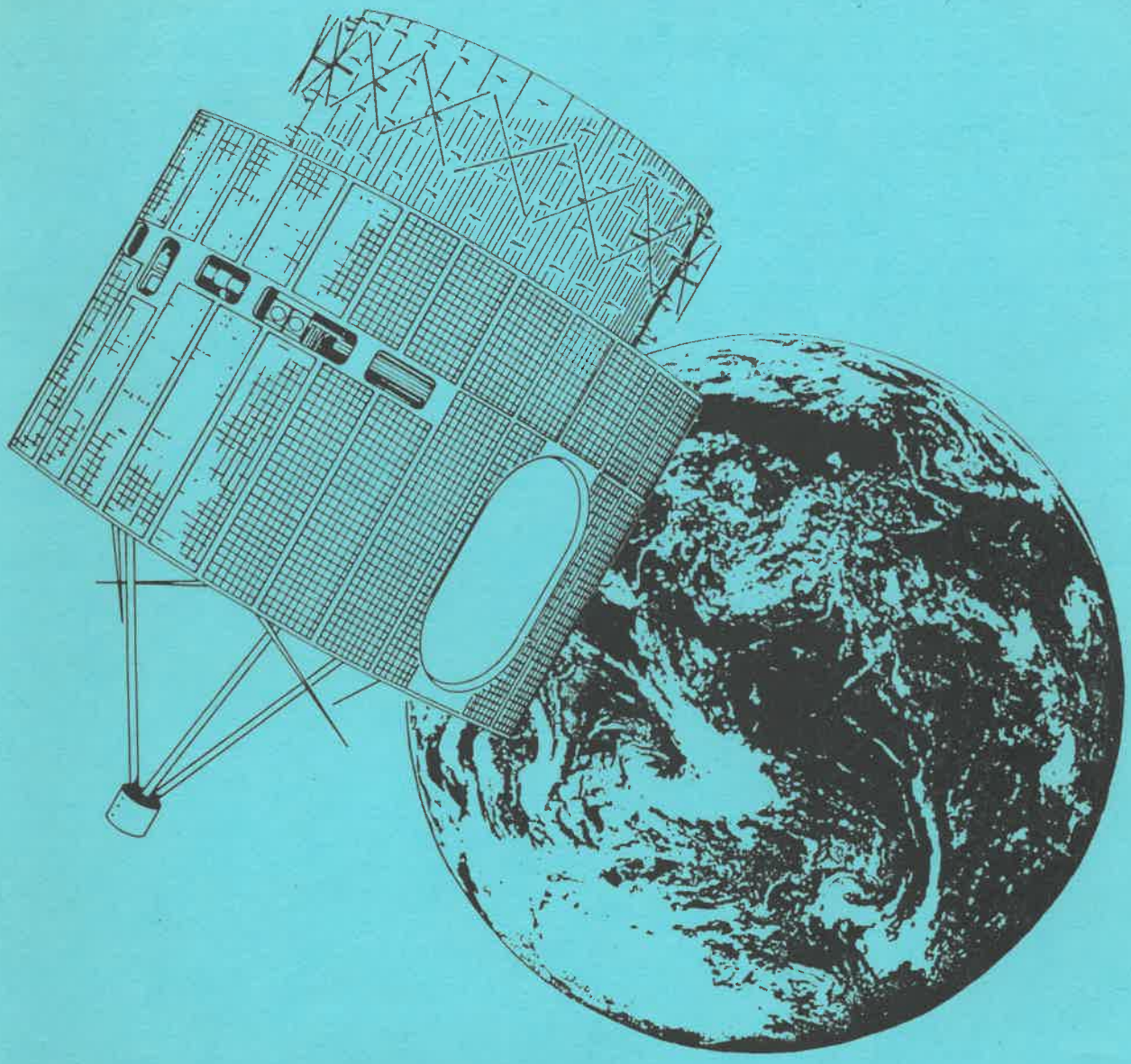
THE GOES/SMS USER'S GUIDE



noaa
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL ENVIRONMENTAL SATELLITE SERVICE

NASA
National Aeronautics and Space Administration

The GOES/SMS User's Guide

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FOREWORD

This publication provides potential data users with background information on the Geostationary Operational Environmental Satellite (GOES) System, including the Synchronous Meteorological Satellite (SMS). General details of the spacecraft and instrumentation carried on board are given, as well as an explanation of the collection and distribution of data to users. Types of images and data available are presented and detailed instructions for obtaining such data are outlined.

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ACKNOWLEDGEMENTS

This document was assembled and edited by Management and Technical Services Company (MATSCO) under Contract No. NAS 5-20694 with Goddard Space Flight Center, NASA. As indicated in the index, different portions of this document have been prepared and coordinated by the Staffs of the National Environmental Satellite Service (NESS), the Environmental Data Service (EDS) of NOAA, and the SMS Project, Goddard Space Flight Center of NASA.

A general guide of this nature is based on the work, expertise and talents of many people. The assistance and complete cooperation of the personnel listed below are gratefully acknowledged.

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Record of Amendments

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SECTION I

BACKGROUND

1.1 The GOES/SMS system of satellites are part of the National Operational Meteorological Satellite System (NOMSS) which was originally funded by Congress under Public Law 87-332, September 30, 1961.

1.2 In 1970 a contract was awarded to Philco-Ford, Inc. (now Aeronutronics Ford, Inc.) for the production of three satellites, using the NASA Applications Technology Satellites ATS-1 and ATS-3 as a basis for design. Two of the three satellites were commissioned by NASA, and were called Synchronous Meteorological Satellites (SMS); the third was ordered by NOAA, and was termed the Geostationary Operational Environmental Satellite (GOES).

1.3 Table 1 shows data for this series of satellites:

Table 1

Nomenclature, Launch Date and Location Data for GOES/SMS Satellites

Name		Launch Date	Original Station		Current Station		Remarks - See Paragraph
Prior to Launch	After Launch		Equator and	Date on Station	Equator and	Arrival on Station	
SMS-A	SMS-1	5-17-74	45°W	6-07-74	105°W	2-16-76	1.3.1
SMS-B	SMS-2	2-06-75	115°W	2-22-75	135°W	12-19-75	1.3.2
GOES-A	GOES-1	10-16-75	75°W	12-18-75	75°W	12-18-75	

1.3.1 SMS-1 was originally located at 45°W for support of the Global Atmospheric Research Program (GARP) Atlantic Tropical Experiment (GATE). Upon completion of GATE the satellite was moved to 75°W, arriving on-station November 15, 1974, to provide a more operationally suitable viewing of the Eastern U.S. and the Atlantic Ocean. After the launch of GOES-1, SMS-1 was subsequently relocated to 105°W, and placed in stand-by mode. It will replace SMS-2 or GOES-1 in the event either experiences a major problem.

1.3.2 SMS-2, originally over the equator and 115°W, was moved to 135°W to provide increased coverage of the Western Pacific Ocean. This move was initiated on 8 January, 1976 and ended on 16 February, 1976. The rate of movement was 2° of longitude per day. Figure 1-1 shows the current location.

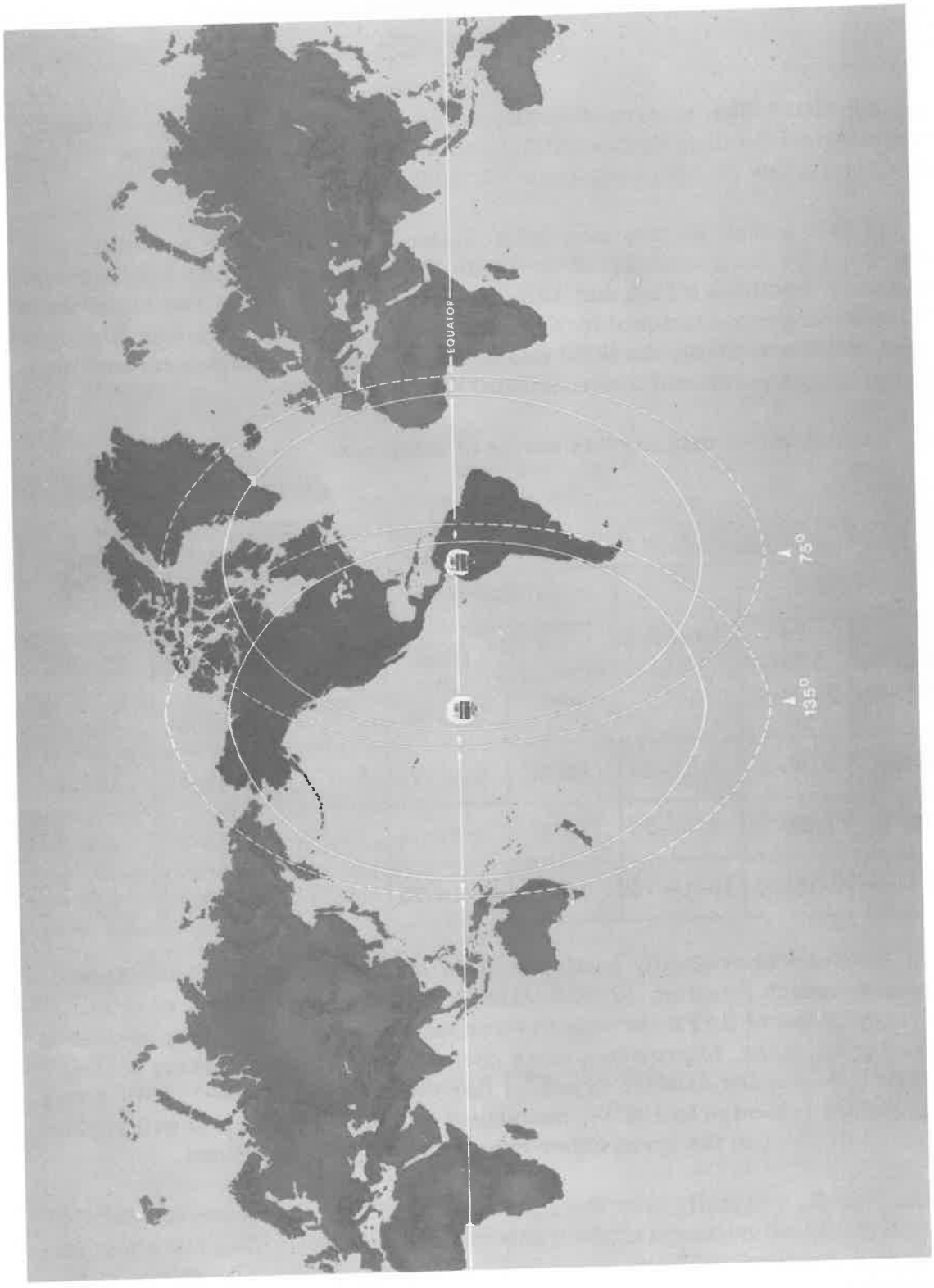


Figure 1-1. SMS-2 and GOES-1 Coverage

1.4 Eventually, SMS-2 and GOES-1 or their replacements, will form a part of an international array of five geostationary spacecraft, targeted for the First GARP Global Experiment (FGGE), a project under the auspices of the World Meteorological Organization (WMO), and the International Council of Scientific Unions (ICSU). The other three satellites, added to the GOES/SMS satellites, will provide global coverage from approximately 60°N to 60°S. Table 2 shows the latest available information on these additions:

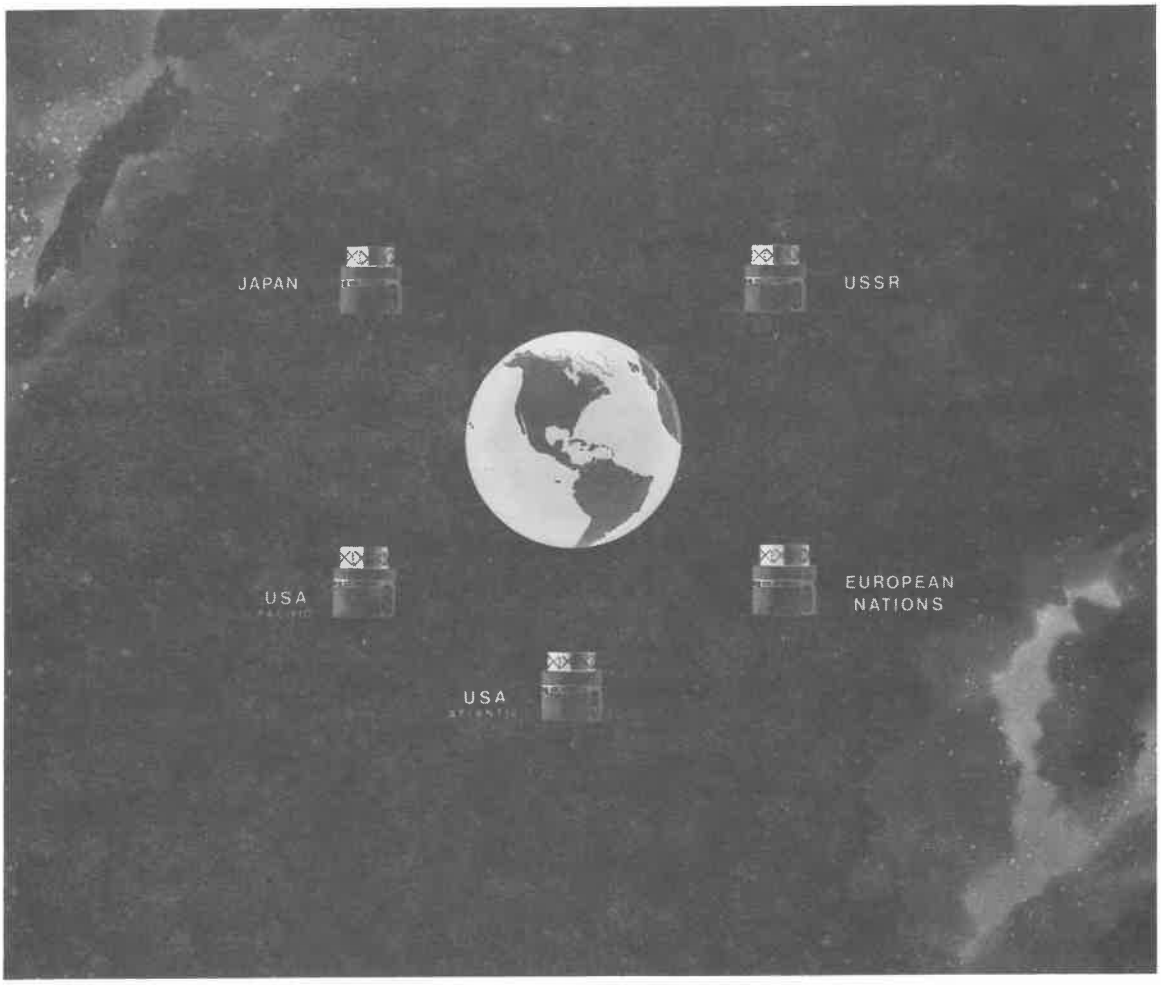
Table 2

Additional Geosynchronous Satellites Planned

To Be Launched By:	Satellite To Be Centered Over	Approximate Launch Date
European Space Agency (ESA)*	Greenwich Meridian (Eastern Atlantic)	June/July 1977
U.S.S.R.	70°E (Indian Ocean)	Mid 1978
Japan	140°E (Western Pacific)	August 1977

*ESA was formerly called the European Space Research Organization (ESRO).

1.5 Figure 1-2 shows the anticipated coverage of the Worldwide Geosynchronous Meteorological Satellite System.



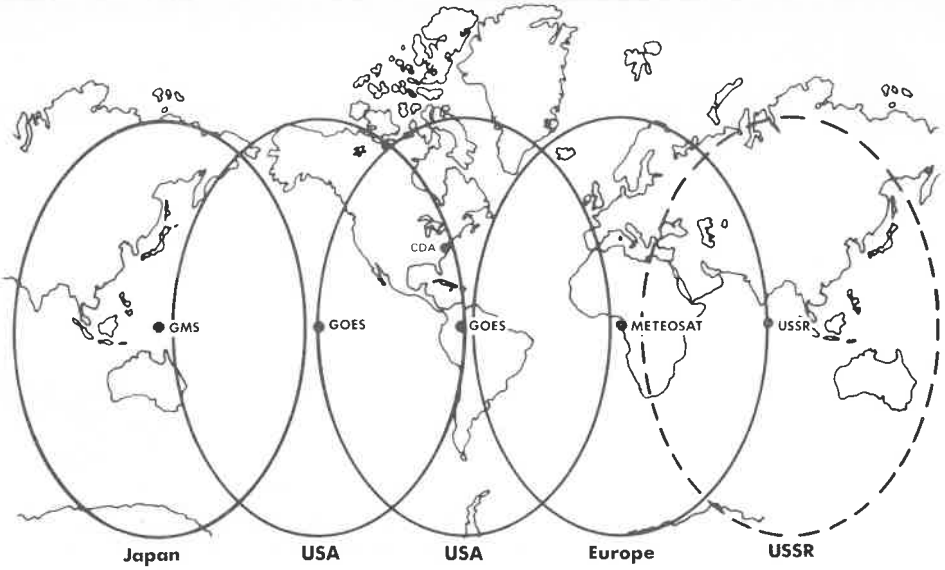


Figure 1-2. Anticipated Coverage, World Wide Geosynchronous Satellite System

SECTION II

DESCRIPTION OF SPACECRAFT

2.1 The GOES/SMS spacecraft (Figure 2-1) is cylindrical, and weighed 578 kilograms (1,384 pounds) at launch. Spacecraft were placed in a circular orbit at about 35,800 km (19,318 nautical miles). The satellites travel at about 11,000 km/hour (5,936 knots). At this altitude and speed, a satellite remains continuously above the same point on the earth, and thus is termed geostationary, geosynchronous, earth-synchronous, or merely synchronous.

2.2 The spacecraft is controlled for proper earth imaging by an attitude control subsystem which maintains the spin rate at 100 rpm, and aligns the spacecraft spin axis parallel to the earth's polar axis, and thus perpendicular to the earth's orbital plane. Attitude is determined within 0.1 degrees. The attitude stability of the satellite is 0.5 arc sec maximum. The spacecraft antenna points to within +11° in the East-West direction relative to the subsatellite point.

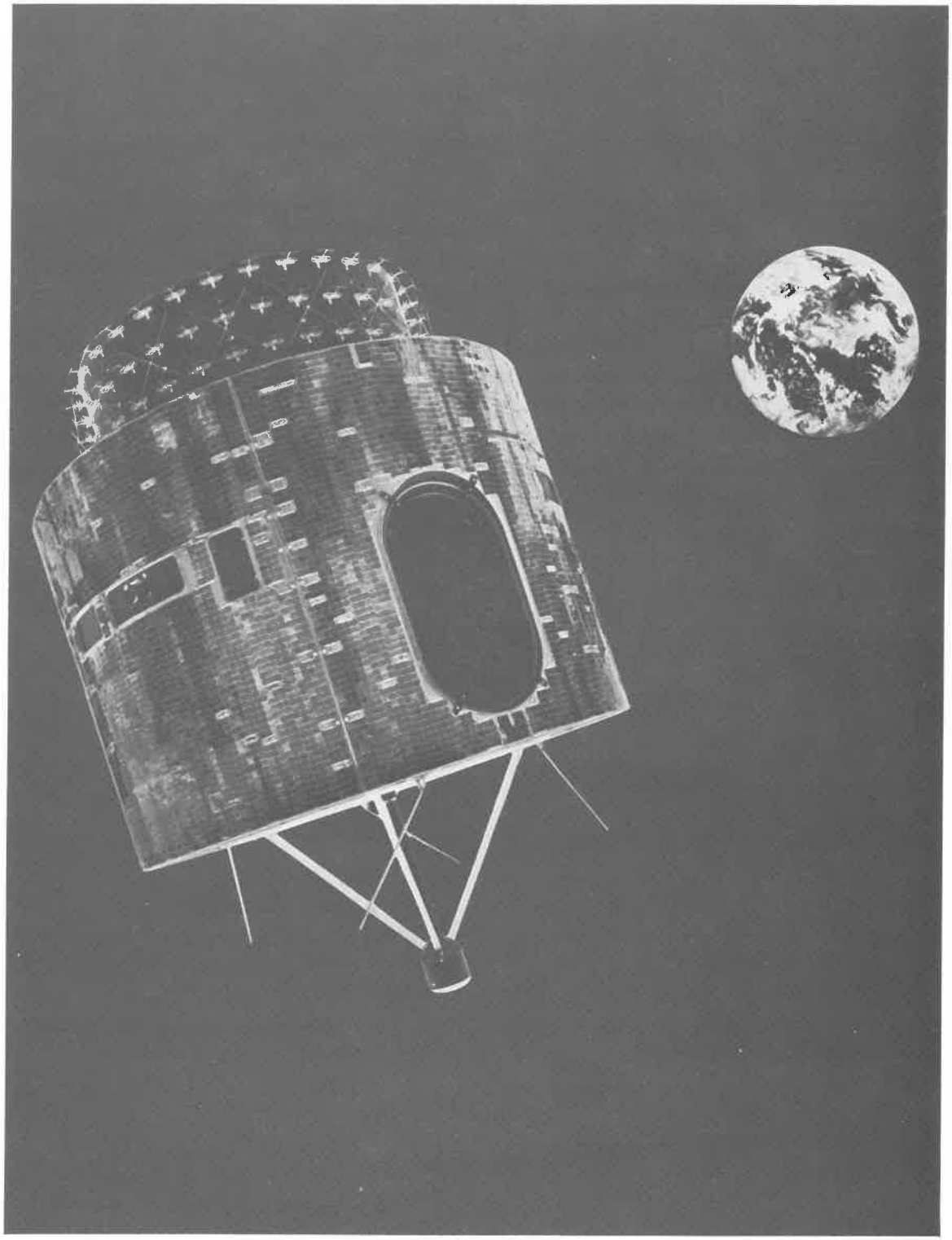


Figure 2-1. GOES/SMS

SECTION III

DESCRIPTION OF SPACECRAFT SUBSYSTEMS

The configuration of the GOES/SMS and its various subsystems is shown in Figure 3-1.

3.1 The Visible and Infrared Spin Scan Radiometer (VISSR), shown in Figure 3-2, scans from west to east in eight identical visible channels and two redundant infrared channels. This sensor provides visible data at 0.8 km (0.43 n.m.) resolutions and infrared data at 8 km (4.3 n.m.) resolution. These are realized at satellite subpoint and deteriorate as the area viewed moves away from subpoint. With the satellite rotating at 100 revolutions per minute, the VISSR scanning mirror scans the earth for about one-twentieth of each complete 360° rotation. The radiometer performs 1821 steps in successive scans from North to South in 18.2 minutes. This provides an image of the complete earth disc or about one quarter of the earth's surface. The resulting visible images (0.55 to 0.70 micron band) contains 14,568 lines and have a resolution of nearly 0.43 n.m. Infrared images (10.5 to 12.6 micron band) have a total of 1821 lines with a 9.3-km (5 n.m.) resolution. In addition to this normal scan mode, the spacecraft may be placed into a limited scan mode. While in this mode, the North to South scan may be limited to a fewer number of scans; this reduces the area of coverage, but increases the frequency of imaging.

3.2 The Space Environmental Monitor (SEM) Subsystem includes a magnetometer, a solar X-ray telescope, and an energetic particle monitor. These were designed to provide direct quantitative measurements of the important effects of solar activity for use in real-time solar forecasting and subsequent research. Unusual solar flares with high levels of radiation are detected, and the intensity of the solar wind as well as the strength and direction of the earth's magnetic field are measured.

- The SEM subsystem provides the data via the spacecraft telemetry system which are received at the NOAA Environmental Research Laboratories (ERL) at Boulder, Colorado. ERL then processes the data and produces bulletins for space disturbance forecasting, to support ionospheric communications activity, the manned space program, and supersonic transport flights.

- As this Guide is intended primarily for users of meteorological data, there will be no further discussion of the SEM subsystem in the pages to follow. Readers who require further information are referred to:

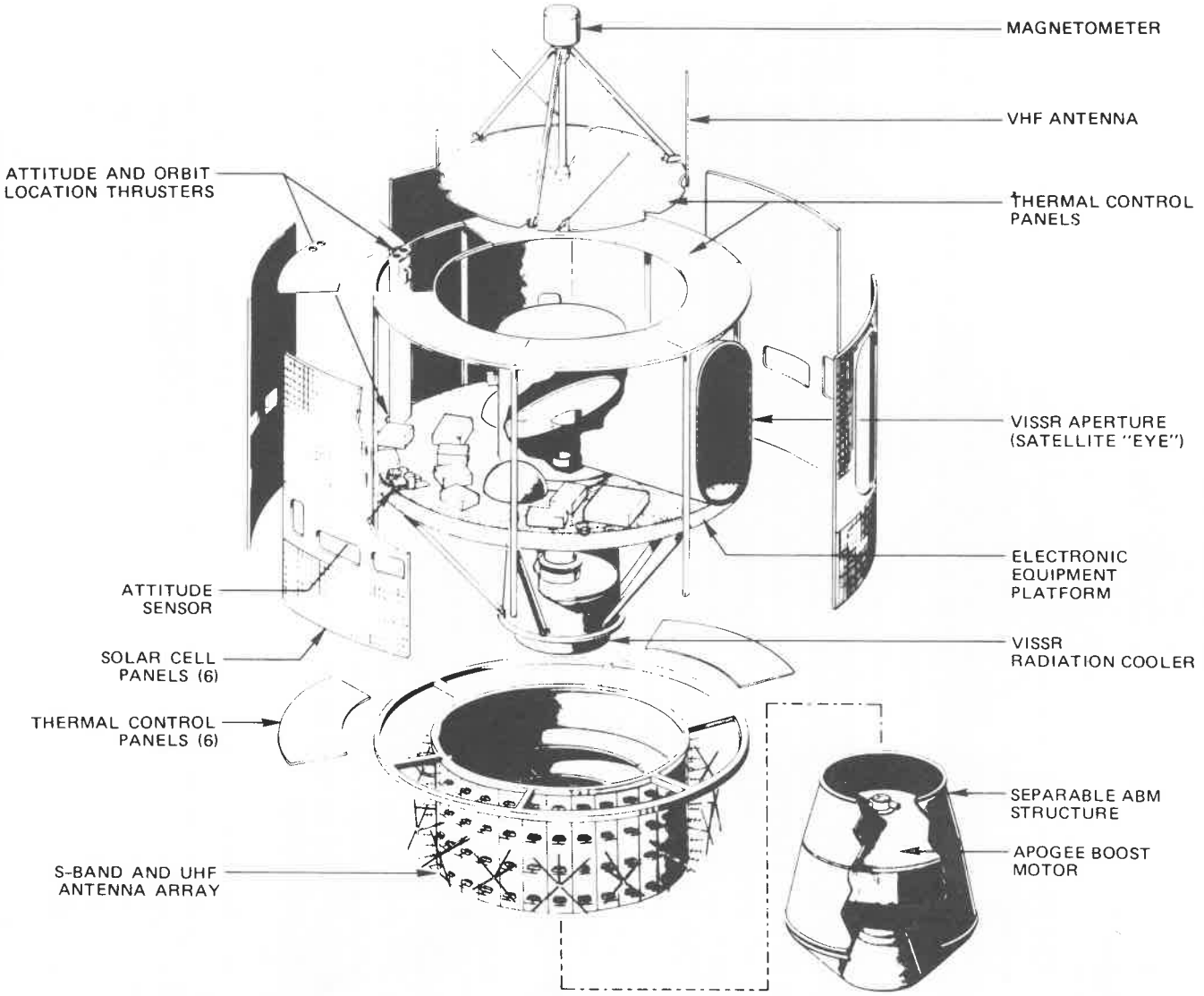


Figure 3-1. GOES/SMS Configuration

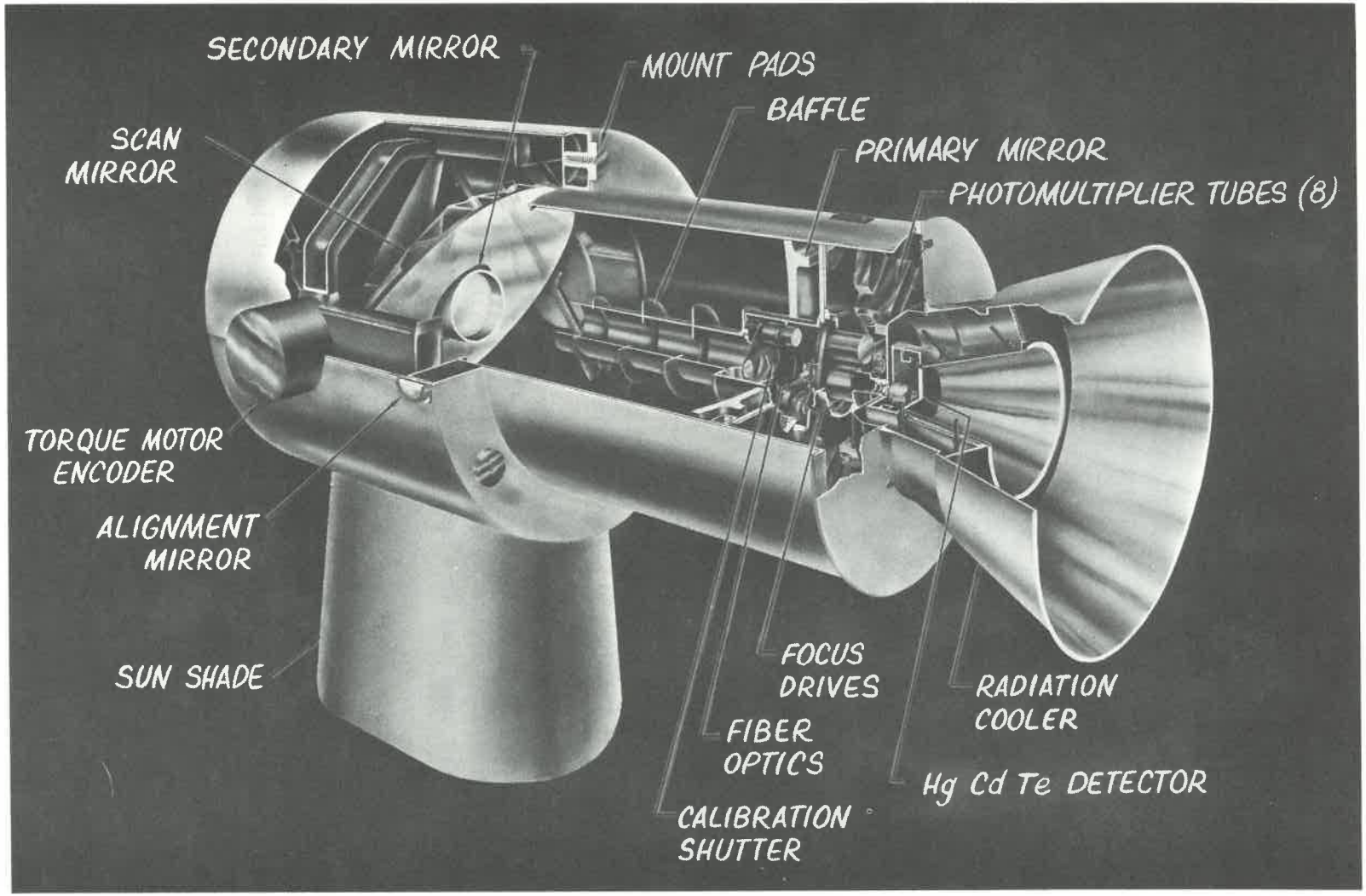


Figure 3-2. VISSR Configuration

Environmental Research Laboratories
National Oceanic & Atmospheric Administration
Boulder, Colorado 80302

Phone: Area Code 303-499-6384/6208

3.3 The Telemetry, Tracking, and Command (TTC) subsystem uses various carrier frequencies to perform the functions indicated:

- S-band, for transmission of wideband video data from the VISSR to the Command and Data Acquisition (CDA) station at Wallops Island, Va.

- S-band, for relay of reduced bandwidth or "stretched" VISSR data from the CDA via the spacecraft to the 7.3-meter (24-foot) dish antennas at NESS, Suitland, or any other facility with appropriate receiving capability.

- S-band, for transmission of weather facsimile (WEFAX) data to local ground stations equipped to receive S-band automatic picture taking (APT) data. The WEFAX data are centrally produced on the NOAA computers in Suitland, Maryland, and then transmitted to the spacecraft from the CDA.

- UHF, for transmissions from data collection platforms to the spacecraft, and downlink to CDA on the S-band system.

- VHF and S-band, for commanding the spacecraft, for telemetry, and for transmitting the space environment monitoring data to ERL. The VHF command system is used primarily during launch and injection into orbit, and also as a back-up to the primary S-band command system.

3.4 The spacecraft location system uses trilateration ranging techniques. The position of the satellite is determined once per week. A landmark registration program utilizing the Man-Machine Interactive Processing System (MMIPS) is used on a day-to-day basis for updating orbital elements.

SECTION IV

DATA ACQUISITION AND DISTRIBUTION SYSTEM

4.1 The National Environmental Satellite Service (NESS), of NOAA, implemented a Central Data Distribution System (CDDS) to receive, process and distribute the VISSR image data to users throughout the fifty United States, in near-real time. Figure 4-1 illustrates the data flow, and shows how data are received from the satellite and communicated to the Satellite Field Service Stations and other users, at several locations.

4.1.1 CDA - Wallops Island, Virginia

The unprocessed VISSR data from each operational satellite are transmitted via the S-band system to the 18.3-meter (60-foot) dish antennas at the Wallops CDA. These data are received during the 18 degrees of spacecraft rotation during which the instrument views the earth. The CDA processes the incoming data in a synchronizer/data buffer (S/DB). The S/DB reduces the data rate about 16 to 1 for simplification of data transmission. The CDA processes and retransmits the stretched data back to the satellites during the remaining 342° of rotation of the spacecraft. The lower resolution IR data are formatted in special computers for analog transmission via 3 kHz C-5 type telephone lines directly to the Satellite Field Services Stations (SFSS) and to the Central Data Distribution Facility (CDDF).

4.1.2 NESS - Suitland, Maryland

This facility receives the stretched VISSR data on 7.3-meter (24-foot) dish antennas, and relays the data via dedicated microwave link to the CDDF in the World Weather Building in Marlow Heights, Maryland.

4.1.3 Central Data Distribution Facilities (CDDF) - Marlow Heights, Maryland

The CDDF receives the stretched VISSR data from the NESS Suitland complex via a microwave link. These data are formatted and "sectorized" into a form suitable for transmission over 3-kHz C-5 type telephone lines to Satellite Field Service Stations (SFSS's) throughout the country.

