

# A-Bomb Might Become Super-Excavator

## AEC foresees construction role for nuclear explosions in mass movement of earth and minerals

The Atomic Energy Commission has high hopes that, in the not too distant future, it will be able to put the devastating force of atomic bombs to work for mankind—by making excavations for harbors or canals, breaking up underground formations for oil or mining companies, or even producing steam for use in the Antarctic.

Already-confirmed experience with a mountain-shaking shot made last September convinces top officials that a similar shot could be used almost any time to create a harbor or increase the flow of oil from tight formations underground.

The commission, since its creation at the end of World War II, has been forced by cold-war circumstances to concentrate on development and production of devices for death and destruction.

For several years, though, a few scientists and engineers have been intrigued by the thought that these devices designed to level a city could also be harnessed to move millions of tons of earth.

Now the idea is beginning to get out of the talking stage and the AEC wants industry to help in making the dream come true.

Last July, the AEC established "Project Plowshare" at the University of California's Radiation Laboratory at Livermore. The aim is to explore whether, and how, nuclear weapons can be used for peaceful purposes.

In September, the commission and the Pentagon cooperated in the first underground explosion of an atomic bomb at AEC's Nevada testing site.

This test, dubbed "Rainier" by the government, had a military purpose—to determine whether it was feasible to conduct some A-bomb tests underground, thus avoiding all the messy problems posed by atomic fallout.

It was not part of Project Plowshare, but the researchers at Livermore are reported to be learning some valuable lessons from this test.

AEC Commissioner Willard F. Libby, the most enthusiastic booster for Project Plowshare within the government, describes the test this way:

A horizontal tunnel, seven feet by six, was dug 2,000 ft into the side of a mesa. Deep within the mountain, the tunnel was curled into a spiral, and an atomic bomb placed at the very end. The object was to trap the blast as far as possible, instead of letting it shoot back out the tunnel.

The point at which the bomb was placed was 800 ft below the top of the mesa.

The bomb used had a power of 1.7 kilotons—that is, power equivalent to 1,700 tons of TNT. This bomb, relatively speaking, was a midget. Its power was only one-tenth that of the 20,000 tons-of-TNT bomb used at Hiroshima.

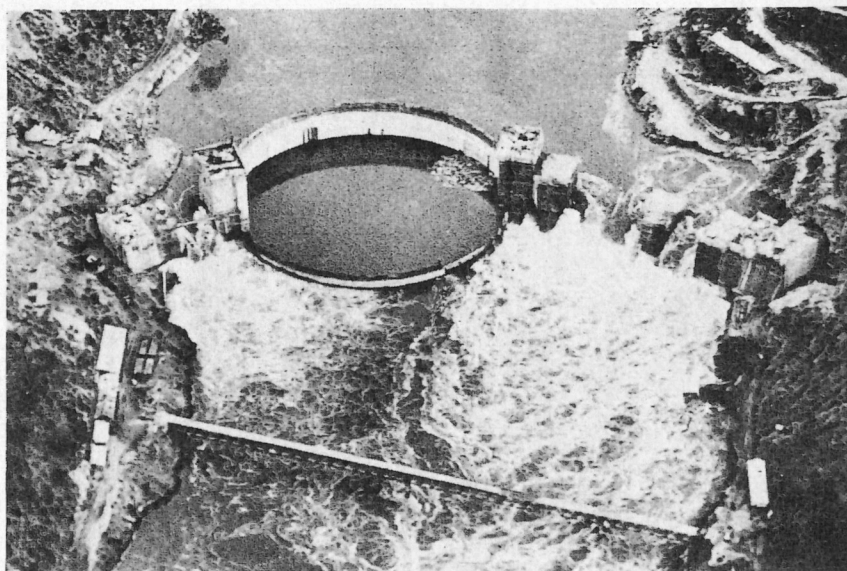
The shot came off without incident. The surface was not ruptured and scientists—intrigued by the thought of all that heat trapped somewhere in the

earth—began digging a new tunnel to the blast site within the mountain.

The AEC is elated over what they found, says Mr. Libby.

