TECHNOLOGY

Power to Burn

A new process at the Peach Bottom, Pa., Power Station is making possible operation of a high temperature, nuclear power plant of far greater efficiency—By Charles A. Betts

➤ WITH LITTLE FANFARE and public attention, a major development in the quest for dramatically wider use of atomic energy for power is under way at modern science's newest and most advanced nuclear power station at Peach Bottom, Pa.

Shortly after the first of this year, scientists and technicians carefully placed the first fuel element, a cylinder 12 feet long and 3.5 inches in diameter containing graphite-covered uranium and thorium, into the atomic reactor. The work of loading had begun and was to continue until 804 of the potent, giant pencils had been inserted, enough fuel to run the plant for three years.

Early in March, when the 682nd fuel element had been inserted, the first nuclear chain reaction was achieved and scientists called a temporary halt in the loading while they gathered data. Actual generation of electricity is expected to begin early next year.

In an era when the generation of atomic power is hardly earth-shaking, what makes Peach Bottom something special?

Operating Tests Completed

The plant represents a first in the production of steam at temperatures and pressures high enough to take advantage of the utility industry's modern generating station technology. Successful low-power nuclear operating tests were completed April 29.

Peach Bottom had its origin in 1958, when the Philadelphia Electric Company noted that an advanced type of helium-cooled atomic reactor was under development by the General Atomic Division of General Dynamics Corporation in California. Following discussions with the Atomic Energy Commission, Philadelphia Electric and 52 other utilities formed a non-profit organization known as High Temperature Reactor Development Associates Inc. to "promote research and development in the field of nuclear energy."

In the summer of 1959, the project was approved by Congress and a contract signed with AEC. Cost of the plant is about $28.5 million. In addition, AEC agreed to support a research and development program specifically for this promising type of reactor up to a cost of $14.5 million. Further, AEC is waiving about $2.5 million in fuel-use charges through the first five years of the plant's operation.

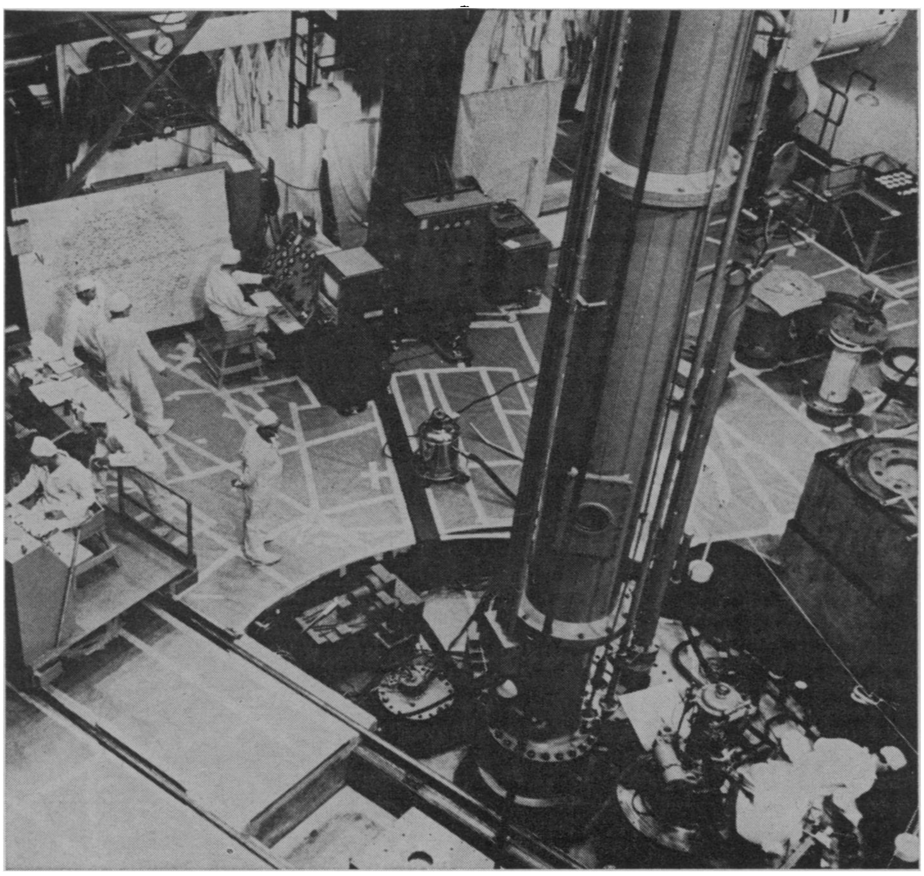
The facility, along the banks of the Susquehanna River about 70 miles from Philadelphia, will produce a modest 40,000 kilowatts of electricity. Its designers and operators, however, are quick to point out that the importance of the plant is as a prototype in the first application of its new high-performance concept. Already a 330,000-kilowatt reactor of the same type has been contracted for in Colorado.

