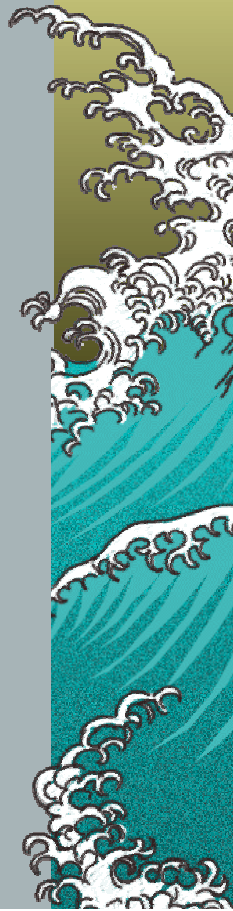


Remote Sensing of The Oceans: United States Plans for the Coming Decade

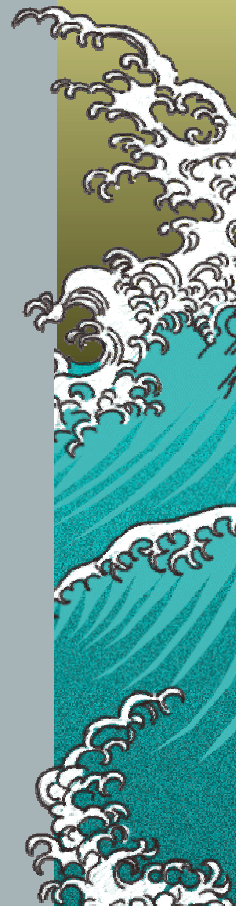


*A presentation to JAXA by
Dr. Stephen E. Borders
June 23, 2005*



INTEGRATED OCEAN OBSERVING SYSTEM

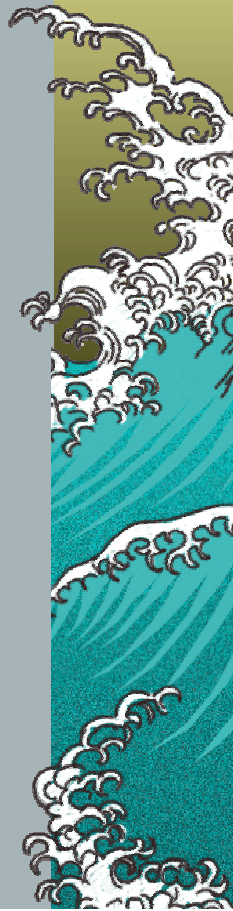
Recently, the US Commission on Ocean Policy expressed concern about the health of Coastal waters and recommended to Congress the development and implementation of an Integrated Ocean Observing System (IOOS). The IOOS is critically dependent on remotely sensed data. The following space missions are part of IOOS.





SCHEDULE

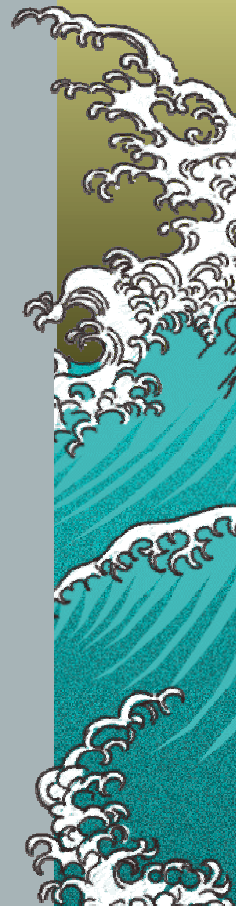
- ✦ *The NPP satellite is scheduled to be launched in mid 2006*
- ✦ *METOP (EUMETSAT) launch in 2006*
- ✦ *The Jason-2 satellite is scheduled to be launched in early 2008*
- ✦ *The first NPOESS satellite is scheduled to be launched in early 2010*
- ✦ *The GOES-R satellite is scheduled to be launched in 2012.*



NPP MISSION



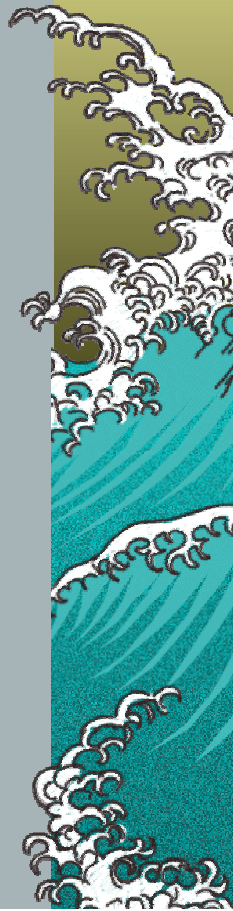
- ✦ *NPP is a bridging mission to continue the TERRA and AQUA measurements of Global Water Cycle, Climate Change and Carbon Cycle.*
- ✦ *NPP provides risk reduction for the national Polar-Orbiting Satellite System (NPOESS)*





