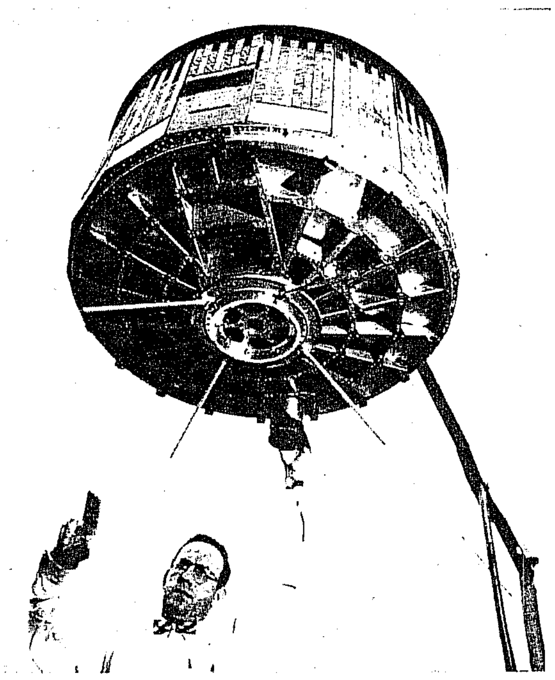
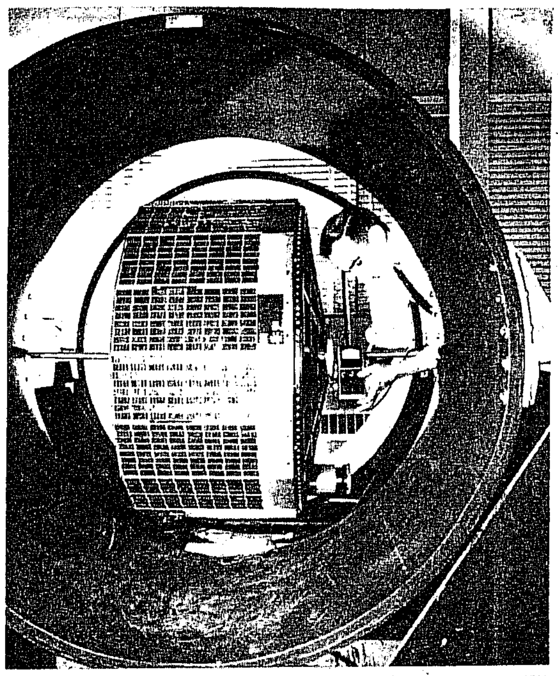
April 11, 1960

missiles and rockets

THE MISSILE/SPACE WEEKLY



COMPLETE SATELLITE is positioned for tests of solar cell power supply at RCA Astro-Electric Products Div., Princeton, N.J., where *Tiros* and its ground system were built for NASA under Army direction, by Asst. Project Mgr. A. Schnapf.



DRUM-SHAPED *Tiros* is placed on its side in a special AEP magnetic drag test device to measure effect on satellite of earth's magnetic field. Engineer Robert Wilkes observes effect as satellite rotates on its axis between large magnetic coils.

Tiros Presages Long-range Forecasts

Highly successful first launching also proves feasibility of military reconnaissance satellite

by Paul Means

Mark Twain's observation that "everybody talks about the weather but nobody does anything about it" lost a little of its weight on April Fool's day with the launching of *Tiros I*, the 270-pound camera-carrying weather satellite.

The satellite—the first of a series to give the Weather Bureau a satellite's eyeview of the earth's cloud formation—doesn't actually do anything about the weather, but eventually it will enable meteorologists to anticipate storms many days in advance.

The satellite also demonstrated the feasibility of a reconnaissance satellite which could seek out enemy missile bases.

The payload, which looks like a giant pillbox, is encrusted with 9200 solar cells developed by Hoffman Electronics Corp., and contains two miniature television cameras, video tape recorders, transmitters, rechargeable battery power supplies, and an array of control and communications equipment.

Orbiting in a 48-degree angle of inclination from the equator, the wide-angle camera, which has a resolution of about a mile and a half, will take a strip of overlapping pictures of the earth each 135 miles long and about 800 miles wide.

The smaller camera, with a resolution of about 1500 feet, will take pictures of about 100 miles in width.

• **Northern exposure**—Both cameras, developed by the Astro-Electronic Products Division of the Radio Corporation of America, have been programed so they will operate only while over the Northern Hemisphere, and in the sunlit area. During the lifetime of the satellite (approximately three months and 1300 orbits), its cameras will have taken pictures of most of the Northern Hemisphere.

Both of the cameras use a one-half Vidicon tube designed for satellite use. A focal plane shutter permits still pictures to be stored on the tube screen, and an electron beam converts the stored picture into an electronic signal which is transmitted to ground receivers.

The wide-angle camera has a f/1.5 lens speed; the narrow-angle camera f/1.8. Shutter speed for both cameras is 1.5 milliseconds, lines per frame is 500, frames per second one-half, and the video bandwidth is 62.5 kc.

Linked to each camera is a miniature television magnetic tape recorder which stores 32 photographs on tape for later relay. Picture data can also by-pass the tape and be transmitted directly to the ground within range of a station. The Mylar-base tape is 400 feet long and moves 50 inches per second during recording and playback. The cameras and their equipment operate independently of each other.

• **Transmission & tracking**—During ground transmission, photo data is transmitted from one camera at a time and takes 3½ minutes per camera. The satellite is within transmission range of the ground stations up to 12 minutes. Connected to each photo system is a two-watt FM transmitter operating at a nominal frequency of 235.00 mc which relays picture information on command to ground stations.

Two readout stations are operated for the satellite: one by the Air Force at Kaena Point, Hawaii, and one by the Army Signal Corps at Fort Monmouth, N.J. They consist of approximately 15 bays of electronic control, transmitting, receiving and picture storage equipment. The antennas are 60-foot automatic tracking types, with a command antenna on the outer edge.

The nickel-cadmium battery cells, which are actually overcharged by the solar cells, are hermetically sealed and rechargeable, and were developed by the Sonotone Corp. They can be recharged thousands of times and are designed to live as long as the satellite. Sixty-three Sonotone "F" cells, each three and one-half inches long and one and a quarter inches in diameter, and weighing approximately eight ounces, were used.

Data concerning the satellite's spin-axis attitude is provided by the infrared horizon scanner developed by the Barnes Engineering Co. The radially-oriented scanner senses the thermal radiation discontinuity between the earth and space. As the spin-stabilized satellite rotates, the scanner develops an electrical pulse whenever the thermal horizon crosses its field of view. Thus, as the scanner sweeps across the earth, two signals are produced—each one marking an edge of the earth. These signals are transmitted to the ground stations to provide data determining the satellite's attitude.

Two beacon transmitters, operating on 108.00 mc and 108.03 mc, both with a power output of 30 mw, will be used for tracking purposes. They can be modulated to provide information on satellite attitude, environmental conditions, and satellite equipment operation. For backup purposes, both frequencies carry the same data. Besides the two readout stations, the satellite will be tracked by the Minitrack fence.

Tiros Data

Weight	270 lbs.
Apogee	468.28 statute miles
Perigee	435.5 statute miles
Period	99.15 minutes
Angle of inclination	48 degrees