- The "sectorizer" in the CDDF extracts from the total high resolution "full disc" data, sections of specified geographical areas and resolutions of 0.9, 1.9, 3.7 km (1/2, 1, or 2 n.m.). A total of seven 1/2 n.m. resolution sectors and/or a total of four 1 n.m. resolution sectors covers the contiguous 48 states. Also, a standard 2 mile resolution sector covers the Western U.S., Alaska and the Eastern Pacific to about

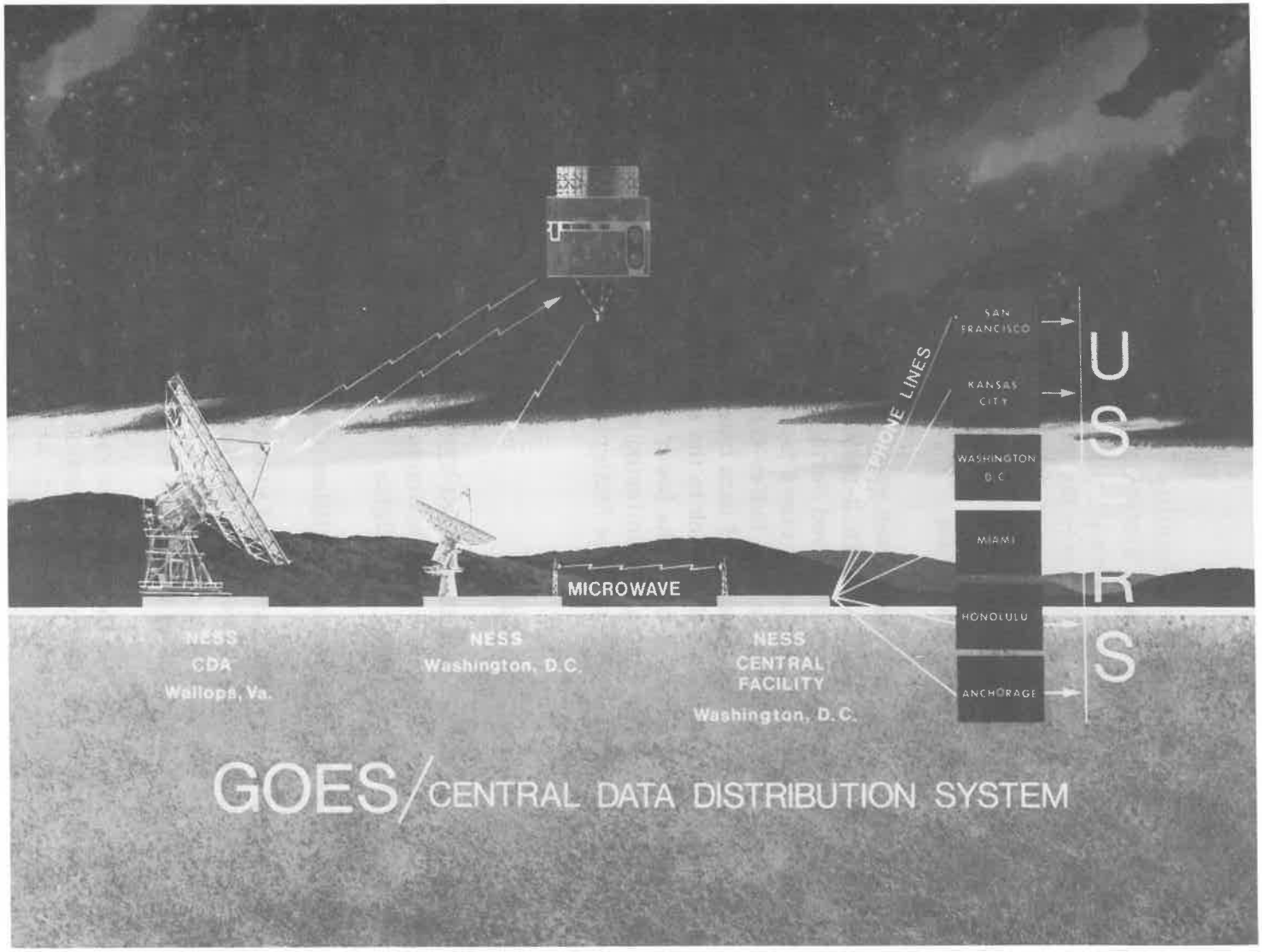


Figure 4-1. GOES/SMS Data Flow Diagram

170°E. These sectors are available for each picture every 30 minutes or more frequently if partial disc pictures or limited scan is in operation. An additional 0.9, 1.9, 3.7 km (1/2, 1, or 2 n.m.) resolution sector is transmitted to the Weather Service Forecast Office (WSFO) in Puerto Rico every 30 minutes. See Appendix I for GOES/SMS imagery available to users and other details. All standard sectors have automatically implanted grids.

- IR data is provided in the form of full disc coverage over the C-5 telephone lines direct to all SFSS's from the CDA station at Wallops. In addition, the IR data can be sectorized at the CDDF to provide equivalent IR imagery with the same geographical coverage as the visible sectors described above for 1.9 and 3.7 km (1 and 2 n.m.) resolution. The CDDF and Wallops have the capability of temperature (IR) enhancement for emphasis of specified features in the imagery. These are available to all users through the normal distribution system (See Appendix II).

- The sectors are produced by a digital device called a sectorizer. The unit receives the stretched VISSR data arriving over the microwave link from NESS-Suitland, extracts and converts sectors of the image into analog form and subsequently makes an analog transmission of the sectorized data to selected users. The sectorizer operates in a serial fashion (i.e., it does not have the capability to receive and transmit data simultaneously), which causes data transmission from the CDDF to be on a near real-time basis. The average data user in the United States usually requires data covering only the Northern Hemisphere. The sectorizer uses about 9 minutes to receive these data and about 17 more minutes for handling and transmission of selected sectors, which is completed well within the normally scheduled 30-minute spacecraft imaging interval. Also, partial disc picture operation and limited scanning for short interval viewing is available. Numerous sectorizers are located within the CDDF producing the various sectors required by the users. The sectorizers are controlled by a central console and automated scheduler.

4.2 OPERATIONAL GOES/SMS DATA USERS

There are three primary types of GOES/SMS data users who are provided with image data through the CDDF. They are:

- The Satellite Field Services Stations (SFSS)

- The National Weather Service Forecast Offices (WSFO)

- The NESS Analysis and Evaluation Branch (AEB)

Also, GOES/SMS data are transmitted by the CDDF to various DOD units, universities, TV stations, news media and other users. The primary users are discussed below with respect to their functions.

4.2.1 Satellite Field Service Stations (SFSS's)

To meet the needs of the entire user community most efficiently, the contiguous U.S. is divided into four areas, each containing a communications hub and first-line user interface, i.e., an SFSS. Also, the Honolulu SFSS serves as the hub/interface for the Eastern Pacific and the Anchorage SFSS for Alaska. See Appendix I, Attachment A. The SFSS's currently in operation are co-located as shown in Table 3.

Table 3

Current SFSS's in Operation

SFSS	Co-located NWS Units
Washington, D.C.	Washington, D.C. WSFO
Miami, Florida	National Hurricane Center (NHC), Miami
Kansas City, Missouri	Nat'l. Severe Storms Forecast Center (NSSFC) Kansas City, Missouri
San Francisco, California	San Francisco WSFO and Eastern Pacific Hurricane Center (EPHC)
Honolulu, Hawaii	Honolulu WSFO and Central Pacific Hurricane Center (CPHC)
Anchorage, Alaska	Anchorage WSFO, Alaska

The SFSS's receive sectorized data from the CDDF (see para. 4.1.3) and the full disc IR data from the CDA over dedicated C-5 telephone lines. Since only one sector at a time can be transmitted over a single line, several lines to each SFSS are required for simultaneous transmission of several sectors.

- When visible data are not available (night time), equivalent IR data are available for the standard 1.9 and 3.7 km (1 and 2 n.m.) sectors as indicated in Appendix I, Attachment B. During daylight hours, both

visible and equivalent IR data are available, on request or as scheduled. Standard times are established (adjusted seasonally) for transition from Visible to IR at each SFSS. As noted, full disc IR is available 24 hours each day. Equivalent IR imagery is also enhanced (on a scheduled/request basis) to emphasize specified features, i.e., convective areas, freezing level, fog and stratus, etc. (see para. 4.1.3 and Appendix II).

- "Floating Sectors" (non-standard) of 0.9, 1.9, and 3.7 km (1/2, 1 and 2 n.m.) resolution are available at each SFSS (two at each SFSS except at the Anchorage SFSS). In some instances, these sectors are ungridded and are used by the SFSS to meet specific requirements. The real-time user is notified of the location and resolutions of these floaters. Requests for the floater products can be made by the user through the appropriate SFSS. However, specific resolution and sector location will be provided by the SFSS's only if priorities and scheduling permit.

- The SFSS's have the capability to display on automatic photorecorders any sector transmitted through it to the regional WSFO's (and other users) which it supports, and to provide satellite data interpretation assistance. Using these sectors, meteorologists on each end can view the same high quality image simultaneously, while discussing its interpretation. The SFSS's include a complement of satellite meteorologists, oceanographers and hydrologists who provide, in most instances, a capability for 24 hours per day operation.

4.2.2 Analysis and Evaluation Branch

The Synoptic Analysis Section and the Satellite Winds Section of this Branch are responsible for the operational interface with the NWS National Meteorological Center (NMC) on a global basis in near-real time. They are co-located with the NMC in the World Weather Building.

- GOES/SMS data are routinely made available on a continuing basis to the Synoptic Analysis Section in hard copy format (prints and movie loops) from the CDDF Photographic Laboratory. In addition, the Synoptic Analysis Section has automatic photorecorders on which it receives selected sectors as they are being transmitted to appropriate SFSS's. All these GOES/SMS data are used in current global meteorological and hydrologic interpretations in the real time operations of the several branches of the Forecast Division of the NMC.

- The CDDF supplies the NESS Satellite Winds Section with time lapse movie loops produced from registered GOES/SMS images. The Satellite Winds Section images include the full earth disc, with 7.4 km

(4 n.m.) resolution IR images every thirty minutes. An additional sector of visible data of 3.7 km (2 n.m.) areal coverage, but at 1 n.m. resolution, can also be provided at thirty minute intervals. These products are obtained using two specially modified sectorizers and four special Muirhead display devices, operated alternately in order to produce all images without loss of data. Using both manual and computer techniques, the Satellite Winds Section utilizes selected cloud tracers in successive GOES/SMS images to determine wind speeds and directions. An interactive processor, the Man-Machine Interactive Processing System (MMIPS), is used to determine cloud heights (hence vector heights) for winds at three synoptic times per day - 0000Z, 1200Z, and 1800Z. The satellite-derived wind information is used in synoptic scale analyses and forecasts prepared for the National Meteorological Service's Global Telecommunications System under the headings TWXN KWBC and TWXS DWBC. Satellite derived winds are of obvious value over the vast oceanic areas where conventional wind observations are quite sparse.

4.2.3 Data Collection System (DCS)

With the advent of the Geostationary Operational Environmental Satellite, a satellite environmental data collection capability became a reality. The environmental Data Collection System (DCS) consists of synchronous, geostationary satellites, radio equipped environmental sensor platforms, the NOAA Command and Data Acquisition (CDA) station located at Wallops Island, Virginia, and the control and data dissemination center located in the CDDF at the World Weather Building.

- The GOES/SMS data collection system (Figure 4-2) can perform these functions:

  — Collect and distribute environmental data measured on remotely located, attended and unattended data collection platforms (DCP's) located on land, at sea, or in the atmosphere.

  — Collect all data on a scheduled or on a request basis.

  — Collect data from a minimum of 10,000 DCP's.

  — Provides a capability for collecting data in a routine or emergency manner.

The data collection platforms are environmental sensing devices with radio transmission and reception capabilities to relay data as required. These

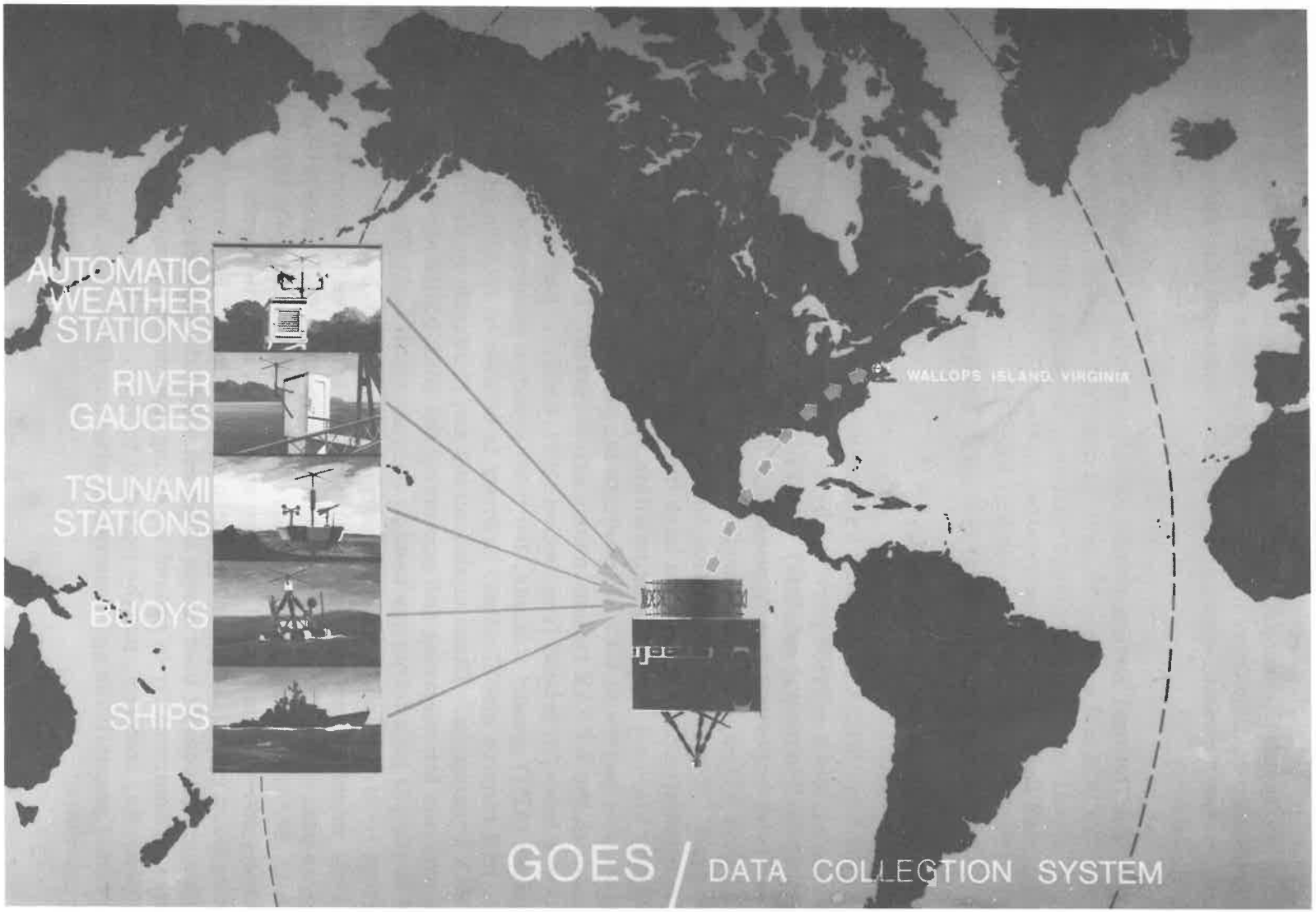


Figure 4-2. GOES/SMS Data Collection System

platforms include instrumented buoys, river gauges, automatic weather stations, seismic and tsunami stations, and manned ships. Examples of data received are information on earthquakes, wind direction and speed, humidity and rainfall amount, ocean currents, water levels, tides, water and air temperatures and tsunami data.

- The National Environmental Satellite Service (NESS) is the operator of the DCS and works with several different types of national and international users, government agencies, academic institutions and industry. Additional detailed information on the DCS can be obtained from the NOAA Technical Memorandum NESS 76, "Data Collection System, Geostationary Environmental Satellite: Preliminary Report."

4.2.4 WEFAX (Weather Facsimile)

The term WEFAX (Weather Facsimile) identifies both a communications sub-system, and a service provided by and through the GOES (geostationary operational environmental satellite). WEFAX was first introduced as a communications relay experiment on Applications Technology Satellite (ATS-1), later included on ATS-3, and subsequently refined for incorporation on the GOES/SMS spacecraft. It involves acquisition and processing of satellite data on the ground, and retransmission of these data back through the geostationary spacecraft to relatively low-cost receiving units within receiving range of the spacecraft. The original data source of WEFAX products may or may not be the same spacecraft from which the WEFAX transmissions are received. GOES WEFAX transmissions are made on S-band frequencies (1691.0 MHz). Automatic Picture Transmissions (APT) ground stations, the most common recipients of ATS WEFAX data, will require modifications in order to be able to receive GOES/SMS S-band WEFAX broadcasts. These modifications are primarily in the nature of conversion systems for receiving and converting the 1691.0 MHz signal from GOES/SMS to the 137 MHz frequency used by current satellites. This would enable existing receiving and facsimile recorder equipment to be used to the maximum possible extent. Geostationary environmental satellites launched by other nations as part of the First GARP Global Experiment (FGGE) also will provide the WEFAX service. The intent is to have compatibility among the WEFAX communications sub-systems on all of these spacecraft so as to permit transient vessels or fixed ground stations the option of selecting WEFAX broadcasts from whichever spacecraft best meets their existing data requirements. For this reason, a commonality in ground receiving equipment is expected; schedules and products, however, may be expected to vary. Following is a brief description of the possibilities and constraints affecting GOES/SMS WEFAX products and schedules:

- Transmission Schedules—VISSR data acquisition and WEFAX broadcasts from GOES/SMS are not presently scheduled simultaneously. Full-disc VISSR image acquisition requires slightly more than 18 minutes. Generally, no more than two complete VISSR images would be acquired each hour. WEFAX broadcasts, therefore, are scheduled in the 10-minute time interval between successive VISSR read-outs. However, certain other functions or events occur in the interval between VISSR image acquisition, thus reducing by nearly one third the amount of time available for WEFAX broadcasts. Four 10-minute intervals are reserved daily for operation of the trilateration ranging system. Two periods are needed daily for up-dating solar and grid information. Preventive maintenance requires a 90 minute period. Additionally, certain severe weather phenomena — specifically tornadoes and hurricanes — require a shorter interval between VISSR observations. When severe weather is not a factor, approximately 35 ten-minute time blocks are available for WEFAX transmissions. These are not evenly distributed throughout a 24-hour period, however, due to the constraints indicated above. At present, GOES/SMS WEFAX transmissions are made only from GOES-1, eight times each day. An increase in scheduled broadcasts from GOES-1 and initiation of operational WEFAX transmissions from SMS-2 are expected to commence in late 1976.

- Products—At present, plans indicate that the primary GOES/SMS WEFAX product line will consist of both visible and infrared disc imagery, transmitted in sections, or "chips", so as to be compatible with the WEFAX transmission format. Beyond this point, the primary options are to transmit either 4 km or 8 km (2.2 n.m. or 4.3 n.m.) resolution data. Complete full disc (4.3 n.m.) coverage at 8 km resolution would require transmission of four chips, each chip covering an area from the equator to 60°N (or S) latitude, and 60° east or west from a central longitude. At 4 km (2.2 n.m.) resolution, 16 chips would be required to give the equivalent coverage. Since IR coverage nominally provides an 8 km (4.3 n.m.) resolution, it seems most feasible to use that resolution as the basic transmission resolution.

  Each WEFAX chip requires slightly more than four minutes to transmit; thus, two chips may be contained in each 10-minute WEFAX broadcast interval. Assuming that the basic transmission resolution will be 8 km (4.3 n.m.), six-hourly repetitive coverage in the IR and twice-daily coverage in the visible would yield 24 WEFAX charts (chips), and would require 12 WEFAX time intervals (ten minute blocks) for transmission.

- Future Possible Products—It was mentioned earlier that 35 ten-minute time intervals are potentially available for WEFAX data transmission. Utilizing 12 of these (as indicated above) leaves 23 intervals still unassigned. There are several possible products which could be transmitted in these intervals, among them being:

    1. Polar orbiter mosaics of areas not seen by the geostationary satellites.

    2. GOES-1 data on SMS-2, and vice versa (i.e., cross-transmissions).

    3. Tropical sectors overlapping the proposed 4-chip, full earth disc coverage.

    4. Higher resolution sectors of specific areas.

    5. More frequent data.

Final decision regarding the GOES/SMS WEFAX products and schedules are being held in abeyance pending the outcome of a user review of the proposed WEFAX data distribution plan. Once this decision has been made, a start date will be announced, and the list of products and schedules will be distributed to all APT users, interested agencies, organizations, and countries. "Operational immediate" deviations from this schedule will be announced in the daily TBUS messages distributed over the Global Telecommunications System (GTS) following the same procedures used to notify users of changes in the ATS WEFAX schedules.

A "GOES/SMS WEFAX Users Guide" is being prepared by NOAA, and should be available to the WEFAX user community in late 1976. This Guide will contain information on the WEFAX transmission characteristics, antenna aiming procedures, data format and geometry, products, schedules, and WEFAX operational considerations and constraints. Requests for information on ground equipment requirements, data reception, and WEFAX products and schedules may be addressed to:

Coordinator, Direct Readout Services
U.S. Dept. of Commerce
National Oceanic and Atmospheric Administration
National Environmental Satellite Service
Suitland, Maryland 20023

SECTION V

GOES-TAP DISTRIBUTION SYSTEM

For other users who wish to receive GOES imagery (such as universities, government agencies, state institutions, TV stations, news media and the general public), a program has been developed to enable the user to obtain GOES imagery produced on a real-time basis. This program has been titled "GOES-TAP," and pertinent information is available in the Appendices to this Guide.

5.1 In order for a user to receive the electronic signals available to an SFSS (para. 4.1.3, 4.2.1 and Appendix I), he must provide appropriate telephone communications from the SFSS to his location, purchase or lease his terminal display equipment, consummate an Agreement with the Government and pay both an initial connection fee and an annual recurring service fee to cover costs involved. The information which follows should provide sufficient detail for the user to proceed in all of these areas. Details are given in Appendix III.

5.2 TELEPHONE SERVICE

NESS recommends that users install a full duplex telephone line of C-5 quality with 0 db insertion loss. This recommendation is made for two reasons: First, C-5 quality service guarantees a point to point connection using the same wires at all times. This greatly reduces the incidence of failure or variation of quality. Secondly, full duplex service provides the means for "looping" the line back to the SFSS for line checks. This is convenient for the user since, should a problem arise, the line can be evaluated by SFSS personnel. Once the problem has been identified, it will be reported to the user who must arrange repair with the telephone company directly. This service provided by the SFSS personnel will greatly reduce the period of lost or poor quality data.

- Where lower grade lines are used, NESS will not offer this evaluation service. In addition, NESS insists on a 0 dbm normal insertion level at the SFSS regardless of the type of line used.

- When the user orders communications lines, the telephone company must be provided with terminal locations. Appendix III, Attachment F, lists the addresses and personnel contacts at the Field Services Division (FSD) and each SFSS.

5.3 TERMINAL DISPLAY EQUIPMENT

Terminal display equipment may be of any type so long as it is compatible with the signal characteristics defined in Appendix III, Attachment D. Cost of such equipment varies with quality; however, an average cost of $14-25 K should be expected. A list of known commercial vendors of display devices is included as Appendix III, Attachment E. This does not necessarily represent a complete list of commercial manufacturers capable of providing appropriate display devices, nor does it imply government approval of these, nor rejection of equivalent devices, in any way. Consequently, Appendix III, Attachment D (Signal Structure and Characteristics) is included in this guide for information and dissemination to interested vendors.

SECTION VI

ARCHIVAL DATA SERVICE

6.1 NOAA/EDS

6.1.1 The Satellite Data Services Branch (SDSB) of the Environmental Data Service's National Climatic Center is the national archive for operational environmental satellite data and is responsible for the provision of all environmental satellite data to other users once the original collection purposes (i.e., current weather analysis and forecasting) have been satisfied. As such, it is the primary source from which retrospective users may obtain GOES/SMS data. SDSB is co-located with the operations center of NESS, expediting SDSB acquisition of data.

6.1.2 The SDSB library of GOES/SMS data includes both full disc and sectorized images. More than 300 negatives are received and archived each day. Subsets of these data are available in digital form on magnetic tape starting in July 1976.

6.1.3 The various GOES/SMS products included in the SDSB formal archive are described below:

- Visible Infrared Spin-Scan Radiometer (VISSR)

  Period of Record: SMS-1 (GATE positioning) 6/74 to approx. 9/21/74
  SMS-1 (at 75°W) 9/21/74 to 1/7/76
  SMS-2 (at 115°W) 3/10/75 to approx. 1/19/76
  SMS-2 (at 135°W) 1/19/76 to date
  GOES-1 (at 75°W) 1/8/76 to date

  a. Infrared pictures, 8-km resolution: 25 cm x 25 cm negatives

  Format: Full disc

  Quantity: 48 negatives per day per satellite; 35,040 negatives per year

  Retention time at NESS: One working day

  Retention time at SDSB: 5 years; NESS/EDS review before disposal

b. Visible pictures, 5-km resolution: 25 cm x 25 cm negatives

Format: Full disc

Quantity: 32 negatives per day, 11,680 negatives per year

Retention time at SDSB: 5 years; NESS/EDS review before disposal

c. Visible pictures, 2-km resolution (Winds Section): 25 cm x 25 cm negatives

Format: Quarter disc, variable location

Quantity: Up to 32 negatives per day; 11,700 negatives per year

Retention time at NESS: One working day

Retention time at SDSB: Indefinite; NESS/EDS review in one year

d. Visible pictures, 1-km and 2-km resolution (SFSS's): 25 cm x 25 cm negatives

Format: Sectors of variable size, resolution, and location

Quantity: Potential for 280 negatives per day; 102,200 negatives per year

Retention time at SFSS's: One working day at Washington SFSS and one month at the other SFSS's

Retention time at SDSB: Indefinite; NESS/EDS review in one year

e. Visible pictures, 1-km and 2-km resolution (SFSS's): 25 cm x 25 cm paper prints

Format: Sectors of variable size, resolution, and location

Quantity: Potential for 28 prints from each of approximately 13 sectors per day; 132,806 prints per year

Retention time at stations: At least 3 months

Retention time at SDSB: Positive paper prints are not included in the formal NOAA/EDS archive because of the large number produced each day and the difficulty in making copies of adequate quality. Upon completion of retention time at the receiving station, the pictures are deposited at a University within the region covered by the images where they are available for use in a library mode.

Present depositories are:

SFSS	Coverage	University
San Francisco	Western U.S.	Calif. State University, San Jose
Kansas City	Central U.S.	Texas A&M University
Washington	Eastern U.S.	University of Maryland
Miami	Florida, Gulf of Mexico, Caribbean	University of Miami

f. TV movie strips: 16 mm film negatives and positives

Format: 15 meter strips

Quantity: Estimated 2 per day; 730 strips per year

Retention time at NESS: One working day

Retention time at SDSB: Indefinite; NESS/EDS review in one year. (Special movie loops (16 mm) can be produced for specific dates and periods as requested by the user. Copies of these loops are not archived by SDSB.)

g. Wind vectors: Magnetic tape

Wind vectors are derived by computer over ocean areas at 2-1/2° latitude-longitude intervals using low-level cloud tracers in two pictures one to two hours apart. Editing of these, and derivation of upper-level wind vectors, is done manually using the Man-Machine Interactive Processing System (MMIPS) for animated display, automatic data call-up, basic data calculations, and utilization of concurrent infrared data to determine estimated temperatures and pressure of the cloud tracers. Currently, vectors are derived for 1200Z, 1800Z, and 0000Z synoptic times utilizing cloud motions during the period three to one hours prior to synoptic time. The archive of these data begins with the vectors for July 29, 1974.

Format: 9-track, 1600 bpi. Contains earth-located wind vectors over ocean areas with estimated temperature and pressure level of cloud tracers.

Quantity: About 570 vectors daily per satellite; one tape per month

Retention time at NESS: Up to one month

Retention time at SDSB: Indefinite; NESS/EDS review in five years

Note: Wind vectors provided operationally to National Meteorological Center (NMC) are included in a magnetic tape archive prepared at NMC for deposit at the National Climatic Center (NCC).

h. VISSR images: Digital magnetic tape

Starting 27 July 1976 NESS is supporting a digital archive from the SMS-2/GOES-1 data acquired for picture-pair winds processing.

Archive Specifications

1. Geographical coverage: 89° lat x 99° long/each satellite
2. Types of data and resolution: Infrared 4 x 4 mi (IR)
   Visible 4 x 4 mi (VIS)
3. Times of data archived/day (± one hour)

WEST Satellite (SMS-2)	EAST Satellite (GOES-1)
0915Z (IR), 0945Z (IR) → (12Z)	0930Z (IR), 1000Z (IR) → (12Z)
1515Z (IR), 1545Z (IR) → (18Z)	1600Z (IR), 1600Z (VIS) → (18Z)
2145Z (IR), 2145Z (VIS) → (00Z)	2130Z (IR), 2200Z (IR) → (00Z)

4. Earth location — provides the user with the capability of determining scan line and sample number for a given latitude/longitude location. Earth location will be provided by:

   Archive Data Acquisition Software: given satellite parameters and latitude/longitude will provide an array of data centered at the scan line and sample number corresponding to the given latitude/longitude.

   Advantage - Provides data centered at any given latitude/longitude.

   Disadvantage - User has to interpolate values falling between benchmarks.

Format: Three files will be required for each picture. 9-track, 1600 bpi

File 1 - Header record (Satellite ID, Picture Time, etc.)

Quality control information

Satellite parameters (orbit/attitude)

File 2 - Benchmarks

File 3 - 89° latitude x 99° longitude data file

Quantity: 12 pictures/day = 2 tapes

Note: Upon installation of mass storage equipment in late 1977, current plans call for the possible archive of full disc Visible and IR GOES digital data at highest resolution (i.e., 0.9 and 7.4 km) (1/2 and 4 n.m.) by time and location.

6.1.4 To meet the varied demands of its worldwide user community, SDSB offers GOES data in several standard formats which allow fixed user costs to be determined for each product type. Prices of these formats vary with their production costs and are reviewed and adjusted, if necessary, at least once annually. Cost for these data is basically that required for reproduction. A current price list is furnished in Table 4 of this guide. GOES/SMS can be ordered from the following address:

Satellite Data Services Branch, D543
World Weather Building, Room 606
Washington, D.C. 20233
Telephone: (301) 763-8111

The requester should furnish SDSB with as much of the following information as possible:

1. Satellite from which data are requested.

2. Type of data needed (Visible or Infrared).

3. Data format desired (print, transparency, etc.).

4. Use that will be made of the data.

5. Task number to be charged (Federal).

Table 4 20 July 1976

National Climatic Center
Satellite Data Services Branch
Price List - FY 76
GOES/SMS Photographic Products

Description (Black & White Products)		Unit Price
10" x 10" Contact Paper Print		$ 2.50
20" x 20" Paper Print Enlargement		5.25
30" x 30" Paper Print Enlargement		8.00
10" x 10" Contact Dupe Negative from Positive		4.50
10" x 10" Contact Positive Transparency from Negative		4.50
10" x 10" Contact Dupe Negative from Negative		5.50
35 mm Mounted Slide from Negative		4.00
16 mm Operational Movie Loop (3 Hours)		16.00
16 mm Operational Movie Loop (6 Hours)		26.50
16 mm Operational Movie Loop (12 Hours)		37.00
16 mm Operational Movie Loop (24 Hours)		73.00
16 mm TV Movie - 15 meter Strip (Dupe)		6.00
3-1/4" x 4-1/2" Glass Mounted Slide from 10" x 10" Film		5.00
($0.25 per scene should be added to items requiring gridding)		
Digital Imagery on Magnetic Tapes (CCT)		
Tape-to-Tape Copying	1 to 9 Tapes	$50.00 plus cost of tape*
	10 to 49 Tapes	35.00 plus cost of tape*
	50 or more	25.00 plus cost of tape*

*About $10-12/tape

When other than straight tape-to-tape operation is involved, the cost of the tapes will be determined on a case-by-case basis and the requester will be given a firm (quoted) price.

6. Address where data are to be sent and telephone number, including area code.

7. Other information which might help SDSB personnel identify and locate the correct data from the archive.

6.2 NASA/GSFC

If requested GOES/SMS imagery and/or digital data are not available through the Satellite Data Services Branch, a secondary source exists at Goddard Space Flight Center (NASA/GSFC). NASA/GSFC holdings and services are described in the following section.

6.2.1 To establish a digital data base prior to 1 October 1975 to meet requirements of NASA research activities, VISSR data were sent from White Sands, NM or Baltimore, MD to NASA/GSFC. This file at GSFC begins with SMS-1 images on 25 May 1974. Images are on 22-inch roll film. While complete data coverage is not available, Table 5 lists those photos which are on file. In general, visible images were recorded when any portion of the disc was illuminated by sunlight, while infrared images were recorded when the entire disc was dark. Simultaneous infrared and visible images were not obtained. Image quality varies from picture to picture. Copies of these images can be produced at the original or reduced scale. The capability also exists to produce movie loops, provide special processing, and provide photo reproductions.

6.2.2 In addition to images on 22-inch roll film, digital data were recorded on tape and sent to GSFC. Table 6 indicates the digital data on file prior to November 1, 1975. No data were recorded in this format between 1 November 1975 and 27 January 1976 when GSFC began routinely receiving tapes of digital data from NOAA/NESS. Selected portions of this data base are processed for use on the Atmospheric and Oceanographic Information Processing System (AOIPS) by research activities at GSFC, and these selected data are available in a computer-compatible format.

6.2.3 All requests for data should be directed to:

Satellite Data Services Branch
World Weather Building, Room 606
Washington, D.C. 20233
Telephone: (301) 763-8111

Requests for GOES/SMS digital data not available in the SDSB archives will be forwarded by SDSB to the National Space Science Data Center (NSSDC) at Goddard Space Flight Center for servicing.

