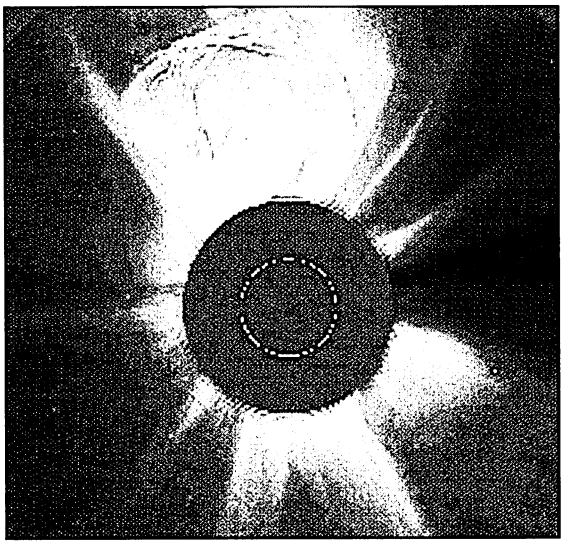


Angry star. A new technique that reveals magnetic disturbances on the far side of the sun may give 2 weeks' advance warning of major solar storms, such as this massive ejection of gas on 27 February.

CREDIT: SOHO/LASCO CONSORTIUM/ESA/NASA

site SOHO's vantage point on 28 and 29 March. Sure enough, the travel times of certain waves sped up by about 6 seconds on those days—a mere hiccup during their 3.5-hour journeys from the near to the far side, but enough to create a splotch in the acoustic signatures. Many such analyses over the face of the sun allowed the team to construct a fuzzy hologram of the hidden plage, which covered 300 square degrees of the sun's surface.

That's a gigantic swath, but the technique can't yet visualize anything much smaller than 100 square degrees. "We're working on improving our resolution, but the larger regions are exactly the ones of most interest to space-weather forecasters," says Braun, who now works at Northwest Research Associates Inc. in Boulder. The method can detect active regions within about 50 angular degrees of the center of the sun's opposite face, Braun notes, although he is now devising ways to extend the analysis to areas near the edge of the far side.

Indeed, researchers at the Space Environment Center often see huge plages rotate into view on the sun's eastern limb "angry and ready to explode," says Hildner. That gives the forecasters no more than a week's warning before the regions may take aim at Earth with a barrage of flares and coronal mass ejections, huge belches of plasma laced with magnetic fields. Solar physicists are still struggling to understand which plages will erupt and which outbursts will affect Earth once they arrive (*Science*, 24 December 1999, p. 2438). Even so, another week of advance warning may help electrical utilities or satellite operators plan for possible disruptions and put key instruments into a safe mode. "If this technique can reveal which active regions are growing in magnetic strength as they cross the far side of the sun, that's enormously promising," Hildner says.

Protecting humans in space may be the greatest benefit, especially with astronauts due to spend thousands of hours on spacewalks during the next decade to assemble the international space station. With far-side monitoring, "we probably will be able to give a general 'all-clear' notification that we see no evidence of big active regions for the next 2 weeks or so," says William Wagner, discipline scientist for solar physics at NASA headquarters in Washington, D.C. However, such an alert system would require continuous listening and rapid analysis of the sun's acoustic symphony. That may fall to the next generation of solar satellite beyond SOHO or to a ground-based helioseismic network now being upgraded: the Global Oscillation Network Group, appropriately known as GONG.

–ROBERT IRION

PLANETARY SCIENCE

Buried Channels May Have Fed Mars Ocean

A team of geophysicists may have found a missing link in the growing body of evidence that Mars once had a major ocean. On page 1788 of this issue of *Science*, researchers analyzing gravity data from the Mars Global Surveyor (MGS) spacecraft report that they have detected a system of now-invisible, buried channels that delivered water from Mars's southern highlands into the northern lowlands billions of years ago. If they're real, these channels "greatly increase the chances of an ocean" on early Mars, says geophysicist Norman Sleep of Stanford University. But MGS geophysicist Roger Phillips of Washington University in St. Louis warns that "whatever it is, it's going to be tough to test."