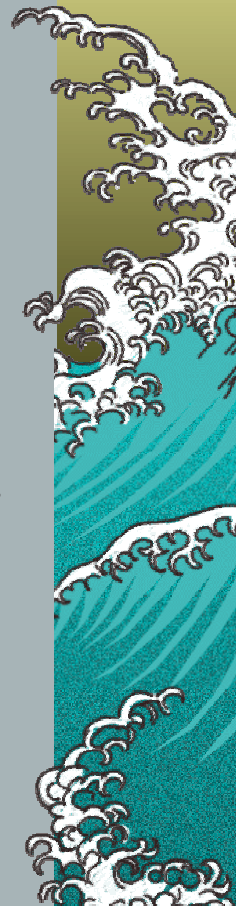
NPP SENSORS

- ▶ *The Visible IR Imaging Spectroradiometer Suite (VIIRS)*
- ▶ *Cross Track IR Sounder (CrIS)*
- ▶ *Advanced Technology Microwave Sounder (ATMS)*
- ▶ *Instrument of Opportunity (CERES, OMPS, SAGE III...)*



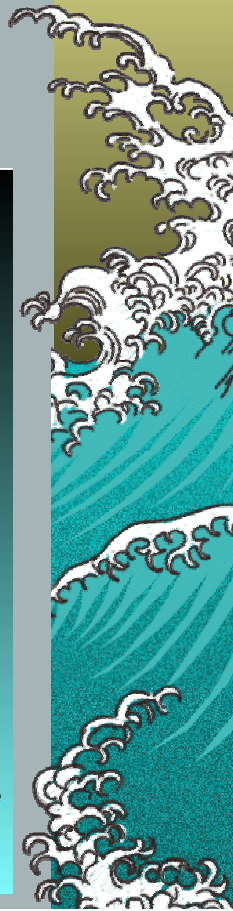
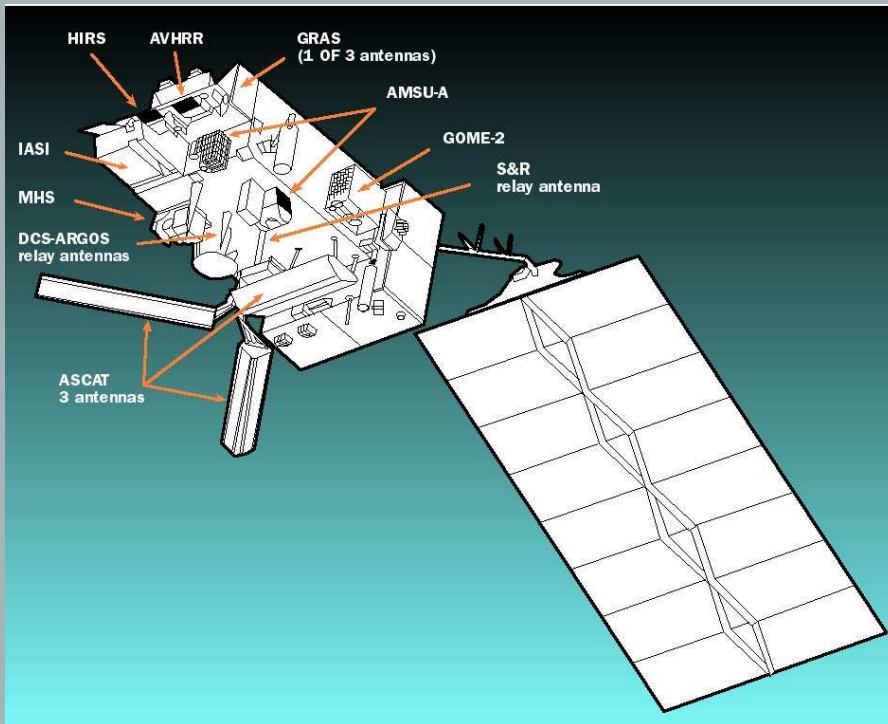
METOP MISSION