Heart of the nuclear system is the reactor where the 804 fuel elements will produce the heat required to generate electricity. The reactor unit is a 135-ton carbon steel cylinder approximately 30 feet long, with an inside diameter of 14 feet, capped with a 40-ton steel lid.

Helium is used as the coolant, the atomic scientists say, because it "is a chemically-inert gas; has good heat-transfer characteristics; cannot burn, explode or cause corrosion, and it does not absorb neutrons." These features make it an exceptionally good choice for removing the heat from the nuclear reactor to produce steam.

The combination of using a helium coolant and, for the first time, an all-graphite nuclear core will make Peach Bottom the first commercial nuclear plant capable of producing steam at 1,000-degree temperatures.

In operating the power plant, the helium gas will be circulated by blowers through the reactor to pick up heat released by nuclear fission. The hot helium is carried through pipes to a boiler where its heat is used to produce steam. The steam spins a



General Dynamics

POWER AT PEACH BOTTOM—Graphite-clad fuel elements are loaded into the reactor core at the Peach Bottom Atomic Power Station in the Philadelphia Electric Company system.

conventional turbine generator to produce electricity.

The mechanical-electrical portion of the Peach Bottom Atomic Power Station is very similar to the conventional power plant which burns coal, gas or oil. The steam rotates the turbine, which turns the generator via a connecting shaft. Thus the heat energy contained in the steam produces mechanical energy in the turbine, which is then converted into electrical energy in the generator.

Atom-produced electricity is no different from the electric power generated in a conventional generating station. No customer can tell whether his power comes from an atomic plant or a conventional plant.

The Susquehanna River water used to condense steam from the turbine is returned to the river with same purity as when it was removed. The water never actually enters the nuclear portion of the plant. Actually, the conventional, steam-producing portion of the plant is physically separated from the nuclear portion.

Moreover, as at all nuclear plants, extensive instrumentation has been set up for the detection and control of radioactivity. Monitoring stations keep a constant check on the water and atmosphere in the area to assure that radiation stays within the limits set by Federal and state laws.

Sophisticated Facilities

The trend toward more sophisticated atomic energy producing facilities like Peach Bottom will see an increasing percentage of electrical needs being met by nuclear power.

For example, in his last annual report, Dr. Glenn T. Seaborg, Chairman of the Atomic Energy Commission, said that he believes nuclear power plants will be furnishing the electrical needs of more than two million persons by the end of this year. He further predicted that the figure will reach 60 million by 1980.

The Seaborg forecast is echoed at Peach Bottom by Noble T. McHugh, director of the facility's atomic information center. He adds that by the turn of the century, "80% of our electricity will originate from atomic reactors."

Mr. McHugh says that atomic power is the energy source of the future because the nation is using electrical power at a rate double that of 10 years ago. "We will need four times as much electricity in 20 years, eight times as much in 30 years. Thus, the growing need for economical electricity is evident."

Peach Bottom's 40,000-kilowatt capacity is small compared to Philadelphia Electric's other, conventional generating stations, which have a combined capacity of nearly 3.8 million kilowatts. But as a prototype, Peach Bottom looms large indeed in the commercial development of Atomic power here and around the world.

