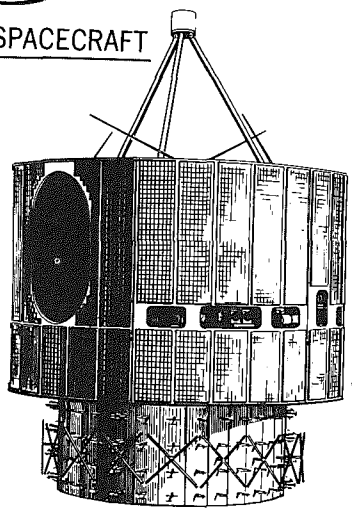
NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION
Washington, D. C. 20546
202-755-8370

FOR RELEASE:
May 8, 1974

SMS SPACECRAFT



PRESS KIT

PROJECT: SMS-A

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May 8, 1974

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RELEASE NO: 74-95

FIRST GEOSYNCHRONOUS WEATHER SATELLITE PREPARED FOR LAUNCH

In a major step forward in the use of space observations to advance the science of weather forecasting, NASA is preparing to launch the first Synchronous Meteorological Satellite (SMS-A) from Kennedy Space Center, Fla., no earlier than May 16.

The cylindrical 627-kilogram (1,379-pound) spacecraft will be carried to its station 36,357 kilometers (22,591 miles) over the Atlantic (45° W longitude) by a Delta 2914 launch vehicle.

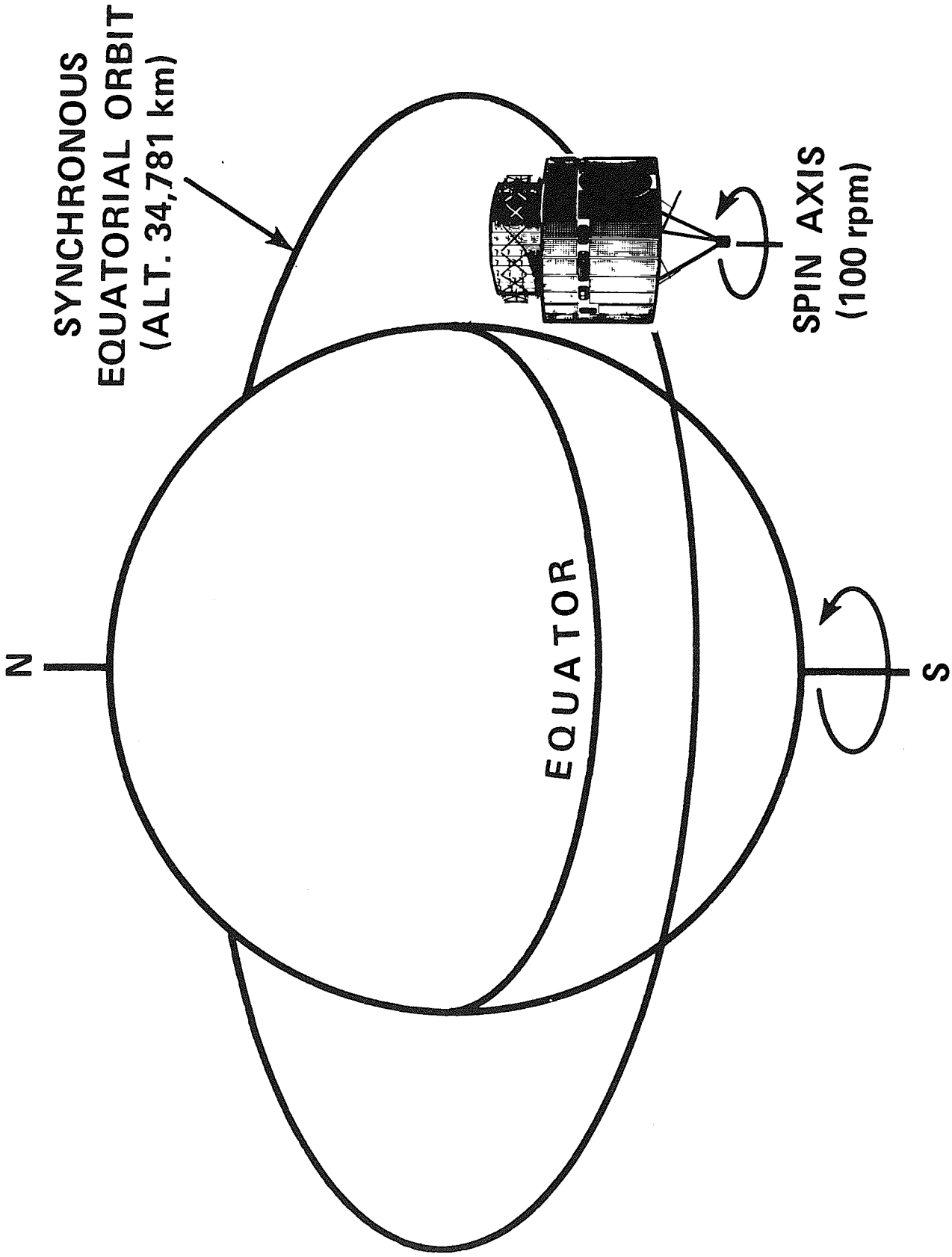
-more-

April 19, 1974

From its initial stationary position over the equator just off the coast of Brazil,the satellite will transmit electronic data to produce day and night pictures of the Western Hemisphere every 30 minutes; receive and transmit environmental information from up to 10,000 manned and unmanned data collection platforms; transmit and relay weather data and pictures to hundreds of small receiving stations; and monitor solar flare activity for future manned spacecraft and supersonic aircraft flights.

An onboard telescope will be able to produce .9-kilometer (1/2-mile) resolution images in visible light, and 9-kilometer (5-mile) resolution images during night time using infrared sensors.

These electronically devised images will be received at the National Oceanic and Atmospheric Administration (NOAA) Command and Data Acquisition Station, Wallops Island, Va., and from there transmitted to the National Environmental Satellite Service (NESS) at Suitland, Md., for national and worldwide distribution.


SYNCHRONOUS
EQUATORIAL ORBIT
(ALT. 34,781 km)
SPIN AXIS
(100 rpm)
N
S
EQUATOR

Images will be "stretched" for lower data rate retransmission through SMS from Wallops to the NOAA Central Data Distribution Facility, Marlow Heights, Md. The pictures will be sectorized and transmitted via land line to regional analysis and distribution centers in Miami, San Francisco, Kansas City, Washington, and later Honolulu. Twelve sectors make up the continental U.S.

The regional analysis and distribution centers, or Satellite Field Services Stations (SFSS), will receive the sectorized pictures and infrared data from the Central Data Facility, reduce these data to video imagery for analysis and interpretation, and then route the sectors to Weather Service Forecast Offices (WSFO) that each SFSS supports. The WSFOs can receive either visible weather pictures or infrared pictures every 30 minutes.

All SFSS stations, besides receiving standard sector data direct from the Central Data Facility on a continuous basis, will be able to receive two Northern Hemisphere sectors of their own choosing every 30 minutes. The Miami station will also be able to receive sectors as required south of the equator. Southern Hemisphere pictures are important to the Miami station especially for hurricane information.

Data, including weather maps and pictures, also can be transmitted via the satellite directly to some 500 small Automatic Picture Transmission (APT) stations, most of them in the Western Hemisphere.

In an experiment that is expected to get underway in September 1974, 20 balloons will be released by the National Center for Atmospheric Research (NCAR) over a period of 90 days from the balloon launch site in French Guiana operated by the French National Center for Space Studies. The balloons will reach an altitude of about 30 kilometers (100,000 feet) and will float around the globe at the equator. Each balloon will carry transmitting and receiving equipment as well as 64 dropsondes (instrumented packages dropped by parachute) each weighing 400 grams (14 ounces).

Working with both SMS and Nimbus F, a meteorological satellite to be launched next fall, the Carrier Balloon System will sample vertical wind data as well as temperature and humidity data at many points around the world as the dropsondes are released and drift to Earth. This information will be transmitted from each dropsonde through the Carrier Balloon Electronic Package, through SMS, to the Wallops Island, Va., Command and Data Acquisition Station, and by land line to the NCAR facility at Boulder, Colo. NCAR will process the data.