- ▶ *Metop will gather essential global information by day and by night, about the atmosphere, and land and ocean surfaces. A primary task is to measure the temperature and the humidity of the global atmosphere, using instruments capable of sounding the atmosphere throughout its depth. A second important task is to obtain global images of clouds and weather systems, and information about the sea and land surfaces, including, in particular, ocean surface winds. Atmospheric ozone will also be monitored. In addition to these instruments, Metop will carry a data collection system to gather information from ground-based systems, support Search and Rescue services, and measure the local space environment.*





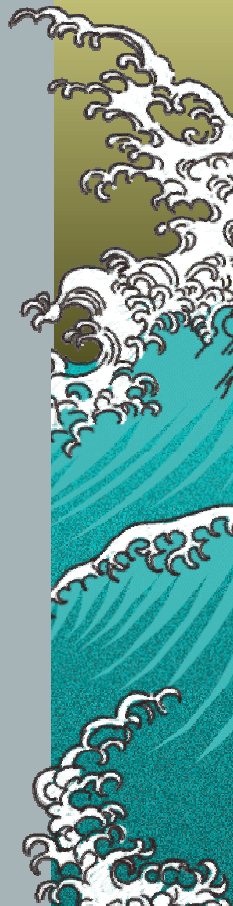
METOP PLATFORM



METOP SENSORS

- ▲ AVHRR/3* *Advanced Very High Resolution Radiometer*
- ▲ HIRS/4 *High Resolution Infrared Radiation Sounder*

- ▲ AMSU-A* *Advanced Microwave Sounding Unit-A*
- ▲ MHS *Microwave Humidity Sounder*
- ▲ IASI *Infrared Atmospheric Sounding Interferometer*
- ▲ GRAS *Global Navigation Satellite System Receiver for*
- ▲ ASCAT *Advanced Scatterometer*
- ▲ GOME-2* *Global Ozone Experiment-2*

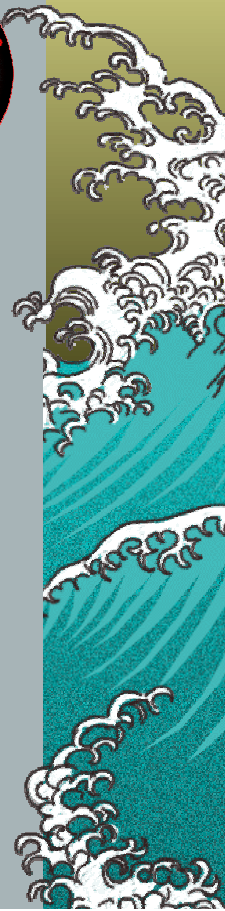




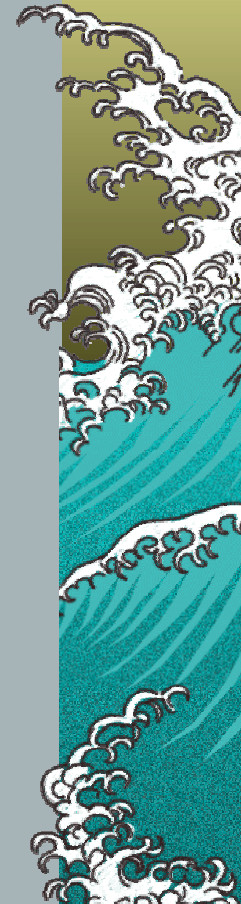
NPOESS MISSION



- ▶ *Provides a national operational polar orbiting environmental capability*
- ▶ *Achieve savings by converging civilian and military programs (POES, DMSP)*
- ▶ *Incorporate new NASA, EUMETSAT technology*



