Earth Science

NASA faces problems with satellite data

Starting in 1998, NASA will launch an armada of expensive satellites designed to monitor the Earth's health through the beginning of the next century. But this program, called the Earth Observing System (EOS), may suffer severe setbacks because NASA is not preparing adequately to handle the flood of data coming from the satellites, report investigators from Congress' General Accounting Office (GAO).

During its 15-year lifetime, EOS could collect roughly 11 million gigabytes of data – more than 1,000 times the information stored by the Library of Congress. NASA is currently devising the EOS Data and Information System (EOSDIS), a nationwide computing system that will process, store and distribute EOS information to the estimated 10,000 researchers and other users around the world who will want access to it.

For years, NASA has come under fire for the way it manages data. Critics have charged that the agency spends millions to send a probe into space and then fails to archive the information collected during the mission. In preparing for the EOS program, NASA sought to avoid repeating past mistakes by designing a revolutionary system for handling and disseminating data. The agency plans to spend $3 billion on EOSDIS by the turn of the century – that's more than a quarter of the total amount slated for the EOS project during that period. Last year, an engineering board reviewing NASA's plans called EOSDIS "the largest data and information system contemplated by this nation."

Yet NASA is currently not performing the work necessary for creating a successful EOSDIS, the GAO charges in its report, issued last month. In particular, the space agency has not devoted enough funding or attention to building prototypes of critical EOSDIS elements. At the same time, NASA has not made sufficient efforts to develop the new computing technologies that will prove essential for EOSDIS, according to the GAO. "NASA is running an unnecessarily high risk that EOSDIS may not meet future global change research needs and may need costly modifications to be useful," the GAO investigators conclude.

Rock slide under the waves

The deep sea is not as quiet as it may seem. Oceanographers surveying the volcanic mountain range running down the center of the Atlantic basin have discovered the remains of a massive underwater avalanche that surpasses in size any landslide in recorded history.

The bathymetric survey reveals a large scar on the side of the mid-Atlantic ridge at 26.5° N latitude, about 3,000 meters below the surface of the ocean. The mountainside apparently gave way and slid downhill at tremendous speed, running up and over a smaller ridge farther down the slope in a matter of minutes, suggests Brian E. Tucholke, who reports the finding in the February GEOLOGY. This is the first evidence of a rock slide ever found in the rift valley of the mid-ocean ridge.

The avalanche carried about 19 cubic kilometers of rock, Tucholke estimates. By comparison, less than 3 cubic kilometers of rock moved in the landslide that sparked the 1980 eruption of Mount St. Helens.

Tucholke says the mid-Atlantic slide must have occurred sometime in the last 450,000 years. If it happened quickly, the avalanche could have spawned a wave 700 meters high. But by the time the wave reached the North American or African coastline, it would have dwindled to less than a meter in height.

In the past few years, oceanographers have found underwater rock slides far larger even than the example in the mid-Atlantic. An ancient slide discovered along the flank of a Hawaiian volcano measures approximately 5,000 cubic kilometers in size.

Science & Society

Microbes to sup at Superfund sites

By pairing two kinds of bacteria and adding a little sugar, environmental engineers have drafted a winning team for purifying contaminated groundwater.

Separately, these bacteria had proved too slow or ineffective at breaking down industrial carcinogens such as perchloroethylene (PCE), also known as tetrachloroethylene, and trichloroethylene (TCE). But then William Jewell and his colleagues at Cornell University decided to piggyback the efforts of these microbes. They built a two-stage "bioreactor" that looks a lot like a moonshine still.

In one chamber, they add sugar to bacteria that need no oxygen to survive. Fueled by this sweet stuff, the bacteria readily strip chlorine atoms from the carcinogens, producing vinyl chloride and methane. The reactor then shunts the vinyl chloride (a toxic gas), methane and oxygen to a second compartment, where bacteria consume the methane and degrade the vinyl chloride into water, carbon dioxide and chloride ions. "And we found that the second-stage system could use vinyl chloride [rapidly] like a rocket," says Jewell. This hybrid reactor can reduce the concentration of PCE in water from 10,000 parts per billion to less than 1 part per billion, safe enough for drinking, the researchers will report in an upcoming JOURNAL OF ENVIRONMENTAL ENGINEERING.

This cost-effective treatment system works fast, even in cool temperatures, and could travel in the back of a truck to contaminated areas designated as Superfund sites by the U.S. Environmental Protection Agency, Jewell adds.

This year, Westinghouse Savannah River Co. in Aiken, S.C., will build a pilot bioreactor capable of processing 40,000 gallons of contaminated groundwater a day.

Aerogels make cool insulators

Sometimes known as solid smoke, the ultralight materials called aerogels are showing promise as insulators (SN: 11/17/90, p.316). In fact, carbon-based aerogels made with resorcinol-formaldehyde can insulate better than any other material known, Xianping Lu of the University of Würzburg in Germany and his colleagues report in the Feb. 21 SCIENCE.

The researchers tested the insulating potential of several of these red, gossamer solids by placing a platinum wire through a small sample of each, passing an electrical current through each wire and then measuring how hot the wires got.

The results show that the aerogel consisting of 88 percent air conducts one-third as much heat as a typical polyurethane foam insulator. The aerogel's many tiny pores make it difficult for trapped air to move and carry heat away from the wire, says Richard W. Pekala, who helped develop aerogels at the Lawrence Livermore (Calif.) National Laboratory.

These materials could replace insulating foams made from chlorofluorocarbons, but first scientists must develop ways to make large quantities cheaply, Pekala notes.

Refiguring phone numbers

Telephone companies are running out of numbers. Now Bellcore, which conducts research for nine regional phone companies, has proposed broadening area-code possibilities and suggests that within the next 30 years everyone will have to dial 10 digits (the area code plus the number) when making calls, even local ones. Since 1947, the area code's middle number has had to be 0 or 1, which told the switching system that the dialer was making a long-distance call. But now just two of the 144 possible combinations of numbers remain. Putting 2 through 9 in that position creates 640 more combinations, according to Bellcore's Fred Gaechter. Bellcore, of Livingston, N.J., seeks comment through April 30 on the new plan, which covers the United States, Canada and 16 Caribbean countries.