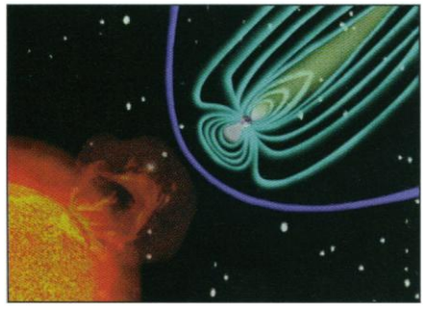
Propulsion for the Next Millennium

Scientists are about to begin laboratory testing of a device that could make it possible to propel a spacecraft out of the solar system for the first time. Funded by a $500,000, 2-year grant from NASA's Institute for Advanced Concepts, the device is called the Mini-Magnetospheric Plasma Propulsion (M2P2) system.

M2P2 is a pickle-jar-sized collection of solar cells and electric coils dreamed up by geophysicist Robert Winglee of the University of Washington, Seattle. It generates a small magnetic bubble filled with plasma—electrons and ionized atoms—and then electric fields in the coils shoot the plasma out of the cylinder. The charged particles in the plasma drag the field along with them and inflate a 33-kilometer-wide magnetic "balloon." The balloon would deflect ionized gases carried by the solar wind, which can blow at speeds approaching 3 million km per hour, driving the spacecraft forward in the same way sails deflect wind to push a sailboat. A 140-kg M2P2-powered spacecraft could achieve a top speed of more than 290,000 km per hour, estimates Winglee, fast enough to beat Voyager I out of the solar system despite the older craft's 22-year head start.



Futuristic propulsion system mimics magnetic bubble (above) created by solar energy bursts.

The idea for M2P2 came in part from Winglee's study of energetic solar outbursts called coronal mass ejections, in which the sun inflates a magnetic bubble and blows it across the solar system. "We just mimic a naturally occurring phenomenon on a smaller scale," he says.

The M2P2 proposal "is audacious in scope," says space propulsion expert Robert Forward, founder of Forward Unlimited, "but he [Winglee] has worked out the numbers to do it." If the laboratory tests go as planned, says Winglee, the first M2P2-powered craft could be built for an estimated $1.5 million and depart in 10 years. With a good battery, he says, M2P2 could go to 70 astronomical units, or slightly more than twice the distance to Pluto.

More Criticism for EPA

What may be the most thorough dissection ever of how the Environmental Protection Agency (EPA) uses science to make decisions concludes that the agency's recent attempts to mend its ways still fall short. Agency officials have been stung by the new report—partially paid for by EPA—which Office of Research and Development chief Norine Noonan, in a staff memo, called "naïve" and guilty of "flawed analysis."

The 433-page report by Mark Powell of Resources for the Future (RFF), a Washington, D.C., think tank, meticulously picks apart eight regulatory decisions over the past 2 decades, drawing on interviews with more than 100 people. It says the science behind the policy gets watered down and often has little to do with how a decision is made. "EPA for a variety of reasons is unwilling, unable, and unequipped to address and acknowledge the uncertainties in the underlying science," Powell says.

The report covers a plethora of issues that EPA administrator Carol Browner has been trying to address, so far with mixed success. For example, EPA has beefed up its extramural grants, but the RFF report concludes that that has led to research irrelevant to the agency's regulatory needs. "The sort of important but perhaps routine or nonexciting research doesn't get done," such as synthesizing data or screening methods for endocrine disrupters, says Powell, who calls for a near doubling of the research budget. The report also faults Browner for failing to appoint a science adviser. "In general, scientists have little stature and power within EPA," it says.

Noonan said the report "does not reflect the current reality of science ... at the agency." The "only good news," she added, is a brief report that came out the same day (18 August) from the National Research Council that praises EPA for its research program on airborne particulate matter.

Vintage Spacewear

This orange nylon suit, complete with leather gloves and boots, is expected to fetch up to $250,000 at a Christie's auction on space exploration, to be held 18 September in New York. Billed as the world's first orbital space suit, it was one of nine used in 1960 for training the Soviet Union's Vostok I cosmonauts. Other items include a piece of James Irwin's space suit from Apollo 15 covered with lunar dust ($90,000), a length of window seal from the Apollo 14 command module signed by Edgar Mitchell ($2500), and a page containing 2 hours of the Apollo 11 flight plan ($4000). (For more, see www.christies.com)

Beetles as Sharpshooters

For centuries, bombardier beetles—so cleverly designed that creationists have cited them in arguments against evolution—have been known for the explosive, hot discharges they release when harassed. Now two Cornell entomologists have pictures showing how they do it. The beetles defend themselves with a binary chemical weapon: Glands in their rear ends hold chemicals that heat to the boiling point when mixed. To find out how well they aim, Thomas Eisner and Daniel Aneshansley tethered some African specimens, *Stenaptinus insignis*, from wire hooks and photographed them as they teased them with forceps. The photos, showing beetles' high-precision targeting, appear in the 17 August *Proceedings of the National Academy of Sciences*.

CREDITS: (TOP LEFT) UNIVERSITY OF WASHINGTON, SPACE PROPULSION; (TOP RIGHT) CHRISTIE'S IMAGES LTD., 1999; (BOTTOM) T. EISNER AND D. ANESHANSLEY