Table 5

SMS-1 and 2 Photos Available at NASA/GSFC
(on 22-Inch Roll Film)

Ground Station Location	Spacecraft	
	SMS-1	SMS-2
White Sands	25, 28, 29 May 1974	
	11-13, 16, 19, 20, 27, 29, 30 June 1974	
	1-20, 24-27 July 1974	
	1-3, 6-13 September 1974	
	18, 21-23, 30, 31 October 1974	
	1, 2, 4-21, 26-30 November 1974	
	1-11, 20, 21 December 1974	
	17, 22-24 February 1975	
	24, 25 April 1975	
Baltimore	1-13, 18-31 January 1975	12, 17-28 February 1975
	1-26 February 1975	1 March 1975
	1, 2 March 1975	30 May 1975
	10-11, 28-31 August 1975	28 August 1975
	1-4, 6-9, 11-30 September 1975	22 September 1975
	1-9 October 1975	

Table 6

SMS-1 and 2 Digital Tapes Available at NASA/GSFC

Ground Station Location	Spacecraft	
	SMS-1	SMS-2
White Sands	11-13, 16, 17, 19, 20, 27-30 June 1974	
	1-12, 18-20, 23-31 July 1974	
	1-24, 26-31 August 1974	
	1-30 September 1974	
	1-31 October 1974	
	1-30 November 1974	
	1-24, 27-31 December 1974	
	27, 28 February 1975	
	1 March 1975	
Baltimore	1-31 January 1975	17-28 February 1975
	1-26 February 1975	1 March 1975
	2-31 March 1975	16-30 April 1975
	1-16 April 1975	1-31 May 1975

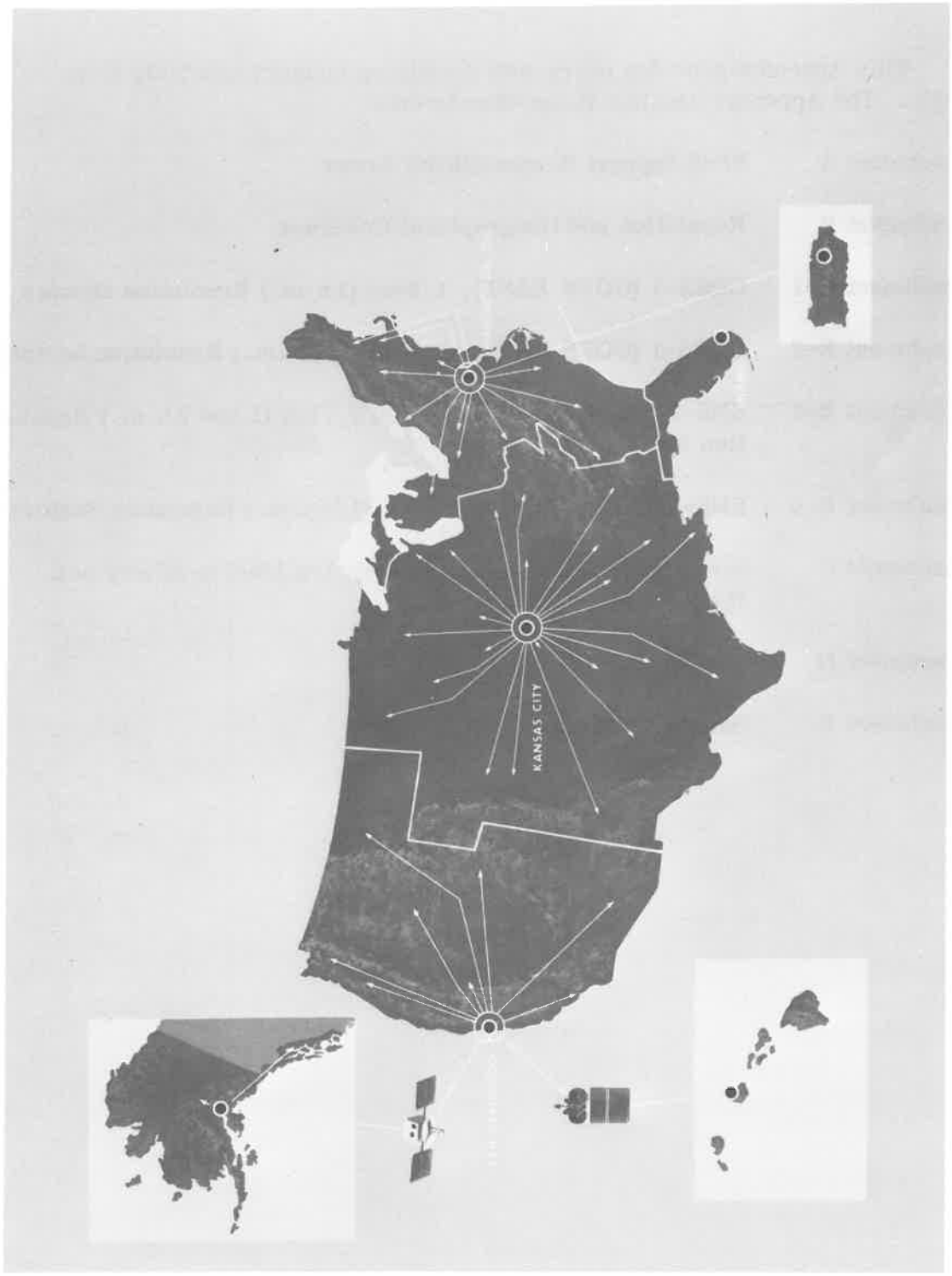
APPENDIX I

GOES/SMS IMAGERY AVAILABLE TO USERS

This Appendix provides users with details on imagery available from NOAA. The Appendix contains these Attachments:

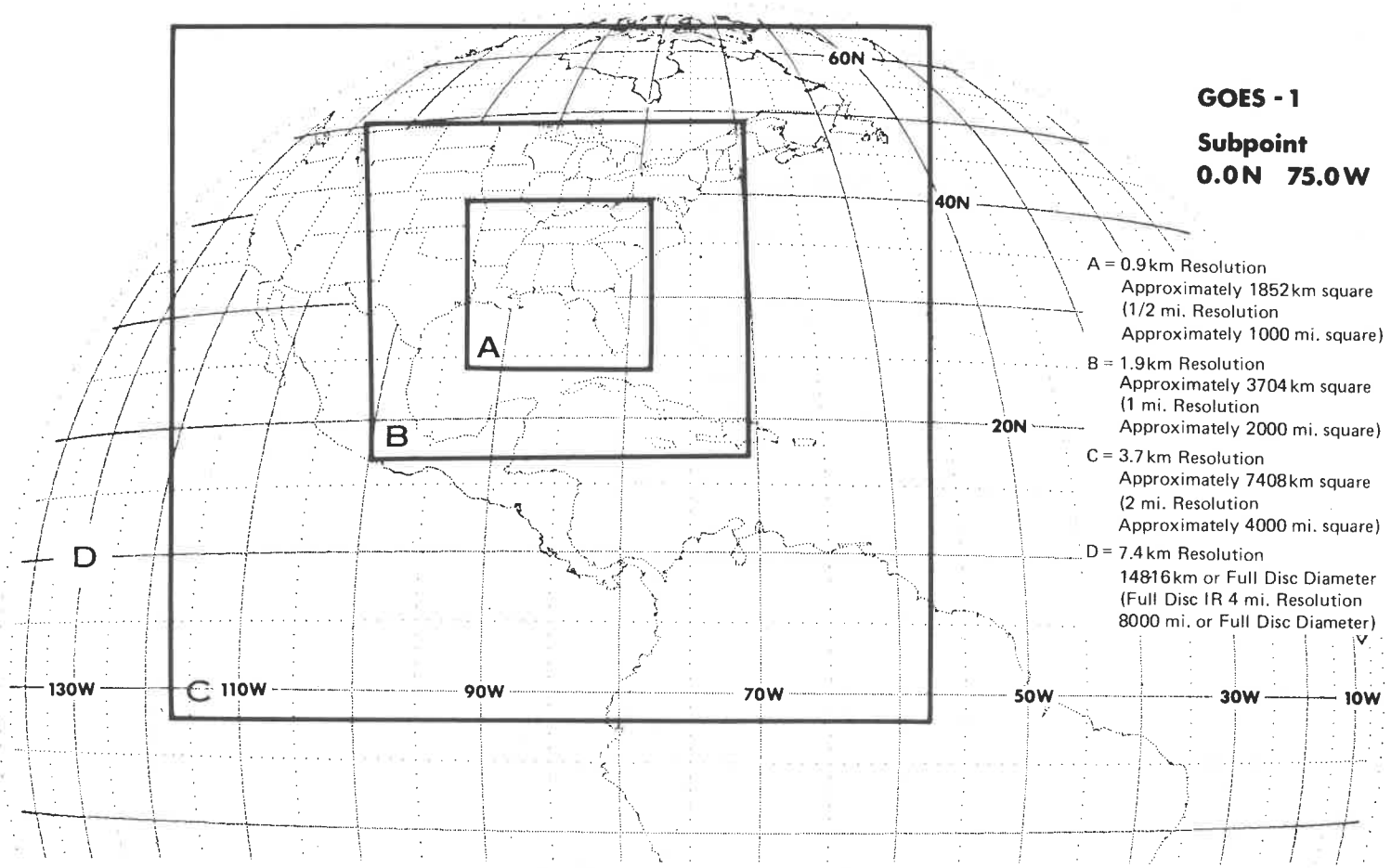
Attachment A	SFSS Support Responsibility Areas
Attachment B	Resolution and Geographical Coverage
Attachment B-1	GOES-1 (GOES EAST), 1.9 km (1 n.m.) Resolution Sectors
Attachment B-2	GOES-1 (GOES EAST), 0.9 km (1/2 n.m.) Resolution Sectors
Attachment B-3	SMS-2 (GOES WEST), 1.9 and 3.7 km (1 and 2 n.m.) Resolution Sectors
Attachment B-4	SMS-2 (GOES WEST), 0.9 km (1/2 n.m.) Resolution Sectors
Attachment C	Inventory of GOES/SMS Imagery Available to SFSS's and their Users
Attachment D	GOES/SMS Product Legend
Attachment E	Sample Imagery

Appendix I
Attachment A



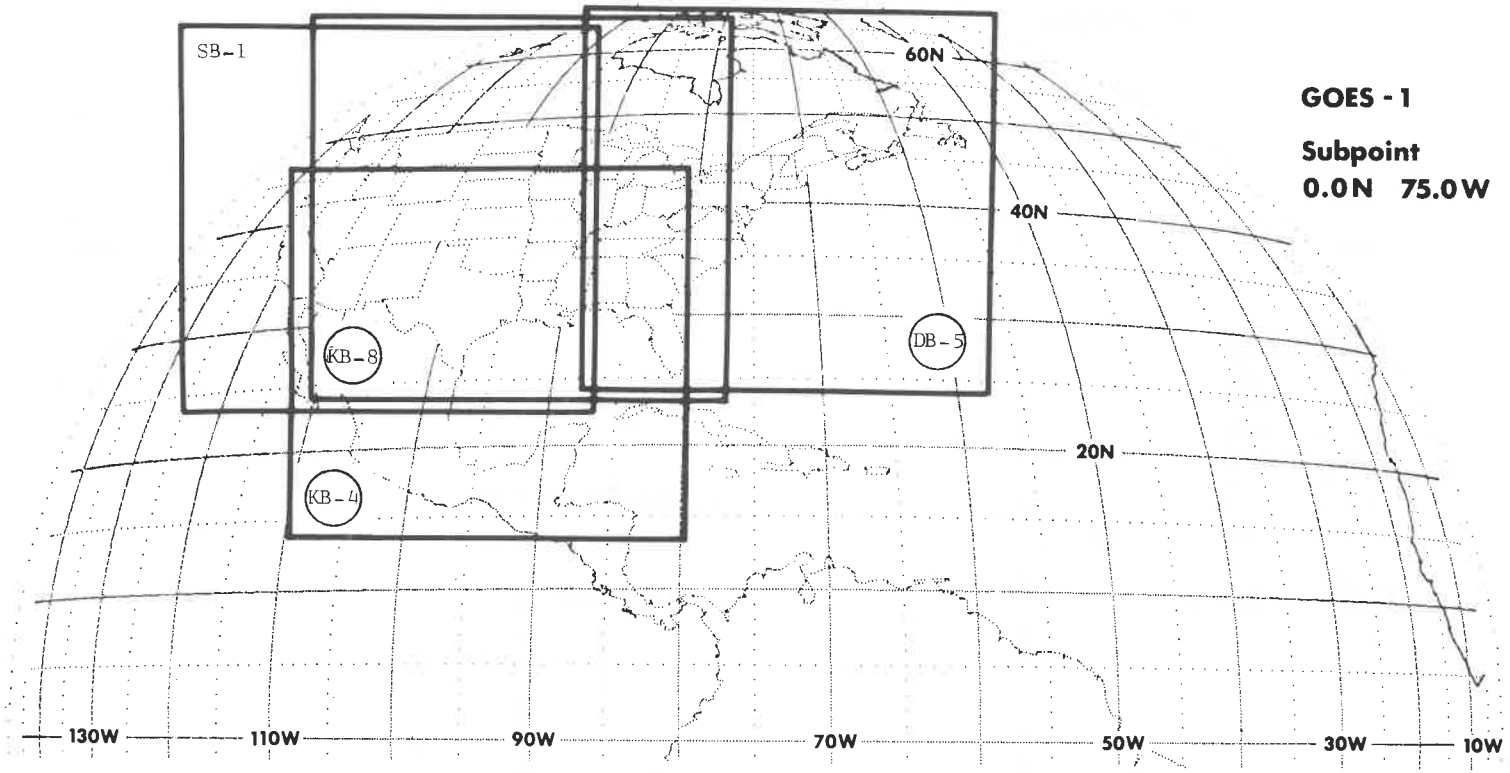
Appendix I Atch. A NESS Satellite Field Services Station Geographical Areas of Responsibility

FIELD SERVICES DIVISION NESS



RESOLUTIONS AND GEOGRAPHICAL COVERAGE

FIELD SERVICES DIVISION NESS



GOES - 1 (EAST GOES) 1 MILE RESOLUTION SECTORS

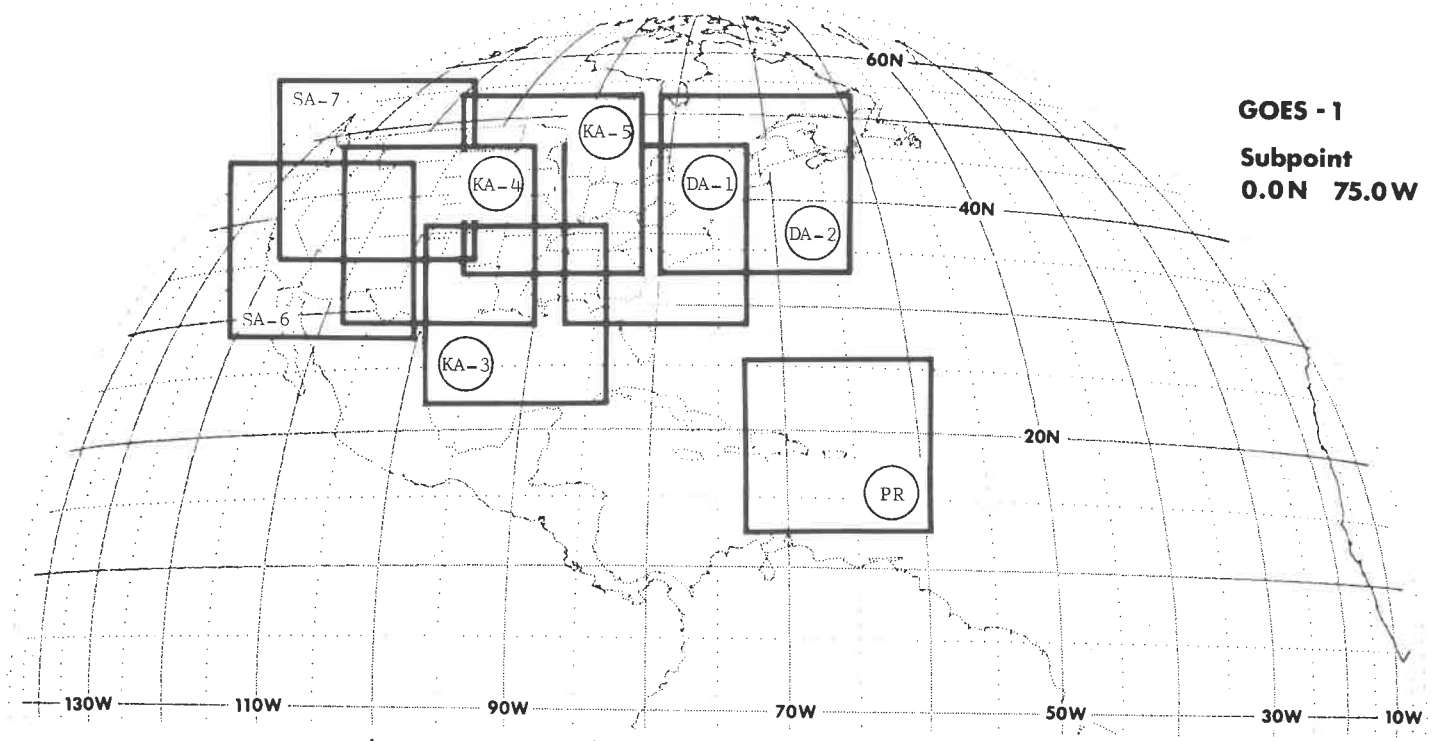
(SECTOR LOCATIONS EFFECTIVE JULY 27, 1976)

VIS & Equiv. IR Sectors

Sector	Center Point Lat/Long
SB-1	40.0/109.0
(KB-8)	40.0/ 97.0
(KB-4)	27.0/ 95.0
(DB-5)	38.0/ 79.0

NOTE: Sector numbers that are circled are routinely available. Those not circled are reserve sectors to be utilized in case of WEST GOES failure. UC-1 utilized for enhancement tables only.

FIELD SERVICES DIVISION NESS



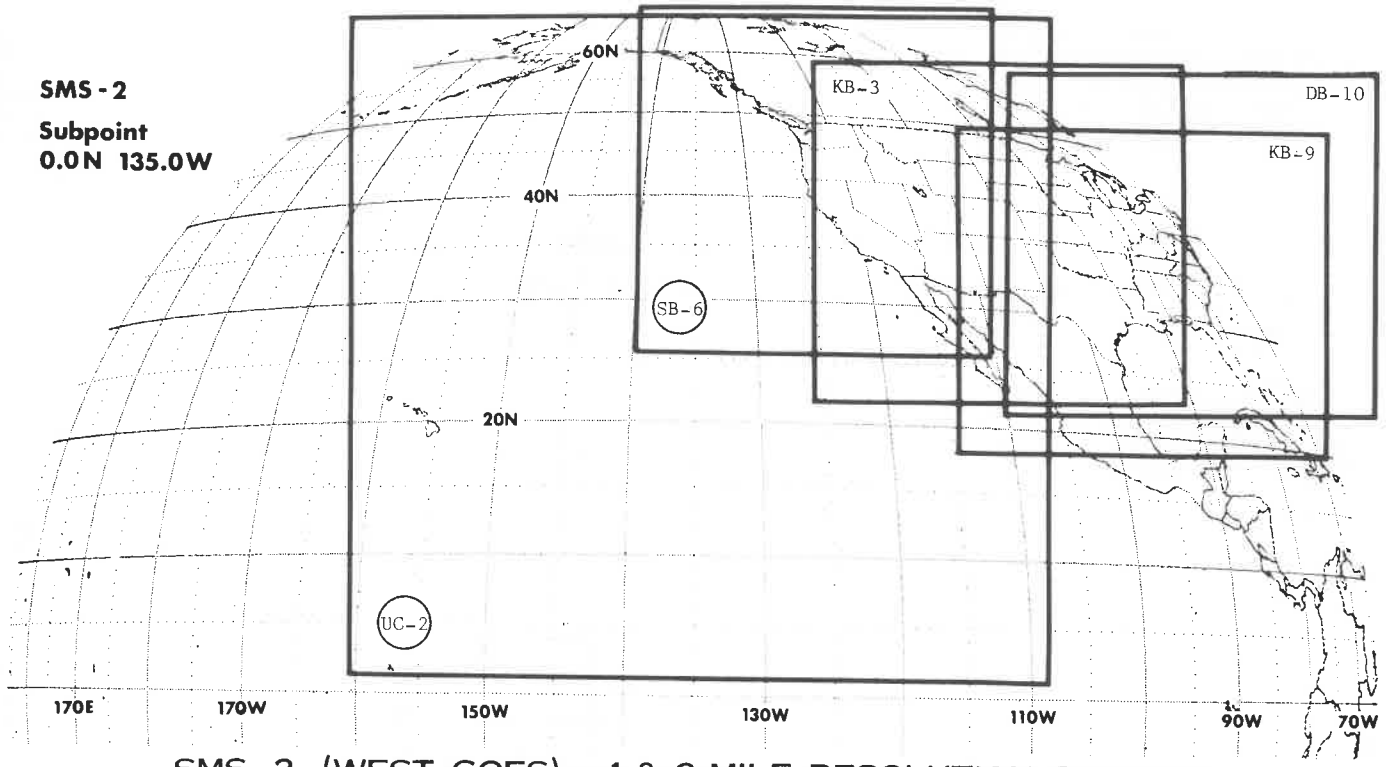
GOES - 1 (EAST GOES) HALF MILE SECTORS (VIS ONLY)

(SECTOR LOCATIONS EFFECTIVE JULY 27, 1976)

Sector	Center Point Lat/Long
DA-1	37.0/ 82.0
DA-2	42.0/ 72.0
KA-3	30.0/ 92.0
KA-4	37.0/102.0
KA-5	42.0/ 91.5
SA-6	36.0/115.0
SA-7	45.0/116.0
PR	18.0/ 66.0

NOTE: Sector numbers that are circled are routinely available. Those not circled are reserve sectors to be utilized in case of WEST GOES failure.
Puerto Rico has routinely six scheduled sectors utilizing ½, 1 and 2 mile resolution.

FIELD SERVICES DIVISION NESS



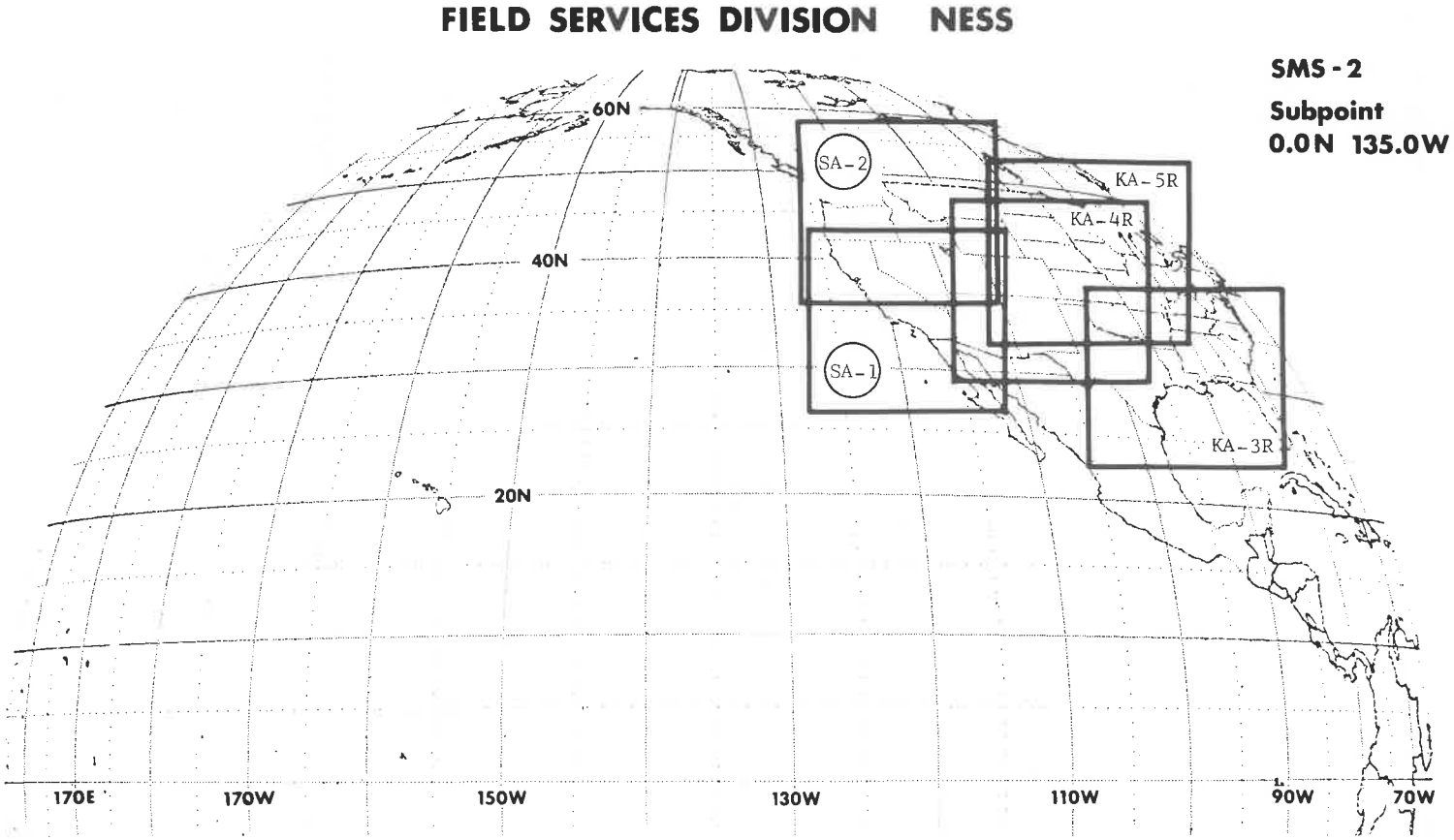
SMS - 2 (WEST GOES) 1 & 2 MILE RESOLUTION SECTORS

(SECTOR LOCATIONS EFFECTIVE JULY 27, 1976)

VIS & Equiv. IR Sectors

Sector	Center Point Lat/Long
SB-6	42.0/124.0
KB-3	37.0/107.0
KB-9	33.0/ 91.0
DB-10	35.0/ 80.0
UC-2	28.0/135.0

NOTE: Sector numbers that are circled are routinely available. Those not circled are reserve sectors to be utilized in case of EAST GOES failure.



SMS - 2 (WEST GOES) HALF MILE SECTORS (VIS ONLY)

(SECTOR LOCATIONS EFFECTIVE JULY 27, 1976)

Sector	Center Point Lat/Long
SA-1	36.0/118.0
SA-2	45.0/116.0
KA-3R	30.0/ 94.0
KA-4R	37.0/102.0
KA-5R	42.0/ 92.0

NOTE: Sector numbers that are circled are routinely available. Those not circled are reserve sectors to be utilized in case of EAST GOES failure.

Appendix I
Attachment C

1. As of September 1, 1976 the total inventory of GOES Imagery available to the SFSS's and their respective users follows. This inventory will be updated as required to meet existing requirements and priorities of operations.

SFSS	Primary Sector	Reserve Sector
a. Miami	Full Disc IR (E GOES)	Full Disc IR (W GOES)
	Floater M1 (E GOES)	Floater M1 (W GOES)
	Floater M2 (E GOES)	Floater M2 (W GOES)
b. Washington	Full Disc IR (E GOES)	Full Disc IR (W GOES)
	DB-5 VIS & EQUIV IR	DB-10 VIS & EQUIV IR
	KB-8 VIS & EQUIV IR	KB-3 VIS & EQUIV IR
	KA-5 VIS Only	KA-5R VIS Only
	DA-1 VIS Only	DA-6 VIS Only
	DA-2 VIS Only	DA-7 VIS Only
	Floater D1 (E GOES)	Floater D1 (W GOES)
	Floater D2 (E GOES)	Floater D2 (W GOES)
c. Kansas City	Full Disc IR (E GOES)	Full Disc IR (W GOES)
	KB-8 VIS & EQUIV IR	KB-3 VIS & EQUIV IR
	KB-4 VIS & EQUIV IR	KB-9 VIS & EQUIV IR
	SB-6 VIS & EQUIV IR	SB-1 VIS & EQUIV IR
	KA-3 VIS Only	KA-3R VIS Only
	KA-4 VIS Only	KA-4R VIS Only
	KA-5 VIS Only	KA-5R VIS Only
	SA-1 VIS Only	SA-6 VIS Only
	SA-2 VIS Only	SA-7 VIS Only
	UC-2 VIS & EQUIV IR	
	Floater K1 (W GOES)	Floater K1 (E GOES)
	Floater K2 (E GOES)	Floater K2 (W GOES)
d. San Francisco	Full Disc IR (W GOES)	Full Disc IR (E GOES)
	SB-6 VIS & EQUIV IR	SB-1 VIS & EQUIV IR
	SA-1 VIS Only	SA-6 VIS Only
	SA-2 VIS Only	SA-7 VIS Only
	UC-2 VIS & EQUIV IR	
	Floater S1 (W GOES)	Floater S1 (E GOES)
	Floater S2 (W GOES)	Floater S2 (E GOES)
	VHRR (Polar Orbiter)	
e. Honolulu	Floater H1 (W GOES)	VHRR (Polar Orbiter)
	Floater H2 (W GOES)	VHRR (Polar Orbiter)
	VHRR (Polar Orbiter)	

SFSS	Primary Sector	Reserve Sector
f. Anchorage	VHRR (Polar Orbiter) (UC-2, FD IR/W GOES	
g. Central (CDDF)	PR-1 E GOES (Scheduled, 1/2 mi., 1 mi. or 2 mi. sectors)	Floater M1 (E GOES) Floater M2 (E GOES)
h. Central CDDF (Available locally only)	WB-1 (E GOES) WB-2 (W GOES) Full Disc VIS (E GOES) (WC-1) Full Disc VIS (W GOES) (WC-2)	WB-2 (W GOES) WB-1 (E GOES) Full Disc VIS (W GOES) (WC-2) Full Disc VIS (E GOES) (WC-1)

2. Clarification Notes

a. Standard Visible B Sectors (1.9 km resolution) (1 n.m. resolution) will be provided during daylight hours. Equivalent standard IR sectors (B and C sectors with 1.9 and 3.7-km (1 and 2 n.m.) sector geographical areas but 7.4 km (4 n.m.) resolution) will be produced during night hours. Certain standard sectors, as designated by NWS Regions, are produced on a "ping-pong" schedule (i.e., VIS, IR, VIS, IR) throughout existing daylight hours. Seasonal adjustments are requested by appropriate SFSS's for time of change from VIS to IR and IR to VIS. Selected IR enhancement products are also provided on a scheduled basis on some 1.9 and 3.7 km (1 and 2 n.m.) resolution sectors.

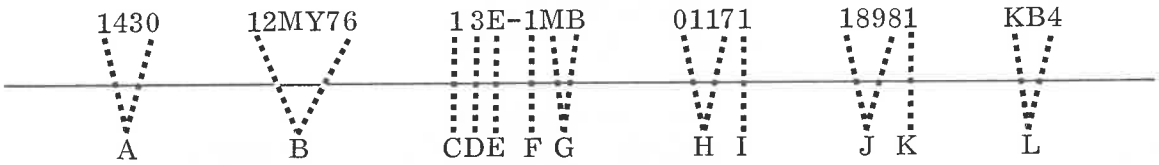
b. SFSS Floater Sector Capability; location and resolution will be determined by each SFSS. Users will be notified of locations and resolution of floaters by their respective SFSS.

c. Reference paragraph 1.h. Products listed are available for local (Washington complex) distribution only and at EDS Archive. Full Disc VIS (GOES East) (WC-1) is produced once an hour on the hour except for PM periods. Full Disc VIS (GOES West/SMS-2) (WC-2) is produced once an hour at 45 minutes after the hour. WB-1 is a 3.7-km (2 n.m.) geographical coverage sector with 1.9 km (1 n.m.) resolution from GOES E. WB-2 is a 3.7 km (2 n.m.) geographical area with 1.9 km (1 n.m.) resolution from GOES W.

Appendix I
Attachment D

NATIONAL ENVIRONMENTAL SATELLITE SERVICE
FIELD SERVICES DIVISION

GOES PRODUCT LEGEND EXPLANATION
(as of April 27, 1976)



A. Greenwich time in hours and minutes indicating time of actual picture start.

B. Calendar day, month, year. Months are abbreviated as follows:

January	JA	July	JL
February	FE	August	AU
March	MR	September	SE
April	AP	October	OC
May	MY	November	NO
June	JN	December	DE

C. Line Stretcher/Data Buffer (LS/DB) Identification.

D. Satellite Identification:

1 = SMS-1 (Stand-by) 2 = SMS-2 (West GOES) 3 = GOES-1 (East GOES)

E. Image Type

F = Full Disk IR

E = Equivalent IR Sector

A, B, C, D = Denotes Visible Sectors as well as the (LS/DB) mode of operation. Details are beyond the scope of this document.

F. Resolution of image in nautical miles:

H = 1/2 x 1/2	2 = 2 x 2
1 = 1 x 1	4 = 4 x 4 (IR only)

G. Enhancement curve identifier for IR data only. Two letters (AA thru ZZ) in this position identifies the enhancement curve displayed. No letters signifies no enhancement.

H. Starting Scan Line number for the Image (Y axis).

Range = 0 to 1821

I. Vernier correction factor for starting scan line number.

J. The X axis element number of the mid point of each horizontal line contained in the sector.

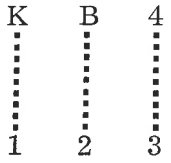
Range 0 to 3822

K. Vernier correction factor for sector center location.

L. Sector Identification - Three conventions exist:

CONVENTION #1

Standard Sectors



1. Major NESS hub (SFSS or Regional area requirement) for which the sector was generated.

S - San Francisco	W - Washington complex production only (Not transmitted over GOES network)
K - Kansas City	
D - Washington, D.C.	WB - 2n.m. geographic sector with 1n.m. resolution
M - Miami	
H - Honolulu	WC - 4n.m. geographic, or Full Disc, with 2n.m. resolution
U - Universal	

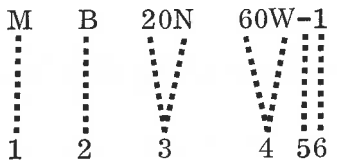
2. Sector Resolution in nautical miles, except for Equivalent IR products.

H - 1/2 x 1/2	C - 2 x 2
B - 1 x 1	D - 4 x 4

3. Identifier number for the specific standard sector (1 thru 9)

CONVENTION #2

Floating Sectors
(each SFSS has two floaters)



1. Same as Standard Sector 1.

2. Same as Standard Sector 2.

3. Latitude of Image Center Point.

4. Longitude of Image Center Point.

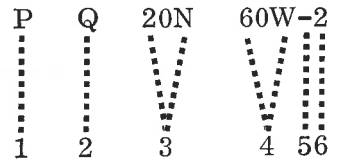
5. Separator

6. Identifier number for the specific floater (1 or 2).

CONVENTION #3

Rapid Scan Sectors

For identification of products produced at intervals less than 30 minutes under partial disc or limited scan operation.



1. Identifier of type of scan.

   P = Partial Disk, L = Limited Scan

2. Identifier of cycle time of the rapid scan data.

   Number 1 thru 9 = Approximate number of minutes of the scan cycle.

   EXAMPLES:

   7 = 7-1/2 minute scan cycle
   Q = 15 minute scan cycle

3. Latitude.

4. Longitude.

5. Separator.

6. Floater #1 = 1, Floater #2 = 2.

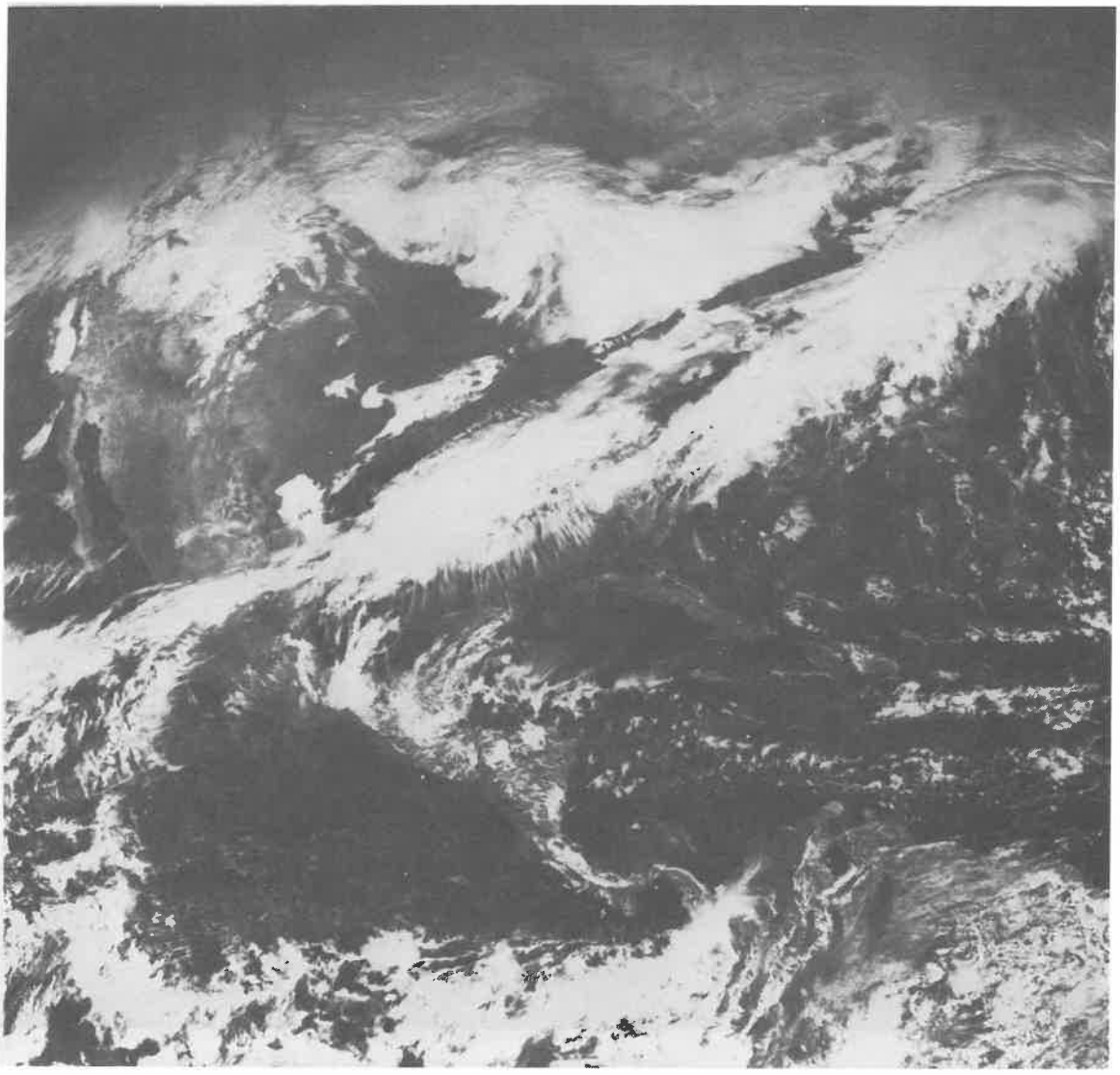
Appendix I
Attachment E

SAMPLE IMAGERY

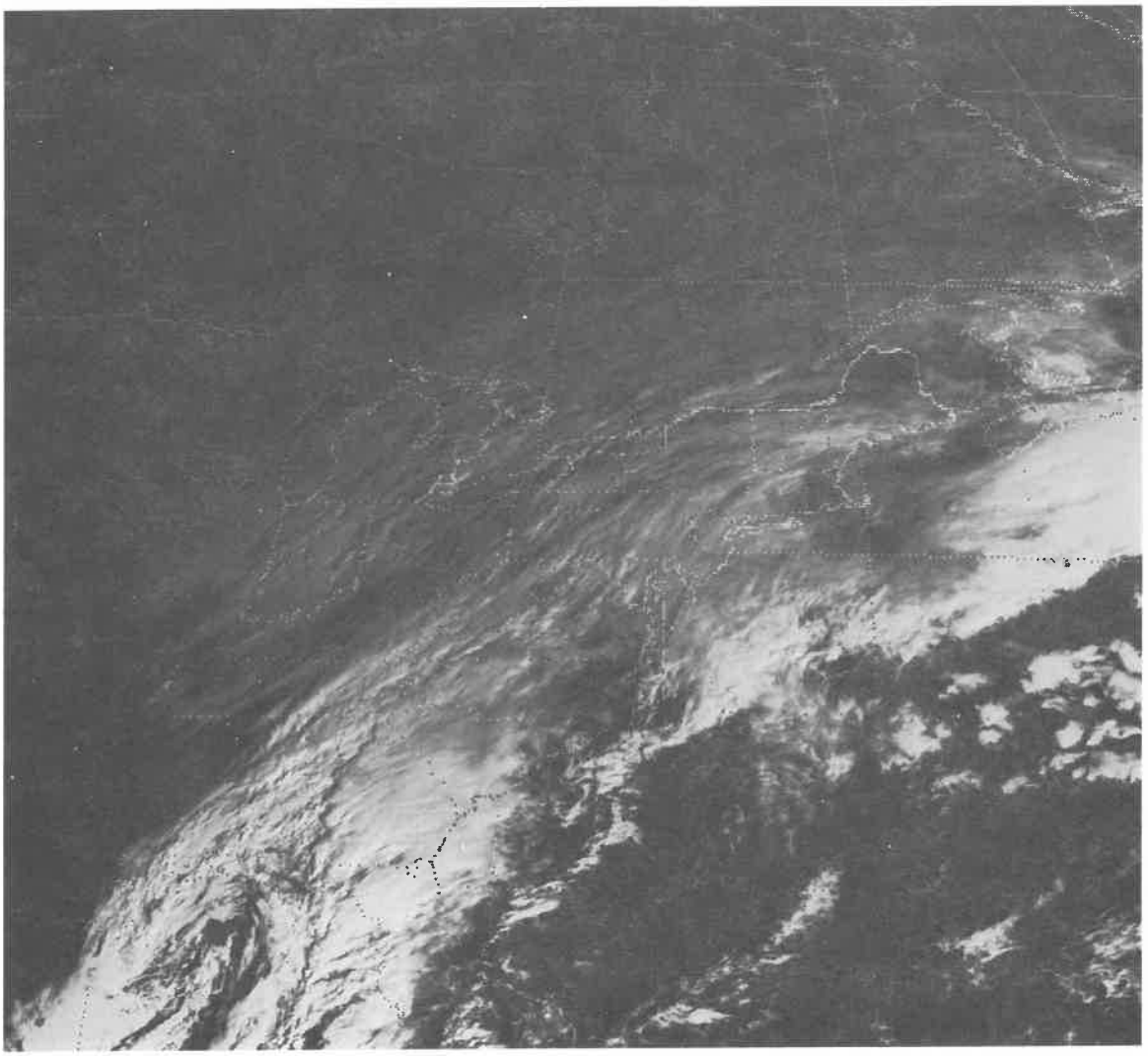
This is a series of 16 photographs illustrating coverage and detail available in GOES/SMS imagery.

