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SCIENCE

25 Years Ago, TIROS-1 Ushered in Era of Satellite Weather Forecasting

By William Harwood
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CAPE CANAVERAL, Florida— The United States launched TIROS-1, its first weather satellite, 25 years ago this Monday, providing the first view of global cloud patterns and ushering in an era of improved forecasts and international cooperation.

In the past quarter of a century, satellites have closed broad gaps in the world's storm surveillance system and have been credited with saving countless lives.

Continent-spanning pictures of cloud cover from satellites 22,300 miles (36,150 kilometers) high are now routine on television. Forecasters use weather satellites to track tropical storms with unprecedented accuracy, thousands of atmospheric and ocean temperature readings are made every day and sensitive instruments keep track of solar and magnetic activity, ozone levels, even forest fires.

International cooperation has grown out of the expanding capabilities of weather satellites, transcending ideological boundaries. More than 1,000 ground stations around the world receive data from U. S. weather satellites, often equipped with instruments supplied by other nations, and data is freely exchanged.

It all began at 6:40 A.M. EST on April 1, 1960, when a three-stage Thor-Able rocket carried the experimental Television-Infrared Observation Satellite into orbit about 450 miles up. Circling the world at more than 17,000 miles an hour, the 270-pound (122-kilogram), drum-shaped satellite was equipped with two television cameras that made 22,952 still pictures during its three-month life.

One of the first fuzzy pictures received from TIROS-1 the day it was launched, a shot showing the northeastern United States and Canada, with the ice-blocked St. Lawrence River, was rushed to President Dwight D. Eisenhower.

Within a few days, TIROS-1 pictures were being sent to meteorologists around the world, recalled David Johnson, a member of the original TIROS team and later satellite program manager for what became the National Oceanic and Atmospheric Administration.

"We were all going into this as a research program and we fully expected there would be several years of research and development before one would ever consider an operational system," Mr. Johnson said. "The impact of being able to see storms in areas that were completely devoid of conventional weather information was so great that this led to a decision to look and see if it made sense to proceed with an operational system."

Meteorology has not been the same since.

"The biggest impact, of course, is that the satellites for the first time opened up a whole new vista of areas that were never photographed or seen or forecasted before," said Abraham Schnapf, former TIROS program manager for RCA Astro Electronics of Princeton, New Jersey, where the satellites were built.

"All the oceans, for example, the remote parts of the northwest and northeast of the United States and Canada, the African area, parts of Asia, never got any kind of forecasts on a timely basis. Today we're getting images every six hours of the whole globe."

On May 25, 1961, President John F. Kennedy asked Congress to authorize the Commerce Department to set up an operational weather satellite program.

The National Aeronautics and Space Administration and the Commerce Department's National Weather Bureau — later part of the Environmental Satellite Services Administration, or ESSA — achieved that milestone in 1966 with the launch of ESSA-1 and ESSA-2, improved versions of TIROS.

NASA and NOAA have launched more than 40 weather satellites equipped with ever-more-sophisticated instruments. Accurate weather information is also vital to military planners; almost 30 weather satellites have been launched since 1966 in the Defense Meteorological Satellite Program.

"We exchanged weather for a long period of time with China when China wasn't even talking to this country," Mr. Schnapf said. "For some reason or other, weather has no boundaries, and nations have learned to cooperate in the exchange of data."

The current satellite fleet includes advanced fourth-generation TIROS-type spacecraft in low orbit around Earth's poles, and other satellites operating 22,300 miles over the equator, where they orbit at the speed the Earth turns, providing continuous coverage of the Western Hemisphere.

"The polar-orbiting satellites carry French instruments, English instruments, Canadian communications hardware," Mr. Schnapf said. The polar orbiters can photograph the entire planet every 12 hours, collecting data on a swath 1,700 miles wide, and relaying up to 16,000 readings daily to ground stations.

The coverage includes extreme northern and southern latitudes that escape the hemispheric views of the satellites stationed over the equator. In addition, the polar orbiters can capture more detailed images from their vantage point about 600 miles up.

Both types of spacecraft carry cameras and instruments to study solar and magnetic activity and gather temperature data. They also are able to collect and relay information from buoys, automatic weather stations and other ground systems in remote areas.

The latest advanced TIROS-type polar orbiter, called NOAA-9, and two Soviet satellites carry instruments designed to pinpoint ships and airplanes in distress. Their ground stations are in the United States, Canada, France, Norway and the Soviet Union.

The most obvious benefit of weather satellites is their ability to monitor and track storms. Hurricane Iwa, for example, was discovered in November 1982 by a NOAA Geostationary Operational Environmental Satellite before it reached Hawaii.

But weather satellites are only one tool in an arsenal of forecasting aids. Neil Frank, director of the National Hurricane Center in Miami, puts the utility of weather satellites into perspective when it comes to forecasting the movements of the giant tropical storms.

"The myth says because we've got these beautiful observing tools, and particularly weather satellites, you must be doing a great job forecasting. No, we do a great job observing. We can make some estimates of the strength of a hurricane from the eyes of the satellite, but if you really want to know how strong the winds are, fly out into it." Reconnaissance airplanes do just that.

The TIROS series of polar orbiting satellites, which cost $55 million each, is now in its fourth generation covering the entire planet.

NOAA-9 now is the only fully operating member of the polar fleet. NOAA-8 broke down and is out of control, and NOAA-7 is only partially operating. But the system is able to fulfill the needs of meteorologists, and three new satellites are in production.

The pictures most familiar to television viewers are provided by the Geostationary Operational Environmental Satellites, or GOES.

Six operational GOES have been launched into stationary orbit 22,300 miles high since 1975. The system relies on one GOES stationed over the Pacific and one over South America.

The camera system aboard GOES-5, which had been stationed over South America, broke down last year. To take up the slack, GOES-6 was moved east to allow monitoring of the Atlantic and Caribbean for hurricanes.

Two new GOES satellites will be launched next year and NOAA is planning an improved version called GOES-Next for launch in the early 1990s.

France Unveils Satellite For Commercial Images

United Press International

TOULOUSE, France — France has unveiled its 4-billion-franc "Spot" Earth observation satellite, designed to produce up to 50,000 custom-ordered high-definition pictures a year for oil companies, farms and other clients.

The satellite, scheduled to be launched in October by the European rocket Ariane, is intended as competition for Landsat, NASA's Earth-resources satellite, and as an entry into the U. S. market.