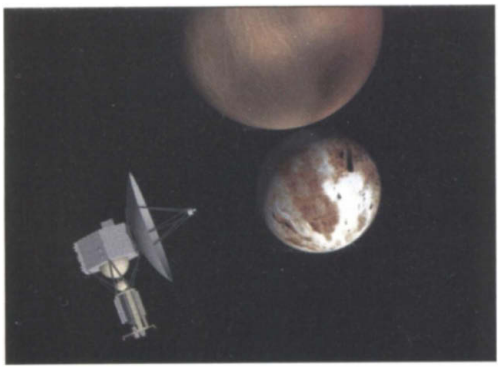


Back from the dead. A NASA mission to Pluto, shown arriving in 2015, got a boost last week from Congress.

Space Telescope, and chides the agency for backing away from materials science research on the space station.

The Pluto mission has been unpopular with both the Clinton and Bush administrations, which would prefer that NASA work on advanced propulsion systems that might eventually provide a faster trip to Pluto and the Kuiper belt. But Senator Barbara Mikulski (D–MD) has fought hard to restore funding, and last week the House panel matched the $105 million approved for Pluto by a Senate panel in late July (*Science*, 2 August, p. 755) for the 2003 fiscal year that began on 1 October. There's another $15 million for it as part of a new series of low-cost missions, leaving the project just $2 million shy of the amount supporters say is needed to keep it on track for a 2006 launch. Although Congress has fallen far behind in passing spending bills for the new year, the similar funding levels in both houses for the Pluto mission virtually ensures its continuation.

A 2006 launch would deliver the spacecraft to Pluto by 2015 and to the Kuiper belt by 2026. The date was picked to stay ahead of a projected freezing of the planet's thin atmosphere as it moves away from the sun, although last week astronomers reported new data suggesting that Pluto's atmosphere in fact might be warming rather than cooling. Administration officials say privately that a 2006 launch might be impossible because the spacecraft's nuclear-electric power system requires a complex approval process and a new launch vehicle might not be ready. But project manager Tom Coughlin of the Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland, insists that neither problem is a showstopper.

The House panel also provided a $20 million boost to NASA's Mars exploration program to cover rising costs in planned robotic and orbiter missions. It also urged NASA to ignore the advice of a recent controversial report that ranked some materials science as a low priority aboard the space station. At the same time, lawmakers decided that equipment shortages on the orbiting base preclude a proposed $11 million biology project called Generations.

As for the Hubble, the committee told NASA to study an extension beyond 2010, when the instrument was scheduled to return to Earth aboard the space shuttle. Committee members fear that delays in launching the newly named James Webb Space Telescope could leave astronomers with a viewing gap. The new scheme would require an additional Hubble servicing mission in 2007.

–ANDREW LAWLER

BIOLOGICAL AND CHEMICAL WARFARE

Secret Weapons Tests' Details Revealed

Documents released last week by the Pentagon about secret biological and chemical weapons tests have fueled the anger of veterans who say they were used as unwitting guinea pigs. But biological and chemical arms experts say that there are no major revelations in the documents—although they do illustrate the vast scope of the U.S. chemical and biological warfare program at the height of the Cold War.

The information was released as the Pentagon tries to document a series of 134 chemical and biological warfare studies that were planned in the 1960s. The tests came to light as the result of pressure from worried veterans—some of whom blame health problems on exposure to test agents—and members of Congress. Many of the trials were never carried out, but at least 46 trials took place, acknowledged William Winkenwerder, assistant secretary of defense for health affairs, last week at a press briefing. The newly released material pertains to 27 of them. The Department of Defense intends to produce and post online detailed fact sheets about all of the tests by next spring (deploymentlink.osd.mil).

Guinea pigs aboard. The U.S.S. *Power* was sprayed in 1965 with stand-ins for biowarfare agents.

CREDITS: (TOP TO BOTTOM) GSFC/NASA; NAVSOURCE ARCHIVES

ScienceScope

Budget-Delay Jitters Supporters of the National Institutes of Health (NIH) are worried that new programs could be crippled if legislators don't pass the agency's 2003 budget soon.