1. Full disc visible image received from GOES-1 located at 75° W over the Equator. This image has a 2 n.m. (3.7 km) resolution and covers a near-circular geographical area approximately 8,000 n.m. (14,816 km) in diameter. This image (WC-1) is not available for transmission but is available to the Washington Complex (CDDF) and EDS archives.

Appendix I
Attachment E

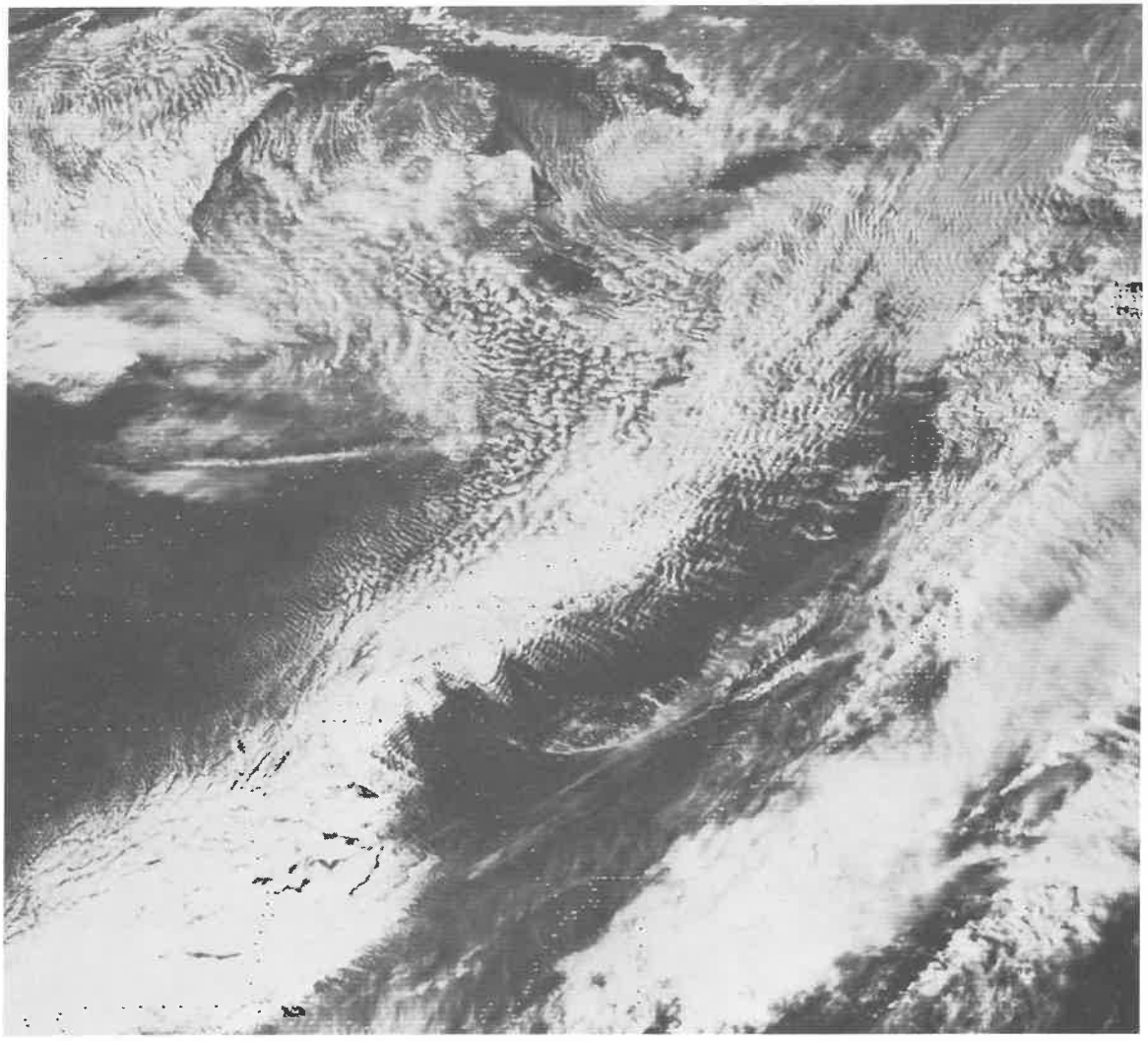


2. A VISIBLE 2 n.m. (3.7 km) resolution sector received from GOES-1. This sector (UC-1) covers a geographical area approximately 4,000 n.m. (7,408 km) square.



3. A VISIBLE 1 n.m. (1.6 km) resolution sector image received from GOES-1. This sector (DB-5) covers a geographical area approximately 2,000 n.m. (3,704 km) square. A computerized grid has been automatically implanted on the image.

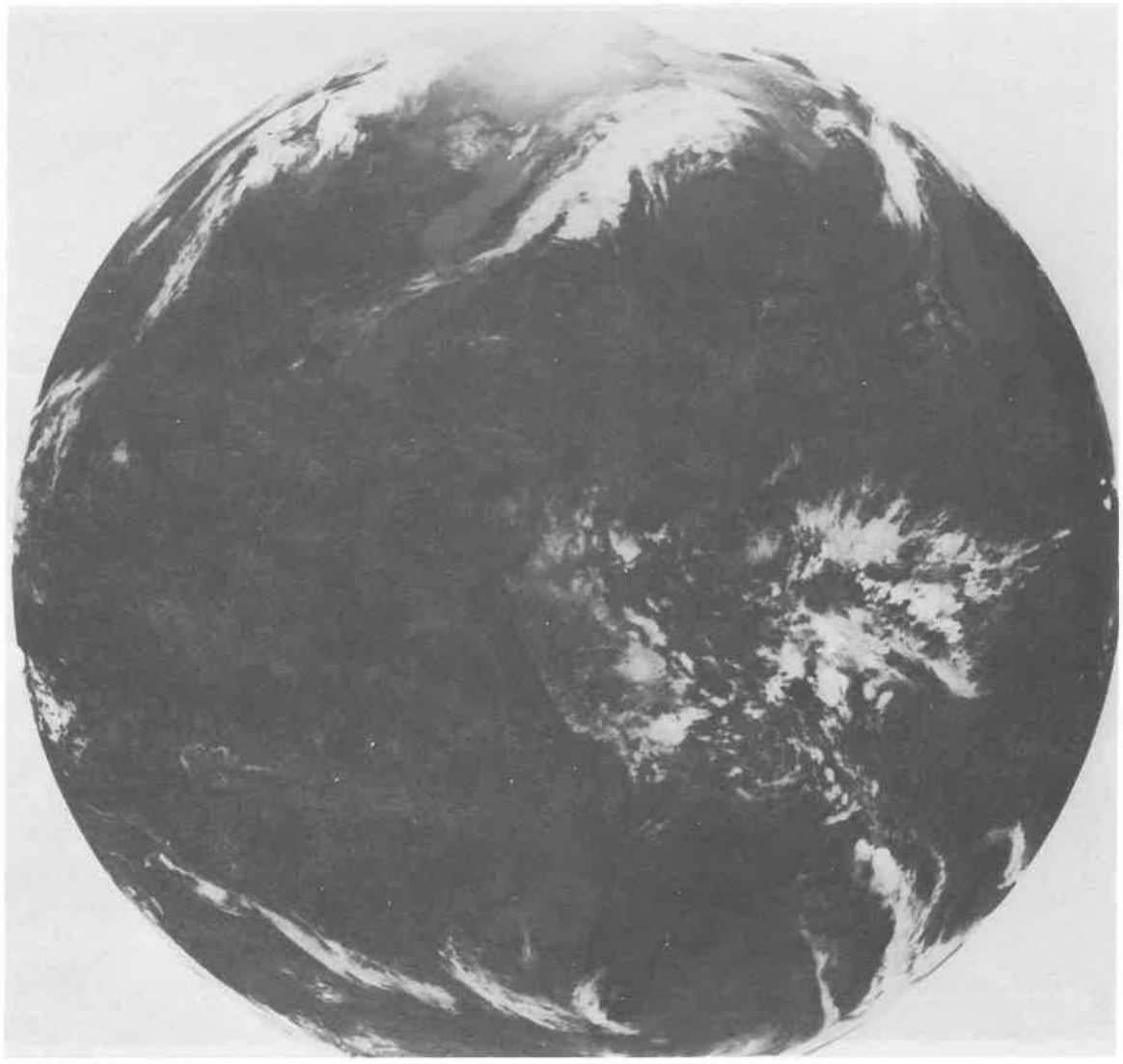
Appendix I
Attachment E



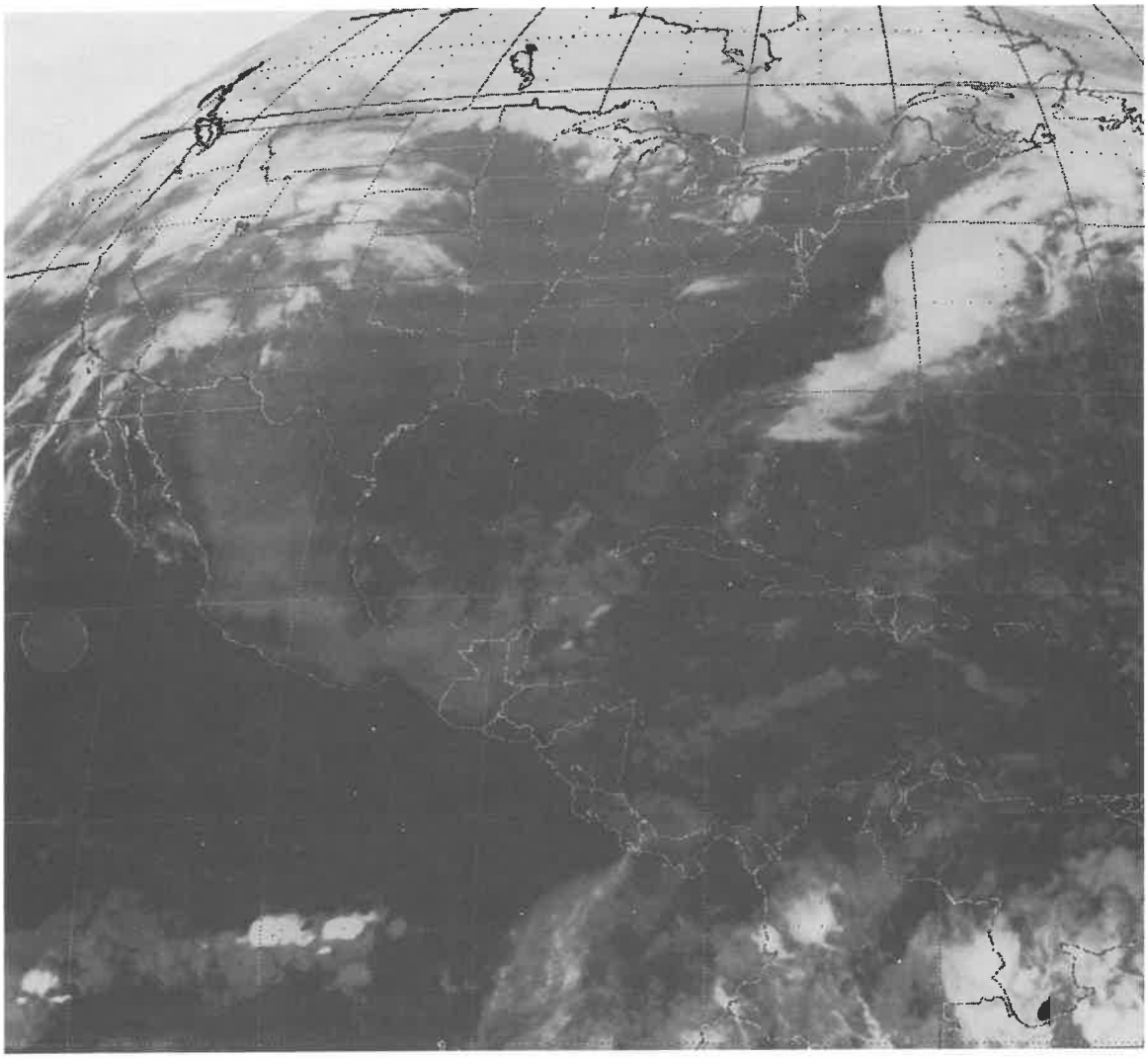
4. A VISIBLE 1/2 n.m. (0.9 km) resolution sector image received from GOES-1. This sector (DA-1) covers a geographical area approximately 1,000 n.m. (1,852 km) square. A computerized grid has been automatically implanted on the image.

5. A VISIBLE 1 n.m. (1.9 km) resolution sector image received from GOES-1. This sector (WB-1) covers a geographical area approximately 4,000 n.m. (7,408 km) square. This image is not available for transmission but is available to the Washington Complex (CDDF) and EDS archives.

Appendix I
Attachment E

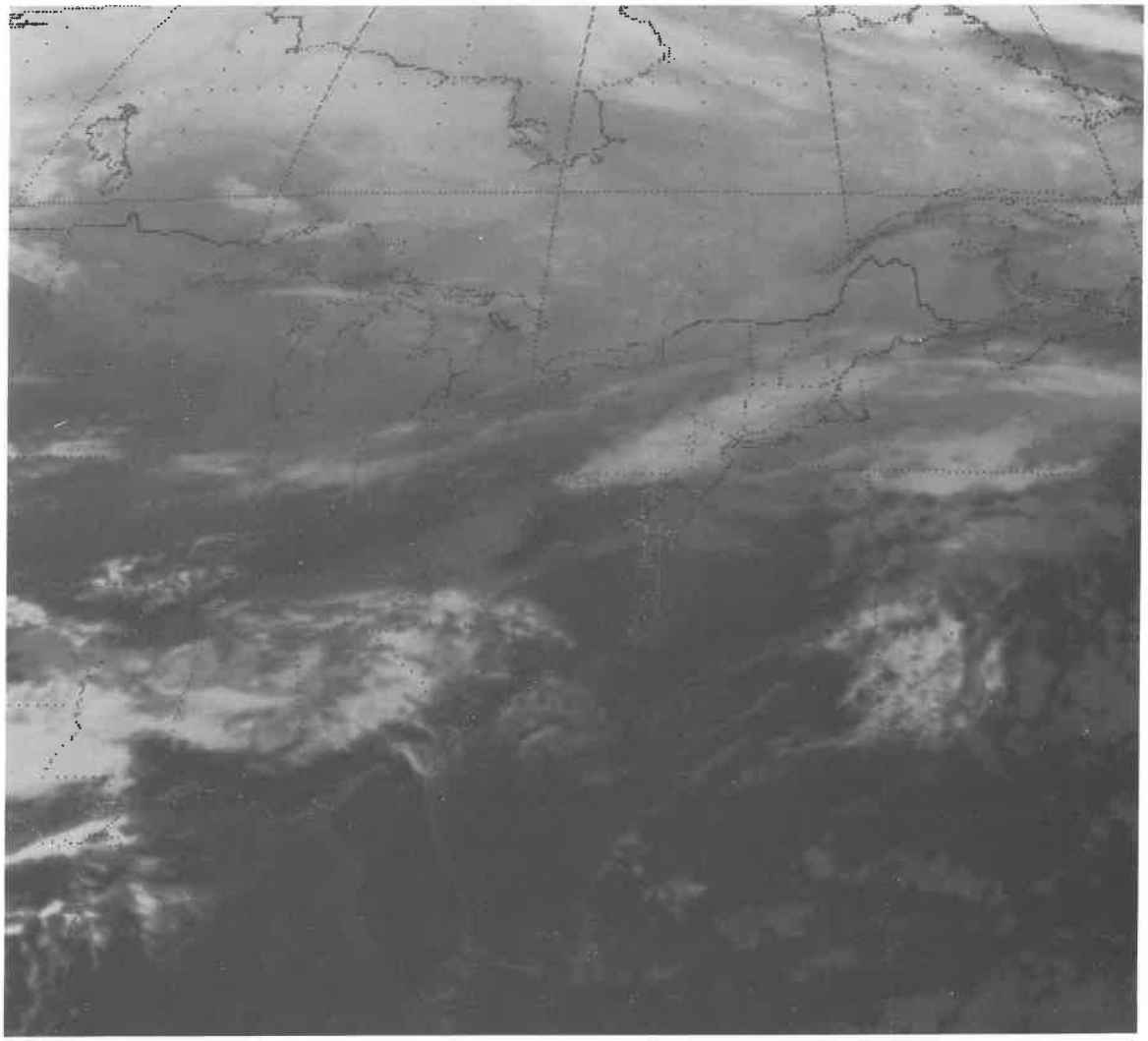


6. Full Disc INFRARED image received from GOES-1 located at 75° W over the Equator. This image has approximately 5 n.m. (9.3 km) resolution and covers a near-circular area approximately 8,000 n.m. (14,816 km) in diameter.



7. Equivalent INFRARED 2 n.m. (3.2 km) sector (UC-1) from GOES-1. This image has approximately 5 n.m. (9.3 km) resolution and covers a geographical area approximately 4,000 n.m. (7,408 km) square. A computerized grid has been automatically implanted on the image.

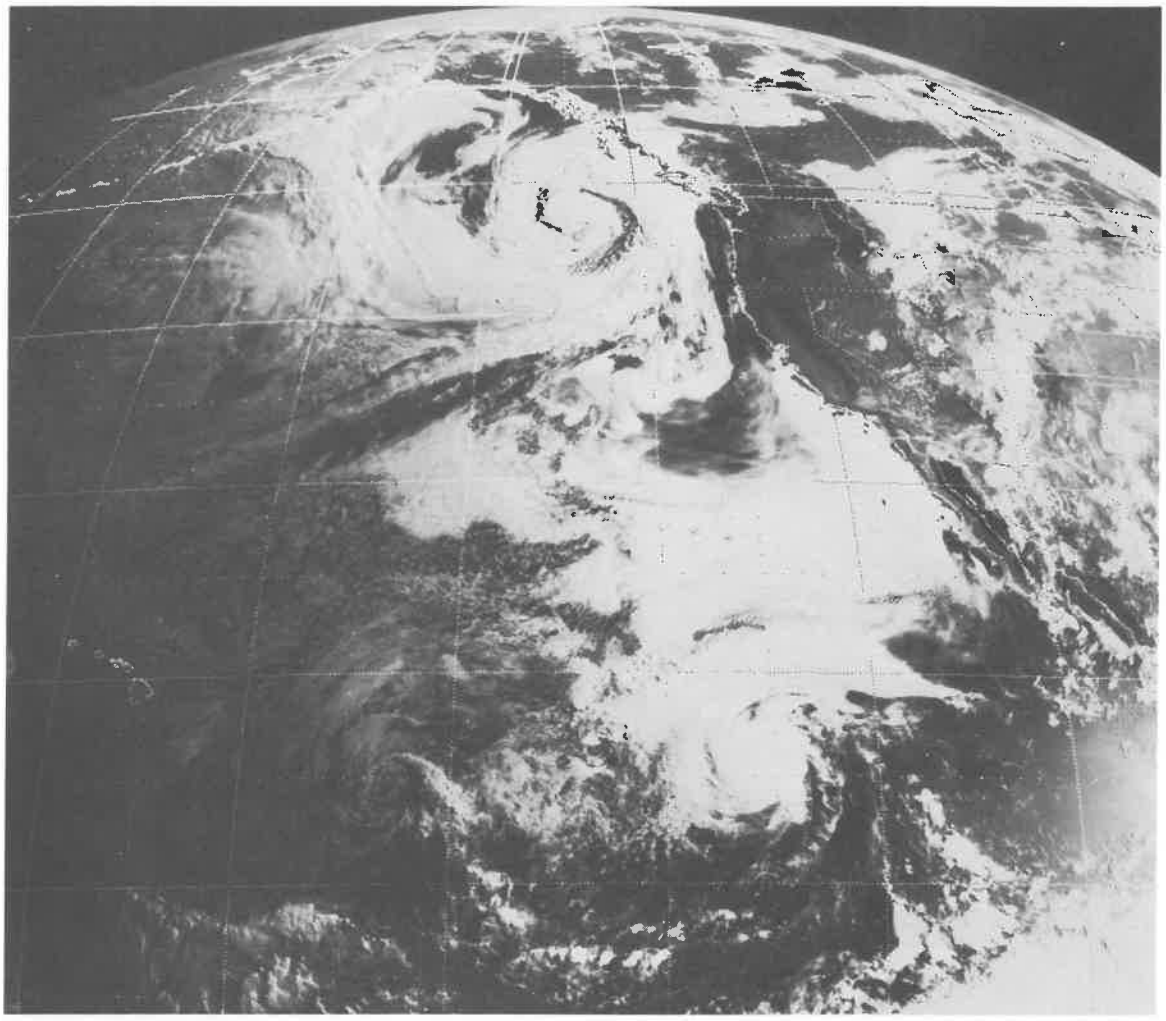
Appendix I
Attachment E



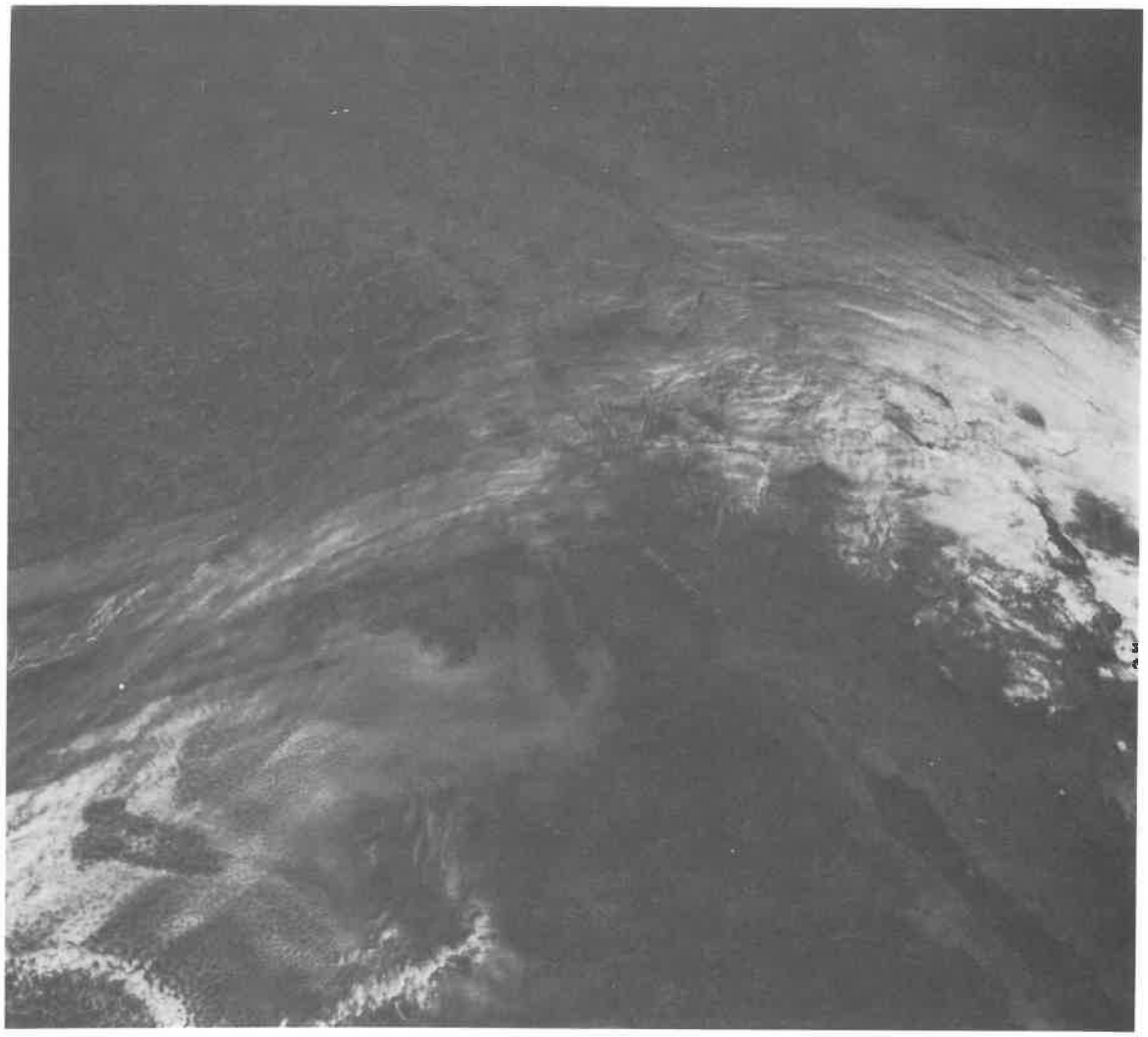
8. Equivalent INFRARED 1 n.m. (1.9 km) sector (DB-5) from GOES-1. This image has approximately 5 n.m. (8 km) resolution and covers a geographical area approximately 2,000 n.m. (3,704 km) square. A computerized grid has been automatically implanted on the image.

9. Full disc visible image received from SMS-2 located at 135° W over the Equator. This image has a 2 n.m. (3.7 km) resolution and covers a near-circular geographical area approximately 8,000 n.m. (14,816 km) in diameter. This image is not available for transmission but is available to the Washington Complex (CDDF) and EDS archives.

Appendix I
Attachment E

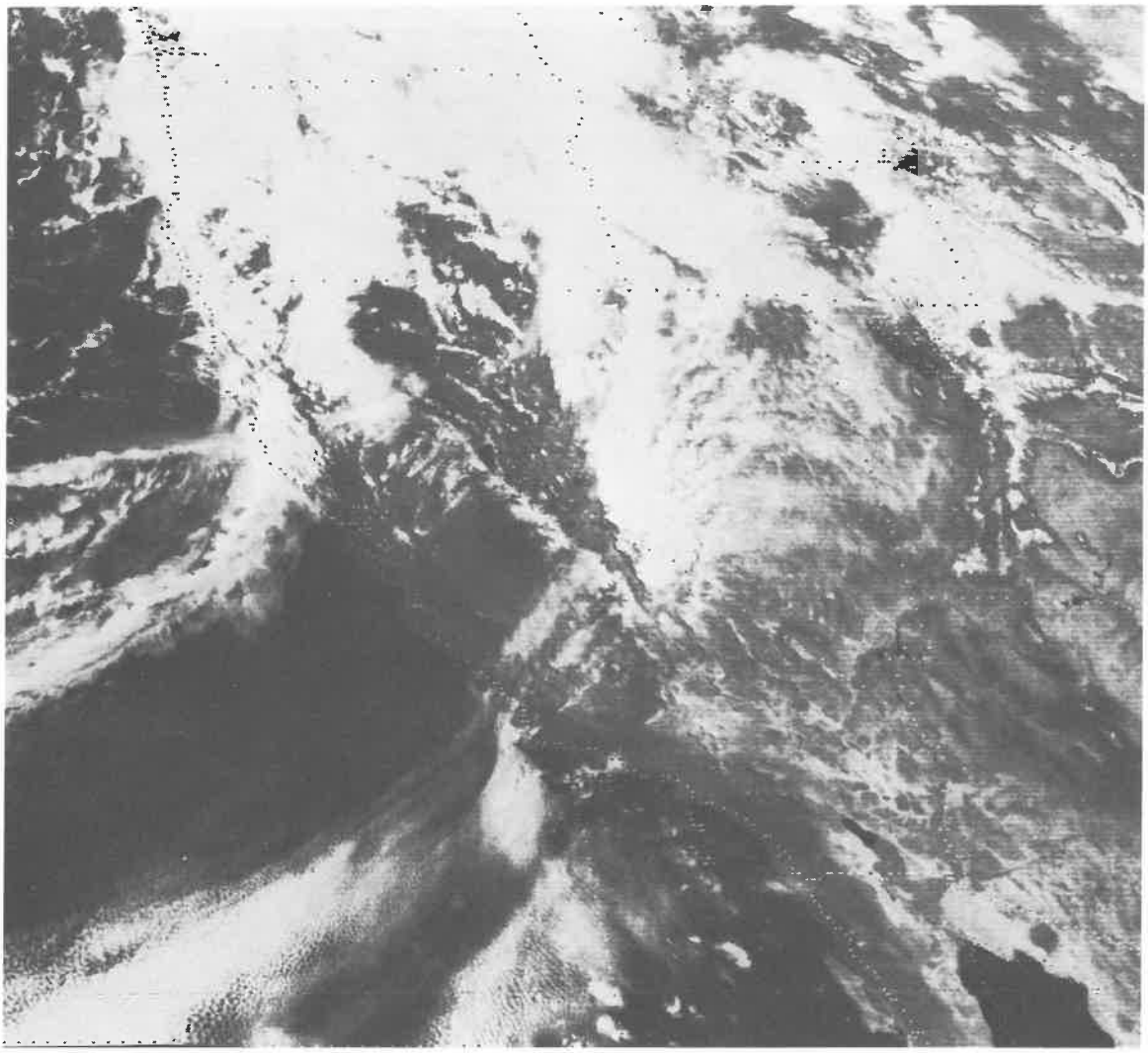


10. A VISIBLE 2 n.m. (3.2 km) resolution sector received from SMS-2. This sector (UC-2) covers a geographical area approximately 4,000 n.m. (7,408 km) square. A computerized grid has been automatically implanted on the image.

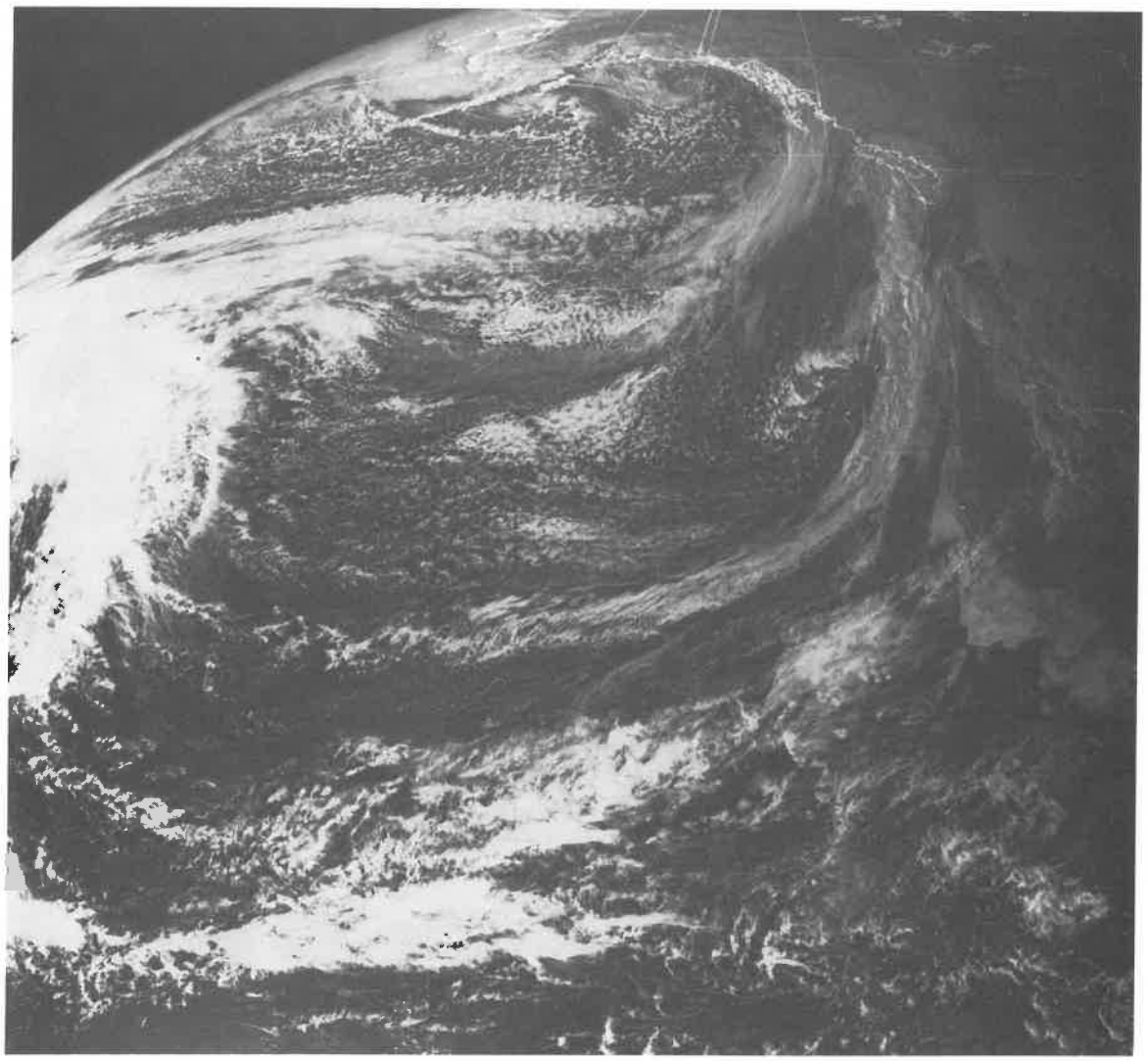


11. A VISIBLE 1 n.m. (1.9 km) resolution sector image received from SMS-2. This sector (SB-6) covers a geographical area approximately 2,000 n.m. (3,704 km) square.

