NUCLEAR STOCKPILES

Useless Secrecy and the World Bomb Balance

This week a prominent American scientist is scheduled to appear before an audience of military officers at the War College in Washington, D.C., and lay out the details of the nation's nuclear arsenal. He is on no Government payroll. He has access to no classified information on his pet subject.

"After I'm done," says physicist Ralph E. Lapp, "I'm going to tell them, 'By the way, nothing you've heard today is classified.' And that will make their jaws drop."

As a leading critic of what he calls useless secrecy on the part of the Atomic Energy Commission, Dr. Lapp has for years insisted that the carefully guarded information on the nation's nuclear might could be computed by any interested, competent person, using available data.

The U.S. nuclear stockpile is a case in point. When the AEC revealed recently that it could produce enough uranium each year for 10,000 Hiroshima-sized bombs, it was announcing a figure within 10 percent of the estimates Dr. Lapp had been making for years. Yet those same estimates had been denounced as "fantastic" by those who had access to secret data Dr. Lapp didn't have.

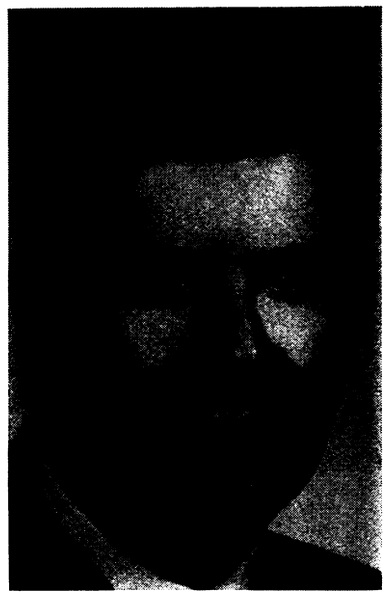
China's nuclear capacity is another example of how security holds back rational analysis of the future, says Dr. Lapp. A magazine article of his in May 1965, analyzing the Chinese potential, "first made the Department of Defense think seriously about China," he claims. "They later let a contract to a private research firm to analyze the situation, but I don't know how far they've gone. It took the project director nine months to get cleared."

Dr. Lapp's estimates are based on careful computation, identifying important indicators, and considerable detective work. In determining the size of the nuclear stockpile, he used three main sources: the amount of uranium ore procured by the AEC, the electricity used by the huge separation plants, and the operating costs of those plants—all available figures.

Natural uranium consists mostly of a heavy isotope, U-238, which can't be used in fission-type bombs, and less than one percent of the minutely lighter U-235, which can. For weapons, the uranium has to be enriched so that 90 percent is U-235. To do this, the uranium is turned into a gas and forced through filters so fine that a pin-prick represents a gaping hole. The lighter isotope moves through the filter a little faster, and so can be separated. The high enrichment needed for weapons requires the gas to be passed through the filters many times.

The electric power necessary to keep the three U.S. gaseous diffusion plants running ranges from two million to six million kilowatts. These plants have to run continuously—if they shut down momentarily, it takes months to reestablish the proper equilibrium pressures in the filter systems, says Dr. Lapp.

By keeping a running graph of the power consumed, Dr. Lapp estimated the amount of U-235 that had been produced at 910 tons by 1967. He also



Dr. Lapp

calculated the same stockpile based on the uranium procured—this estimate came to 1,080 tons.

When the AEC released figures on the precise amount of U-235 it could produce at various power consumption levels—figures that had been closely guarded up to then—Dr. Lapp checked his chart of the total power consumed over the years and computed the output. It came to 970 tons of 90 percent enriched uranium.

"This," he says, "is more than adequate to fabricate 100,000 Hiroshima-size bombs," each with an explosive power of about 20,000 tons of TNT.

Enriched uranium can also be used as a trigger for much larger hydrogen bombs—and these explosives bring down the cost tremendously. According to AEC figures, a 20 kiloton fission bomb costs $380,000. For another $100,000, a 200 kiloton fusion bomb can be made. A two megaton hydrogen bomb cost only $600,000.

