



National Aeronautics and Space Administration

**WELL-DRESSED ASTRONAUTS**—What the well-dressed U.S. astronauts wear in the desert is displayed by the group after a training session, near Stead AFB, Nev., to teach how to live in the desert in case of emergency landing. Front row, left to right: Frank Borman, James A. Lovell, John W. Young, Charles Conrad, James A. McDivitt and Edward H. White. Back row, left to right: Ray Zedebor (Astronaut Training Officer), Thomas P. Stafford, Donald K. Slayton, Neil A. Armstrong and Elliot M. See.

## METEOROLOGY

## Thunderstorm Violence

A new downdraft theory developed with the aid of a giant computer has helped scientists discover the reason for the violence of thunderstorms—By Tove Neville

► A GIANT COMPUTER has helped discover what causes the violent behavior of thunderstorms.

By feeding information, collected from ground observation, balloons and planes flying through thunderstorms, to the advanced International Business Machines 7094 computer for one and a half years, two scientists tested a theory explaining the downdraft in thunderstorms causing damage every summer all over the United States.

The downdraft is a stream of air sweeping down to earth out of the storm causing the heaviest gusts of wind, the driving rain, the drop in temperature, the sudden jump in pressure and the greatest lightning activity, Dr. Horace R. Byers, professor of geophysics at the University of Chicago, told SCIENCE SERVICE.

Dr. Byers, president of the International Association of Meteorology and Atmospheric Physics, revealed the new theory for the downdraft, worked out by him and co-worker P. M. Das, to his colleagues in his presidential address at the International Union of Geodesy and Geophysics.

This two-week meeting in Berkeley, Calif., brought together 2,500 scientists from all over the world to exchange knowledge of the earth sciences.

The downdraft, culprit of the thunder-

storm, has been measured before, but how it develops has never been explained.

The thunderstorm starts with an updraft that forms a thunderhead, Dr. Byers said. The theory is that in this updraft, cloud droplets condense and grow, and some of these raindrops fall down through the cloud. The raindrops accumulate in the lower part of the cloud and their weight drags the air down.

In moving downward, this wet cloud air becomes colder than the air around it. This causes it to sink farther and it accelerates downward until it reaches the earth as a violent burst of wind.

Calculations with data fed to the giant computer gives values for the fall of the raindrops in the cloud, for temperature, moisture and the downdraft speeds that agree with the theory and thus support it.

Dr. Byers said that the downdraft actually spells the death of the thunderstorm, which reaches its peak when the downdraft begins, because it is the mechanism leading to the storm's end.

However, when the downdraft hits the earth, it spreads and can start new thunderstorms nearby if it acts to form cold fronts, making the air rise and forming new thunderheads. For this reason, thunderstorms often come in clusters, Dr. Byers said.

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## GEOLOGY

## Russians Dig to Reach Below Earth's Crust

► THE RUSSIANS are digging through land to reach down just below the earth's crust to the mantle and expect to dig from six to nine miles down within three to five years.

The digging is being done at five locations in the USSR, Prof. Vladimir V. Belousov of the Soviet Academy of Sciences said in Berkeley, Calif. He is president of the International Union of Geodesy and Geophysics, which held a two-week meeting in Berkeley, Calif. Scientists from 60 nations attended.

The United States is planning to dig to the mantle through the ocean floor in a program called Project Mohole. Prof. Belousov pointed out that since the two countries are approaching the exploration of the earth from two different angles, they are not competing with each other.

He said that digging through the continent is very difficult and that techniques are still being worked on for the project. Although the immediate practical gains from such a project are not obvious, Prof. Belousov said that future exploration of the mantle might give men knowledge of where in the earth's crust to find and mine metals.

Prof. Belousov noted that man now knows quite a bit about cosmic space, but that his knowledge of the earth reaches only a few miles into the ground and much of this knowledge is based on shaky theories.

Nuclear explosions for exploring the earth's crust are not recommended by the Soviet seismologist. The upper mantle has a different composition and construction than the crust itself, Prof. Belousov noted.

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## HYDROLOGY

## Tidal Power Surveyed In North Australia

► POTENTIAL TIDAL power sites in Australia's Collier Bay area are being surveyed by the French research organization, France Technique, with West Australian Public Works Department officers.

John G. Lewis, Government engineer, suggested the survey, which began in the Northwest of Western Australia in April, could have far-reaching results for the whole of the sparsely settled northern half of Australia.

Some of the tidal power resources of the Northwest could be fed into the power grid, or even carried 1,800 miles to the main Australian grid, in the southeastern corner of the continent.

The survey will concentrate on Walcott Inlet and Secure Bay where the rise and fall of tides is about 36 feet.

If on-site aluminum production is ultimately to be established in the nearby area, large sources of cheap electric power would be essential for production.

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