NEWS NASA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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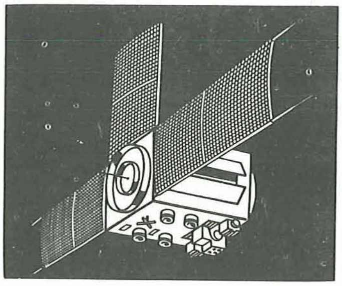

PROJECT: TIROS-M

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NEWS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (202) 962-4155
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NEW TIROS SERIES LAUNCH

A new era in global weather prediction is expected to begin this year with the launching by the National Aeronautics and Space Administration of the first in a new series of operational meteorological satellites.

Called TIROS-M or Improved TIROS Operational Satellite-1 (ITOS-1) in orbit, the satellite is scheduled to be launched no earlier than Jan. 15 from the Western Test Range, Lompoc, Calif.

The launch vehicle will be the two-stage Delta-N which will use, for the first time, six solid-fuel, strap-on rockets for additional thrust at liftoff and at about 46,000 feet.

The spacecraft will be placed in a circular, 909-mile altitude polar orbit, inclined 78.24 degrees (retrograde) to the Equator and will circle the Earth every 115 minutes. Its orbit will be Sun-synchronous (Sun always at the same angle behind the spacecraft) to provide maximum power for keeping batteries charged and for illumination for photography.

In addition, Australis OSCAR-A, a 39-pound spacecraft designed and constructed by amateur radio operators, has been accepted as a secondary payload aboard the Delta second stage.

This second-generation operational spacecraft will not only more than double the daily weather coverage now possible from the current series of Environmental Survey Satellites (ESSA), but at less cost, more effectively and during a longer lifetime.

It is capable of taking infrared pictures of the Earth's cloud cover at night and will be able to transmit cloud top and surface temperatures.

None of this was possible with previous operational weather satellites. However, similar sensors have been flown successfully on NASA's research and development Nimbus weather satellites.

With the nighttime photo capability meteorologists will be provided with cloud cover photos night and day, every 12 hours, rather than just once a day with daytime TV pictures only as is now the case with ESSA satellites. Automatic Picture Transmission (APT) system stations, relatively inexpensive ground receiving units, can receive the night and day pictures as well as the cloud and surface temperature data.

Other experiments include a solar proton monitor for solar flare warnings and a radiometer to measure the Earth's heat balance (the amount of heat reflected from and absorbed by the atmosphere).

Another new feature is the attitude control system. Instead of spinning the whole spacecraft, as with previous ESSA satellites, the body of the spacecraft will be stabilized in all three axes (pitch, yaw and roll) so that it will always face the Earth. Employing a large, spinning wheel and appropriate electronic circuitry, this stabilization system is called "Stabilite."

Such a system has distinct advantages over a spinning satellite. They are:

--Sensors will be able to scan the Earth constantly, providing cloud cover photos and temperature measurements.

--The spacecraft's antenna will point toward Earth all the time providing better communications.

--Several weather-measuring sensors can be operated simultaneously.

TIROS-M will weigh more than twice as much as previous TIROS Operations System (TOS) satellites, 682 pounds as opposed to 300 pounds, and will return more and better data than two of the present TOS or ESSA satellites.

Instead of having the former TOS hatbox shape with solar cells around the exterior, TIROS-M is rectangular or box-shaped with a deployable three-panel solar array. With the panels unfolded the spacecraft measures 14 feet across.

Rather than two TOS satellites carrying two cameras each, two APT cameras in one and two Advanced Vidicon Cameras (AVCS) in the other, the new spacecraft will carry two of each with the AVCS cameras being much improved models. In addition, TIROS-M will carry redundant two-channel infrared radiometers for global daytime and nighttime cloud cover and surface data which can be transmitted to the more than 500 APT stations in 50 countries along with the conventional day-time APT pictures.

The radiometer data will also be taped on the spacecraft for later readout at ESSA's two main data acquisition stations at Wallops Island, Va., and at Fairbanks, Alaska.

The AVCS takes a series of photos which are also recorded on a spacecraft tape recorder for later readout at the main data acquisition stations. They are then transmitted to the Environmental Science Services Administration's National Environmental Satellite Center, Suitland, Md. This system takes photos of the entire Earth daily.

The two daytime cameras, APT and AVCS, with a picture resolution of two miles, will operate for about 48 minutes of each orbit. The radiometer, with a resolution of about two miles during the day and four miles at night, will operate for 71 minutes of each orbit.

With the improved technology housed in one spacecraft rather than in two, and the new stabilization system, the TIROS-M is expected to be longer lived as well as substantially more economical. Earlier TOS satellites were expected to last about six months, but most of them have operated up to a number of years.

The ITOS System is a joint effort of the NASA and the Commerce Department's Environmental Science Services Administration. While TIROS-M, the first of the new series was funded by NASA, with the exception of the meteorological sensors, future spacecraft in the ITOS series will be funded by the Commerce Department.