Appendix I
Attachment E



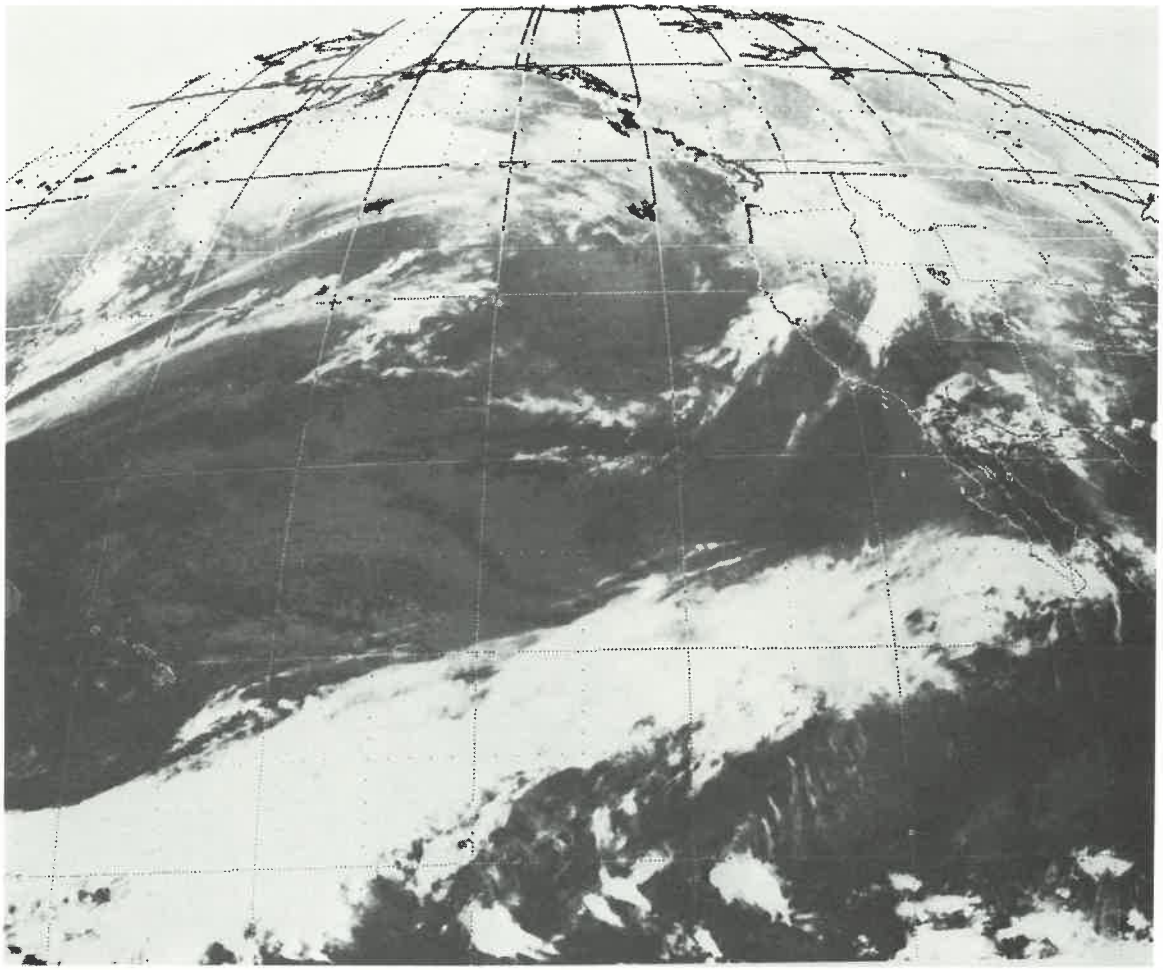
12. A VISIBLE 1/2 n.m. (0.9 km) resolution sector image received from SMS-2. This sector (SA-1) covers a geographical area approximately 1,000 n.m. (1,852 km) square. A computerized grid has been automatically implanted on the image.



13. A VISIBLE 1 n.m. (1.9 km) resolution sector image received from SMS-2. This sector (WB-2) covers a geographical area approximately 4,000 n.m. (7,408 km) square. A computerized grid has been automatically implanted on the image. This image is not available for transmission but is available to the Washington Complex (CDDF) and EDS archives.

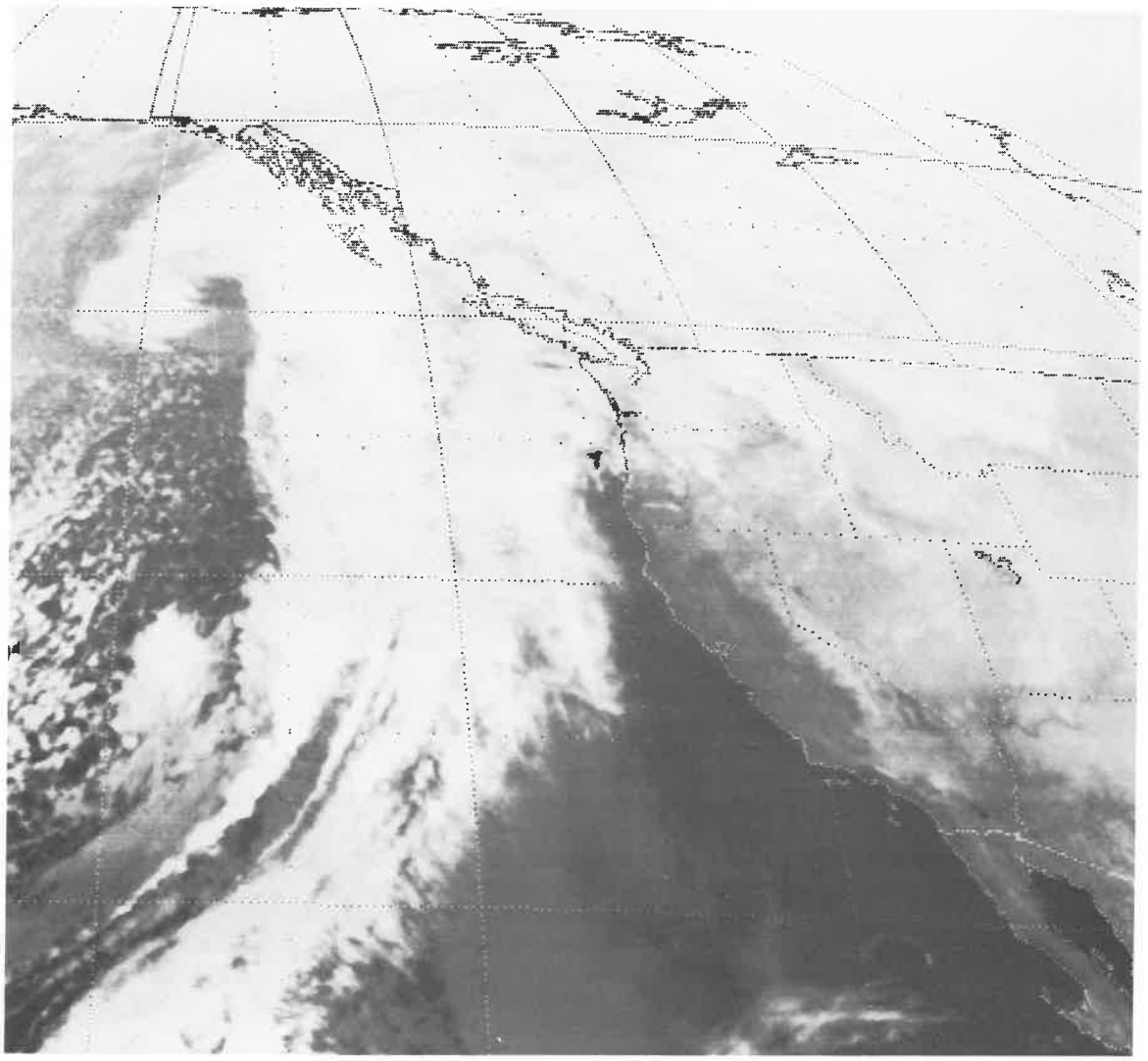
Appendix I
Attachment E

14. Full Disc INFRARED image received from SMS-2 located at 135° W over the Equator. This image has approximately 5 n.m. (9.3 km) resolution and covers a near-circular area approximately 8,000 n.m. (14,816 km) in diameter.



15. Equivalent INFRARED 2 n.m. (3.7 km) sector (UC-2) from SMS-2. This image has approximately 5 n.m. (8 km) resolution and covers a geographical area approximately 4,000 n.m. (7,408 km) square. A computerized grid has been automatically implanted on the image.

Appendix I
Attachment E



16. Equivalent INFRARED 1 n.m. (1.9 km) sector (SB-6) from SMS-2. This image has approximately 5 n.m. (8 km) resolution and covers a geographical area approximately 2,000 n.m. (3,704 km) square. A computerized grid has been automatically implanted on the image.

APPENDIX II

ENHANCED IMAGERY

This Appendix describes the current capability to enhance GOES/SMS imagery to highlight special phenomena of interest. Appendix II contains these Attachments:

Attachment A	GOES/SMS Imagery Enhancement Capability
Attachment A-1	Enhancement Table
Attachment A-2	Enhancement Curve
Attachment A-3	Standard IR Calibration Table
Attachment B	Introduction to GOES/SMS Imagery Enhancement
Attachment B-1	General
Attachment B-2	Examples of Enhancement Response Curves
Attachment C	Operational Enhancement Curves in Active Memory Bank

Appendix II
Attachment A

A.1 GOES/SMS IMAGERY ENHANCEMENT CAPABILITY

A.1.1 The Field Services Division of NESS implemented an operational Imagery Enhancement capability in early 1976. Since then, numerous Enhancement Curves have been tested for possible operational use. Appendix II, Attachment B, "Introduction to GOES Imagery Enhancement," has been prepared to familiarize all users with this enhancement capability. A complete review of this section is recommended.

A.1.2 As of September 1, 1976 there are 13 curves in the active memory bank for distribution to SFSS's, via their floater capability. These curves are AB, BB, CA, CB, DB, EB, FB, GC, HB, MB, PB, SA and ZA. In order to provide samples of new enhanced products that will become operational, the SFSS's will advise their respective users of the data periods when new Enhancement Curves will be available, via the SFSS floaters, for dissemination.

A.1.3 In order to establish an automatic dissemination program of enhanced IR imagery to the WSFO's, via established standard sectors, each NWS Region will submit their desires to the NWS Satellite Services Staff (W11 x 1). The NWS Region should provide a schedule of the 48 data periods and indicate at what times they desire an enhanced product (indicating the curve and sector desired) in lieu of visible data and/or the general purpose equivalent IR Sector (Curve ZA). In the case of the Central and Southern Regions' sectors, NWS has requested a coordinated effort between the Regions prior to submission of their desired schedules. Approved schedule changes will be implemented by NESS/FSD after notification has been disseminated to the GOES user community.

A.2 SUBMISSION OF NEW ENHANCEMENT CURVES FOR OPERATIONAL IMPLEMENTATION

A.2.1 It is envisioned that WSFO's will desire to submit new Enhancement Curves to be considered for operational use. All new curves to be considered will be submitted to their respective Regions for review, modification and approval or disapproval. Approved curves will be forwarded to NWS Headquarters for presentation to the NESS Imagery Enhancement Review Group (IERG). All SFSS's and other staffs in NESS will submit their curves directly to FSD for review by the IERG. This group will be chaired by FSD and composed of one representative each from the NESS Applications Group, NESS Analysis and Evaluation Branch, NESS Environmental Support Group and National Weather Service.

A.2.2 In order to properly record and implement Enhancement Curves, the following information and submission procedure will be required with each new curve that is forwarded for consideration:

A.2.2.1 A short narrative of the intent and justifications for the enhanced product; i.e., what it will be used for; what specific information within the data will be enhanced; time of year desired (seasonal adjustment); desired geographical coverage (sector); and recommended schedule (data periods) for distribution of the enhanced product.

A.2.2.2 Locally reproduce the attached table (Attachment A-1) and the basic chart for plotting the curve (Attachment A-2). Fill in the 256 values in the Enhancement Table. (A calibration table, Attachment A-3, from temperature to count value is included.) Interpolated count values should be rounded to whole numbers.

A.2.2.3 A graph of the table on the enclosed form (Attachment A-2). Number each segment of the graph consecutively from the origin. Fill in the chart below the graph so that other users can easily identify the exact temperature range of each segment. For quick reference indicate the count value at the beginning and end of each segment on the graph. Fill in comment block for temperature segments. Leave "Enhancement Table" legend and "Data Submitted/Implemented" (in upper right corner) blank. Indicate in upper left corner of Attachment A-2, the WSFO, NWS Region, SFSS or NESS unit submitting the curve.

A.2.2.4 Upon approval by the IERG, the curve will be placed in the active inventory for use either as a scheduled product or SFSS Floater Call-up. All WSFO's will receive, from their respective SFSS's, a copy of the Enhancement Curve (table), and its availability (either SFSS Floater and/or approved NWS sector schedule) via telecopier or mail prior to its implementation.

A.3 AMENDMENTS TO THE IMAGERY ENHANCEMENT PROGRAM

As new Enhancement Curves are implemented for operational use, amendments to this section will be forwarded to all users so that a current inventory of Enhancement Curves, and a current list of those Enhancement Curves in the active memory banks, can be maintained.

Appendix II
Attachment A-1

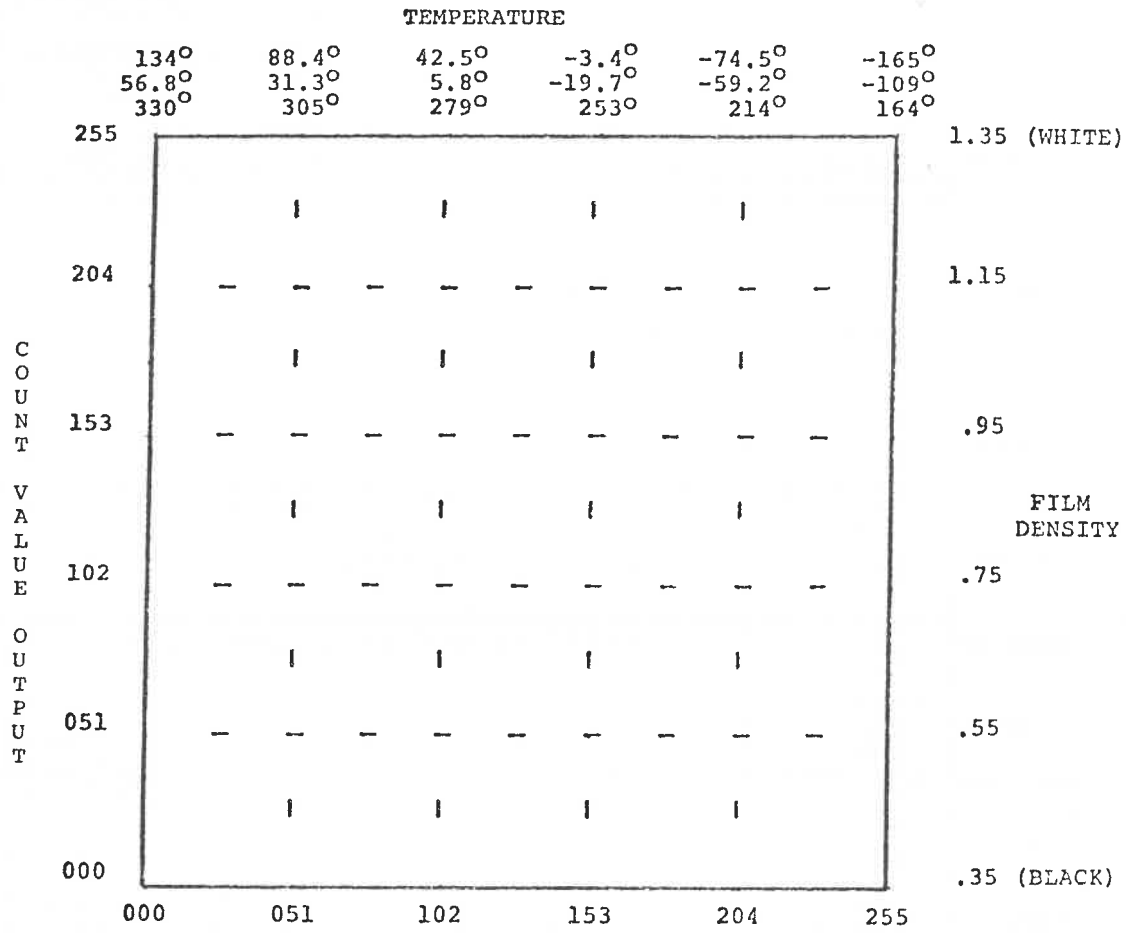
ENHANCEMENT TABLE

	000	001	002	003	004	005	006	007	008	009
000										
010										
020										
030										
040										
050										
060										
070										
080										
090										
100										
110										
120										
130										
140										
150										
160										
170										
180										
190										
200										
210										
220										
230										
240										

NESS
FIELD SERVICES DIVISION

SUBMITTED BY: _____

ENHANCEMENT CURVE _____
DATE SUBMITTED/IMPLEMENTED _____



VERIFIED BY FSD

_____
INITIALS

SEGMENT NUMBER	°C Temperature _____ TO _____	COMMENTS REASON FOR SEGMENT ENHANCEMENT
1		
2		
3		
4		
5		
6		
7		
8		
9		

COUNT VALUE	KELVIN	CENTIGRADE	FAHRENHEIT
000	330.0	56.8	134.3
001	329.5	56.3	133.4
002	329.0	55.8	132.5
003	328.5	55.3	131.6
004	328.0	54.8	130.7
005	327.5	54.3	129.8
006	327.0	53.8	128.9
007	326.5	53.3	128.0
008	326.0	52.8	127.1
009	325.5	52.3	126.2
010	325.0	51.8	125.3
011	324.5	51.3	124.4
012	324.0	50.8	123.5
013	323.5	50.3	122.6
014	323.0	49.8	121.7
015	322.5	49.3	120.8
016	322.0	48.8	119.9
017	321.5	48.3	119.0
018	321.0	47.8	118.1
019	320.5	47.3	117.2
020	320.0	46.8	116.3
021	319.5	46.3	115.4
022	319.0	45.8	114.5
023	318.5	45.3	113.6
024	318.0	44.8	112.7
025	317.5	44.3	111.8
026	317.5	43.8	110.9
027	316.5	43.3	110.0
028	316.0	42.8	109.1
029	315.5	42.3	108.2
030	315.0	41.8	107.3
031	314.5	41.3	106.4
032	314.0	40.8	105.5
033	313.5	40.3	104.6
034	313.0	39.8	103.7
035	312.5	39.3	102.8
036	312.0	38.8	101.9
037	311.5	38.3	101.0
038	311.0	37.8	100.1
039	310.5	37.3	99.2
040	310.0	36.8	98.3
041	309.5	36.3	97.4
042	309.0	35.8	96.5
043	308.5	35.3	95.6
044	308.0	34.8	94.7
045	307.5	34.3	93.8
046	307.0	33.8	92.9
047	306.5	33.3	92.0
048	306.0	32.8	91.1
049	305.5	32.3	90.2
050	305.0	31.8	89.3

COUNT VALUE	KELVIN	CENTIGRADE	FAHRENHEIT
051	304.5	31.3	88.4
052	304.0	30.8	87.5
053	303.5	30.3	86.6
054	303.0	29.8	85.7
055	302.5	29.3	84.8
056	302.0	28.8	83.9
057	301.5	28.3	83.0
058	301.0	27.8	82.1
059	300.5	27.3	81.2
060	300.0	26.8	80.3
061	299.5	26.3	79.4
062	299.0	25.8	78.5
063	298.5	25.3	77.6
064	298.0	24.8	76.7
065	297.5	24.3	75.8
066	297.0	23.8	74.9
067	296.5	23.3	74.0
068	296.0	22.8	73.1
069	295.5	22.3	72.2
070	295.0	21.8	71.3
071	294.5	21.3	70.4
072	294.0	20.8	69.5
073	293.5	20.3	68.6
074	293.0	19.8	67.7
075	292.5	19.3	66.8
076	292.0	18.8	65.9
077	291.5	18.3	65.0
078	291.0	17.8	64.1
079	290.5	17.3	63.2
080	290.0	16.8	62.3
081	289.5	16.3	61.4
082	289.0	15.8	60.5
083	288.5	15.3	59.6
084	288.0	14.8	58.7
085	287.5	14.3	57.8
086	287.0	13.8	56.9
087	286.5	13.3	56.0
088	286.0	12.8	55.1
089	285.5	12.3	54.2
090	285.0	11.8	53.3
091	284.5	11.3	52.4
092	284.0	10.8	51.5
093	283.5	10.3	50.6
094	283.0	9.8	49.7
095	282.5	9.3	48.8
096	282.0	8.8	47.9
097	281.5	8.3	47.0
098	281.0	7.8	46.1
099	280.5	7.3	45.2
100	280.0	6.8	44.3
101	279.5	6.3	43.3

COUNT VALUE	KELVIN	CENTIGRADE	FAHRENHEIT
102	279.0	5.8	42.5
103	278.5	5.3	41.6
104	278.0	4.8	40.7
105	277.5	4.3	39.8
106	277.0	3.8	38.9
107	276.5	3.3	38.0
108	276.0	2.8	37.1
109	275.5	2.3	36.2
110	275.0	1.8	35.3
111	274.5	1.3	34.4
112	274.0	.8	33.5
113	273.5	.3	32.6
114	273.0	-.2	31.7
115	272.5	-.7	30.8
116	272.0	-1.2	29.9
117	271.5	-1.7	29.0
118	271.0	-2.2	28.1
119	270.5	-2.7	27.2
120	270.0	-3.2	26.3
121	269.5	-3.7	25.4
122	269.0	-4.2	24.5
123	268.5	-4.7	23.6
124	268.0	-5.2	22.7
125	267.5	-5.7	21.8
126	267.0	-6.2	20.9
127	266.5	-6.7	20.0
128	266.0	-7.2	19.1
129	265.5	-7.7	18.2
130	265.0	-8.2	17.3
131	264.5	-8.7	16.4
132	264.0	-9.2	15.5
133	263.5	-9.7	14.6
134	263.0	-10.2	13.7
135	262.5	-10.7	12.8
136	262.0	-11.2	11.9
137	261.5	-11.7	11.0
138	261.0	-12.2	10.1
139	260.5	-12.7	9.2
140	260.0	-13.2	8.3
141	259.5	-13.7	7.4
142	259.0	-14.2	6.5
143	258.5	-14.7	5.6
144	258.0	-15.2	4.7
145	257.5	-15.7	3.8
146	257.0	-16.2	2.9
147	256.5	-16.7	2.0
148	256.0	-17.2	1.1
149	255.5	-17.7	.2
150	255.0	-18.2	-.7
151	254.5	-18.7	-1.6
152	254.0	-19.2	-2.5

COUNT VALUE	KELVIN	CENTIGRADE	FAHRENHEIT
153	253.5	-19.7	-3.4
154	253.0	-20.2	-4.3
155	252.5	-20.7	-5.2
156	252.0	-21.2	-6.1
157	251.5	-21.7	-7.0
158	251.0	-22.2	-7.9
159	250.5	-22.7	-8.8
160	250.0	-23.2	-9.7
161	249.5	-23.7	-10.6
162	249.0	-24.2	-11.5
163	248.5	-24.7	-12.4
164	248.0	-25.2	-13.3
165	247.5	-25.7	-14.2
166	247.0	-26.2	-15.1
167	246.5	-26.7	-16.0
168	246.0	-27.2	-16.9
169	245.5	-27.7	-17.8
170	245.0	-28.2	-18.7
171	244.5	-28.7	-19.6
172	244.0	-29.2	-20.5
173	243.5	-29.7	-21.4
174	243.0	-30.2	-22.3
175	242.5	-30.7	-23.2
176	242.0	-31.2	-24.1
177	241.0	-32.2	-25.9
178	240.0	-33.2	-27.7
179	239.0	-34.2	-29.5
180	238.0	-35.2	-31.3
181	237.0	-36.2	-33.1
182	236.0	-37.2	-34.9
183	235.0	-38.2	-36.7
184	234.0	-39.2	-38.5
185	233.0	-40.2	-40.3
186	232.0	-41.2	-42.1
187	231.0	-42.2	-43.9
188	230.0	-43.2	-45.7
189	229.0	-44.2	-47.5
190	228.0	-45.2	-49.3
191	227.0	-46.2	-51.1
192	226.0	-47.2	-52.9
193	225.0	-48.2	-54.7
194	224.0	-49.2	-56.5
195	223.0	-50.2	-58.3
196	222.0	-51.2	-60.1
197	221.0	-52.2	-61.9
198	220.0	-53.2	-63.7
199	219.0	-54.2	-65.5
200	218.0	-55.2	-67.3
201	217.0	-56.2	-69.1
202	216.0	-57.2	-70.9
203	215.0	-58.2	-72.7

COUNT VALUE	KELVIN	CENTIGRADE	FAHRENHEIT
204	214.0	-59.2	-74.5
205	213.0	-60.2	-76.3
206	212.0	-61.2	-78.1
207	211.0	-62.2	-79.9
208	210.0	-63.2	-81.7
209	209.0	-64.2	-83.5
210	208.0	-65.2	-85.3
211	207.0	-66.2	-87.1
212	206.0	-67.2	-88.9
213	205.0	-68.2	-90.7
214	204.0	-69.2	-92.5
215	203.0	-70.2	-94.3
216	202.0	-71.2	-96.1
217	201.0	-72.2	-97.9
218	200.0	-73.2	-99.7
219	199.0	-75.2	-101.5
220	198.0	-75.2	-103.3
221	197.0	-76.2	-105.1
222	196.0	-77.2	-106.9
223	195.0	-78.2	-108.7
224	194.0	-79.2	-110.5
225	193.0	-80.2	-112.3
226	192.0	-81.2	-114.1
227	191.0	-82.2	-115.9
228	190.0	-83.2	-117.7
229	189.0	-84.2	-119.5
230	188.0	-85.2	-121.3
231	187.0	-86.2	-123.1
232	186.0	-87.2	-124.9
233	185.0	-88.2	-126.7
234	184.0	-89.2	-128.5
235	183.0	-90.2	-130.3
236	182.0	-91.2	-132.1
237	181.0	-92.2	-133.9
238	180.0	-93.2	-135.7
239	179.0	-94.2	-137.5
240	178.0	-95.2	-139.3
241	177.0	-96.2	-141.1
242	176.0	-97.2	-142.9
243	175.0	-98.2	-144.7
244	174.0	-99.2	-146.5
245	173.0	-100.2	-148.3
246	172.0	-101.2	-150.1
247	171.0	-102.2	-151.9
248	170.0	-103.2	-153.7
249	169.0	-104.2	-155.5
250	168.0	-105.2	-157.3
251	167.0	-106.2	-159.1
252	166.0	-107.2	-160.9
253	165.0	-108.2	-162.7
254	164.0	-109.2	-164.5
255	163.0	-110.2	-165.3

STANDARD IR CALIBRATION

INTRODUCTION TO GOES/SMS IMAGERY ENHANCEMENT

B-1.1 GENERAL

Starting in early 1976, additional memory and sectorizer control capability was installed at the Central Data Distribution Facility (CDDF). This expansion provided temperature enhancement capability of GOES/SMS IR data. All SFSS's and NWS regions have the use of this capability. This Attachment provides field offices with the basic principles of enhancing and examples of enhancement tests conducted to date.

B-1.2 BACKGROUND

Infrared energy detected by the GOES/SMS infrared sensor is transmitted in digital form from the satellites to the Wallops CDA station. Here the radiance measurements are converted to equivalent black body temperatures (the calibration process). The data is then re-transmitted in digital form via the satellite to the CDDF where it is sectorized and converted to analog for re-transmission to users.

In the sectorizer, 256 digital count values represent a specific range of temperatures. After conversion to analog, these count values are transmitted to the field offices as 256 gray shades. This number of gray shades cannot be seen on the displayed image due to several reasons (primarily the gray scale range and linearity of the display equipment and the level of the noise on the C-5 circuits). The maximum number of gray shades that can be seen is from about 15 to about 40, depending on the combined effect of the limiting conditions at each specific office. (The 256 gray shades in the satellite data should not be confused with the gray scale at the top of each transmitted image. That gray scale contains only 17 steps when transmitted, and is intended only to check the gray scale range and linearity of the display equipment.)

Presently, the count values of the satellite data are unchanged by the sectorizers. Also, the calibration of the data received at the CDDF is maintained constant by the Wallops CDA station and is defined in Attachment A-3. It should be noted that this satellite calibration is not linear. Each count represents a 0.5° change from 330°K to 242°K and a 1.0° change from 242°K to 163°K.

Appendix II
Attachment B

B-1.3 ENHANCEMENT

When temperature gradients are small, it is difficult to recognize significant cloud and surface features in IR imagery. These include fog and stratus, haze, thunderstorm tops, ocean current boundaries and terrain features. The purpose of enhancement is to increase the contrast between those features and their background. If more temperature definition is desired than that which can be displayed without enhancement, the available gray shades can be displayed through a smaller temperature range by modification of the count values in the sectorizers (before conversion to analog). Completion of the "Enhancement Table" (Attachment A-1) will define the desired modification.

Figure B-1 is a graphic illustration of a sectorized enhancement table. Count values as input to the sectorizers are plotted on the horizontal axis and count values as modified by the sectorizers are plotted on the vertical axis. As points of reference, the six count values on the horizontal axis correspond to the six sets of temperatures at the top of the graph. The count values on the vertical axis result in the gray shade range as referenced at the right of the graph. The solid line (AB) represents the case of no enhancement (output count values equal input count values).

If, for example, the warmer (darker) end of the spectrum requires greater definition, the data can be modified in the sectorizers as illustrated by the dotted segment (AC) in Figure B-1. Here all gray shades are displayed from +56° to 5.8°C. This technique is commonly referred to as a steep linear enhancement with a slope of greater than 1.0. Another enhancement technique is that of contouring or "step function" construction. In this technique, certain temperature ranges are assigned specific gray shades. An example is given in Figure B-1 as segment D E F, G H I. A black shade is assigned to all temperatures from +5.8° to -8.0°C, a dark gray shade within the range -8.0° to -19.7°C, and a lighter gray shade from -19.7° to -39.5°C. This technique has the advantage of simplicity in interpretation.

For an enhancement curve to be fully utilized by field forecasters, two basic criteria should be considered: (1) a limited number of features enhanced, and (2) afford as much detail in the data as possible without making the display overly confusing. The "step function" technique, providing contouring in a display, has the advantage of making deep vertically structured cloud areas obvious. However, some data loss is encountered when assigning a range of temperatures to a given gray shade. The steep linear enhancing technique, on the other hand, provides excellent detail in the data. Multiple linear enhancement provides

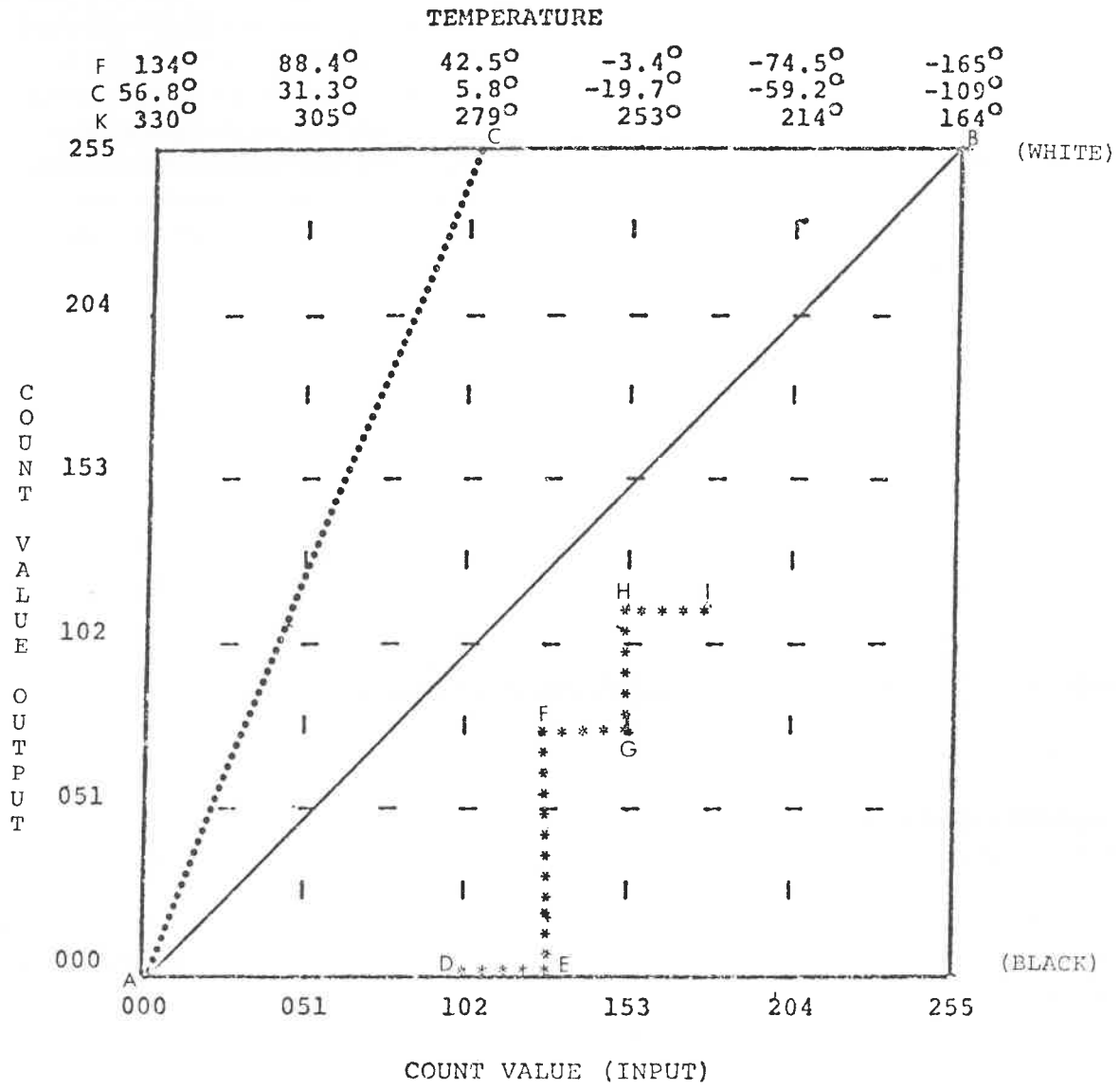


Figure B-1. Examples of IR enhancement look-up curves: AB, normal linear; AC, steep linear; and D-I, step function or contouring

increased contrast over the total temperature range but also introduces multiple gray scale boundaries in cloud systems, which may mask meteorologically significant cloud edges. There are always trade-offs between simple enhancement curves, which sacrifice detail but can be quickly interpreted in an operational environment, and complex curves, which maximize the information content but require more time to interpret. Experience to date indicates a blend of contouring and steep linear enhancing is the best approach in constructing an operational display.

Appendix II
Attachment C

OPERATIONAL ENHANCEMENT CURVES IN ACTIVE MEMORY BANK

More than 100 Enhancement Curves have been tested and evaluated by NESS since the implementation of the IR Imagery Enhancement Program. Presentation of these tests and evaluations are beyond the scope of this document. Consequently, only the operational Enhancement Curves (as of September 1, 1976) are provided. Changes, additions, and deletions of curves in the Operational Memory Bank will be provided by amendments to this publication.

Appendix II
Attachment C

OPERATIONAL ENHANCEMENT CURVES IN ACTIVE MEMORY BANK

(September 1, 1976)

(Updates will be provided by formal amendments to this section.)