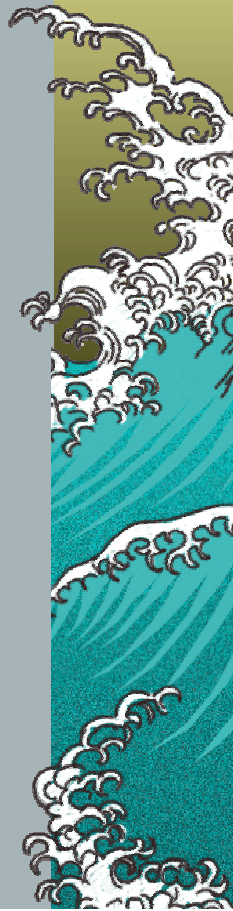
NPOESS PLATFORM





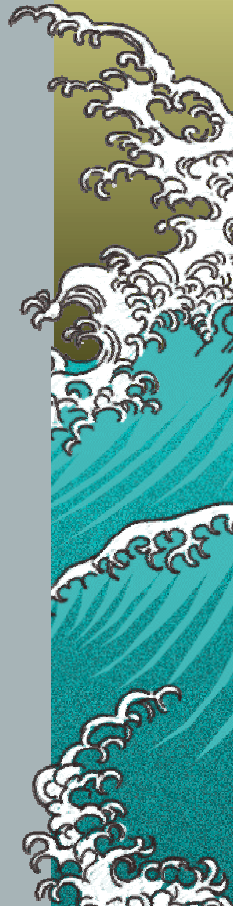
NPP/NPOESS ORBITS

- ▲ *NPP 824 km Sun synchronous*
 - ▲ *10:30 am descending node*
 - ▲ *98.74° inclination*
 - ▲ *Mimics TERRA ground track 16-day cycle*
- ▲ *NPOESS 833 km Sun synchronous*
 - ▲ *9:30 am descending node*
 - ▲ *13:30 am ascending node*
 - ▲ *17:30 am ascending node*



NPOESS INSTRUMENTS

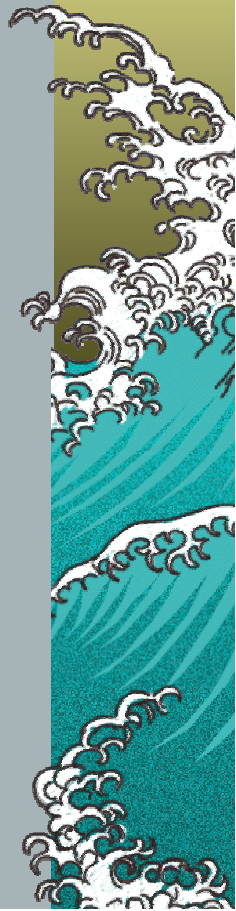
- ▲ *The Visible IR Imaging Spectroradiometer Suite (VIIRS)*
- ▲ *Cross Track IR Sounder (CrIS)*
- ▲ *Advanced Technology Microwave Sounder (ATMS)*
- ▲ *Earth Radiation Budget Sensor (ERBS)*
- ▲ *Conical Microwave Imager Sounder (CMIS)*
- ▲ *Ozone Mapping and Profiler Suite (OMPS)*
- ▲ *Aerosol Polarimeter Sensor (APS)*



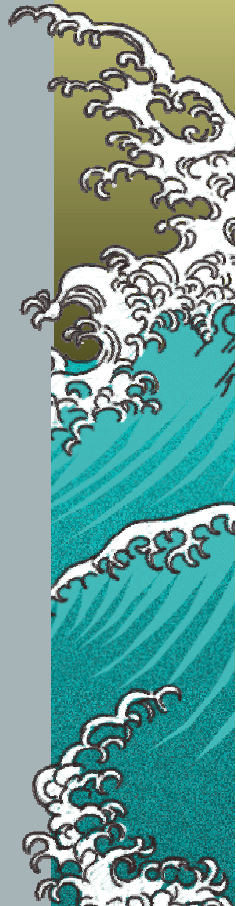
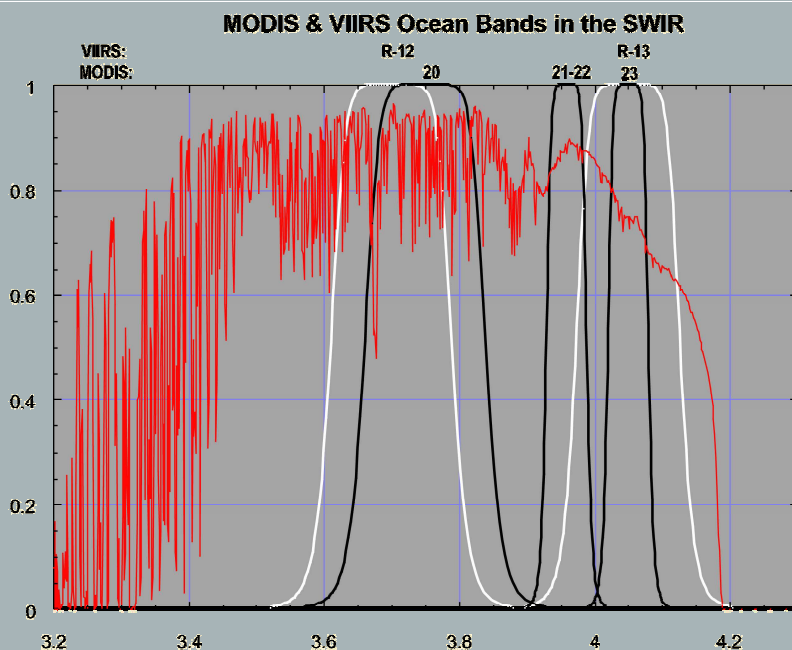


