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COMMENTARY

Other Worlds

Aerial reconnaissance of Mars is being revisited

As NASA mission planners wait with bated breath for the Mars Science Laboratory to scream into the Martian atmosphere at hypersonic speed on Aug. 5, deploy its braking parachute, fire its retro-rockets and lower the Curiosity rover by tether to a soft landing, thoughts are again turning to exploring the red planet from the air.

If the $2.5 billion mission succeeds, Curiosity is expected to make the most detailed in-situ assessment yet of the planet's habitability, but it will range just 5-20 km (3-12 mi.) from the landing site over the course of a Martian year—less than the distance driven by the still-functioning Opportunity rover and a speck on the unexplored surface of the 6,790-km-dia. planet.

Unmanned aircraft would bridge the gap between the detailed, but limited-area, measurements by surface rovers and the global, but low-resolution, observations by Mars orbiters. Airborne missions have been mooted on and off for decades, but held back by the challenges of navigating and communicating on Mars, not to mention the planet's thin atmosphere, high winds and giant dust storms.

But the idea of aerial reconnaissance may be making a comeback, as my colleague Mark Carreau reports from the NASA Mars Program Planning Group workshop in Houston. At the three-day gathering, which was held to help replan the exploration strategy after deep budget cuts, proponents presented plans for hypersonic and slow-moving UAVs, ultralights and balloons.

University of Maryland researchers have perhaps the most intriguing proposal: a rocket-powered, low-drag orbiter, modeled after the hypersonic X-43, that would periodically dip into the atmosphere to altitudes of 60-100 km. There, it would release one of 25 deployment modules, each carrying 15 smaller "explorers." After deploying an inflatable aerodynamic decelerator and ejecting the miniature air vehicles, the radioisotope thermal generator-powered module would land to record and relay atmospheric data collected by the explorers as they flutter to the ground like maple seeds.

In another swarming concept studied by Ohio Aerospace Institute, Georgia Tech and NASA Glenn Research Center, small dragonfly-like entomopters would conduct close-to-the-surface exploration and sample acquisition using a lander or rover as a forward base to offload data and recharge or refuel. With 1-meter-span (3.3-ft.), solar-cell-covered wings, the vehicles would take off and land vertically, fly slowly and maneuver easily.

NASA CONCEPT

The "gas hopper" proposed by Robert Zubrin, president of the Mars Society, would collect carbon dioxide from the Martian atmosphere to use as propellant to boost the ballistic or winged vehicle between sites 10-20 km apart, carrying a ground-penetrating radar to search for subsurface ice. After landing, the vehicle would release a microrover to explore the local area while it collects CO_2 for the next "hop."

There are several proposals for balloons as secondary payloads on Mars rovers. Global Aerospace's Directed Aerial Robot Explorer would lift a gondola with 10-20 kg (22-44 lb.) of scientific instruments from the proposed Pegasus rover and be guided through the atmosphere rather than simply drifting with the wind. A superpressure balloon similar to the Soviet Vega missions to Venus would float at an altitude of 5-6 km after aerial deployment and inflation upon arrival at Mars.

Two flyer concepts that competed to be Mars Scout missions, but were not selected, continue to be matured and would be ready for launch in 2018, their backers say. One is NASA Langley Research Center's Ares (see photo), a rocket-powered UAV that would be deployed directly into the Martian atmosphere. Unfolding of the vehicle was demonstrated in 2002 with release of a half-scale prototype from a balloon at 100,000 ft., a density equivalent to Mars.

The other is an electric-powered rotary-wing VTOL UAV studied by NASA Ames Research Center that could be deployed from a lander or in mid-air, from a descending atmospheric entry vehicle. The aerial platform is "going from the lunatic fringe to conventional wisdom," says Ames engineer Larry Lemke. "[But] it has to compete its way into the program, to justify that it's costs are better than other ideas."