

The unscheduled return of Cosmos 954

The job of Cosmos 954 — keeping an orbiting radar eye on U.S. ship positions for Soviet military planners — was serious enough, but it was the satellite's unscheduled return to earth that captured the headlines and raised concerns of a wholly different kind. Launched last Sept. 18, the multi-ton probe apparently encountered early difficulties that led ultimately to its reentering the earth's atmosphere on the morning of Jan. 24 for a fiery descent over western Canada. Aboard Cosmos 954 as it fell was its power supply: a nuclear reactor fueled, according to Soviet sources, by about 100 pounds of uranium 235.

Fragments of the satellite apparently struck the earth in several places in Canada's remote Northwest Territories. Members of a wilderness expedition found some "struts" and other pieces of metal in a small crater near the Thelon River, about 110 kilometers southwest of Baker Lake; investigators described the material as "moderately radioactive," but not part of the reactor itself. (The expedition members were examined and reported to have been exposed only to the equivalent of "two chest X-rays.") A U.S. Department of Energy official, however, was reported on Jan. 31 as saying that helicopter-borne searchers had located two other areas where the radiation was higher, possibly representing pieces of the reactor.

Cosmos 954's reactor, according to one U.S. analysis, was estimated to occupy a little less than a cubic meter (although finding even a piece of it might enable a much more accurate calculation). Its 100 pounds of uranium 235 could imply a power output in the range of tens to hundreds of kilowatts. Any recovered scraps of the device would be informative, and U.S. officials early this week were hoping for what could be an intelligence bonanza, revealing details of the state of Soviet reactor design, metallurgy and other technologies including the radar system.

But the growing interest/concern — at least 120 people from the United States had joined Canadian investigators within days of the incident — has another side.

President Carter told a Jan. 30 news conference that he "would favor at this moment an agreement with the Soviets to prohibit earth-orbiting satellites with atomic radiation material in them." The last U.S. nuclear fission reactor acknowledged to have been used for spacecraft power was launched in 1965, carrying 25 pounds of U 235 and designed to burn up and disperse in a high orbit. Since that time, however, a number of earth-orbiting U.S. satellites (as well as deep-space probes) have carried radioisotope thermal generators (RTG's) which work by the passive thermoelectric conversion of heat from their fuel, typically plutonium. The president's FY 1979 budget request for the Department of Energy, issued only a day

before the Cosmos incident, also contains several million dollars to begin development of a 10- to 100-kilowatt nuclear reactor for spacecraft use. (A department official says that, unlike the case of Cosmos 954, which apparently failed to ascend as planned to a higher, longer-lived orbit, any reactor aboard a U.S. spacecraft would not be turned on until it was safely in high orbit. The initial fuel load of U 235 is considered a relatively minor hazard compared with the by-products, such as strontium and cesium, that accumulate during its operation.) Funding has also been requested for improved-efficiency RTG's, using a "dynamic" heat-conversion system rather than direct thermoelectrics.

Another concern is Skylab, the 100-ton U.S. space workshop that has been orbiting the earth since it was launched in 1973. It may reenter the atmosphere in late 1980, by some NASA estimates, but, says one official, the uncertainties are such that it could be as early as October of 1979. Cosmos 954 renews questions of whether pieces of Skylab will reach the ground, and a booster now being developed for NASA to send it higher may be hard-pressed to meet the uncertain deadline. □

An antidote for kepone poisoning

Only two and a half years after severe neurological symptoms were first linked to the pesticide kepone, a treatment has emerged. The resin cholestyramine, a drug used to lower blood cholesterol levels, has been found to hasten the excretion of kepone, dramatically decreasing blood and fat levels and reversing the toxic symptoms. Because cholestyramine is already on the market, it is immediately available to other kepone victims.

Philip Guzelian of Virginia Medical College announces that more than 20 affected persons, half of whom had been so severely impaired that they could not work, now have no more than very mild symptoms. In the Feb. 2 *NEW ENGLAND JOURNAL OF MEDICINE*, he describes a study of twenty-two workers exposed to kepone. As treatment, each person ingested a powdered material four times a day. None of the patients or investigators knew which patients received the cholestyramine and which took an inert placebo. The amount of kepone in the blood of the placebo group fell slowly at the same rate as in the months before the experiment. However, among treated patients the kepone elimination rate increased significantly. Half the kepone was removed every 80, instead of 160, days.

Guzelian believes that kepone binds to cholestyramine and is eliminated from the body, instead of being reabsorbed in the

intestinal tract. A preliminary experiment showed a sixfold increase in kepone in the feces of seven patients given cholestyramine for three days (SN: 11/20/76, p. 324). Researchers are continuing to search for the exact mechanism underlying the drug effect. Recent experiments on rats and humans indicate that the direct intestinal transport of kepone is altered.

Because only about 5 percent of the contaminating kepone circulates in the blood, Guzelian also checked levels in small samples of fat taken with a needle from abdomens of the patients. Fat is generally a major reservoir of pesticides in the body. Guzelian found that decreases in kepone levels in the fat parallel decreases in the blood levels.

