National Park Service

Searing lava leaps 200 feet from the earth fires of Kilauea.

KILAUEA

The balloon bursts, more to come

Red-orange fountains of lava that boiled 200 feet high from Hawaii's Kilauea last week were less than a complete surprise to volcano-watchers who already forecast another eruption.

With arrays of tiltmeters, seismometers, lasers and other gear, scientists at the U.S. Geological Survey Observatory on the lip of Kilauea have long been monitoring every detail of volcanic activity, in hope of better understanding what makes volcanoes erupt, and when. Such knowledge could help scientists anticipate eruptions of the world's most dangerous volcanoes, located mostly in Indonesia, where thousands of people have been killed by sudden explosions of fiery mountains such as Krakatau which killed 35,000 people in 1883, and Mount Agung which killed 1,500 people in 1963.

All signs of the present eruption were there, says Dr. Dallas Peck, Survey geologist. It was just a matter of time. Since April, geologists had been momentarily expecting the eruption, although they could not pinpoint the exact time. It is much like blowing up a balloon, expecting it to burst, but not knowing exactly when, Dr. Peck explains. Minor earthquakes had been recorded as often as 200 to 400 a day in late October, and Kilauea's summit had puffed up to a size greater than ever recorded as molten rock flowed up from reservoirs some 25 to 40 miles below the earth's surface.

The eruption began about 2:30 a.m. (7:30 a.m. EST), Nov. 5, with skyrocketing fountains of flaming lava, pumice and fumes. Lava spurted out at the rate of about 2 million cubic yards per hour, forming a lava lake 160 feet deep at the bottom of the 500-foot crater. About 35 million cubic yards of lava poured out before the eruption died 23 hours later. The lava level began dropping as the molten rock drained back into a subterranean chimney.

So far, lava fountains and flows have been safely contained within the crater and caused no damage—only spectacular fireworks that attracted some 8,000 sightseers jammed in hired cars and chartered planes.

Scientists cannot tell how long the present activity will last, but swelling has begun again, foreboding additional activity. ◈

WEAPONRY

Shadow of the FOBS; bombs in orbit

On Sept. 17, 1966, the Russians launched a mysterious object from their Tyuratam complex at Baykonur, about 300 miles northeast of the Aral Sea. It had no name, not even a meaningless Cosmos number, and it followed a new trajectory inclined for the first time at 49.6 degrees from the equator. The mystery deepened when the object suddenly exploded in space, scattering debris into several different orbits. Less than seven weeks later, on Nov. 2, an identical object was launched, and again exploded in orbit.

Now the probable reason for the two strange shots has come to light. They were, it seems, the first of almost a dozen development flights for the latest weapon being tested by the Soviet Union, an orbiting nuclear bomb.

Defense Secretary Robert McNamara revealed the bomb's likelihood at a press conference called so hastily that the State Department—concerned with such matters as violations of the space weapons treaty—didn't know about it until it was over. McNamara describes the weapon as "something we have called a Fractional Orbital Bombardment System, or FOBS."

The difference between a FOBS and an intercontinental ballistic missile is that the ICBM is launched on a high ballistic trajectory, reaching a peak of perhaps 800 miles and then falling down to its target. The FOBS, McNamara says, is fired into very low orbit about 100 miles above the earth (about the same height as most manned orbital flights to date and well below most satellites), where it travels around the earth until a braking rocket slows down the payload and causes it to fall out of orbit, usually before the completion of one revolution.

The Russian system would probably have a warhead of from one to three megaton size, equivalent to from one million to three million tons of TNT and in the same range as the warheads of the submarine-launched Polaris missiles. Carried into orbit by a three-stage liquid-fueled rocket, the FOBS would get its downward kick when it was about 500 miles from the target.

A FOBS would have both advantages and disadvantages, McNamara says. Because of the long, low trajectory of its descent compared to an ICBM, it could avoid detection by the U.S. Ballistic Missile Early Warning System (BMEWS). Also, the impact point of such a weapon could not be determined until the rocket motor had fired to send it out of orbit, possibly as

little as three minutes from the target.

Accuracy, however, is one of the FOBS' weak points. A Russian system, says the Defense Secretary, would not be accurate enough to destroy U.S. Minuteman missiles, protected in their silos, though "the Soviets might feel it could provide a surprise nuclear strike against United States' soft land targets such as bomber bases."

The most severe of the system's shortcomings, as far as U.S. ability to defend against it is concerned, is the need for many FOBS missiles to be launched at the same time. A few FOBS weapons waiting in orbit, disguised as satellites, would do no good, McNamara said. To be effective, a large number of them would have to be launched en masse, which would then make them susceptible to detection by a recently deployed countermeasure which the U.S. has developed, over-the-horizon radar.

