

ROCKETS and MISSILES

# Space Program Outlined

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► PRESIDENT EISENHOWER has outlined for the first time the U.S. space program for 1959. Important projects include scheduled launchings of some 40 sounding rockets and a dozen satellites.

Reporting to Congress on the first year of this nation's space activities, Mr. Eisenhower also presented details concerning research experiments for future space vehicles.

They fall in six main fields: atmosphere, ionosphere, energetic particles, electric and magnetic fields, gravitational fields and astronomy. The program is a stepped-up version of the space aspects of the International Geophysical Year, which ended last Dec. 31, and is under the direction of the National Aeronautics and Space Administration.

To many scientists, one of the most intriguing experiments included is a further test of Einstein's general theory of relativity. This would be done by comparing the time kept by an atomic clock in an earth-circling satellite with a similar clock at a ground station during a month or more.

Atomic clocks run on the billions of vibrations made each second by atoms. Those using cesium are considerably more accurate than one second in a billion. A systematic difference between the earth-bound clock and the satellite clock would be expected, because Einstein's theory holds that the fundamental time scale of atoms is influenced by the gravitational field in which the atom is located.

If the satellite were orbiting at distances more than 2,000 miles from the earth's surface, its clock would "tick" faster than the one on earth.

A precisely instrumented satellite would be launched into a very high orbit to plot the earth's exact shape as part of the study of gravitational fields.

In probing the earth's atmospheric structure, both sounding rockets and satellites will be used. Particular emphasis will be placed on obtaining and understanding daily, geographic and seasonal variations in the atmosphere, and the relationships between surface weather and changes in the upper atmosphere.

Much new information about the ionosphere and its ability to reflect radio waves for long-distance communications will be gleaned by polar-orbiting satellites and those equipped with radios operating at lower frequencies than the 108 megacycles now used.

The interactions of high energy particles with the earth's atmosphere will be studied intensively, and the types and energies of such particles and their spatial distribution

measured, Mr. Eisenhower said, including the recently discovered radiation belts believed hazardous to men in space flight.

The earth's and moon's magnetic fields will be measured by magnetometers in space probes. Proton magnetometers will be used to study ring currents above the ionosphere and their relations to magnetic storms.

The astronomy program will be expanded. A survey of the so-called "hot spots" of the sky, areas of intense radiation in the far ultraviolet that were discovered during the IGY, will be extended to the southern hemisphere sky by sounding rockets. Particular emphasis, Mr. Eisenhower said, will be placed on using scanning satellites and rockets to observe the previously unexplored infrared and high-energy gamma ray spectral regions.

Such studies will lay the ground-work for the satellite observatory program, when man himself will be in space.

In the military satellite program, directed by the Defense Department's Advanced Research Projects Agency (ARPA), Mr. Eisenhower said some of the later vehicles in the Discoverer program would carry biomedical experiments essential to launching a man into space.

A 150-pound, battery-powered satellite to aid navigation of aircraft, surface vessels and submarines is among the several scheduled for launching during the first six months of 1959. Later versions will be larger and longer-lived than the three months expected for the first navigation satellite.

By 1960 or 1961, Mr. Eisenhower predicted three satellites will be circling the earth at a distance of 26,000 miles from the center to relay radio, television and teletype messages continuously. Such satellites are called "fixed," because they maintain the same position over a given point, revolving at the same speed as the earth.

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## GEOPHYSICS

### Polar Ice Cores Reveal Trapped "Ancient Air"

► BUBBLES OF "ancient air" trapped in polar ice may reveal whether the modern industrial world is polluting the atmosphere with carbon dioxide.

The air bubbles were found in cores drilled at depths down to 1,345 feet in the Greenland and Antarctic ice caps. The ice originated as snows that fell as long ago as ten centuries.

James Bender of the U. S. Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill., said the bubbles are now

being analyzed for their carbon dioxide content.

If the analysis shows a lower percentage of the gas in the ancient atmosphere and an increase in later years, this will indicate more carbon dioxide enveloping the earth due to industrialization.

The outcome would be a warming of the earth, according to a theory known as the "greenhouse effect." The carbon dioxide would act like the glass roof of a greenhouse, allowing heat rays from the sun to pass through and containing the warmed air below.

Mr. Bender found the bubble diameters varied from 0.02 inch at the greatest depths (and greatest pressures) to 0.12 inch in the shallow areas. The smallest bubbles are under pressure 25 times greater than that of the atmosphere.

The main problem facing the scientists now is development of ways to analyze the bubbles without first contaminating them.

One interesting finding is the total absence in the Greenland and Antarctic samples of preserved bacteria or any other form of biological material. Col. Frederick W. Timmerman, conducting the analyses at Walter Reed Army Medical Center in Washington, does not draw any conclusions for the present. He said there is no telling that future cores will not be filled with frozen bacteria.

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**HISTORY'S FROZEN RECORD—** This ice core portion is more than 800 years old. Theodore R. Butkovich, physicist, examines the core in the "cold room" at Wilmette, Ill., laboratory of U. S. Army Snow, Ice and Permafrost Research Establishment. The core is four inches in diameter and 1,300 feet long. It was drilled from the Arctic ice cap and cut into sections. Samples of the atmosphere for each year from the year 1100 are trapped in the ice in the form of bubbles.