SPACE

Nuclear Rocket by 1975

The nuclear rocket engine, said to be the greatest advance in rocketry since the 1930's, could power an atomic rocket by 1975.

➤ AN ATOMIC ROCKET—a rocket engine powered by a nuclear reactor—could be ready to fly by 1975.

Harold B. Finger of the Government's Space Nuclear Propulsion Office (SNPO) said that the nuclear rocket engine is the greatest advance in rocketry since Goddard's early chemistry rockets in the 1930's.

The payload of a Mars-orbiting mission, he said, could be increased from 30,000 pounds to 50,000 pounds, by substituting an atomic third stage in a Saturn V rocket, such as the one that will carry Project Apollo's two American astronauts to the moon sometime around 1970.

Tests of the Westinghouse-developed NERVA reactor (Nuclear Engine for Rocket Vehicle Application) have already shown a specific impulse—the rocket equivalent of miles-per-gallon or efficiency—better than twice as great as that of equally powerful chemically-powered engines.

Furthermore, Mr. Finger added, efficiency of a reactor rocket is limited only by the temperature that the reactor itself can withstand. Currently, the pile, or reactor, is built with graphite, since it is one of the few materials that gets stronger as it gets hotter. Tungsten and several other materials are being investigated for their heat-resistance.

While larger reactors are desirable for future missions, however, a design such as the present NERVA could greatly increase the payload that a Saturn V vehicle could direct-land (without first going into orbit) on the moon.

In its present form, a Saturn V rocket has an escape payload of 94,000 pounds, of which it can direct-land 27,000 to 28,000 pounds on the moon. A nuclear third stage would raise the landing capacity to more than 47,000 pounds.

There is, nevertheless, a considerably larger version under development. Called Phoebus, it will have one quarter of a million pounds of thrust.

It is being developed by the Los Alamos Scientific Laboratory, which was responisble for the Kiwi series of reactors, the basis of NERVA.

Phoebus may turn out to be usable in clusters, for greatly increased total thrust. This could mean that many different-sized rocket vehicles could be built around two basic engines, NERVA and Phoebus.

Getting a flight-ready version will cost about one billion dollars over and above what has already been spent, Mr. Finger said. So far, through the end of fiscal 1964, the program has spent about $582 million, with another $130 million budgeted for 1965.

SNPO is jointly run by the National Aeronautics and Space Administration and the Atomic Energy Commission.

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Massachusetts Institute of Technology

MIGHTY MAGNET—D. Bruce Montgomery, staff member at the National Magnet Laboratory, makes adjustments in experimental apparatus mounted atop the laboratory's giant new water-cooled magnet.

PHYSICS

Synthetic Magnetic Fields Hit High Peak

➤ THE HIGHEST continuous magnetic fields ever made by man have been achieved by scientists at the National Magnet Laboratory, Cambridge, Mass.

The magnetic fields attained were 255,000 gauss, or more than 500,000 times the strength of the earth's surface magnetic field of one-half gauss, which is a unit for measuring magnetism.

Such high magnetic fields, even though they last for only a minute, are extremely valuable in studies of the behavior of matter.

The large magnet at the National Magnet Laboratory drew more than ten million watts of electrical power when it operated at the peak of 255,000 gauss. This power was converted to direct current by four giant motor-generator units. The magnet was cooled by 2,000 gallons of water per minute during the experiments.

Children's toy magnets usually measure between 800 and 900 gauss, while magnets in a good hi-fi speaker range up to 12,000 gauss.

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SPACE

Engineers Emerge From 8 Days in Centrifuge

See Front Cover

➤ FOUR RESEARCH engineers emerged Nov. 12 from eight days of confinement in a windowless, whirling room only 14 feet long and eight feet wide.

They had been serving as human guinea pigs, studying the effects on man of artificial gravity produced by a centrifuge, such as might be encountered during long interplanetary journeys or tours of duty on space stations.

The crew was divided into two two-man teams, each serving alternately as observers and test subjects for numerous psychological and physical tests.

The tests were also monitored outside the chamber, via closed circuit television and several other systems.

An important feature of the test was that the whole centrifuge chamber, seen on this week's front cover, could swing out and tilt itself relative to the rate of spin.

This ability permitted the test subjects to stand "upright" according to the "new" artificial gravity, just as they would do in space.

No ill effects were observed after the test, most of which was conducted at six revolutions per minute, with long speed-up and slow-down periods to accustom the scientists to the changing environment.

The experiment, run by the astronautics division of General Dynamics Corp., was only one of many similar tests by various aerospace companies who are using their own engineers and scientists, instead of astronauts, as guinea pigs in the nation's space program.

Though these men are not likely to be among the first men on the moon, the Russian three-man Sunrise, with scientists and doctor aboard as well as an astronaut, demonstrated that we need not send only supermen into space.

In fact, the National Aeronautics and Space Administration has started a training camp for space-bound scientists who do not approach the one-in-a-million standards of America's astronauts. Private industry will doubtless be NASA's source of raw material.

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PHYSICS

Solid Laser Material Grown in Crystal Form

➤ A NEW solid laser material than can be operated continuously is now commercially available.

The new material is yttrium aluminum garnet with a small amount of neodymium. It is small, water-cooled and has a toughness comparable to ruby laser rods. The new material was grown in crystal form by the Linde Division of Union Carbide for scientists at the National Aeronautics and Space Administration's Marshall Space Flight Center, Huntsville, Ala.

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