Impaired testicular function, another effect of kepone, also appears to be reversed by cholestyramine treatment. Most of the men with high blood levels of kepone produced few or no sperm. In 12 of 13 patients examined, the sperm counts rose as the blood kepone levels fell.

Most important, once kepone is eliminated from the body the tremor, stutter, chaotic eye movements and other neurological symptoms become less severe. The major toxic effects of the pesticide thus seem reversible. After the five-month experiment ended last February, all the participants, the controls as well as the treated patients, were given cholestyramine. Treatment was eventually stopped in half the patients; their blood kepone levels became too low to measure.

"Our study establishes that cholestyramine is a practical treatment for patients exposed to large quantities of kepone," Guzelian says. "It also is important to note that cholestyramine can possibly have the same effect of detoxifying the body of other environmental toxins." Last week Guzelian began tests on a single patient poisoned by chlordane, another pesticide. He expects other researchers to try cholestyramine to treat victims of PBB poisoning in Michigan (SN: 8/13/77, p. 100). □

A measles, mumps link to diabetes?

During the past 100 years, a viral cause for diabetes has tantalizingly surfaced from time to time, as diabetes has followed outbreaks of mumps, infectious hepatitis and infectious mononucleosis, and as Coxsackie viruses and encephalomyocarditis viruses have produced diabetes in mice. Now the case for a viral cause for diabetes — specifically measles and mumps infections — is tightening, according to reports in the Jan. 14 *LANCET* and the Jan. 12 *NATURE*.

Margaret A. Menser and her colleagues at the Children's Medical Research Foundation in New South Wales, Australia, have been following, since 1967, 45 persons born with German measles infections. So

far nine of these persons, 20 percent, have come down with diabetes, the researchers report in *LANCET*, strongly suggesting that congenital German measles can spark diabetes. The researchers have also discovered eight other cases of diabetes among 318 patients born with German measles infections.

Further evidence that a German measles virus can induce diabetes comes from animal experiments. Menser and colleagues infected 16 pregnant rabbits with German measles viruses. None of the females developed diabetes, but both their pancreases and the pancreases of their offspring showed diabetes-like damage when compared with those of control rabbits. (Diabetes consists of a deficiency of insulin production by the pancreas and, hence, an overloading of the body with sugar.)

As for the role of mumps in diabetes, Gregory A. Prince and his colleagues at the National Institute of Dental Research in Bethesda, Md., have done experiments to see whether human pancreas cells grown in tissue culture are susceptible to mumps virus — a condition never shown before. The researchers tagged antibodies to mumps virus for identification purposes. Then they introduced the antibodies into pancreas cultures from seven persons and attempted to infect the cultures with mumps virus. Sure enough, the mumps antibodies revealed the presence of mumps virus in pancreas cultures from all seven individuals. This finding, reported in the Jan. 12 *NATURE*, also provides evidence that a virus, specifically a mumps virus, might trigger diabetes.

In the event that measles or mumps virus really sparks diabetes, though, it may well do so only in certain genetically predisposed persons, since the disease does appear to have some genetic basis. More specifically, a person might inherit some genetic (immune) weakness that allows a measles or mumps virus to invade the pancreas and produce diabetes there. In fact, the next step in implicating viruses as a cause of diabetes will probably be to link genetic predisposition toward diabetes with a particular susceptibility to the viruses.

For instance, Prince and his co-workers suggest that the same antibody technique they used might now be employed to see whether pancreases from persons with certain HLA antigens are especially susceptible to mumps. HLA antigens are the chemicals on the surface of human cells that are genetically determined and that help comprise the human immune system. HLA antigens in diabetics seem to differ somewhat from those in the general population. Thus, if persons with diabetically linked HLA antigens are found to have pancreases particularly prone to mumps infections, it would tighten the proposal that mumps can trigger diabetes, at least in genetically (immunologically) vulnerable individuals. □

Forty top young scientists chosen

At 14, Samuel A. Weinberger of New Rochelle, N.Y., is already an experienced mathematician. He has studied partial differential equations and complex analysis at Columbia University and has taken a graduate course in abstract algebra. In addition to his studies at Yeshiva University High School in Manhattan and a course in algebraic topology at Columbia University this year, he completed a project on an advanced concept called the fixed point theory.

Weinberger and 39 other high school science enthusiasts were rewarded for their research this week when Science Service announced the winners of the 37th Annual Science Talent Search. The winners — 10 girls and 30 boys — will take displays of their independent research projects to Washington where they will be on display March 4th and 5th in the Great Hall of the National Academy of Sciences for final judging and distribution of \$67,500 in Westinghouse Science Scholarships and Awards.

