National Aeronautics
And
Space Administration
Press Kit

GOES-M Mission
July 2001

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RELEASE: 01-136

NASA, NOAA PREPARE TO LAUNCH WEATHER SATELLITE DESIGNED TO SEE SOLAR STORMS

Another workhorse of weather forecasting is ready for launch, but the next advanced environmental satellite sent into orbit will be the first capable of detecting storms outside our Earth's atmosphere.

The satellite, GOES-M, will monitor hurricanes, severe thunderstorms, flash floods and other severe weather. However, this satellite also comes equipped with the first operational Solar X-ray Imager to detect solar storms.

GOES-M, or Geostationary Operational Environmental Satellite, is scheduled to lift-off from Cape Canaveral Air Force Station, FL, 3:01 a.m. EDT, July 22, on top of a Lockheed Martin Atlas II rocket.

Real-time weather data gathered by GOES satellites, combined with data from Doppler radars and automated surface observing systems, helps weather forecasters provide better warnings of severe weather. GOES-M provides the ability to monitor and forecast turbulent solar events, which is valuable to operators and users of military and civilian radio and satellite communications systems, navigation systems and power networks, as well as to astronauts, high-altitude aviators and scientists.

The GOES-M Solar X-ray Imager will take a full-disk image of the Sun's atmosphere once every minute. The images will be used by NOAA and the U.S. Air Force to monitor and forecast solar flares, coronal mass ejections, coronal holes and active regions. These features are the dominant sources of disturbances in space weather that lead to geomagnetic storms.

"The SXI will provide the kind of improvements in space weather forecasting that satellite imagery did for tracking hurricanes," said Steven Hill, SXI Program Manager at NOAA's Space Environment Center in Boulder, CO.

The United States operates two GOES meteorological satellites in geostationary orbit 22,300 miles over the Equator, one over the East Coast and one over the West Coast. NOAA's GOES-10 spacecraft, launched in 1997, is currently overlooking the West Coast out into the Pacific including Hawaii; it is located at 135 degrees west longitude. GOES-8, launched in April 1994, is overlooking the East Coast out into the Atlantic Ocean and is positioned at 75 degrees west longitude.

"NASA is excited about providing another fine tool for the NOAA to use in weather operations, including space weather forecasts," said Martin A. Davis, GOES program manager at NASA's Goddard Space Flight Center in Greenbelt, MD. "The launch of the GOES-M is the continuation of a 25-year joint program between NASA and NOAA."

GOES-M will be stored on orbit ready for operation when needed as a replacement for GOES-8 or 10. It joins GOES-11, also in storage. "GOES-M will ensure continuity of GOES data, especially for the Atlantic hurricane season," added Gerald Dittberner,

GOES program manager, Suitland, MD. The satellite will be renamed GOES-12 once reaching geostationary orbit.

NOAA's National Environmental Satellite, Data, and Information Service operates the GOES series of satellites. After the satellites complete on-orbit checkout, NOAA assumes responsibility for command and control, data receipt, and product generation and distribution.

Images taken by the GOES-M Solar X-ray Imager will be available in real time to the general public via the World Wide Web, through NOAA's National Geophysical Data Center in Boulder, CO, at:

http://www.ngdc.noaa.gov/stp/stp.html

Additional GOES information, imagery and space weather information are available on the Internet at:

http://www.goes.noaa.gov
http://goes2.gsfc.nasa.gov
http://rsd.gsfc.nasa.gov/goes/
http://sec.noaa.gov

-end-

Media Services Information

NASA Launch Coverage

NASA TV live coverage and commentary of the GOES-M launch July 22 will begin at approximately 2:45 a.m. EDT for the launch scheduled for 3:01 a.m. EDT. This coverage will be broadcast on NASA TV on G-2, transponder 9C, located at 85 degrees west longitude. The GOES launch will be replayed on NASA TV on July 22 from 8:00 –10:00 a.m.

Live audio coverage will be available on the V circuits at 1:30 a.m. by dialing 321/867-7135, -4003, -4920. A live webcast of the launch will be available at KSC's web site at: www.ksc.nasa.gov

Briefings

A pre-launch press briefing is scheduled on L-1 at 12:30 p.m. EDT on July 20, 2001 at KSC to discuss the details of the launch vehicle, spacecraft readiness and the weather for launch day. The briefing will be carried live on NASA TV.

