NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

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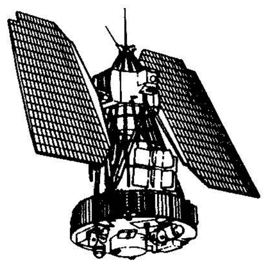

PROJECT: NIMBUS-D

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NEWS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (202) 962-4155
WASHINGTON, D.C. 20546 TELS: (202) 963-6925

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NIMBUS-D LAUNCH APRIL 8

The fifth in a series of seven advanced research and development weather satellites is scheduled to be launched no earlier than April 8, 1970, from the Western Test Range, Lompoc, Calif.

Weighing a record 1,366 pounds, the newest satellite in the series, Nimbus-D, (Nimbus-4 in orbit) will be placed in a nearly circular 690-mile polar orbit by a Thorad/ Agena-D rocket. Circling the Earth every 107 minutes and viewing the entire planet twice daily, Nimbus-D is expected

-more-

to transmit the most information on the atmosphere ever returned from space.

The objectives of the Nimbus research and development program are to explore and understand the nature and behavior of the atmosphere and to reduce the economic impact of adverse weather on all nations.

Scientific objectives of Nimbus-D are to develop and expand the capabilities to measure the atmospheric structure on a global scale, particularly the vertical profiles of temperature, ozone and water vapor. This was first done with Nimbus-3, launched April 14 last year and still operating.

The launch window for Nimbus-D is 3:10 to 3:40 a.m., EST.

In addition to the Nimbus-D meteorological experiments, the Agena-D upper-stage vehicle will carry a Department of Defense "piggy-back" payload into its own separate circular orbit, 675 miles high.

The U.S. Army Corps of Engineers secondary payload, designated TOPO-A, weighs 40 pounds, will be mounted on the aft rack of the Agena-D and will remain dormant until Nimbus D/Agena separation when its timer will be initiated and TOPO-A separated.

TOPO-A will be carried by NASA for the DOD as part of an interagency program to use available booster power for maximum space-research cost effectiveness.

Three new experiments are being carried by Nimbus-D as well as three significantly improved versions of sensors which have been flown on earlier Nimbus missions. In addition, there are three experiments similar to those aboard Nimbus 3.

The new experiments cover potentially important regions of the electromagnetic spectrum of the Earth's atmosphere which have yet to be investigated on a global scale.

Being tested for the first time are:

-- The Backscatter Ultraviolet Spectrometer (BUV) will monitor the spatial distribution of atmospheric ozone by measuring the intensity of ultraviolet radiation backscattered from the Earth's atmosphere. Knowledge of atmospheric ozone distribution on a global basis is needed for studies of the energy balance and photo-chemistry of the stratosphere, the mass exchange between the lower stratosphere and troposphere, and general atmosphere circulation.

-- The Filter Wedge Spectrometer (FWS) will monitor the distribution of water vapor in the atmosphere. Determination of the total amount of water vapor and its vertical distribution is of primary interest in weather prediction.

-- The Selective Chopper Radiometer (SCR) will determine the temperature profile of the atmosphere from Earth cloud top level to about 40 miles altitude. The Radiometer allows temperatures to be taken along a strip seven miles long in the direction of flight by 70 miles wide. Radiation measurements are achieved with a very high spectral resolution due to carbon dioxide absorption cell filters. The SCR was provided by the United Kingdom through its National Research Council.

The three significantly improved meteorological experiments which have flown on earlier Nimbus spacecraft are:

-- Infrared Interferometer Spectrometer (IRIS) will provide local information on vertical and horizontal distribution of temperatures, water vapor and ozone throughout the atmosphere. This instrument features improved spectral and spatial resolution.

-- Satellite Infrared Spectrometer (SIRS) through differing instrument techniques than IRIS will also provide data on vertical temperature and water vapor in the Earth's atmosphere. This will be the first time the SIRS will provide water vapor data. SIRS was provided by the Department of Commerce, Environmental Science Services Administration, ESSA.

-- Interrogation Recording and Location System (IRLS) will provide for more complete collection of global data from remote platforms such as balloons, oceanographic data, buoys and automatic weather stations in inaccessible land areas or aboard ships. This system uses up to fives times as many platforms as the Nimbus III system and requires less transmitter power on the platforms.

IRLS platforms will be placed on up to 30 balloons and about 15 surface platforms to gather information on the atmosphere's wind circulation. Its ranging system permits accurate platform locations to within one mile by triangulation techniques after two successful interrogations.

The IRLS system can be applied to oceanography, geology, hydrology and ecology.

The three experiments which are quite similar to those aboard Nimbus III are:

-- Temperature Humidity Infrared Radiometer (THIR) will measure infrared radiation from Earth and provide round the clock Earth photos as well as temperature mapping of clouds, land and ocean surface temperatures and relative humidity readings. The local cloud mapping pictures can be transmitted immediately to small Automatic Picture Transmission ground stations.

-- Image Dissector Camera System (IDCS) will provide local weather pictures to APT ground stations as well as record cloud cover photos of world cloud structure.

