NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

2002 NOAA-M Launch

Press Kit

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Contacts

David Steitz Headquarters, Washington, D.C.	Policy/Program Management	202-358-1730
Cynthia M. O'Carroll Goddard Space Flight Center, Greenbelt, MD	NOAA-M Mission	301-614-5563
George Diller Kennedy Space Center, FL	Launch Operations	321-867-2468
Patricia Viets NOAA Suitland, MD	NOAA-M Mission	301-457-5005
VAFB PAO Office VAFB, CA	2 days before the launch	805-605-3051

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NASA, NOAA to Launch the Latest in a Series of Environmental Satellites

A new environmental satellite, NOAA-M, is set to become the newest sentinel for weather forecasters to monitor environmental events around the world. NOAA-M is being prepared for launch June 24 from Vandenberg Air Force Base, Calif. NOAA-M will lift off aboard an Air Force Titan II launch vehicle at 2:22 p.m. EDT (11:22 a.m. PDT). The launch window is approximately 10 minutes.

“The NOAA-M satellite will improve weather forecasting and monitor environmental events around the world,” said Conrad C. Lautenbacher, Jr., USN (ret.), Under Secretary of Commerce for Oceans and Atmosphere, and the National Oceanic and Atmospheric Administration (NOAA) Administrator.

“The satellite will enable continuity of data for monitoring events such as El Nino, droughts, volcanic ash, fires, and floods. In addition, it will support the international search and rescue system by providing capabilities essential for detection and location of ships, aircraft, and people in distress,” Lautenbacher added.

NOAA-M is the third in a series of five Polar-orbiting Operational Environmental Satellites (POES) with instruments that provide improved imaging and sounding capabilities that will operate over the next 10 years.

Like the two previous satellites, NOAA-M’s Advanced Microwave Sounding Unit has additional channels that will provide improved temperature and water vapor monitoring throughout the troposphere and the stratosphere, especially under very cloudy conditions. Its Advanced Very High Resolution Radiometer includes a new sixth channel in the visible range that will be used to provide the capability to distinguish between clouds and snow/ice on the ground.

This latest series of satellites also features significantly increased weight, power, and computer memory to support the new instruments as well as improvements to the spacecraft’s command system.

NOAA-M will collect meteorological data and transmit the information to users around the world to enhance weather forecasting. The data will be used primarily by NOAA's National Weather Service for its weather and climate forecasts. NOAA-M will be re-named NOAA-17 after achieving orbit.

The polar-orbiting satellites monitor the entire Earth, tracking atmospheric variables and providing atmospheric data and cloud images. They track global weather patterns affecting the weather and climate of the United States. The satellites provide visible and infrared radiometer data for imaging purposes, radiation measurements, and temperature and moisture profiles. The polar orbiters' ultraviolet sensors also measure ozone levels in the atmosphere and are able to detect the ozone hole over Antarctica from mid-September to mid-November. Each day, these satellites send global measurements to

NOAA's command and data acquisition station computers, adding vital information to forecasting models, especially over the oceans, where conventional data are lacking.

NOAA's environmental satellite system is composed of two types of satellites: Geostationary Operational Environmental Satellites (GOES) for national, regional, short-range warning and current observations; and the polar-orbiting satellites for global forecasting and environmental monitoring. Both GOES and POES are necessary for providing a complete global weather monitoring system. Both also carry search and rescue instruments to relay signals from aviators and mariners in distress. These satellites are operated by NOAA's National Environmental Satellite, Data, and Information Service in Suitland, Md.

NASA is responsible for the construction, integration, launch and verification testing of the spacecraft, instruments and unique ground equipment. NASA turns operational control of the spacecraft over to NOAA after 21 days of comprehensive subsystem checkout. An on-orbit instrument performance verification period lasts an additional 24 days. Lockheed Martin Missiles and Space Co., Sunnyvale, Calif., built the spacecraft, under contract to NASA.

Data from the NOAA spacecraft are used by researchers within NASA's Earth Science Enterprise to better understand and protect our home planet.

For more information about NOAA-M and the polar orbiting satellites, see the following Web sites:

http://www.gsfc.nasa.gov/topstory/20020624noaam.html
http://www.earth.nasa.gov

-- End of General Release --

Media Services Information

NASA Television Transmission
NASA Television is broadcast on the satellite GE-2, transponder 9C, C band, 85 degrees west longitude, frequency 3880.0 MHz, vertical polarization, audio monaural at 6.8 MHz. The schedule for television transmission for the NOAA-M launch will be available at http://www.nasa.gov/ntv/breaking.html.

News Center/Status Reports
The NOAA-M News Center at the NASA Vandenberg Resident Office (phone: 805-605-3051) will open beginning on launch minus two days. Recorded status reports will be available by dialing 805-734-2693.

Launch Media Credentialing
Media seeking launch accreditation, including international media, should contact the Resident Office at Vandenberg Air Force Base, Calif. by 12:00 p.m. PDT on Friday, June 21, 2002 at 805-606-3595, fax: 805-606-8303, or e-mail: pubaffairs@plans.vafb.af.mil. Requests must be on the letterhead of the news organization and specify the editor making the assignment to cover the launch.

Briefings
A Mission Science briefing was held on May 30 at 10:00 a.m. EDT at the Department of Commerce in Washington, D.C. The L-1 Mission Launch briefing is scheduled for June 23 at 4:00 p.m. EDT (1:00 p.m. PDT) in the Building 840 conference room at VAFB. The briefing will be carried live on NASA TV.

NASA Launch Coverage
Live commentary and coverage of the NOAA-M launch will be available on NASA TV beginning at approximately 1:00 p.m. EDT (10:00 a.m. PDT).

Internet Information
Detailed information about the NOAA-M mission and science objectives can be found at the following NASA and NOAA websites:
http://www.gsfc.nasa.gov/topstory/20020624noaam.html
http://poes.gsfc.nasa.gov
http://www2.ncdc.noaa.gov/docs/intro.htm
http://www.osd.noaa.gov/POES/index.htm

Quick Facts

The NOAA-M spacecraft consists of a spacecraft platform provided under a NASA contract with Lockheed Martin Space Systems Company and eight instruments procured under NASA contracts with several U.S. and international entities. It also includes two search and rescue instruments.

