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ADVANCED TECHNOLOGIES FOR SURFACE EVA SYSTEMS ENHANCEMENT

Abstract

Robotic missions have been at the forefront of space exploration programs ever since the end of the Apollo program almost 50 years ago, and accordingly, research and development in manned exploration systems have been limited. Today, as we witness a will to renew human exploration, there is a need to update those technologies to get the most out of the astronauts' capabilities during their missions. Extravehicular activities (EVA) are among the most challenging tasks for the crew and, in addition to the psychological stress induced by the exercise, the necessary EVA suit usually brings its share of physical constraints: the bulky structure impairs mobility and visibility, communication and information sharing is limited to voice, and tool handling capabilities are diminished. Moreover, the new exploration programs will ask for longer missions and more complex tasks, inducing a need for efficient communication, improved potential for teamwork and greater adaptability. This study is set in a scenario of a surface exploration mission and tries to answer how human performance during EVA can be enhanced with the help of new technologies, initially designed or not for space applications. The subject is explored through the analysis of six requirements called by an EVA: mobility, dexterity, navigation, communication, payload transport, and multi-crew operation. For each requirement, advances in wearable technologies and robotic assistance are addressed and, for potentially adequate solutions, performance enhancement and integrability are assessed. Finally, based on these results, a conceptual design of the next-generation EVA suit is presented.