-- Monitor of Ultraviolet Solar Energy (MUSE) will measure the ultraviolet radiation flux from the Sun in five broad bands. These flux variations are related to changes in the upper atmosphere.

The THIR and IDCS provide basic supporting data needed for the other experiments aboard the spacecraft.

In addition to new experiments, Nimbus-D has an attitude control system which will not only allow the spacecraft to maintain its stabilization constantly pointing toward Earth within an accuracy of one degree, but also permit initial acquisition and reacquisition of the Earth from any attitude.

Modularized in construction to allow last minute adjustments in case of component failure prior to launch, the new attitude control system is expected to be more versatile than previous systems used in the Nimbus program. In case of main system failure, a passive gravity gradient system has been added which would use the Earth's gravitational field to keep the spacecraft oriented properly. This consists of a 45-foot gravity gradient boom which can be extended on command.

Another significant improvement over previous Nimbus satellites is the improved flexibility of the command telemetry system which allows more commands--512 compared to 128--to be sent to Nimbus-D, and also permits more data to be received from the satellite.

Nimbus-I, launched August 28, 1964, worked for about one month before it stopped operating due to a failure of the solar array drive system. During its lifetime, it proved that a weather satellite could maintain three axes stability, and it provided man with the first high resolution TV and infrared weather photos.

Nimbus II, designed for a six-month lifetime, was launched on May 15, 1966, operated far beyond this minimum goal before it became silent January 18, 1969. Its horizon scanner, which keeps the spacecraft properly oriented, stopped working and the satellite began to tumble. The satellite's beacon has been shut off.

The 32-month lifetime of Nimbus-2 is considered one of the most notable accomplishments in Earth-oriented spacecraft longevity.

Nimbus-B was destroyed in May 1968 after the launch vehicle veered off course.

Nimbus-3, first weather-eye to measure the vertical temperature profile of the Earth's atmosphere, continues to operate after almost a year of orbital operation. All of the experiments except the IRIS are working, including the SNAP-19 nuclear powered generator.

Nimbus-E and F, scheduled for launching in 1972 and 1973, respectively, will test advanced technology and experiments for meteorology and other applications disciplines.

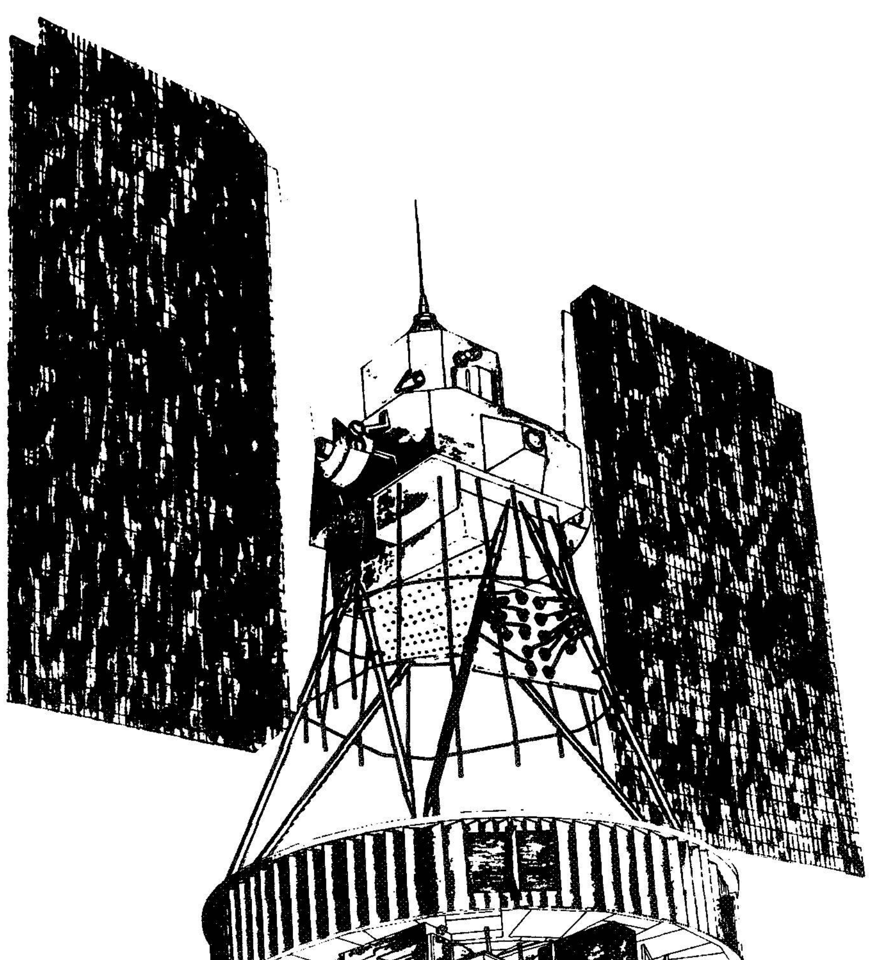
Nimbus is managed by NASA's Office of Space Science and Applications. NASA's Goddard Space Flight Center, Greenbelt, Md., is responsible for both the spacecraft and the launch vehicle.