Signs of an early ocean on Mars have been accumulating for years, but the evidence has been far from conclusive. First, geologists spied hints of a shoreline around the northern lowlands in 20-year-old Viking images, although preliminary analysis of more detailed MGS images has failed to confirm them. Then, after MGS topographic measurements showed the northern lowlands to be the flattest, smoothest known surface of broad extent in the solar system, planetary geologist James Head of Brown

ScienceScope

Bright Idea Indian researchers could soon share in the fruits of their labors. The Indian government last week presented Parliament with a budget proposal that would give institutions full intellectual property rights to ideas developed with public money and allow inventors to share in any profits.

The $2.8 billion R&D budget, which gives a 20% boost to civilian research and an 11% increase to military science, would reverse existing rules that allow funding agencies to patent discoveries but cut universities and scientists out of any royalties. Asis Datta, vice chancellor of New Delhi's Jawaharlal Nehru University, says the new policy could be just what "universities need to unleash their creative potential." Parliament is expected to approve the change later this year.

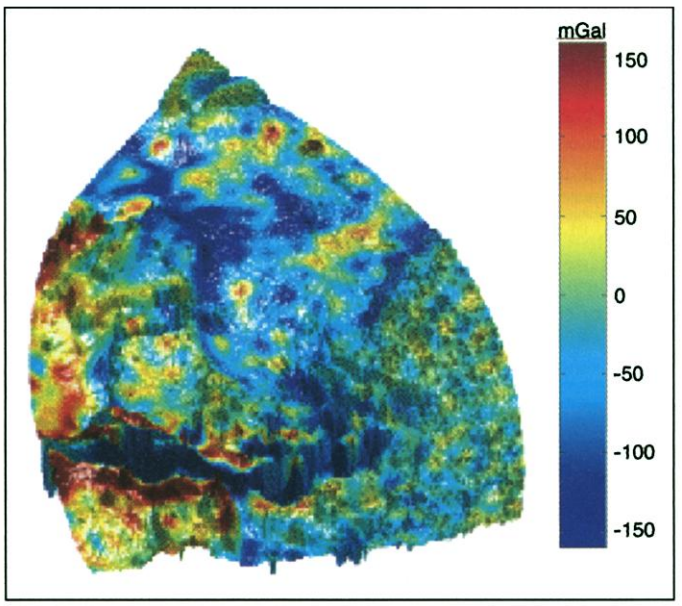
Warming to Hot Zone After months of delay, Canada is preparing to open its borders to some of the world's most dangerous pathogens. Last week, a community panel endorsed a plan for the Canadian Science Center for Human and Animal Health in Winnipeg to open a biosafety level 4 lab.

Shortly after the center's dedication last summer (*Science*, 18 June 1999, p. 1902), officials admitted to accidentally releasing waste water into the city sewage system without properly heating it to kill germs. A review concluded that the release posed no threat, but riled neighbors caused the government to delay issuing a permit to work with high-risk level 4 pathogens, such as the Ebola virus. To restore confidence, the lab invited local residents to join a new community liaison committee, which gave the lab's safety procedures a green light on 2 March. A thumbs-up from the government is expected shortly.

Choices, Choices After a 13-month search, the Department of Energy's Pacific Northwest National Laboratory in Richland, Washington, has named Lura Powell, a former administrator at the National Institute of Standards and Technology, as its new director. The choice pleased DOE Secretary Bill Richardson, who last fall reportedly derailed the lab's first choice, saying lab contractor Battelle had not tried hard enough to find a woman or minority to fill the post. Similar concerns have stalled the search for a new leader of DOE's Argonne National Laboratory in Illinois.

Contributors: Jon Cohen, David Malakoff, Pallava Bagla, Martin Enserink

University and his colleagues marshaled a variety of MGS images and topographic data to suggest that the lowlands resemble an ocean basin that has been at least partially filled with water (*Science*, 4 December 1998, p. 1807, and 10 December 1999, p. 2134). But where would the water have come from? Catastrophic floods gushing toward the northern lowlands clearly cut deep channels into the edge of the southern highlands, but they would have been too infrequent and too small to have created and maintained an ocean in the freezing cold of Mars. And there's no sign of a Mississippi or Nile river that carried enough water to fill the lowlands.



Deep blues. Gravity lows (blues) leading northward from the long gouge of the Valles Marineris (bottom) may reveal buried channels.

The new gravity data from MGS may provide the answer. The varying pull of gravity from place to place on Mars causes MGS to bob up and down, motions that show up as Doppler frequency shifts in the spacecraft's radio transmissions. After accounting for gravity variations due to the undulating surface—the extra mass of volcanoes and the dearth of mass over deep basins—the remaining variations can be attributed to variations in subsurface density. The deeper the crust extends into the denser mantle or the deeper sediment fills a channel in the denser crust, the lower the gravity.