News Center/Status Reports

NASA Public Affairs will staff the News Center at KSC beginning on L-2 and continuing about two hours after a successful launch. Recorded status reports also will be available beginning two days before launch by dialing 321-867-2525 or 301-286-NEWS.

Media Credentials

Media seeking launch accreditation should fax their requests **at least two days** prior to launch to:

George Diller, KSC/PAO
NASA Kennedy Space Center
Kennedy Space Center, FL
FAX: 321-867-2468

Requests must be submitted on the letterhead of the news organization and specify the editor making the assignment to cover the launch

GOES-M Quick Facts

Spacecraft Dimensions:

- Main Body: 6.5' x 7' x 7.6' (2.0 m x 2.1 m x 2.3 m)
- Deployed length: 88.3' (26.9m)
- Weight: 5005 lbs. (2270 kg)
- Nominal orbit: geosynchronous
  - Altitude: 22,240 miles (35,790 km)
  - Longitude: 90 degrees west

- Latitude: ±0.5 degrees latitude

- Power: Solar array and batteries
- Launch vehicle: Atlas IIA
- Subsystems:
  - Communications: rebroadcast GOES variable (GVAR) Data Rate – 2.1 Mbs
  - Propulsion: Fuel - monomethyl hydrazine; Oxidizer – nitrogen tetroxide
  - Attitude Control: 3-axis body stabilized
  - Thermal: Primarily passive, augmented with heaters
  - Solar Array Power Output at end of life: 1050 watt
- Instruments: Imager, Sounder, and the Space Environment Monitor System (SEM). The SEM consists of a three-axis vector magnetometer, an Energetic Particle Sensor (EPS) and associated High-Energy proton and Alpha Detector (HEPAD), the X-Ray Sensor (XRS) and the Solar X-ray Imager (SXI).

Mission Lifetime: 5 years after 2 years of on-orbit storage
Launch Site: Eastern Range SLC 36A, Cape Canaveral Air Force Station
Launch Window: 3:01 a.m.- 4:25 a.m. EDT
Spacecraft separation: 27.02 minutes after launch
First Signal Acquisition: 35 minutes after launch at Diego Garcia
On-orbit Check-out: L+17 days through 130 days
Launch Vehicle Provider: Lockheed Martin International Launch Services
Launch Operations: Kennedy Space Center, Fl.
Spacecraft Operations: Satellite Operations Control Center, Suitland, Md.
Mission Management: NASA Goddard Space Flight Center, Greenbelt, Md. and National Oceanic and Atmospheric Administration.
Mission Cost: Total mission costs are approximately $350 million for the spacecraft, the instrument payload, launch services, data analysis, ground operations and mission operations.

The Mission of the GOES Program

The GOES I-M series of spacecraft are the principal observational platforms for covering dynamic weather events and the near-earth space environment for the 1990s and into the 21st century. These advanced spacecraft enhance the capability of the GOES system to continuously observe and measure meteorological phenomena in real time, providing the meteorological community and the atmospheric scientist greatly improved observational and measurement data of the Western Hemisphere. In addition to short-term weather forecasting and space environmental monitoring, these enhanced operational services also improve support for atmospheric science research, numerical weather prediction models, and environmental sensor design and development.

The main mission is carried out by the primary payload instruments, the Imager and the Sounder. The Imager is a multichannel instrument that senses radiant energy and reflected solar energy from the Earth's surface and atmosphere. The Sounder provides data for vertical atmospheric temperature and moisture profiles, surface and cloud top temperature and ozone distribution.

Other instruments on board the spacecraft are the search and rescue transponder, ground-based meteorological platform data collection and relay and the space environment monitor (including the Solar X-ray Monitor on GOES-M). The Space Environment Monitor consists of an x-ray sensor for monitoring the Sun's x-ray brightness; a magnetometer; a high-energy proton and alpha particle detector; and an energetic sensor, all used for in-situ surveying of the near-Earth space environment.