Launch operations will be conducted by the U.S. Air Force 6595th Aerospace Test Wing under the technical supervision of NASA's Unmanned Launch Operations, Kennedy Space Center, Western Test Range Operation Division.

General Electric Co., Space Systems Organization, Valley Forge, Pa., is the Nimbus integration and test contractor. General Electric also integrated the three-axis stabilization system.

McDonnell Douglas Astronautics Company, Huntington Beach, Calif., built the Thorad booster and Lockheed Missiles and Space Co., Sunnyvale, Calif., built the Agena-D upper stage.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS)



NIMBUS D Spacecraft

NIMBUS-D FACTS

Launch Information:	
Vehicle	Two stage, Thorad (long tank Thor) Agena D
Pad	Western Test Range, Calif. SLC-2 East
Azimuth	194° True
Date	No earlier than April 8, 1970
Window	3:10 a.m. EST - 3:40 a.m. EST
Orbital Elements:	
Orbit	Circular, 690 statute miles high
Period	107 minutes
Inclination	Nearly polar and Sun-synchronous 80° retrograde to the Equator
Spacecraft:	Butterfly-shaped, 10-feet-tall, 11 feet wide, with a five-foot diameter sensory ring for housing experiments and electronics weighing 1,366 lbs.
Spacecraft lifetime:	Six months
Stabilization:	Earth-oriented and three axes stabilized to within one degree
Mission Objectives:	
Meteorology	Acquisition of a sufficient number of global samples of atmospheric radiation measurements for the purpose of comparing vertical temperature, water vapor, and ozone profiles and of providing a basis for comparing the merits of the several instrument approaches.

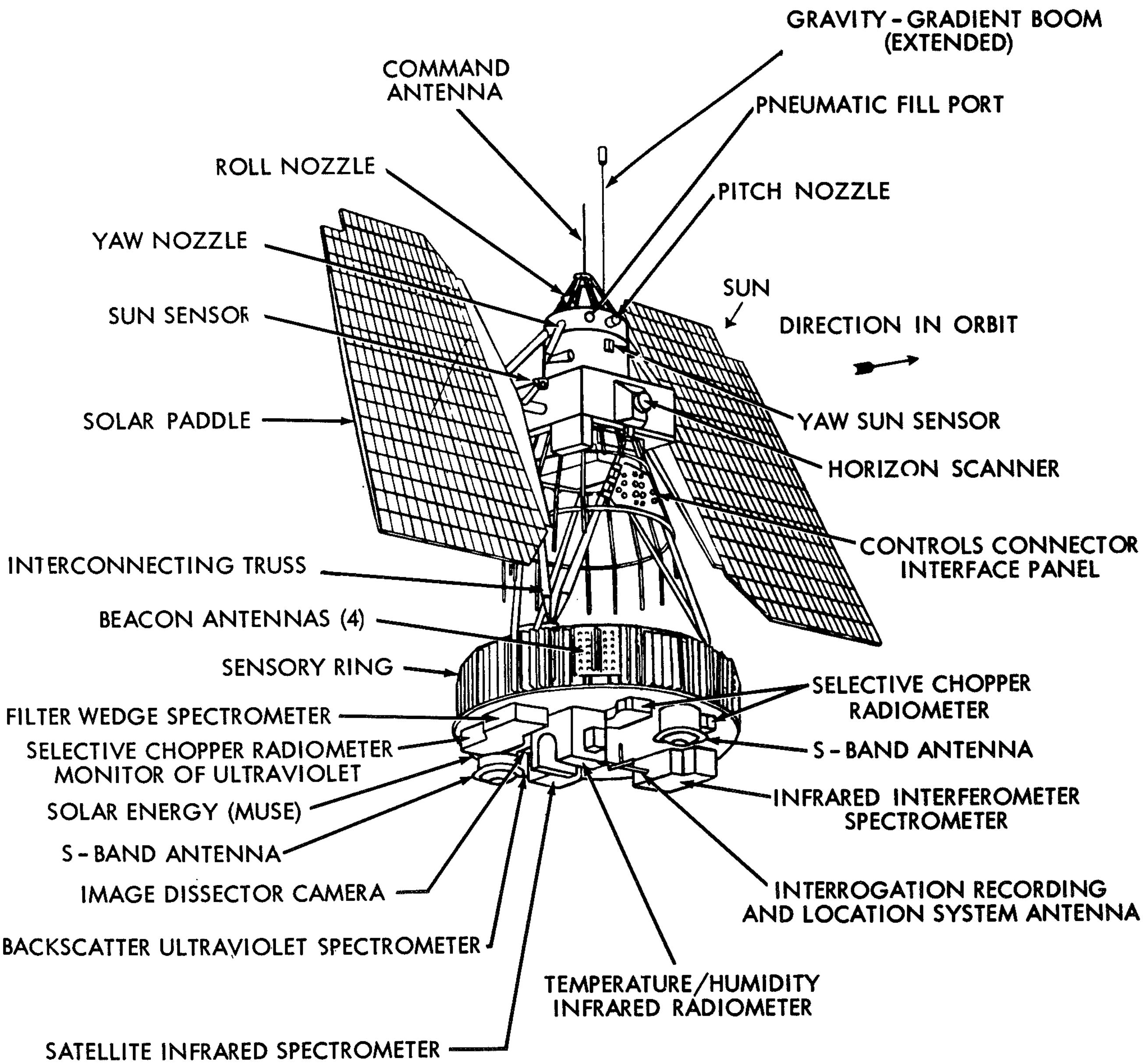
Meteorology (Con't.)	Comparative data are to be obtained from the successful operation of at least three of the five spectrometric experiments: The Satellite Infrared Spectrometer (SIRS), the Infrared Interferometer Spectrometer (IRIS), the Filter Wedge Spectrometer (FWS), the Selective Chopper Radiometer (SCR), or the Backscatter Ultraviolet (BUV) Spectrometer, or from successful operation of either the FWS or SCR plus either the SIRS or IRIS.
Secondary Objectives:	A. Demonstration of the feasibility of determining wind velocity fields by tracking of multiple balloons. B. Demonstrate satisfactory operation of an advanced modular-three-axis attitude control system for a period of at least six months.
Meteorological Experiments:	
Infrared Interferometer Spectrometer (IRIS)	Globally measure infrared energy and infer the atmosphere's vertical temperature, water vapor and ozone distribution.
Satellite Infrared Spectrometer (SIRS)	Measure infrared energy and infer the atmosphere's vertical temperature and water vapor globally.
Interrogation Recording and Location System (IRLS)	Provide an increased capability for using a satellite to locate and determine the position of sensors (balloons, buoys, aircraft, ships and fixed platforms) anywhere, for relay to the Goddard Space Flight Center.
Monitor of Ultraviolet Solar Energy (MUSE)	Measure ultraviolet radiation flux from the Sun in five relatively broad bands. Flux variations are relative.