The current contract with the prime contractor, RCA Corp., calls for six ITOS spacecraft, including TIROS-M.

All of the ITOS spacecraft will be launched and checked out in orbit by NASA for the Commerce Dept. With the exception of TIROS-M, the ITOS spacecraft will be turned over to ESSA shortly after they have been launched and checked out in orbit by NASA.

Since TIROS-M is a prototype of a new series, NASA will maintain control of the satellite in orbit for several months to assess its engineering performance. All of the weather data from ITOS spacecraft, including TIROS-M, will be transmitted in real time to ESSA.

This maiden flight of TIROS-M comes almost one decade after the world's first weather satellite, TIROS-1, blasted off from Cape Kennedy, Fla. (then Cape Canaveral) April 1, 1960. Meteorologists hailed it as one of the most "revolutionary" events in the history of weather forecasting.

Since that first meteorological breakthrough, a total of 10 TIROS and 9 ESSA weather observers have been launched. All have met or exceeded their mission objectives. These satellites have returned more than 1 1/4 million weather pictures.

Since the first operational weather eye, ESSA 1, was launched Feb. 3, 1966, the world's weather has been monitored daily by ESSA satellites.

TIROS and ESSA satellites have tracked nearly all of the more than 400 tropical storms, hurricanes and typhoons recorded since TIROS I was launched in 1960.

The world meteorological community has called the APT camera the "single most significant contribution to meteorology in the past twenty years."

A number of private users in the United States and numerous foreign countries have built their own receivers and facsimile machines at costs ranging from several hundred to several thousand dollars.

-more-

Many of the world's large airports have APT pictures for commercial pilots to study before a flight. Now, with the TIROS-M system, pilots will be able to see weather conditions during the night as well as daylight hours, from New York to London, or San Francisco to Tokyo. Sometime in the future it is expected that pilots will be able to receive APT cloud cover photos in flight.

In addition to contributing to meteorology, TIROS and ESSA satellites have been extremely valuable in ice pack reconnaissance. ESSA publishes sea-ice charts of the Great Lakes and other important sea travel routes as an aid to navigators.

The operational weather satellite program is a joint effort of NASA and the Environmental Science Services Administration. The Delta booster for ITOS missions is managed by Goddard while launch operations are conducted by NASA's Kennedy Space Center, Fla. Unmanned Launch Operations.

ITOS spacecraft, as well as the earlier 19 TIROS/ESSA satellites, were built for NASA by the RCA Corp., Astro Electronics Division, Princeton, N.J. Prime contractor for the Delta booster is the McDonnell Douglas Corp., Huntington Beach, Calif.

The Australis OSCAR-A piggyback satellite was built by a group of amateur radio operators at Melbourne University in Australia, giving rise to the "Australis" portion of its name. The Radio Amateur Satellite Corp. (AMSAT), a group of United States amateurs, is preparing the satellite for launch, testing and qualifying it to comply with NASA requirements. OSCAR is an acronym for Orbiting Satellite Carrying Amateur Radio.

A group of American radio operators based on the Pacific Coast has successfully launched and operated four amateur radio satellites since 1961 in a program known as Project OSCAR. The previous four OSCAR launches were in conjunction with Department of Defense spacecraft.

The satellite (OSCAR-5 in orbit) will be placed into a 910-mile orbit and will be inclined 102 degrees to the Equator with a period of about 114 minutes.

Transmission frequencies are 29.45 megahertz in the ten-meter band and at 144.05 Mhz in the two-meter band. A transmitting life of approximately two months is expected from the 20 pounds of batteries carried by the satellite.

END OF RELEASE; BACKGROUND INFORMATION FOLLOWS

TIROS-M FACT SHEET

Spacecraft:	Box-shaped, 14 feet wide with solar panels deployed, weighing 682 pounds.
Stabilization:	Earth oriented and three-axis stabilized to within 1 degree
Mission Objectives:	
Primary	Observe day and night cloud cover in the visible and infrared spectrums for "live" transmission to users anywhere in the world.
	Observe global cloud cover daily in both the visible and invisible (infrared) spectrums as recorded in the satellite for later playback and processing (Advanced Vidicon Camera System & Scanning Radiometer)
Secondary	Gather heat balance data (Flat Plate Radiometer) and identify proton flux levels at the spacecraft altitude (Solar Proton Monitor).
Launch Information:	
Vehicle	Delta N (Two Stage) with six solids strapped onto the first stage Thor
Complex	Western Test Range, Calif., SLC-2 West
Azimuth	259 degrees True
Date	No earlier than January 15, 1970
Window	3:31 AM PST - 3:51 AM PST
Orbit	Circular, 909 statute miles
Period	115 minutes
Inclination	78 degrees (retrograde)
Power Supply	10,000 negative-on-positive solar cells mounted on three identical panels 3 feet wide by 5 feet long producing 250 watts of average power.