Lifetime of the balloons, which will circle Earth every 15 to 25 days between 10° N and 10° S, are expected to be at least 90 days and possibly as much as one year. The dropsondes will be released on command through the SMS from the Wallops Island ground station. Two to four releases a day are planned.

The tropic area was chosen for release of the balloons because there is a major gap in knowledge of equatorial winds which affect long-range forecasting capability.

SMS also will test for the first time a widespread data collection system designed to provide NOAA with near real-time (as it happens) data from the planned 10,000 Data Collection Platforms (DCP) spread around the United States on land, in rivers and lakes, and at sea.

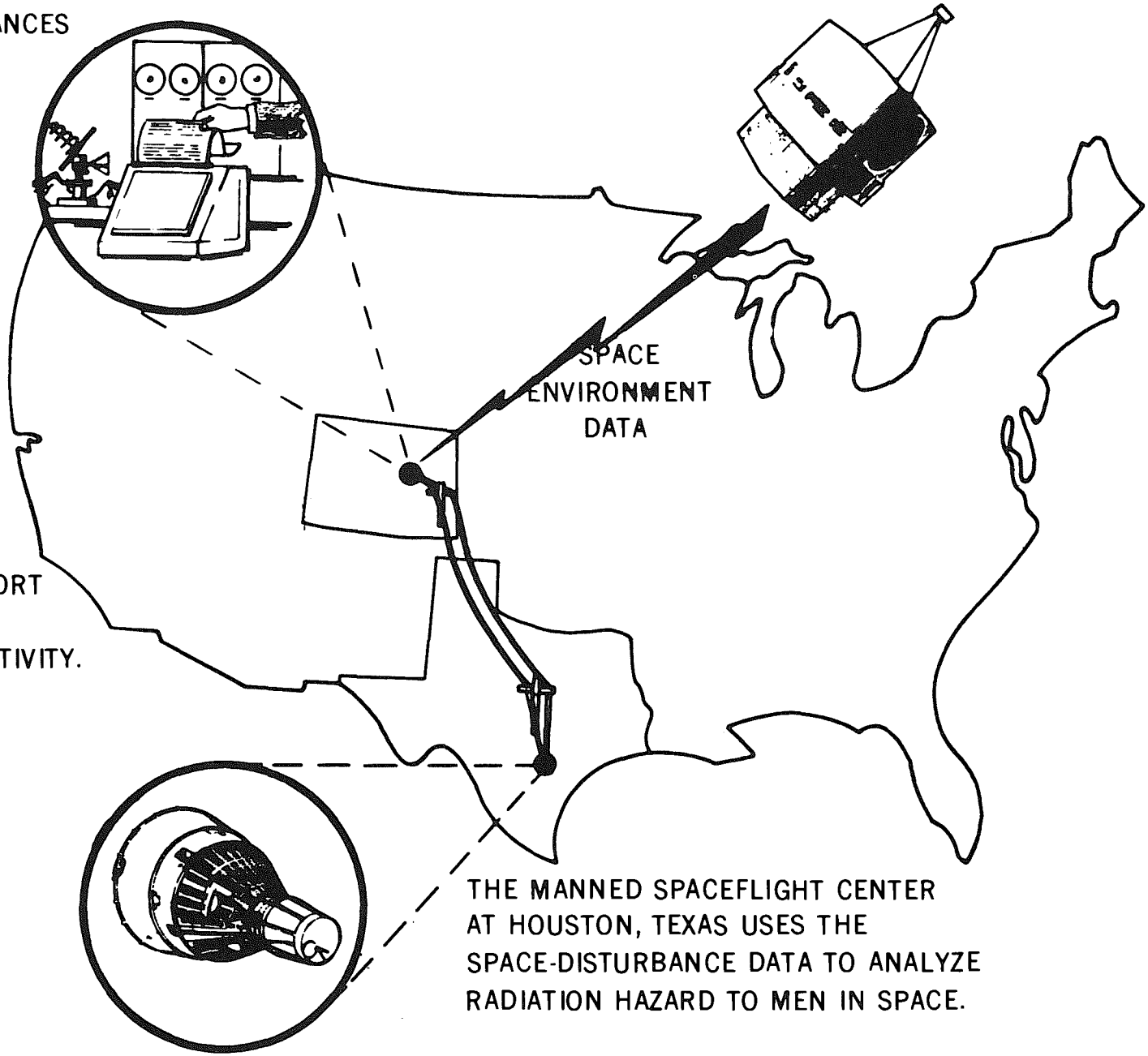
The platforms are small environmental sensing stations that collect data and transmit them through the satellite to the Command and Data Acquisition Station and from there by land line to NOAA's Data Processing Facility. Most are unmanned small platforms, although some will be on board ships.

The primary type of data to be obtained are meteorological, hydrological, oceanographic, seismic, and tsunami information. For example, fixed platforms in remote land areas will send information on earthquakes, wind direction and velocity rainfall, and the humidity. River platforms will measure currents, water levels, and temperatures. Platforms at sea, fixed or floating, will measure tides, water temperatures, and air temperatures and give tsunami warnings.

The Space Environment Monitoring (SEM) System carried on SMS-A is designed to provide direct measurement of important effects of solar activity, such as solar flares, in real time. NOAA will use SEM in studying solar effects on the environment and for advisory or warning messages on possible significant solar radiation hazards or conditions. SEM information is expected to be especially useful to warn manned spacecraft, and later on supersonic aircraft, of potential solar radiation dangers. Also it is expected to be used for radio communications blackout alerts. Continuous monitoring is needed for these data, and past studies have shown satellite data is at least ten times as accurate in picking up small solar flares as ground-based equipment.

SPACE ENVIRONMENT MONITORING (SEM) SYSTEM

THE SPACE DISTURBANCES LABORATORY OF THE NOAA RESEARCH LABORATORIES AT BOULDER, COLORADO RECEIVES THE SPACE ENVIRONMENT DATA, AND FORMATS IT BY COMPUTER INTO BULLETINS FOR SPACE-DISTURBANCE FORECASTING TO SUPPORT THE MANNED SPACE PROGRAM, SUPERSONIC TRANSPORT FLIGHTS, AND COMMUNICATIONS ACTIVITY.



THE MANNED SPACEFLIGHT CENTER AT HOUSTON, TEXAS USES THE SPACE-DISTURBANCE DATA TO ANALYZE RADIATION HAZARD TO MEN IN SPACE.

NASA and the National Oceanic and Atmospheric Administration, Department of Commerce, are working toward Geostationary Operational Environmental Satellite (GOES) System, with NASA's Goddard Space Flight Center, Greenbelt, Md., responsible for designing, developing and evaluating the spacecraft and ground system, for spacecraft checkout in orbit, and for the launch vehicle and launch operations.

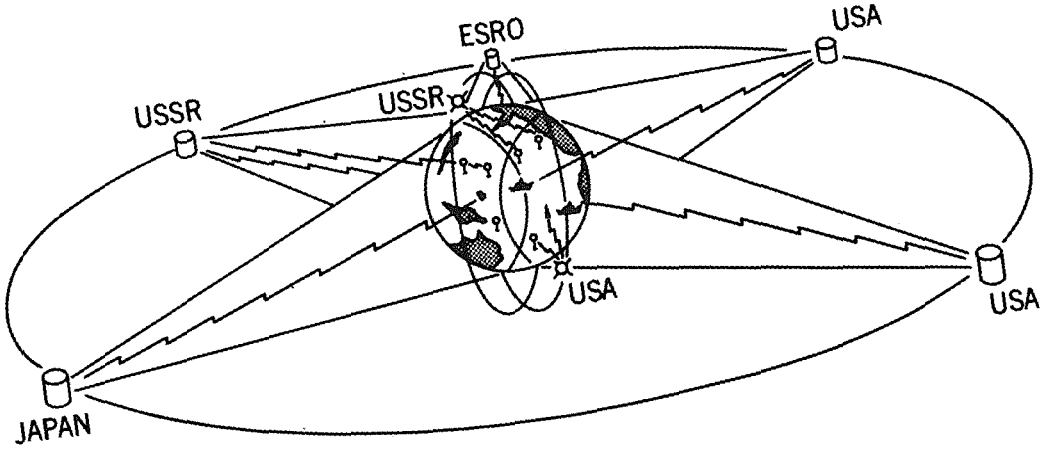
NOAA is responsible for operation of the satellites, the ground system, acquiring and processing data, and deciding when a replacement spacecraft is needed.