The goals of the Geostationary Operational Environmental Satellite (GOES) system program are to:
• Maintain reliable operational, environmental•and storm warning systems to protect life and property
• Monitor the earth's surface and space environmental conditions
• Introduce improved atmospheric and oceanic observations and data dissemination capabilities
• Develop and provide new and improved applications and products for a wide range of federal agencies, state and local governments and private users.

To address these goals, the National Weather Service (NWS) and the National•Environmental Satellite Data and Information Service (NESDIS) of the Department of Commerce established mission requirements for the 1990s that are the basis for•design of the GOES I-M system and its capabilities. The GOES system thus functions to accomplish an environmental mission to service the needs of operational meteorological, space environmental and research users.

Each mission function is supported or performed by components of the GOES I-M payloads:
Environmental sensing:

• Five-channel Imager
• Nineteen-channel Sounder
• Space environment monitor (SEM)
  - Energetic particles sensor (EPS)
  - High energy proton and alpha particle detector (HEPAD)
    - X-ray sensor (XRS)
    - Magnetometer
    - Solar X-ray Imager (SXI)•••••

Data collection:
• Data collection system (DCS)
Data broadcast:
• Processed data relay (PDR) and weather facsimile (WEFAX) transponders
• Search and rescue (SAR)
• Sensor data and multiuse data link (MDL) transmitters

The remote sensing function is carried out by the 5-channel Imager and 19-channel•Sounder, both of improved spatial and spectral resolution, and in-situ sensing by a•SEM X-Ray Sensor and, on GOES-M, the 7-channel Solar X-ray Imager. The in-situ sensing is preformed by the SEM EPS, HEPAD and the magnetometers. The acquisition of sensed data and final distribution are performed in real-time to•meet observation time and timeliness requirements, including revisit cycles. Remotely sensed data are obtained over a wide range of areas of the Western Hemisphere, encompassing the Earth's disk, selected sectors, and small areas. Area•coverage also includes the visibility needed to relay signals and data from ground•transmitters and platforms to central stations and end users.

NASA and NOAA Launch Latest Environment Satellite GOES-M

In 1983, NASA signed an agreement with the National Oceanic and Atmospheric Administration (NOAA) to design and build a new generation of environmental satellites. These satellites would carry instruments designed to operate as never before, taking near continuous observations of Earth.

The NASA-NOAA Partnership

NASA and NOAA are actively engaged in a cooperative program to continue the Geostationary Operational Environmental Satellite (GOES) system with the launch of the GOES-M satellite. NASA and NOAA have worked jointly to perfect, develop and complete the GOES program, begun in 1975 with the launch of the GOES-1 satellite.

This new generation of environmental satellites – GOES I through M – are a key element in NOAA's National Weather Service (NWS) modernization program.

NASA's Goddard Space Flight Center, Greenbelt, Md., is responsible for procuring, developing and verification testing of the spacecraft, instruments and unique ground equipment. Following deployment of the spacecraft from the launch vehicle, GSFC is

responsible for the mission operation phase leading to injection of the satellite into geostationary orbit and initial in-orbit satellite checkout and evaluation.

NOAA is responsible for program funding and the in-orbit operation of the system. NOAA also determines the need for satellite replacement.

NOAA and NASA jointly design, develop, install and integrate the ground system needed to acquire, process and disseminate the data from the sensors on the GOES satellites. NASA's Kennedy Space Center is responsible for launch services.

Design and Operations

Goddard engineers design the satellite to operate in geosynchronous orbit 22,240 miles (35,790 kilometers) above the Earth. At this orbit, because the satellite's orbital velocity matches the rotation of the Earth, it appears to remain stationary in the sky. In addition, Goddard engineers developed the GOES satellites with a three-axis body stabilized spacecraft design. This enables the satellite to "stare" at the Earth and more frequently provide images of clouds, Earth's surface temperature and water vapor fields, and to continuously sound the atmosphere for vertical thermal and vapor profiles.

In the past, scientists from environmental service agencies have stated a need for continuous, dependable, timely and high-quality observations of the Earth and its environment. This series of GOES satellites provide half-hourly observations to fill the need. The instruments on board the satellites measure Earth's emitted and reflected radiation from which atmospheric temperature, winds, moisture and cloud cover can be derived.