Tracking:	
Orbit	Sixteen stations in NASA's world-wide Space Tracking and Data Acquisition Network (STADAN)
Data Acquisition Facilities	Fairbanks, Alaska (Gilmore Creek) and Wallops Island, Virginia
Automatic Picture Transmission Ground Stations	More than 500 independent stations in more than 50 countries in every continent.
Spacecraft Lifetime:	One year
Spacecraft Management:	Office of Space Science and Applications, NASA Headquarters, and the Goddard Space Flight Center, Greenbelt, Md.
Launch Vehicle:	
Management	Goddard Space Flight Center
Operations	NASA/Kennedy Space Center Unmanned Launch Operations
Prime Contractors:	
Spacecraft	RCA Corporation, Astro Electronics Division
Launch Vehicle	McDonnell/Douglas Corp.

THE SPACECRAFT

Major features of the spacecraft are the equipment module (main body), the deployable three-panel solar array, and the momentum flywheel. The base of the main body is approximately 40 inches x 40 inches and the overall height of the body is approximately 48 inches. Total weight is approximately 682 pounds.

The solar array consists of three panels, each independently hinged to the main body of the spacecraft with a total array area of 48 square feet. Each panel measures 36.4 inches x 63.8 inches.

In the launch configuration, the panels are folded and held against the sides of the equipment module. Following the initial orientation maneuver, squib-actuated pin pullers are fired, allowing spring-loaded actuators to deploy each panel so that its surface is perpendicular to the spacecraft pitch axis.