The 40 winners were picked by a panel of judges, including scientists in each student's field of research. During their expense-paid trip to Washington, the winners will display their work, be interviewed by a committee of judges, visit laboratories and hear talks by Rosalyn S. Yalow, 1977 Nobel prize winner in Physiology or Medicine, and by Glenn T. Seaborg of the University of California at Berkeley, Nobel laureate in Chemistry, 1951, president of the board of Science Service.

This year's winners, chosen from 967 qualified entrants, come from 37 schools in 19 states and range from 14 to 18 years old. All plan to continue their studies in some field of science. Among their choice career are plasma fusion research engineer, medical researcher, research mathematician, environmental researcher, industrial psychologist and astrophysicist.

The students did their projects during their spare time or summer vacations, some using college or laboratory facilities. For example, a student from Michigan used the telescope at Kitt Peak National Observatory in Arizona. Many built their own equipment. A Pennsylvania winner made a nine-and-a-half-foot wind tunnel to analyze the forces acting on different airfoils; another constructed a digital computer for his project on analyzing seismic waves.

Often the projects were extensions of hobbies. A student from Connecticut, with a hobby of tracking satellites, designed and made the equipment to track the National Oceanic and Atmospheric Administration's weather satellite NOAA-5 and to display pictures from the satellite. Flying rubber-band-powered model airplanes

led a Colorado winner to examine the torque output of rubber strips in an effort to improve their power output.

As always, many projects reveal new scientific insights. Based on her studies of the star V839 Cygni, a student from Illinois believes it to be a pulsating rather than an eclipsing star as it is now classified. A Massachusetts student who began grinding the mirror, designing and building her own telescope at 12, suggests modifications to a standard optical test used to determine the precise shape of a "fast" telescope mirror. During a study of various grasses in a Rhode Island marsh, a Pennsylvania student discovered a type of grass not detected by local ecologists. Her work is now being used as part of an environmental impact study on the area.

This year's 40 winners are:

CALIFORNIA: *William H. Collins*, Canoga Park H.S., Canoga Park; *Mary E. Kroening*, Clairemont H.S., San Diego; *Jonathan S. Feinstein*, Woodside H.S., Woodside.

COLORADO: *Peter A. Sandborn*, Fort Collins H.S., Fort Collins; *Anne M. Gibbons*, Wheat Ridge H.S., Wheat Ridge.

CONNECTICUT: *Richard C. Chedester*, Darien H.S., Darien.

HAWAII: *Judith L. Bender*, Henry J. Kaiser H.S., Honolulu.

ILLINOIS: *Gregory S. Terrell*, Arlington H.S., Arlington Heights; *Ann T. Piening*, Civic Memorial H.S., Bethalto; *Frank C. Hansen*, Oak Park and River Forest H.S., Oak Park.

IOWA: *Lance G. Johnson*, Spirit Lake H.S., Spirit Lake.

MARYLAND: *Michael S. Briggs*, High Point H.S., Beltsville; *David T. Vader*, Colonel Z. Magruder H.S., Rockville.

MASSACHUSETTS: *Michael C. Gurnis*, Cohasset H.S., Cohasset; *Barbara C. Shutt*, The Bromfield School, Harvard.

MICHIGAN: *Russell W. Carroll*, Rochester H.S., Rochester.

MISSOURI: *John D. Rainbolt*, William Chrisman H.S., Independence; *Robert V. Duncan*, Central H.S., St. Joseph.

NEW JERSEY: *Daniel S. Groisser*, Montclair Kimberley Academy, Montclair; *Philip G. King*, Rumson-Fair Haven Reg. H.S., Rumson.

NEW YORK: *Lawrence R. Bergman*, Benjamin N. Cardozo H.S., Bayside; *Therese Lung*, Forest Hills H.S., Forest Hills; *Jay B. Stallman*, Forest Hills, H.S., Forest Hills; *Michio Hirano*, Irvington H.S., Irvington; *Robert J. Klerer*, Irvington H.S., Irvington; *Elias Reichel*, Bronx H.S. of Science, New York; *Roger E. Mosesson*, Ramaz School, New York; *Jonathan T. Kaplan*, *Julie W. Pan*, Stuyvesant H.S., New York; *Samuel A. Weinberger*, Yeshiva University H.S., New York; *Robert O. Hamburger*, Martin Van Buren H.S., Queens Village; *Michael P. Mattis*, Scarsdale H.S., Scarsdale; *Daniel S. Rokhsar*, Susan E. Wagner H.S., Staten Island; *Ronald A. Fisher*, West Seneca East Sr. H.S., West Seneca.

OHIO: *Donna J. Pickrell*, Rosecrans H.S., Zanesville.

PENNSYLVANIA: *Mark Drela*, Abington H.S., Abington; *Patricia Furlong*, Bishop Carroll H.S., Ebensburg.

RHODE ISLAND: *Joseph P. Tanzi*, Cranston H.S. East, Cranston.

TEXAS: *Sara E. Dennis*, John Marshall Sr. H.S., San Antonio.

VIRGINIA: *Joseph P. Dougherty*, McLean H.S., McLean.