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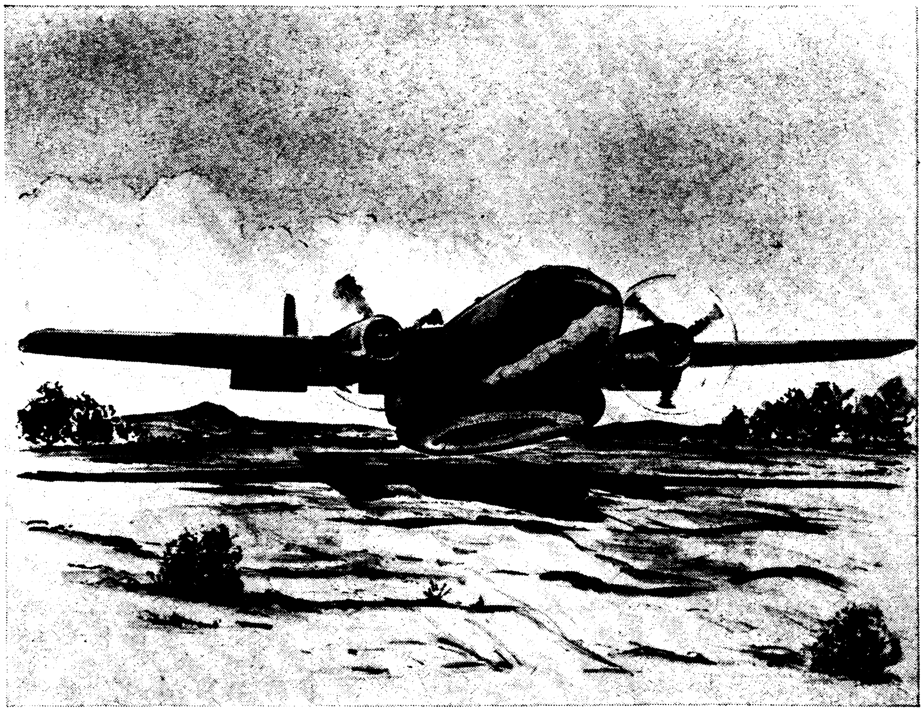

Bell Aerosystems

CUSHION OF AIR—An air cushion landing system for aircraft is depicted in this drawing of a C-119 "Flying Boxcar." Developed by Textron's Bell Aerosystems Company, Buffalo, N.Y., the gear consists of a giant rubber tube encircling the bottom of the plane's body. The "tread" is pierced by thousands of tiny vent holes from which pressurized air jets, forming the air cushion on which the plane floats several inches above the ground.

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'Hitting the Beach'

➤ HITTING the beach in Viet Nam or anywhere else could be made much easier by a troop-and-cargo landing craft riding on a cushion of air that would carry it over reefs, rice paddies and even three-foot boulders.

A flexible rubber "skirt" around the edge of an air cushion vehicle (ACV) traps air pulled down between the water's surface and the bottom of the ACV by two huge fans. Several ACVs called Hydroskimmers, have already been built for the U.S. Navy by Bell Aerosystems Company, Buffalo, N.Y.

It takes about five hours and 20 minutes for one of the LARC-5 unloading boats now in use to move cargo from the six-fathom transfer point off the coast of Viet Nam to the base at Nha Trang. An ACV with a five-ton payload could get there in 58 minutes, or in only 42 minutes by cutting overland across some sand dunes, said John B. Chaplin, a Bell engineer, speaking to the American Society of Naval Engineers in Washington, D.C.

Carrying troops, jeeps or other cargo, the ACV could skim along at more than 80 miles per hour, driven by two small propellers at the rear.

One operation described by Mr. Chaplin was the landing of an entire division of U.S. Marines in 12 hours. The best ACV for the job, he said, would be a huge one capable of carrying 60-ton payloads. Bought by the fleetload, such craft would cost the Navy about $3,250,000 each. This is more expensive than the LCM-8 ships now in use, but the ACV's would more than make up the difference by not having to stand far offshore when unloading.

ACVs can even cross mine fields with little danger, Mr. Chaplin said, since they do not touch the ground and their fans only exert a downward force of 35 pounds per square foot. A 200-pound man walking would exert about 400 pounds per square foot.

Fifty-caliber machine guns have been test-fired from Hydroskimmers with "good" accuracy.

Although ACVs do tend to sideslip during fast cornering or crosswinds of more than 25 miles per hour, they have crossed through nine-foot surf and have operated in rough seas with wave peaks 18 feet high.

Commercial passenger-carrying ACVs are already in experimental use, and Mr. Chaplin estimated that versions could be made capable of carrying up to 500,000 pounds.

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