Each satellite in the series carries two major instruments: an Imager and a Sounder. These instruments acquire high-resolution visible and infrared data, as well as temperature and moisture profiles of the atmosphere. They continuously transmit these data to ground terminals where the data are processed for rebroadcast to primary weather service offices in the United States and around the world, including the global research community.

These instruments provide two valuable features. The first, flexible scan, offers small-scale area imaging that lets meteorologists take pictures of local weather trouble spots. This allows them to improve short- term forecasts over local areas. The second feature, simultaneous and independent imaging and sounding, is designed to allow weather forecasters to use multiple measurements of weather phenomena to increase the accuracy of their forecasts.

In addition to the Imager and the Sounder instruments, GOES-M will carry the new Solar X-ray Imager (SXI). The imager will be used to determine when to issue forecasts and alerts of "space weather" conditions that may interfere with ground and space systems.

Space weather conditions include ionospheric changes that affect radio communication and magnetospheric variations that can induce currents in electric power grids and long distance pipelines, cause navigational errors in magnetic guidance systems and, introduce changes in spacecraft charging producing high energy particles that can cause single event upsets in satellite circuitry. Magnetospheric variations can also expose astronauts to increased radiation.

The SXI will observe solar flares, solar active regions, coronal holes and coronal mass ejections. Images from the SXI will be used by NOAA and U.S. Air Force forecasters to monitor solar conditions that affect space weather. The SXI will fly on future GOES satellites.

The GOES satellites also provide instantaneous relay of distress signals from people, aircraft, or marine vessels to the search and rescue ground stations of the Search and Rescue Satellite Aided Tracking (SARSAT) System. A dedicated search and rescue transponder on board GOES is designed to detect emergency distress signals originating from Earth-based sources. These unique identification signals are normally combined with signals received by NOAA's Polar Operational Environmental Satellite system and relayed to a search and rescue ground terminal. The combined data are used to perform effective search and rescue operations.

The GOES I-M system serves the central and eastern Pacific Ocean; North, Central and South America; and the central and western Atlantic Ocean. Pacific coverage includes Hawaii and the Gulf of Alaska. This is accomplished by two satellites, GOES West located at 135 degrees west longitude and GOES East at 75 degrees west longitude. NOAA's Command and Data acquisition station located in Wallops, Va., supports the interface to both satellites. The NOAA Satellite Operations Control Center in Suitland, Md. provides spacecraft scheduling, health and safety monitoring and engineering analyses. Processed data are received at the National Weather Service's National Centers for Environmental Prediction in Camp Springs, Md., and NWS forecast offices across the United States.

GOES System in Weather Forecasting

The GOES system is a basic element of U.S. weather monitoring and forecast operations and is a key component of NOAA's National Weather Service modernization program. Spacecraft and ground-based systems work together to accomplish the GOES mission of providing weather imagery and quantitative sounding data that form a continuous and reliable stream of environmental information for weather forecasting and related services.

The GOES I-M satellites provide weather imagery and atmospheric sounding information for improved weather services, particularly for the timely forecasting of life- and property-threatening severe storms. Commercial weather groups, universities, the Department of Defense, NASA and the global research community also use GOES data products. Other users of these products can also be found in air and ground traffic control, ship navigation and agricultural sectors.

Satellite Series
The GOES satellites are given a letter designation while under construction on the ground and are renamed with a numerical designation after launch. This is done for two reasons. First, satellites are easier to track in orbit if they are designated with a number. Second, 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 first satellite in the series, GOES-I, was launched April 13, 1994, from Cape Canaveral Air Force Station (CCAFS), Fla. This advanced satellite is providing more precise and timely weather observation and atmospheric measurement data for the United States than ever before possible. GOES-8 is located at 75 degrees west longitude, overlooking the East Coast of North and South America and the Atlantic Ocean. GOES-I was renamed GOES-8 after achieving orbit and is still actively collecting data.

GOES-J, the second in the I-M series, was launched aboard an Atlas 1 rocket from CCAFS, on May 23, 1995. GOES-J was renamed GOES-9 after achieving orbit. In early 1996, GOES-9 was positioned to view the western the United States, Hawaii, Alaska, and the Pacific.

