

**Five Essential Technologies for Next Generation, Affordable Mars Surface Missions**M. Murbach<sup>1</sup>, P. Papadopoulos<sup>2</sup>, A. Guarneros Luna<sup>3</sup>

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A set of 5 essential technologies are described which can enable a next generation of scientifically provocative, yet affordable Martian surface missions. These are suggested to include a) new Entry Descent Landing (EDL) technologies, b) compact and low power telemetry (TM) unit, c) radiation-hardened avionics set, d) a radioisotope power source, and e), enhanced small-scale mobility. In the first set (a), the EDL may be comprised of both a low-ballistic coefficient ('ultra-light') system, and at the other extreme, a precision targeting system ('ultra-precise') using a high L/D entry system. Both systems are described with associated flight testing and can enable simple landed packages and, exploration of small target sites of great interest. The second set, (b), is related to a Mars Communication Relay - compatible transceiver system at the 2W size. The third, (c), is a convenient rad-hard avionics set that

can be easily programmed to encompass different missions and sensor suites. An example would be the Space Plug-and-Play modules which were originally inspired by the AFRL (Air Force Research Laboratory) and now in flight test. The fourth, (d), relates to the advancement of small radioisotope power units, the encapsulation (important for launch approval) and physics of energy conversion. At present, there are technologies in the 1-2 We class that may be especially applicable. Finally, the fifth, (e), relates to small rover designs - incorporating some of the above technologies - yet have relatively high ground clearance and can provide 1km-scale mobility. These technologies, in different applications and combinations - may offer unique opportunities to explore the Martian surface - and involve more faculty and students in preparation for a next Martian exploration epoch.

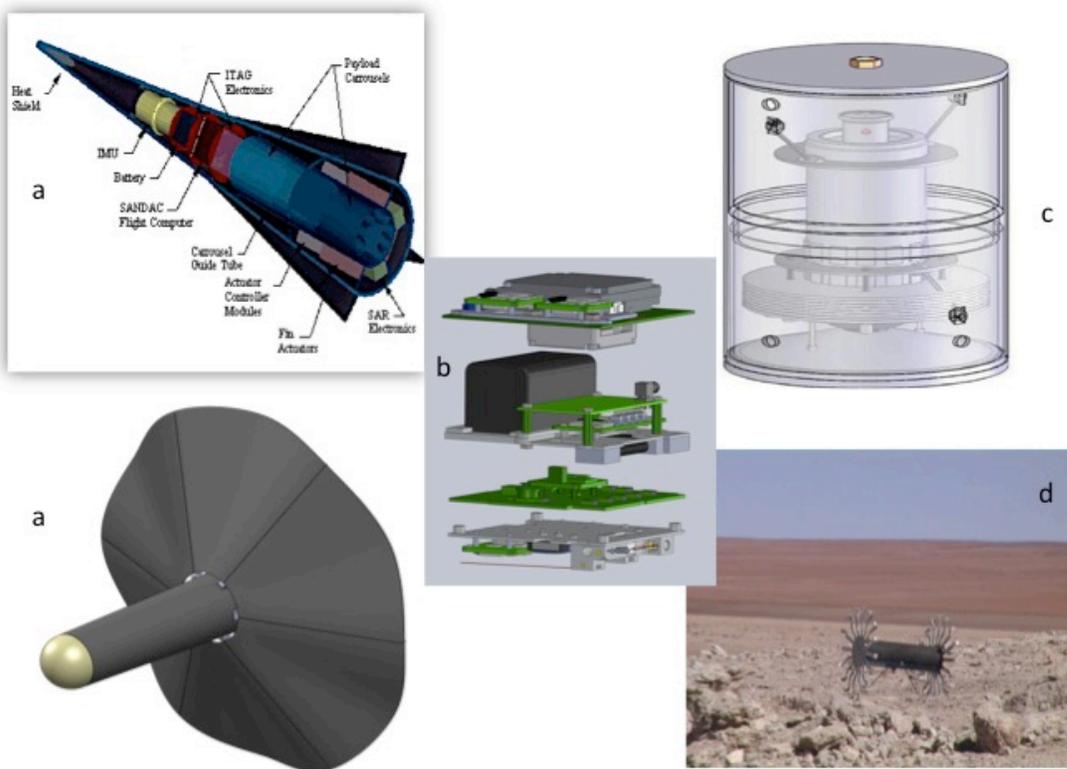


Figure 1. a) Examples of entry systems for future exploration (‘ultra-light’ and ‘ultra-precise’), b) The development of reconfigurable rad-hard avionics (Space Plug and Play architecture, or SPA) and related transceivers, c) The development of small Radioisotope Power Sources (RPS), d) Small high-ground clearance rovers.

**References:**

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