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LOGISTICAL SUPPORT OF MARTIAN EVA OPERATIONS USING UNMANNED AERIAL SYSTEMS

Abstract

With the increased challenges that Extra-Vehicular Activity (EVA) will bring on the surface of Mars, reducing or eliminating the requirement of astronauts to navigate complex terrain in cumbersome environment suits will inherently translate into a risk-reduction strategy as comparatively high-risk and fatigue-inducing activities are avoided. From our experience on Earth, it is also being increasingly routinely demonstrated that Unmanned Aerial Systems ('drones') can excel at delivering generic payloads and emergency lifesaving medical equipment to persons who are otherwise physically-isolated by the environment. Strong parallels clearly exist between human-drone partnerships on Earth and for future applications on the surface of Mars, and this paper thus explores the engineering requirements, limitations, as well as operational and practical considerations of using Unmanned Aerial Systems for the logistical supply of astronauts on EVA on the surface of Mars.

By reviewing relevant aspects of UAS engineering and specific environmental challenges unique to both UAS and human operations on Mars and contrasting those to emergent requirements from mission design, the viability and appropriateness of using drones in such a manner are shown to be heavily dependent on individual mission design, system topology, safety-related imperatives, and additional considerations.