GOES-K, the third in the series, was successfully launched aboard an Atlas IIA rocket from CCAFS on April 25, 1997. GOES-K was renamed GOES-10 upon reaching orbit. GOES-10 replaced GOES-9 as the West Coast operational spacecraft on July 28, 1998. GOES-L was launched aboard an Atlas rocket on May 3, 2000 from CCAFS. The satellite was renamed GOES-11 upon reaching orbit where it is stored until it is needed to replace one of the older GOES satellites.

The launch of the final spacecraft in the series, GOES-M, is scheduled for July 12, 2001. It will also be stored on orbit until it is needed to replace one of the older GOES satellites. Its primary objective is to provide a full capability satellite in an on-orbit storage condition, to assure NOAA continuity in services from a two-satellite constellation.

Data from the GOES spacecraft are helping NASA scientists design instruments for follow-on missions for the NASA program known as the Earth Science Enterprise.

The goal of the Earth Science Enterprise is to allow humans to better understand natural environmental changes. Earth science data, which NASA distributes to researchers worldwide, is essential to making informed decisions about the environment.

For more information, visit the GOES web sites at:
http://goes2.gsfc.nasa.gov

http://www.osd.noaa.gov/sats/goes.htm
http://rsd.gsfc.nasa.gov/goes/

The Solar X-ray Imager

The Solar X-ray Imager (SXI) -- to be launched as part of the Space Environment Monitor suite of instruments on the GOES-M weather satellite -- will be used to aid National Oceanic and Atmospheric Administration (NOAA) and U.S. Air Force personnel in issuing forecasts and alerts of “space weather” conditions that may interfere with ground and space systems. Turbulent “space weather” can affect radio communication on Earth, induce currents in electric power grids and long distance pipelines, cause navigational errors in magnetic guidance systems, upset satellite circuitry and expose astronauts to increased radiation.

The first in a series of instruments, the Solar X-ray Imager will observe solar flares, coronal mass ejections, coronal holes, and active regions in the X-ray region of the electromagnetic spectrum from 6 to 60 A (Angstroms). These features are the dominant sources of disturbances in space weather that lead to, for example, geomagnetic storms. The Imager will also examine flare properties, newly emerging active regions and X-ray bright points on the Sun.

NOAA and the Air Force will use Solar X-ray Imager data for solar forecasting and monitoring solar storms, and to develop a better understanding of Sun-related phenomena that affect the Earth’s environment.

The imager was developed, tested, and calibrated by NASA’s Marshall Space Flight Center in Huntsville, Ala., in conjunction with the NASA Goddard Space Flight Center in Greenbelt, Md., NOAA, and the Air Force.

The imager instrument consists of a telescope assembly with a 6.3-inch (16-centimeter) diameter grazing incidence mirror and a detector system. Incoming X-rays graze the mirror's surface at very shallow angles and are brought to a focus on the detector system.

As long as the grazing angles are very shallow, about one degree, the X-rays do not penetrate the surface but are reflected, just like visible light. The detector system contains a micro-channel plate which converts the X-rays to visible light which is then recorded using a CCD camera. Resulting data are electronically packaged for transfer to NOAA ground stations in Suitland, Md., and Boulder, Colo. The images are processed and distributed to space weather forecast centers by the NOAA Space Environment Center in Boulder. The images are made immediately available to the public via the World Wide Web by the NOAA National Geophysical Data Center, also in Boulder.

The imager will provide continuous, near real-time observation of the Sun’s corona, acquiring a full-disk image every minute. The images cover a 42 arc-minute field of view with five arc-second pixels. The Sun, as viewed from Earth, is approximately 32 arc-minutes in diameter.

By recording solar images every minute, NOAA observers will be able to detect and locate the occurrence of solar flares. This is the name given to the explosive releases of vast amounts of magnetic energy in the solar atmosphere. Since scientists are not

yet able to predict the occurrence, magnitude or location of solar flares, it is necessary to continually observe the Sun to know when they are happening.

