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Even though the giant computer at M.I.T. needs only 21 seconds to compute the orbit of an earth satellite, more than 223 hours of its time have been devoted since last October 4 to satellite work, the M.I.T. Computation Center reported today. The orbit changes slightly every time that a satellite goes around the earth, and the orbits of the first three satellites sent into space have been computed over and over again so that these changes can be traced.

The M.I.T. computer, an IBM 704, made available by the International Business Machines Corp., is the largest machine of its kind in America that is devoted wholly to unclassified research. Its full potentialities have not been realized yet in satellite tracking, but theoreticians already are being forced to race to keep up with the numerical findings that are pouring out of it.

Checking the instruction program given to the machine, comparing observers' reports to find which are most precise, and predicting the positions of a satellite requires much more machine-time than the computation of an orbit.

The mathematical program that the machine follows to obtain the six quantities that give a satellite's orbit has been completely rewritten five times, and a sixth and better program is being prepared now. A stack of paper higher than a man was consumed in writing the first five programs.

More than 1500 observations of the Russian satellites, reported from places outside Russia, have been fed to the machine, but only a few score have been used in finding the orbit of the American satellite. The size and orbits of the Russian satellites made many more visual observations of them possible, but experience gained in computing their orbits has helped in finding that of the smaller, more distant, American satellite. Its orbit now has been determined with greater precision than is needed to track it without instruments. As new telescopic cameras swing into action, and more precise observations are reported than can be made by the eye, the little American moon's orbit will be computed with still more precision.

(MORE)

Satellite
Tracking
IBM 704

2. M.I.T. -- Satellite Program

After computing an orbit, the machine must follow another program to predict a satellite's positions in the future. Predictions that formerly required $2\frac{1}{2}$ hours, however, are now being run off in an hour.

More than 2,300 determinations of the time that a satellite's orbit will carry it directly over given points on the earth's surface have been typed out by the machine, and more than 1,000,000 findings of the positions of satellites on the celestial sphere have been made, but the demand for such data is still increasing. At the same time, numbers accurate to more decimal places are being requested.

Reports from the M.I.T. Computation Center go to the Smithsonian Astrophysical Observatory in Cambridge, which is in charge of visual tracking of satellites sent up during the International Geophysical Year. A similar computer in Washington, D.C. is used to determine orbits and make predictions on the basis of radio reports.

In addition to the machine-time, the International Business Machines Corp. has provided four staff assistants for the Smithsonian Observatory's scientists and mathematicians. They are Dr. John Rossoni, Dr. John Greenstadt, Thomas Apple and Richard Hatch.

These men and the Smithsonian Observatory staff responsible for computations have devoted more than 12,000 man-hours to the satellite programs and expect to be kept busy for many more months. The M.I.T. computer is scheduled to be used for satellite work at least through June 30, 1959.

"The change in a satellite's orbit during a single trip around the earth is imperceptible," Dr. Rossoni, satellite coordinator at the Computation Center explains, "but these perturbations from external causes -- such as air resistance and irregularities in the earth's gravitational field -- pile up as the number of revolutions increases.

"New theories may be evolved as a result of the refinements that are being made in our computations. New terms already have been added to the equations that we use when we program the machine to compute an orbit."

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