SPACE

It's 'Just a Game'

Technicians, engineers and professors played a game of managing a satellite project to study pitfalls and causes of failures in programs—By Jonathan Eberhart

➤ AFTER misguiding a $3.9 million satellite program over its budget by 50%, the guilty project manager simply shrugged and told himself that it was just a game—and it was.

Besides money troubles, he was plagued for a week with such hypothetical problems as parts that would not fit together, sloppy technicians who short-circuited vital components, and memos from "on high" with warnings to drop everything and prepare next year's budget. Sometimes setbacks were encountered when it was found too late that some item had been magically left out of the blueprints.

Happily tearing their hair through all of these "perturbations" were a dozen players, including nine National Aeronautics and Space Administration engineers and technicians from space installations around the country, two business administration professors from the University of Southern California (including the head of the Master's Degree program), and from International Business Machines, the only real-life project manager in the group.

The game was called GREMEX, for Goddard Research Engineering Management EXercise. During its five playing days, each "move" represented 4.2 highly compressed weeks of progress (or lack of it) in managing a simulated 13-month satellite project at NASA's Goddard Space Flight Center, Greenbelt, Md.

Project GREMEX was actually the pilot effort for a possible series of such games, designed to teach the complex and ulcer-causing art of program management to the technical types who will probably be dropped into the jobs without any front-office experience at all.

The director of the game, Goddard's Milton F. Denault, estimated that 12 man-years of planning had gone into the relatively brief exercise since the idea was born in 1962.

All the players enjoyed the game—most worked full eight-hour days and then took their studies home with them at night—but they made their mistakes. In selecting seven experiments for the satellite from among the 10 offered, for example, players who tried to save money by contracting for only the minimum seven invariably found that one or two of them became hopelessly delayed or simply did not work as planned.

Contracts were awarded late (resulting in a completed satellite with nothing to put in it), data were misinterpreted, and once, when everything was going smoothly, a memo announced that due to the failure of the previous satellite in the hypothetical series the entire program would have to be speeded up.

Too much speed was not a good thing, however. There were financial penalties for being behind schedule, of course, but also for finishing too early. The Government does not fancy paying the staff of a project that has finished early for sitting on its hands.

It is too early to know whether there will definitely be more such games, but there are so many people in the aerospace business in need of management training that it is not at all unlikely.

PHYSICS

New Method to Measure Mass in Space Devised

➤ A SCALE for measuring weight in space that does not depend upon the attraction of gravity has been devised.

Known as the "linear spring/mass pendulum" or simply "mass scale," the system was developed by Capt. (Dr.) William E. Thornton, Jr., Aerospace Medical Division, Air Force Systems Command, Brooks Air Force Base, Texas.

He said "Ever since man has been measuring mass, he has been using a principle dependent upon the attraction of gravity." However, "in orbit or weightless state, such a system cannot be employed."

Dr. Thornton said his system is one of several ways to solve the problem. In his method, the weight of the mass is determined mechanically oscillating a weight in a tray. The heavier the mass, the slower the oscillation rate.

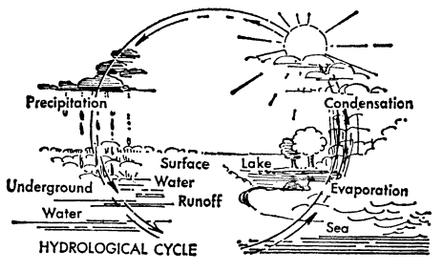
The scale is tied to an electronic unit measuring the time required for five cycles of oscillation. A reference to a chart gives the mass's weight.

The electronic package can be used with a small or large pendulum tray giving it versatility. The unit has been tested in a weightless state for accuracy and practicability.

Accuracy for a solid mass has been established at .01 of one percent. A small scrap of paper can be weighed with accuracy as well as a man. Fluids are weighed in plastic containers. The scale which was designed primarily for medical applications during weightless conditions, enables researchers to continuously monitor man's weight in orbit around the earth as well as various foods he consumes and body by-products.

Nature Note

Hydrological Cycle



U.S. Geological Survey

➤ ONE of the great wonders of this planet is the never-ending circulation of vast amounts of water from earth into the atmosphere and down to the earth again. This is called hydrological cycle.

Nearly 326 million cubic miles of water have been constantly moving in this cycle for some three billion years. The total water supply has neither diminished nor increased, but is endlessly redistributed—rising as mist, falling as sleet, whirling in a hurricane, driving hydroelectric power plants, bonded in chemical and industrial materials, flowing in rivers and surging in oceans.

With power from solar radiation, water evaporates and rises from lakes, oceans, forests, fields and even animals and men—a process called evaporation. At any moment during the history of earth, there are about 3,100 cubic miles of water distributed throughout the atmosphere. Transported in vast air movements across oceans and over continents, this water vapor cools and condenses into droplets of moisture in the form of fog or clouds—a process known as condensation. Gravity returns this condensing water to earth in the form of rain, snow, hail, and sleet—precipitation.

Trillions of waterdrops then start their long voyage to the sea, flowing downward from high mountains across plains and lowlands. Some drops are caught for a while in surface water.

Over 55,000 cubic miles of water are held in lakes, river, streams and reservoirs. Some are frozen for many years in glaciers and ice caps—about seven million cubic miles.

Other drops of water percolate through the soil and rock material—there are more than two million cubic miles of this subsurface water.

The water eventually returns to the ocean—a surging mass of 317 million cubic miles of water. Here, drawn up by the hot sun and sprayed by pounding waves, water once again is evaporated and returns to the sky in the endless, wondrous hydrological cycle.