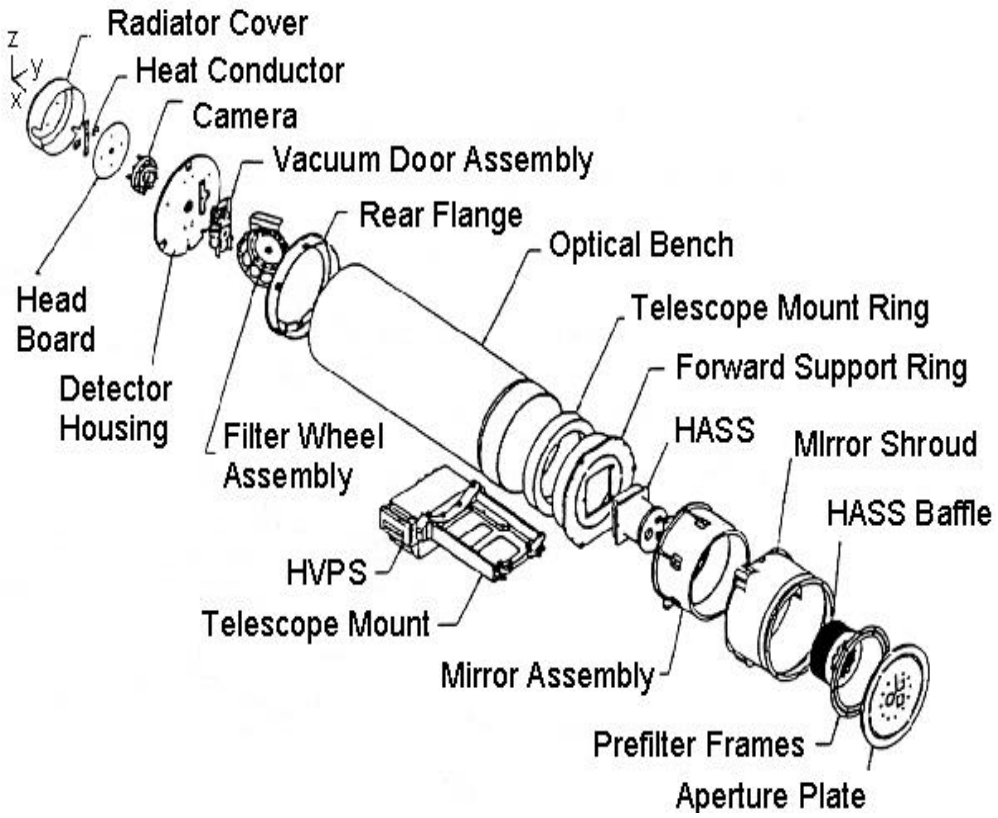
When a flare erupts, it throws out large clouds of ionized, or electrically charged, gas. A small fraction of the cloud is very energetic and can reach the Earth within a few minutes to hours of the flare being observed. These energetic particles pose a hazard to both astronauts and spacecraft.

Coronal mass ejections, which are often associated with flares, take several days to reach the Earth. Fast, powerful ejections give rise to geomagnetic storms, which can disrupt radio transmissions and induce large currents in power transmission lines and oil pipelines. They have resulted in large-scale failures of the North American power grid and greatly increased pipeline erosion. SXI also will monitor coronal holes -- persistent sources of high-speed solar wind. As the Sun rotates every 27 days, these sources spray across the Earth like a lawn sprinkler and cause recurring geomagnetic storms.

The first Solar X-ray Imager instrument is scheduled for launch on NOAA's GOES-M weather satellite. GOES stands for Geostationary Operational Environmental Satellite. That name refers to the fact that the satellites are "parked" in a geostationary orbit, 22,300 miles (35,890 kilometers) above the Earth's equator. The orbital velocity of these satellites matches the Earth's rotation, so they remain in the same position in the sky.

For more information about NOAA's Space Environment Center and the SXI visit:
Space environment Center: http://sec.noaa.gov
SXI Home Page: http://sec.noaa.gov/sxi
Today's Space Weather: http://sec.noaa.gov/today.html
Solar-Terrestrial Physics: http://www. ngdc.noaa.gov

Solar X-ray Imager Telescope


Radiator Cover
Heat Conductor
Camera
Vacuum Door Assembly
Rear Flange
Optical Bench
Telescope Mount Ring
Forward Support Ring
HASS
Mirror Shroud
HASS Baffle
Head Board
Detector Housing
Filter Wheel Assembly
HVPS
Telescope Mount
Mirror Assembly
Prefilter Frames
Aperture Plate

PROGRAM MANAGEMENT

NASA/GSFC is responsible for the construction, integration and verification testing of the spacecraft, instruments and unique ground equipment. NASA coordinates the launch of the spacecraft with the U.S. Air Force. NASA's comprehensive on-orbit verification period is expected to last 130 days after launch when NASA will hand over formal operations to NOAA.

