The Future of Collaboration and Development of Space Robotics

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Abstract. With the increasing interest and need for in-orbit servicing and manufacturing (IOSM), the deployment of robotics becomes a necessity to carry out those missions. Such robotics enables a range of mission scenarios from in-orbit servicing and mission extension of existing spacecraft to manufacturing, assembly (of new and more complex spacecraft, habitation) or in-situ resource utilization infrastructure. Whilst a few manned in-orbit servicing missions have been attempted, unmanned and fully autonomous servicing and manufacturing missions are yet to undertaken. The use of robotics in space is not new, but true commercialization of space requires a new generation of robots that can work autonomously or alongside human astronauts to achieve these promising IOSM missions. These would relieve the need for human space flight and the inherent dangers of working not just in space, but in the processes being proposed.

However, building new type of robots to revolutionize the commercial application of space is only a part of the picture. Verifying that the developed robot will work as expected in the space environment and can interact with other element of the environment while carrying out a complex mission is vital, not just for success, but for the safety of all concerned. Whilst the availability of facilities to test robots as individual modules widely exists, the ability to test them at a mission level is lacking. Providing such a mission level "space" to researchers and market entrants to validate their robots is a key gap in the space industry.

However, the space industry is not alone in trying to achieve autonomous remote operations for complex tasks in challenging environments. Looking at adjacent industries such as the nuclear, offshore, and subsea industries could provide a useful insight. These industries are facing similar challenges, with the need to maintain, decommission or extend the life of existing infrastructure, build new and more complex facilities in environments hostile for humans to the fore. They also have a need to validate their technologies at a mission level before deploying them. Could a collaboration between industries solve some of the challenges faced and provide a more cost-effective approach? What would be needed to provide such "new testing space" and how would it operate?

Drawing on the experience gained during the development of the Satellite Applications Catapult's robotics facility in the UK, this paper provides an examination on how robotics development and validation should be carried out and how collaborating with adjacent industries might provide a faster path to widespread commercial use of robotics in the space environment.

Keywords: in-orbit, space robotics, servicing, manufacturing, industries collaboration, commercial.