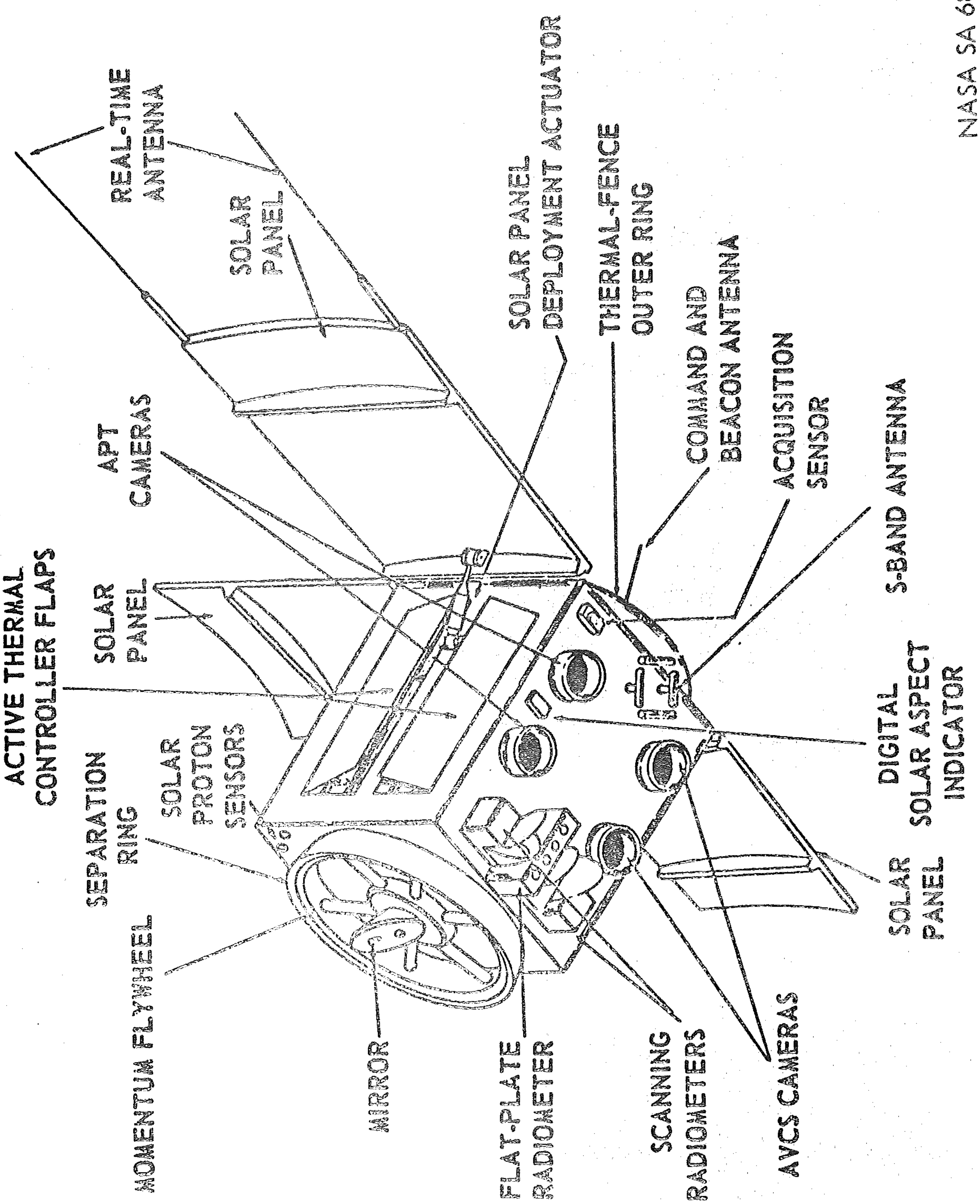
Dynamics Control Subsystem

Four major dynamics control devices are incorporated in the spacecraft: a quarter-orbit magnetic attitude control (QOMAC) coil, a magnetic bias control (MBC) coil, a pitch control loop (two devices operate by establishing magnetic fields which interact with the magnetic field of the Earth to produce a torque on the spacecraft. The torque, in turn, causes the spacecraftto precess or change its orbital path slightly to the west each day.

The QOMAC system is used to postition the spin axis (pitch axis) of the spacecraft so that it will be perpendicular to the plane of the orbit. The MBC coil is used to reduce the residual magnetic dipole moment of the spacecraft and retain the necessary dipole moment to precess the spacecraft approximately one degree per day for the required Sun-synchronism.

The pitch control loop consists of a momentum flywheel, a flywheel drive motor, a scanning mirror, pitch and roll sensors, two momentum coils, and associated electronics. The flywheel, operating in the mission mode at a nominal spped of 150 rpm, provides gyroscopic stiffness to the spacecraft and serves as a source and sink of pitch momentum. Trhough the action of the pitch control loop, the spacecraft sensors are continuously maintained in alignment with the local vertical. The momentum coils provide fine wheelspeed momentum control about the spacecraft pitch axis.

TIROS M CONFIGURATION



NASA SA 68-437
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The spacecraft uses five attitude sensors: a digital solar-aspect sensor (DSAS), two pitch horizon sensors, and two roll horizon sensors. The DSAS is used during the initial orientation maneuver; it derives its scanning from the spin of the spacecraft.

After the initial orientation maneuver, sensing is accomplished by the pitch horizon and roll horizon sensors which view the Earth via a scanning mirror located on the momentum flywheel.

Antennas

The spacecraft carries four antennas: a command and beacon antenna, two real-time antennas, and a play-back (S-band) antenna. The command and beacon antenna, a single whip, is utilized on both the command link and the beacon and telemetry link. Each real-time antenna consists of two half-wave dipoles installed at the extremity of one of the solar panels. The S-Band antenna, a crossed dipole above a ground plane, is designed to give right-hand circular polarization over the required cone of coverage.

Power Subsystem

The power subsystem converts solar energy into electrical power for delivery to all the electrical equipment of the spacecraft. It comprises a solar array, power supply electronics, batteries, and shunt dissipators.

During the daytime portion of the orbit, the array supplies power for the spacecraft subsystems and for charging the batteries. The charging rate of the batteries is regulated by a charge controller. Array power, in excess of spacecraft requirements, is dissipated in the shunt dissipators. The batteries supply power during the nighttime portion of the orbit and when spacecraft demands exceed the power available from the solar array.

Thermal Control Subsystem

The thermal control subsystem is composed of a geometrically variable absorption surface (thermal fence) on the upper face of the spacecraft, variable emittance surfaces on both the AVCS and APT equipment panels (the variable feature provided by louver-type active controllers), and a fixed radiator on the spacecraft baseplate.

The remaining surfaces of the spacecraft or equipment module are covered with multifoil-layer insulation blankets. The thermal fence is designed to absorb more solar energy at higher Sun angles.

This design compensates for the reduction in spacecraft electrical power level caused by the increasing Sun angle.

Accelerometer Subsystem

The accelerometer subsystem consists of two servo-type accelerometers and a control unit. It provides measurements of the g-levels induced in the spacecraft during the launch maneuver, from liftoff to spacecraft/launch separation. These data are transmitted to the ground station via the beacon link. The accelerations are sensed in only one direction in each of two axes. It is anticipated that the direction of measurement may be alternated on succeeding ITOS spacecraft.

Tiros-M Weather Measuring Sensors

The primary meteorological sensors include two Advanced Vidicon Camera System (AVCS) cameras for storing pictures of the world's weather; two Automatic Picture Transmission (APT) cameras for direct readout at small ground stations; and two scanning radiometers (infrared) for sending direct APT pictures as well as recording the entire Earth's weather at nighttime for playback later.

Secondary meteorological sensors are a Flat Plate Radiometer (FPR) and a Solar Proton Monitor (SPM). These sensors have been designed to gather Earth-heat-balance data and to measure proton flux levels at the satellite altitude.

