Unifying and Dynamic Resource," that was meant to explain, in lay language, some of the recent exciting advances in several fields of mathematics. But it is written in what is a sort of layperson's lapidary style.

For example, the opening section, entitled "D-Modules," begins by defining the three broad general areas of mathematics and then starts discussing D-modules themselves in paragraph two: "Algebraic geometry has been one of the most lively areas of research in algebra during recent decades. It is the study of geometric objects that are the loci of points satisfying polynomial equations in two or more variables, such as the familiar cones from classical geometry." From there, the author quickly moves to define Lie groups. "A continuous symmetry group such as the latter example is called a Lie group. Lie groups can also be viewed as certain groups of matrices with their usual matrix multiplication."

This pamphlet, the mathematicians hope, will open the eyes of policy-makers to exciting and important advances in mathematics. ■ GINA KOLATA

EPA Approves Second Genetic Test

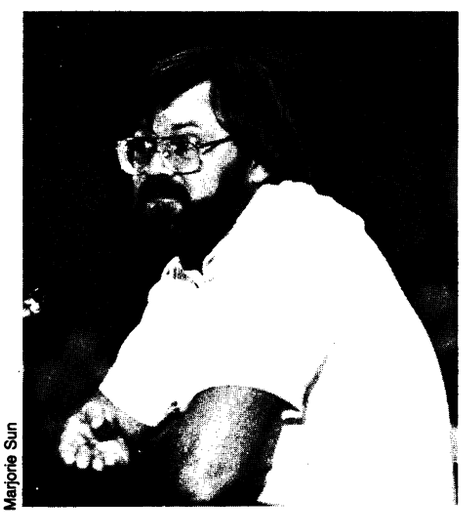
The Environmental Protection Agency recently approved a second experiment that will involve a field test of genetically engineered microbes designed to prevent frost formation on plants. However, local opposition to the test is brewing.

On 13 May, EPA granted permits to University of California researchers Steven Lindow and Nickolas Panopoulos to test altered strains of *Pseudomonas syringae* on potatoes at two sites at the school's research farm in Tulelake, Calilfornia, near the Oregon border. The bacteria normally secrete a protein that initiates the formation of ice crystals, but, in the modified strain, scientists have deleted the gene that codes for the protein. The permit allows the researchers to begin testing immediately and to conduct experiments over a 3-year period.

The test has some community support, but might eventually be blocked. The same day EPA gave the go-ahead to Lindow, the Siskiyou County board of supervisors voted not to delay the experiment, said board chairman George Thackeray in a telephone interview. But the two test sites are located in different counties and the other county board has not yet acted. It is expected to take up the matter shortly. In the meantime, a petition calling for a delay of the test has 460 signatures, said Eva Edgar, a local organizer.

Local opposition is a factor that has delayed a similar experiment downstate in Monterey county. Last November, EPA gave permission to Advanced Genetic Sciences to test altered *Pseudomonas* on strawberry plants outdoors. The county board voted to delay the test. Then EPA suspended the company's permits before the test began. The agency discovered that, prior to approval, the company had injected the modified *Pseudomonas* into test trees that were located outdoors on the company's rooftop in Oakland, California, in violation of EPA rules.

In approving the university scientists' experiment, EPA inspected the lab notebooks of Lindow and co-workers and inspected the test sites at Tulelake, two things that the agency did not do in its review of Advanced Genetic Sciences' proposal.



Marjorie Sun

Steven Lindow: *waiting for 2 years to conduct a field test of genetically altered microbes.*

Lindow has been waiting for federal approval for nearly 2 years. Environmental activist Jeremy Rifkin blocked approval in 1984 by suing the National Institutes of Health, which initially reviewed the test proposal. Earlier this month, however, NIH and Rifkin settled the matter out of court, agreeing that EPA is the proper authorizing agency, and the federal court dismissed the case.

