Microwave Rocketry

Beamed power could create a low-cost paradigm for access to space

Humans have been riding rockets into space for more than 50 years, and for all that time, the cost of reaching orbit has remained astronomical—$5,000 to $50,000 per kilogram, depending on which rocket is used. The problem is that *none* of our rockets is very efficient. About 90 percent of a rocket's weight is fuel and propellant, leaving little room for payload. If it could lose some of that weight, a rocket could lift more cargo, reducing the cost of putting a given kilogram of stuff into orbit.

In 1924 Russian scientist Konstantin Tsiolkovsky proposed a way to make this happen, suggesting that beams of microwaves from ground-based transmitters could power a rocket's ascent. Tsiolkovsky proposed using parabolic mirrors to aim "a parallel beam of electromagnetic rays of short wavelength" at the belly of a rocket, heating propellant to produce thrust without the need for large amounts of onboard fuel. This, he wrote, was the most attractive method available "to acquire cosmic velocity." The idea languished until recently, when technology finally caught up with Tsiolkovsky's vision. Microwave lasers—masers—were invented in the 1950s, but it was not until the advent of better, more affordable generators called gyrotrons that masers could reach the megawatt-scale power levels required for space launches. Recent advances in batteries and other energy-storage systems have also made it possible to power sufficiently large gyrotrons without straining the electrical grid.

Today researchers around the world are investigating the concept, including Kevin Parkin, who led a pioneering study in 2012 while at the California Institute of Technology. Based in part on Parkin's work, one private company, Escape Dynamics, is now conducting tests to develop a microwave-powered, reusable system that could launch satellites—and eventually humans. NASA is taking notice: in July the agency added beamed rocketry to its road map for future technology development. —*Lee Billings*

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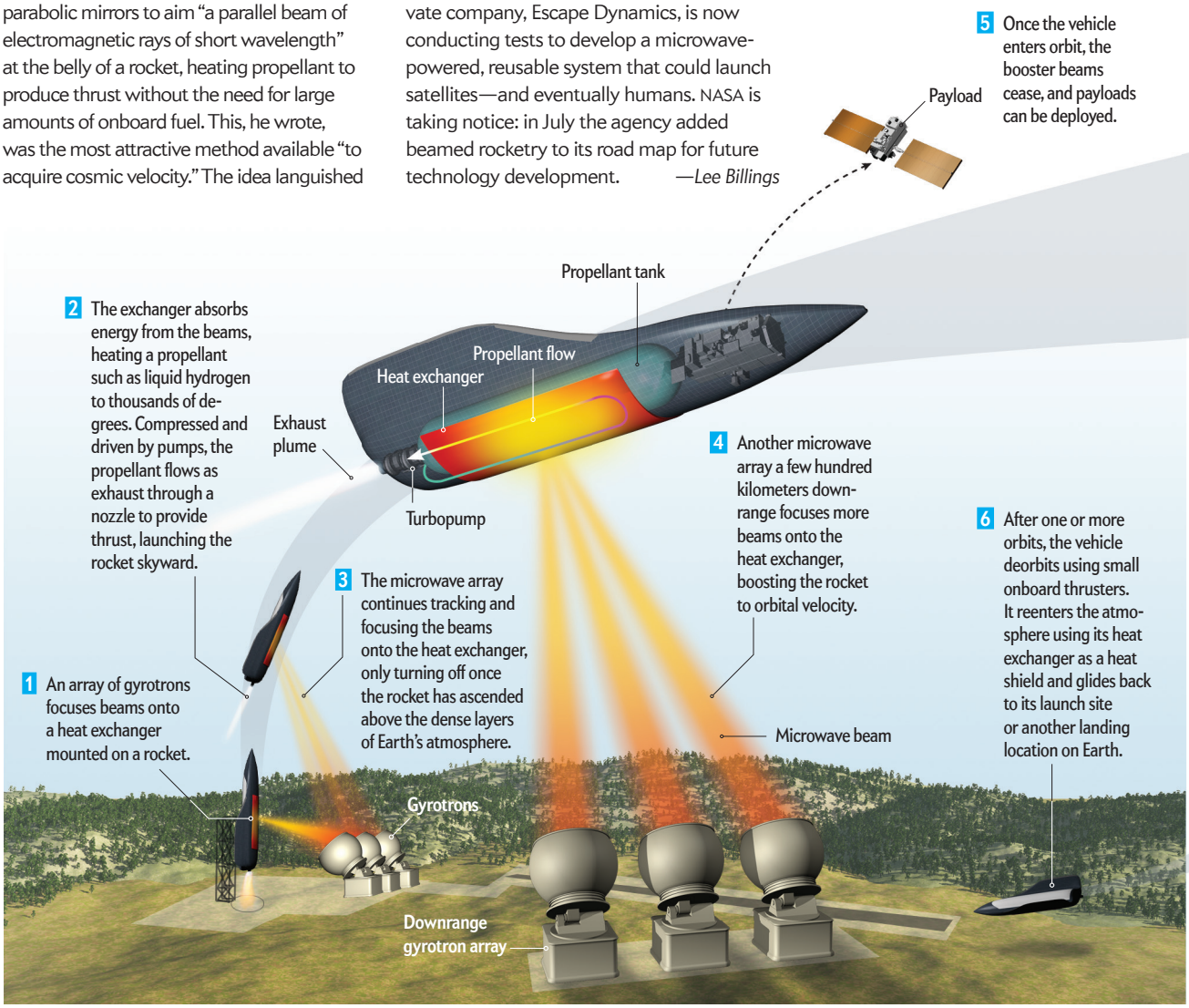

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