Example of Imagery Enhancement Curve A_B
Sectorizer Enhancement Curve A_B

Example of Imagery Enhancement Curve B_B
Sectorizer Enhancement Curve B_B

Example of Imagery Enhancement Curve C_A
Sectorizer Enhancement Curve C_A

Example of Imagery Enhancement Curve C_B
Sectorizer Enhancement Curve C_B

Example of Imagery Enhancement Curve D_B
Sectorizer Enhancement Curve D_B

Example of Imagery Enhancement Curve E_B
Sectorizer Enhancement Curve E_B

Example of Imagery Enhancement Curve F_B
Sectorizer Enhancement Curve F_B

Example of Imagery Enhancement Curve G_C
Sectorizer Enhancement Curve G_C

Example of Imagery Enhancement Curve H_B
Sectorizer Enhancement Curve H_B

Example of Imagery Enhancement Curve M_B
Sectorizer Enhancement Curve M_B

Example of Imagery Enhancement Curve P_B
Sectorizer Enhancement Curve P_B

Example of Imagery Enhancement Curve S_A
Sectorizer Enhancement Curve S_A

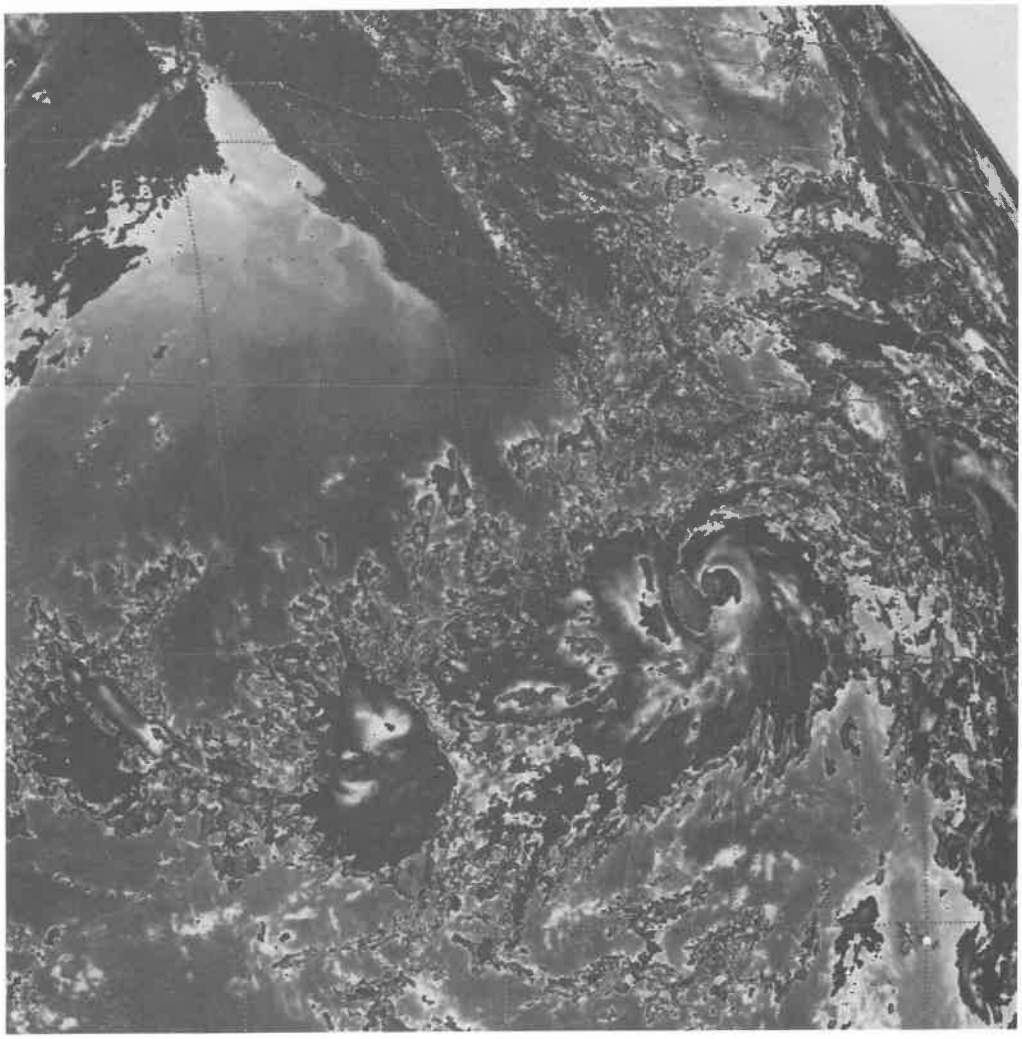
Example of Imagery Enhancement Curve Z_A
Sectorizer Enhancement Curve Z_A

Appendix II
Attachment C

ENHANCEMENT CURVE
A_B

General Description

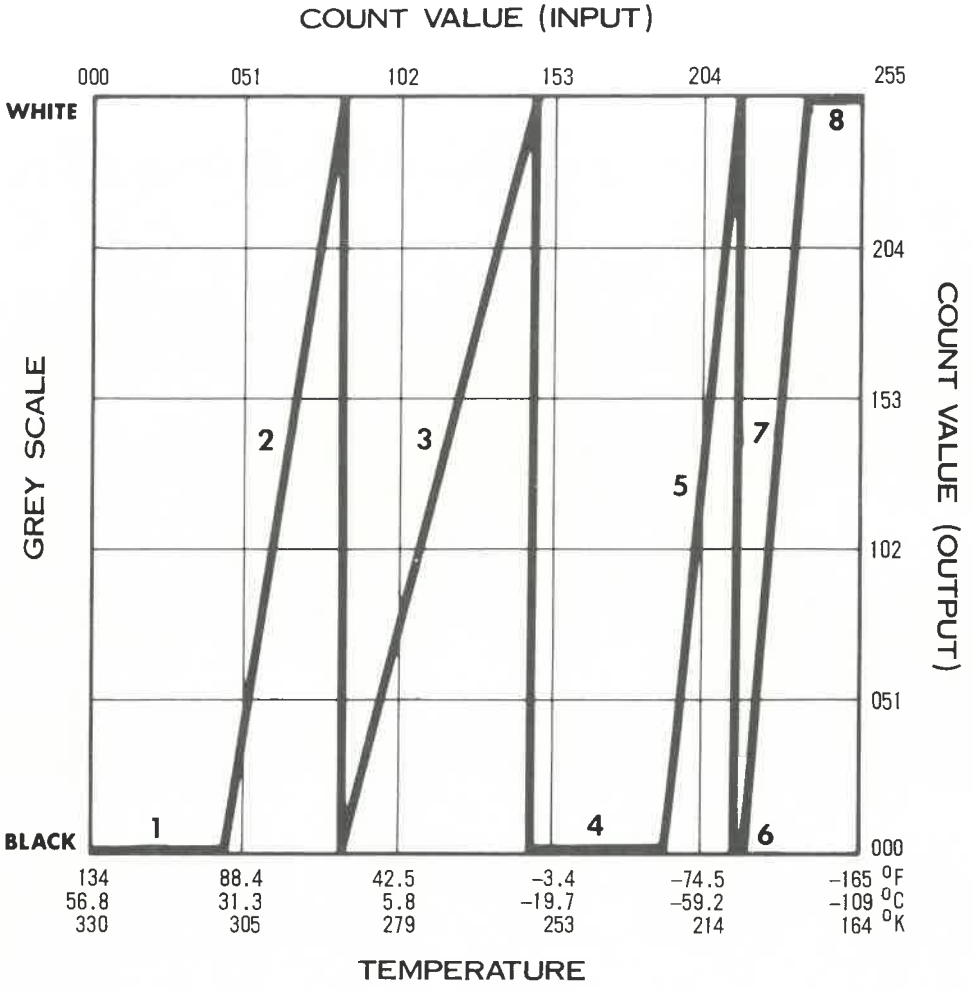
Hurricane Curve. Provides a broader range of temperatures to depict the cirrus canopy to include warmer storms, and a better presentation of cumulus cloud bands. It retains the buffer between the cloud bands and cirrus canopy for ease of use. It provides enhancement of 2C steps in the cirrus canopy with a marker band in black to allow determination of the gray shade representing the storm top. The primary use of this curve is to assist the analyst in precisely locating tropical cyclones at night using IR data, as well as to depict the structure of the cirrus canopy with underlying heavy convection and the surrounding cumulus banding.



NESS
FIELD SERVICES DIVISION

SUBMITTED BY:
Miami SFSS (& NHC)
VERIFIED BY:
RPC
(FSD Initials)

ENHANCEMENT TABLE $^{A}_{B}$
IMPLEMENTED 5/27/76



SEGMENT NUMBER	°C TEMPERATURE ____ TO ____			COMMENTS REASON FOR SEGMENT ENHANCEMENT
1	+56.8	to	+35.3	(Black)
2	+35.3	to	+15.3	Land-Sea Contrast for Registration
3	+15.3	to	-15.3	Depict Cumulus Cloud Bands
4	-15.3	to	-44.2	Buffer Zone (Black)
5	-44.2	to	-68.2	Depict Cirrus Canopy, 2 Deg. Increments
6	-68.2	to	-70.2	Marker Band (black)
7	-70.2	to	-90.2	Cirrus Canopy, 2 Deg. Increments
8	-90.2	to	-110.2	(White) (Above Hurricane Tops)

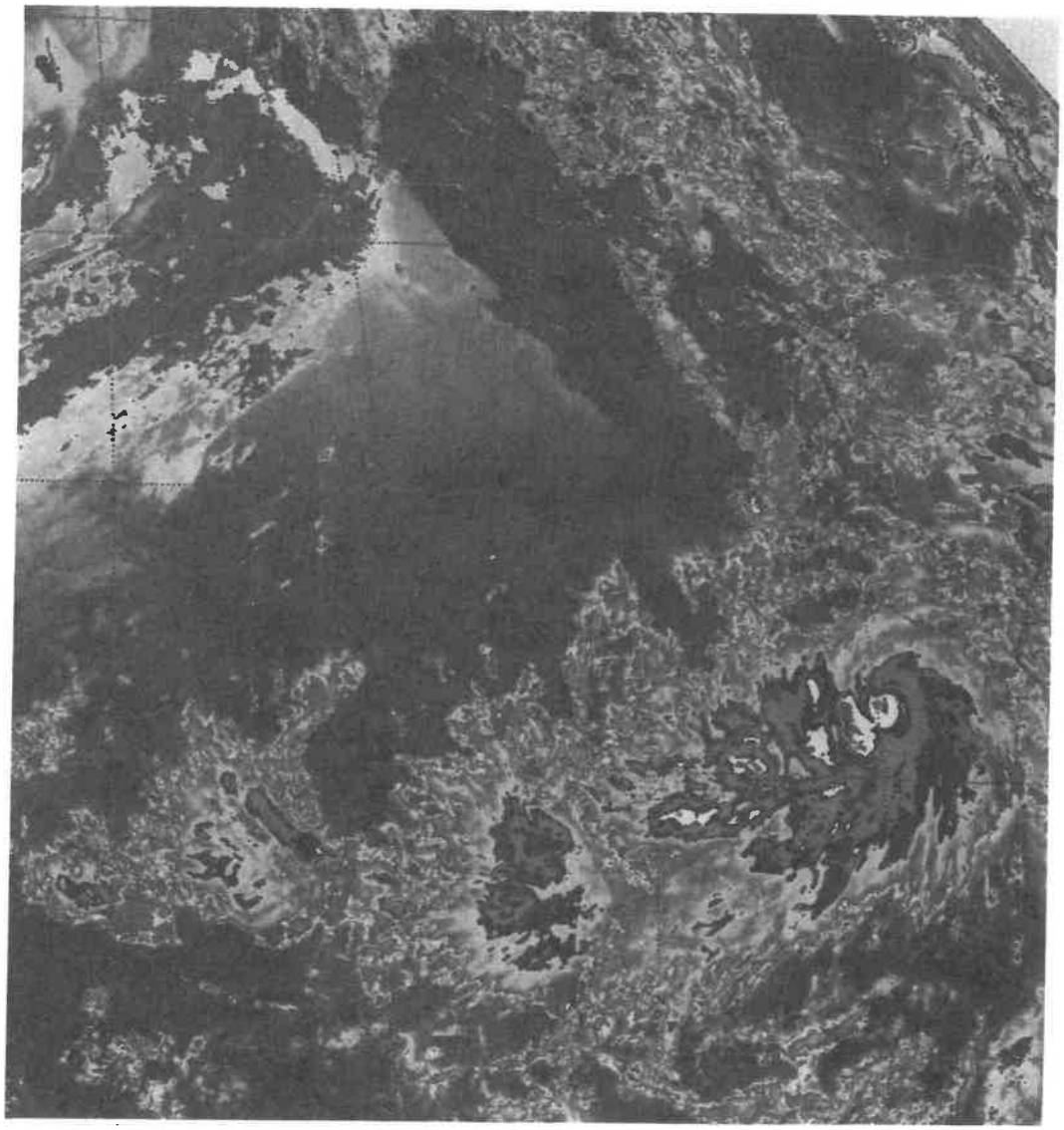
Appendix II
Attachment C

ENHANCEMENT CURVE
B_B

General Description

Hurricane pattern recognition curve. The purpose of this curve is to enhance hurricane patterns in specified temperature ranges. These temperatures are used to aid the analyst in classifying tropical cyclones for wind speed determinations.

(Hurricane Research Support - NESS Applications)



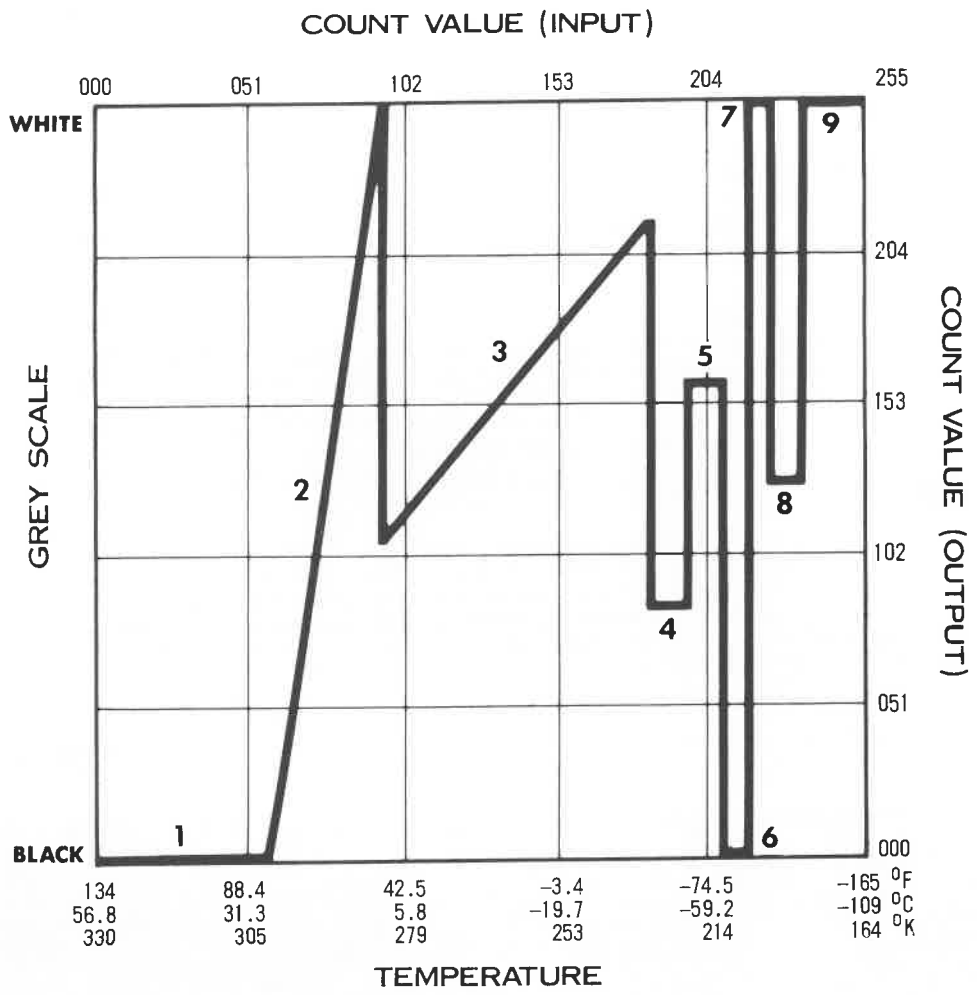
NESS
FIELD SERVICES DIVISION

SUBMITTED BY:

VERIFIED BY:
RPC
(FSD Initials)

ENHANCEMENT TABLE $^{B}_{B}$

IMPLEMENTED 5/27/76



SEGMENT NUMBER	°C TEMPERATURE ____ TO ____	COMMENTS REASON FOR SEGMENT ENHANCEMENT
1	56.8 to 28.3	No Significant Data
2	27.8 to 9.3	Ocean Thermal Features/Low Cumulus
3	8.8 to -41.2	Buffer/Cirrus Outflow
4	-42.2 to -53.2	Dark Grey-Primary Pattern Outline
5	-54.2 to -63.2	Lt. Grey-Primary Pattern Outline
6	-64.2 to -69.2	Black Outline of Central Dense Ovc
7	-70.2 to -75.2	Cold Pattern Outline
8	-76.2 to -90	Cold Pattern Outline
9	< -90	No Data

Appendix II
Attachment C

ENHANCEMENT CURVE
C_A

General Description

This curve uses a step function format to enhance the cold cloud tops as well as steep linear enhancement for the coldest and warmest portions of the data. The step function of Curve M is combined with the steep linear enhancement of the coldest cloud tops used in Curve A. The warmer portion of the data is displayed using a steeper curve than M to give better definition to low clouds.

Advantages

1. Convective tops stand out with good detail in the higher tops.

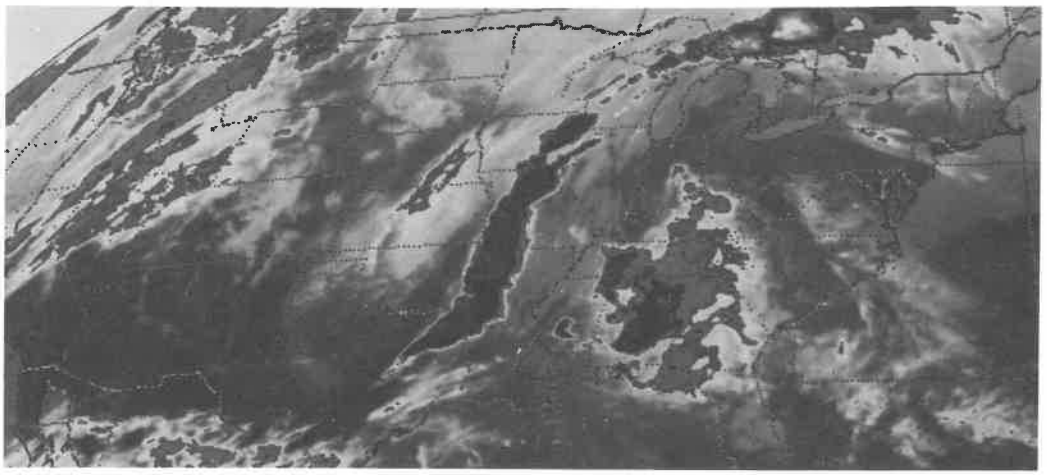
2. This display is a good compromise -- simple enough to be easily interpreted but with steep slopes at the warm and cold end to provide useful details.

Disadvantages

1. When the coldest anvil tops are relatively flat, segment 8 of the curve can produce areas of gray similar in shade to those which appear in the contoured portion of the data. This can lead to confusion on a given picture as to whether one is looking at cold tops or breaks containing warmer lower clouds within a convective area.

Comments

Convective activity in southern Louisiana, southeast Texas, and across the northern Mississippi Valley appears contoured. Distinct lighter gray shades exemplify the coldest thunderstorm tops within this contoured zone. Take for example, the cluster northwest of Houston. The portion of the display which progresses from black to almost white is a result of all the gray shades being displayed from -63.2^{o} to $-70.2^{o}C$ (segment #8). The same result is revealed in other thunderstorm clusters. Features within the warmer end of the spectrum are also better defined, but not as much as in Curve A. Note the sharpness in the oceanic stratus boundary off California and Baja, California.



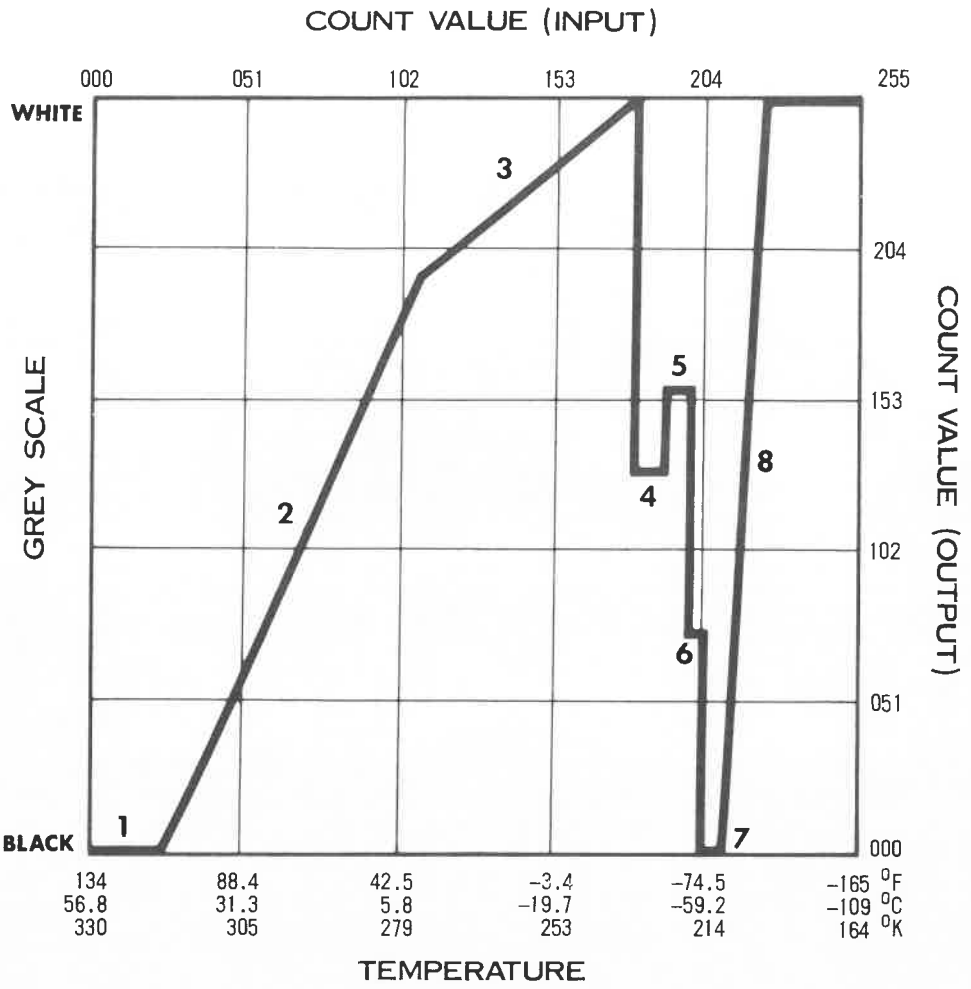
NESS
FIELD SERVICES DIVISION

SUBMITTED BY:

VERIFIED BY: RPC
(FSD Initials)

ENHANCEMENT TABLE C_A

IMPLEMENTED 5/11/76



SEGMENT NUMBER	°C Temperature ____ To ____	COMMENTS REASON FOR SEGMENT ENHANCEMENT
1	56.8 to 40.8	
2	40.8 to 0.8	Surface and low cloud enhancement
3	0.8 to -31.2	Cloud Tops temps below freezing
4	-32.2 to -41.2	Thunderstorm enhancement
5	-42.2 to -52.2	
6	-53.2 to -58.2	
7	-59.2 to -62.2	
8	-63.2 to -70.7	Overshooting CB temps

Appendix II
Attachment C

ENHANCEMENT CURVE
C_B

General Description (convective activity)

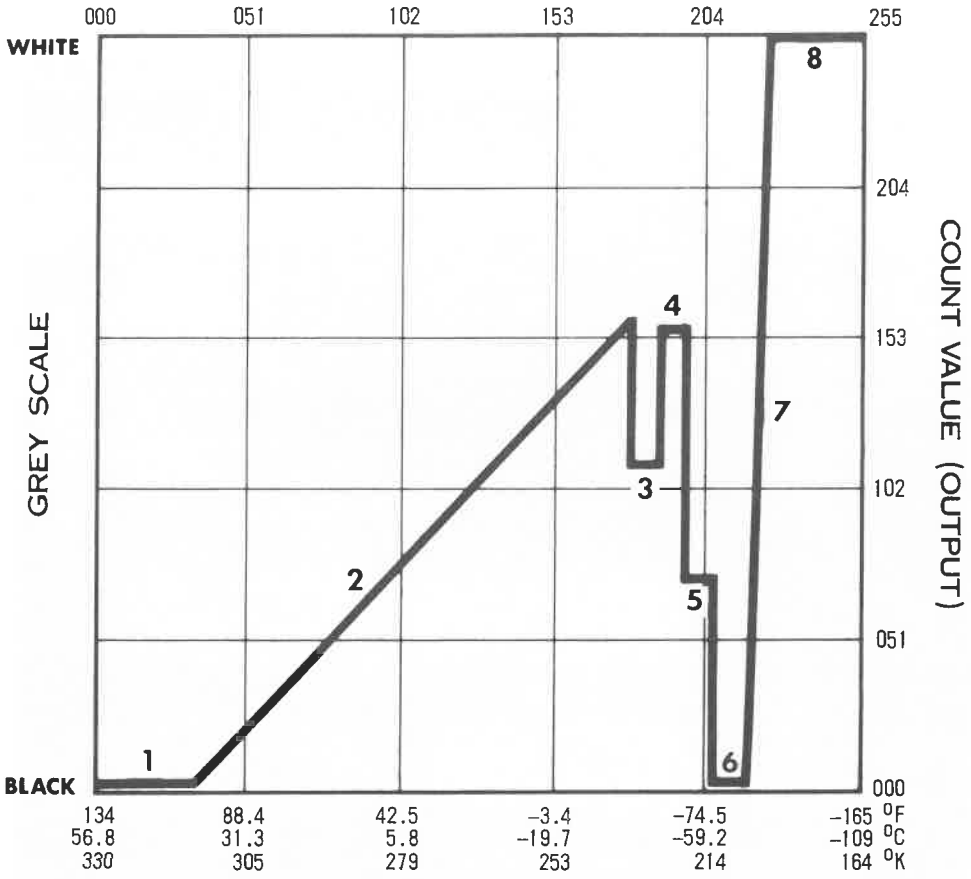
A modification of the original C Curve to better display warm features such as terrain "hot spots". The lower end of the old C Curve appeared too bright which was a distinct disadvantage. This curve should be suitable for fall and spring seasons. Also useful during colder season along the Gulf Coast region. In order to cover different seasons of the year, vertical extent of convective activity and tropopause thermal changes - a family of curves have been implemented to choose from (C_B, D_B, E_B AND M_B).

NESS
FIELD SERVICES DIVISION

SUBMITTED BY:
MKC SFSS
VERIFIED BY:
RPQ
(FSD Initials)

ENHANCEMENT TABLE ^{C}B
IMPLEMENTED 4/21/76

COUNT VALUE (INPUT)



TEMPERATURE

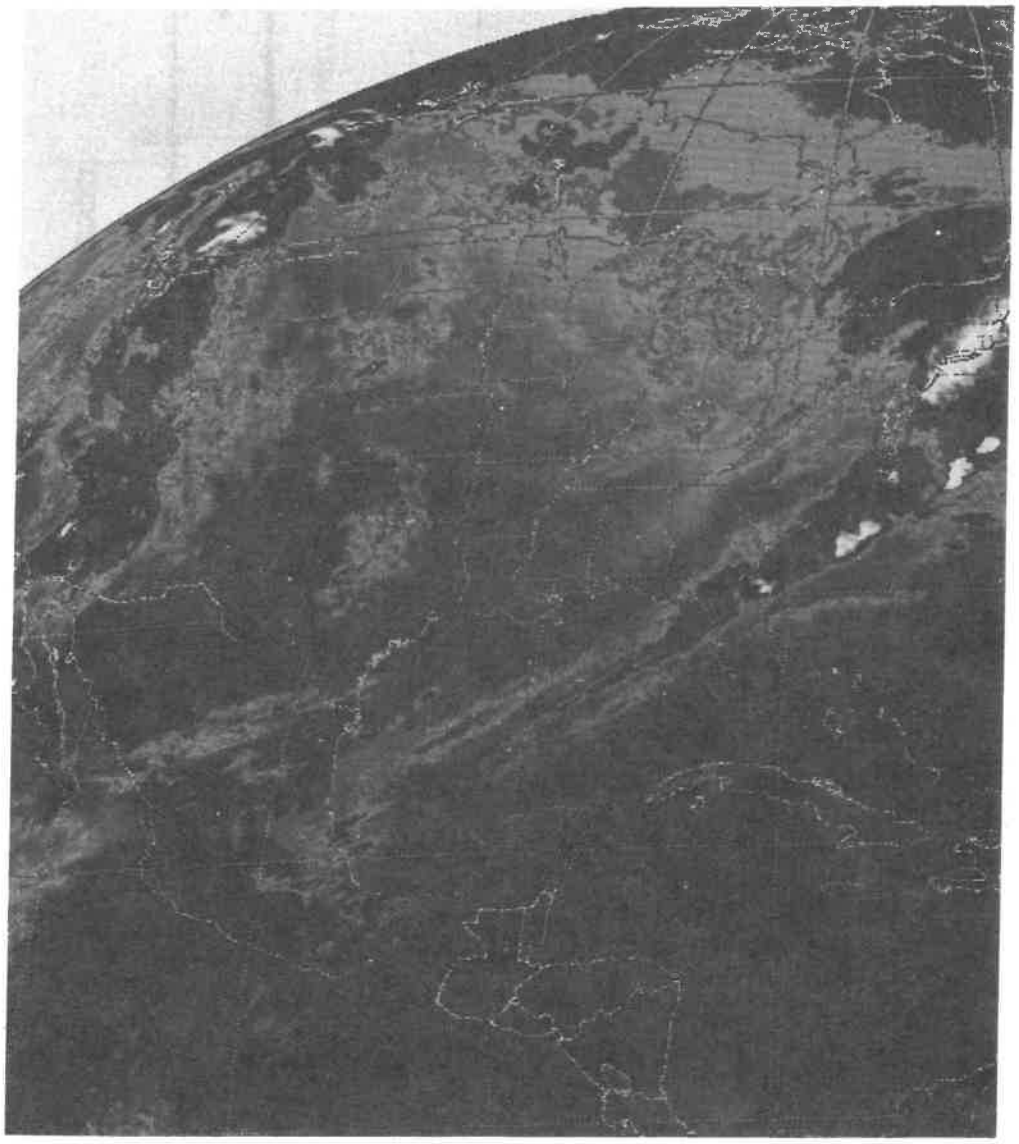
SEGMENT NUMBER	°C TEMPERATURE ____ TO ____	COMMENTS REASON FOR SEGMENT ENHANCEMENT	
1	58.8 to 40.3	No Met Data	
2	39.8 to -31.2	Low Level Features	
3	-32.2 to -41.2		(Med Grey)
4	-42.2 to -52.2	Thunderstorm	(Light Grey)
5	-53.2 to -58.2	Enhancement	(Dark Grey)
6	-59.2 to -62.2		(Black)
7	-63.2 to -70.2	Cb Tops	(Black to White)
8	-71.2 to -109.0	White	

Appendix II
Attachment C

ENHANCEMENT CURVE
D_B

General Description

Convective activity curve for use in spring and fall. One of a family of convective activity curves with slight changes to compensate for temperature differences in the vertical extent of convective activity and troppopause thermal changes. Offers flexibility when choosing from other convective curves (C_B, E_B and M_B).



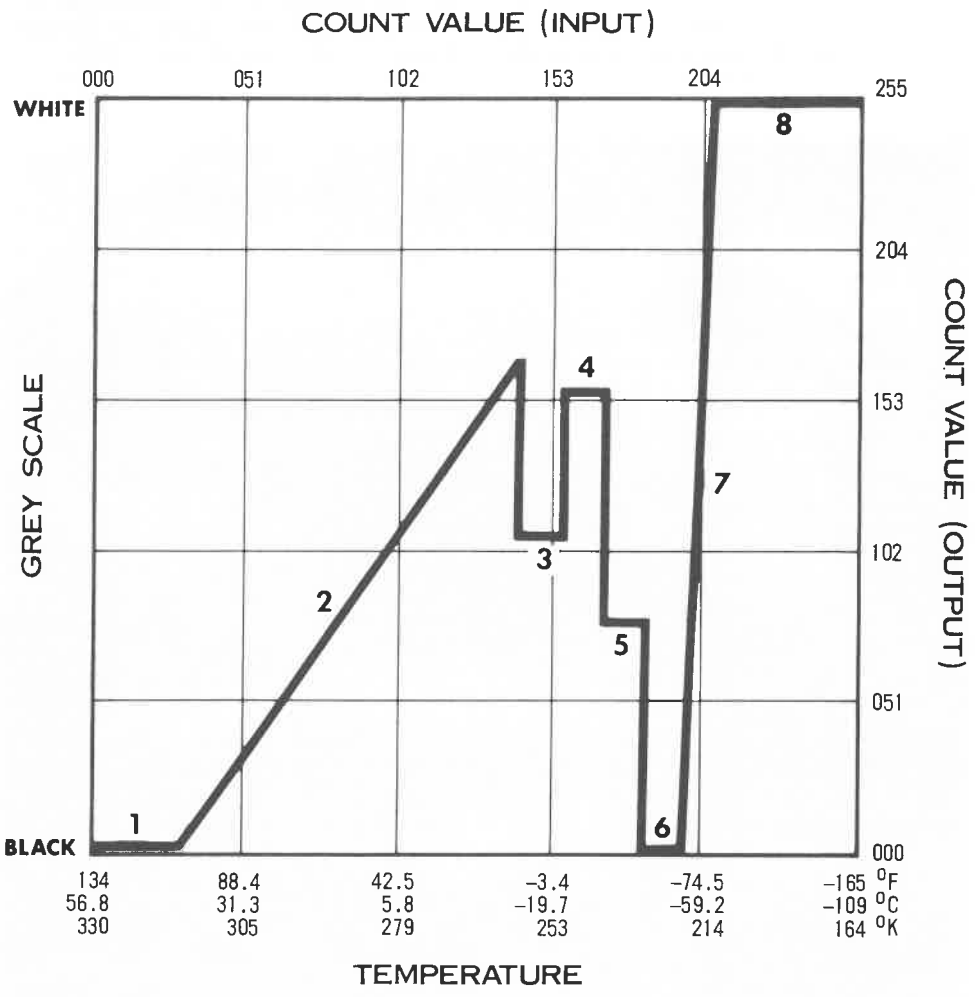
NESS
FIELD SERVICES DIVISION

SUBMITTED BY:
MKC SFSS

VERIFIED BY:
RPc
(FSD Initials)

ENHANCEMENT TABLE $^{D}_{B}$

IMPLEMENTED 4/21/76



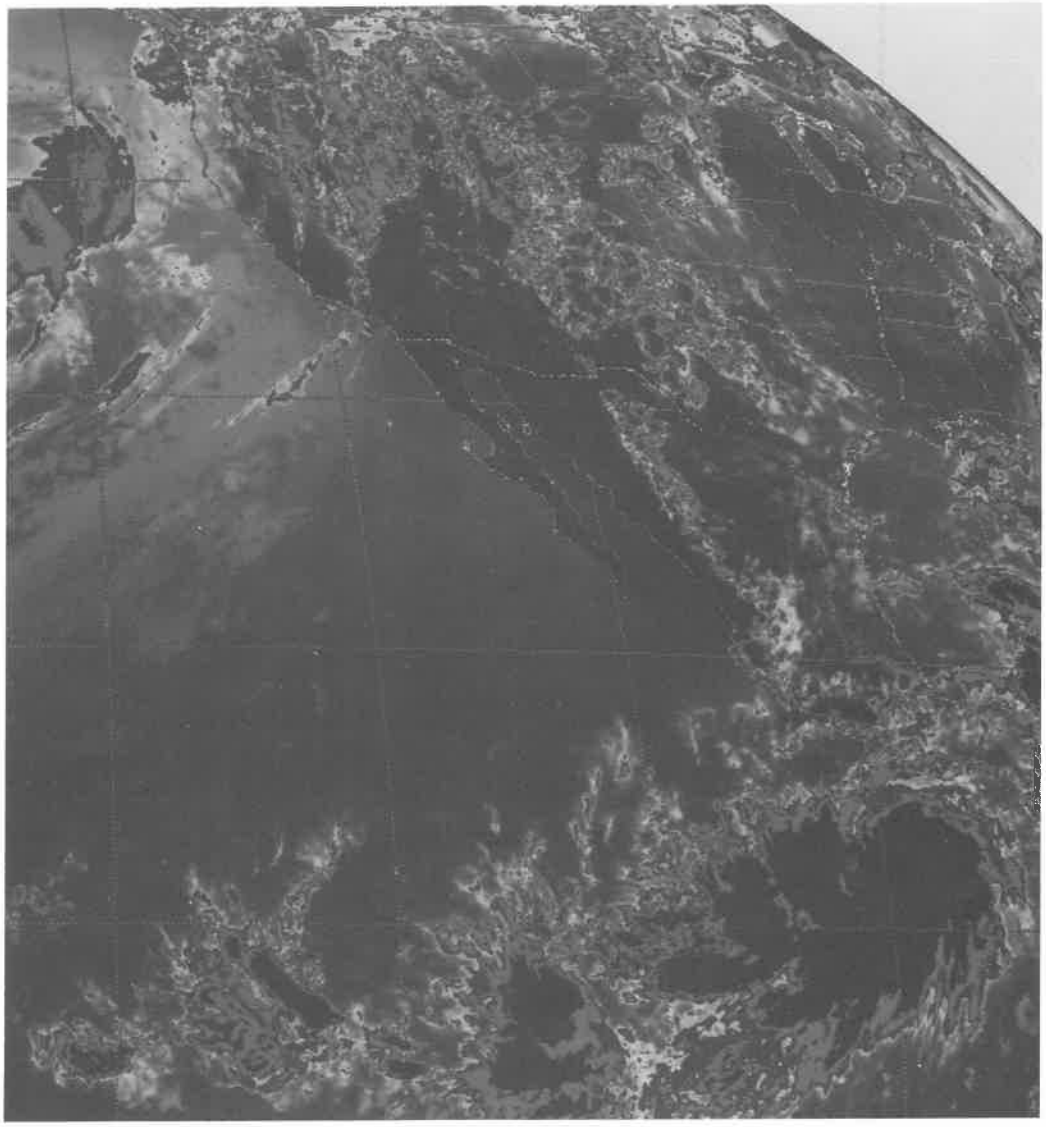
SEGMENT NUMBER	°C TEMPERATURE ____ TO ____			COMMENTS REASON FOR SEGMENT ENHANCEMENT	
1	58.8	to	40.8	No Met Data	
2	40.3	to	-15.7	Low Level Features	
3	-16.2	to	-20.7	Thunderstorm Enhancement	(Med Grey)
4	-21.7	to	-30.2		(Light Grey)
5	-30.7	to	-40.2		(Dark Grey)
6	-41.2	to	-50.2		(Black)
7	-51.2	to	-60.2	Cb Tops	(Black to White)
8	-61.2	to	-109.0	White	

Appendix II
Attachment C

ENHANCEMENT CURVE
E_B

General Description

Enhancement of middle clouds and convective activity. During fall, winter and spring precipitation is often associated with middle cloudiness. This curve will help delineate the middle clouds and hopefully call attention to areas of possible precipitation. In addition, it will differentiate between the anvil of thunderstorm turrets which penetrate the tropopause. This curve is one of the family of convective activity curves (C_B, D_B, E_B AND M_B).

