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PROMISING MANNED SPACECRAFT WITH FLEXIBLE INFLATABLE SHELL

Abstract

The next stage in the space development is the deep space exploration by man. In the meantime, biomedical problems come to the forefront - the creation and maintenance of fully autonomous optimal conditions for human life throughout the entire space flight. Of these problems, weightlessness is the most acute problem, because of which negative changes accumulate in the human body, which irreversibly destroys the body precisely with prolonged exposure. This problem has not yet been completely resolved. The solution to this problem may be the creation of a promising manned spacecraft (PMS) “Dzhamilya”, which is a freely rotating torus with a diameter of 100 m. The main proposals for the design of the torus offered in the assembly work and operation of the torus system: the basic elements of the torus are typical segments and specialized modules; assembly of segment elements delivered into orbit; the use of a robotic complex for assembling segments and the torus as a whole in orbit. It is essential to maximize the lightness of the outer shell of the PMS “Dzhamilya” as one of the heaviest parts of the structure. For this reason, comprehensive solutions are proposed: the usage of soft flexible inflatable shell. This type of shell differs from a rigid metal shell in the content of various layers of flexible materials, either of which accomplishes its own functions. The functions of protection against thermal effects and from micrometeorites, as well as the functions of deploying the structure in space to the desired shape are divided. Existing design solutions and characteristics of the American BEAM spacecraft shell and the shell developed at RSC Energia are considered. A soft inflatable shell has been developed for the PMS “Dzhamilya”, the identifying feature of which is the forming layer, which gives the necessary shape to the inflatable module due to the charging of a special layer. The characteristics of the three types of shells are compared with the determination of merits and demerits of each of them. The basic principles of the purpose and operation of the torus: spacecraft of the next larger level in mass and dimensions. A spacecraft not capable of taking off and landing on the surface of cosmic bodies; inhabited spacecraft for long flights in outside space; maximum closure of the cycles of functioning of systems; maximum implementation of all essential vital systems in PMS “Dzhamilya”.