These facts are behind Dr. Lapp's conviction that China will "Go-H," as he puts it, and build up a quick arsenal of hydrogen bombs. "I don't think people realize how cheap it is to build H-bombs," he says. They cost less than a hundredth of the same yield in fission bombs, he declares.

Using the same ratio of power consumed to U-235 produced, Dr. Lapp estimates that China, with a national power output of 5,000 megawatts—compared to the U.S. output of some 250,000 megawatts—can produce one-third of a ton of 90 percent U-235 a year. This will give China 100 H-bombs by 1970, he says.

With China thermonuclear, the world political situation has turned into what he calls three-party deterrence. And the outcome of that kind of a game, he says, is practically unpredictable.

HOSPITAL COSTS

A Lavish 'Happening'

Patient costs are likely to climb to $100 a day in some hospitals in the next few years. In the shadow of that threat, and at the direction of President Johnson, leaders in the medical community met with representatives of labor and the public last week in Washington in a working conference on medical costs.

How to lower the costs without impairing the quality was the task assigned by the President in his message to Congress last Feb. 28. He asked for the nation's best thinking on the urgent problem. Health, Education and Welfare Secretary, John W. Gardner, issued the call; 250 conferees responded.

A labor relations vice president from the Pacific Coast and a Harvard economics professor tackled the problem as though it could be solved; most of the speakers pointed out that no blueprints were being drawn up.

If bad planning is keeping a lot of hospital beds vacant and jacking up costs, something ought to be done to get rid of the hospitals or the beds, Harvard's Dr. Jerome B. Pollack indicated.

"In New York State, I recently studied the cost of hospital care. This study, I believe, first pointed to the imminence of $100 average daily costs," he said.

"We found that poor planning in the past had permitted excessive beds and whole hospitals to exist that should never have been built in the first place or long ago discarded. The general hospital beds were vacant between one-fifth and one-fourth of the time at prodigious cost."

The new health system America is putting together is a lavish "happening" that could turn into a masterpiece or a bust, depending on the way the show is organized. Perhaps the system has been too lavish and stylish, Dr. Pollack

suggests. Innovation after innovation pouring out of our $2 billion research effort and the consequent great medical advances may have been blighted by serious disorganization.

Hospitals have too long occupied a place apart from the community, he says. The medical school and the university need to join with the medical practitioner, the teaching hospital, the community hospital, the insurance prepayment plans and the Government to attempt to develop, on an ongoing basis, programs that will improve practical health services for people.

Many of the health problems can be solved only in a larger context than medicine alone.

Dr. Benton H. Goodenough, vice president in charge of labor relations, Pacific Maritime Association, says "health is bargainable." Management and labor can sit down together on the same side of the table and use all their efficiency to create a profitable system for everybody, Dr. Goodenough believes.

CRYOGENICS

Lowest Temperature Yet

A common pin dropped on a table from a height of one-eighth of an inch generates about 10 ergs of energy, obviously a miniscule amount.

That 10 ergs raises temperature, and even that tiny amount is "much too much" to be allowed in the experiment during which Dr. Arthur Spohr of the Naval Research Laboratory reached the lowest temperature yet achieved—within less than a millionth of a degree of absolute zero.

The previous low had been about 1.3 millionths of a degree above absolute zero, which is 459.7 degrees below zero F. Although three-tenths of a millionth of a degree seems like an insignificant change, it is very important to scientists studying atomic nuclei because even such a slight decrease in temperature in this range results in decided changes in some of the physical properties of matter.