A few months after the first SMS is launched, another one, SMS-B, will be placed over the Pacific Ocean at near 130° W longitude. When NASA has thoroughly checked out each spacecraft, these two prototype satellites will be turned over to NOAA for full operational use and control.

Later in the year, the first NOAA-funded synchronous orbit satellite will be launched by NASA. This spacecraft, after initial checkout by Goddard, also will be under full operational control of NOAA. The two NASA satellites will be called, upon attaining orbit, SMS-1 and SMS-2. NOAA's first satellite will be called GOES-1, for Geostationary Operational Environmental Satellite.

Five operational synchronous satellites, working in conjunction with one or two near-Earth satellites in near-polar orbits will be used as the space based observational element of the internationally supported Global Atmospheric Research Program (GARP).

In t. e late 1970s, the European Space Research Organization (ESRO), Japan, and the Soviet Union are expected to join the U.S. in providing meteorological satellites in synchronous orbit. The spacecraft will be about 70° apart, spaced around the world. The U.S. satellites then will cover the western hemisphere; ESRO's satellite will observe Europe, and near Eastern areas; Africa, the USSR spacecraft will cover the Soviet Union as well as other parts of Asia and India; and the Japanese will close the global system with a spacecraft monitoring the Far East and the Western Pacific Ocean. All except the Russian spacecraft are planned to be launched aboard Delta launch vehicles from Kennedy Space Center, Fla.



GLOBAL OBSERVING SYSTEM

The first satellite, SMS-A, will participate this year in the first international field experiment of the Global Atmospheric Research Program (GARP), the research arm of the World Meteorological Organization's World Weather Program. This first experiment, beginning in June this year and ending September 30, is called the GARP Atlantic Tropical Experiment (GATE). As part of GARP's goal to increase man's knowledge of the atmosphere and learn causes of climate variations, GATE will investigate Earth's tropical belt from the eastern Pacific to the Indian Ocean with ships, aircraft, land stations, satellites, and instrumented ocean buoys

The United States has been launching weather satellites since 1960. Since the satellite system became operational in 1966, very few major storms anywhere in the world have gone undetected by one of these weather satellites. In fact, meteorological services around the world rely on their continued operation for up-to-date information about the weather especially violent storms or hurricanes.

These satellites, flying polar orbits, observe each spot on Earth twice a day The geosynchronous satellites, with their full-disk coverage of Earth every 30 minutes, will supplement that coverage by providing the added short-term observations required by local forecasters around the clock, especially of severe weather phenomena such as tornadoes.

Some work has been done already in predicting short-term severe weather phenomena based on the photos received from SMS's predecessors, Applications Technology Satellites-1 and -3, launched in December 1966 and November 1967, respectively. ATS-1 provided the first synchronous-orbit black-and-white photos of Earth, and ATS-3 provided the first color photos.

SMS-A will be launched by a three-stage Delta rocket with nine strap-on solid motors. It will be placed into a 185-kilometer (115-mile) parking orbit and allowed to coast to the first equator crossing off the Coast of Africa. There, the third stage and SMS will be separated from the second stage and the third stage will then ignite to inject the spacecraft into a transfer orbit with an apogee of 36,357 kilometers (22,591 miles) where it will be fired into synchronous orbit by the solid-propellant Apogee Boost Motor on the spacecraft at the first or second apogee. SMS will be drifted to its station at 45° W longitude in 15 to 20 days depending on which apogee the firing takes place.

SMS program management is under the direction of NASA's Office of Applications, with project management the responsibility of the Goddard Space Flight Center, Greenbelt, Md., which also manages the Delta launch vehicle project. Philco-Ford, Palo Alto, Calif., is the spacecraft prime contractor. The Santa Barbara Research Center of the Hughes Aircraft Company has developed and produced the Visible and Infrared Spin Scan Radiometer which is the main sensor for SMS. McDonnell Douglas Astronautics Co., Huntington Beach, Calif., is the prime contractor for the Delta. Launch services are provided by Kennedy Space Center's Unmanned Launch Operations Directorate.

The spacecraft, including all onboard instrumentation, cost about $45 million for the first three. The Delta rocket and launch services cost about $8.6 million each launch.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS)

GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE SYSTEM

NASA, the Department of Commerce, and the National Oceanic and Atmospheric Administration (NOAA), are working together toward a Geostationary Operational Environmental Satellite (GOES) System. NASA's Goddard Space Flight Center (GSFC) is responsible for designing and developing the spacecraft and ground system, for the launch vehicle, for launch operations, for initial satellite checkout in orbit, and for spacecraft evaluation. NOAA is responsible for operation of the satellite, including decisions on replacement; for operating the ground system; and for acquiring, handling, and processing satellite data. Operational control and management of the program is delegated to the National Environmental Satellite Service (NESS) located at Suitland, MD.

- GOES Objectives -

Objectives of the GOES system are to:

o Provide near continuous observation of Earth and its environment, day and night, over large areas of North and South America and the surrounding oceans within view of the spacecraft;

o Provide data collection from remote observing platforms such as buoys, automatic weather stations, ships, aircraft, and balloons;

o Measure energetic solar particle flux, X-rays, and the strength of Earth's magnetic field;

o Broadcast centrally prepared environmental data to remote stations.

SYNCHRONOUS METEOROLOGICAL SATELLITE (SMS)

The SMS system is a logical development from existing space technology. SMS is based on technology developed in the Applications Technology Satellite (ATS), Synchronous Communications Satellite, Television Infrared Observation Satellite (TIROS), TIROS Operational System (TOS), and Nimbus Satellite programs.

The immediate and long-range requirements for, and benefits of an operational meteorological satellite system are to develop a remote sensing capability for determining the vertical structure of the atmosphere globally as is done by present ITOS/NOAA satellites which, when supplemented by conventional observation techniques, will obtain the data required for large-scale, long-term weather forecasts. Additionally, short-term weather forecasting can be aided by providing a system for near-continuous observation of short-duration weather features--as the SMS system will do.

The short-term weather forecasting satellite observational requirements are met with the capability to take day and night full-Earth-disk pictures every one-half hour. The simultaneous operation of two meteorological satellites in synchronous orbits is a large step toward a complete meteorological observation system.

The SMS system also provides for data collection of meteorological significance initially from about 10,000 remote observation stations. In addition, both raw and processed meteorological data can be distributed to the small local (APT) stations by using the data relay capabilities of SMS. The Space Environment Monitoring (SEM) system provides real-time warnings of solar disturbances.

- International Participation -

As part of international participation in the World Meteorological Organization Joint Organizing Committee, ESRO, Japan, and Russia are planning to launch their own geostationary environmental satellites in the late '70s to complement the SMS system for global use. Commonality of the data collection system has been determined essential for transmission from ships, etc. Image data links will not be in a common format, but reduced data will be exchanged between participants.

