

Veto may kill liquid metal fast breeder

For the first time in his administration, the president has exercised his power of veto. The subject of the veto, and the president's wrath (judging from the tenor of the message that accompanied it), is Congress's decision to back the controversial liquid-metal fast breeder reactor demonstration plant. The bill sent up from Congress would have authorized \$80 million for its construction on the Clinch River in Oak Ridge, Tenn.

Carter has taken a strong stand against programs and policies that could aid the proliferation of nuclear weapons. Plutonium, a breeder fuel, could be used to make nuclear weapons, and many experts feel that the United States is not yet capable of safeguarding breeder fuel against diversion by terrorists. The president apparently shares this view; chief among the many reasons he gave for vetoing Clinch River breeder funds is that the breeder would unnecessarily introduce the country to a plutonium economy and the attendant risk of nuclear-weapons proliferation.

He also said the Clinch River breeder was technologically and economically unnecessary. The LMFBR program is the single largest energy project in the U.S. government. The scheduled cost, in 1970, was \$450 million; today the best estimate for the completed demonstration plant is \$2.2 billion. The president said the money Congress authorized for the project will be better spent if channeled into other programs, including the search for acceptable alternative-breeder technologies.

The president also said the Clinch River project is no longer needed. It became apparent many years ago that while nuclear fission was an efficient way to generate power, the uranium used to fuel commercial reactors would run out somewhere near the turn of the century. Breeder reactors, however, create more fuel than they use. It was reasoned that by switching to breeder reactors around the 1990s, uranium reserves could be stretched out until fusion and solar energy were developed for large-scale power production. The president now says that current projections of the need for nuclear-generated electrical power in the year 2000 are only one-third the projections made in 1970. "The breeder reactor will therefore not be needed in the early 1990s as had been projected when the Clinch River facility was first authorized," Carter said.

This week at the International Scientific Forum on an Acceptable Nuclear Energy Future for the World, many participants disputed the logic behind the president's de-emphasis of the breeder in general, and the LMFBR in particular. Among the more than 200 scientists, government officials and utility-company

executives attending the "by invitation only" meeting in Fort Lauderdale, Fla., were several "fathers of the nuclear age."

They heard James Boyd, a member of the long-awaited National Academy of Sciences panel which is completing a report on nuclear and alternative energy sources, release figures from his committee's draft section on uranium reserves. The figures suggest that the United States can expect a uranium shortfall as early as 1985. There may be only enough economically recoverable uranium to cover the life-cycle of nuclear plants currently operating or under construction, he told *SCIENCE NEWS*. Utilities won't build a nuclear plant, even if it is already scheduled, unless they can obtain assured fuel supplies to last the life of the plant. But even the availability of uranium is not the most important problem, Boyd said. New deposits are harder to find and buried deeper. It's going to take a more than doubling of uranium exploration and drilling to keep pace with an even moderate increase in the number of operating nuclear plants. He said greatly overstated uranium reserves have built up a false confidence that has caused many to alter their view on the necessity of a breeder.

Carter's veto would seem to herald the breeder's demise except that the real legislative drama is more complex. Money for each government agency goes through a two-phase budget review. In phase one, Congress looks at all the programs to set an upper ceiling on spending. That is the authorizations bill. Then congress repeats the process, carefully scrutinizing each program to decide how much to actually give—or appropriate—for each program within the agency. Appropriation figures cannot exceed those authorized, but they can be lowered.

The bill vetoed by the president was the Energy, Research and Development Administration budget-authorizations bill. (ERDA is now part of the new Department of Energy.) All ERDA programs except the Clinch River breeder were written into a public-works appropriations bill that has already passed. The vetoed bill would have authorized that spending. Now a continuing resolution is needed to unlock funds for on-going ERDA programs.

But the breeder is different. To actually halt that program, the president must also veto a supplemental appropriations bill. It is expected that he will do so. Although Congress could override a veto, most feel there will not be enough votes.

Where does that leave the LMFBR? The president said he would support an orderly phase-out of the program. Earlier this year he suggested a \$33 million figure. Congressional leaders must now wrestle with how to get such a "minimum compromise" figure by the president. So although the LMFBR program appears to be gravely ill, it's not dead—yet. □

Study faults behavior modification

A continuous, heated debate has rumbled during the past few years over the potential abuses of behavior modification as a form of mind control. But perhaps camouflaged by this highly-publicized controversy are questions about the effectiveness of behavior modification and whether or not it is being utilized to the best advantage by clinicians.

"There are a great deal of data demonstrating that behavior modification techniques are successful in reducing the frequency of bizarre and institutionalized behavior, as well as teaching a variety of functional skills," note researchers David Marholin of Boston University and Robert E. Emery, formerly of Massachusetts General Hospital and now at the State University of New York at Stony Brook. "However, there is little reliable evidence that behavioral programs are more effective than more traditional [therapy] in influencing the number of clients discharged into the community or the length of time a client remains in the community."

In possibly the most critical look to date at behavioral therapy, the researchers analyzed 27 behavior modification programs for delinquents. The programs had been reported in a variety of journals between 1968 and 1976. In the October *AMERICAN PSYCHOLOGIST*, Emery and Marholin present a somewhat less than omni-powerful picture of behavior modification, at least in the way it has been employed in the programs studied.

The researchers report that in only 9.1 percent of the programs have the therapists individualized their techniques for a youngster's behavioral problems. In the vast majority of treatments therapy was aimed, rather, at a mass goal for all the delinquents. "This finding is contrary to the basic tenet of a behavioral . . . approach," say Emery and Marholin.

Moreover, in nearly half of the programs analyzed, the delinquent youngsters were encouraged to display behaviors which—although they were positive—were not aimed at the specific bad behavior that got the youngster in trouble to begin with. For example, a boy who had been stealing cars might be in a program aimed at encouraging promptness in attending classes.

