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KOBOT ERA: ROBOT MODULARITY FOR OPTIMIZED MANNED SUPERVISION.

Abstract

In the next era of human space exploration, the collaboration between robots and humans will become an important aspect that will have to be organized and planned for. This in particular applies to the establishment of an extraterrestrial outpost and its exploitation, where the robots will not be shipped directly as an entire functional system, but as various parts, that humans will be able to mount depending on the objectives of their missions.

During the last decades, autonomous robots have evolved drastically to reach the complexity and adaptability that we know today. To pursue the objective of a sustainable base, we must redefine their paradigm to respond to the challenges of tomorrow. These robots will have to achieve repetitive and specific tasks, but they will be directly accessible by humans to perform construction, maintenance and when it is necessary, adapt their architectures to be aligned with the next objectives of the mission.

This paper will present the different modules capable of fulfilling our requirements. Different high level modules are already identified: the motorization system (wheels, motors, suspensions, articulations and thrusters), the Core module (PCDU, COM, OBC, Buses) and the mission specific payloads (drills, 3D printer, backhoes, excavators. . .). These elements can be split into two different categories: the “complex” part (composite element, electronic, optic, communication, motor. . .) that must be transported from Earth, and the “simpler” ones like structures, enclosing and mono-elements; these pieces should be made as much as possible with in situ resources. In order to successfully achieve this vision, we must develop and adapt solutions to create modular robots that can be “easily” built and maintained directly in-situ with the possibility of improvement depending on the performances and expectations of the mission.

It will also cover the different approaches that can be taken for designing these architectures and the state of the art of the technologies that permit the realization of these solutions (ISRU, Regolith 3D printing, reusability. . .).