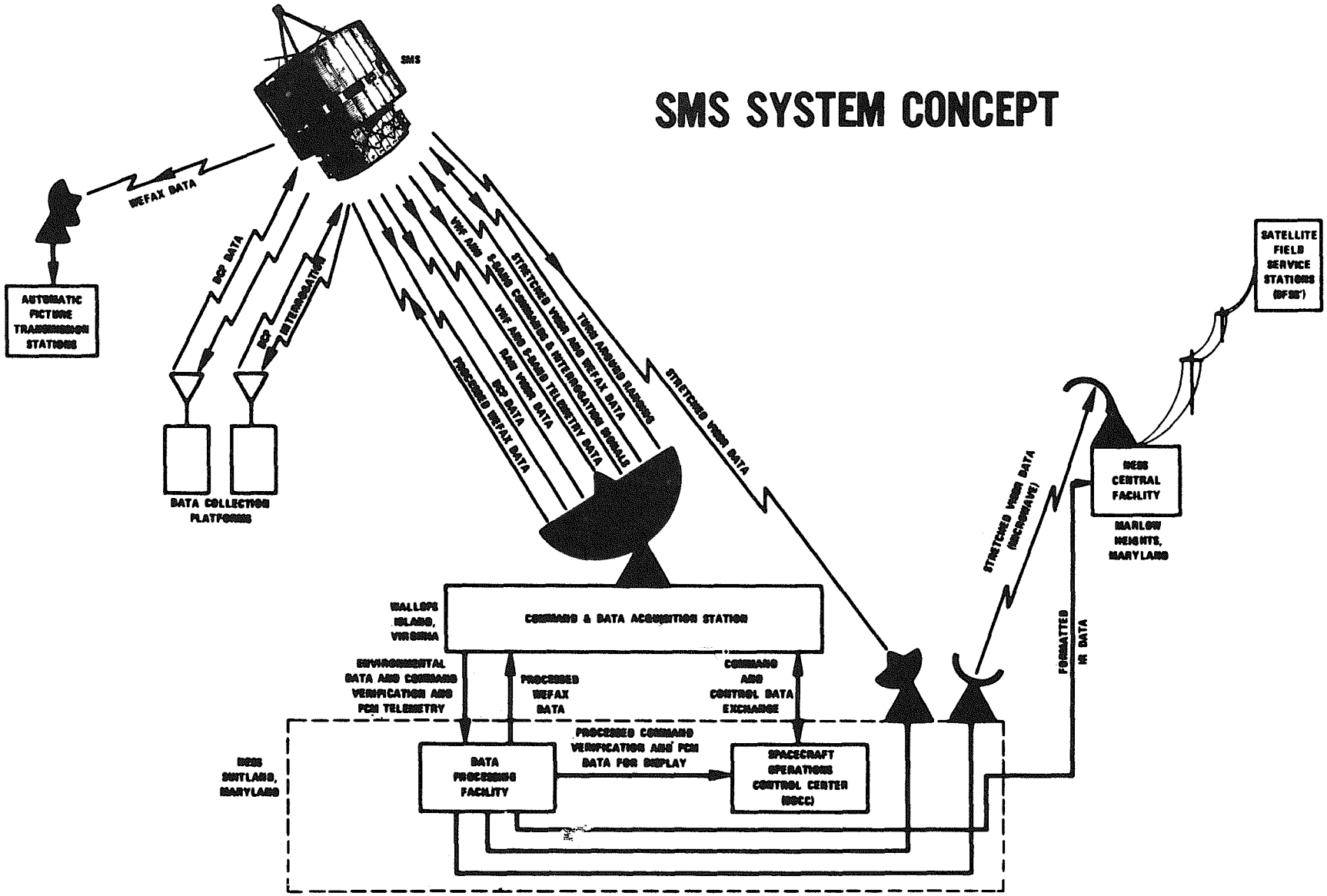
SMS-A MISSION OBJECTIVES

The spacecraft will be placed into a synchronous equatorial orbit to exhibit the following system performance:

° 0.9 km (½-mile) visible resolution, using 40.6 cms. (16 inch) diameter telescope/radiometer for cloud data;

° 9.0 km (5-mile) IR resolution, using the same telescope optics;

SMS SYSTEM CONCEPT



Capability to collect data from small, remote terminals and relay it, with no degradation, through the spacecraft transponder and directive antenna to a master station;

Capability to provide solar activity and space environment data monitored by energetic particle and magnetometer sensors

SMS SYSTEM DESCRIPTION

The SMS system includes the spacecraft, ground stations, and remote Data Collection Platforms (DCP). The ground system consists of a master station, the Command and Data Acquisition (CDA) station, located at Wallops Island, Va, the Spacecraft Operations Control Center (SOCC) and Data Processing Facility, located at Suitland, MD, the Central Facility, located at Marlow Heights, MD, and several Satéllite Field Services Stations (SFSS).

The system provides for collection from remote Data Collection Platforms (DCP)--small environmental sensing stations. The system also permits transmission via the satellite of narrow-band environmental data to existing small Automatic Picture Transmission (APT) stations with a minimum modification to the present stations.

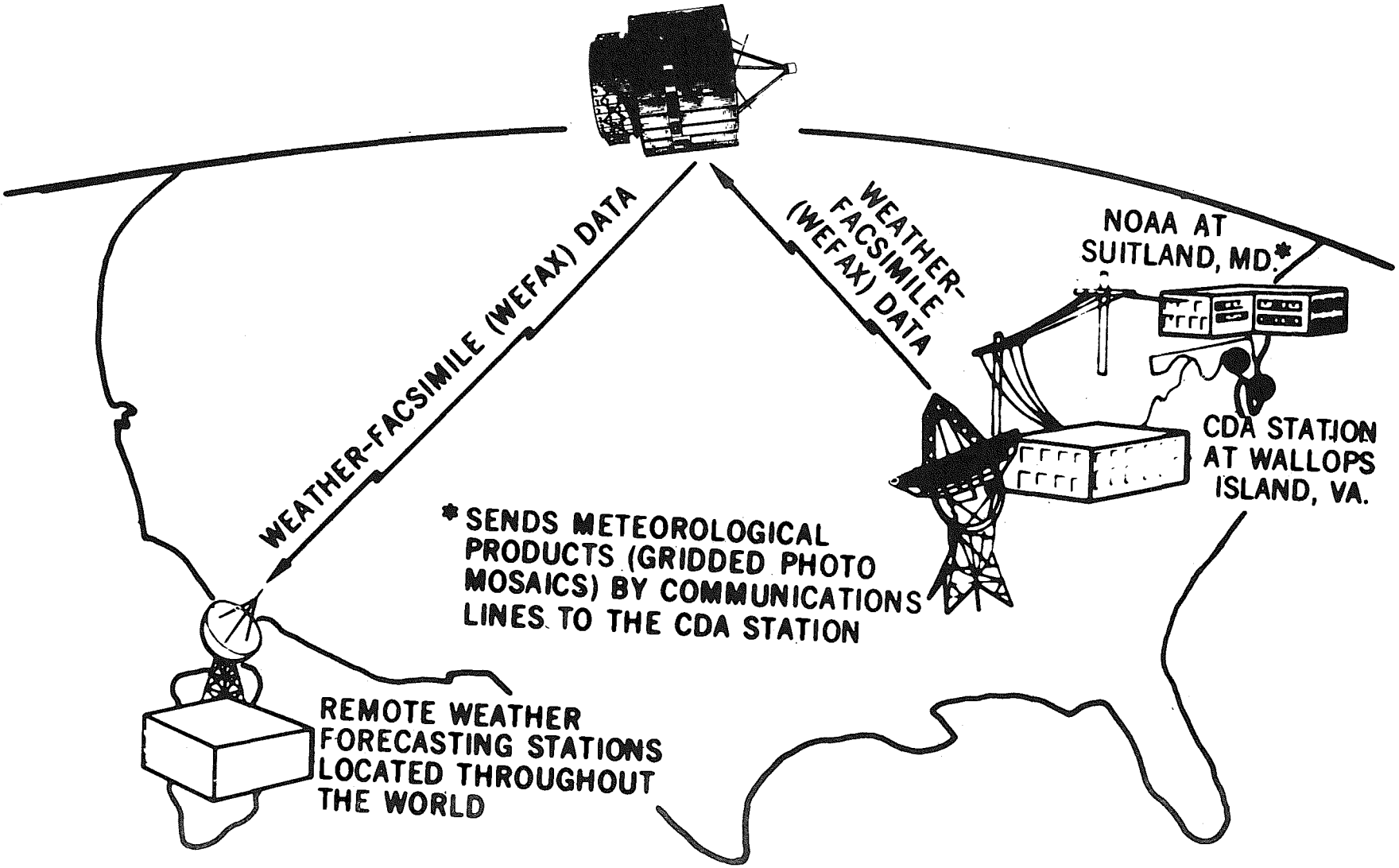
The basic payload of the spacecraft consists of a telescope/radiometer, called the Visible Infrared Spin-Scan Radiometer (VISSR) providing both infrared (IR) and high-resolution visible photography, a communications system for data collection and distribution, and a Space Environment Monitoring (SEM) subsystem.