VIIRS

- ▶ 22 bands
- ▶ 0.4 μm -12 μm
- ▶ 12-bit quantization
- ▶ 3000 km swath width
- ▶ 6.7 μm water vapor band (FM-3 and beyond)



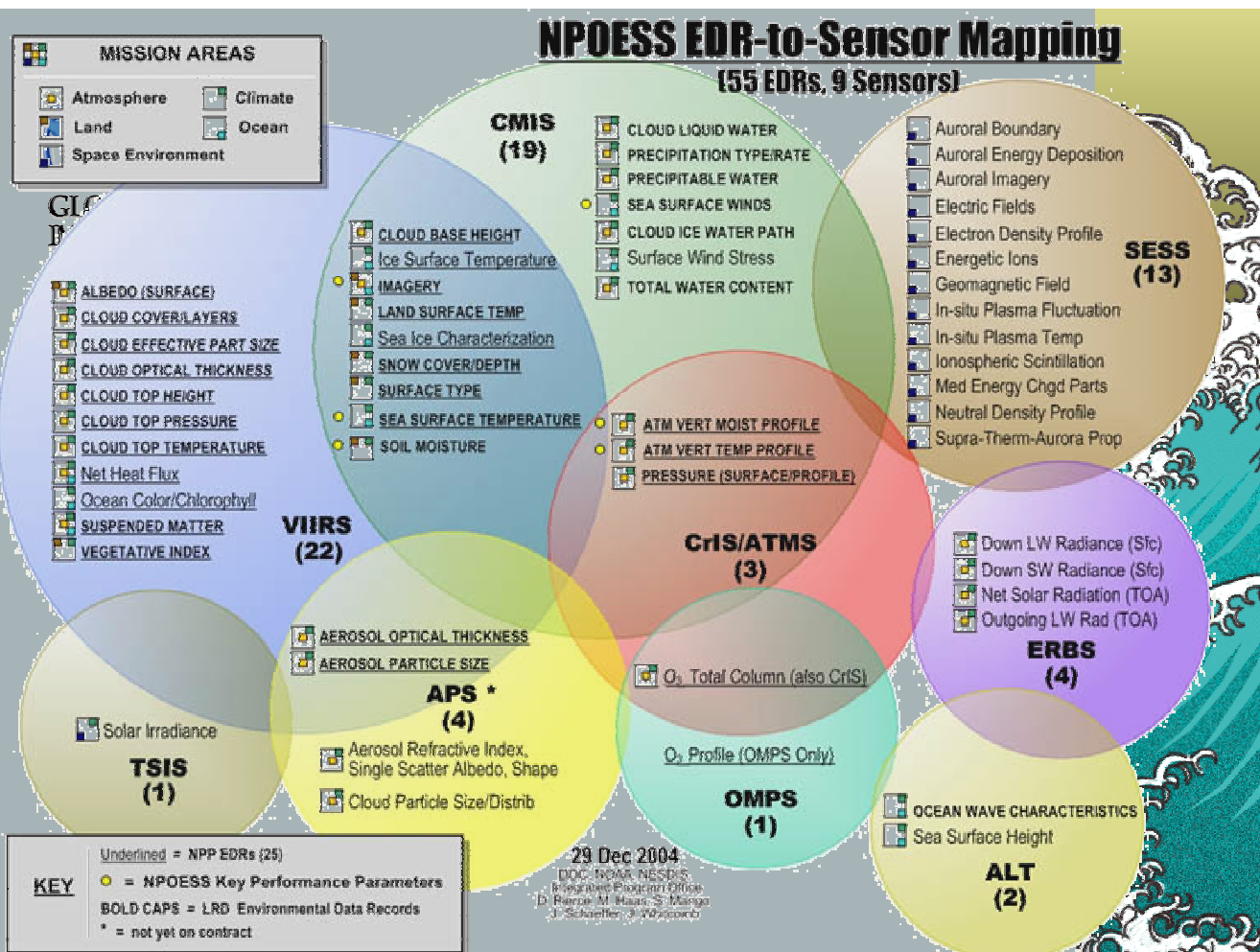
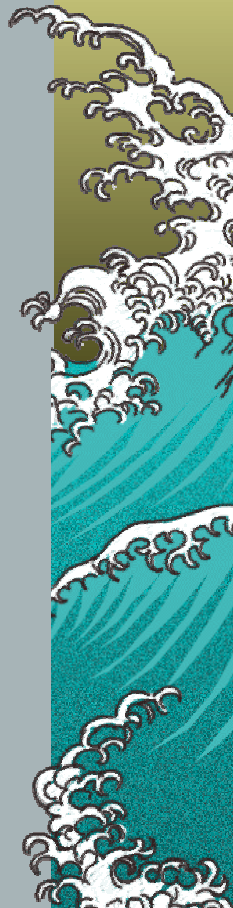
VIIRS