Image Dissector Camera (IDC)	Record daytime cloud cover photos of the entire Earth, with a resolution of one mile, for readout at Goddard for support of the other experiments. "Live" photos will be relayed to more than 400 small ground stations on all seven continents.
Backscatter Ultraviolet Spectrometer (BUV)	Measure ozone distribution in the atmosphere, globally.
Filter Wedge Spectrometer (FWS)	Measure water vapor content and its vertical distribution, globally.
Selective Chopper Radiometer (SCR)	Determine the temperature in the atmosphere, from Earth/cloud top level to 40 miles height.
Temperature Humidity Infrared Radiometer (THIR)	Measure infrared radiation from Earth during both day and night and provide a picture of cloud cover, three dimensional mappings of cloud cover, temperature mapping of clouds, land and ocean surfaces, cirrus clouds and relative humidity, and to supply supporting information for the other experiments.
Tracking:	
Orbit	Sixteen stations of the world-wide Space Tracking and Data Acquisition Network (STADAN)
Data Acquisition Facilities	Fairbanks, Alaska and Rosman, N.C.
Automatic Picture Transmission ground stations	More than 500, including more than 80 stations in some 45 foreign countries.
Spacecraft Management	Office of Space Science and Applications NASA Headquarters, and the Goddard Space Flight Center, Greenbelt, Md.
Integration & Test Contractor (plus attitude & control system)	General Electric Co., Missile and Space Division, Valley Forge, Pa.

Launch Vehicle:

Management Launch Operations	Goddard Space Flight Center, U.S. Air Force 6595th Aerospace Test Wing, Vandenberg AF Base, under technical supervision of the NASA Kennedy Space Center Unmanned Launch Operations
Thorad	McDonnell Douglas Astronautics Co., Huntington Beach, California
Agena-D	Lockheed Missiles & Space Co., Sunnyvale, California

NIMBUS D



NASA G-70-6556

NIMBUS-D INTERROGATION RECORDING & LOCATION SYSTEM PLATFORMS

Experimenter	Location	Purpose
NASA	Goddard Space Flight Center, Greenbelt, Md.	Fixed platforms to determine accuracy of IRLS experiment.
NASA	mobile	Van will be tracked from Western Test Range, California to east coast after launching.
NASA	Ascension Island	Thirty balloons will be released from Ascension Island to determine wind circulation patterns and their effect on meteorology. Based on an April launching, three balloons will be released per week for five weeks beginning about May 1. This same procedure will be followed about one month later.
Naval Oceanographic Office	Moored buoy off the coast of Puerto Rico and a fixed platform on Bermuda	Determine wave height, surface current, speed and sub-surface buoy depth; the Bermuda platform will be used as a calibration of reference station.
Woods Hole Oceanographic Institution	Georges Bank (Off Cape Cod)	Measure water surface temperature, water temperature at a depth of 985 feet and 490 feet, and the air temperatures above the surface.
Bureau of Commercial Fisheries	Drifting buoy in the North Pacific Ocean south of Alaska	Measure water surface temperature, water temperature and pressure at a depth of 165 feet, and salinity of sea water at a depth of 3 feet.