Primary Meteorological Sensors

Advanced Vidicon Camera Subsystem (AVCS)

The AVCS takes a series of wide-angle, high resolution television pictures of the Earth and its cloud cover, stores these pictures on one of two satellite borne tape recorders, and, on command, transmits the video signal to a ground station.

Picture-taking operations of the AVCS are controlled by a program of instructions transmitted to the satellite by a Command and Data Acquisition (CDA) station.

A complete picture sequence lasts approximately 48 minutes, during which 11 pictures (or frames) are taken at intervals of 260 seconds and stored on the selected tape recorder. When the last picture in the sequence is taken and recorded, the command subsystem provides a "power off" signal for the AVCS.

A "power on" command and the picture-taking sequence are repeated during succeeding orbits until the active programmer is either reloaded or turned off. The repeat time is determined by the data loaded into the programmer and normally is the time of one orbital revolution.

Consequently, successive orbit picture sequences start at approximately the same latitude as the first, but are displaced in longitude by approximately 28.5 degrees at the Equator.

This displacement produces a slight lateral overlap in coverage at the Equator. The amount of lateral overlap increases with increasing latitude.

The overlap of successive pictures along the orbital track is a function of the fixed picture-taking rate and is about 50 percent.

Automatic Picture Transmission (APT) Camera Subsystem

The APT camera subsystem, like the AVCS camera subsystem, is used to take up to 11 wide-angle TV pictures of the Earth and its cloud cover during the daylight portion of the satellite orbit. However, a basic difference between the APT and AVCS camera subsystem is that the APT subsystem always transmits television data directly as the pictures are being taken (in real time) whereas the AVCS subsystem normally records the TV pictures for later playback.

Like the AVCS cameras, the APT camera subsystem also has a picture resolution of two miles. It is controlled by ground-initiated commands that are transmitted to the satellite from the CDA stations and are processed and stored by the satellite's command subsystem. The program of commands directs the APT camera subsystem to start taking a sequence of pictures at a predetermined point in orbit.

A full APT picture sequence contains 11 pictures. They are taken at 260-second intervals. Any of the 11 pictures may be omitted by programming so that a sequence may contain from one to 11 pictures, and the pictures taken may be located at any desired positions in the sequence. Once the sequence is initiated, the camera will take pictures under satellite command until the programmed picture sequence has been taken. These pictures are transmitted to APT field stations within communications range of the satellite by a transmitter in the real-time data link.

The sequence is repeated automatically during each orbit of the satellite until the command subsystem is turned off or programmed otherwise by a CDA station.

The APT camera employs a high-persistency vidicon that provides a 600x800-scan-line image. Use of this vidicon permits narrow band transmission of the video signal which, in turn, allows the use of relatively simple equipment at the APT field stations.

Scanning Radiometer Subsystem

The scanning radiometer (SR), or infrared subsystem, measures emitted radiation from the Earth during orbit day and night and measures reflected radiation from the Earth during daytime. The data obtained is transmitted in real time to local user stations and is also recorded for later playback to the CDA stations. Daytime resolution is 2 miles and 4 miles at nighttime.

The scanning radiometer, a meteorological instrument built especially for use on the ITOS satellite, is unique in sensing two spectral regions and in its high spatial resolution. The radiometer measures reflected radiation from the Earth in the 0.52- to 0.73- micron region (visible) during daytime and emitted radiation from the Earth in the 10.5- to 12.5- micron region (infrared) during day and night.

The subsystem permits determination of the surface temperatures of ground, sea, or cloud tops viewed by the radiometer. Sensitivity in the 10.5- to 12.5- micron spectral region permits surface temperatures to be determined in daylight as well as at night, since reflected solar radiation in this wavelength region is small compared with emitted radiance. The visible measurement of reflected solar radiation has a higher calibration accuracy capability than television camera systems presently in use and is not subject to shading which occurs in the vidicon camera systems.

The SR subsystem consists of two scanning radiometers, a dual SR processor and two scanning radiometer recorders (SR recorders).

Each radiometer and tape recorder can be turned on or off by command from a CDA station. Each half of the SR processor is associated with one radiometer and is powered when that radiometer is powered. The radiometers are mounted on the satellite structure in a manner to provide them with maximum sun shielding and to permit a scan of approximately 150 degrees without obstruction.

As the spacecraft proceeds along its orbit, the radiometer scans the Earth's surface from horizon to horizon, perpendicular to the orbital plane. The radiometer scans the Earth by means of a continuously rotating mirror, which is inclined 45 degrees to its axis of rotation (parallel to the satellite's velocity vector.)

Secondary Environmental Sensor Devices

Solar Proton Monitor

The Solar Proton Monitor (SPM) is designed to measure the proton fluxes encountered in the ITOS orbit and to convert these measurements to a floating point binary code for recording and subsequent playback and transmission to ground stations. The SPM equipment on the satellite consists of a sensor assembly, an electronics assembly, and an electrical harness.