NPP/NPOES GROUND SYSTEM

- *X-Band Local User Terminals*
- *2m tracking system*
- *CCSDS packets*
- *Reed-Solomon encoding*

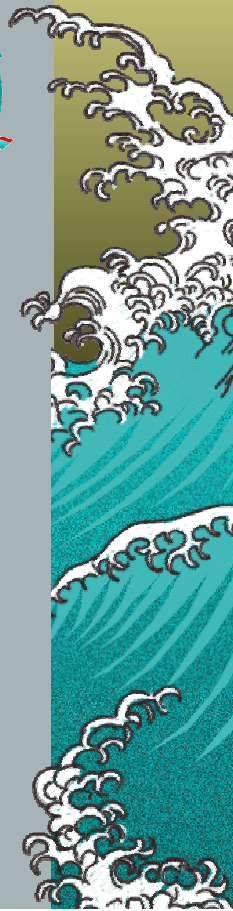




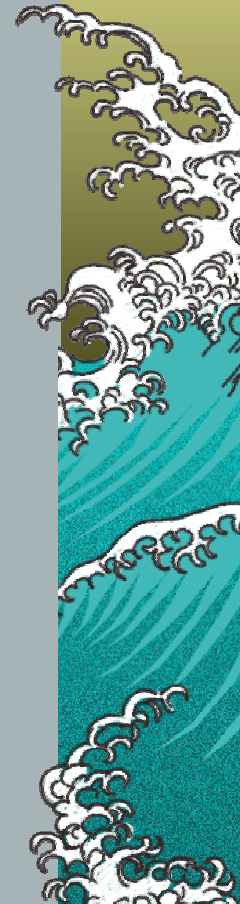
JASON-2 MISSION



- ▲ *The Ocean Surface Topography Mission (OSTM) is a joint effort by four organizations to measure sea surface height by using a radar altimeter mounted on a low-earth orbiting satellite called Jason-2. The four mission participants are:*
 - ▲ ** National Oceanic and Atmospheric Administration (NOAA)*
 - ▲ ** National Aeronautics and Space Administration (NASA)*
 - ▲ ** France's Centre National d'Etudes Spatiales (CNES)*
 - ▲ ** European Meteorological Satellite Organisation (EUMETSAT)*