Experimenter	Location	Purpose
Naval Air Systems Command		Demonstrates the use of a satellite/IRLS system in the Air-Sea Rescue Program.
National Science Foundation	Research ship, the Hero, operating in the Antarctica area	Study weather/sea conditions in the Antarctica area and Palmer Island near the tip of South America.
Smithsonian Institution	Jackson Hole, Wyoming	Feasibility test to track a female elk outfitted with a 23-pound electronic collar. Information will include the ambient temperature in the elk's vicinity, the light intensity, her altitude above sea level, her skin temperature and ranging or movement information.
ESSA Research Laboratory	Canada (near north pole) and Antarctica	Make geophysical (magnetic) measurements near the magnetic north pole (near Tungsten, Canada) during the first few months of Nimbus-D's lifetime; move the platform south for the Antarctica summer in December for similar measurements.
University of California at San Diego (Scripps Institution)	Magnetic North & South Poles	Deep ocean capsule, 3,000 fathoms deep and located near the equator about mid-Pacific, will relay the water pressure and temperature and water current direction, to a surface buoy for transmission to Nimbus-D.

NIMBUS RESULTS

All of the three Nimbus satellites, launched into orbit in 1964, 1966, and 1969, respectively, have exceeded their objectives.

The more than 1-1/2 million daytime and nighttime (infrared) photos taken by these three spacecraft have provided meteorologists with a look at the Earth's cloud cover and surface temperatures never before possible.

Meteorology

Meteorologists single out the vertical temperature profile measurements (or soundings) from Nimbus-3 and the APT camera (which provides weather pictures of the original area to small ground stations anywhere in the world) as two of the most significant contributions to meteorology in the past 20 years.

Soundings taken by satellite were compared with data obtained from conventional sounding techiques (weather balloons) and the correlation between the two was excellent. Vertical temperature measurement by satellite represented a breakthrough in meteorological technology. It enabled meteorologists to obtain quantitative data from the entire globe, rather than from conventional stations only which are mostly located in the temperate belt of the northern hemisphere. The temperature profile readings provided by Nimbus-3 were so good that the data were made available by NASA to the Weather Bureau for preparing daily weather forecasts. Over 3 million temperature soundings have so far been collected.

More than 400 APT stations are now scattered around the world. In many parts of the world APT pictures are the major, and in some cases the only weather information source. A number of private users in the United States and numerous foreign countries have built their own receivers and facsimile machines at costs ranging from several hundred to several thousand dollars.

Many of the world's large airports have APT pictures for commercial pilots to study before a flight. Pilots can see what the weather was like within the preceding twelve hours, during the day or at night, from New York to London, or San Francisco to Tokyo before taking off.

Nimbus II demonstrated, for the first time, that infrared pictures could be read out "live" on simple APT ground equipment.

Probably the most significant results from Nimbus satellites have been their contributions to providing quantitative measurements globally. Nimbus has shown that satellites can supply these data twice a day from all the world within less than 3-1/2 hours. Previously these data were available from only about 20 per cent of the world, with delays often making sizeable quantities of data unusable.

Oceanography

It has been possible at night under certain cloud-free conditions to detect areas of sharp temperature contrast, such as currents and upwelling, from Nimbus HRIR photographs.

A study on large scale fluctuations of the Gulf Stream was based on Nimbus infrared pictures. Under cloudless skies the northern boundary of the Gulf Stream between Cape Hatteras and 60 degrees West was identified by the contrasting gray tones on pictures over several months.

The Gulf Stream boundary was seen on Nimbus photos in about 50 cases. Other ocean current boundaries and pronounced sea-surface temperature patterns, such as the Falkland and Brazil Current discontinuity, the Agulhas Current and the Kurohsio Current could be seen from Nimbus infrared photographs.

In one single infrared photo, oceanographers were able to trace the meandering path of the Gulf Stream for 1,000 miles.

Ice Pack Reconnaissance

High resolution television cameras and infrared radiometers on Nimbus were able to "photograph" an iceberg in the Weddell Sea. This is the first known case in which an iceberg has been photographed from a satellite over the Arctic or Antarctic.

The iceberg was an estimated 71 miles long and 20 miles wide.

Another series of Nimbus II pictures showed a southward drift of an individual iceberg along the Greenland coast over a six-week period. Progress was observed regularly as it followed the major East Greenland Current.

Nimbus II, regularly covering the Antarctic areas, presented possibilities for mapping extremely remote areas where conventional techniques are at best difficult and expensive.

Nimbus pictures of the Weddell Sea regions depict a semi-permanent coastline that is generally marked as a fixed feature on charts of the Antarctic Ocean. Portions of this coast have not been mapped for more than 20 years.

Cartography and Geology

Information obtained by Nimbus weather satellites has provided useful data for geographers and geologists.

