22nd IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM (A5)
Human and Robotic Partnerships in Exploration - Joint session of the IAF Human Spaceflight and IAF Exploration Symposia (3-B3.6)

Author: Ms. Caitlin King
United States

Dr. Thomas Low
SRI International, United States
Mr. John Troll
United States
Mr. Antonio Ortiz
United States
Mr. Brand Griffin
Genesis Engineering Solutions, Inc., United States
Mr. Matthew Stephens
National Aeronautics and Space Administration (NASA), Goddard Space Flight Center, United States

EVALUATION OF A HIGHLY DEXTEROUS ROBOTIC MANIPULATOR FOR UTILIZATION OF ON-ORBIT SERVICING

Abstract

The Single-Person Spacecraft (SPS) is being developed by Genesis Engineering Solutions (GES) to provide the space industry with a new piloted and remotely operated EVA solution. The SPS provides a free-flyer inspection, assembly, and servicing solution for host vehicles and stations such as the Lunar Gateway. This represents a new technology to enhance human mobility and work efficiency during EVAs and will also be capable of standalone robotic capability through a locally commanded tele-operated mode. Hardware is being designed and built for a fully robotic Demonstration Mission, as a precursor to human operations, which will test and validate several key SPS systems in LEO. An effort is currently underway to develop an on-orbit dexterous manipulation capability by combining the Taurus robotic system, developed by SRI International, with a custom positioning robotic platform that will operate in a seamless end-to-end control system. The commercially available Taurus Robotic System is being validated as a highly dexterous manipulator platform for spacecraft related tasks, and its space-worthiness is being evaluated. A developmental task board has been built and will be used to demonstrate activities including MLI repair, hook and loop access, wire manipulation, optical performance, and harness connector removal/installation. An evaluation will be conducted on the capabilities of the Taurus robotic system to complete the activities in a tele-operated mode particularly as compared to the capabilities of a spacesuit glove. The control program will also be evaluated to adapt to pre-routined scripts to perform the activities. Quantitative and qualitative results of the task board evaluations will be discussed as well as an assessment on how this feeds into the system requirements of the positioning robotic platform. In addition to this, a short discussion on other significant robotic efforts of the program will be mentioned including key trades related to the design and ground testing of the robotic system, a virtual environment zero gravity tele-operated simulation, and the space worthiness evaluation and testing of the Taurus Robotic System. The latter of these will outline the methodology being implemented to rapidly bring the commercially available robotic system to space readiness. This work represents the significant efforts being made within the SPS program to enhance the capabilities of on-orbit servicing.