BOOKS & ARTS

The rovers' tale

How NASA scientists overcame the odds to find signs of water on Mars.

Roving Mars: Spirit, Opportunity, and the Exploration of the Red Planet

by Steve Squyres

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Roving Mars is a deftly and dramatically written history of the Mars rovers, Spirit and Opportunity. It is also a primer on how to do exotic geology at a distance of 100 million miles using robots. Steve Squyres knows how to render scenes and intricate technical detail to build tension, without losing sight of the thrill and grind of the groundbreaking work.

"Eleven years had passed since I had started trying to send hardware to Mars, and in all that time I hadn't seen a single plan for Mars exploration survive for more than about eighteen months before there was some sort of cataclysm," writes Squyres. Chief among these was the loss of the 1999 Mars Climate Orbiter: "The Mars program had become so screwed up that nobody had caught a high-school mistake like mixing up English and metric units."

NASA doesn't escape criticism over the rover mission either. According to Squyres, NASA's rules meant that "cutting corners and taking chances" were the Jet Propulsion Laboratory's only management tools. After the losses of the Climate Orbiter and the Polar Lander, Squyres' team had 34 months to try for Mars again — six months too little, by the usual rules.

They proposed twin rover missions. A team member advised him: "Our top three problems are schedule, schedule and schedule. There's nothing in fourth place." The Polar Lander failed because NASA broke an old rule: "Test as you fly, fly as you test." So the 2003 team set out to test everything and put every design aspect through fresh trials. But NASA gave them more problems, wanting to send only one rover. As Squyres shows — with a novelist's dialogue skills, quoting from meetings and arguments — this idea "doubled our risk and cut our science in half" because it removed the advantage of flying to two very different locations.

Squyres' account also captures the emotions involved: "I do my best to play the steely-eyed space explorer dude," but the first time he saw Spirit move, "crawling slowly forward over blue plastic mats on the high bay floor, it brought tears to my eyes."

Squyres' missions had enormous bad luck.

On a roll: during testing for manoeuvrability in the lab, the rovers overcame a series of obstacles.

The team had to trim experiments and patch problems right up to the launch date. The largest solar flare ever recorded erupted during their flight. The team got spooked, even after Spirit's successful landing at Gusev Crater. For the second landing, many people, including Squyres, wore the same outfit they wore for the first one. "We may be feeling looser than we did last time, but we still need all the good mojo we can get."

Yet both missions succeeded, and the rovers, engineered for a 90-day mission, are still on the go now after more than 500 days in action. Opportunity ("the glamour rover") even landed in a small depression, Eagle Crater, its first pictures showing true bedrock — what Squyres describes as "a three-hundred-million-mile interplanetary hole in one".

Then came the grind of moving the rovers on a martian day schedule and coaxing pictures from the software: "I love these rovers, but damn, they're slow." It takes them a full martian day to do a simple task that a human explorer on Mars could do in a minute. The drama came as a result of hard work, the long march of rovers across rugged terrain. Moving at a few tens of metres a day, the rovers sought

signs of ancient surface water and found it, principally in the 'blueberries' that proved to be haematite, a mineral often formed in the presence of water. Then the rovers reached 140 metres a day and exceeded their engineering lifetimes. Cross-laminated ripples told the research team that Opportunity had found clear signs of layered terrain laid down (perhaps "in a ruby red sea under a pink Martian sky") by flowing water, and now sealed in the geological record. Spirit later discovered layered terrain with clear signs of layered deposition and erosion by water. These findings confirmed the growing view that a warm, wet early Mars was a plausible site for life.

Squyres shows both management skills and an eye for the far horizon, an unusual combination. More geology can be done, but he implies that biology is the next challenge. He concludes: "There are many things I could wish for our rovers, but in the end, there's only one thing that matters. What I really want, more than anything else, is boot prints in our wheel tracks at Eagle Crater."

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