The synchronous orbit will permit continuous viewing of large areas of Earth in much greater detail than presently possible, which will permit spotting and tracking tropical disturbances and other major storms as well as short-term weather phenomena such as tornadoes or severe thunderstorms.

- Earth Imaging -

The SMS will use the VISSR for simultaneous imaging of Earth's surface and cloud cover. The VISSR is an optical line-step scanner that uses a combination of the satellite spin motion and a servo loop, using a torque motor drive together with a digital encoder, to position the mirror to form an entire-Earth-disk image of land, sea, and cloud tops every 20 minutes both day and night. Allowing for retrace and nutation damping, an entire sequence will take 30 minutes.

WEATHER-FACSIMILE (WEFAX) DATA RELAYED TO REMOTE WEATHER FORECASTING STATIONS



The VISSR contains eight identical visible channels that will operate in the 0.55-to 0.70-micron band to to make 0.9 km resolution images of visible radiation emitted from the cloud tops during day-time. It also contains a single IR (thermal) channel that operates in the 10.5-to-12.6-micron band to make 9.0 km resolution images of IR radiation emitted from the land, sea, and cloud tops during both day and night.

- Carrier Balloon System -

The Carrier Balloon System is a combination of high-altitude super-pressure balloons, VLF retransmission drop sondes, the Omega Navigation System, and SMS.

The balloon is a constant-volume Mylar sphere 25-meters (75-feet) in diameter. It carries a sonde dispenser that contains the UHF command receiver and UHF transmitter, meteorological and Omega data digitizer control unit, and the power supply. The dispenser can carry 65 Omega sondes and is open on the bottom.

The control unit decodes drop commands received from the ground through SMS and provides timimg signals for the data digitizer. The control unit also formats data for housekeeping telemetry that is transmitted to the Nimbus F, which can provide worldwide balloon locations each day to within 5 kilometers (3 miles).

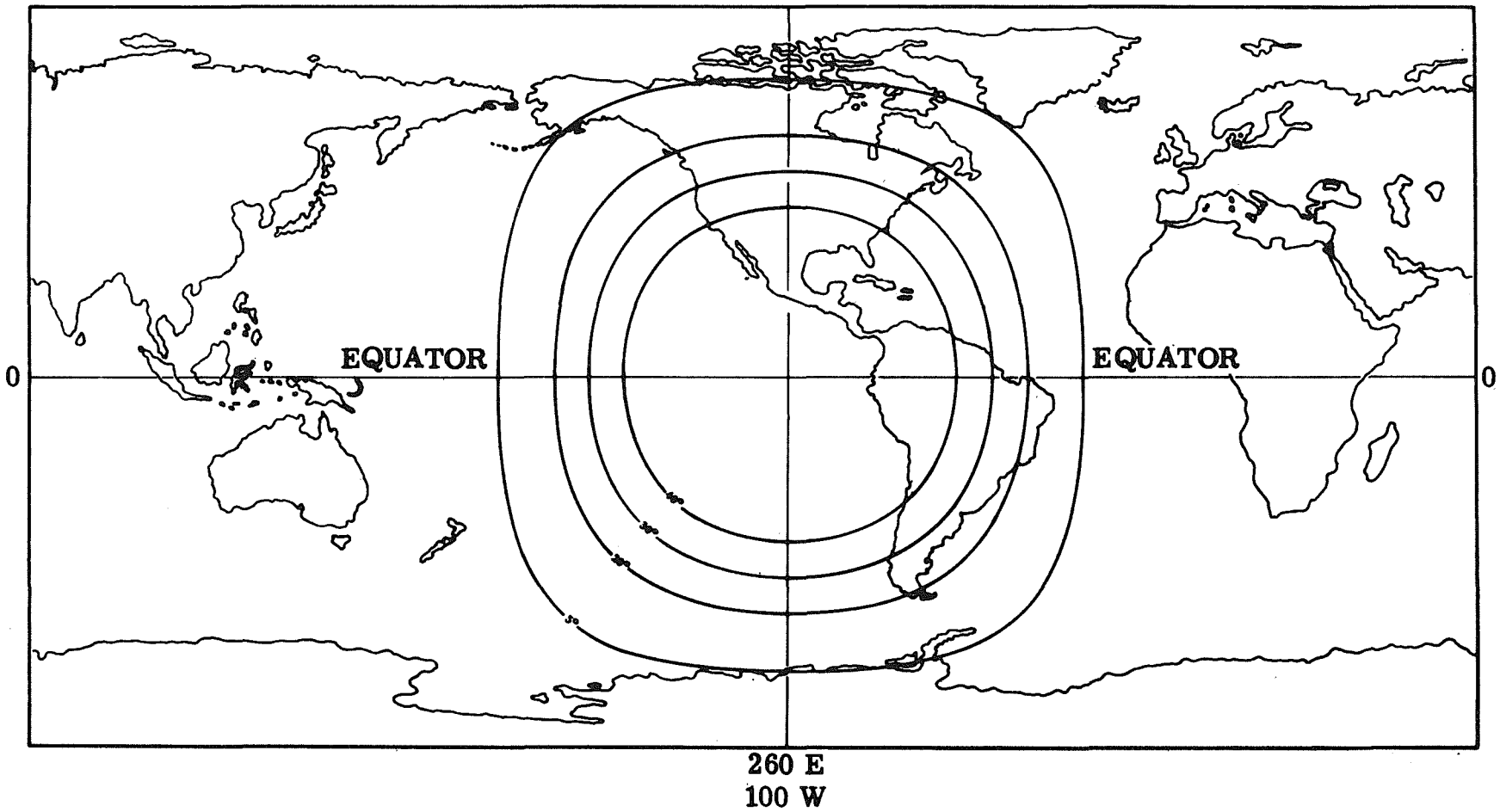
The Omega sonde consists of a polystyrene chassis 7.5 centimeters (3 inches) in diameter by 50 centimeters (20 inches) in length with one-centimeter (.4-inch) thick walls. The chassis contains the Omega receiver, an FM transmitter, and all electronics support circuitry. Power for the sonde is provided by five lithium-cell batteries. A constant-drag parachute controls the sonde descent to the surface of Earth. The single antenna between the parachute and the top of the sonde chassis is for transmitting and receiving.

The instruments for measuring meteorological parameters are mounted in a double-wall Mylar radiation shield at the bottom of the chassis. A standard rod thermistor measures temperature, and a standard carbon element provides humidity information.

Data Collection System

The Data Collection System (DCS) will enable environmental data sensed at a maximum of 10,000 Data Collection Platforms (DCPs) to be relayed through SMS to the Command and Data Acquisition (CDA) Station.

SMS VISSR COVERAGE



Examples of types of DCP are:

- Atlantic, Pacific, and Caribeean Ships;
- Remote Weather Stations;
- Hydrological Stations;
- Buoys;
- Agricultural Stations;
- Fire Weather Stations;
- Seismic and Seismic Sea Wave Stations;
- Other types of Stations.