Spacecraft

Dimensions: Main body - 4.2 meters (13.75 feet) long, 1.88 meters (6.2 feet) diameter; Solar array: 2.73 meters by 6.14 meters (8.96 feet by 20.16 feet); 16.76 square meters (180.63 square feet)

Weight at Liftoff: 2,231.7 kilograms (4,920 pounds). Weight includes 756.7 kilograms of expendable fuel (1,666.7 pounds).

Science Instruments: Advanced Very High Resolution Radiometer/3; High Resolution Picture Transmission/3; Advanced Microwave Sounding Unit-A1, -A2; Advanced Microwave Sounding Unit –B; Solar Backscatter Ultraviolet Radiometer/2; Space Environment Monitor/2; Data Collection System/2; High Resolution Infrared Radiation Sounder

Search and Rescue Instruments: Search and Rescue Repeater and Search and Rescue Processor

Power: solar array; three nickel-cadmium batteries each consisting of two battery packs

Load Power Requirements: 833 watts for zero degrees sun angle; 750 watts for 80 degrees sun angle

Instrument Data Rate: 665.4 kilobits per second

Design Lifetime: At least two years

Launch Vehicle

Type: Titan II, Lockheed Martin Space Systems Company

Weight: at liftoff, 336,561 pounds

Mission

Mission Planned Launch Date: June 24, 2002

Launch Time**:** 2:22 p.m. EDT (11:22 a.m. PDT)

Launch Window: 2:22 p.m. to 2:32 p.m. EDT (11:22 a.m. to 11:32 a.m. PDT)

Launch Site: Western Test Range, Vandenberg Air Force Base, Calif.

Orbit: 450 nautical miles (833 kilometers)

Inclination: 98.6 degrees to the equator

Spacecraft Separation: 394 seconds after launch

First Acquisition of NOAA-M Signal: 30 minutes after launch, or 2:52 p.m. EDT (11:52 a.m. PDT) at the McMurdo Tracking Facility

Program

Cost: $202 million for spacecraft and instruments

$54 million for the launch vehicle

$42 million for technical management and other support

History of NOAA's Environmental Satellite System

The first weather satellite in a series of spacecraft originally known as the Television Infrared Observation Satellites (TIROS) was launched on April 1, 1960. By the mid 1970's NOAA and NASA agreed to produce the series operationally based on the TIROS-N generation of satellites. TIROS-N, a research and development spacecraft serving as a prototype for the operational follow-on series, NOAA-A through NOAA-N-Prime was on launched October 13, 1978.

Beginning with NOAA-E, launched in 1983, the basic satellite was "stretched" to permit accommodation of additional research instruments. This became known as the Advanced TIROS-N configuration. Some of the additional instruments flown include: Search and Rescue; Earth Radiation Budget Experiment, and the Solar Backscatter Ultraviolet spectrometer. Three of those instruments, Search and Rescue Repeater, Search and Rescue Processor and Solar Backscatter Ultraviolet Radiometer, became part of the operational program. The primary sounding instrumentation has remained essentially unchanged until the addition of Advanced Microwave Sounding Units-A and -B on NOAA-K (15).

The satellite design life throughout the series has been two years. The lifetime is a cost/risk tradeoff since more years normally result in a more expensive satellite. To mitigate that risk, the NOAA-M satellite uses the most reliable NASA-approved flight parts, Class S, and considerable redundancy in critical subsystem components. The instruments are not redundant, so they are purchased to a three-year design life in order to enhance their expected operational reliability. Because of the inherent reliability built in and the extensive ground testing prior to launch, this series of satellites has demonstrated performance well exceeding the design lifetime.

TIROS-N was launched October 13, 1978, and was the first satellite in the fourth generation operational environmental satellite system. TIROS-N was a research and development spacecraft serving as a proto flight for the operational follow-on series, NOAA-A through N' spacecraft. The spacecraft was deactivated on February 27, 1981.

NOAA-A (6) was launched June 27, 1979 and was totally deactivated on March 31, 1987, after nearly eight years of operational service.
NOAA-B was launched May 29, 1980, and failed to achieve a usable orbit because of a booster engine anomaly.
NOAA-C (7) was launched June 23, 1981, and was deactivated in June 1986.
NOAA-E (8) was launched March 28, 1983. It was the first of the Advanced TIROS-N configuration satellites and included a stretched structure to provide growth capability; it also included the first search and rescue package. The satellite was deactivated on December 29, 1985.
NOAA-F (9) was launched December 12, 1984, and was deactivated on February 13,1998.
NOAA-G (10) was launched September 17, 1986, and was deactivated on August 30, 2001.

NOAA-H (11) was launched September 24, 1988. Some instruments are currently in use to a limited degree.
NOAA-D (12) was launched on May 14, 1991, and some instruments and other subsystems continue to operate satisfactorily. NOAA-12 was placed in standby mode on December 14, 1998, when NOAA-15 became operational.
NOAA-I (13) was launched on August 9, 1993, and two weeks after launch, the spacecraft suffered a power system anomaly. Attempts to contact or command the spacecraft since the power failure have been unsuccessful.
NOAA-J (14) was launched on December 30, 1994, and is currently designated the backup afternoon satellite. NOAA-L (16) replaced NOAA-J (14) as the operational afternoon satellite on March 19, 2001.
NOAA-K (15) was launched on May 13, 1998, and is currently the designated operational morning satellite. It replaced NOAA-D (12) on December 14, 1998, as the primary morning spacecraft.
NOAA-L (16) was launched on September 21, 2000, and is currently the designated operational afternoon satellite. It replaced NOAA-J (14) on March 19, 2001, as the primary afternoon spacecraft.

