposed to be oriented on neutralization of relatively small objects with overall dimensions up to 20-100 meters. According to preliminary assessments the development of described Earth-protection system will require 8-10 billion dollars, and possible terms of development, taking into account existing scientific and technical experience and base are estimated at the level of 8-12 years.