When the bomb exploded, 400,000 tons of rock were crushed within a diameter of 130 ft. At the center, for a short time there was a bubble of vaporized rock 55 ft in diameter. However, the shell around this bubble was too thin to withstand the weight of the crushed rock on top; hence, it collapsed, with the crushed rock falling into and mixing with the material in the saucer-like portion of the bubble which was left.

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**RECORD FLOOD** of Zambezi River in central Africa topped Kariba cofferdam by 6 ft a few days after photo was taken and swept away bridge in foreground.

## Flood Tops Kariba Cofferdam

A Zambezi River flood estimated to be 50% greater than last year's record flood last week breached the cofferdam containing the foundation of 400 ft Kariba arch dam. The raging central African river, flowing at 60 ft per sec, swept away a \$300,000 construction bridge across the river and tore away huge chunks of riverbank and numerous contractor buildings along the shore.

Work is virtually halted and now the only connection between river banks is a suspension foot bridge.

The cofferdam, a circular arch originally constructed to pass safely the record flood of last year, was heightened by 12 ft in the days preceding this year's flood. But at last report, it was 6 ft under water. This report

received early this week from ENR's correspondent in Rhodesia, also mentioned the distinct possibility that the cofferdam would be completely swept away. As it was, unofficial estimates by the Rhodesian Federal Government Hydro-Electric Board and the contractor, Impresit, Ltd., of Italy, placed damage at more than \$1 million.

Designed by Andre Coyne as a thin arch of 400 ft maximum height, Kariba will span a 1,800 ft gorge and back up a reservoir of 140 million acre-ft, 4½ times the size of Lake Meade behind Hoover Dam (ENR Sept. 6, 1956, p 71). Zambezi River flow during rainy seasons has been estimated as 450,000 cfs. There was no information as to the magnitude of last week's flow.

## . . . A-bomb to move earth

To the surprise of the investigators, says Mr. Libby, radioactivity was confined to 700 tons of radioactive rock at the center which could be easily identified because of its color—black.

The entire region of the 400,000 tons of crushed rock days after the explosion was still heated to a point 130 C above the normal rock temperature.

Mr. Libby says the Livermore researchers will have to make some blasts of their own (probably late this year) in order to make further findings.

The first shot, for example, was made in moist volcanic ash; the moisture was lost in the explosion. Future tests might well be carried out at a shallower depth, in a different type of rock and in formations where no moisture is present.

As it is, Mr. Libby sees six possible peacetime uses for underground nuclear explosions:

### 1. To move earth:

"We know how to dig out a harbor right now," says Mr. Libby. (Other AEC sources have said three prospective harbor sites already have been chosen). "But we are stymied for the present by the fallout problem."

AEC also envisions possible use of A-bombs to excavate for canals, or in changing the course of rivers.

### 2. To loosen underground formations:

Both oil and mining companies have held exploratory talks with AEC concerning possible use of nuclear bombs to break up underground formations, thereby making extraction of minerals easier.

### 3. To make natural steam which can be tapped for industrial use:

It may be possible to introduce water into the "hot" underground area, thus producing steam which then can be tapped for heating purposes or for generating electric power.

### 4. To study the internal structure of the earth:

The shocks produced by the explosions will be valuable to seismologists studying the internal structure of the earth, since the shock waves are sharp and clear compared to the fuzzy waves produced by earthquakes.

### 5. To produce radioisotopes:

They may be produced as byproducts of a blast set off primarily for another purpose.

### 6. To induce chemical reactions:

Mr. Libby thinks it would prove possible to gasify coal or shale, as well as produce a number of other chemical reactions—depending on the type of geological formation in which the blast is exploded.