Earth System Science and Polar Operational Environmental Satellite Program Objectives

Beginning in the 1960s, NASA pioneered the study of the atmosphere from the unique perspective of space with the launch of its Television Infrared Observation Satellite. Thanks to new satellite and computer technologies, it is now possible to study the Earth as a global system.

Earth System Science integrates many disciplines of scientific research that focus on understanding the planet as a whole, its integral parts and how its parts interact. Through research, scientists are getting better at understanding and improving their forecasting of climate phenomena such as the onset of the 1997-98 El Niño.

Weather and climate prediction is a challenge that requires the collection of data over long periods of time. Climate changes occur over vast ranges of space and time and their causes and effects are often difficult to measure and understand. Scientists must obtain long-term data if they are to reach a clearer understanding of the interactions among the Earth's many systems. Polar-orbiting satellites provide both long-range weather forecasting and current data for global change research. Operating as a pair, two satellites ensure that non-visible data for any region of the Earth is no more than six hours old.

The NOAA satellites help to carry forth the U.S. commitment to systematic, global weather observation and provide total global coverage four times a day. The mission supports growing international cooperation in space; the spacecraft instrument suite provides data supporting requirements of 140 nations, and several instruments are provided by foreign nations. The Search and Rescue component of the program makes major contributions toward international search and rescue operations. All nations can access NOAA spacecraft data and for many, NOAA data is their sole weather forecasting reference.

The POES program objectives contribute to NASA's Earth Science Enterprise objectives of understanding the causes and consequences of long-term climate variations on regional as well as global scales. Its objectives also support the Enterprise's objectives by providing for distribution of meteorological data to various organizations, improving the capability for forecasting and providing real-time warnings of solar disturbances and extending knowledge and understanding of the atmosphere and its processes to improve short- and long-term weather forecasts. Data from the NOAA spacecraft are helping NASA scientists design instruments for follow-on missions for NASA's Earth Science program.

The POES program disseminates information about the Earth system, expands scientific knowledge by characterizing the Earth system and enables productive use of Earth Science products in the public and private sectors.

Mission Overview

NASA will launch and activate the NOAA-M spacecraft, the latest in a series of polar-orbiting spacecraft that provide environmental observations for the National Oceanic and Atmospheric Administration. Part of an active NASA-NOAA cooperative program, the NOAA satellites carry instruments that observe the Earth and provide global data for NOAA's operational user requirements including short-, medium-, and long-range weather forecasts. The operational system consists of two polar-orbiting satellites. One operates in an afternoon orbit and the other in a morning orbit with equator crossing times chosen to maximize the usefulness of the data for a variety of applications.

NOAA-M is the latest in the series of advanced TIROS-N spacecraft that provide a platform to support the environmental monitoring instruments for imaging and measuring the Earth's atmosphere, its surface and cloud cover. The polar-orbiting spacecraft serve as complementary satellites to the geosynchronous Geostationary Operational Environmental Satellites (GOES) system. Whereas the GOES satellites provide near-term data for the continental United States and Hawaii to NOAA’s forecasters, the polar-orbiting spacecraft provide full global data for short-, medium-, and long-range forecast models, climate modeling and various other secondary missions.

Instruments on board the spacecraft monitor the entire Earth, providing atmospheric measurements of temperature, humidity, ozone and cloud images as they track weather patterns that affect global weather and climate. The satellites send millions of global measurements daily to NOAA's command and data acquisition stations in Fairbanks, Alaska and Wallops Island, Va., and a data processing center in Suitland, Md. These measurements add valuable information to forecasting models, especially for ocean areas, where conventional ground-based data is lacking. The spacecraft also provides a platform for the Search and Rescue Satellite Aided Tracking system, part of the COSPAS-SARSAT constellation. This international search and rescue system detects and locates emergency beacons transmitted from ships, aircraft and people in distress and has aided in saving thousands of lives.

NOAA-M forms one of a pair of orbiting operational satellites that ensure that environmental data for any region of the Earth is no more than six hours old. With its partner satellite, NOAA-M not only provides cost-effective data for very immediate and real needs but also for extensive climate and research programs. The weather data, including images that are often seen on television news programs, affords both convenience and safety to viewers throughout the world.

NOAA-M will operate in a circular, near-polar orbit of 450 nautical miles (833 kilometers) above the Earth with an inclination angle of approximately 98.6 degrees (retrograde) to the Equator. The NOAA-M orbit period, which is the time it takes to complete one orbit of the Earth, will be approximately 101.35 minutes. The sunlight period will average about 71 minutes with approximately 30 minutes in the Earth’s shadow. Since the Earth rotates 25.34 degrees during each orbit, the satellite observes a different portion of the Earth’s surface during each orbit.

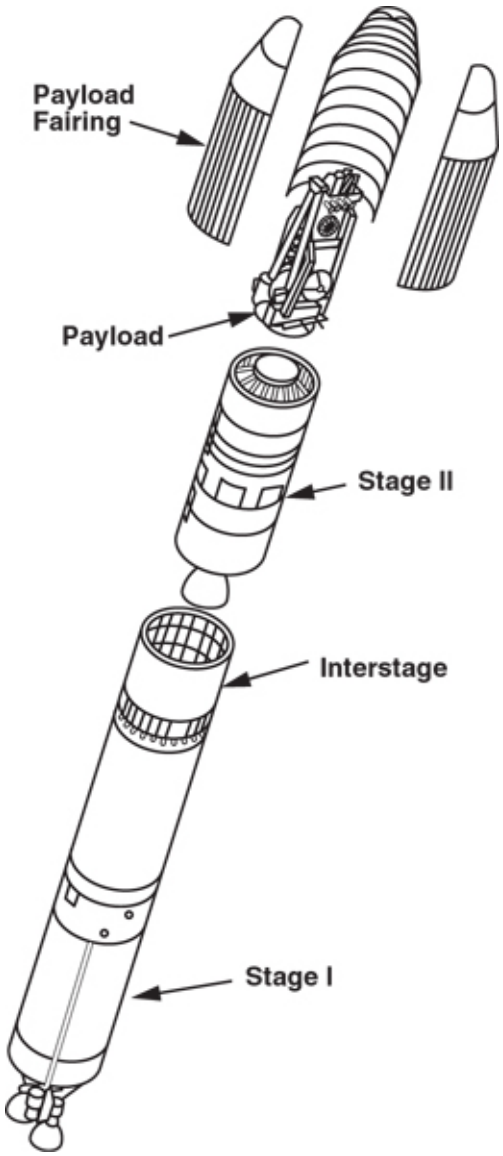
The nominal orbit is Sun-synchronous and rotates eastward about the Earth's polar axis 0.986 degrees per day, approximately the same rate and direction as the Earth's average daily rotation about the Sun. The rotation keeps the satellite in a constant position with reference to the Sun for constant illumination throughout the year.