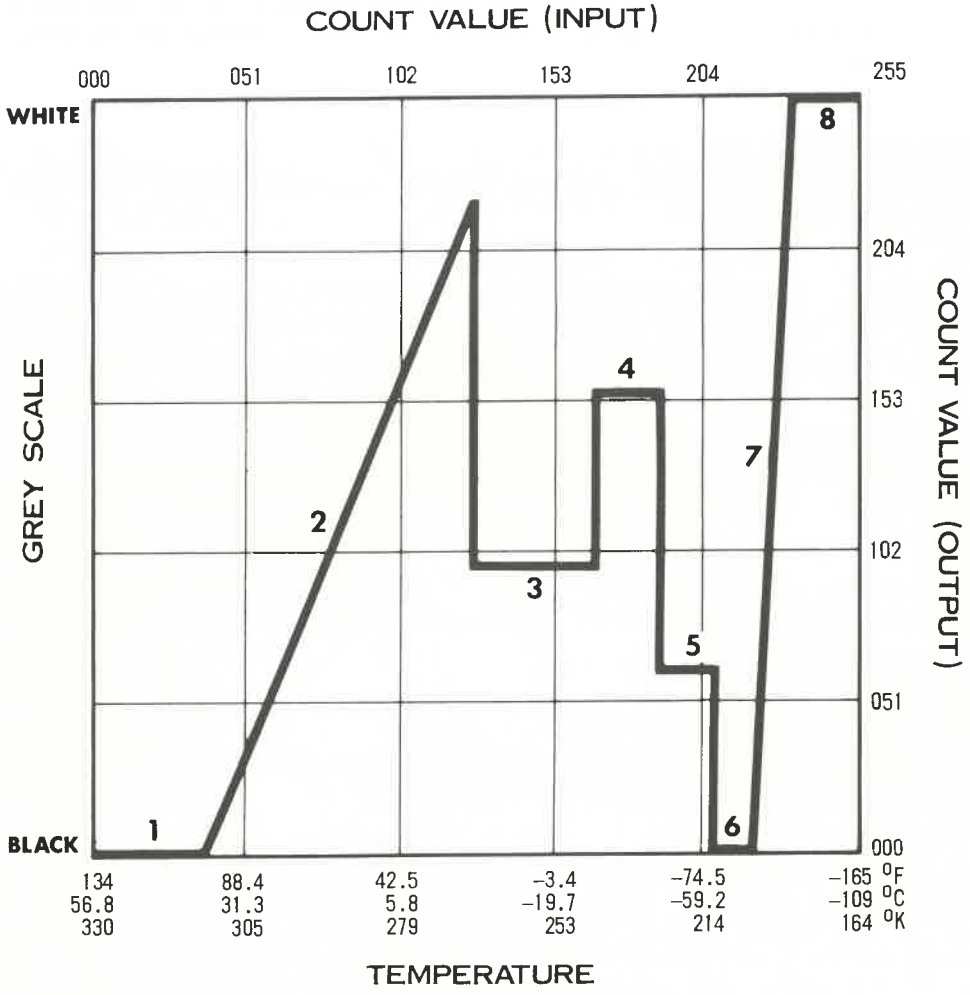


NESS
FIELD SERVICES DIVISION

SUBMITTED BY:
Western Region
VERIFIED BY:
RPc
(FSD Initials)

ENHANCEMENT TABLE E_B

IMPLEMENTED 4/21/76



SEGMENT NUMBER	°C TEMPERATURE ____ TO ____	COMMENTS REASON FOR SEGMENT ENHANCEMENT
1	56.8 to 40.3(33)	
2	39.8 (34) to -9.7(133)	land and low clouds
3	-10.2 (134) to -25.7(165)	middle cloud threshold
4	-28.2 (166) to -42.2(187)	middle clouds and high clouds
5	-43.2 (188) to -62.2(207)	high cloud
6	-63.2 (208) to -73.2(218)	thunderstorm anvil
7	-74.2 (219) to -87.2(232)	thunderstorm turret
8	-88.2 (233) to -110.2(255)	

Appendix II
Attachment C

ENHANCEMENT CURVE
F_B

General Description

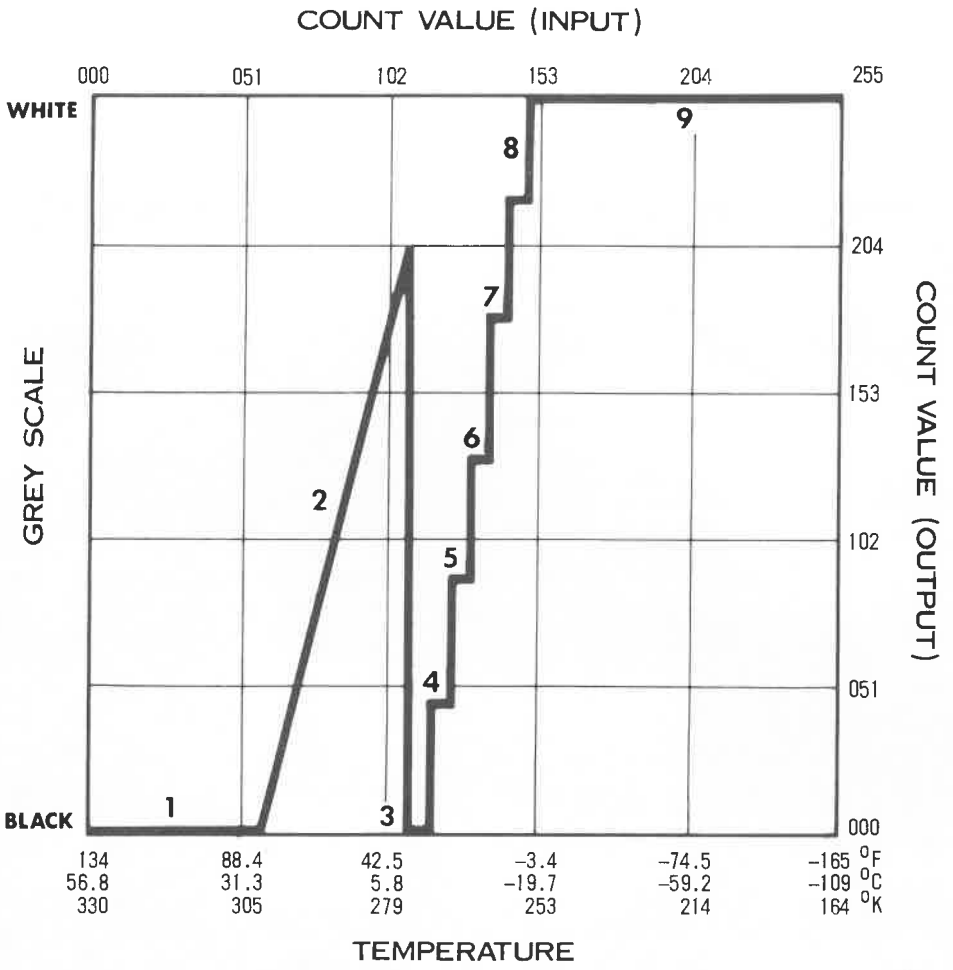
Hydrology Curve. Developed for special support projects in the Mid West. Utilized for snow melt in spring and also for soil moisture content projects supporting wheat production yield.

NESS
FIELD SERVICES DIVISION

SUBMITTED BY:
MKC SFSS
VERIFIED BY:
RPC
(FSD Initials)

ENHANCEMENT TABLE F_B

IMPLEMENTED 4/21/76



SEGMENT NUMBER	°C TEMPERATURE ____ TO ____	COMMENTS REASON FOR SEGMENT ENHANCEMENT
1	56.8 to 28.3	No significant information
2	28.3 to 01.3	Location of land features (Gulf especially)
3	01.3 to -01.2	Approximate snow line
4	-01.2 to -04.2	Steps to show temperature distribution on snowfield
5	-04.2 to -07.2	
6	-07.2 to -10.2	
7	-10.2 to -13.2	
8	-13.2 to -16.2	
9	-16.2 to -110.2	No significant information

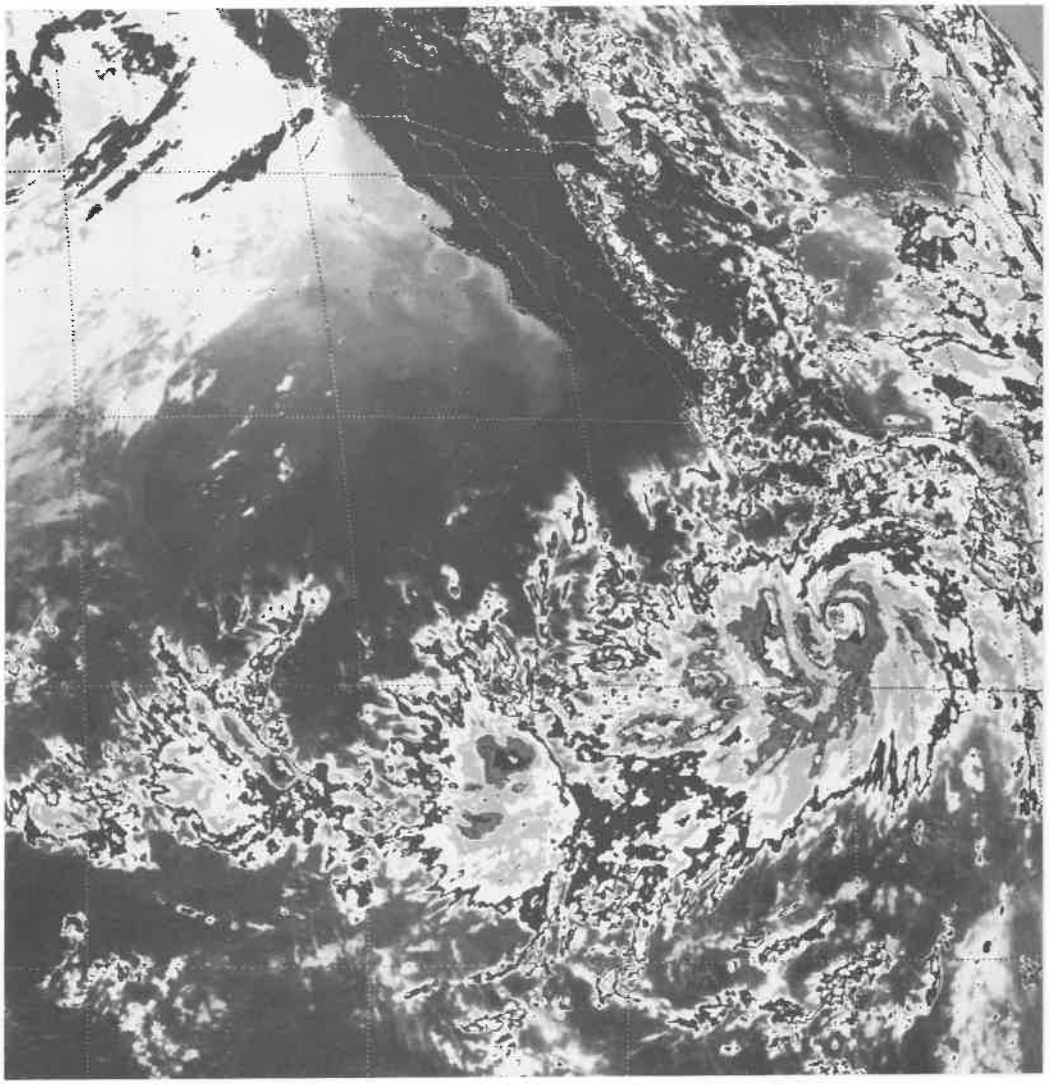
Appendix II
Attachment C

ENHANCEMENT CURVE

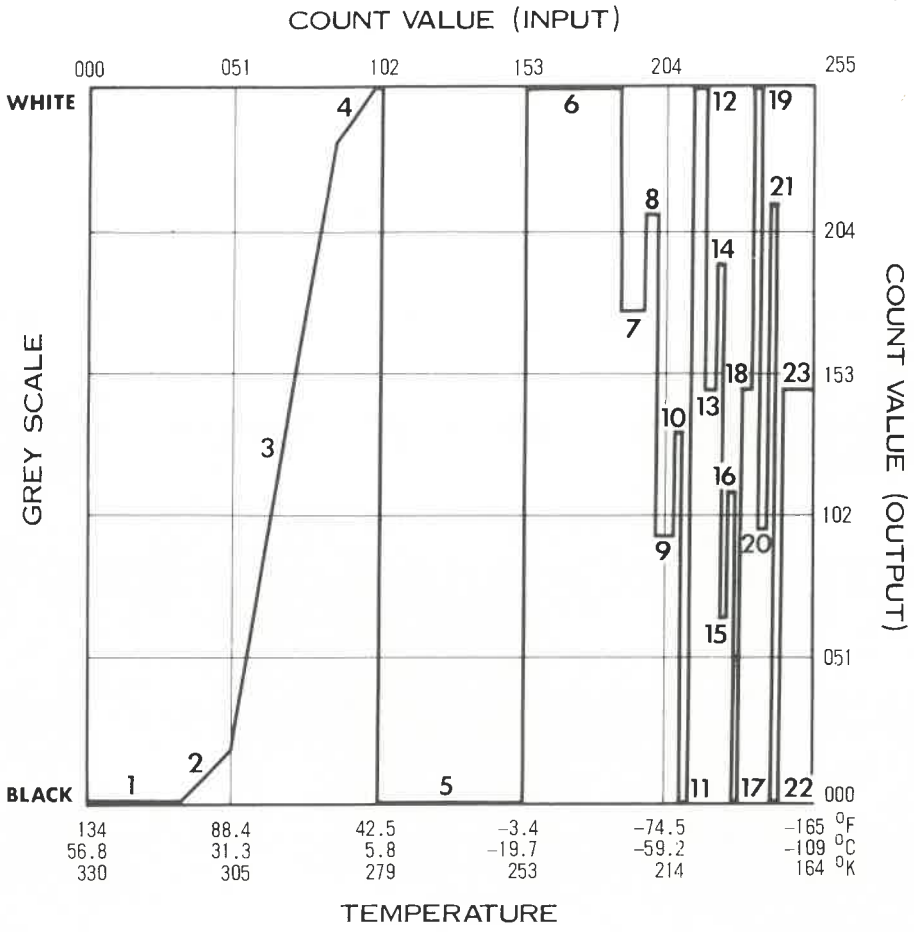
G_C

General Description

Hurricane and severe storm curve. This G_C curve slightly modifies the G_B curve by: 1) Changes in the coding to correct the error in the warm portion below -20C, and 2) Making the buffer represented by segment 5 appear entirely black.



Appendix II
Attachment C
Enhancement Table
G_C



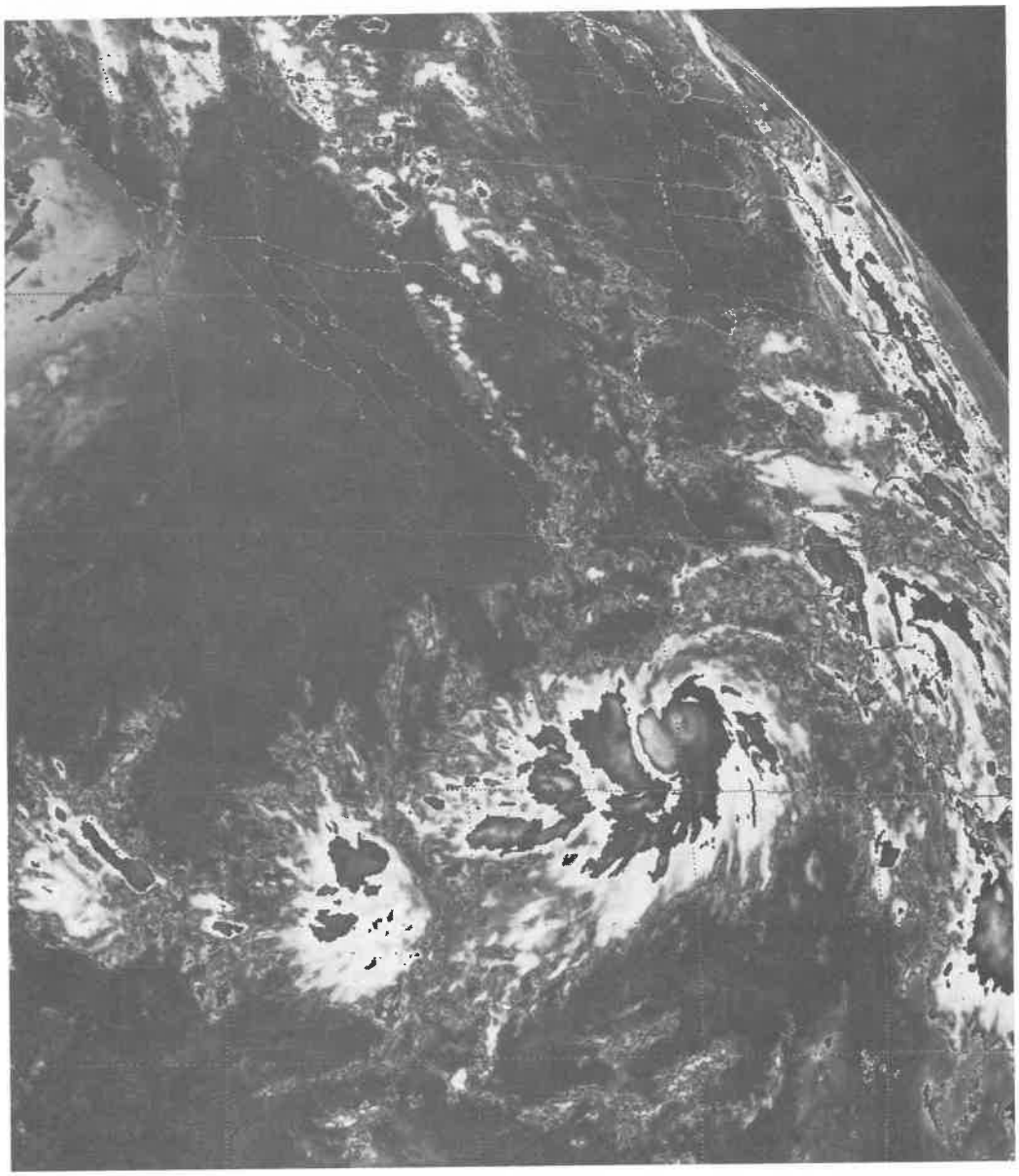
SEGMENT NUMBER	°C Temperature To	COMMENTS REASON FOR SEGMENT ENHANCEMENT
1	+56.8 " +41.3	Hot land features
2	+40.8 " +31.3	Enhancement of land - sea contrast
3	+30.8 " +14.3	and sea surface features
4	+13.8 " + 6.3	
5	+ 5.8 " -20.2	Buffer
6	-20.7 " -40.2	Enhance hurricane and severe
7	-41.2 " -50.2	thunderstorm cirrus canopies for
8	-51.2 " -55.2	precise cloud height, structure
9	-56.2 " -60.2	and precipitation measurement
10	-61.2 " -64.2	
11	-65.2 " -68.2	
12	-69.2 " -72.2	
13	-73.2 " -74.2	Enhance hurricane and severe thunder-
14	-75.2 " -76.2	storm cirrus canopies for precise
15	-77.2 " -78.2	cloud height structure and precip-
16	-79.3 " -80.2	itation measurement
17	-81.2 " -82.2	
18	-83.2 " -84.2	
19	-85.2 " -86.2	
20	-87.2 " -88.2	
21	-89.2 " -90.2	
22	-91.2 " -92.2	
23	-93.2 " -109.2	Coldest Cb tops

Appendix II
Attachment C

ENHANCEMENT CURVE
H_B

General Description

Increases the resolution in the lower cloud levels and provides better definition of the clouds above the freezing level.



NESS
FIELD SERVICES DIVISION

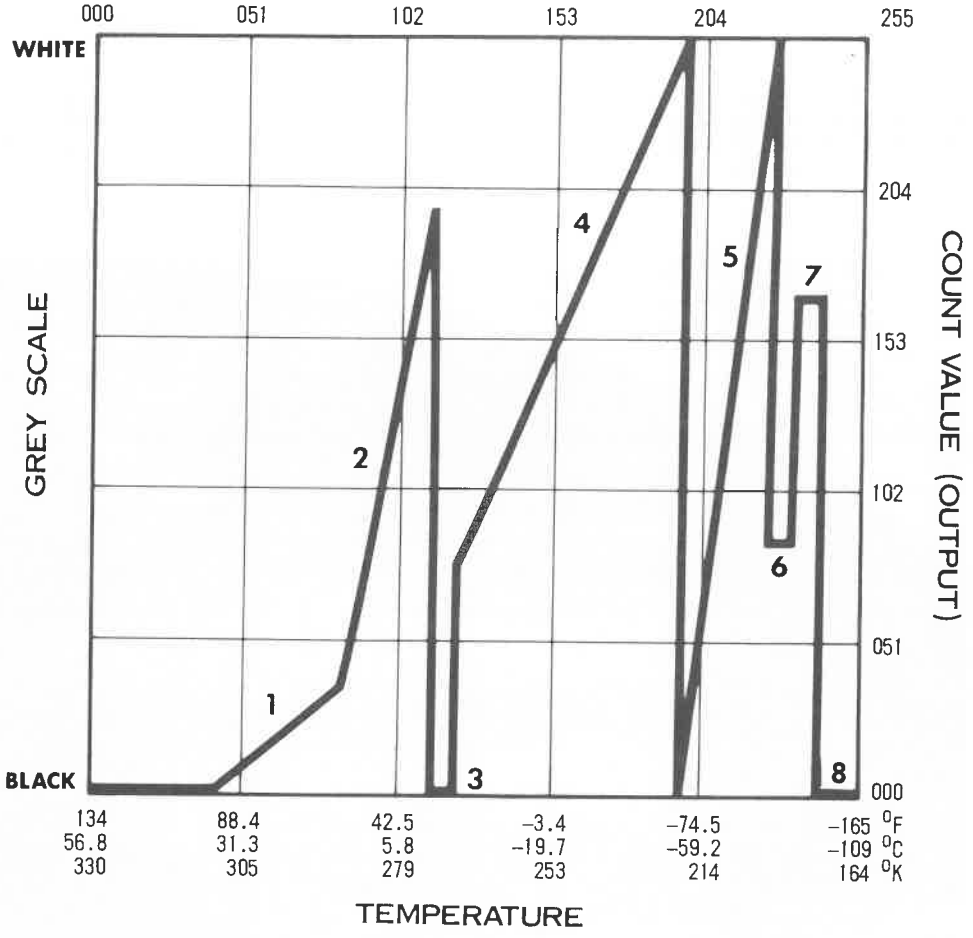
SUBMITTED BY:

VERIFIED BY: RPC
(FSD Initials)

ENHANCEMENT TABLE $^{H}_{B}$

IMPLEMENTED

COUNT VALUE (INPUT)



SEGMENT NUMBER	°C TEMPERATURE ____ TO ____	COMMENTS REASON FOR SEGMENT ENHANCEMENT
1	34.8 to 21.3	Land and Water
2	21.3 to - 0.2	Water and Low Clouds
3	- 0.2 to - 3.3	Freezing Zone
4	- 3.3 to -55.2	Mid and Hi Clouds
5	-55.2 to -85	Convective and Very High Clouds (CSC)
6	-85 to -90	Contour Coldest Cloud Tops
7	-90 to -95	Contour Coldest Cloud Tops
8	-95 to -109	Turn Space Black

Appendix II
Attachment C

ENHANCEMENT CURVE
M_B

General Description

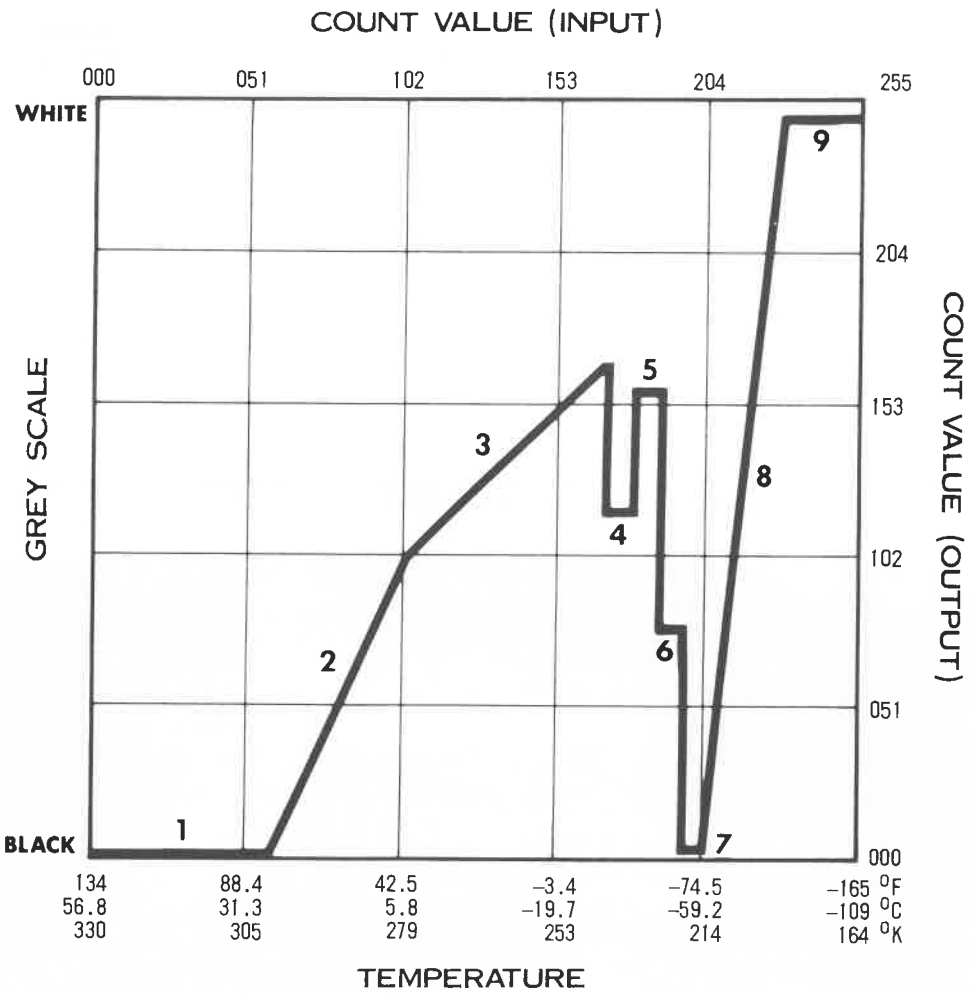
The primary purpose of this modified "M" curve (M_B) is to minimize the two "disadvantages" of the present "M", while maintaining the "advantages". The M_B curve is expected to be a better "all-around" curve that will not be as restricted seasonally as is the present M. Segments 1, 2, and 3 are extracted directly from the present Z curve: This steeper slope will give better definition to the low and mid clouds. Segments 4 through 7 maintain the contouring of convective areas as does the present M and continues to restrict contours to the coldest portions of the clouds (<-32°C). Segment 8 slopes with a factor greater than zero from -63°C to -80°C which allows for better definitions of very cold domes. Although specific temperatures cannot be obtained--it better isolates the coldest tops by gradually going to white rather than producing a complete white-out at all temperatures colder than -65°C.

NESS
FIELD SERVICES DIVISION

SUBMITTED BY:
Wash. SFSS
VERIFIED BY:
RPC
(FSD Initials)

ENHANCEMENT TABLE M_B

DATE SUBMITTED/ 3/8/76
IMPLEMENTED 3/10/76



SEGMENT NUMBER	°C TEMPERATURE ____ TO ____	COMMENTS REASON FOR SEGMENT ENHANCEMENT
1	+58.8 to +28.2	Little or no useful Met Data (Black)
2	+28.8 to + 6.8	Low Level/Sea Surface Difference
3	+ 6.8 to -31.2	Middle Level - No Enhancement
4	-32.2 to -41.2	First Level Contour (Med Grey)
5	-42.2 to -52.2	Thunderstorm Enhancement (Light Grey)
6	-53.2 to -58.2	Thunderstorm Enhancement (Dark Grey)
7	-59.2 to -62.2	Thunderstorm Enhancement (Black)
8	-63.2 to -80.2	Overshooting Tops Enhancement
9	-80.2 to -109.0	Overshooting Tops Enhancement (White)

Appendix II
Attachment C

ENHANCEMENT CURVE
P_B

General Description

Primary purpose of this curve was to enhance coastal upwelling along the California-Washington coasts that occurs and is visible from late spring through early fall. This upwelling is many times indicative of the salmon and albacore fishery and is used as a "tag" in search for these fisheries.

Advantages

1. Gives extremely good detail of upwelling.

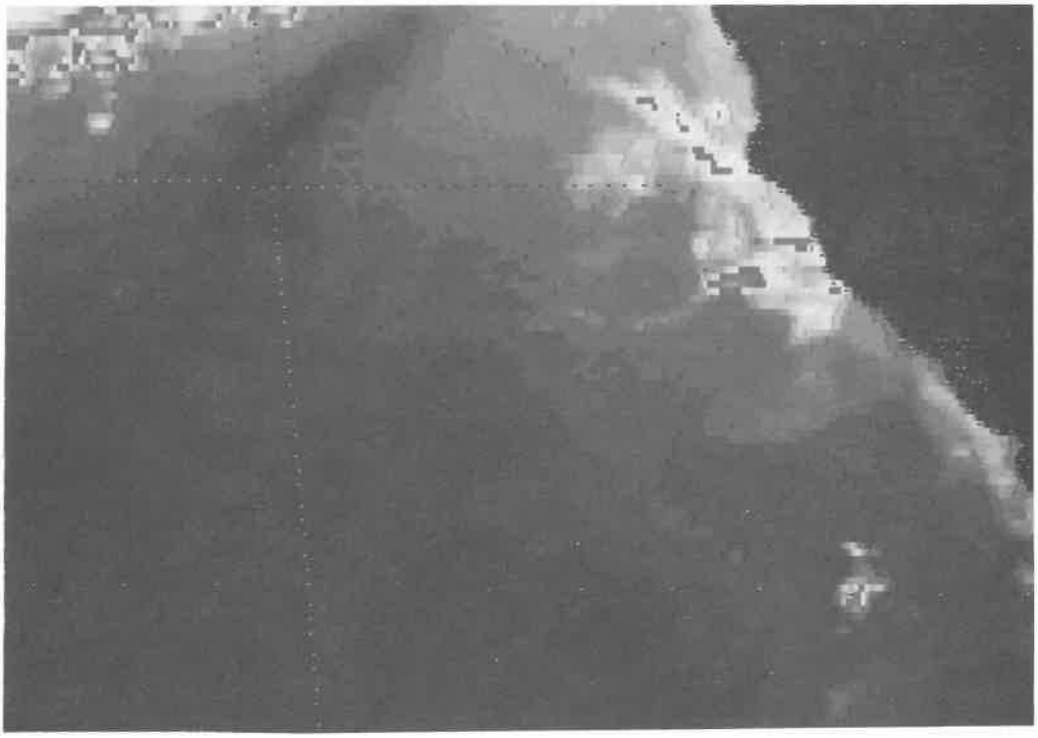
2. Also has shown to be useful for enhancement of fog and low stratus found quite often along this stretch of coastline.

Disadvantages

1. The very narrow range of temperature enhancement excludes many other geographical areas that have both warmer and cooler waters.

Comments

Although this curve was primarily developed for use off the U.S. west coast, this SMS-1 image illustrates the limited range of temperature enhancement. Quite a bit of surface detail can be observed along the Baja coast.