Mr. Libby agrees that some of these uses may prove impractical. But he

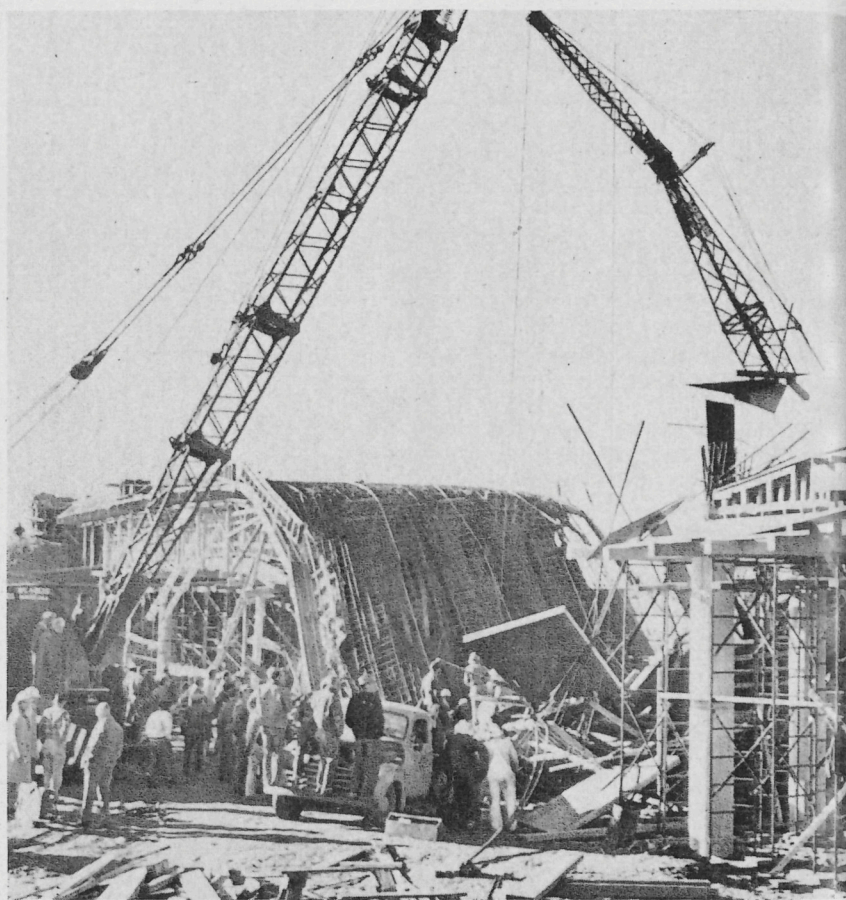
has full confidence that further research will uncover some practical uses for atomic explosives, and that advances may come rather rapidly.

"We welcome ideas from industry," he says. "We're trying to keep this thing unclassified, and we'd like nothing better than for some people to come in with well thought out proposals on tests for specific purposes."

The bombs, in the foreseeable fu-

ture, must remain under the close control of the government. No one can buy an A-bomb from the government. But Mr. Libby promises the cooperation of the AEC to the maximum extent possible.

Mr. Libby is confident that at least one underground test shot will be made this year, probably in Nevada. (No underground tests will be made in the upcoming tests in the Pacific.)



## Falsework Failure Dumps Bridge

Tubular steel falsework supporting the wood forms for a highway overpass north of Denver collapsed during concreting operations February 19 and dropped a 60 ft section 15 ft to the ground. Six workmen of 20 on the structure were injured.

Investigations are being conducted by the Colorado Highway Department, the contractor and the scaffolding manufacturer.

The failure occurred an hour after concrete placement began. About 39 cu yd of a total of 100 cu yd scheduled for the ill-fated section had been placed, the job superintendent said. Total weight of the fallen section was estimated at 115 tons, including 79 tons of fresh concrete.

Frank Wiggs, structural superintendent for Peter Kiewit Sons Co., the contractor, said the supports were intended to have a safety factor of two. He attributed the collapse either to misplacement of the shoring or to defects in it. The pipe shoring had been newly purchased, he said. Mr. Wiggs estimated the damage at \$40,000.

Martin Trotsky, president of Waco Scaffolding & Equipment Co., Denver, manufacturers of the steel falsework, said he would have no statement to make until Waco engineers complete a thorough investigation.

The structure was one of six bridges and overpasses being erected by the Kiewit firm under a \$1.2 million contract with the state.