Launch Vehicle

The Titan II space launch vehicle is a modified Titan II intercontinental ballistic missile built by Lockheed Martin Missiles and Space Company, Sunnyvale, Calif., and provides low- to medium-weight launch capability into low Earth orbit. It consists of two liquid-propellant stages, a payload adapter and payload fairing. Lockheed Martin has modified the Titan II forward structure of the second stage to accommodate a 10-foot diameter payload fairing with variable lengths; manufactured the new fairings plus payload adapters; refurbished the Titans' liquid rocket engines; upgraded the inertial guidance systems; developed command, destruct and telemetry systems; performed payload integration; and modified Space Launch Complex 4 at Vandenberg Air Force Base, Calif., to conduct the launches.

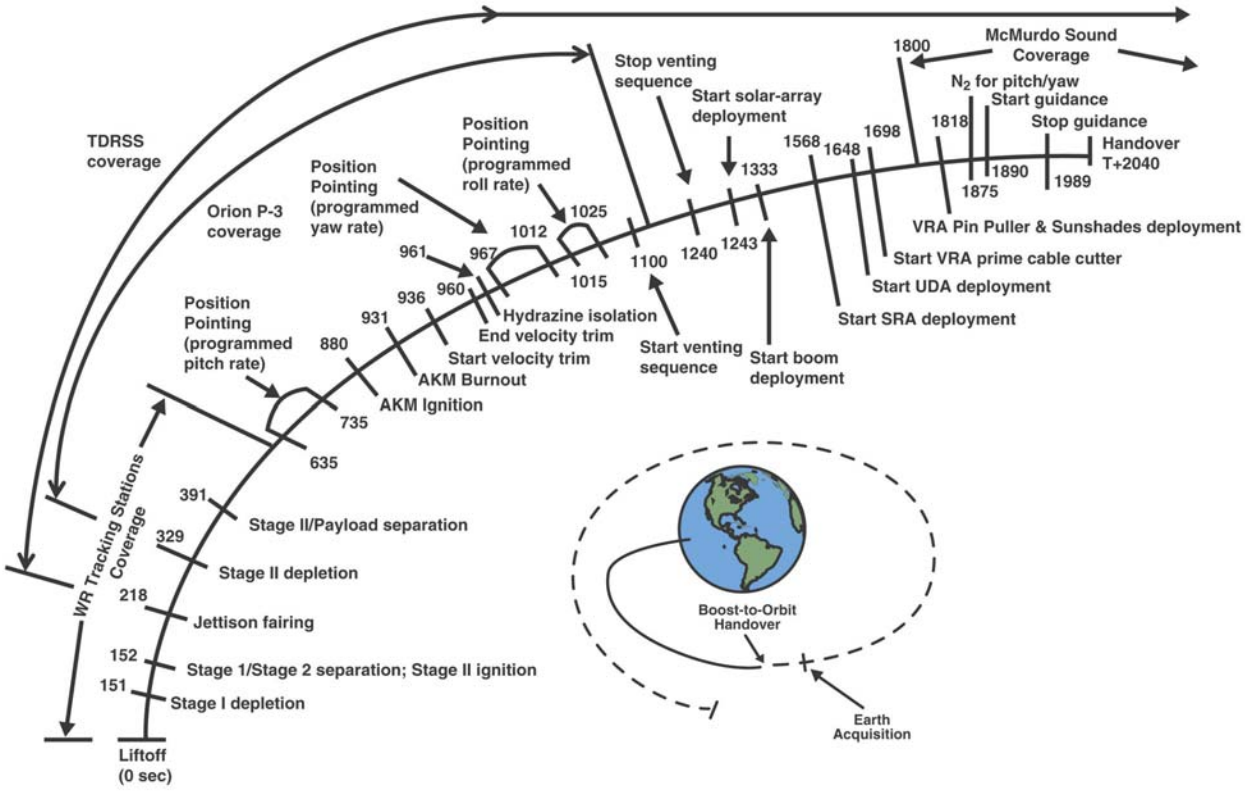
The engines are refurbished Titan II intercontinental ballistic missile engines that burn nitrogen tetroxide and aerozine 50. The Titan II can lift approximately 4,200 pounds into polar low-Earth orbit.

The Air Force and Lockheed Martin have successfully launched 10 Titan II space launch vehicles from Vandenberg Air Force Base. The first four were Sept. 5, 1988; Sept. 5, 1989; April 25, 1992; and Oct. 5, 1993. On Jan. 25, 1994, a Titan II launched the first U.S. moon mission in more than two decades: the Deep Space Program Science Experiment 1 spacecraft, also known as Clementine, for the Department of Defense's Ballistic Missile Defense Organization. The sixth Titan II was launched April 4, 1997, carrying a Defense Meteorological Satellite Program satellite. The seventh Titan II was launched May 13, 1998, carrying the NOAA-K satellite for NASA and NOAA. The eighth launch was June 19, 1999, carrying the QuikScat satellite for NASA. The ninth launch was December 12, 1999, carrying a Defense Meteorological Satellite Program satellite. The most recent launch was Sept. 21, 2000, carrying the NOAA-L satellite.