The new radar sees around the curvature of the earth by bouncing its signals off the ionosphere. In case of a multiple Soviet FOBS launch, the signals would bounce off the wake left by the departing missiles and return to detection instruments in U.S. territory. Over-the-horizon radar would offer perhaps a 15-minute advance warning, about the same that BMEWS gives of approaching ICBMs. The new radar system, which has been in operation for scarcely two months, is due to become fully operational in the first few months of next year.

One concern when the FOBS announcement was made was whether the Russians had violated the space treaty by their test flights, the most recent of which was Oct. 28. The treaty, designed to keep weapons of mass destruction from being stationed in space, is only weeks old, having been ratified by the United States and the Soviet Union on Oct. 10.

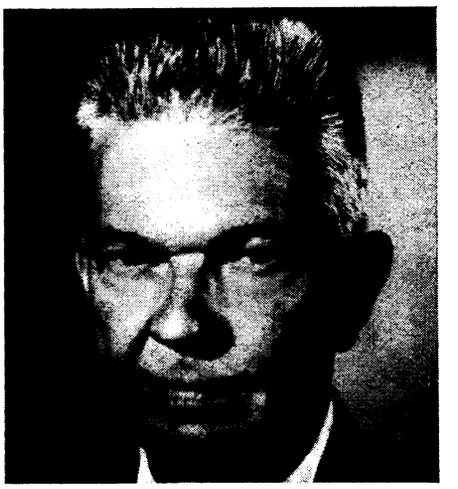
A FOBS system does not violate the treaty, McNamara says, because it is only in space for a fraction of an orbit. Flight tests of FOBS hardware, even for more than an entire orbit, would also be permitted as long as no nuclear warhead was included.

Last week, as a joint House-Senate atomic energy subcommittee began taking a close look at the controversial U.S. antiballistic missile program, the Defense Department's director of defense research and engineering, Dr. John S. Foster, said that Russia was making a mistake in developing an orbital bombardment system. Not only would the system fail to give them any additional military capability, he said, but it would offer less punch than if the same warheads were used in their regular form, as intercontinental ballistic missiles.

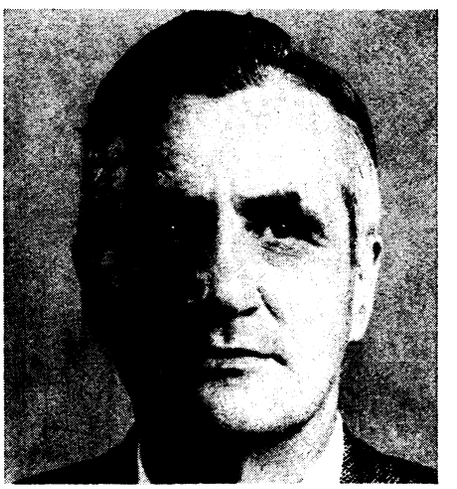
LASKER AWARDS

Two doctors and a Senator

Pepper



Phillips



Brodie

When cholera invaded Egypt in 1947, in that country's first outbreak in 20 years, Dr. Robert A. Phillips had just arrived in Cairo to head the Navy's Medical Research Unit. From work begun there and continued in Taiwan, Thailand and Pakistan, he conquered the disease, learning why it kills and how to stop it.

While Dr. Phillips was in the Orient, Dr. Bernard B. Brodie was in New York studying the biochemical behavior of antimalarial agents. His work on these drugs and others for heart disease, mental disorders and cancer has changed profoundly the course of drug studies and therapy (SN: 11/11).

As these two men pursued the substance of scientific research, Senator Claude Pepper (D-Fla.) pursued the economics of it, encouraging Congress to put money and support behind establishment of the National Institutes of Health. Backing from Pepper—now a member of the House—helped NIH get started and expand from a $2.4 million operation in 1944 to a $1.5 billion agency that today supports between 40 and 60 percent of all medical research in the United States.

Last week these three men met in New York to receive the 1967 Albert Lasker Awards—the most prestigious medical prizes in America. The awards, given over the last 22 years, carry a $10,000 honorarium from the Albert and Mary Lasker Foundation. Seventeen Lasker winners have gone on to win Nobel Prizes.

Dr. Phillips, currently director of the Pakistan-SEATO Cholera Research Laboratory, Dacca, East Pakistan, discovered that death from cholera is caused by dehydration. When Vibrio cholerae organisms grow in the intestine, body fluids and chemicals are thrown out of balance. The patient suffers severe diarrhea in which stool volume within four to seven days can exceed his body weight. Loss of water and electrolytes—chemical conductors essential to many physiological processes—kills unless quickly remedied.

Dr. Phillips' cholera treatment, which he says is so simple that even paramedical persons can administer it, consists of intravenous administration of an electrolyte solution which brings body chemistry back into balance. Effective in 99 percent of cases, its only problem is cost. Intravenous solutions are not produced in the developing nations where cholera is prevalent; importing costs are high. "Treatment may cost a peasant five months' wages," Dr. Phillips says. "While one member of the family is cured of cholera, the rest starve at home."

Dr. Phillips also has investigated cholera vaccines; so far effectiveness