



IBM

INSTRUMENT IN THE ROUND—A three-foot high instrument unit assembled by International Business Machines will be launched into orbit with a huge Saturn second stage 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.

SPACE

Cold Welding Dangerous

Cold welding causes damage to satellites and prevents them from operating properly

► **TWO AIR FORCE** satellites, launched in secret last summer, are studying a problem that has already played havoc with other satellites and even with test chambers that simulate the conditions of space.

At least one U.S. satellite, intended to jettison a capsule containing secret photos or data records, failed to do so because some of its metal parts simply stuck together and failed to operate. They were not frozen; there were no congealed lubricants to glue them together. They were simply "cold welded."

Investigators of cold welding have yet to find a metal that will not cold weld under the proper conditions—cold, vacuum and two super-clear surfaces. All it takes is a prolonged touch. Copper, aluminum, steel, tungsten carbide and other metals have produced welded joints with shear strengths as high as five tons per square inch.

Each of the two small, eight-sided USAF satellites is equipped with four solenoid valves and a solenoid actuator. The valves and actuator make thousands of metal-to-metal contacts, during the satellite's lifetime, constantly

exposed to the cold, airless space environment.

Information from the satellites will be correlated with cold welds produced in simulation chambers on earth.

Only a few years ago, when cold welding was scarcely known, it used to do considerable damage in test chambers, "freezing" components such as threaded bolts and leaving scientists baffled as to the cause. Now such parts are simply built where they are not exposed to the chambers' vacuums.

The National Aeronautics and Space Administration is nervous enough about the phenomenon that when Astronaut Edward White's hatch stuck during the Gemini 4 flight in June 1965, cold welding at first got the blame. Later a different cause was found.

Controlled cold welding could be a boon in the future, however. Since the process often takes only seconds and requires no special equipment at all, it could become an invaluable technique for the construction of space facilities on the moon, in orbit around the earth, or anywhere outside of planetary atmospheres.

TECHNOLOGY

Handpainted 'Speech' Helps Teach Languages

► **MACHINES** speaking with foreign accents and a man who paints speech on cellophane are working to upgrade the efficiency of modern language teaching and improve understanding of human communications.

Electronic machines are being used to transform handpainted speech patterns into intelligible sound similar to the way a player piano translates paper notes into music. Changes can be made in the painted patterns to find out what modifications of sound result from each change in speech as it is put on cellophane.

Hopefully, one day scientists will learn the musical cues by which vowel and consonants are perceived.

The speech painter is linguist Pierre Delattre, professor of French and head of the Speech Synthesis Project at the University of California, Santa Barbara.

The project, he said, is "a unique research center for the study of the physical nature of speech and its perception."

"Hydrotherapy" or just plain self-indulgence?

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