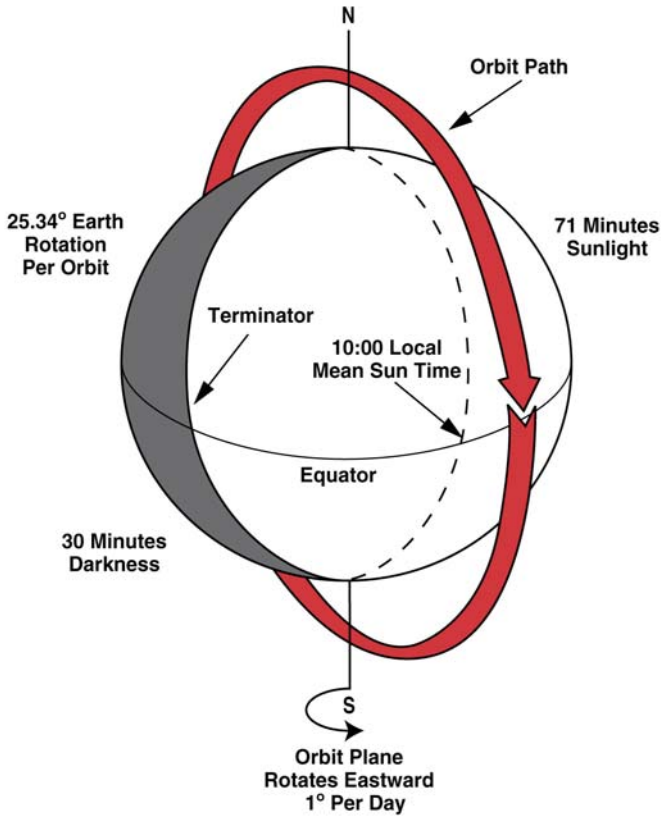


First Stage	Length:	70 feet
	Diameter:	10 feet
	Engine Thrust:	474,000 pounds (vacuum)
	ISP:	296 sec (vacuum)
Second Stage	Length:	40 feet
	Diameter:	10 feet
	Engine Thrust:	100,000 pounds (vacuum)
	ISP:	316 sec (vacuum)
Guidance and Navigation	Inertial guidance system consisting of inertial measurement unit and missile guidance computer	
Payload Fairing	Diameter:	10 feet

NOAA-M Launch Sequence



NOAA-M Orbit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1° Per Day

Spacecraft

Lockheed Martin Space Systems Company of Sunnyvale, Calif., built the spacecraft. The instruments onboard NOAA-M include the Advanced Very High Resolution Radiometer/3; the High Resolution Infrared Radiation Sounder/3; the Advanced Microwave Sounding Unit-A1, A2; the Advanced Microwave Sounding Unit-B; the Solar Backscatter Ultraviolet Radiomete/2; the Space Environment Monitor/2; and the Data Collection System/2. In addition, it carries two search and rescue instruments: the Search and Rescue Repeater and the Search and Rescue Processor.

Instrument Payload and Capabilities
For over 30 years, NOAA has freely and openly provided satellite data through direct broadcast to users in the United States and in 100 other countries throughout the world. In the United States, any commercial firm receiving data through direct readout may provide tailored products to customers and/or viewers. In addition, polar operational environmental satellite data products are made available to users in the United States and throughout the world through NOAA's Satellite Active Archive.

The NOAA polar operational environmental satellites collect global data on cloud cover; surface conditions such as ice, snow, and vegetation; atmospheric temperatures; and moisture, aerosol, and ozone distributions; and collect and relay information from fixed and moving data platforms.

The Advanced Very High Resolution Radiometer/3 is the primary imaging system and consists of visible, near infrared (IR) and thermal IR channels. The primary sounding suite flying on NOAA-M is the High Resolution Picture Transmission/3, Advanced Microwave Sounding Unit-A and Advanced Microwave Sounding Unit-B, which measure atmospheric temperature and humidity. The Solar Backscatter Ultraviolet Radiometer/2 instrument is both an imager and a sounder. As an imager, it produces total column ozone maps. As a sounder, it obtains and measures the ozone distribution in the atmosphere as a function of altitude.

The Advanced Very High Resolution Radiometer/3, built by International Telephone and Telegraph-A/CD (Fort Wayne, Ind.), is composed of six detectors: three view reflected energy in the visible portion of the electromagnetic spectrum and three view energy in the near-infrared portion of the electromagnetic spectrum. The Advanced Very High Resolution Radiometer (which is the type of instrument called an "imager") observes vegetation, clouds, and the surface of bodies of water, shorelines, snow, aerosols and ice. It can detect the heat in the environment, the temperature of snowcaps and the sea surface, vegetation growth around the world and forest fires. From this data, scientists on the ground can determine whether snowcaps are growing or diminishing in size, the effects of changes in ocean temperature and other changes in the environment. The instrument has a scan mirror that continuously rotates and scans the Earth at six revolutions per second to provide continuous coverage. The data generated by the Advanced Very High Resolution Radiometer is used worldwide by scientists, commercial fisherman, teachers and many others.

The High Resolution Picture Transmission/3, built by ITT-A/CD, is an atmospheric sounding instrument. It observes “columns” in the atmosphere and obtains data from each of 20 segments (or bands) in that column. Each of these 20 bands can be associated with energy from a specific region and height in the atmosphere. By combining the data from the different bands, the instrument can generate complete temperature and moisture profiles. It can also measure how much of the Sun’s energy remains as it travels through the atmosphere. The instrument has 19 infrared channels and one visible channel. Each channel takes measurements at a particular frequency that is associated with a particular element (or gas) in the atmosphere. These gases are principally carbon dioxide, water and ozone. These measurements allow scientists to determine the amount of each of these gases in the atmosphere and the altitude at which they appear.

High Resolution Picture Transmission/3 is used along with the Advanced Microwave Sounding Unit instruments to produce atmospheric temperature, humidity and total ozone profiles from the Earth’s surface to about 40 kilometers (23.3 miles) altitude. The data is also used to determine ocean surface temperatures, precipitable water, cloud height and coverage and surface radiance. The instrument completes one scan every 6.4 seconds.