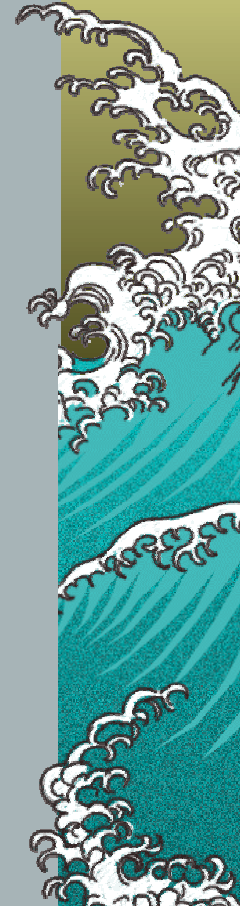
JASON-2 PLATFORM





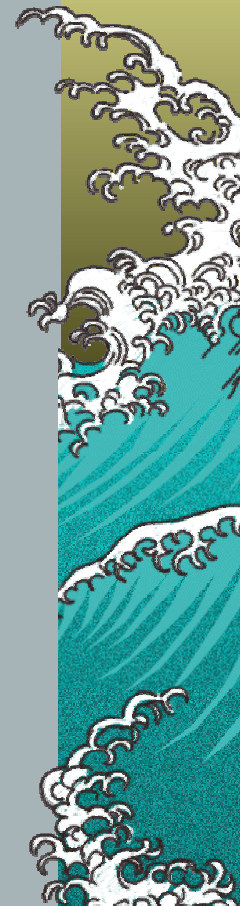
JASON-2 ORBIT

- ▲ *1336 km elevation*
- ▲ *66° inclination*



JASON-2 INSTRUMENTS

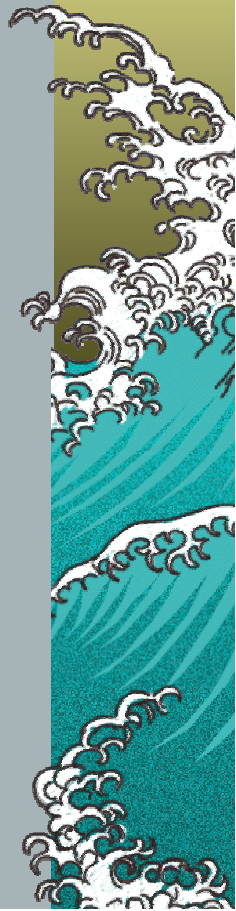
- ▲ *POSEIDON-3 RADAR ALTIMETER*
- ▲ *ADVANCED MICROWAVE
RADIOMETER (AMR)*
- ▲ *DORIS TRACKING RECEIVER*
- ▲ *LASER REFLECTOR ARRAY (LRA)*
- ▲ *GPS RECEIVER (GPSR)*





JASON-2 GROUND SYSTEM

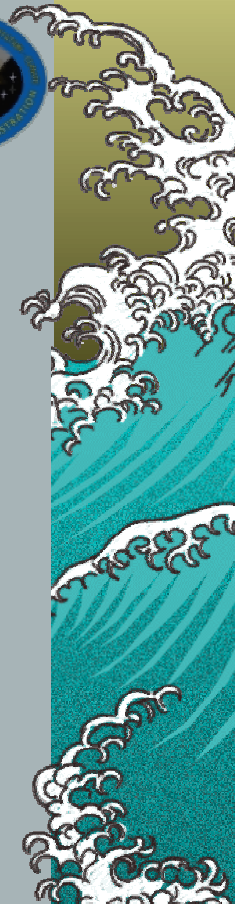
- Under the OSTM program NOAA will provide support from its satellite ground segment capabilities for management of the Jason-2 Satellite flight operations during its routine operational phases and to acquire, produce, and distribute geophysical data in a manner beneficial to all interested users.



GOES-R MISSION

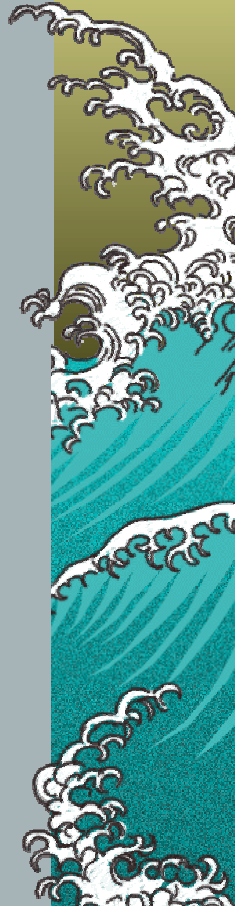


- In addition to advanced Earth imaging and atmospheric sensors, new coastal imaging, lightning mapping and solar imaging capabilities will be included on the GOES-R platform. This program is building on the incredibly successful GOES series of satellites.