The solar proton monitor will provide warnings of solar proton storms, which are currently used in several ways. High altitude users, such as supersonic transports and manned spacecraft, make provisions for the protection of personnel on the basis of this data.

Solar proton storms affect radio frequency links (VLF through HF), and since satellite warnings often precede ionospheric disturbances, alternate radio paths or frequencies are often selected in advance.

The ITOS SPM data will be correlated with data from other satellites (such as the IMP and Pioneer), rocket probes, with ground based optical/radio sightings.

The long-term goal of this data-gathering and correlation activity is the better understanding of the interaction between solar radiation and the Earth's environment by providing a systematic monitoring of the proton fluxes over an extended period of time, especially during the current solar cycle.

Flat Plate Radiometer

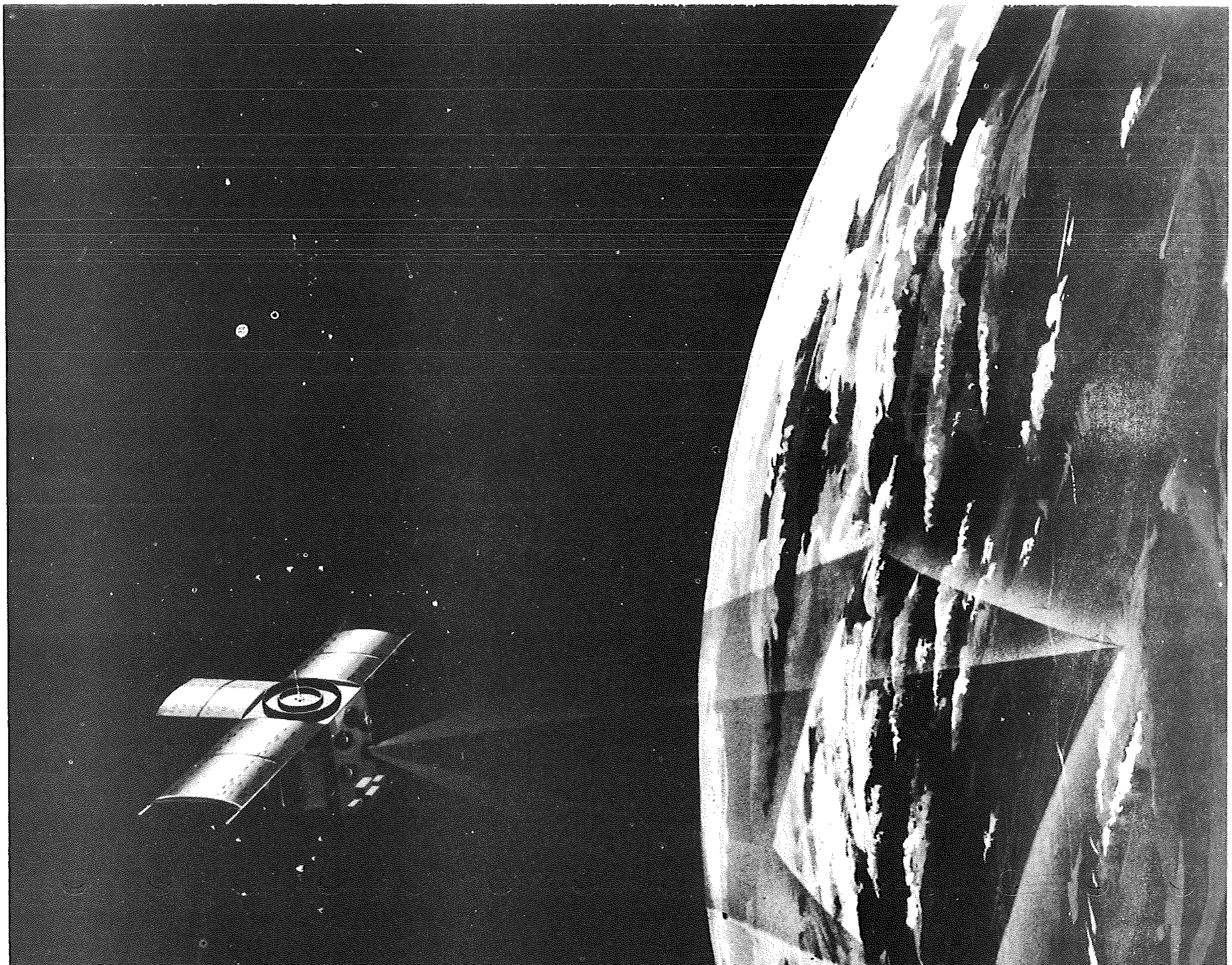
The flat plate radiometer (FPR) measures the amount of heat being radiated into space by the Earth and is employed to continue the program of mensuration of the Earth's heat balance initiated on the TOS spacecraft program.

By knowing the solar input (believed to be a constant) to the Earth, the amount of heat absorbed by the Earth may be determined. One of the FPR program objectives is to determine the long-term heat changes, thus determining whether the Earth is getting warmer or cooler.