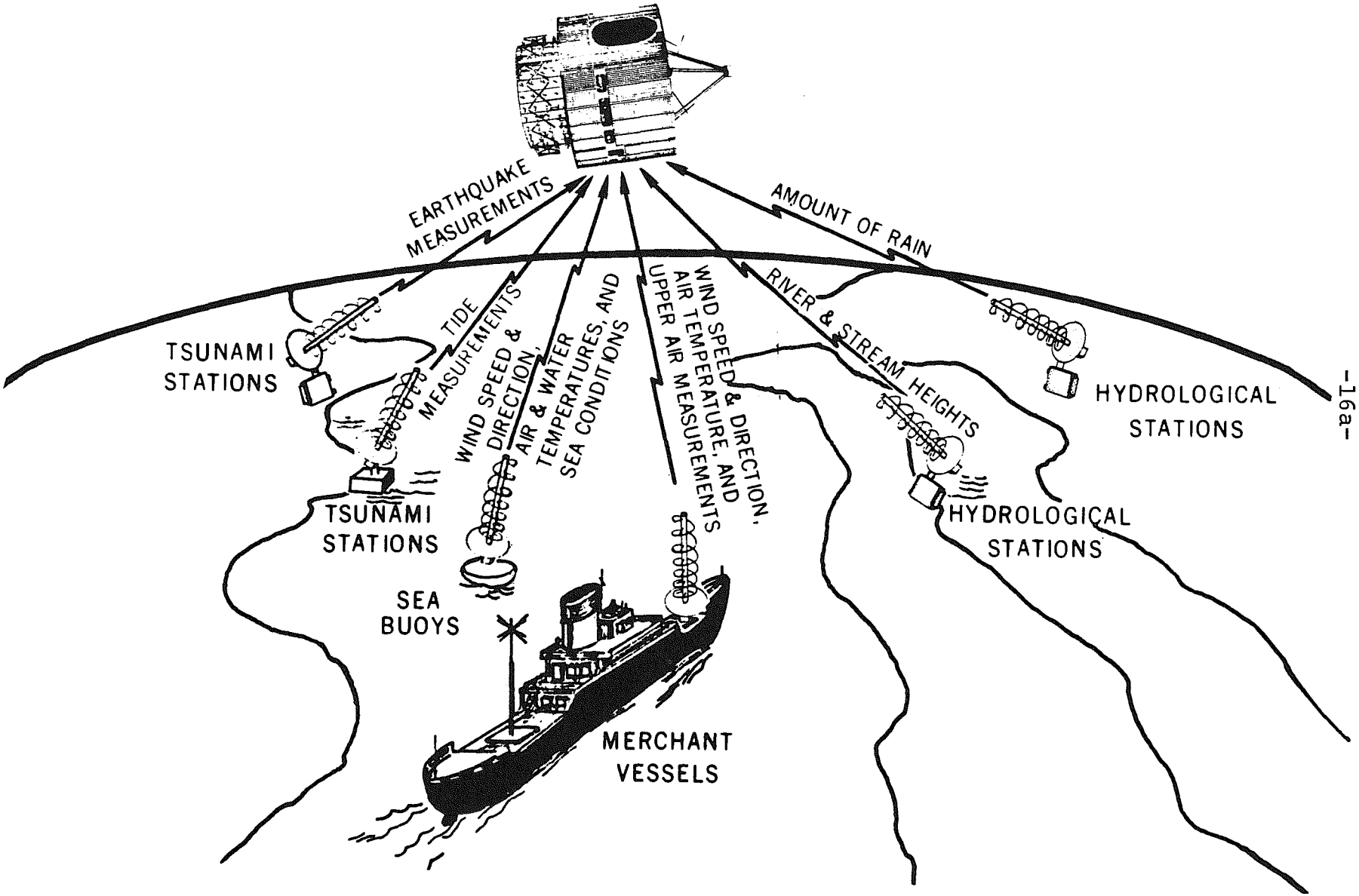
There will be two types of DCP radio sets, the interrogated and the self-timed. The interrogated DCP will be equipped with a radio receiver and decoder, so that it can be interrogated through the spacecraft and commanded to send its stored data at any time. The self-timed DCP will be equipped with an accurate timer that will initiate transmission of stored data at a predetermined time.

The collection of data from the interrogated DCPs will begin with the preparation of a programmed sequence of interrogation commands, which will be recorded on magnetic tape. The interrogation command will consist of a digital word, the first part of which is a preamble common to all DCPs, followed by an address unique to each DCP. These digital commands will drive a modulator at the DCA station. The decoding circuit in each DCP will continuously compare the incoming addresses with its own. When the decoding circuit recognizes that DCP's address, it will turn on its transmitter and send the stored data to the satellite. Upon completion of the message, the DCP transmitter will automatically shut off.

Each self-timed DCP will be assigned a time slot in which to operate and will be equipped with a timer of sufficient accuracy to stay within that time slot for a period of one year. At a predetermined time, the timer in the self-timed DCP will initiate a transmission of its stored data to the satellite. Upon completion of the message, the DCP transmitter will shut off and the DCP will wait for the next predetermined time for transmission of data.

Both the interrogated and self-timed DCPs will be equipped to transmit automatically to the satellite in case of emergency. The interrogated DCP will transmit only its address to the satellite on a frequency assigned for emergency reporting. The CDA station will then command that DCP to send its stored data in the normal manner. The self-timed DCP will transmit its stored data to the satellite on its assigned emergency reporting frequency whenever sensor levels exceed a preset value.

COLLECTION OF ENVIRONMENTAL DATA FROM DATA COLLECTION PLATFORMS



The data will then be sent to the National Environmental Satellite Service (NESS), Suitland, Md., by land line for distribution to the user.

COMMUNICATIONS SYSTEM

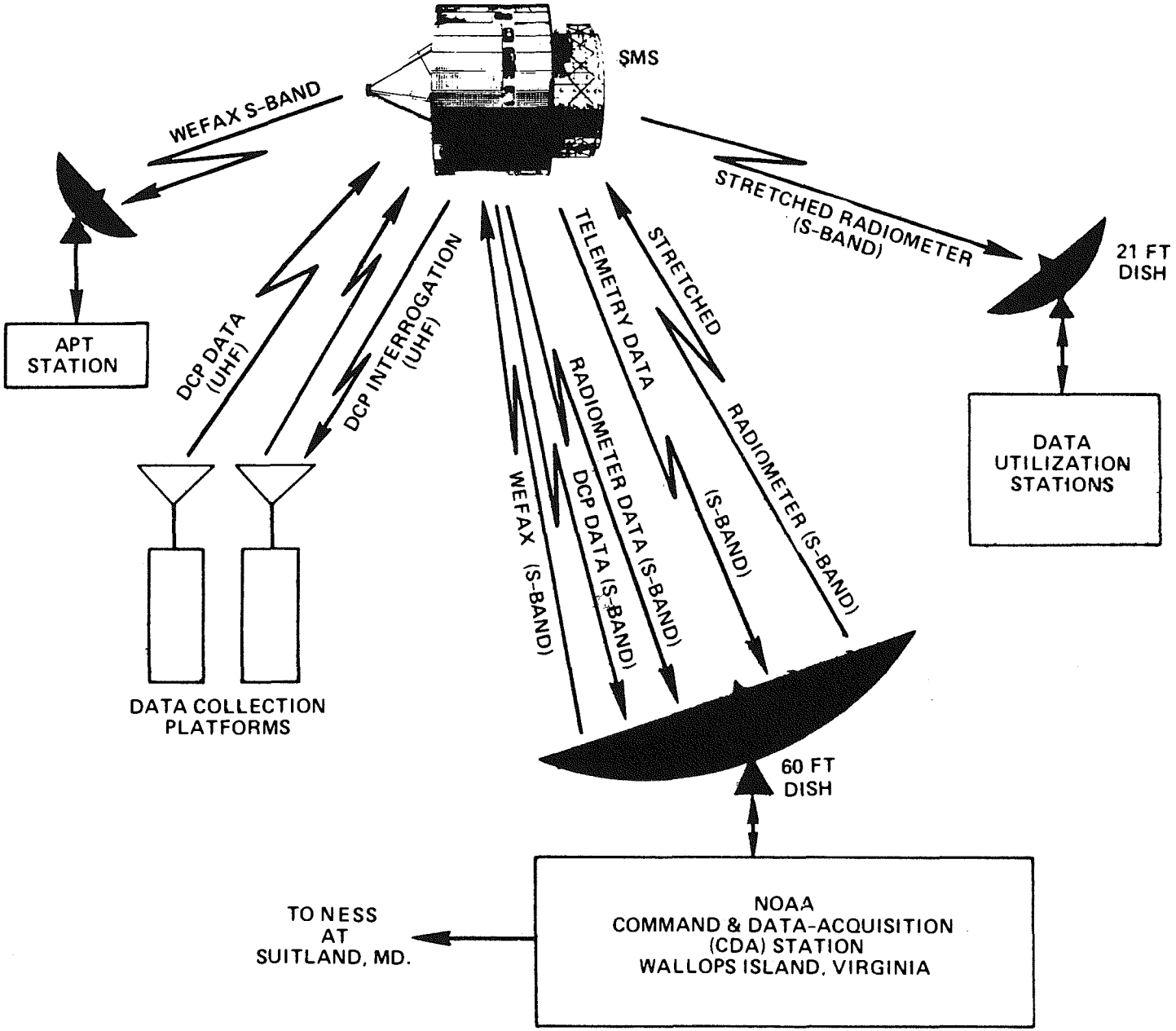
The communications system functions are:

- Transmit onboard telescope/radiometer data to the CDA station;
- Receive and retransmit stretched telescope/radiometer data;
- Receive and retransmit WEFAX (weather facsimile) data to APT stations;
- Receive and retransmit sensor data from remote DCPs;
- Transmit interrogation signals to DCPS:
- Transmit and receive telemetry and command signals (including data from SEM system);

Central Data Distribution System Operations (CDDS)

The SMS CDDS consists of six major parts: A CDA station, a NESS operations control and data relay center, and a Central Facility, all maintained and operated by NOAA/NESS. The three primary data users are Satellite Field Services Stations(SFSS), Weather Service Forecast Offices (WSFOs), and the Central Wind Extraction Unit.

SMS COMMUNICATIONS LINK



Command and Data Acquisition

The CDA station commands the operation of the satellite and is the primary data collection center for SMS operations.

Nine channels of raw VISSR data (eight lines of visible plus one line of IR) will be transmitted from SMS over a 25 MHz bandwidth RF link to the CDA station during the 18 to 20 degrees of satellite rotation that the VISSR views the Earth, or during 30 milliseconds (ms) of the total 600 ms satellite spin period.

The received data will be fed to a synchronizer/data buffer (line stretcher), which stores the data during the 30 ms Earth-viewing time for stretching or reducing the bandwidth (approximately 8 to 1) for simplification of handling. These data will also be annotated and gridded and put into a form more suitable for display. The stretched data will then be transmitted to the satellite transponder for retransmission to NESS at Suitland, MD, over an RF bandwidth of approximately 8 MHz for a period of 480 ms during the remaining 340 degrees of satellite rotation.

The 30 ms Earth-viewing and 480 ms stretched data-transmission times will be synchronized to ensure completion of both transmissions within the nominal 600 ms spin period.

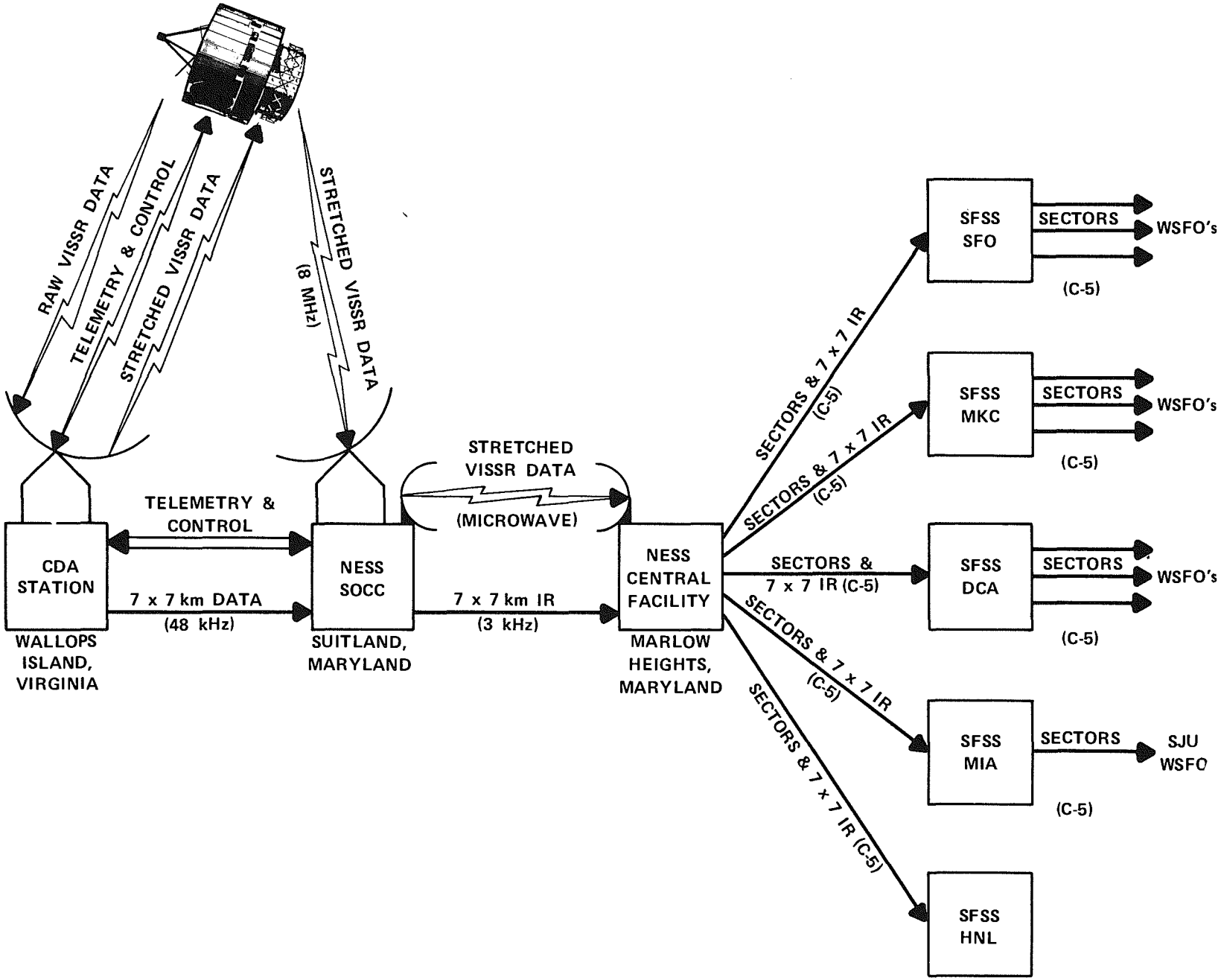
The received IR data are also separately formatted into a 7-by-7 km resolution image for transmission to NESS over a 48 kHz wideband telephone line. This is NOAA's back-up system for providing data to users in the event of a failure in the retransmitted RF data loop.

The CDA station also transmits telemetry, command, selected events, and other satellite data in real time to NESS to facilitate management of the SMS system.

Central Facility

The Central Facility will transform the stretched VISSR and IR data into a form suitable for transmission over 3kHz C-5 grade telephone lines to outlying Satellite Field Services Stations (SFSS) and Weather Service Forecast Offices (WSFOs) through the SFSS. In addition, these data will be supplied to the Winds Derivation Unit and several other units located with the Central Facility through direct data lines.

SMS CENTRAL DATA DISTRIBUTION SYSTEM (CDDS)



Allowing for VISSR retrace and satellite nutation damping an entire sequence will take 30 minutes. The resulting large accumulation of data could be handled by reducing the information bandwidth and transmitting a large geographical area of coverage or transmitting the maximum resolution available covering a smaller geographical area. The latter choice was selected.

-Sectors-

The smaller geographical areas are called sectors and are available in 0.9, 1.8, 3.6, and 7 km resolutions. For example, a total of 12 0.9 km resolution sectors will cover the contiguous 48 states. A sector is produced by a digital hardware device called a sectorizer. This unit inputs digital data, converts two selected sectors of it to analog form, and then makes an analog transmission of the sectorized data to a data user.

The unit operates in a serial fashion (i.e., does not have the capability of receiving and transmitting at the same time), which causes sectorized data transmission from the Central Facility to be on a non real-time basis. A large bank of these units will be located in the Central Facility, producing the various sectors required by users scattered principally throughout the United States.

Normally, the average data user will require data only of the Northern Hemisphere, which will require nine minutes for receiving data and approximately 17 minutes for handling and transmission of data. This will be well within the planned 30-minute imaging interval. However, some data of the Southern Hemisphere will also be included.

