TDNR: A MODULAR NANO-ROVER PLATFORM FOR NETWORKED PLANETARY MISSIONS

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A 1kg nano-rover platform is designed to extend the benefits recognized in nano-satellites into the domain of planetary rovers. This nano-rover concept, hereto referred to as the Tube Deployable Nano Rover (TDNR), provides a unique solution to planetary exploration; augmenting traditional high-cost, high-risk, rover/sensor systems by expanding the traditional networked planetary probe configuration. With the TDNR, a conventional networked mission can be enhanced with a sub-network of modular, low-cost, nano-rovers. Each nano-rover has modular payload capacity, and each rover can be equipped with independent instruments to cover a range of scientific missions. The TDNR employs a unique expanding wheel design based on Hoberman geometry and a tubular shape allowing the two-wheeled rover to efficiently package within a SCRAMP (Slotted Compression RAMP) entry decent and landing probe. Integrating the TDNR within the SCRAMP leverages several years of research at NASA Ames in next-generation self-stabilizing planetary entry vehicles, which are specifically designed for companion missions. A prototype TDNR is designed and constructed using off-the-shelf hardware at San Jose State University equipped with a Beagle Board main processing board, camera and a 3 axis accelerometer for sensing and navigation, wireless N adapter and foldable antenna for command and communication, and as described in the concept, a payload bay to accommodate mission specific sensors. A prototype TDNR is constructed to identify components required, demonstrates feasibility of the concept, and serves as a development platform to further refine the concept.