

IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Life Support, habitats and EVA Systems (7)

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METHODS OF THE SPACESUITS MOBILITY IMPROVEMENT

Abstract

Spacesuit is one of crucial elements of the human spaceflight. It protects astronauts not only from harmful effects of low barometric pressure in case of depressurization, but also from overheating and hypothermia. However to create a small weight spacesuit with a good mobility is complicated. This paper is dedicated to mobility of spacesuits with a special attention to inflatable spacesuit and its design. Spacesuits resist the movement of a body and this is one of the main problems of inflatable spacesuits design as to satisfy necessary requirements on this parameter is technically difficult. The mobility of the spacesuit is provided by movable joints of its shell (hinges), located in accordance with the main human joints. In modern spacesuits the mobility of extremities is limited and demands additional efforts. Ideally the level of mobility of a spacesuit has to correspond to the level of mobility in usual clothes. The hinge has to provide the movement in a corresponding joint in the required range of corners with minimum moments for its bending. Moving parts of a cover should be designed to meet following conditions: hinges have to be combined with joints of the human (whenever it is possible); a gap between a human body and the cover has to be provided in case of impossibility of their matching by movement in hinges. This article analyzes soft hinges which are providing bending of parts of a body as well as the way to reduce efforts required for bending. The main idea is in transfer of longitudinal efforts to the power elements located in the neutral surface or the plane of the hinge. Articulations of the skeleton allow two types of movements: rotation and bending (corresponds to technical connections: shaft with sleeve and ball joint). In addition to the kinematic mobility of the spacesuit, it is also characterized by energy (power) factors. To assess the mobility of any hinge, the information on limiting angles of its deviation should be known as well as “the cost” of this result. Difficulties of the inflatable spacesuits design and “harmful” effects on astronauts caused by spacesuits during EVA are also discussed.