MARS ROVING: MAKING TRACKS, LEAVING FOOTPRINTS, FEATHERING ABOUT, OR DRAGGING YOUR SNAKE?

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The challenges of designing and operating robotic vehicles with which to explore an appreciable area of the surface of Mars are explored. Two major problems may be identified, the first of which (power supply) may seem simple, but is in fact a limiting factor in most potential designs.

The second problem is autonomy: how to build a robot that is at least semi-autonomous, given the radio travel time from Earth to Mars. Martian rovers to date have employed wheels, although a naive view might be that a legged vehicle would be advantageous for navigating rough terrain. Considerations of the escalating permutations and combinations of possible gaits and footfall sequences with an increasing number of legs, coupled with the need for static stability, imply that a hexapod or octopod would require very powerful programming if it were to be able to move autonomously in a stable, pre-planned way. An alternative which has been advocated and trialled is the opposite: copy the cockroach and don't think about it at all. This, however, is a high-risk approach that would require the deployment of large numbers of necessarily small and therefore low-capability rovers if it were to be used for Mars exploration.

Rather than wheeling or perambulating over the surface, a wide area might be surveyed in far more detail than possible from orbit by making use of the Martian atmosphere: hence heavier-than-air (Mars planes, or entomopters) or lighter-than-air (balloon-borne) vehicles. The design and deployment of such systems on Mars would be quite different to the situation on Earth, as will be briefly reviewed.

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