The Advanced Microwave Sounding Unit-A1,-A2, built by Aerojet (Azusa, Calif.) provides data that is used along with data obtained from the High Resolution Picture Transmission to produce a new suite of microwave-based surface and hydrological products, including global atmospheric temperature and humidity profiles from the Earth’s surface to the upper stratosphere, about 48 kilometers or 29.8 miles. Among these products are total precipitable water (water vapor), cloud liquid water, rain rate, snow cover and sea ice concentration, It has 15 channels and continuously scans the Earth’s surface and the atmosphere, measuring naturally emitted microwave signals radiated by the Earth’s surface and atmosphere. The microwave signals measured by the Advanced Microwave Sounding Unit-A range from 23 gigahertz to 89 gigahertz. The Advanced Microwave Sounding Unit-A is divided into two physically separate modules, each of which operates and interfaces with the spacecraft independently.

The Advanced Microwave Sounding Unit -B, built by British Aerospace (Bristol, England) for the United Kingdom Meteorological Office, allows the calculation of vertical water vapor profiles from the Earth’s surface to about 12 kilometers or 7.5 miles from the Earth’s surface. It has five channels and continuously scans the Earth’s surface and the atmosphere, measuring microwave signals radiated by the Earth’s atmosphere. The Advanced Microwave Sounding Unit-B measures microwave signals from 89 GHz to 183 GHz.

The Solar Backscatter Ultraviolet Radiometer/2, built by Ball Aerospace (Boulder, Co.) is flown on the NOAA afternoon satellites. It is a long-term monitoring device that takes global measurements and observes how elements in the atmosphere change over time. The Solar Backscatter Ultraviolet Radiometer uses its 12 channels to measure the amount of radiation (or energy) that comes directly from the Sun (using a diffuser) and how much energy is reflected back from the Earth. This information is integrated into a scientific model that calculates the concentration and distribution of ozone in the stratosphere.

However, the primary use of the data from the Solar Backscatter Ultraviolet Radiometer is determining the vertical distribution of ozone over the global surface - how it varies at various distances from the Earth's surface up to approximately 79 kilometers (or 49 miles). The instrument also provides for the generation of layer ozone values, which represent the amount of ozone found in a "chunk" of the atmosphere.

Each channel on the Solar Backscatter Ultraviolet Radiometer detects a particular near-ultraviolet wavelength whose intensity depends on the ozone density at a particular height in the atmosphere. It is nadir pointing, which means that it always points directly toward the center of the Earth and does not scan the atmosphere as the other POES instruments do. The Solar Backscatter Ultraviolet Radiometer has a device called a Cloud Cover Radiometer that provides information on the amount of cloud cover in an image and removes the effects of the clouds from the data.

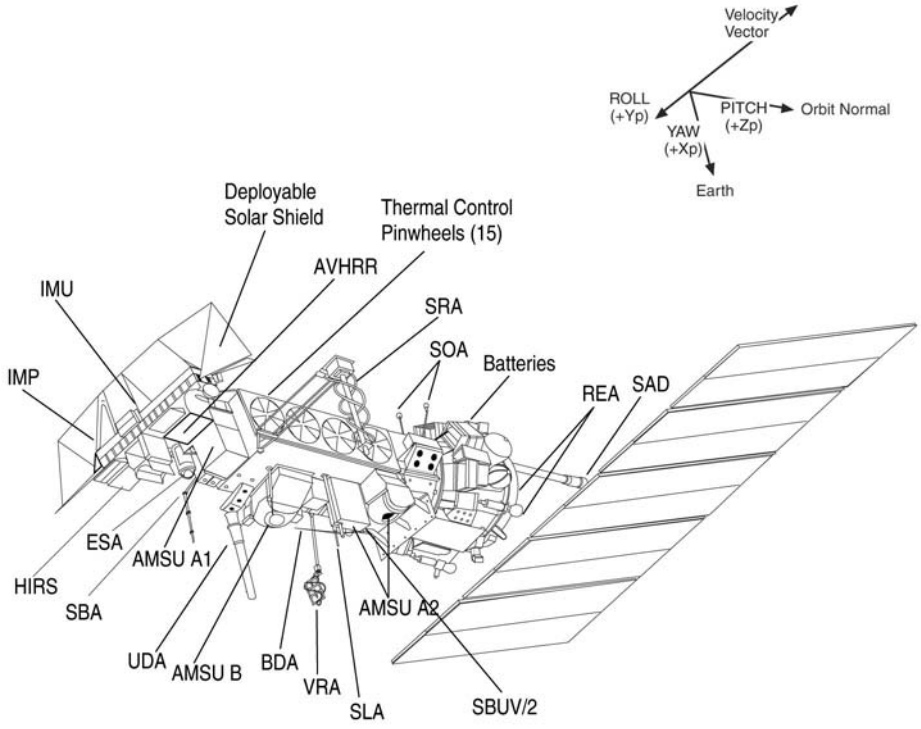
The Space Environment Monitor/2, built by Panametrics (Boston, Mass.) for the NOAA Space Environment Center, detects charged particles and provides measurements to determine the intensity of the Earth's radiation belts and the flux of charged particles into the atmosphere at the satellite's altitude. It provides knowledge of solar terrestrial phenomena and also warns of solar storms that may impair long-range communication and high-altitude operations, damage satellite circuits and solar panels, or cause changes in drag and magnetic torque on satellites. The instrument consists of two separate sensor units and a common Data Processing Unit. The sensor units are the Total Energy Detector and the Medium Energy Proton and Electron Detector.

