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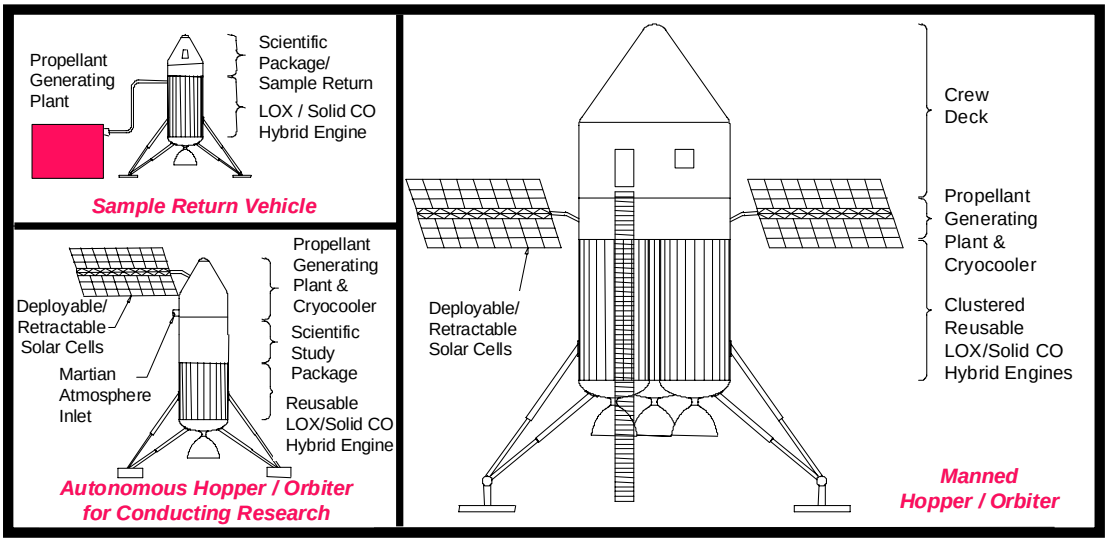
"Advanced System Concept for Total ISRU-Based Propulsion and Power Systems for Unmanned and Manned Mars Exploration"

ORBITEC proposes to conceptualize systems and an architecture for producing and utilizing Mars-based ISRU fuel/oxidizer combinations from the atmosphere to support ground and flight propulsion and power systems. For ground systems, we include rovers and auxiliary power. For flight systems, we include Mars sample return vehicles, follow-on automated surface-to-surface and surface-to-orbit vehicles, and larger vehicles to support manned flight operations from surface-to-surface and surface-to-orbit locations.



Solid CO/O_2-Based Hybrid Rocket Flight Vehicle Concepts

In Phase I we plan to accomplish a preliminary systems study which will provide the data needed to assess the benefits of our proposed approach compared to one of using all Earth-supplied propellants or using some other ISRU infrastructure (e.g., methane/oxygen). For the cost-effective human exploration of Mars, we will need to use in-situ resources that are available on Mars, such as: energy (solar), gases or liquids for life support, ground transportation, and flight to and from other surface locations, orbit and Earth; and materials for shielding, habitats and infrastructure. Probably the most cost-effective and easiest use of Martian resources is the atmosphere (95% CO_2). The CO_2 can be easily processed and converted to carbon monoxide or carbon and oxygen. ORBITEC proposes to conduct the necessary analysis and advanced concept analysis work that will support the knowledge base to allow us the ability to eventually reliably use these resources in the most effective and efficient manner. In this proposal, we are focusing on the innovative and revolutionary use of solid CO and C as fuels in hybrid rocket propulsion and power system applications. New advanced cryogenic hybrid rocket propulsion systems are proposed that will tremendously improve the performance of CO/O_2 or C/O_2 propulsion such that this is the best option for sample return missions, and follow-on unmanned and manned missions. The implementation of this architecture will also greatly support logistics and base operations by providing a reliable and simple way to store solar or nuclear generated energy in the form of chemical energy that can