The FPR, housed in a single enclosure of honeycomb material, includes the four sensors, electronics, and means for calibration of one pair of sensors.

The FPR consists of two portions, the electronics package and the sensor head. The head consists of the four radiometers, the radiative equilibrium (RE) cooling mirror, the motor which drives the thermal feedback (TF) sensors, the TF hemispheres, and the sensors to telemeter the mount and hemisphere temperatures.

The flat plate radiometer is mounted on the Earth-facing surface of the satellite and is partially covered with a thermal blanket.



ESSA USE OF IMPROVED TIROS OPERATIONAL SATELLITES

The TIROS-M spacecraft is a prototype of the Improved TIROS Operational Satellite (ITOS), which will become the vehicle for the Environmental Science Services Administration's operational weather satellite system.

TIROS-M and the first three spacecraft in the ITOS series will include the following sensors: 1) two Advanced Vidicon Camera Systems (AVCS); 2) two Automatic Picture Transmission (APT) systems; 3) two dual-channel Scanning Radiometer systems; 4) a low-resolution Flat Plate Radiometer; and 5) a Solar Proton Monitor.

The new satellite combines in one vehicle the Automatic Picture Transmission and the global picture storage capabilities that require the launch of separate spacecraft in the present operational system. Thus, fewer launches will be needed to keep the system in operation.

As in the current operational system, the global data for analysis by weather centers, provided by the Advanced Vidicon Camera Systems, will be recorded on magnetic tape for transmission to an ESSA Command and Data Acquisition station, and relay to the ESSA National Environmental Satellite Center; the APT pictures will be transmitted directly to ground receiving stations.

The Scanning Radiometer systems will provide data in both visible and infrared channels. The infrared data -- the first to be available on an operational basis -- can provide cloud pictures at night as well as during the day.

The addition of nighttime observations to the operational system will extend satellite coverage of the Earth's weather to a truly global basis. Because the AVCS and APT camera systems photograph only in daylight, the existing spacecraft have not furnished information on areas in polar darkness. With nighttime picture coverage, the entire Earth will be observed twice each day by both stored and direct readout systems.

The Scanning Radiometer data can be broadcast directly through the Automatic Picture Transmission system, and at the same time recorded simultaneously for later readout to ESSA Command and Data Acquisition stations. The infrared data from the SR system can be broadcast continuously for reception by APT stations during the approximately 70-minute nighttime portion of each orbit. Either infrared or visible data can be broadcast continuously, in place of APT pictures, during the 45-minute daylight portion of each orbit. However, it is planned initially to transmit visible channel radiometer data for 94 of the 102 seconds between APT picture transmissions during the daytime portion of the orbit. The radiometer data will cover an area near the center of the next APT photograph to be broadcast.

The infrared channel of the Scanning Radiometer provides temperature measurements at the surface in clear air, or at the tops of clouds. Its signals can be fed into a computer to convert the cloud top temperatures into cloud top heights and to prepare a map of cloud-top topography. Satellite pictures are frequently used to estimate winds, especially for regions where little upper-air information is available, by measuring the motion of the clouds in successive satellite pictures of the same area. It is frequently difficult or impossible to determine the height of cloud tops from the satellite photographs alone, and in these cases the altitude of the derived wind is doubtful. Information on the temperature, and by inference the height, of cloud tops will eliminate this difficulty, and provide meteorologists with better information on wind at various levels of the atmosphere.

In addition, the radiometers will provide surface temperature readings necessary for computation of atmospheric temperature profiles from soundings made by the Satellite Infrared Spectrometer aboard Nimbus III.

The low-resolution Flat Plate Radiometer system is similar to those included in the ESSA AVCS spacecraft and will continue gathering data on the Earth's heat balance.

The addition of the Solar Proton Monitor in TIROS-M and the ITOS series presages the expansion of the environmental sensing capabilities planned for future operational satellites in the ESSA series. The Solar Proton Monitor will count the energetic particles encountered in orbit. Its function is to detect the arrival of energetic solar protons in the vicinity of Earth. Tape-recorded data will be relayed via an ESSA Command and Data Acquisition station to the National Environmental Satellite Center for processing and calibration. The information will be used by ESSA's Space Disturbances Laboratory in Boulder, Colo., for detection and warning of solar storms.

The ITOS spacecraft, unlike the existing operational satellites, is large enough to hold additional environmental sensors. Among those planned for later spacecraft are vertical temperature profile sounders -- similar to the Satellite Infrared Spectrometer -- to obtain global temperature data for use in numerical weather prediction programs.

DELTA LAUNCH VEHICLE

The TIROS-M mission will be the 76th flight for the workhorse Delta launch vehicle. Of the previous 75 launchings, 70 successfully orbited their spacecraft.

