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INSTRUMENT UNIT IN CRUCIAL TEST

A three-foot high Instrument Unit assembled by International Business Machines Corporation will be launched into orbit with a huge Saturn second stage later this month in a crucial test for the Apollo lunar program.

The IBM "nerve center" of Saturn will guide the hydrogen-oxygen S-IVB into orbit where the National Aeronautics and Space Administration will study the behavior of liquid hydrogen in zero gravity, using live television.

Assembled and tested by IBM's Federal Systems Division at Huntsville, Alabama the Instrument Unit (IU) will also simulate restart commands to the second stage J-2 engine, although the engine will not actually be restarted in orbit during the Apollo/Saturn 203 mission. Restart will be necessary to boost the spacecraft into the proper lunar trajectory.

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The IU is the electronic stage of both Saturn IB and V launch vehicles. It was developed by NASA's Marshall Space Flight Center at Huntsville with the aid of associated contractors, including IBM. The 21.7-foot diameter stage contains the instruments which guide Saturn's path into orbit and navigate it throughout its flight.

The IU will keep the second stage steady in orbit while television cameras record the action of liquid hydrogen in the fuel tanks. It will also regulate sequencing of more than 400 events; route ground commands to proper IU instruments; turn tape recorders on and off: make more than 300 measurements, including temperatures, voltages and vibrations; telemeter these measurements at the rate of more than 400,000 words per minute to ground stations and provide 60 degrees cooling for the banks of instruments aboard the IU and second stage while it orbits in the alternating hot and cold of space.

The IBM guidance computer in the Instrument Unit will make more than 7 million calculations during only 8 minutes of powered flight. It will take attitude and velocity information from other instruments in the IU, compare these values with trajectory information stored in its memory, then issue guidance signals to keep the rocket on course. The computer aboard AS-203 will make more than 200 million calculations during the orbital mission.

An IBM data adapter in the IU translates analog signals into digital computer language, and will receive and transmit to the computer more than 1,000 measurements of acceleration during the first 8 minutes of the flight. It will handle more than 4 million instructions before the mission ends.

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The IU will orient the second stage by commanding the S-IVB auxiliary propulsion system. It will turn on T.V. lights and cameras so that controllers can watch the behavior of venting hydrogen as it occurs, and will simulate restart of the second stage engine. Even though the engine will not actually burn, the 118 measurements of J-2 engine machinery and IU signals, sampled up to 7,200 times a minute, will give a good evaluation of the restart capability. The $182 million IBM contract calls for 27 Instrument Units — 12 for Saturn IB and 15 for Saturn V.

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