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USE OF SELF-HEALING MATERIALS TO REDUCE SPACE DEBRIS

Abstract

The problem of space waste is currently one of the global problems of the world. This article examines the work done to reduce space waste. The recovery and extension of life of satellites, rockets, space stations is a factor of special importance for waste reduction. Astronaut repair, Robotized manipulators, Addition of new modules, SpaceX Falcon 9 and Starship systems, Accurate atmospheric access and landing technologies are among the projects based on this factor. Although these methods are effective, they have disadvantages. Thus, Robotized manipulators or astronauts require a very high cost for repair. Service in orbit is risky and difficult, requiring perfect coordination. Some satellites and equipment are not designed for in-orbit repair, so may not be fully recovered. Recovery of reusable rocket heat shields and engines is a complex and expensive process. Reused components degrade over time, requiring strict inspection after each flight. Most of the current satellites are not designed for in-orbit refueling and repair. Robotic systems require very high precision and artificial intelligence to operate in orbit.

One of these projects is micro-capsule-based polymers with a bright perspective. So, in 2014, engineers at the University of Illinois developed a polymer that restores itself as a result of opening capsules during damage. This project has many advantages over others, such as material damaged by external influences (such as micro-meteoroid thrust or radiation) that can repair itself, increase the service life of space vehicles, reduce the need for in-orbit maintenance, additional robotics or astronaut service. can reduce the need for service and, unlike active systems in orbit, work without consuming energy. My proposal based on this comparison study is to give more space to the repair and restoration-oriented use of micro-capsule-based polymer materials and to keep them in the foreground among all projects.

As a result, if these materials are widely applied, the need for in-orbit maintenance and modernization will decrease, the life of space missions will be extended, and total costs will decrease. Therefore, the most optimal approach is to combine both technologies, that is, to improve orbital maintenance and reuse methods in addition to using regenerative materials.

If this project is put in the foreground taking into account its advantages over others, it is inevitable that we will witness new business innovations and successful space missions in the future