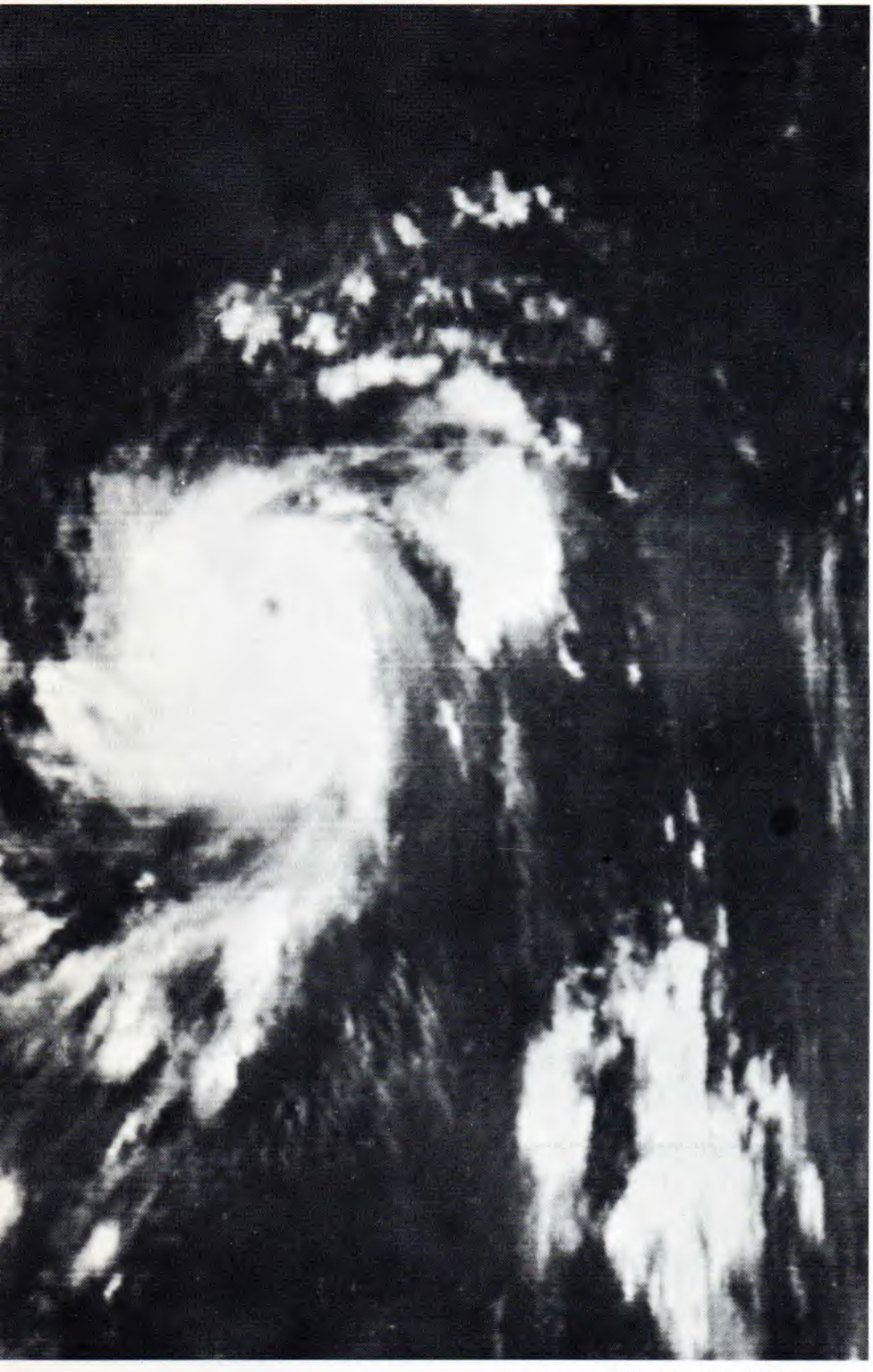
The International Role of U.S. Weather Satellites



American satellites (such as TIROS, shown on the cover in a simulated space atmosphere) keep constant watch over the world's weather. Data relayed by the satellites is analyzed at centers such as the one set up in Bombay for the International Indian Ocean Expedition (top, left). Typical of the sensitive equipment carried by the satellites is the three-camera daylight television system (below, left) of Nimbus II. Nimbus also carries another daylight camera and a night-time infra-red camera. The infra-red lens caught this typhoon (above) at midnight 650 kilometers southeast of Manila.

No subject in the world is more popular—or more vital—than the weather.