The U. S. Geological Survey, after studying more than 300 Nimbus I pictures over the Antarctic, found that relief maps of the Antarctic were in slight error.

As a result, Mount Siple, a 10,000-foot high Antarctic mountain was repositioned 45 miles to the West. Nimbus I pictures of the Kohler Range area at the Antarctic showed one group of mountains, not two as depicted on earlier maps.

Geologists have used Nimbus photos to increase their knowledge of past geologic formations in certain areas of the world such as a river basin in Oregon, Paris Basin in Central France and the Appalachian Mountains of Pennsylvania.

Snow Cover and Hydrology

Areas with snow cover greater than about three inches in nearly all cases had reflectivities significantly higher than areas with lesser snow depths.

Nimbus II APT pictures of the East Coast of the United States showed a very bright Delaware-Maryland-Virginia peninsula blanketed the day before by an eight-inch snowfall. The rest of Maryland and Virginia had received only a trace to 4 inches of snowfall and thus showed lesser reflectivities.

Although present satellite photography cannot provide the quantitative (three dimensional) measurements of snow depth provided by a network of surface stations, it can provide the limits of snow cover and detailed qualitative estimates of snow depth in the areas between reporting stations.

This information is of much importance to hydrologists in making ground water run-off estimates and flood control forecasts.

The Future

Polar orbiting satellites at altitudes of about 700 miles, such as Nimbus, are the only apparent means for obtaining every day on a global basis, quantitative atmospheric measurements.

To predict long-range weather conditions, meteorologists must have an adequate model of the atmosphere, sufficiently large computers, and quantitative measurements of the total atmospheric structure. The needed measurements are pressure, atmospheric temperatures, moisture content and wind velocity at various altitudes on regular, periodic schedules over the entire Earth.

At present, mathematical models that simulate the structure and circulation of the atmosphere are under development.

Scientists already have numerical methods for long-term integration of the governing thermo-hydrodynamical equations, electronic computers for carrying out the calculations, and some understanding of the physics of the heating processes which produce the large-scale motions.

A National Academy of Sciences study has indicated that meteorologists may be able to make predictions of significantly improved accuracy for major weather patterns as much as two weeks in advance by using global information gathered from satellite and conventional meteorological observing systems.

Nimbus experiment concepts support the world weather watch program which is designed to expand weather observational capability and promote understanding of, and ability to predict, weather processes.

The scientific and meteorological communities of the United States and many other countries are formulating and coordinating research directed toward placing long-range forecasting of global weather on a sound scientific basis. This international endeavor is called the Global Atmospheric Research Program (GARP).

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NIMBUS-D LAUNCH VEHICLE

The launch vehicle used for the Nimbus-D mission is a Thorad-Agena-D rocket. The Thorad, or long tank Thor, is an uprated version of the Thrust Augmented Thor (TAT) used in combination with an Agena second stage for Nimbus launches.

The Thorad booster has a 50 per cent greater tank volume than previous Thors which increases engine burn time. Although no increase in thrust is realized, the main engine burn time is increased from approximately 146 seconds to about 223 seconds.

The three strap-on solid rocket motors used on the Thorad are also uprated from the ones used on the TAT's. The Thorad strap-ons provide 62,000 lbs. of thrust for 37 seconds. This compares with 54,000 lbs. for 27 seconds for the old motors.

The greater propellant capacity of the Thorad coupled with the new strap-on solid motors make it possible to boost about 50 per cent more payload into Earth orbit than the original TAT.

The launch vehicle including the 18.7 foot Nimbus shroud stands 109.5 feet high. Because the spacecraft is designed to take meteorological observations near local noon during its south to north pass over the Earth, the possible launch time from complex 2 of the Western Test Range is restricted. The launch window for April is 3:10 A.M. EST to 3:40 A.M. EST.

Nimbus Separation

During the approximately 3 min. 32 sec. between Agena engine cutoff (the second time) and spacecraft separation the vehicle pitches up so that it is at an angle of about 80 degrees in respect to the horizon. At T plus about 58 and a half minutes after lift-off explosive bolt cutters are fired on the spacecraft adapter and compressed springs push the Nimbus spacecraft away from the Agena stage at a rate of about 4.5 feet-per-second.

Retromaneuver and TOPO-A Separation

At two seconds after separation, a simultaneous roll, yaw maneuver is executed by the Agena. This maneuver results in the Agena flying roughly parallel to the Earth with its tail end forward. The first small retro engine is then fired. This lowers the orbit of the Agena in relationship to the Nimbus satellite.

At approximately 104 minutes into the flight an explosive pin puller is fired freeing the TOPO-A from the Agena and placing it in orbit.

A second retro maneuver places the Agena in an orbit where it will maintain a minimum separation of at least 500 feet from the Nimbus spacecraft for a period of at least one year.

Sun-Synchronous Orbit

A high noon orbit is ideal for weather satellites because it provides maximum illumination for photographic purposes, and pictures of the Earth will always be taken at the same local Sun times every day. Night photos will be taken about midnight local time.

