

## TECHNOLOGY

# Digital Modulation Tested

An off-on pattern of coding radio signals being tested is expected to be particularly useful in sending secret messages and data from satellites—By Ann Ewing

► A NEW METHOD for coding radio waves, called DM for digital modulation, is now being tested between two Caribbean islands.

If the current tests prove as successful as the preliminary ones, a new term, DM, will be added to the familiar radio abbreviations of AM and FM.

Any radio link depends on passing energy through the atmosphere. Digital modulation consists of sending on-off radio energy coded into a specific pattern.

Using digital modulation, thousands of items, or "bits," of information may be transmitted each second in the form of these pulsed patterns over regular radio channels, either AM or FM.

Information is now sent over radio circuits by making use of changes in the amplitude of radio waves, which is AM or amplitude modification; or by variations in the frequency of the radio signal, which is FM, or frequency modulation.

The digital modulation tests over the Grand Turk-East Islands radio link, officially known as the Eastern Test Range, are under the auspices of the U.S. Air Force. Scientists at the National Bureau of Standards, who are serving as consultants, will check to see how DM works for long-distance transmission.

Digital modulation offers an ideal method for sending information that is coded, either for secrecy reasons or because the data come that way, as from satellites.

However, when it is important to recognize the voice of a person calling, frequency modulation is better than DM. This is because digital modulation somewhat distorts the voice.

"You can tell what is being said," Walter Johnson of the National Bureau of Standards told SCIENCE SERVICE, but it is difficult to recognize the voice. Mr. Johnson is directing the program for evaluating the digital modulation tests.

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# Peaceful Atom Progress

► "TRULY SIGNIFICANT progress" toward both practical and scientific uses of the exploding atom for peaceful purposes was made during 1964, the U.S. Atomic Energy Commission reported in Washington, D.C.

One advance was finding out how to reduce the radioactivity thrown into the air from nuclear blasts designed to produce craters.

Industrial applications of the tremendous and relatively inexpensive energy from atomic explosives include moving earth to form canals and harbors, and to break rock deep underground for mining and for stimulating oil and gas production.

A scientific use of underground nuclear blasts is to produce samples of ultra-heavy synthetic elements quickly and in significant quantities. This was accomplished at the Nevada Test Site on Oct. 9, 1964, in an underground test shot known as Par.

The AEC's program for developing industrial and scientific applications for nuclear explosives is called Plowshare.

The progress made under Plowshare during 1964, the AEC said in its annual report to Congress, paves the way for future achievements, including the construction, possibly by nuclear means, of a new sea level canal connecting the Atlantic and Pacific Oceans.

The AEC also noted progress in pasteurizing food with radiation. The Food and Drug Administration has approved use of cesium

137 for sterilizing bacon and to disinfect wheat and wheat products, and cobalt-60 for inhibiting sprout formation in white potatoes.

In the space propulsion system called Poodle, full-size thrusters were operated.

Poodle is a rocket engine that would be propelled by hydrogen expelled through a nozzle, the hydrogen having been warmed by the heat of radioactive decay.

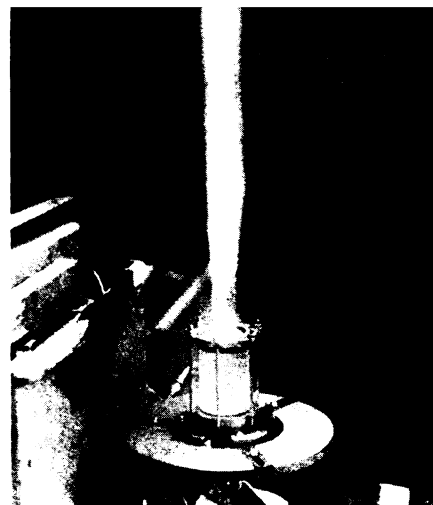
Development of this use is underway at Space Technology Laboratories, Redondo Beach, Calif. Possible uses for Poodle include propelling payloads to high earth orbits, such as a 24-hour equatorial orbit, or deep space probes that could pass within 18 million miles of the sun and yet escape from the solar system. It might also be used for attitude control and artificial gravity systems for large manned orbiting laboratories and manned interplanetary spacecraft.

During 1964, the AEC gave strong support to the International Atomic Energy Agency as a focal point for international cooperation in the study of using large nuclear power plants not only to produce electricity but also to desalt water.

Cooperative studies in this field are underway with the Soviet Union, Israel and Mexico.

Among significant developments in weapons was an increase in the "hardness" and penetration capability of missile warheads to decrease their vulnerability to enemy anti-ballistic missile countermeasures.

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Union Carbide

**STEERING IN SPACE**—This prototype of an attitude control motor was devised by Sperry Rand Corporation to provide the thrust necessary to orient a vehicle traveling in space. Oxidation-resistant graphite composite developed by Union Carbide Corporation was used in its construction.

## SPACE

## Ranger Spacecraft Aim For More Moon Pictures

► THE U.S. IS getting ready to take new close-up pictures of the moon.

Two Ranger spacecraft, just like the one that took more than 4,000 pictures of the moon last summer, will soon be launched by the National Aeronautics and Space Administration. The first, Ranger C, is scheduled for launch between Feb. 17 and 24.

Ranger D will be launched about one month later, between March 18 and 26.

Neither spacecraft will photograph exactly the same target areas as did Ranger VII. Ranger C is to be aimed closer to the moon's terminator zone, the shadowy line between the light and dark areas.

The Ranger program's data on the lunar surface will be important in selecting landing sites for the Surveyor and Apollo programs. Surveyor will soft-land a battery of instruments on the moon, including a fully automatic chemical laboratory that will analyze samples of the surface. Apollo will land astronauts on the moon.

The 800-pound Rangers will be powered mostly by the sun through solar cells.

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## TV Camera Smaller Than a Shoe Box

► A NEW TRANSISTORIZED TV camera system is smaller than a shoe box and weighs only 10 pounds. The closed-circuit system, called the TC-175, has its own regulated power supply in one tiny package and may be fed directly to a conventional TV receiver. Du Mont Laboratories, Clifton, N.J., will make it available early this year.

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