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.

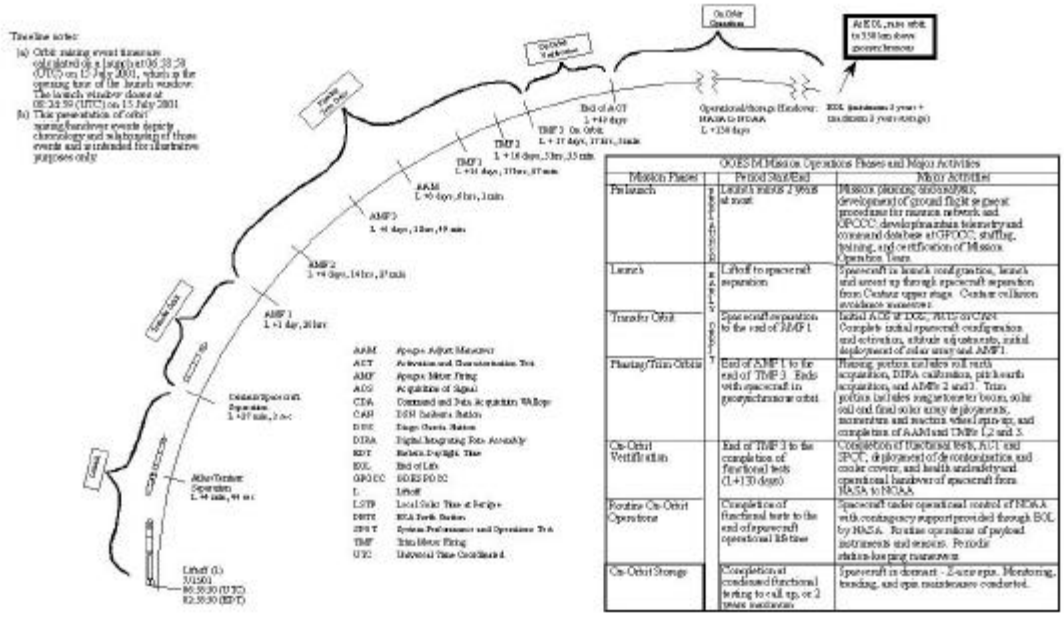
NASA Program Management:

Headquarters
Dr. Ghassem Asrar, Associate Administrator of the Office of Earth Science

Goddard Space Flight Center
Martin A. Davis, GOES Program Manager
Dennis Chesters, GOES Program Scientist

NOAA Management:
Gerry Dittberner, GOES Program Manager
Steve Kirkner, GOES Satellite Acquisition Manager

