

poration or institution to develop a huge "conceptual model" of the entire bight. This will be a guiding influence for the whole project, giving researchers in the study a way to step back and see how their individual results relate to the broad behavior of the area.

Merely gathering a lot of information about one locale is not difficult. Putting it together so that it means something is. So far the awesome management problems of the New York Bight study are being directly confronted by fewer than 10 people in NOAA's MESA office. "Don't quote me," says one oceanographer, "but I wouldn't try it. My God, what a headache!" □

Making Mars livable: An eternal spring

The human race is eventually going to need room to expand. Even with zero population growth the earth is likely to be too small for the rising expectations of its people. The only place to expand is elsewhere in the solar system, most probably the planet Mars. In a forthcoming issue of *ICARUS* (Vol. 19, p. 126) Joseph A. Burns and Martin Harwit of Cornell University tell how Mars may be made more habitable.

The method depends on a model of Martian behavior put forward by Carl Sagan, also of Cornell, called the "long winter model." The orbit of Mars goes through a precession cycle that lasts 50,800 years. During part of this period the north pole of Mars points toward the sun at perihelion; during another part the south pole points toward the sun at perihelion. There are parts of the cycle when neither pole points toward the sun at perihelion, and these are called "spring" for reasons which will appear.

Sagan developed his model to account for the apparent evidence of water erosion on Mars discovered by the Mariner 9 space probe. He supposes that during the "winter periods" a lot of ice, mostly carbon dioxide but with some water, is trapped in a large polar cap on the pole away from the sun. During the "spring," which lasts a few thousand years, the ice becomes vapor. This could cause a greenhouse effect with rising temperatures and the holding of an atmosphere as dense as the earth's. Under these conditions biological organisms might emerge from desiccated dormancy and begin to populate the planet.

The trick to making Mars habitable, propose Burns and Harwit, is to prolong the "spring" indefinitely. This is possible because the precession that causes the "seasonal" cycle is governed by two effects: one is the gravitational influence of the other planets; the other

is the gravitational influence of the sun. It turns out that if the solar part of the precession can be altered, the "spring" will remain.

The alteration can be accomplished by bringing enough mass near Mars and putting it into orbit around the planet to cause a countertorque. Burns and Harwit suggest using an engine driven by sunlight to bring the necessary mass to the proper place. The first candidate considered is the Martian satellite Phobos. But the mathematics indicates that Phobos won't work. The second suggestion is to get mass from the asteroid belt, either in the form of a ring or of a single object. The mass needed is less than one percent of the total mass in the asteroid belt and less than the predicted mass of 10 different asteroids.

It would take time to work out the technology, Burns and Harwit admit, and time to move the requisite mass. But there is time: The next Martian "spring" doesn't start for about 10,000 years. Finally Burns and Harwit make a bow in the direction of those who worry about the ecology of the solar system: "Although there is always something a little repugnant about man pushing his own interests and fixing nature, we believe that—of all possible ways to prolong the spring—the . . . scheme would do the least to directly damage Mars." □

Court releases sewage money

In the latest setback for the Administration over the impounding of congressionally appropriated funds, a Federal judge ordered last week the release of \$6 billion to help build municipal sewage-treatment plants.

U.S. District Judge Oliver Gasch of Washington, D.C., ordered the Environmental Protection Agency to release the funds immediately and begin allocating them to cities across the country. He also ordered that applications be accepted for an additional \$11 billion appropriated for the same purpose over the next two years.

The funds had been appropriated to help cities meet the 1985 goal of having no pollution dumped into the nation's rivers and streams. President Nixon vetoed the bill last October, explaining that "pressure for full funding under this bill would be so intense that funds approaching the maximum authorized amount could ultimately be claimed and paid out," thus stimulating inflation. Congress overrode the veto.

After the appropriated funds were impounded, New York City, and later Detroit, filed suit, claiming the remaining amount would "permit only a token start toward completion" of projects

that have already been approved.

Sen. Edmund Muskie (D-Me.), who had helped fight for the bill during its two rounds through the Congress, called the decision a victory "for the Congress, for the cities, for the American people and for clean water." EPA withheld comment. □

EPA relaxes SO_x standards

The Environmental Protection Agency last week relaxed the secondary emission standards for sulfur-oxide emission from smokestacks, scheduled to go into effect in 1976. Citing "new scientific data," the agency said the original standards had been set lower than necessary.

Primary standards, under terms of the Clean Air Act, are set for protection of human health and safety. Scheduled to go into effect in 1975, these standards were unaffected by last week's ruling. Secondary standards are intended to provide for "general welfare," and their levels have generally depended on damage to vegetation done by pollutants.

The new standards limit emissions to 3.5 parts per million for any three-hour period. The old standards had required concentrations of less than .02 parts per million during continuous operation.

EPA says the standards reduction should not affect most major cities since meeting the three-hour standard would also lower the average concentrations of pollutants. In rural areas, however, where most copper smelters are located, the agency admits it is uncertain of the ruling's effect. □

NCAR granted hail modification permit

The National Center for Atmospheric Research has been granted a permit by the state of Colorado to continue its five-year study of hail modification (SN: 3/20/71, p. 200). The cloud-seeding program began last spring, shortly before the adoption of the Colorado Weather Modification Act of 1972, which requires any such experiments, whether commercial or scientific, to obtain a state permit, which must be preceded by a public hearing. The hearing on the 1973 operations was held on March 29. This year, the aircraft that disperse the silver iodide seeding crystals just beneath the clouds for lifting by updrafts will be augmented by ground-launched rockets, and this should allow the crystals to be released directly within the clouds. □