Congress did not complete most appropriations bills before the fiscal year ended 30 September, instead approving a series of temporary resolutions to fund agencies at 2002 levels. NIH can stay on track if its budget—slated to complete a 5-year doubling to $27.2 billion—is adopted by mid-December, NIH Director Elias Zerhouni told a House appropriations panel last week. But further delay would force NIH to scale back grants, put off construction projects, and "greatly interfere with" $1.7 billion in new bioterrorism research and vaccine development, Zerhouni said. A delay until March—one worst case scenario—could shrink the number of new grants from about 9850 to 6800, according to some research advocates.

Academic Fusion Two of Britain's top universities have announced their engagement. Imperial College London and University College London (UCL) plan to merge into a single university, officials said this week.

Joining forces is the only way to compete in the knowledge economy, says Richard Sykes, the rector of Imperial, who is acting as marriage broker. Before coming to Imperial last year, Sykes was chief executive of Glaxo Wellcome, masterminding the 2000 megamerger of GlaxoSmithKline, now the world's largest pharmaceutical company (*Science*, 16 November 2001, p. 1443). The name of the new university has yet to be decided, and the British Parliament must approve the fusion, "but we'll start sharing resources by December," says Sykes.

Derek Roberts, provost of UCL, says the two institutions complement one another. For example, the 176-year-old UCL has a law school but no business school, whereas the 95-year-old Imperial trains executives but not lawyers. First up is a joint fundraising campaign to boost their combined $12 million endowment.

Schön Papers Pulled Jan Hendrik Schön, the Bell Labs physicist tagged for faking data (*Science*, 4 October, p. 30), and his coauthors earlier this week agreed to retract 16 papers faulted by an inquiry. European officials, meanwhile, have launched two new inquiries. Officials at the University of Konstanz are reexamining Schön's doctoral work. And the DFG, Germany's primary science funding agency, is studying whether grant money given to Schön while at Bell Labs was used to promote fraudulent data. Schön could not be reached for comment.

The papers document a wide-ranging effort to study biological and chemical weapons—including bacteria, nerve agents, and at least one agricultural pest. The tests were conducted from Florida to Alaska, on islands under U.S. jurisdiction and in Canada and the United Kingdom. Several of the tests involved simulants, agents resembling the real thing but considered harmless, such as *Bacillus globigii*, a bug now classified as a strain of *Bacillus subtilis* that is a close relative of the anthrax bacterium.

But real pathogens and toxic chemicals were used in more than 20 of the tests revealed so far. In an operation dubbed Shady Grove, for instance, the U.S.S. *Granville S. Hall* and five army tugboats in the Pacific were sprayed with two species of bacteria: *Francisella tularensis*, which causes tularemia, and *Coxiella burnetii*, the cause of Q fever. Both microbes can cause severe and potentially fatal infections.

U.S. Navy and Army crew members involved in this test "should have been fully informed of the details," according to the fact sheet, and "should have worn appropriate … protective equipment." But during a Senate committee hearing last week, retired Navy commander Jack Alderson, who participated in Shady Grove, testified that he was never told about the test's purpose and that no protective materials were issued. Officials say test records contain no evidence that anyone got sick, although it's not clear whether the microbes caused no infections or whether those infected were successfully treated with antibiotics.

More than a dozen tests used nerve agents, including sarin and the extremely lethal VX. In these tests—designed to show, among other things, how well the agents dispersed under various climate conditions and whether they clung to ships, clothing, or the ground—far fewer participants were involved, and they wore protective gear, according to the Pentagon.

Other trials illustrate the nation's broad interest in biowarfare. In operation "Magic Sword," *Aedes aegypti* mosquitoes, which can transmit yellow and dengue fevers, were released off the coast of Baker Island, a U.S. atoll in the North Pacific, to work out the logistics of mosquito-borne viral attacks. (The mosquitoes weren't infected, and they were eradicated after the exercise.) And in an experiment in Florida, the Army used a plane to spray a fungus that causes a devastating disease called stem rust. The goal was to see whether it reduced crop yields in test plots.

The Pentagon is trying to track down and inform more than 5000 people involved in the tests. So far, more than 50 veterans have filed claims with the Department of Veterans Affairs (VA) because they believe they're suffering from conditions triggered by the tests. But unless the vets share some common set of symptoms—which VA says is not the case—it will be next to impossible to link specific complaints to the tests, says Harvard biologist and arms control expert Matthew Meselson. The Institute of Medicine has just begun working on a $3 million study funded by VA that will compare health status and mortality among test participants to that of a control group of veterans.

