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SPECIAL TO: JULES BERGMAN
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FOR RELEASE DECEMBER 4, 1965

ACCUTRON CLOCK

ABOARD GEMINI 7

There is an Accutron electronic clock on the control panel of the Gemini 7 spacecraft, facing command pilot Frank Borman. The clock, which indicates Greenwich Mean Time, was specially designed and manufactured by Bulova Watch Company, Inc. for McDonnell Aircraft Corporation, prime contractor to NASA for the Gemini series of spacecraft.

The clock's transistorized timekeeping unit is identical with that used in the watch-size consumer models of the Accutron timepiece, and maintains an average accuracy of plus-or-minus two seconds per day. (A fine jewel-lever conventional watch is considered accurate if it maintains an accuracy of plus-or-minus 20 to 30 seconds a day in actual use on the wrist.)

ON GEMINI 6, TOO

Another (identical) Accutron clock is on the control panel of the Gemini 6 spacecraft, where it will face command pilot Walter M. Schirra Jr. during that spacecraft's mission, now scheduled for December 13. The clock aboard Gemini 6 will also indicate Greenwich Mean Time.

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TUNING FORK

The Accutron clock uses a one-inch tuning fork as its frequency standard. It hums gently (between E and F above middle C) as it vibrates 360 times a second -- or 31,104,000 times each 24 hours. That's 144 times as fast as the oscillation rate of the balance wheel in a conventional watch movement. Power is transmitted to the tuning fork through a transistorized electronic circuit from a mercury power cell.

POWER

The clock operates on about .000008 watts (8 one-millionths of a watt), or 19 billionths of a horsepower. The power used by an electric toaster to toast a slice of bread would operate an Accutron timer for 250 years! Power is supplied to the timer from its own tiny mercury cell that lasts a year.

AIR DEFENSE

Defense uses of Accutron timepieces include the clocking of high-velocity airborne targets on the radarscopes of Nike air-defense installations. The Accutron timers are mounted right next to the radarscope, making it possible to show photographically the "air battle situation" as it is at any given instant. Feedback from this photo-recording system includes target speed and position.

BEAR TRACKER

Accutron timepieces have also been used on bears in Yellowstone National Park. The objective was to get a clue on the hibernating habits of the bears. In these experiments, an Accutron timer is attached to the bear, together with a tiny radio transmitter. The transmitter broadcasts the hum of the Accutron tuning fork to listening posts maintained by scientists -- so that all the movements of the bear can be precisely tracked.

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PROJECT APOLLO

Bulova produces more than 100 non-consumer models and combinations of Accutron timers for space, defense, industrial and research applications. The latest version built is for the control panel of Project Apollo's moon-landing craft, the Lunar Excursion Module (LEM). LEM is scheduled to land the first U.S. Astronaut on the moon in 1970.

The Apollo version of the Accutron timer has a 60-hour dial, and a stop-start feature that will permit the astronaut to precisely time or schedule an operation or maneuver. The 60-hour dial is required because 60 hours is estimated to be the maximum period needed to complete the moon-landing and recovery operation from a lunar orbit.

SPACE PRIORITY

The Accutron timepiece was originally developed by Bulova as a consumer timepiece. Actual production was delayed several months as the company converted the timepiece to its first space assignment in 1959 at NASA's request. It was the first and remains the only electronic timepiece for wrist use, and has been worn by the Astronauts on a number of their space missions.

SATELLITE 'SILENCERS'

Accutron timers have been part of the U.S. space program since the launching of Explorer VI on July 16, 1960. They have been used successfully aboard members of all families of America's communications satellites, including the Tiros, Relay, Telstar and Syncom series.

Aboard communications satellites they have had two major functions: silencing a satellite, and switching the satellite's broadcasting from one frequency to another.

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As a silencer, the timer "gavels" a satellite into silence when the satellite's predetermined broadcasting time has expired. The purpose is to free the limited broadcast spectrum assigned to satellites by international agreement.

As a switch, an Accutron timer on May 16 of this year switched off the Ultra High Frequency broadcasts of Telstar II to permit other transmissions.

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