Using Wind Driven Tumbleweed Rovers to Explore Martian Gully Features

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Gully features on the slopes of numerous Martian crater walls, valleys, pits, and graben are of particular interest because of their apparent young age and the potential association with liquid water. The overarching question pertains to the formation mechanism responsible for creating these gullies. Specifically, we seek to determine the agent of erosion and the source of the erosional agent. Several mechanisms for gully formation have been proposed, including: liquid water aquifers (shallow and deep), melting ground ice, snow melt, CO_2 aquifers, and dry debris flow.

Observational tests have been conducted using remote sensing data gathered by three instruments aboard the Mars Global Surveyor spacecraft (instruments include the Mars Orbiter Camera (MOC), the Mars Orbiter Laser Altimeter (MOLA) and the Thermal Emission Spectrometer (TES)). These results indicate that the most likely erosional agent is liquid water; however, debate concerns the source of this water. The observations favor a liquid water aquifer as the primary candidate and because the current strategy in the search for life on Mars is to "follow the water" these areas are of primary interest for conducting additional in situ investigations.

A new vehicle known as a Tumbleweed rover could potentially conduct in-situ investigations in the gullies which are currently inaccessible by current conventional

rovers. Deriving mobility through use of the surface winds on Mars, Tumbleweed rovers would be lightweight and relatively inexpensive, allowing multiple rovers to be deployed in a single mission.