NASA Facts

National Aeronautics and
Space Administration

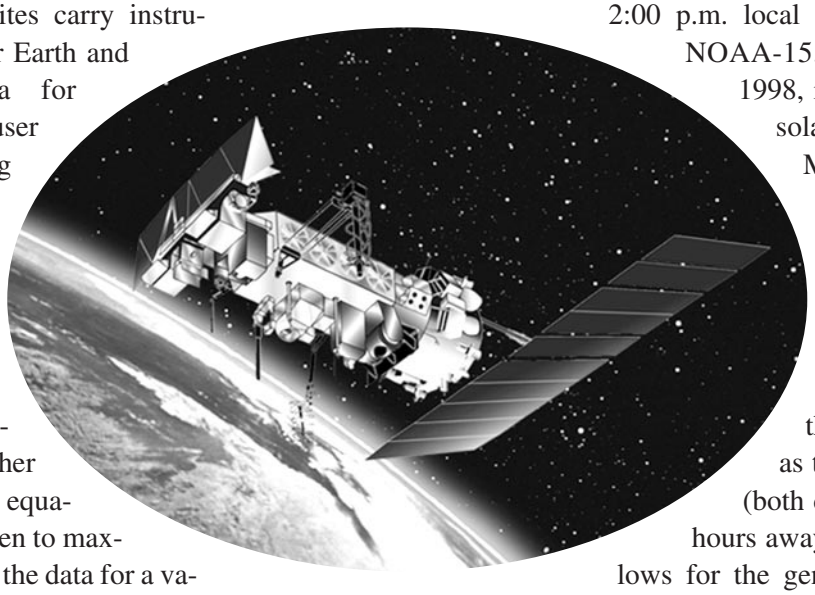
Goddard Space Flight Center
Greenbelt, Maryland 20771
(301) 286-8955

FS-2002-4-042-GSFC

NOAA-M Continues Polar-Orbiting Operational Environmental Satellite Series

Since the 1960s, NASA has developed polar-orbiting operational environmental satellites for the National Oceanic and Atmospheric Administration (NOAA). NOAA-M, the latest NOAA spacecraft, is scheduled for launch in the summer of 2002.

The NOAA satellites carry instruments that observe our 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.



These spacecraft monitor the entire Earth, providing atmospheric measurements of temperature, humidity, ozone and cloud images as they track weather patterns that affect the 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, Virginia, and to its data processing center in Suitland, Maryland, adding valuable information to forecasting models, especially for ocean areas, where conventional ground-based data are lacking.

Currently, NOAA has two operational polar orbiters: NOAA-16, launched in September 2000, into a 2:00 p.m. local solar time orbit and NOAA-15, launched in May 1998, into a 7:30 a.m. local solar time orbit. NOAA-M will replace NOAA-15 in a 10:00 a.m. local solar time orbit. The new 10:00 a.m. orbit will allow NOAA-M to carry the same instruments as the 2:00 p.m. satellite (both cross the equator two hours away from noon), and allows for the generation of the same product suite from each orbit.

NOAA-M will be renamed NOAA-17 after achieving orbit. The satellites receive a letter designation while under construction on the ground and are then renamed with a numerical designation after launch. This is done because the satellites are built in alphabetical order but are not necessarily launched in this same order. Therefore, to avoid confusion, they are numbered upon reaching orbit.

The NASA-NOAA Partnership

NASA and NOAA are actively engaged in a cooperative program to develop and launch the NOAA Polar Operational Environmental Satellites (POES). NOAA is responsible for program requirements, funding and the on-orbit operation of the multisatellite system. NOAA also determines the need for satellite replacement. NOAA designs and develops the ground system needed to acquire, process and disseminate the satellite data. NASA's Goddard Space Flight Center in Greenbelt, Maryland, is responsible for the construction, integration and verification testing of the spacecraft, instruments and unique ground equipment. 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.