In a Sun-synchronous orbit, the precession (eastward drift) of Nimbus will be about one degree daily, at the same rate and direction as the Earth moves around the Sun. The Sun will always be behind Nimbus during daylight orbit, which results in ideal lighting conditions.

THORAD/AGENA-D FACTS

Thorad-Agena-D and Nimbus D
Total Booster Height (including shroud): 109 ft. 5 in.
Weight on pad: 201,637 lbs.

	Thorad Booster	Agena-D Upper Stage
Height:	70 ft. 6 in.	20 ft. 4 in.
Weight:	182,000 lbs.	17,517 lbs.
Propellants:	45,000 lbs. RJ-1 fuel, 100,000 lbs. liquid	570 gallons unsymmetrical dimethyl hydrazine (UDMH)
		740 gallons inhibited fuming nitric acid (IFRNA)
Thurst:	317,050 lbs. total thrust	16,000 lbs. at altitude
Propulsion:	Rocketdyne MB3 BLK 111, 170,000 lbs. thrust	One regeneratively cooled engine (Bell Aerosystems)
	Three Thiokol TX-354-5, each 52,130 lbs. thrust	
Guidance:	Pre-programmed guidance up to 120 sec. WECO on Agena after 120 sec.	Agena IRP (inertial reference package), horizon sensors, and onboard flight programmer.
Prime Contractor:	McDonnell Douglas Astronautics Co., Huntington Beach, Calif.	Lockheed Missiles and Space Co. Sunnyvale, Calif.

THORAD/AGENA D - NIMBUS D NOMINAL FLIGHT TRAJECTORY

EVENT	TIME	(Statute Miles) Surface Range	(Statute Miles) Altitude	Velocity Miles-per-hour
Solid motor burn-out	39 sec.	4 miles	3 miles	690 mph
Solid Motor Separation	1 min. 42 sec.	10 miles	16 miles	1,409 mph
Main engine cutoff	3 min. 43 sec.	143 miles	60 miles	8,976 mph
Agena ignition	4 min. 19 sec.	227 miles	77 miles	8,864 mph
Shroud separation	4 min. 28 sec.	247 miles	82 miles	9,018 mph
Agena first cutoff	8 min. 13 sec.	1,009 miles	98 miles	18,428 mph
Agena restart	54 min. 10 sec.	13,229 miles	687 miles	14,308 mph
Agena second cutoff	54 min. 15 sec.	13,242 miles	687 miles	16,553 mph
Nimbus separation	58 min. 23 sec.	14,026 miles	685 miles	15,678 mph
TOPO-A separation	1 hr. 45 min.	23,540 miles	683 miles	16,590 mph

TOPO-A

1. General - TOPO-A is the first satellite to be launched in a planned series of launches for R&D investigation of a new technique for accurate, real time determination of positions on the Earth's surface. The R&D investigations will utilize modified ground tracking equipment and spacecraft components from the Army's Geodetic SECOR Program which is currently being phased out of operational use. SECOR is an acronym for SEquential COllation of Range. The Army Geodetic SECOR Program, through the use of electronic ranging to the orbiting spacecraft, permitted the extension of geodetic control around the circumference of the Earth thus improving knowledge of the size and shape of the Earth for use in the Army's mapping program.

Although the basic technique utilized in the new R&D program will still be electronic ranging, the modifications will enable all ranging information to be accumulated at a single ground tracking station to enable expedited position computation. This will be accomplished by incorporating a range data relay capability into the system.

2. TOPO-A Spacecraft Description

TOPO-A is not an acronym; it merely identifies the first satellite in a new series to be launched for the U.S. Army Topographic Command (TOPOCOM). TOPOCOM, under the Office of the Chief of Engineers (OCE), has technical cognizance of the R&D program.

TOPO-A is rectangular in shape with the dimensions 14x12x9 inches. The exterior of the spacecraft is almost entirely covered by solar cells which recharge the main battery power supply of the spacecraft. In addition to the batteries, the spacecraft contains a ranging transponder and a telemetry transmitter. The antenna system consists of flexible metal tapes which fold around the spacecraft during launch. The total weight of TOPO-A is 40 pounds.

TOPO-A will be placed in a circular orbit at about 675 miles.

NIMBUS-D PROJECT OFFICIALS

NASA Headquarters, Washington

Dr. John E. Naugle	Associate Administrator, Office of Space Science and Applications
Dr. John M. DeNoyer	Director, Earth Observations Programs
Bruton B. Schardt	Nimbus Program Manager
Joseph B. Mahon	Director, Launch Vehicle and Propulsion Programs
R. W. Manville	Thor/Agena Program Manager

Goddard Space Flight Center

Dr. John F. Clark	Director
Harry Press	Nimbus Project Manager
Stanley Weiland	Observatory Systems Manager
Dr. William Nordberg	Nimbus Project Scientist
William R. Schindler	Launch Vehicles Systems Manager

Kennedy Space Center, Florida

Robert H. Gray	Director, Unmanned Launch Operations
H. R. VanGoey	Manager, WTR Operations
W. S. Cartwright	Manager, Agena Operations, WTR

U.S. Army Corps of Engineers

Richard Malone	Launch Manager, TOPO-A

General Electric Co.