In a separate, but related matter, EPA said on 13 May that it will defer a decision regarding a plan by Monsanto Company to conduct a field test of other altered *Pseudomonas* strains. EPA wants more data on the test organisms. Monsanto changed common soil bacteria to secrete a toxin that is lethal to cutworm, which attacks the roots of corn plants. ■ MARJORIE SUN

DOD Declines to Consider Impact of Nuclear Winter

In a move that aroused some anger on Capitol Hill, the Department of Defense recently declined for the second year in a row to address the policy implications of a potential climatic phenomenon known as "nuclear winter." Its latest report on the subject, released on 13 May, states that "the uncertainties are still much too great even to begin" to assess the potential strategic consequences of extreme darkness and cold brought about by fires in a major nuclear war.

Late last year, Congress ordered the Pentagon to produce a report on these topics by 1 March, largely out of concern that they were inadequately addressed in the Pentagon's first "nuclear winter" report (*Science*, 15 March 1985, p. 1320). Discovery of the climatic phenomenon a few years ago led to speculation that it would render civil defense useless; that it might incapacitate key items of military equipment, such as satellites and airborne command posts; and that it might turn a "first strike" into a suicidal act, through the worldwide distribution of dust, soot, toxic gases, and fallout.

The gist of the Pentagon's 5-page response, which missed a congressional deadline by a month and a half, is that none of these matters can be considered until the scientific basis for a "nuclear winter" is firmly established. A cover letter by deputy secretary of defense William Taft, IV, predicts that this will take "years of research," and says that in any event, "the case at issue, i.e. whether possible climatic effects make a difference, depends critically" on what the Soviets think. "Because we will probably never be confident of knowing the Soviets' real views," he adds, "we must continue to provide against the possibility that predicted climatic effects would have little impact on [their] behavior in an extreme crisis situation." In short, he believes that the Pentagon must continue along its present course.

Taft's letter takes brief notice of the two major scientific studies of "nuclear winter" that appeared in the past year. One, performed by the Royal Society of Canada, determined that the threat of nuclear winter is credible and recommended prompt study of the potential consequences for military policy. Another, performed by a committee of the International Council of Scientific Unions, pointed out that climatic perturbations could be significant far from the nuclear detonations. But Taft adds that "more recent results" which have "not yet been fully subjected to peer review" indicate that

the consequences might be much less severe than initially predicted.

Representative Timothy Wirth (D–CO), among others, has criticized the study, which he terms "five pages of filler." Despite the considerable scientific uncertainties, he says, "there remains substantial evidence on which to build a solid investigation of the policy implications," which the Pentagon has chosen not to heed.

The likelihood that the Reagan Administration will produce the report that Congress seeks is small, however. In February, the General Accounting Office (GAO) contacted "numerous officials . . . within DOD and the military services" and found that they "were very much aware of the nuclear winter issue but they neither planned nor contemplated any actions based on the theory," according to a recent report. "An official of the Plans and Policy staff under the Joint Chiefs of Staff told us that no new policy guidance had been issued or planned based on the nuclear winter issue." Similarly, the White House Office of Science and Technology Policy (OSTP) said that any policy assessments are at least 4 to 5 years away.

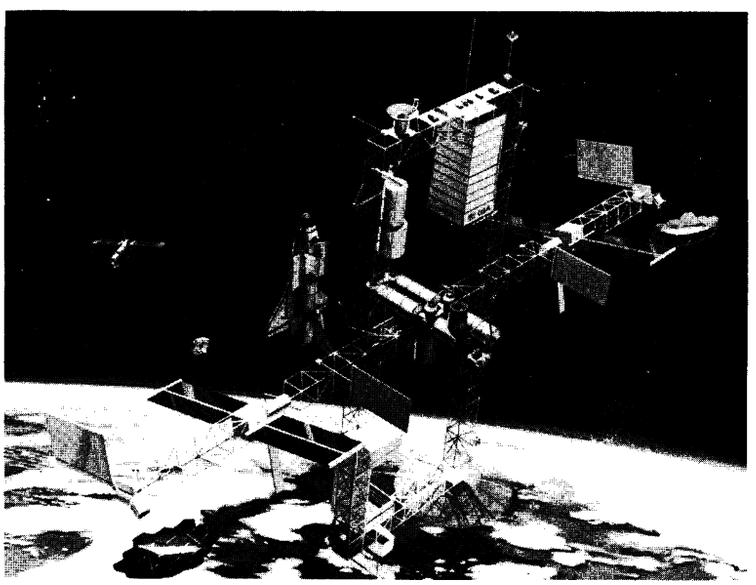
Meanwhile, government research on the subject continues at a level of roughly $5.5 million a year, coordinated by an interagency committee under OSTP's direction. The GAO report revealed for the first time that a range of annual funding options between $3.5 million and $14 million was presented to OSTP by an interagency scientific group last year. ■ **R. JEFFREY SMITH**