On a broad scale, MGS gravity has revealed a thinned crust beneath the northern lowlands, a sign of early plate tectonic–like processes on Mars (*Science*, 14 January, p. 218), but on a finer scale it shows a pattern that geophysicist Maria Zuber of the Massachusetts Institute of Technology and her MGS team members suggest marks a system of now-buried channels. Narrow zones of lower gravity extend from two clearly visible major flood channels—those leading from the Valles Marineris and Kasei Vallis into Chryse Planitia, the plain where the Viking 1 lander still sits. Doubting that the martian crust just happened to thicken along narrow zones that run out from two major flood channels, Zuber, Phillips, and their colleagues attribute the lower gravity to channels cut early in martian history filled with sediment less dense than crustal rock. And these channels are big: 200 kilometers wide, thousands of kilometers long, and at least 1 to 3 kilometers deep.

Such size "indicates that these outflows brought an awful lot of water to the lowlands," says Zuber, as well as a lot of sediment. The putative buried channels extend northward past the end of the flood channels at about 30°N, past the last signs of surface flow now put at about 45°N in MGS topography, to as far north as 75°N, which is well into the North Polar Basin. "You need a huge amount of sediment deposited in the northern part of Mars" to bury the channels, says Phillips. Presumably the sediment would have been carried by an equally huge amount of water.

Oceans of water in the first eon of martian history "may very well be correct," says Sleep. "The explanation they offer is a perfectly reasonable one," agrees planetary physicist David Stevenson of the California Institute of Technology in Pasadena, but "the problem with gravity is there are always other explanations." MGS geologist Michael Carr of the U.S. Geological Survey in Menlo Park, California, would prefer one of those. The gravity lows are real enough, he says, but they could reflect some thickening of the crust rather than sediment-filled channels. "I'm very skeptical," he says, because the flow paths indicated by the buried channels do not follow "what you can see in the topography."

Phillips isn't yet ready to insist on the reality of buried channels. "They could be something else, I suppose," he says. "It's a difficult hypothesis to test." He and his colleagues will be doing their best by checking whether the buried channels could be sloping downward all the way north and whether the highlands could have supplied all the sediment that the buried channels imply.

–RICHARD A. KERR

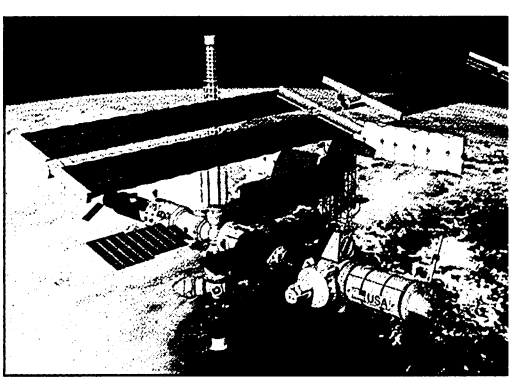
SPACE STATION BIOLOGY

Panel Says NASA Must Show Results—Fast

NASA should pull the plug on efforts to grow crystals in space unless it can show better results from its investment. That stern advice comes from a National Research Council (NRC) panel in a report (www.nap.edu/books/NI000245/html) that takes a critical look at the agency's oft-repeated scientific rationale for building the $100 billion international space station: using a microgravity environment to produce new crystals and to better understand cell growth in microgravity.

NASA spends nearly $20 million annually on cell science and protein crystal growth, which will shift to the space station in the coming years. But the NRC panel said that significant changes are needed to warrant continued support for crystallography. Reviewing years of work on the U.S. space shuttle and the Russian space station Mir, for example, the panel concludes that "one cannot point to a single case where a space-based crystallization effort was the crucial step in achieving a landmark scientific result." The panel also takes NASA to task for not dealing adequately with the perception that the agency is "not really interested in input from outside" in running its research program.

Eugene Trinh, the new NASA microgravity sciences chief, accepts much of the criticism but says the agency already is addressing most of the issues raised. "We're way ahead of this report," says Trinh, a former fluids researcher at NASA's Jet Propulsion Laboratory in Pasadena, California.



Weighty criticism. NRC panel says some microgravity studies need rethinking.

CREDITS: (LEFT TO RIGHT) ZUBER *ET AL.*; NASA

Protein crystals serve as a foundation for much basic science in biology as well as drug development, and the near-complete absence