Lewis T. Seaman	GE Nimbus Program Manager, Missile and Space Division

McDonnell Douglas Corp.

W. L. Duval	Vice President, Director, Vandenberg Test Center Huntington Beach, Calif.

Lockheed Missiles & Space Co.

Ray Gavlak	Resident Manager, Space Systems Vandenberg Air Force Base, Calif.

NIMBUS-D EXPERIMENTERS

Dr. Rudolph A. Hanel Dr. Barney J. Conrath Goddard Space Flight Center Greenbelt, Md.	Infrared Interferometer Spectrometer (IRIS)
Dr. Donald F. Heath Goddard Space Flight Center	Backscatter Ultraviolet (BUV) and Monitor Ultraviolet Solar Energy (MUSE)
Dr. Warren A. Hovis	Filter Wedge Spectrometer (FWS)
Dr. David Q. Wark Donald Hilleary Environmental Science Services Administration	Satellite Infrared Spectrometer (SIRS)
Charles E. Cote Goddard Space Flight Center	Interrogation Recording and Location System (IRLS)
Andrew W. McCullock Goddard Space Flight Center	Temperature, Humidity Infrared Radiometer (THIR)
Gerald L. Burdett Goddard Space Flight Center	Image Director Camera Subsystem (IDCS)
Dr. J. T. Houghton Clarendon Laboratory Oxford, England; and Dr. S. D. Smith J. J. Thomson Physical Laboratory, Reading, England	Selective Chopper Radiometer (SCR)

SPACECRAFT CONTRACTORS

Company	Subsystem
Adcole Corp. Waltham, Mass.	Monitor of Ultraviolet Solar Energy (MUSE)
Beckman Instrument Los Angeles, Calif.	Backscatter Ultraviolet (BUV) Experiment
California Computer Products Los Angeles, Calif.	Command Clock
Elliott Brothers Ltd. London, England	Selective Chopper Radiometer (SCR)
Environmental Science Services Administration Rockville, Md.	Satellite Infrared Spectrometer (SIRS)
General Electric Co. Space Systems Organization Valley Forge, Pa.	Nimbus D Integration and Test, Stabilization and Control Subsystem Integration, Spacecraft Structure and Antennas
International Telephone & Telegraph Industrial Laboratories Ft. Wayne, Ind.	Filter Wedge Spectrometer (FWS) and Image Dissector Camera System (IDCS)
Radiation Inc. Melbourne, Fla.	Versatile Information Processor, (VIP), or housekeeping telemetry, and the Interrogation Recording and Location System (IRLS)
Radio Corporation of America Astro Electronics Division Princeton, N. J.	High Data Rate Storage System, Command Receivers, Solar Power System and the Direct Readout Infrared Transmitter
Santa Barbara Research Center, Subsidiary of Hughes Aircraft Co. Santa Barbara, Calif.	Temperature Humidity Infrared Radiometer (THIR)
Sperry Gyroscope Great Neck, N.Y.	Rate Measuring Package
Texas Instruments, Inc. Dallas, Tex.	Infrared Interferometer Spectrometer (IRIS)

Major Ground Equipment Contractors

Company	Responsibility
Adler/Westrex Communications Division of Litton Systems,Inc. New Rochelle, N.Y.	Temperature Humidity Infrared Radiometer (THIR) Facsimile Equipment
Allied Research Associates Inc. Concord, Mass.	Operate the Nimbus Data Utilization Center
California Computer Products Los Angeles, Calif.	Ground Station Command Console
Control Data Corp. Minneapolis, Minn.	Ground Station Computers
General Electric Co. Space Systems Organization Valley Forge, Pa.	Operate the Nimbus Control Center
Lear Siegler, Inc. Anaheim, Calif.	Computer System for Decomputating Versatile Information Processor (VIP) Telemetry Data
RCA Service Co. Cherry Hill, N.J.	Operate the Nimbus Data Handling System at Goddard Space Flight Center and Alaska

Launch Vehicle Contractors

Company	Responsibility
Bell Aerosystems Co. Buffalo, N.Y.	Agena D Engine
Douglas Aircraft Co. Missiles & Space Systems Division Santa Monica, Calif.	Thorad (Long Tank Thor)
Electrosolids Los Angeles, Calif.	Thor Autopilot

Company	Responsibility
Texas Instruments, Inc. Dallas, Tex.	Thor Autopilot
Lockheed Missiles & Space Co. Division of Lockheed Aircraft Co. Sunnyvale, Calif.	Agena D Vehicle (Airframe and Associated Electronics)
Rocketdyne, Inc. Division of North American Rockwell, Inc. Canoga Park, Calif.	Thorad Engine
Thiokol Chemical Corp. Huntsville, Ala.	Solid Propellant Strap-on Boosters
Western Electric Co. Burlington, N.C.	Thorad Guidance Systems

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