Since each sectorizer will store two sectors, data receive time for the second sector, in the Southern Hemisphere, will be added to and will therefore exceed the normal nine minutes receive time for the Northern Hemisphere sector. Thus, the total sequence will exceed the 30-minute image recording interval.

In order to provide these additional data within a 30-minute interval, two sectorizers will be required on a back-to-back basis, i.e., one recording the second image while the other is transmitting a sector from the first image. A second system exists for transmission of the entire infrared Earth disk in real time.

This system consists of hard-line data distribution of low resolution 7-by-7 km IR data over 3kHz C-5 telephone lines to the SFSS. It will be used as the primary source of SFSS data during that period of the day when Earth is in darkness. It will also be used as a backup system in the event that a catastrophic failure disables the central sectorizing effort. The Central Facility also supplies data to the Central Wind Extraction Unit, using two specially modified sectorizers.

Satellite Field Services Stations

The NESS SFSSs located in Miami, Kansas City, Washington, San Francisco, and later Honolulu interface with NOAA users and the WSFOs in regional and real-time sense. Each SFSS' receives the sectorized and 7-by-7 km IR data from the Central Facility over C-5 telephone lines and reduce these data to video imagery for analysis and interpretation and routes the selected sectors to the WSFOs which it supports. These sectors can all be displayed simultaneously or as selected by the SFSS.

In addition to the sectorizers providing standard WSFO sectors each SFSS except Miami will have one additional sectorizer dedicated to its own use from which it can receive two simultaneous Northern Hemisphere sectors of its own choosing every 30 minutes. These sectors could be any combination of 0.9, 1.8, 3.6, or 7 km sectors.

The Miami SFSS will be unique in that it will have two complete sectorizers dedicated for its use, which will allow it to provide sectors as required south of the equator. These sectorizers will be operated back-to-back and will enable full sectors to be acquired at the satellite picture taking interval of one frame every 30 minutes.

The Kansas City SFSS will have a unique capability in that the four San Francisco WSFO data lines will be bridged at Kansas City. This will allow the Kansas City SFSS to receive any of the four western sectors it desires to utilize in its available displays.

-Weather Service Forecast Offices-

The WSFOs receive sectors of the stretched VISSR data by C-5 telephone lines from the SFSS. These sectors will be available at a frequency of every 30 minutes.

A total of 12 sectors covers the contiguous 48 states and one additional sector is provided for the San Juan, Puerto Rico, WSFO.

Also, the full IR disc can be made available to the WSFOs on a "call-up" basis in lieu of the visible sector during the daylight periods. When visible data are not available in the areas of interest, the low resolution IR data can be substituted up to a frequency of one image every 30 minutes.

-Central Wind Extraction Unit-

The NESS Central Wind Extraction Unit will be supplied a full-disk frame at 3.6 km resolution every 30 minutes.

The CWEU will be initially provided with movie loops from gridded visible images, approximately 20 loops per 24 hours.

In addition to the manual analysis of movie loops, a computer program exists which also derives wind vectors from visible picture pairs appropriately spaced in time. The cloud heights associated with the various vectors are determined through the use of IR images. These images provide temperatures which can be converted to pressure heights.

The Day One SMS System (DOSS) is planned to deliver cloud vectors to users by merging the output from manual alalysis of movie loops with computer wind vectors derived from picture pairs.

LAUNCH VEHICLE

The spacecraft will be launched by a three-stage Delta launch vehicle, which has an overall length of approximately 35 meters (116 feet), and a maximum body diameter of 2.4 meters (8 feet). The Delta launch vehicle has a success-to-launch ratio of 90 percent for the past ten years.

First Stage

The first stage is a McDonnell-Douglas modified Thor booster incorporating nine strap-on Thiokol solid-fuel rocket motors. The booster is powered by a Rocketdyne engine using liquid oxygen (LOX) and liquid hydrocarbon propellants. The main engine is gimbal-mounted to provide pitch and yaw control from liftoff to main-engine cutoff (MECO). Two liquid-propellant vernier engines provide roll control throughout first stage operation and pitch and yaw control from MECO to separation of the first and second stages.

Second Stage

The second stage is powered by a TRW liquid-fuel pressure-fed engine that also is gimbal-mounted to provide pitch and yaw control through second-stage burn. A nitrogen gas system using eight fixed nozzles provides roll control during powered and coast flight as well as pitch and yaw control during coast and after second-stage cutoff (SECO) Two fixed nozzles, fed by the propellant-tank helium-pressurization system, provide retro-thrust after third-stage separation.

Third Stage

The third stage is the TE-364-4 spin-stabilized solid-propellant Thiokol motor. The third-stage motor is secured in a spin table mounted to the second stage. The firing of eight solid propellant rockets fixed to the spin table accomplishes spinup of the third stage assembly.

Injection to First Apogee

After a short coast (1 1/2 minutes) using the Delta second stage for attitude control, the Delta third stage will inject SMS into transfer orbit with an apogee of 36,357 km (22,591 miles) on the first descending node of the parking orbit at 5° E longitude. The Apogee Boost Motor (ABM) is scheduled to place the spacecraft in synchronous orbit on first and second apogee and drift to its station at 45° W longitude at approximately 6 degrees per day.

TRACKING AND DATA OPERATIONS

The Spaceflight Tracking and Data Network (STDN) will provide necessary support for the mission. The tracking stations include the Minitrack Network and stations at Johannesburg, South Africa; Tananarive, Malagasy Republic; Carnarvon; and Ororal, Australis; Santiago, Chile; Quito, Ecuador; Rosman, N.C.; and Wallops Island, Va.

During the transfer orbit and drift phase, the Network stations will:

- Record, display, and send to GSFC the PCM and real time telemetry data;
- Provide tracking data;
- Command the spacecraft as required.

Real time support of spacecraft operations and processing of the scientific data is handled by Mission and Data Operations.

The STDN and mission and Data Operations are managed by the Goddard Space Flight Center for NASA's Office of Tracking and Data Acquisition.

SMS-A MISSION FACTS AT A GLANCE

Launch:	From Complex 17, Eastern Test Range, Cape Canaveral, Fla.
Launch Vehicle:	Three-stage Delta rocket with 9 solid-motor thrust augmenters.
Operating Lifetime:	Up to five years.
Spacecraft Weight:	627 kilograms (1,379 pounds)
Structure:	Drum-shaped, measuring 345 centimeters (135.85 inches) high, including the magnetometer which extends 83 centimeters (32.6 inches) beyond spacecraft, and 190.5 centimeters (74.8 inches) in diameter. Consists of an aluminum honeycomb shelf supported by struts and an Apogee Boost Motor (ABM), 80 centimeters (31.5 inches) in diameter at the widest part and 90 centimeters (35.4 inches) long.

The experiment section is enclosed by metallic cover and solar cell-covered side panels. The ABM is ejected after attaining synchronous orbit.

Power System: 174 solar panels on the outer surface of the spacecraft provide 200 watts of power during normal spacecraft operation and decreasing over 5 years to 150 watts.

Telemetry & Command: VHF in transfer orbit and S-Band on station. VISSR 1.7 gHz downlink and 2.0 gHz uplink.

Tracking and Data Acquisition: Stations of the Spaceflight Tracking and Data Network (STDN) operated by the Goddard Space Flight Center during launch phase. In final orbit CDA station, Wallops Island, Va., NOAA satellite Operating Control Center and Central Data Collecting and Processing Facility, Suitland, Md., Data Utilization Stations as designated by NOAA, some 500 Automatic Picture Transmission stations, some 10,000 Data Collection Platforms.

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SMS-A PROGRAM OFFICIALS

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Charles W. Mathews	Associate Administrator for Applications
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Dr. Morris Tepper	Director of Meteorology
Michael L. Garbacz	Manager, Operational Meteorological Satellite Programs
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Peter T. Burr	Spacecraft Manager
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CONTRACTORS

Spacecraft --- Philco Ford, Palo Alto, Calif.; Prime Contractor

Santa Barbara Research Center --- VISSR

Westinghouse --- Ground Station Integration

Delta Launch Vehicle --- McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

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