East Meets West to Look for Toxic Waste Sites

Researchers from the old East and West Germanies join forces to help find the eastern zone's many hidden dump sites

Space Institute Berlin

Infrared eye. *Photograph* (left) *shows only roads and greenery, but the same area in the infrared scan has a large hot spot* (red swirl)*, possibly a dump site.*

When the East German regime fell in November of 1989, its legacy included an environmental time bomb: dump sites in the tens of thousands, secreted across the East German landscape and possibly leaking hazardous wastes into groundwater and the atmosphere. The reunified German government now wants to identify the sites so they can be detoxified, if necessary. But because the former eastern government did not maintain comprehensive records about the dumps, and kept whatever information it did have from the public, the current government does not know where most of the sites are or what they might contain. Enter a remote-sensing expert from the former East bloc and a West German physicist who have formed an unusual collaboration that may help. But first the problem.

Figures compiled last fall by a federal task force estimate that there are 30,000 potentially toxic dump sites in the old eastern zone. Others have put the number as high as 90,000. And just as uncertain as the number and location of the dump sites is the nature of their contents. Some may contain photoprocessing chemicals, nuclear wastes, mercury, or other toxic materials, while others consist only of West German household trash, which for years was trucked across to East Germany in exchange for hard currency.

No one is certain about what might be contaminating the land, says easterner Joachim Nopirakowski of the Institute for Space Studies in Berlin, because the former eastern government decided that having so many toxic waste sites "went against the idea that in the socialist state all was done for the good of its citizens."

Federal planners want to defuse the time bomb they have inherited and have set themselves the goal of having the five new eastern lands ready to adopt current Western environmental standards by the year 2000. They will have their work cut out for them, says Günter Dehoust of the Öko Institute, an independent research center in Darmstadt that specializes in environmental issues. Not even one tenth of the household trash dumps—and the federal environment ministry estimates there are 11,000 of them in the eastern territory—are supervised and regulated. And only one currently meets Western environmental safety standards.

To begin addressing these environmental woes, Nopirakowski, an engineer who works on remote sensing, has joined forces with a western counterpart, physicist Reinhard Furrer, director of the Space Institute Berlin, in a project that may help: modifying remote-sensing technology to detect toxic dump sites from the air. In addition to its practical goals, the project aims to show that scientists from the old East and West Germanies, each with its distinct 40-year scientific traditions, can indeed collaborate. And so far, Nopirakowski says, things are going very well. "The sum of our scientific potential was not simply added together; instead we found it to be multiplied many times over," he remarks.

The collaboration actually started in the spring of 1989, about 6 months before the Berlin Wall fell. At a symposium held in West Berlin, Furrer met Nopirakowski and learned that eastern scientists were testing a sensitive Soviet infrared scanner as a possible means of locating contaminated ground. Infrared scanners can pick up hot spots, and decaying wastes, whether household trash or industrial chemicals, give off heat. So the researchers reckoned that by mounting their instrument on an airplane, they could use it to scan broad swathes of the 40,000 square miles of eastern territory quickly for the hot spots that would signal the presence of toxic wastes. Such remote sensing would not reveal the identity of the wastes, but that could be determined later by analysis with soil probes.

By the time Nopirakowski and Furrer met at the symposium, however, the East Germans had run into problems. They were having trouble, for example, keeping the equipment from overheating. They also could not get as much flying time as they wanted. And when they were able to collect data, they had difficulty analyzing it. In particular, the easterners lacked the high-tech electronics needed to program experiments and read the data as they were being collected.

That's where Furrer came in. He was able to provide access to the Western computer hardware and software needed to do such real-time imaging. Having that capability is important because it allows the scanner operator to determine while still in the air whether a scan has been successful.

Although the two groups began sharing information in the summer of 1989, the collaboration didn't really take off until after the opening of the East German borders and German reunification. That led to the lifting, on 1 July 1990, of restrictions imposed on technology exports to the East by the United States and its NATO partners.

The Furrer group's contributions since then include wiring a Western PC to the airborne-scanner to give real-time imaging

capabilities, as well as providing time on a mainframe for completing the data analysis back on the ground. The data analysis was also facilitated by computer programs developed by geoscientists at the Free University of Berlin (West). In addition, the Free University made a Cessna 207 research plane available to the collaborators, thus giving them more flying time.

The team began testing their new system last fall. In a standard run, the temperature data obtained in the air are put through the Western mainframe to generate a visual profile of temperature changes. This is then compared with video film of the territory scanned to eliminate known heat sources, such as houses, factories, and so forth. "If a factor shows up on the conventional map, then we know where the heat is coming from," says Nopirakowski.

The team also accounts for natural ground variations, such as the presence of water, sand, or clay, and any known geothermal sources that may affect the infrared profiles. Ground crews are then called in to take a closer look at areas showing any unexplained temperature increases.