The Search and Rescue instruments on-board NOAA-M consist of a Search and Rescue Repeater built by Department of National Defense in Canada and a Search and Rescue Processor built by Centre National d'Etudes Spatiales (Touluse, France). These instruments detect distress calls sent from emergency beacons on-board aircraft and boats and carried by people in remote areas. The instruments on the spacecraft transmit the data to ground receiving stations or local user terminals where the location of the emergency signals is determined by Doppler processing. The Local User Terminals forward the information to a Mission Control Center where further processing of the information occurs. The information is then sent to a Rescue Coordination Center that affects the search and rescue. Since its inception in 1982, the COSPAS-SARSAT system has contributed to saving more than 10,000 lives. The Search and Rescue Repeater accepts signals from emergency ground transmitters at 121.5 MHz, 243 MHz and 406.05 MHz and uptranslates, multiplexes and transmits these signals at L-band to the local user terminals. The Search and Rescue Processor is a receiver and processor that receives 406.05-MHz signals from emergency ground transmitters and demodulates, processes, stores and relays the data to the next local user terminal that is within range of the Search and Rescue Repeater.

The Data Collection System provided by CNES in France measures environmental factors such as atmospheric temperature and pressure and the velocity and direction of the ocean and wind currents. Data is collected from transmitting devices on platforms in the form of buoys, free-floating balloons and remote weather stations. Transmitters are even placed on migratory animals, sea turtles, bears and other animals. Data is

transmitted to the spacecraft for storage and subsequent transmission from the satellite to the ground. The stored data is transmitted once per orbit. Subsequently, the data is sent to the French Centre at the Centre National D' Etudes Spatiales and the Service Argos Facility in Lanham, Md., for processing, distribution to users and storage for archival purposes.

Instrumentation Onboard NOAA-M



LEGEND

AMSU Advanced Microwave Sounding Unit

AVHRR Advanced Very High Resolution Radiometer

BDA Beacon Transmitting Antenna

*DCS Data Collection System

ESA Earth Sensor Assembly

HIRS High Resolution Infrared Radiation Sounder

IMP Instrument Mounting Platform

IMU Inertial Measurement Unit

*MEPED Medium Energy Proton/Electron Detector

REA Reaction Engine Assembly

SAD Solar Array Drive

*SAR Search and Rescue

SBA S-Band Transmitting Antenna (1 of 4 shown)

SBUV/2 Solar Backscatter Ultraviolet Radiometer

SEM Space Environment Monitor

SLA Search and Rescue Transmitting Antenna (L-Band)

SOA S-Band Omni Antenna (2 of 6 shown)

SRA Search-and-Rescue Receiving Antenna

*TED Total Energy Detector

UDA Ultra High Frequency Data Collection System Antenna

VRA Very High Frequency Real-time Antenna

Spacecraft Communications

The spacecraft transmits the instrument data to the ground for three primary functions: command and data acquisition, direct broadcast and search and rescue.

Command and Data Acquisition Station Downlinks

Command and data acquisition stations located at Fairbanks, Alaska, and Wallops Island, Va., receive stored Global Area Coverage and Local Area Coverage data from each spacecraft. The command and data acquisition stations can also receive real-time data when the satellites are within the direct readout footprint.

Global Area Coverage data is recorded and contains satellite housekeeping information, Advanced Microwave Sounding Unit data, and 4-kilometers (2.5 miles) resolution Advanced Very High Resolution Radiometer imagery. Global Area Coverage data contains over 100 minutes of imagery and is transmitted to a NOAA ground command and data acquisition station for relay to centralized viewers.

Local Area Coverage data is recorded information that contains 1-kilometer (0.6 miles) Advanced Very High Resolution Radiometer imagery. Local Area Coverage data is recorded for up to 10 minutes and transmitted to a NOAA ground command and data acquisition station for relay to centralized users.

High Resolution Picture Transmission is a real-time transmission of instrument data and satellite housekeeping data. Command and data acquisition stations intercept High Resolution Picture Transmission data primarily for satellite housekeeping data, but also relay the higher resolution data to centralized users.

Direct Broadcast Downlinks

There are three types of direct broadcast downlinks: the real-time High Resolution Picture Transmission, the direct sounder broadcast, also referred to as the real-time VHF beacon transmissions and the Automatic Picture Transmission.

- **High Resolution Picture Transmission:** High Resolution Picture Transmission provides worldwide direct readout of full-resolution spacecraft parameters and instrument data to ground stations within the footprint of the NOAA polar orbiters. The High Resolution Picture Transmission service was originally designed to provide timely day and night sea surface temperature, ice, snow and cloud cover information to diverse users, but applications have expanded due to the proliferation of moderately priced equipment and software. High Resolution Picture Transmission transmissions contain data from all instruments aboard the NOAA polar satellites. To receive the data, users can purchase the necessary equipment (computer, software, antenna) from commercial companies for unlimited access to the High Resolution Picture Transmission signals. In 1996, there were 541 High Resolution Picture Transmission receivers worldwide registered with the World Meteorological Organization.

- **Direct Sounder Broadcasting:** Very high frequency beacon transmission is available to users who do not intend to install the more complex equipment necessary to receive high data rate S-band service.

- **Automatic Picture Transmission Data:** Automatic Picture Transmission is smoothed 4-kilometer (2.5-mile) resolution IR and visible imagery derived from the AVHRR/3 instrument and transmitted within the footprint of the NOAA polar orbiters. Since Automatic Picture Transmission is captured on low-cost VHF ground stations, it is also very popular in schools. Users purchase the necessary equipment (computer, software, and antenna) from commercial companies for unlimited access to Automatic Picture Transmission signals. In 1996, there were 2,296 Automatic Picture Transmission receivers worldwide registered with the World Meteorological Organization.

Search And Rescue Downlinks

The Search and Rescue instruments are part of the international search and rescue satellite-aided tracking system designed to detect and locate Emergency Locator Transmitters, Emergency Position-Indicating Radio Beacons and Personal Locator Beacons operating at 121.5, 243, and 406.05 MHz. The NOAA spacecraft carries two instruments to detect these emergency beacons: the Search and Rescue Repeater provided by Canada and the Search and Rescue Processor provided by France. Similar instruments are carried by the Russian search and rescue polar-orbiting satellites.