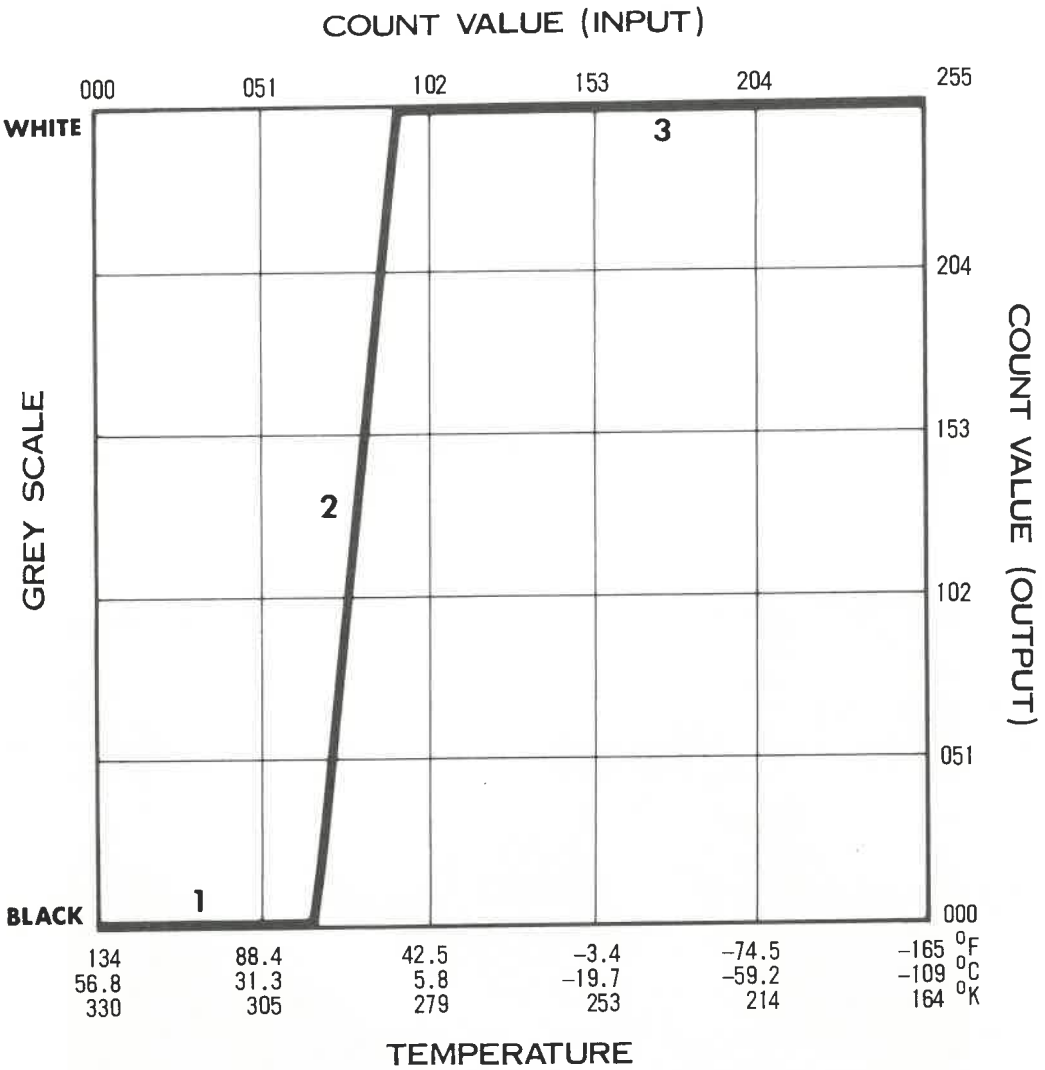
NESS
FIELD SERVICES DIVISION

SUBMITTED BY:

VERIFIED BY:
RPC
(FSD Initials)

ENHANCEMENT TABLE P_B

IMPLEMENTED 1/1/76



SEGMENT NUMBER	°C TEMPERATURE ____ TO ____	COMMENTS REASON FOR SEGMENT ENHANCEMENT
1	56.8 to 21.3	
2	21.3 to 10.3	CA, OR, & WA summer coastal upwelling
3	10.3 to -109.9	

Appendix II
Attachment C

ENHANCEMENT CURVE
S_A

General Description

A curve designed to enhance sea surface temperature detail during the winter months and still maintain some land registration features.

Advantages

1. Cold end landmark spike gives geographic detail lost in winter when land surface temperatures fall well below freezing. Without land features, gridding becomes extremely difficult.

2. Sea Surface temperature range is more in line with what can be found in winter.

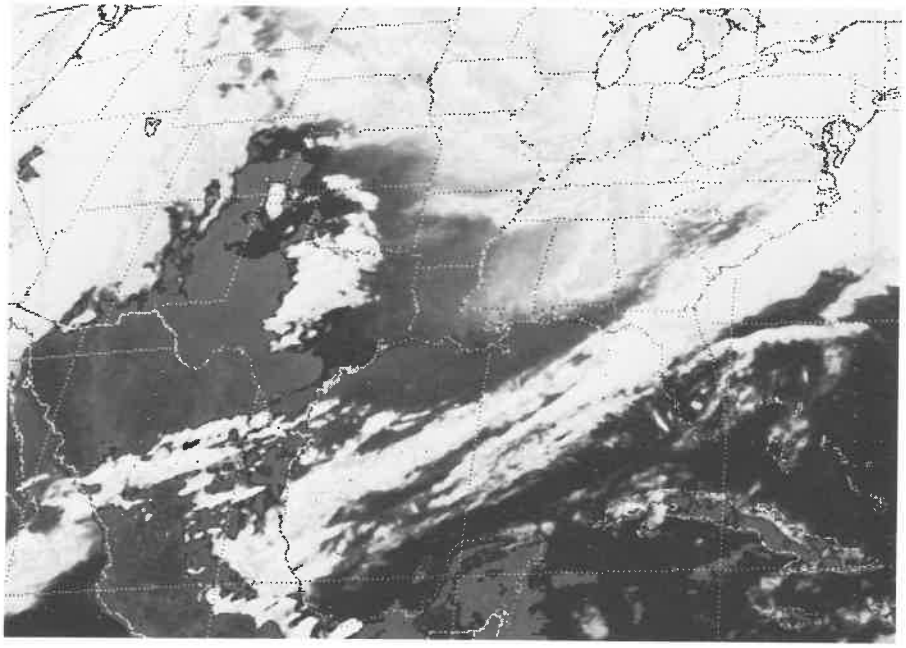
Disadvantages

1. Depending on the geographical area, the warm landmark spike will occasionally interfere with any warm water enhancement (above 22.3°C).

2. Image will occasionally be more busy than straight linear enhancements with no spikes.

Comments

Registration of image is much easier with the two landmark spikes. As long as the cold spike does not go down (in density) far enough to produce very dark clouds, the lightly shaded clouds are not too distracting.



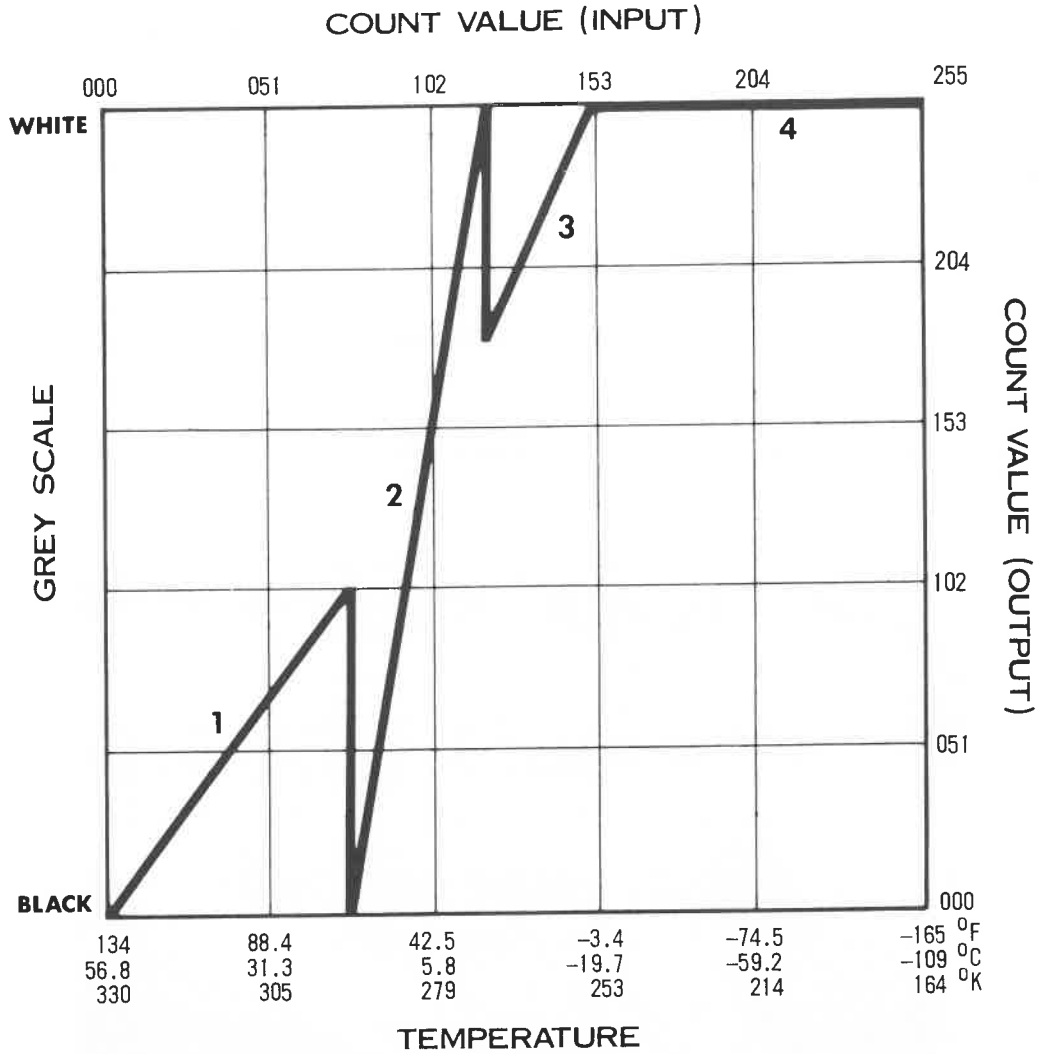
NESS
FIELD SERVICES DIVISION

SUBMITTED BY:

VERIFIED BY: RPC
(FSD Initials)

ENHANCEMENT TABLE S_A

IMPLEMENTED 1/1/76



SEGMENT NUMBER	°C TEMPERATURE ____ TO ____	COMMENTS REASON FOR SEGMENT ENHANCEMENT
1	56.8 to 22.3	Landmarks
2	22.3 to - 0.2	Winter Ocean Enhancement
3	- 0.2 to -20.7	Landmarks
4	-20.7 to -109.0	

Appendix II
Attachment C

ENHANCEMENT CURVE
Z_A

General Description

This curve was developed for general purpose meteorological use for the full disc IR which is primarily used for film loop production for use by the Satellite Field Services Stations, the CDDF, and the Satellite Winds Group. Temperatures outside the range of +56.8°C to 110.2°C are excluded. Enhancement is applied to lower and upper level clouds, while a slope of 1 is applied to the middle levels.

Advantages

1. Since gray shades are not repeated, this curve is used with conventional interpretation techniques.

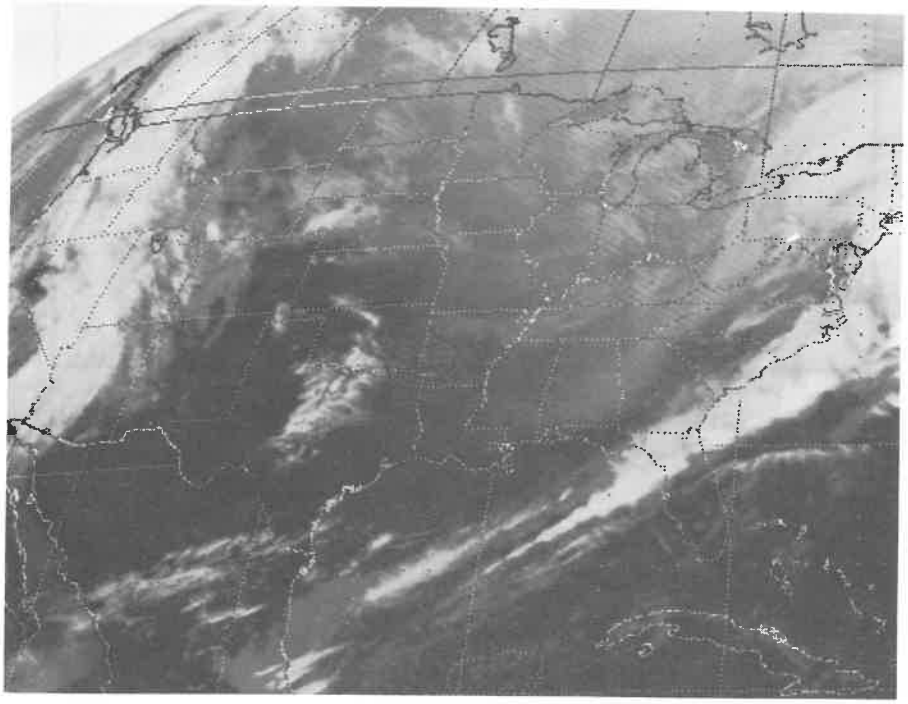
Disadvantages

1. Seasonal adjustment is not possible due to full disc area coverage.

2. Maximum enhancement of specific features is not possible without repeating gray shades or further delimiting the displayed temperature range.

Comments

This curve has been in use in the Wallops Real Time FDIR sectorizers since enhancement capability was installed in April 1975.



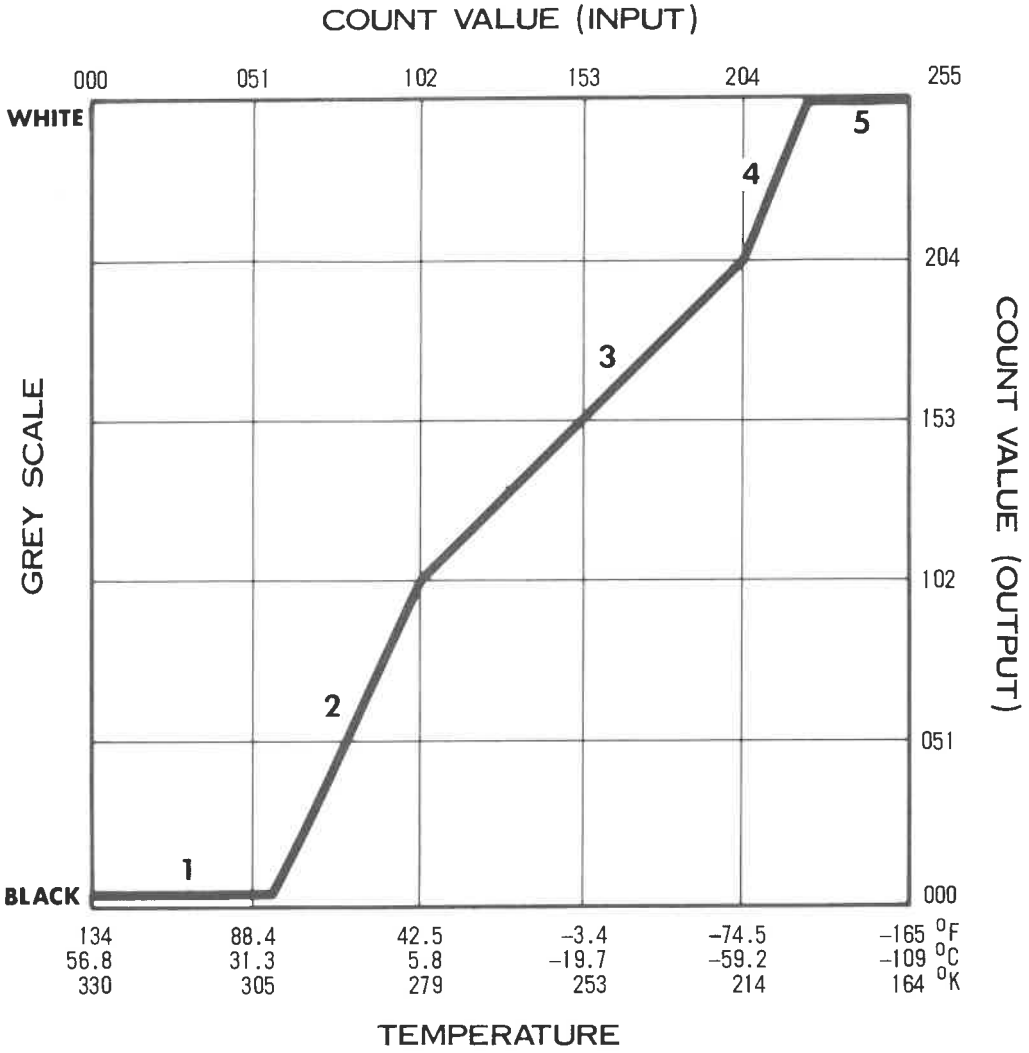
NESS
FIELD SERVICES DIVISION

SUBMITTED BY:

VERIFIED BY: RPC
(FSD Initials)

ENCHANCEMENT TABLE 2A

IMPLEMENTED 1/1/76



SEGMENT NUMBER	°C TEMPERATURE _____ TO _____	COMMENTS REASON FOR SEGMENT ENHANCEMENT
1	56.8 to 29.3	Little or no Met. Data
2	28.8 to 6.8	Low level/Sea Surface Difference
3	6.3 to -55.2	Middle level-no enhancement
4	-56.2 to -75.2	Upper Level enhancement
5	-75.2 to -110.2	Little or no Met. Data

APPENDIX III

GOES-TAP INFORMATION FOR USERS

This Appendix provides details of procedures for a potential user to follow to obtain a connection into the GOES/SMS distribution system. Basic information was given in Paragraph 5.1 of the Guide, and data available for receipt by users are described in Paragraph 4.2.1 as well as in Appendix I.

Appendix III consists of these Attachments:

Attachment A - Introduction

Attachment B - Agreement

Attachment C - Payment

Attachment D - Signal Structure and Characteristics

Attachment E - GOES/SMS System Display Device Vendors

Attachment F - NESS/FSD Address and Contact List

Appendix III
Attachment A

INTRODUCTION

A.1 AGREEMENT, EXECUTION AND PROCESSING

Permission to connect onto the GOES Central Data Distribution System (CDDS) will be granted only upon proper execution of the enclosed Agreement between the Government and the User (Appendix III, Attachment B). This Agreement defines the Government's responsibilities in providing this service. The effective date of the Agreement will be the date that the User's communication line is connected into the appropriate SFSS. The connection cannot be made until the connection fee is received. Advance notice of at least 30 days of user intentions to request a GOES-TAP should be provided so that appropriate arrangements can be made. A reproduction of the enclosed agreement should be completed, signed and forwarded to:

NOAA/NESS, Field Services Division
S122, Room 607, World Weather Building, Stop G
Washington, D.C. 20233
Attention: GOES-TAP

Upon completion of the connection, a copy of the Agreement, signed by the designated government representative, will be returned to the user.

A.2 COST FOR GOES-TAP (As of September 1976)

A.2.1 For Permanent Connection: A non-refundable one-time charge of $1,000.00 to cover expenses involved in the initial connection will be charged each user. In addition, a minimum annual recurring cost currently established at $100.00 will be charged for the SFSS services provided.

A.2.2 For Temporary Connection: A one-time non-refundable fee of $250.00 for a three month period, $500.00 for a six month period, and $750.00 for a nine month period to cover the expense of establishing the connection will be charged. In addition, a minimum service fee, currently established at $25.00 for three months, $50.00 for six months and $75.00 for nine months will be charged for SFSS services provided during the temporary period. A temporary connection cannot be renewed. If continuation of service is desired, the cost will revert to the normal one-time non-refundable fee of $1,000.00 and the annual recurring service charge of $100.00. In order for a user to continue service beyond a specific temporary period he must submit the additional funds necessary to bring his connection charge and his service charge up to the required fee for a permanent connection.

A.3 PAYMENT PROCEDURE

A copy of the enclosed payment form (Appendix III, Attachment C) should be properly executed and forwarded with a check at least 30 days prior to the established date with the telephone company for installation of the communications line. This check should be made payable to: Department of Commerce/NOAA. Please include on the check the notation: "For GOES-TAP". The cancelled check will serve as a receipt. Two copies of the payment form and the check can be returned with the signed agreement; or may be forwarded at a later date to more closely coincide with the call-up of the communications line. However, it must be received at least 30 days prior to establishment of the connection. If payment is to be made by purchase order or MIPR (Military Interagency Procurement Request), these should be forwarded to the same address, with a copy of the enclosed payment form, completely filled out. The purchase order or MIPR should clearly indicate that it is for a GOES-TAP at the appropriate SFSS (Miami, Washington, Kansas City, San Francisco, Honolulu or Anchorage) to cover connection charges and recurring service fee. Correct billing addresses must be included. The requesting agency will be billed accordingly at a later date.

A.4 ADDITIONAL INFORMATION

If any additional information is needed, correspondence should be directed to:

NOAA/NESS, FIELD SERVICES DIVISION
S122, Room 607, World Weather Building, Stop G
Washington, D. C. 20233
Attn: GOES-TAP

Phone (301) 763-8051

Appendix III
Attachment B

AGREEMENT

Between

DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL ENVIRONMENTAL SATELLITE SERVICE

AND

_____

_____

(USER)

UNITED STATES DEPARTMENT OF COMMERCE

WASHINGTON, D. C.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL ENVIRONMENTAL SATELLITE SERVICE

AGREEMENT FOR ACCESS TO THE SYNCHRONOUS METEOROLOGICAL SATELLITE AND THE GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE IMAGERY SIGNALS

THIS AGREEMENT is entered into on this ____ day of _____ 19 , between the United States of America, Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite Service, hereinafter referred to as the Government,and _____ hereinafter referred to as the User. In order to provide for the use of meteorological satellite data the parties hereby mutually agree:

RESPONSIBILITIES.

A. Government agrees -

(1) To authorize the User to connect appropriate telephone communications, provided by the user, to the Synchronous Meteorological Satellite and the Geostationary Operational Environmental Satellite imagery signals at the Satellite Field Services Station located at _____.

(2) To furnish the User a connection at the Satellite Field Services Station specified in subparagraph (1) above, upon payment by User of an initial attachment fee to cover the expenses thereof.

(3) To service and maintain the connection at the specified Satellite Field Services Station, upon payment by User of an annual service fee.

B. User agrees -

(1) To pay all costs and expenses resulting from this agreement:

a. A one-time non-refundable connection fee to cover the expense of establishing a connection at the specified Satellite Field Services Station (see attached "GOES-TAP" Information) and

b. An annual service fee to cover the Government's expense in maintaining the service provided herein.

(2) For telecasting or other release of GOES/SMS derived information to the general public:

a. No visual commercial message shall be superimposed on the picture of the Government image at any time; there shall be nothing in the announcements associated with these telecasts to indicate or imply that the Government endorses any commercial product advertised.

b. To give full credit and identification of the imagery received and to take due care to avoid the implication the interpretations by others are those of the Government.

(3) To assume full responsibility for the use made of any information telecasted or otherwise disseminated, and to hold the Government and its employees harmless for any damage whatsoever which may arise from the use thereof.

(4) To obtain any necessary permits and to abide by all applicable rules, regulations or laws pertaining to agreements with the Government.

(5) If the User should remote the electronic signal, in its original form, to any other point, User will so notify the Government immediately. In such case the Government will not insure the quality of the signal received by the User or those who have remotes off of the User. The Government will not provide diagnostic testing of the communications line between the SFSS and the User, and will only insure the insertion of a 0 (zero) dbm signal into the line. In addition, the SFSS will provide sector change service and imagery interpretation to the User only.

(6) The Government will not be responsible for maintenance service of user terminal equipment or for coordination with the telephone company, of communications problems associated with facilities leased by the User. If the communications line leased by the User is of a quality other than C-5, the Government will only be responsible for the insertion of a 0 (zero) dbm signal into the line.

(7) The frequency of User requests for changes in area of data coverage may be limited by the Government and no requests for retransmission of data will be entertained. The Government does not guarantee the frequency or continuity of data, its form, or area of coverage.

(8) Automatic notifications of satellite imagery schedules can not be provided by the Government. It will be the responsibility of the User to contact the Satellite Field Services Station for information if image is not received. In addition, meteorological interpretation services normally provided by the Satellite Meteorologists at the Field Services Station will be provided upon request by the User on

a noninterference basis only. Operational support to NOAA users will remain as first priority.

EFFECTIVE DATE

THIS AGREEMENT is effective as of _____ (date of connection) and shall be renewed annually unless terminated by either party. Request for renewal should be forwarded, with the annual service fee, to NOAA/NESS, Field Services Division, S122, Room 607, World Weather Building, Stop G, Washington, D. C. 20233, 30 days prior to expiration date.

TERMINATION

User may terminate this AGREEMENT with or without cause upon providing 30 days written notice to the Government. The Government may terminate this AGREEMENT, after 30 days written notice to User, whenever:

(1) The Administrator, NOAA shall determine that such termination is in the best interest of the Government; or

(2) The Administrator, NOAA shall determine that technological difficulties result from the connection provided for in this AGREEMENT.

In the event of termination by either party, User will not be refunded any of the payments provided for under this AGREEMENT.

IN WITNESS WHEREOF, the parties hereto have executed this agreement as of the date first written above.

USER	UNITED STATES OF AMERICA Department of Commerce National Oceanic & Atmospheric Admin. National Environmental Satellite Service
BY: _____	BY: _____
(signature)	(signature)
TITLE: _____	TITLE: _____

Appendix III
Attachment C

Date:

Subject: GOES-TAP Payment

To: NOAA/NESS, Field Services Division
S122, Room 607, WWB, Stop G
Washington, D.C. 20233
Attn: GOES-TAP

Enclosed is a (check) (purchase order) (MIPR) for $ _____ payable to Department of Commerce/NOAA for a GOES-TAP on the SFSS at (Washington) (Kansas City) (Miami) (San Francisco) (Honolulu) which will be terminated at _____ (Location Address of Display Equipment). The enclosed payment covers the connection charge of $ _____ and the recurring service charge of $ _____ for the period _____ (day/month/year) to _____ (day/month/year). My official address is:

_____
(Name of firm or Government Agency)

_____
(Address of firm or Government Agency)

_____
(Phone No. and Personal Contact)

DO NOT WRITE BELOW THIS LINE

1. Payment of $ _____ (amount) received _____ (date). _____ (FSD initials)

2. (MIPR) (Purchase Order): _____ (date received). Bill forwarded _____ (date)

   Check received _____ (date).

3. Task Code: _____. 4. User Agreement Received: _____ (date)

5. Signed Agreement Returned _____ (date). 6. Connection made, Agreement effective _____ (date). 7. Remarks:

National Environmental Satellite Service
Field Services Division

Signal Structure and Characteristics

The analog picture data signals will be in a conventional facsimile format accompanied by control signals as is diagrammed on the next page and described as follows:

Receiver Start

Square Wave modulation at 300 Hz for 1500 cycles (5.0 seconds).

Phasing

25 msec at white (maximum modulation) followed by 475 msec at black (zero modulation) for 40 cycles (20 seconds).

Picture Data

500 msec scan lines (120 rpm): each scan starts with 16.67 msec white followed by 8.33 msec black and 475 msec of analog picture data. 1670 such lines transmitted per picture in approximately 14 minutes.

Receiver Stop

Square Wave modulation at 450 Hz for 2250 cycles (5 seconds).

Carrier Frequency

2400 Hz

Baseband

DC to 1.6 Hz

Modulation

Amplitude, vestigial sideband filtering. Depth of modulation is 26 db, carrier suppressed to -6 db by vestigial filter.

Polarity

Maximum carrier equals black (or warm) video (0 dbm). Minimum carrier equals white (or cold) video (-26 dbm).

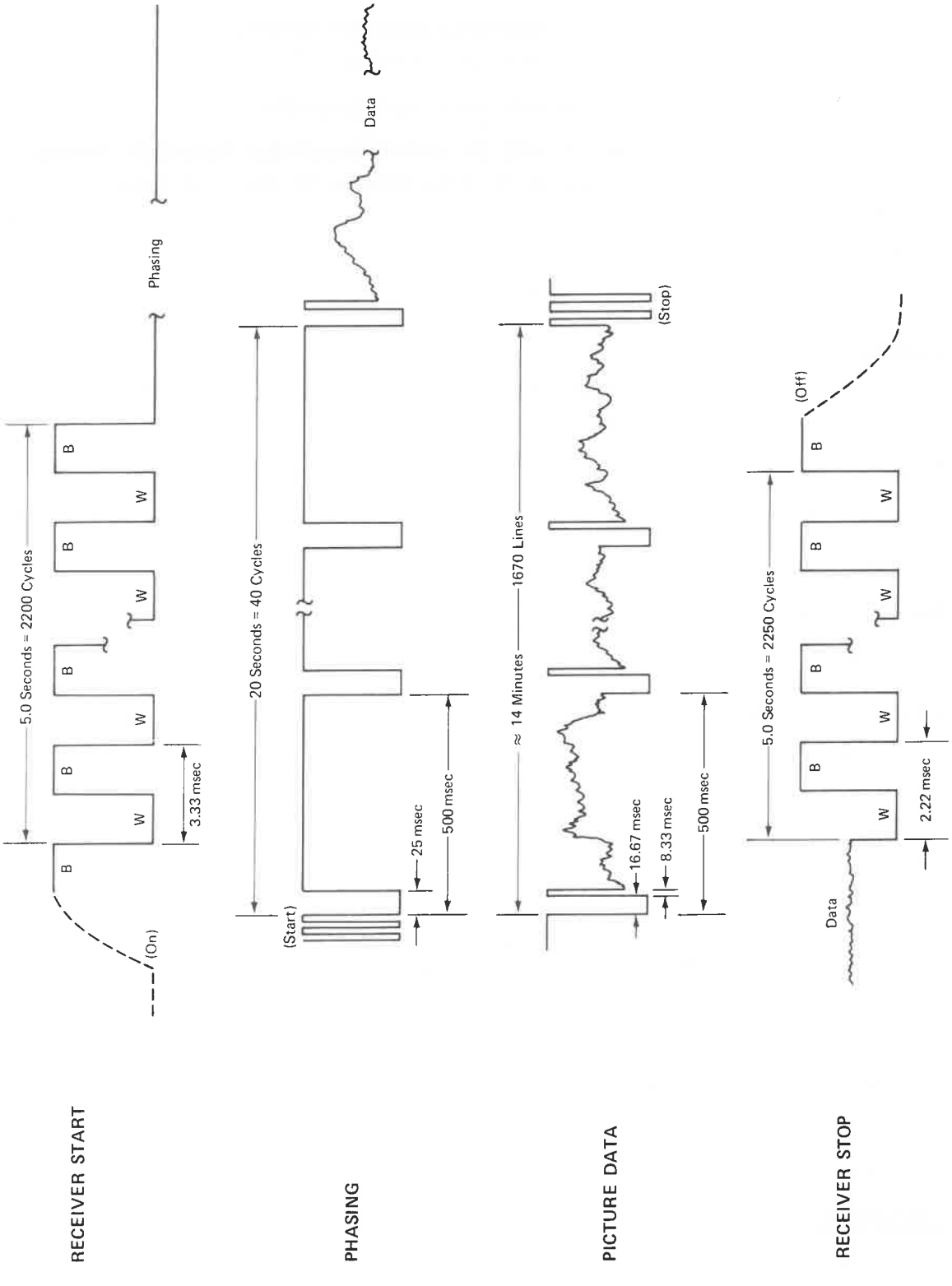
Index of Cooperation

588

Transmitter Source Impedance

600 ohms

Appendix III
Attachment D-1



National Environmental Satellite Service
Field Services Division

Known GOES/SMS System Display Device Vendors for GOES System
(No U.S. Government Endorsement is Implied)

Alden Electronic & Impulse Recording Equipment Co.
1 Washington Street
Westborough, Massachusetts 01581
Telephone: (617) 336-8851

COMPTOL
333 North Santa Anita Avenue
Arcadia, California 91006
Telephone: (213) 445-0764
(TV Compatible Display Only)

Datalog Division, Litton Industries
1770 Walt Whitman Road
Melville, Long Island, N. Y.
Telephone: (516) 694-8300

Harris Corporation
Electronic Systems Division
P.O. Box 37
Melbourne, Florida 32901
Telephone: (305) 727-4000

Muirhead Instruments, Inc.
1101 Bristol Road
Mountainside, New Jersey 07092
Telephone: (201) 233-6010

NOTE

The above does not necessarily represent a complete list of compatible display device manufacturers. It is provided only as an aid for potential GOES-TAP users to obtain information regarding display devices compatible with the GOES system. Appendix III, Attachment D (Signal Structure and Characteristics) has been provided for your information in case you desire to contact other vendors concerning a display device.

ADDRESS AND CONTACT LIST
National Environmental Satellite Service — Field Services Division

Address	Contact/ Telephone #	Satellite Meteorologists/ Telephone #
1. Field Services Division Headquarters NOAA/NESS, Field Services Division S122, Room 607, World Weather Building, Stop G Washington, D.C. 20233 ATTN: GOES-TAP	W. John Hussey R. Phil Corbell Liz Shaw Raymond L. Coldren (301) 763-8051	
2. Miami Satellite Field Services Station NOAA/NESS, Satellite Field Services Station P.O. Box 8286, S1224 Coral Gables, Florida 33124	Station Manager Donald C. Gaby (305) 350-4310	(305) 350-5547
3. Washington, D.C. Satellite Field Services Station NOAA/NESS, Satellite Field Services Station S1223, Room 510H, World Weather Building, Stop G Washington, D.C. 20233	Station Manager H. Ross LaPorte (301) 763-8239	(301) 763-8424 or 763-8425
4. Kansas City Satellite Field Services Station NOAA/NESS, Satellite Field Services Station Room 1724, Federal Building, 601 E. 12th Street Kansas City, Missouri 64106	Station Manager Edward Ferguson (816) 374-5410	(816) 374-2102 or 374-2103
5. San Francisco Satellite Field Services Station NOAA/NESS, Satellite Field Services Station 660 Price Avenue Redwood City, California 94063	Station Manager Jack D. Bottoms (415) 876-9122 or 876-9123	(415) 876-9122 or 876-9123
6. Honolulu Satellite Field Services Station NOAA/NESS, Satellite Field Services Station Honolulu International Airport Tower Building, Room 514 Honolulu, Hawaii 96819	Station Manager Robert Pyle (808) 847-2776	(808) 847-2776

FSD SFSS INFORMATION

Edward Ferguson, Manager, S1221
Satellite Field Services Station
Room 1724, Federal Building
601 E. 12th Street
Kansas City, Missouri 64106
Telephone: 7-8-758-5410

Jack Bottoms, Manager, S1222
Satellite Field Services Station
660 Price Avenue
Redwood City, California 94063
Telephone: 7-8-470-9122/23

Ross LaPorte, Manager, S1223
Satellite Field Services Station
Room 510, World Weather Building
Washington, D.C. 20233
Telephone: 763-8239

Don Gaby, Manager, S1224
Satellite Field Services Station
P.O. Box 8243
Coral Gables, Florida 33124
Telephone: 7-8-350-4310

Robert Pyle, Manager, S1225
Satellite Field Services Station
Honolulu International Airport
Tower Building, Room 514
Honolulu, Hawaii 96819
Telephone: (FTS Opr. 7-8-556-0220)
ask for 847-2776
Commercial 808-847-2776

James Bailey, Manager, S1226
Satellite Field Services Station
632 Sixth Avenue, Room 304
Anchorage, Alaska 99501
Telephone: (FTS Opr. 7-8-399-0150)
ask for 265-4375
Commercial 907-399-0150

APPENDIX IV

LIST OF ACRONYMS

AEB	-	Analysis and Evaluation Branch (NESS)
APT	-	Automatic Picture Taking
ATS	-	Applications Technology Satellite
CDA	-	Command and Data Acquisition
CDDF	-	Central Data Distribution Facility
CPHC	-	Central Pacific Hurricane Center (NWS)
DCP	-	Data Collection Platform
DCS	-	Data Collection System
DOD	-	Department of Defense
EDS	-	Environmental Data Service (NOAA)
EPHC	-	Eastern Pacific Hurricane Center (NWS)
ERL	-	Environmental Research Laboratories (NOAA)
FGGE	-	First GARP Global Experiment
FSD	-	Field Services Division (NESS)
GARP	-	Global Atmospheric Research Program
GSFC	-	Goddard Space Flight Center
GOES	-	Geostationary Operational Environmental Satellite
GTS	-	Global Telecommunications System
ICSU	-	International Council of Scientific Unions
IR	-	Infrared

APPENDIX IV

LIST OF ACRONYMS (continued)

MMIPS	-	Man-Machine Interactive Processing System
NASA	-	National Aeronautics and Space Administration
NCC	-	National Climatic Center (NOAA)
NESS	-	National Environmental Satellite Service (NOAA)
NMC	-	National Meteorological Center (NWS)
NOAA	-	National Oceanic and Atmospheric Administration
NSSDC	-	National Space Science Data Center
S/DB	-	Synchronizer/Data Buffer
SDSB	-	Satellite Data Services Branch (EDS)
SEM	-	Space Environmental Monitor (Subsystem)
SFSS	-	Satellite Field Services Station
SMS	-	Synchronous Meteorological Satellite
TTC	-	Telemetry, Tracking and Command (Subsystem)
VHRR	-	Very High Resolution Radiometer
VIS	-	Visible
VISSR	-	Visible and Infrared Spin Scan Radiometer
WEFAX	-	Weather Facsimile
WMO	-	World Meteorological Organization
WSFO	-	Weather Service Forecast Office