Delta is managed for NASA's Office of Space Science and Applications by the Goddard Space Flight Center, Greenbelt, Md. Launch operations are conducted by the Kennedy Space Center's Unmanned Launch Operations. The McDonnell Douglas Corp., Huntington Beach, Calif., is Delta prime contractor.

This Delta 76/TIROS-M mission will mark another first in Delta's history. For the first time, six solid boosters will be strapped onto the first stage Thor. Three of these will ignite while Delta is still on the launch pad, while the other three will "light-off" at altitude some 38 seconds after lift-off and about 46,000 feet above the launch site.

The three extra solids are needed to place the heavier TIROS-M/ITOS spacecraft into 900-mile-high orbit.

Following are the general characteristics of the three-stage vehicle for the TIROS-M mission:

Total Height:	106 feet
Total Weight:	225,000 pounds
Maximum Diameter (First Stage):	8 feet
First Stage Thrust (average):	325,000 pounds (includes solids)

First Stage (Liquid Only): Modified Air Force Thor, produced by McDonnell-Douglas Corp.; engines by Rocketdyne Division of North American Rockwell.

Height:	75 feet
Diameter:	8 feet
Propellants:	RP-1 kerosene for the fuel and liquid oxygen (LOX) for the oxidizer.
Thrust:	172,000 pounds

Weight:	186,000 pounds
Burning time:	3 min. 41 sec.

Strap-on Solids: Three Castor I and three Castor II rockets produced by the Thiokol Chemical Corp.

Height:	24 feet
Diameter:	31 inches
Propellants:	Solid
Weight:	9,200 pounds (Castor-I) 9,900 pounds (Castor-II)
Burning time:	40 sec. (Castor-I) 39 sec. (Castor-II)

Second Stage: Produced by the McDonnell Douglas Corp. utilizing the Aerojet General Corp., propulsion system; major contractors for the autopilot include Minneapolis--Honeywell, Inc., Texas Instruments, Inc., and Electro-solids Corp.

Height:	13 feet
Diameter:	4 feet 7 inches
Propellants:	Liquid, Unsymmetrical Dimethyl Hydrozine (UDMH) for the fuel and Inhibited Red Fuming Nitric Acid (IRFNA) for the oxidizer.
Thrust:	7,800 pounds
Weight:	13,000 pounds
Burning time:	First burn - 6 min. 4 sec. Second burn - 13 sec.

DELTA #75 TIROS-M NOMINAL FLIGHT EVENTS

EVENTS	TIME AFTER LIFT-OFF	ALTITUDE (STATUTE MILES)	SURFACE RANGE (STATUTE MILES)	VELOCITY (MILES PER HOUR)
First Solid Motor Burnout (Castor-I)	49 sec.	15,380 feet	3,457 feet	972 mph
Second Solid Motor Burnout (Castor-II)	1 min 10 sec.	9 miles	5 miles	1,468 mph
Solid Motor Separation (Castor-I)	1 min 30 sec.	15 miles	16 miles	1,694 mph
(Castor-II)	1 min 35 sec.	16 miles	13 miles	1,789 mph
Main Engine Cutoff (MECO)	3 min 41 sec.	67 miles	122 miles	9,988 mph
Second Stage Ignition	3 min 46 sec			
Second Engine Cutoff (SECO)	9 min 50 sec	173 miles	1,460 miles	18,010 mph
Restart Second Stage	1 hr 1 min 3 sec	909 miles	10,584 miles	15,285 mph
Second Stage Restart Cutoff	1 hr 1 min 16 sec.	909 miles	10,537 miles	15,950 mph
Spacecraft Separation	1 hr 5 min 26 sec.	908 miles	10,810 miles	15,951 mph

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INDUSTRY

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Abraham Schnapf	TIROS/ESSA Project Manager RCA Corporation Astro-Electronics Division Princeton, N. J.

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PRIME CONTRACTORS

COMPANY	RESPONSIBILITY
RCA Corporation Astro-Electronics Division Princeton, N. J.	Spacecraft Cameras Realtime transmitters Dynamics Systems including momentum wheel (Pitch control subsystem) Command and Control Spacecraft integration and test and launch support
McDonnell-Douglas Corp. Huntington Beach, Calif.	Delta Launch Vehicle

MAJOR SUB-CONTRACTORS

Santa Barbara Research Center Subsidiary of Hughes Aircraft Co. Santa Barbara, Calif.	Scanning Radiometers
Teledyne	S-Band transmitters Subcarrier oscillators Telemetry commutators
RCA Camden, N. J.	Beacon transmitters
Gulton	DC-DC converters
Texas Instruments Dallas, Texas	Solar cells
General Electric Co.	Battery cells
Fairchild-Hiller	Integrated Circuits
University of Wisconsin Madison	Flat Plate Radiometer (FPR)
Johns Hopkins University Applied Physics Laboratory Baltimore	Solar Proton Monitor

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