Meanwhile, biological and chemical arms experts are scouring the documents for details about the U.S. program, which President Nixon ended in 1970. But most say there's little new information. An unclassified Army document published in 1977 confirmed that field tests with biological agents had taken place, says Meselson, who's surprised that the fact sheets have triggered so much publicity. "I guess the media tends to forget these things," he says. Still, the stream of documents illustrates the surprisingly large scale of the research program, says Jonathan Tucker of the Monterey Institute's Center for Nonproliferation Studies in Washington, D.C.

The revelations also serve another, unintended purpose, says Leonard Cole of Rutgers University in Newark, New Jersey, author of a book about previously revealed Army experiments on unwitting subjects. They serve as a reminder to authorities not to conduct experiments—even those in the national interest—without first obtaining informed consent from the participants.

–MARTIN ENSERINK

POWER TOOLS

Into Painless Piercing? Try It With Microwaves

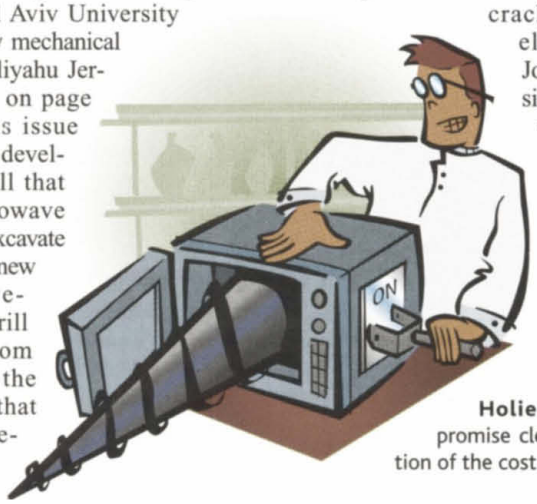
Anyone unfortunate enough to remain awake in the dentist's chair may be acutely aware of at least two of the three primary drawbacks to using a spinning mechanical drill to grind a hole: noise, vibration, and flying debris. The drill bit feels the pain, too, eventually wearing out or breaking under the repeated stress. Now, a Tel Aviv University team led by mechanical engineer Eliyahu Jerby reports on page 587 of this issue that it has developed a drill that uses microwave energy to excavate solids. The new microwave-powered drill suffers from none of the problems that plague mechanical drills. It is silent, steady, and dust-free, and the bits almost never wear out.

Drilling with electromagnetic radiation is nothing new. For years, engineers and scientists have been using the tightly focused light beams from laser drills to punch tiny holes as small as 1 micrometer in everything from semiconductor circuit boards to human bone. But laser drills are expensive, and a several-hundred-thousand-dollar laser drill might not always be the right tool to quietly put a 1-millimeter-wide hole in a concrete block.

So Jerby's team cooked up a low-cost alternative in the kitchen. "We pulled the magnetron from a domestic microwave oven," Jerby says. "It cost about $20." To focus the microwaves, radiation from the magnetron is directed into a rectangular metal box that guides the microwaves into one end of a piece of coaxial cable—"just like the cable going to your TV, except ours is a little stiffer," Jerby explains. The other end of the cable is placed near the surface where the hole will be drilled.

By adjusting a mirror at one end of the metal box, the researchers can match the impedance of the coaxial cable to the surface being drilled. That tuning allows microwave energy to travel into the surface instead of being reflected, thus concentrating the energy of the microwaves into a spot just below the surface. As the spot starts to heat up, changes in the material cause a peculiar thing to happen: Instead of cooling more rapidly to shed the excess heat, the spot starts to soak up even more energy than before. A molten hot spot forms beneath the surface of the material, and a drill bit passing down the center of the coaxial cable can easily scoop out the molten material.

Jerby's team has already used a prototype microwave drill to put holes with diameters ranging from about 1 millimeter to 1 centimeter in ceramics, concrete, basalt, glass, and silicon. Because regions near the hot spot stay relatively cool, even brittle materials don't build up enough thermal stress to shatter, Jerby says. "The cool thing is that you can drill without wear, breakage, or cracking the tool bit," says electromagnetic scientist John Booske of the University of Wisconsin, Madison, who believes that the microwave drill will be particularly useful for drilling ceramics such as those used to mount semiconductor devices on a circuit board. "It would also be great for drilling jewelry and pot-



Holier than thou. Microwaves promise clean, silent drilling at a fraction of the cost of lasers.

ILLUSTRATION: TIM SMITH