Man always has been preoccupied with the weather, for it governs so much of his life. He especially wants, and needs, to know what kind of weather is coming.

The United States, through the world's first operational weather satellite system, is helping to provide that foreknowledge and improve human life.

Called TOS (for TIROS Operational Satellite), the system is financed, managed and operated by the Environmental Science Services Administration of the U.S. Department of Commerce.

ESSA (for Environmental Science Services Administration) satellites equipped with highly sophisticated cameras continuously photograph and transmit pictures of the world's cloud cover. These cloud-cover photographs, received in 44 countries on over 300 automatic picture transmission devices, supply immediate data for day-to-day and long-range weather forecasting.

Development of this global weather observation system is a striking illustration of the practical application of U.S. space science to everyday living everywhere.

The system evolved from TIROS (for Television and Infrared Observation Satellite), originally a research and development project pioneered by the U.S. National Aeronautics and Space Administration.

NASA launched the first TIROS April 1, 1960. Nine others followed, the last July 2, 1965. Three ESSA satellites were orbited in 1966, with others following in 1967.

Weather satellites have taken about one million pictures of the earth's cloud cover, giving meteorologists information never before available.

The satellites have proved the most effective storm detectors ever known. They have enabled earth's weathermen to track, forecast and analyze storms—from hurricanes in the Caribbean Sea to typhoons in the Pacific Ocean. Thousands of bulletins warning of hurricanes and other destructive weather disturbances have been sent by the United States to areas throughout the world.

TIROS photographs also are proving useful in geology, geography and other earth sciences. They show, for example, the extent of river and sea ice and snow cover, data necessary for flood predictions. Valuable as the weather satellite has proved, its full potential still is to be realized.

Accurate forecasts covering up to three —and sometimes five—days are now possible. In the near future, as technology progresses, this period could be lengthened to a week or even two weeks. The benefit to farmers, manufacturers, airlines, construction companies, resort operators and other individuals would be inestimable.

Weather satellites would be an integral part of a truly global system of weather observation envisioned by meteorologists and atmospheric scientists for many years.

A major step in this direction was taken at the fifth Congress of the World Meteorological Organization (WMO) held in April, 1967, at Geneva, Switzerland.

The WMO, a special agency of the United Nations, adopted plans for the first phase of a "World Weather Watch" to cover the years 1968 to 1971. Essentially, the plans call for improvement of international observation, data-processing and telecommunications systems.

This first phase is expected to make possible a more rapid country-by-country exchange of weather information and to permit the making of longer-term forecasts.

Eventually, it is hoped these advances will lead to the creation of a global observation network which would enable scientists to better understand the general circulation of the atmosphere and possibly to take effective measures in modifying the weather.

Testing of advanced equipment for use in future operational weather satellites is carried out under the Nimbus program.

Nimbus I, orbited by NASA August 24, 1964, was the first satellite to provide both day and night pictures of the earth.

Nimbus II, launched May 15, 1966, obtained for the first time on a global basis information about the earth's heat balance. This refers to how much of the sun's radiation the earth absorbs and how much it reflects back into the atmosphere. Such information is essential for an understanding of how storms are born, develop and die.

On December 6, 1966, NASA put into orbit ATS-I (for Applications Technology Satellite), one of the most versatile spacecraft ever developed. Among other scientific accomplishments, it has returned the first high quality cloud cover pictures taken from synchronous (stationary) orbit.

Although the TIROS, ESSA and Nimbus satellites provide extremely valuable observations, their view of any weather system is fleeting. A synchronous satellite permits continuous surveillance of short-duration weather changes over large areas of the globe.

Early in the weather satellite program, complex and expensive ground equipment was needed to receive picture signals and translate them into usable photographs.

NASA recognized that this presented a financial and technical problem to developing nations. To insure truly global participation, it developed a simplified system known as Automatic Picture Transmission. Instead of the old process where television-like pictures were sent line-by-line, an entire photograph is transmitted by a process similar to that used in sending radio photographs.

Ground stations anywhere in the world within range of a satellite can pick up the pictures on a facsimile machine. The necessary equipment costs about $30,000.

Thus, U.S. space research and its policy of sharing technology is providing peoples everywhere with the data to help them predict their weather.

By W. A. Swartworth
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Under an experimental program, photos of weather formations taken by satellites along routes flown by international airliners are provided to pilots at takeoff. Weather information gathered by satellites will enable navigators on ocean-going ships, as well as planes, to circumvent nature's ambushes.

B-68-69 (12) 11-1-67

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