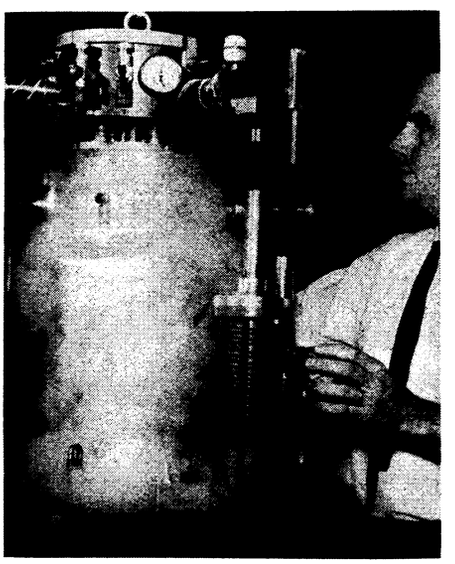
One of the most important changes is that, as the temperature gets colder, the magnetic pole of each atomic nucleus becomes more aligned with all other nuclei. The drop of three-tenths of a millionth of a degree means that instead of only about one percent of the nuclei being aligned, 15 percent of them have poles pointing in the same direction.

At room temperature, atomic nuclei have dancing magnetic poles that point in one direction, then another in random motions.

The experiments in which the record low temperature was produced were preliminary to developing an apparatus for studying the interaction of forces between aligned atomic nuclei. Dr. Spohr, with assistant Edwin Althouse, used two techniques, including one known as nuclear cooling, to reach the record low temperature.

This method was first demonstrated in 1956 at Oxford University by Dr. Nicholas Kurti and Dr. Spohr, using apparatus requiring two stages.

The first stage consists of a paramagnetic salt, cerium magnesium nitrate, cooled to a temperature of about 200 thousandths of a degree above absolute zero by a magnetic cooling technique. Using this salt made it possible to reach a lower initial temperature than had been obtained elsewhere with other materials.



Navy

Dr. Spohr and lowest temperature rig.

The second stage, during which the record low temperature was obtained, is connected to the first by heat-conducting copper wires.

An intense magnetic field applied to the second stage generates heat that flows up the copper wires to the first, which is cooler at this step in the procedure. The link between stages is then broken, and the magnetic field at the site of the specimen—a bundle of copper wires for the NRL experiment—reduced to zero, causing further cooling.

A magnetic field is used to cool materials through a process known as "adiabatic demagnetization," which prevents the production of energy generated when the magnetic poles of atomic nuclei change direction.

FOREIGN RESEARCH

CIA Damage

American social scientists working overseas have always had trouble with politics. Before a sociologist or anthropologist could get to work, he had to convince his subjects he was not an arm of U.S. foreign policy—specifically military policy. It wasn't always easy, since the Defense Department did, in fact, support much of the research.

When Camelot, an Army-financed study of social conditions in Chile, broke into the news in 1965, social scientists found their positions more tenuous than ever. The Chilean press shouted intervention and the United States reacted by placing military studies under State Department review.

But the Camelot furor waned—in this country at any rate—and when Senators began drafting a bill setting up a National Foundation for the Social Sciences (SN: 2/18), they apparently did not think they had to shut out military funds.

The new foundation would greatly expand and support research in all the social sciences, and in addition would provide a civilian umbrella for foreign studies. Besides, the foundation would need some of the money the Defense Department spends annually on such research—roughly $10 million—so a section allowing any Government agency to contract for research in the new foundation was drawn into the bill. The contracts could make up 25 percent of the foundation's yearly budget. That was last year.

Then, in February, Central Intelligence Agency links with students and universities, through supposedly independent foundations, came to light. The effect on foreign research has been predictably disastrous. Scientists are meeting with reluctance, subtle forms of resistance and sometimes outright cancellation of their projects. The heat is particularly strong in Latin America.

"We must be aware," said sociologist Myron Glazer last week in testimony before the subcommittee which is considering the bill, "that we face a crisis of credibility overseas."

A professor at Smith College, Dr. Glazer had done his own analysis of student political attitudes in Chile and almost failed at the task. Even before Camelot and the CIA disclosures, Dr. Glazer and his co-workers had been accused of representing U.S. intelligence. They very nearly lost all cooperation because of the false rumors.

Since February, the entire U.S. academic world has come under suspicion. A joint Brazilian-Cornell University project was dropped by the Brazilians though they did not suspect their American colleagues of CIA connections, reports the June 23 issue of SCIENCE, in an analysis of the CIA aftermath. In another case, an American scientist was encouraged by his associates in Peru and Chile to drop