NASA Unveils Space Station Concept

Amidst continued budgetary uncertainty in the wake of the Challenger disaster, officials of the National Aeronautics and Space Administration (NASA) have unveiled the new baseline design for their permanently manned space station. Assuming that the program continues as now planned—a big assumption—the "dual-keel" design shown here will form the basis for more detailed studies during the next year, leading to the selection of contractors and the beginning of actual construction in May 1987. The station itself would begin in-orbit operation in 1994, exactly 10 years after President Reagan gave NASA the go-ahead for building a permanently manned space station "within a decade."

"[This] pretty much represents what the space station will look like in orbit," said the agency's new administrator, James C. Fletcher, when he introduced the design. The most obvious structural features are two vertical beams that flank the station's central region; thus the name dual keel. The box-like configuration is stiffer and offers more room for expansion than NASA's previous concept, the so-called "power tower," which clustered the modules at the bottom of one long central spine.

The international character of the space station is indicated by the four pressurized modules. The United States will contribute two modules: one for living, eating, and sleeping, and the other for hands-on laboratory work. (Previous plans called for four U.S. modules; however, design changes in the way the modules are joined to each other means that the total usable volume is only slightly reduced.) The European Space Agency and the Japanese Space Agency are expected to contribute one laboratory module apiece—although the agreement with Europe still has some sticking points (*Science*, 16 May 1986, p. 816). Canada will build a remote manipulator arm that will travel around the station on a kind of cart that moves along the superstructure.



The space station's international character also shows up in a less obvious feature: for the first time in its history, NASA has agreed to do all its engineering in metric units.

The baseline design is somewhat scaled back from NASA's original plan for the station. It will carry a crew of six to eight instead of ten, for example, and it will generate less power. On the other hand, the station is designed so that modules and other structures can be added as the need arises. The baseline configuration shown here will require an investment of $8 billion from the United States and roughly $3 billion to $4 billion total from the foreign partners. As currently scheduled, assembly will begin in 1993, and will require 14 shuttle flights to complete. Maintenance, resupply, and crew rotation will require about eight to ten flights per year thereafter, for about $1.5 billion in annual operating costs.

The immediate question, of course, is whether any of this money will be forthcoming. If NASA gets the go-ahead to build a replacement for Challenger, the money will have to come from somewhere. And with the Gramm-Rudman-Hollings process squeezing the federal budget from every side, the most obvious place to get it is by deferring the space station.

On the other hand, Capitol Hill continues to support the station. NASA has gotten generally high marks from the science and engineering communities for its efforts to design a space station around user needs instead of around pure technology. "I think NASA, up to this point, has been very responsive," says Thomas M. Donahue of the University of Michigan, chairman of the National Research Council's Space Science Board and a vocal skeptic of the space station in the past. And in the Senior Interagency Group on Space, a White House policy group now trying to decide whether NASA should build a replacement shuttle, the station is seen as a major international commitment and an important symbol of the space program as a whole. No one really wants to decimate the station for the sake of a new orbiter.

Nonetheless, choices have to be made. It remains to be seen how they will go. ■

M. MITCHELL WALDROP