# U.S.S.R. developing industrial use of nuclear explosions?

by Charles B. Stevens

Recent information indicates that the Soviet Union is making wide use of peaceful nuclear explosions, and there is speculation that the Soviets may be developing a Pacer project.

In the Nov. 1980 issue of *Fusion* magazine, Dr. Walter Seifritz of the Swiss Federal Institute for Reactor Research reviewed the tremendous energy and economic potentials of using hydrogen bombs to generate hydrogen and fissile fuel in a Pacer-type project.

Pacer is the concept developed by U.S. researchers for using H-bomb explosions contained within salt-dome cavities to produce energy and breed fissile fuel—the concept upon which Seifritz based his own proposals.

In the United States, the Carter administration curtailed even the studies of this technology, along with all remnants of the U.S. Plowshare program—peaceful applications of nuclear explosions, or PNEs.

The Plowshare program, begun in 1957, took its title from the Biblical phrase, "They shall beat their swords into plowshares; neither shall they learn war any more." After a series of successful experiments, Plowshare began to investigate the use of nuclear explosives for excavating canals; building tunnels, harbors, and dams; and recovering such natural resources as oil, gas, and minerals.

Even at the time of Plowshare's initiation, it was noted that peaceful nuclear explosions were particularly attractive for the Soviet Union, with its huge deposits of minerals and petrochemicals and its vast development projects. Now that the United States has aborted Plowshare and the Pacer research, the question remains: to what extent is the Soviet Union carrying out work along these lines, and what are the strategic implications?

The fact is, the Soviet Union has maintained the largest PNE program in the world. For example, U.S. intelligence estimates that at least seven PNE test shots were performed in the Soviet Union in 1979. These same sources calculate that the Soviet Union has devoted as much as 8 percent of its nuclear tests to peaceful applications over the last few decades. Given the siting and explosive power of recent Soviet underground detonations, it is likely that the Soviets have an active program to develop Pacer.

Since the United States shut down Plowshare in 1976, all exchange of information with the Soviet Union on PNEs has ceased, and the United States has not even maintained a working intelligence group to monitor the Soviet PNE program. It should also be noted that the former director of Air Force intelligence, Gen. George Keegan, included in his discussions of Soviet antimissile beam weapons the necessary development of a Pacer-type system for the pulsed electric power supply to drive them.

## How Pacer works

The key idea in the Pacer concept was first developed by H. W. Hubbard of R&D Associates. Experience from numerous underground nuclear tests indicated that, given the proper geological formation, several hundred H-bombs could be detonated successively without destroying the cavity within which they were exploded. The particular geological formation needed is that of a salt dome, in which the mechanical stresses caused by the explosion-induced seismic shock can be dissipated in a controlled manner.

The Pacer concept consists of setting off a 20-kiloton TNT-equivalent, deuterium-based H-bomb every few hours within such a cavity. Steam containing suspended particulates of uranium or thorium is continuously passed through the 575-foot-diameter cavity located about 1 mile below the surface. In this way, the heat energy from the bomb blast can be extracted. Simultaneously, fusion-generated neutrons are absorbed by the uranium or thorium suspended in the steam. When this occurs, the uranium or thorium is converted into fissile

fuel (plutonium or uranium-233), which can then be extracted from the steam and fabricated into fuel rods for nuclear-fission electric power reactors.

Pacer is a most prolific breeder of fissile fuel. Enough fissile fuel can be bred from fusion-generated neutrons so that 12 to 20 times more energy is created in the form of fission reactor fuel than the immediate energy released by the H-bomb detonation.

## Strategic implications

It is commonly thought that there are more than enough nuclear weapons in today's arsenals (currently estimated at a total of 100,000 strategic and tactical warheads) to destroy the world several times over. In reality, however, when one considers alternative applications of nuclear devices such as antimissile "flak," military excavation and construction with clean H-bombs, and explosive power supplies for beam weapons, the possession of greatly enhanced nuclear-weapons stockpiles could be of immense strategic significance. The chief cost and production constraint on nuclear weapons production is that of procuring the fissile fuel needed in all types of warheads.

With conventional technology, such as uranium diffusion plants and nuclear breeding reactors, major increases in production of weapons materials would take at least several years to develop and could not be done in complete secrecy. A Pacer system for solely breeding fissile materials would not suffer from these drawbacks and could only be definitely observed—through seismic measurements of the continuous thud of Pacer underground explosions—once production had actually begun.

The key factor determining just how efficient and economic Pacer could be as a fissile-material breeder is the question of how large an H-bomb could be detonated within a 575-foot-diameter cavity without destroying it. The original U.S. projection of 20 kilotons was an extremely conservative estimate based on a limited number of underground explosions and theoretical calculations. Some experts believed that explosions as large as 200 kilotons could be achieved. These larger devices would incur no increased economic or fissile-fuel investment and would effect a tenfold increase in the amount of fissile fuel generated.

In order to determine whether use of these more efficient, larger detonations is feasible, actual tests would have to be carried out. And in fact, the Soviet Union has carried out a number of underground explosions near this 200-kiloton level (which is slightly above the maximum levels allowed by the Nuclear Test Ban Treaty, 150 kilotons) in Azgir, a region of the Soviet Union that contains natural salt-dome formations.

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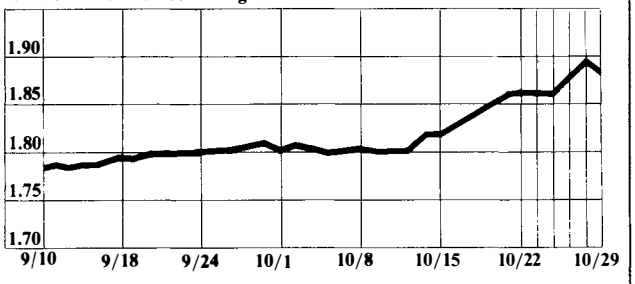
# Currency Rates

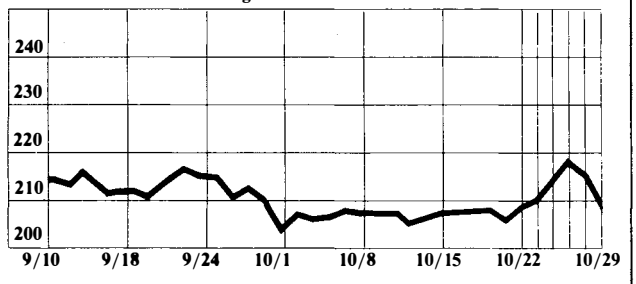
### The dollar in deutschemarks

New York late afternoon fixing



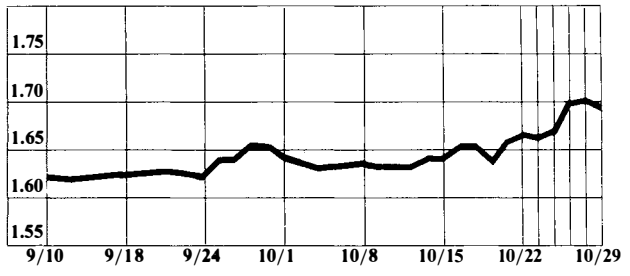

### The dollar in yen

New York late afternoon fixing




### The dollar in Swiss francs

New York late afternoon fixing




### The British pound in dollars

New York late afternoon fixing