NOAA-M

NOAA-M, the latest in the spacecraft series, will broadcast data directly to thousands of users around the world. The spacecraft will continue providing a polar-orbiting platform to support the environmental monitoring instruments for imaging and measuring the Earth's complex coupled systems–it's atmosphere, its surface and cloud cover. Observations include information about Earth radiation, sea and land surface temperature, atmospheric vertical temperature, water vapor and ozone profiles in the troposphere and stratosphere.

Measurement of proton and electron flux at orbit altitude, remote platform data collection and the Search and Rescue Satellite-aided Tracking system (SARSAT) are also supported. NOAA-M will be the third in the series to support a new suite of dedicated microwave instruments to generate improved temperature and moisture profiles and surface and hydrological products in cloudy regions where visible and infrared instruments have decreased capability.

Spacecraft Design

The NOAA satellite series is designed for a two-year mission life, but historically, they have averaged a lifetime almost twice as long. The satellite has a three-axis body stabilized design. This enables the satellite to point accurately toward the Earth and provide continuous global images of cloud cover; surface parameters such as snow, ice and vegetation; and atmospheric temperatures, moisture and aerosol distributions. The satellite is also able to collect and relay information from fixed and moving data platforms, such as buoys, free-floating balloons and remote weather stations.

Each satellite consists of an imaging system, the Advanced Very High Resolution Radiometer and a sounding suite of instruments consisting of the High Resolution Infrared Radiation Sounder and the Advanced Microwave Sounding Units, one for temperature profiles and one for moisture profiles.

The NOAA satellites also include a Space Environment Monitor that provides measurements to determine the intensity of the Earth's radiation belts and the flux of charged particles at the satellite altitude. The monitor warns of solar wind occurrences that may impair long-range communication or high-altitude operations, damage satellite circuits and solar panels, or change drag and magnetic torque on satellites.

Also flying on NOAA-M is the Solar Backscatter Ultraviolet Radiometer. Both an imager and a sounder, the Radiometer produces total ozone maps and measures the ozone distribution in the atmosphere as a function of altitude. In the past, the Radiometer has not flown in the morning POES satellite, but the new 10:00 a.m. orbit permits the collection of ozone data.

A very important mission of these spacecraft is that of lifesaving. Each polar-orbiting NOAA satellite, except NOAA-12, is equipped with a SARSAT system, which receives emergency beacons from ships and aircraft in distress. SARSAT is part of an international satellite system for search and rescue that includes the NOAA spacecraft and the Russian-provided satellite COSPAS. The system consists of the satellites in polar orbit and an international network of Earth stations, which provide global distress alert and location information to appropriate rescue authorities for maritime, aviation and land users in distress. SARSAT has been attributed to saving more than 12,000 lives since it became operational in November 1982.

Orbit and Command

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. NOAA-M will be launched at approximately 2:22 p.m. Eastern Daylight Time (11:22 a.m. Pacific Daylight Time) so that it will cross the Equator at about 10:00 p.m. northbound and 10:00 a.m. southbound local solar time.

The NOAA Satellite Operations Control Center in Suitland, Maryland, provides spacecraft scheduling, health and safety monitoring and engineering analyses. NOAA's Command and Data Acquisition stations are located at Wallops, Virginia, and at Fairbanks, Alaska.

NOAA processes the data in the NOAA Central Environmental Satellite Computer System and delivers it to the National Weather Service's National Centers for Environmental Prediction in Camp Springs, Maryland, National Weather Service forecast offices across the United States, other Federal agencies, and to public and private users worldwide.

The NOAA POES System in Weather Forecasting

The POES spacecraft serve as complementary satellites to the geosynchronous Geostationary Operational Environmental Satellites (GOES) system. Where the GOES satellites provide near-term data from 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, environmental studies and various other secondary missions.

The Future of the POES Program

Two more POES satellites will be launched after NOAA-M, NOAA-N and NOAA-N'. They have planning launch dates of June 2004 and March 2008, respectively, and will both be operated in afternoon orbits. Under an agreement with NOAA, the European Organisation for the Exploitation of Meteorological Satellites will begin operating polar-orbiting satellites known as Metop in 2005 and will assume responsibility for the morning orbit. The Metop satellites will carry both US-provided and European-developed instruments. The data from these satellites will be made available to NOAA as part of the agreement.

