The Mars Hopper: an impulse driven, long range, long-lived mobile platform utilizing in-situ Martian resources

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The requirements for performance by planetary exploration missions are increasing. Landing at a single location to take data is no longer sufficient. Due to the increasing cost, the missions that provide mobile platforms that can acquire data at displaced locations are becoming more attractive. Landers have also had limited range due to power limitations, limited lifetime of subsystems and the inability to negotiate rough terrain. The Center for Space Nuclear Research has designed an instrumented platform that can acquire detailed data at hundreds of locations during its lifetime?a Mars Hopper. The Mars Hopper concept utilizes energy from radioisotopic decay in a manner different from any existing radioisotopic power sources?as a thermal capacitor. By accumulating the heat from radioisotopic decay for long periods, the power of the source can be dramatically increased for short periods. Thus, a radioisotopic thermal rocket (RTR) is possible. The platform will be able to ?hop? from one location to the next every 5?7 days with a separation of 5?10 km per hop. Each platform will weigh around 52 kg dry, i.e. empty of propellant, which is the condition at deployment. Consequently, several platforms may be deployed on a single launch from the Earth. With a lifetime estimated at 5?7 years, the entire surface of the Mars can be mapped in detail by a couple dozen platforms. In addition, Hoppers can collect samples from all over the planet, including hard to reach geographical locations, and return the samples to a central location for retrieval by a Mars Sample Return mission. The design and performance of the Mars Hopper will be discussed.

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