Orbit Raising Sequence

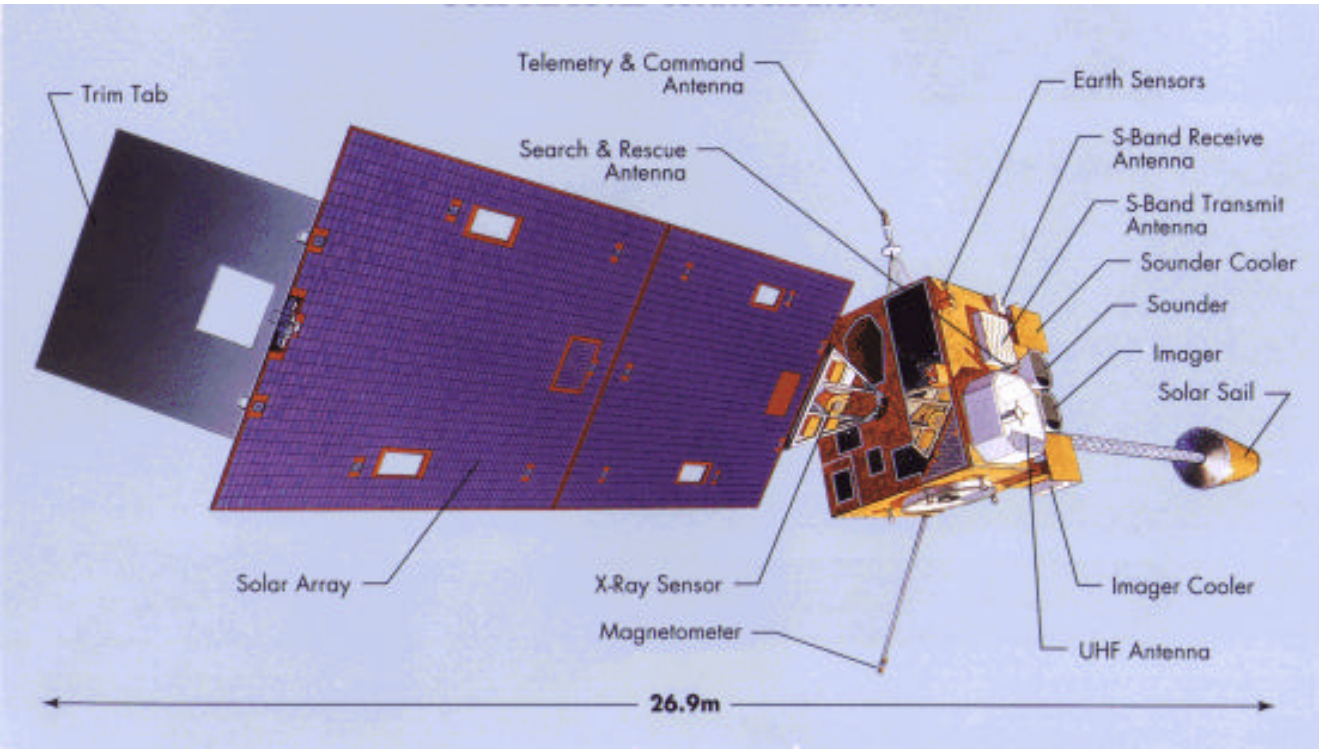


GOES-DL Mission Operations Phases and Major Activities

Mission Phases	Period Start/End	Major Activities
Pre-launch	Launch minus 2 years to launch	Mission planning, procedures development, development of ground flight segment procedures for mission network and GOSCC, develop/maintain telemetry and command database at GOSCC, staffing, training, and certification of Mission Operation Team
Launch	Launch to spacecraft separation	Spacecraft in launch configuration, launch and ascent up through spacecraft separation from Centaur upper stage. Centaur collision avoidance maneuver.
Transfer Orbit	Spacecraft separation to the end of AMF 1	Initial AOS at DOC, ACS activated. Complete initial spacecraft configuration and activation, attitude adjustments, initial deployment of solar array and AMF1.
Phasing/Trim Orbits	End of AMF 1 to the end of TMF 3. Ends with spacecraft in geosynchronous orbit	Phasing portion includes roll north acquisition, DIRA calibration, pitch earth acquisition, and AMFs 2 and 3. Trim portion includes momentum/yaw biases, solar sail and final solar array deployments, momentum and reaction wheels spin-up, and completion of AAM and TMFs 1,2 and 3.
On-Orbit Verification	End of TMF 3 to the completion of Functional tests (L+130 days)	Completion of functional tests, ACT and IPCT, deployment of de-contamination and cooler covers, and health and safety and operational handover of spacecraft from NASA to NOAA
Routine On-Orbit Operations	Completion of functional tests to the end of spacecraft operational life time	Spacecraft under operational control of NOAA with contingency support provided through EOL by NASA. Routine operations of payload instruments and sensors. Periodic station-keeping maneuvers.
On-Orbit Storage	Completion of condensed functional testing to call up, or 2 years maximum	Spacecraft is dormant - Z-axis ops. Monitoring, trending, and ops. maintenance conducted.

Note: A larger version of this drawing is available at: http://pao.gsfc.nasa.gov

GOES-M Line Drawing



GOES-M Image