The Search and Rescue Repeater transmits the signals of 121.5, 243, and 406.05-MHz emergency beacons. However, these beacon signals are detected on the ground only if the satellite is in view of a ground station known as a Local User Terminal. The Search and Rescue Processor detects the signal only from 406.05-MHz beacons but stores the information for subsequent downlink to a Local User Terminal. Thus, global detection of 406.05-MHz emergency beacons is provided. After receipt of information from a satellite's Search And Rescue Processor or Search and Rescue Repeater, a Local User Terminal locates the beacons by Doppler processing. The Local User Terminal forwards the located information to a corresponding Mission Control Center, which, after further processing, forwards the information to an appropriate Rescue Coordination Center that effects search and rescue.

The U.S. fishing fleet is required to carry 406.05-MHz emergency beacons. The 406.05-MHz beacons are also carried on most large international ships, some aircraft, and pleasure vessels, as well as on terrestrial carriers. The 121.5-MHz and 243-MHz beacons are required on many small aircraft with a smaller number carried on maritime vessels.

Satellite Operations Control Center

The control center for satellite operations is located at NOAA's National Environmental Satellite, Data and Information Service at Suitland, Md. The Satellite Operations Control Center is responsible for operational control of the entire ground system and the following areas:

Command and Data Acquisition Stations
The primary command and data acquisition stations are located at Fairbanks, Alaska and Wallops Island, Va. Through a cooperative agreement between NOAA/National Environmental Satellite, Data, and Information Service and the Establissement d'Etudes et de Reserches Meteorologiques in France, real-time TIROS Information Processor data can be relayed from the Lannion Centre de Meteorologie Spatiale in France via a data link provided by NOAA to the United States.

The command and data acquisition stations transmit commands to the satellites and acquire and record environmental and engineering data from the satellites for retransmission to the Satellite Operations Control Center. All data and commands are transmitted between the Satellite Operations Control Center and the Command and Data Acquisitions via commercial communications links.

Ground Communications
The ground communications links for satellite operations are provided by the Satellite Communications Network and NASA Communications Network. The NASA Communications Network provides any launch-unique communications links for satellite launch. Satellite Communications Network provides all voice and data links between the Satellite Operations Control Center and the command and data acquisition stations after launch. Satellite Communications Network is provided and operated by National Environmental Satellite, Data, and Information Service.

National Environmental Satellite, Data, and Information Service Central Environmental Satellite Computer System
Central Environmental Satellite Computer System acquires the data from the command and data acquisition stations via the Satellite Operations Control Center and is responsible for data processing and the generation of meteorological products on a timely basis to meet the POES program requirements. NOAA provides all hardware and software for Central Environmental Satellite Computer System. NOAA will provide ephemeris data.

Search And Rescue Ground System (Local User Terminals And Mission Control Centers)
The U.S. local user terminals are located at Fairbanks, Alaska; Vandenberg Air Force Base, Calif.; Wahiawa, Hawaii; Johnson Space Center, Houston, Texas; NOAA, Suitland, Md.; Anderson Air Force Base, Guam; and Sabana Seca, Puerto Rico. The Local User Terminals receive the Search and Rescue data from the satellite, determine the distress location and forward the data to the Mission Control Center at Suitland, Md. The Mission

Control Center determines the proper Rescue Coordination Center and forwards the distress location data after removing redundant information. There are also Mission Control Centers and Local User Terminals in Canada, France, Russia and 10 other cooperating countries. All Mission Control Centers cooperate in forwarding data to provide rapid global delivery of distress locations received through the satellites.

Goddard Space Flight Center Facility Support
The Office of Space Communications associated support is requested through the Mission Requirements Request and the Detailed Mission Requirements Document, with other support as described in Memoranda of Understanding. NASA/Goddard Space Flight Center provides nominal prelaunch orbital and prediction information, special support for initial orbit estimation and initial quality control checks of the North American Air Defense Command orbital data. All ground attitude determination is to be accomplished by the NOAA central data processing facility.

The North American Air Defense Command
North American Air Defense Command has prime responsibility for orbit determination, which includes establishing the initial orbit solution and providing updated orbital parameters routinely throughout the life of the mission.

Launch, Early Orbit And Contingency Downlink
An S-band downlink operating at 2247.5 MHz is used during satellite ascent to recover TIROS Information Processor boost telemetry through Western Test Range tracking sites. During on-orbit operations, orbit mode TIROS Information Processor will be available on this link to provide early-orbit and contingency support through the ground-tracking network operated by the Air Force Satellite Control Network in Sunnyvale, Calif., and the Jet Propulsion Laboratory Deep Space Network. The Deep Space Network provides contingency command uplink capability. The McMurdo Tracking Facility in Antarctica also provides early orbit telemetry and command support.

Program Management/Responsibility

NASA and NOAA are actively engaged in a cooperative program to develop and launch the NOAA Polar Operational Environmental Satellites.

NASA's Goddard Space Flight Center, Greenbelt, Md., is responsible for the construction, integration and verification testing of the spacecraft, instruments and unique ground equipment.

NOAA is responsible for program requirements funding and the on-orbit operation of the multi-satellite system. NOAA also determines the need for satellite replacement. NOAA designs, develops and operates the ground system needed to acquire, process and disseminate the satellite data.

NASA coordinates the launch of the spacecraft with the U.S. Air Force. NOAA-M will be launched by the U.S. Air Force on a refurbished ballistic missile, a Titan II. After launch, NASA checks out the satellite to assure it meets its performance requirements. NASA turns operational control of the spacecraft over to NOAA after 21 days of comprehensive subsystem checkout. An on-orbit instrument performance verification period lasts an additional 24 days.

NASA's Kennedy Space Center will conduct launch operations at the VAFB. They are responsible for all launch preparations, the Launch-1 Mission Briefing, launch commentary and NASA TV coverage originating from Vandenberg Air Force Base.

NASA Program Management:
Headquarters
Tom Magner, Director (Acting), Program Planning and Development Division, Earth Science Enterprise

Goddard Space Flight Center
Karen Halterman, POES Program Manager
Joel Susskind, POES Program Scientist

NOAA Management:
Michael Mignogno, POES Program Manager
Wilfred E. Mazur, Polar Satellite Acquisition Manager