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RAMA - ROVER FOR ADVANCED MISSION APPLICATIONS

Abstract

The work described in this paper was done under ESA and Thales Alenia Space contract in the frame of the Analysis of Surface Architecture for European Space Exploration - Element Design. Future manned space missions to the Moon or to Mars will require a vehicle for transporting astronauts in a controlled and protected environment and in relative comfort during surface traverses of these planetary bodies. The vehicle that will be needed is a pressurized rover which serves the astronauts as a habitat, a refuge and a research laboratory/workshop. A number of basic issues influencing the design of such a rover, e.g. habitability, human-machine interfaces, safety, dust mitigation, interplanetary contamination and radiation protection, have been analysed in detail. The results of these analyses were subsequently used in an investigation of various designs for a rover suitable for surface exploration, from which a single concept was developed that satisfied scientific requirements as well as environmental requirements encountered during surface exploration of the Moon and Mars. This concept was named in memory of the late Sir Arthur C. Clark RAMA (Rover for Advanced Mission Applications, Rover for Advanced Moon Applications, Rover for Advanced Mars Applications) RAMA meets the scientific and operational requirements defined during the course of the Surface Architecture Study. It is designed for surface missions with a crew of two or three lasting up to approximately 40 days, its source of energy, a liquid hydrogen/liquid oxygen fuel cell, allowing it to be driven and operated during the day as well as the night. Guidance, navigation and obstacle avoidance systems are foreseen as standard equipment to allow it to travel safely over rough terrain at all times of the day. The rover allows extra-vehicular activity and a remote manipulator is provided to recover surface samples, to deploy surface instruments and equipment and, in general, to assist the astronauts' field activities wherever and whenever needed. The vehicle has also been designed to have a very high degree of manoeuvrability. In addition, RAMA may be operated and replenished from a fixed site base or co-operate with other rovers of the same type to provide a mobile

base. The rover in all cases will be refuelled using the products supplied by an in-situ resources facility. Technologies needed to support the design of the rover and its subsystems are described to identify the issues concerned with a possible implementation.