Finally, the researchers found that only 2 of the 27 treatment programs reported followup data beyond one year; 3 did followups six months after treatment; and 7 followed youngsters for one month after formal treatment.

"The lack of individualized target [desirable] behaviors, the absence of followup data and a failure to show the relationship between successful behavior change and a subsequent reduction in

measures of delinquency are critical omissions," say Emery and Marholin. "Although the techniques consistently demonstrate changes in behavior, the question of whether these changes are meaningful to the individual and society remains to be answered." □

X-raying special relativity

The special theory of relativity pervades all of contemporary physics. From the doings of subatomic particles to the astrophysics of peculiar stars, it is applied every day. The theory is based on two postulates. The first (called the principle of relativity) says that any law of physics that holds in one coordinate system holds in identical form in any other coordinate system moving at a constant velocity with respect to the first. The second is that the velocity of light is independent of the source.

There have been numerous laboratory proofs of the first principle, but, Kenneth Brecher of Massachusetts Institute of Technology writes in the Oct. 24 PHYSICAL REVIEW LETTERS, there have been few experimental proofs of the second, and some of those are ambiguous and not generally accepted. Brecher proposes a test involving binary X-ray sources that he says is more sensitive than those possible in laboratories.

The second postulate is responsible for much of the strange view of space and time that special relativity leads to. It makes light a special case in nature; anything else emitted by a moving object has a velocity with respect to an observer that depends on the velocity of the emitter. Proving the second postulate is not just an academic exercise because a self-consistent theory of electromagnetics can be derived, as W. Ritz showed in 1908, in which the velocity of light does depend on the velocity of the source.

To test the postulate one assumes that it does not hold. In that case the velocity of light reaching the earth from a celestial object would not be the familiar constant c (which is approximately 300,000 kilometers per second) but c plus the velocity of the source. This would make a difference in the observations of binary stars, because the orbital motions of such stars give them a constantly changing velocity with respect to the earth. The effect can't be tested with visual binaries, Brecher points out, because visible light is dispersed by the interstellar medium and comes to a velocity characteristic of the medium, which may not be moving with respect to the earth. X-rays are not so badly affected, and Brecher argues that the timing of a number of pulsing X-ray binaries can be used as a test. His survey indicates that the X-ray binaries support special relativity to an accuracy of 2 parts in a billion. The best laboratory tests are good only to about 1 part in 10,000. □

Listening for intelligent aliens



A special receiver to search for intelligent alien signals is attached to the middle telescope in this picture of the Hat Creek Observatory in California.

By their radio waves shall ye know them. Such might be called the general principle of scientists interested in the question whether there is intelligent life on other planets in the universe. The question has aroused a lot of interest but very little in the way of observation. The odds against finding anything in a reasonable time are so extremely long that managers of radio observatories are reluctant to devote time to such observations when there are many things needing to be done that will surely bring results, and current radioastronomical receivers are designed to discriminate against intelligent signals so as to filter out terrestrial broadcasts.

Special equipment has been proposed to look for intelligent signals, but some of it carries enormous price tags. One such proposal, called project CYCLOPS, could cost as much as \$30 billion. A far less expensive system (one that has cost about \$4,000 to date) has been put into operation by the University of California at its Hat Creek Observatory near Mt.

Lassen. The system consists of a special receiver attached to Hat Creek's 85-foot radiotelescope, which will process all signals received by the telescope for evidence of intelligent signals.

The project, which is called SERENDIP (Search for Extraterrestrial Radio Emission from Nearby Developed Intelligent Populations), is under the direction of Stuart Bowyer. Working with him are Michael Lampton, Jack Welch, Jill Tarter, graduate student David Langley (who built most of the equipment) and Alvin Despain.

The search has to be of nearby objects since the telescope is much less sensitive (by a factor of hundreds or thousands) than the telescope array proposed for CYCLOPS, and that makes it something of a longer shot than CYCLOPS. However it will not cost observing time because it will piggyback on the observing program of the 85-foot telescope, which will be determined by astronomers' interests in the natural signals of the objects it is pointed toward. □

Dyes boost efficiency of solar concentrator

A transparent plastic seeded with dilute concentrations of dyes, such as rhodamine-6G, is able not only to concentrate sunlight falling on solar cells but also to extend the range of "usable" wavelengths (those able to transfer their energy to a silicon or other photovoltaic cell), according to Ahmed Zewail of the California Institute of Technology. (Photovoltaics transform light energy directly into electricity.) Zewail and colleagues Barry Schwartz and Terry Cole have seeded a plastic, polymethyl methacrylate with 0.0001 molar concentrations of each of three dyes. They found that certain dyes can convert energy entering the plastic at wavelengths around 4,000 to 5,000 angstroms—normally rather unusable wavelengths to silicon cells—to about 7,000 angstroms, a wavelength which silicon cells can convert to electricity with relatively good efficiency.

In this process, incident light absorbed

by molecules of two "donor" dyes is transferred to molecules of a third, "acceptor" dye. The acceptor in turn re-emits light at "near the narrow wavelength band most efficiently used by silicon cells," about 7,500 angstroms, Zewail says. The smaller the mismatch between the wavelength emitted by acceptor molecules and the narrow wavelength band preferred by the silicon cells, the better the solar-cell conversion efficiency, Zewail told SCIENCE NEWS.

Implanting a dye in plastic is not new, although harnessing a combination of them in a single concentrator like this is, Zewail says. The Caltech team plan to add more dyes in an attempt to further extend the range of usable wavelengths to between 3,500 and 7,000 angstroms.

Because the refractive index of the plastic is so different from that of air, about 75 percent of the "usable" incident light gets trapped within the concentrator where it makes its way, by in-