A new generation of environmental satellites called the National Polar Operational Environmental Satellite System (NPOESS) will become operational after the POES satellites complete their mission. NPOESS is a tri-agency (NOAA, Department of Defense, NASA) program. NPOESS will provide more capable sensors for improved data collection and better weather forecasts.

More information about these two programs can be found on the Internet at:

http://www.eumetsat.de

http://www.ipo.noaa.gov

Data Archiving and Dissemination

Data from the NOAA spacecraft are helping NASA scientists design instruments for follow-on missions for NASA's Earth Sciences program. NOAA has the responsibility to process, analyze, disseminate and archive all operational data. These data are made available to NASA researchers and others for research and environmental applications.

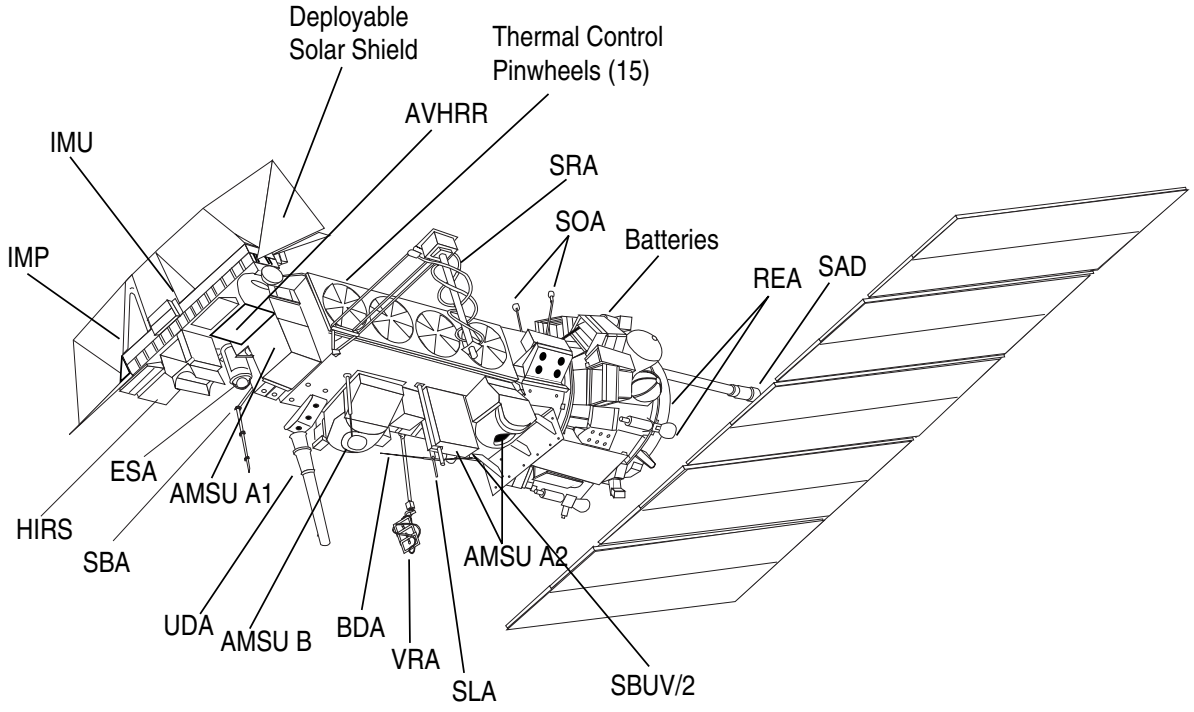
More information on the POES program can be found on the Internet at:

http://poes.gsfc.nasa.gov

http://www2.ncdc.noaa.gov/docs/intro.htm

http://www.osd.noaa.gov

Instrumentation On Board NOAA-M



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