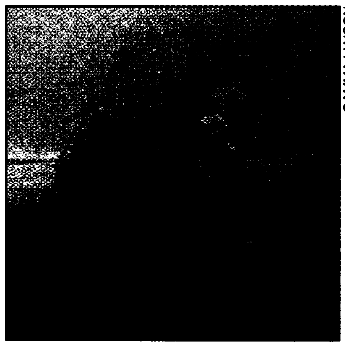
LAUNCHERS

Europe Set to Try Again With Ariane 5

Space scientists and engineers across Europe are waiting anxiously as ground crews at Europe's spaceport in Kourou, French Guiana, make final preparations for a second attempt at lofting Europe's new heavy-lift launcher, Ariane 5. The flight, now scheduled for 28 October at the earliest, will be the acid test of fixes made to Ariane 5's software after it veered off course and self-destructed on its inaugural flight last year (*Science*, 14 June 1996, p. 1579).

Europe has a lot riding on Ariane 5. The launcher is planned to be the workhorse for Europe's space telecommunications industry, and the European Space Agency (ESA) plans to use it for some important future science missions, such as the X-ray Multi-Mirror satellite in 1999 and the FIRST and Planck telescopes, which will begin surveying infrared and millimeter wavelengths around 2005. Last year's disaster destroyed the $600 million Cluster mission—a suite of four spacecraft for mapping Earth's magnetosphere—and put a severe strain on ESA's science budget. Researchers cannot afford a repeat performance.

Ariane 5 can loft 23 tons into orbit, compared with the shuttle's 29.5 tons, and 5.9 tons into high-altitude geostationary orbit. It was designed principally to cater to the trend toward larger commercial satellites, says André van Gaver, head of Ariane 5 programs at ESA. Because geostationary orbits are becoming more congested, he says, communication companies are cramming more and more transponders onto their telecom satellites, resulting in "a significant increase in the weight of geostationary satellites."



GAMMA LIAISON

Second time a charm? Researchers hope Ariane's next flight won't go the way of the first.

The blame for last year's disaster was pinned on software derived from a program used on Ariane 4, Ariane 5's predecessor, that could not cope with the flood of data from the new launcher's inertial guidance system. The fault has now been corrected and all of the launcher's software thoroughly checked. "We have made a global survey of all the software at all levels," says van Gaver.

ESA has learned its lesson and is not putting a valuable scientific payload on this second launch. It will carry two dummy satellites, Maqsat A and Maqsat B, which will simulate a real payload and record vibrations and other parameters to help make future satellites strong enough to withstand launch. Its main scientific cargo will be a $700,000 package of five experiments called TEAMSAT, designed and built in 7 months by ESTEC, ESA's technology center in the Netherlands, with the involvement of students in Spain and the Netherlands. One of the experiments, the Young Engineer's Satellite (YES), will be ejected from TEAMSAT to carry a global positioning system (GPS) receiver into geostationary orbit to see if it can get a fix on its position from the armada of low-altitude GPS satellites. Engineering student Martin van der Pol of Delft University in the Netherlands, who is writing a degree dissertation on the YES satellite, is hopeful about Ariane 5: "I've seen her in Kourou and she looks great; I'm sure it will be a success." A lot of space scientists and telecommunications engineers are hoping he's right.

–Alexander Hellemans

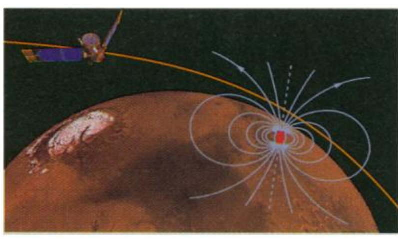
Alexander Hellemans is a writer in Naples, Italy.

PLANETARY SCIENCE

Mars Has Magnetic Spots

Last month, the Mars Global Surveyor (MGS) created a bit of a mystery when it went into orbit around the planet and promptly detected a weak magnetic field (*Science*, 26 September, p. 1924). Did Mars still have a churning core of molten iron like the one that generates Earth's magnetic field? Or might the Mars field instead have been imprinted on the planet before its internal dynamo wound down?

Last week, MGS researchers announced that the martian interior must be magnetically dead. "Mars once had a strong global field, but that field is now gone," says MGS magnetometer team member John Connerney of NASA's Goddard Space Flight Center in Greenbelt, Maryland. Instead, what MGS detected last month is one of many smaller magnetic fields resembling giant bar magnets embedded in the outer crust of Mars. These fields seem to be remnants of an ancient global field that froze into spots in the crust, perhaps where magma cooled and solidified billions of years ago. "We hope to use these magnetic anomalies to go back in time and reconstruct the early history of Mars," says Connerney.



SOURCE: GSFC/NASA

One of many. MGS found numerous magnetic anomalies sprouting from the crust of Mars.

That MGS is mapping crustal magnetic anomalies at all is an unintended benefit of NASA's "faster, better, cheaper" approach to planetary exploration. In order to limit the amount of rocket fuel it needed to carry, MGS is using atmospheric drag near the low point of its highly elongated orbit to slow it down into a circular, 380-kilometer-high orbit. During five such aerobraking passes, it skimmed low enough—as low as 110 kilometers—for its magnetometer to pick up signs of at least eight or nine patches of magnetization, each a few hundred kilometers in size. "It appears the crust of Mars is littered with magnetic anomalies," says Connerney. The strongest field measured by MGS was 400 nanoteslas—far short of the 30,000 nanoteslas of Earth's global field at such altitudes. Still, Connerney says, the strongest martian field "dwarfs any magnetic anomaly measured by satellites at Earth or the moon."

On Earth, and presumably on Mars, magnetic anomalies rooted in the crust are remnants of the core-generated field. When magma solidifies within the crust or on the surface, the new rock locks in whatever magnetic field the core dynamo was generating at the time. The martian anomalies may be stronger than those on other bodies, says planetary physicist David Stevenson of the California Institute of Technology in Pasadena, because martian magma may be richer in the iron mineral magnetite, which is what actually captures the field.

Researchers now want to try to link the newly found records of Mars's ancient field with geologic features on the planet's surface to piece together a story about how the once active Mars became senescent. "To me, the exciting thing now is that we have a tool for learning something about the history of Mars," says Stevenson. Indeed, the MGS team can already see that some anomalies record fields with opposite orientations, suggesting that the martian field, like Earth's, flipped from time to time. The martian interior may be magnetically dead, but the postmortem should prove interesting.

–Richard A. Kerr