The team's first test flights, made over the greater Berlin area last November, gave promising results. The flight team scanned known trash dumps, and, while the video images showed green fields, the infrared profile picked up heat emissions from the buried sites. When mounted on a plane flying at an altitude of 1000 feet, the scanner's array of 128 sensors can, the researchers found, evaluate a 400-meter-wide strip of land in a single pass, picking up temperature changes as small as 0.1°C.

Now that the initial stages of the infrared project have proved successful, the collaborators are hoping for additional funding that will enable them to expand the work. But for the eastern partners, time may be running out: The Institute for Space Studies, until reunification part of the East German Academy of Sciences, is undergoing a credibility evaluation by an international scientific commission charged with reunifying German science.

So far, Nopirakowski is optimistic. Chances are good, he says, that the institute will be incorporated into the unified German scientific community when the commission makes its recommendations in March. At stake are 400 jobs at the space institute alone, and the future of research projects like the remote-sensing collaboration—one that is certainly needed given the large task that the Germans will have in finding the eastern zone's old dump sites. ■ ANDREA CEZEAUX

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Cooling the Greenhouse Cheaply

As representatives from 130 nations gathered near Washington this week to plan an attack on the greenhouse problem, the U.S. Office of Technology Assessment issued a report that offers just such a plan—actually two plans: a "moderate" and a "tough"—for the United States. In the moderate scenario, the nation can substantially reduce its own contributions to global warming over the next 25 years while avoiding any net cost—and the country would even reap side benefits such as a cleaner environment. Then there's the tough scenario: If the United States followed the ambitious example of other nations that have already pledged to reduce carbon dioxide emissions, the costs could be considerable, according to the report, though not unbearable. In this second scenario, the OTA predicts costs of up to $150 billion per year, as much as is spent already to reduce all forms of pollution.

So far, the Bush Administration has refused to make even a mild commitment to cut back on carbon dioxide just for the sake of avoiding a greenhouse effect. It objects that the scientific case for taking such action is not clearly established. But whether the case has been proved or not, OTA's *Changing by Degrees: Steps to Reduce Greenhouse Gases* finds that carbon dioxide controls are technically feasible and need not cripple the economy.

OTA, an agency of Congress, has released these findings at a key moment, just as the UN-sponsored International Negotiating Committee begins deliberations in Chantilly, Virginia, on an international climate convention. The agreement, scheduled to be ready for signing in June 1992, would include or shortly lead to numerical goals for reducing greenhouse gas emissions. But many countries are already setting their own targets. Germany is planning to reduce emissions 30% below the present level by the year 2005, for example, and the European Community is aiming at a more modest goal—holding emissions at the current level by the end of the century. These countries are likely to propose similar targets during the negotiations. In contrast, without new legislation, U.S. carbon dioxide emissions will increase 50% by 2015, according to the report.

If the United States were to pursue the tough emissions control scheme, warns the report, it would have to use most of the technical options available now or likely to become available early in the next century. The report lists such steps as improving the insulation of buildings, making motor vehicles and industrial motors more efficient, and increasing the use of nonfossil electricity generating plants.

However, even in its tough scenario, OTA is not counting on miracles. No technological breakthroughs would be required, nuclear power would not make a big comeback, solar-based electricity generation would not be pervasive, and most people would not be driving 80-mile-per-gallon cars. And OTA did not even consider technical options that would necessitate "loss of comfort or convenience."

All told, OTA's tough approach to emission control would yield a 20% to 35% reduction in greenhouse gases by 2015. The report is less specific about costs. "A rough estimate of the cost range ... is a savings of $20 billion [per year] to a cost of about $150 billion per year (in 1987 dollars)," says the report.

If this pill seems too bitter, Congress might prefer OTA's moderate scenario. In it, cogeneration of heat and electricity would be minor, increases in motor vehicle efficiencies would be modest, and no nonfossil fuel electric utilities would have to come on line. Existing nuclear plants could contribute, however, by increasing the proportion of time they are producing power from the current 50% to 75%. Carbon dioxide emissions would be held to a 15% to 22% increase by 2015 as compared with the 50% increase that would occur without controls. If the goals of this approach are modest, so is the price. OTA concludes that this significant reining in of emissions would more than pay for itself, assuming that oil will be $50 per barrel (in 1987 dollars) by 2015.

The technical means are there, says OTA, but getting Americans to use them will be a challenge. The report recommends a variety of new regulations and market mechanisms, ranging from performance standards to tax incentive programs. "This report says you could reduce carbon dioxide emissions," says Rosina Bierbaum, OTA project director, "but it won't happen without a strong signal that this is national policy." Noting that U.S. energy consumption froze in the 1970s when oil became dear, she observes that "we certainly can do it if there's a will." ■ RICHARD A. KERR