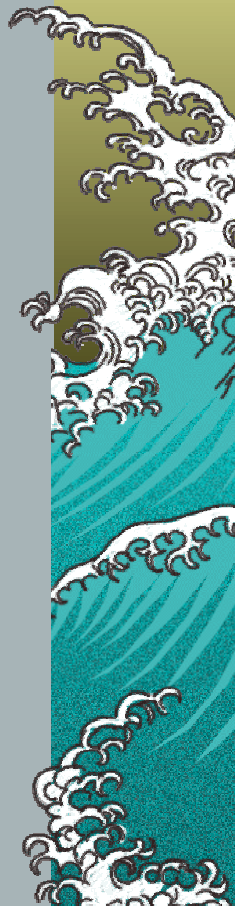


GOES-R PLATFORM



GOES-R ORBIT

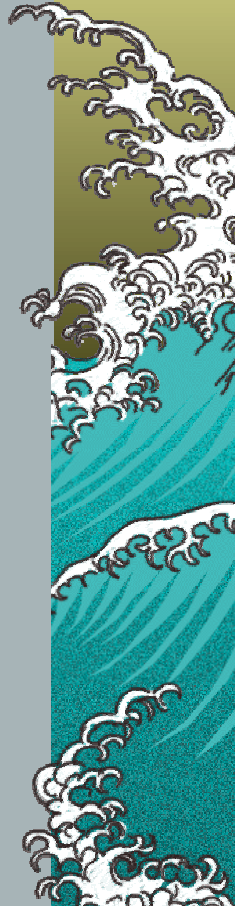
- ▲ *GEOSTATIONARY*
- ▲ *75 ° and 135° W Positions*
- ▲ *In Orbit Spare*





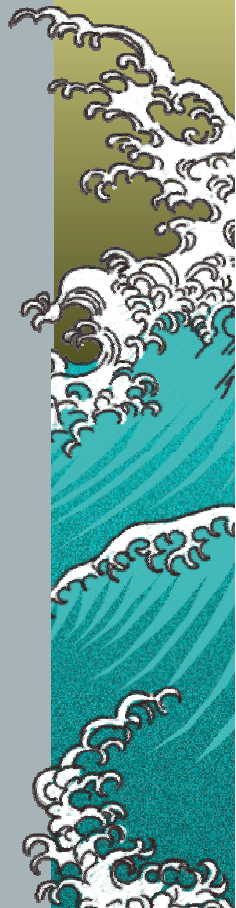
GOES-R INSTRUMENTS

- ▶ *Hyperspectral Environmental Suite for Coastal Waters (HES-CW)*
- ▶ *Advanced Baseline Imager (ABI)*



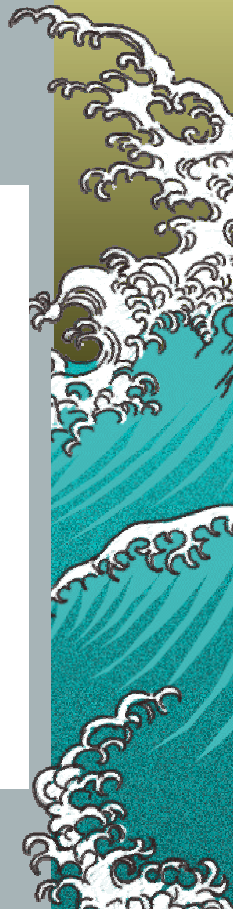
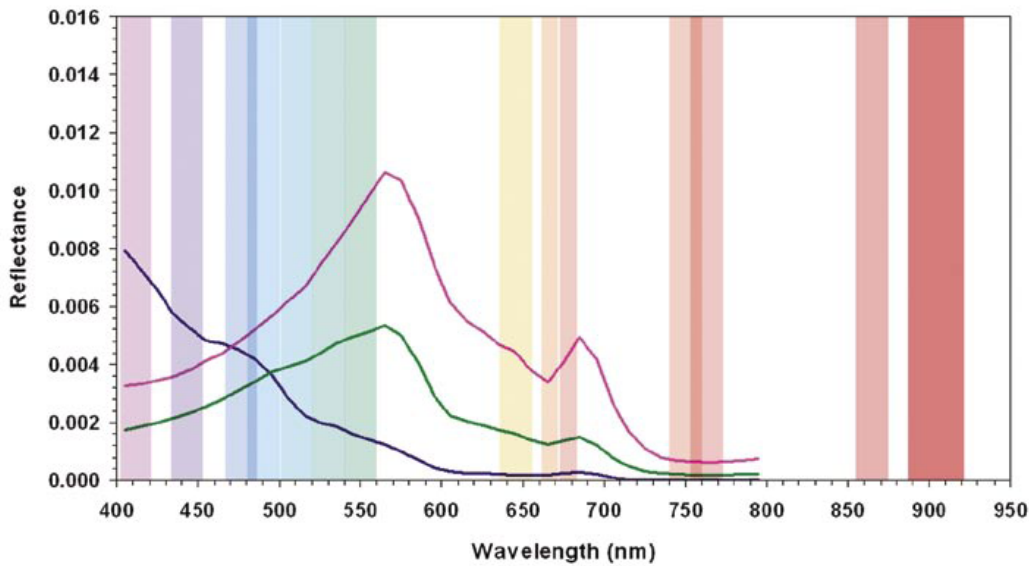
HES-CW CHARACTERISTICS

- ▶ *14+ bands*
- ▶ *0.4 μ m-9.5 μ m*
- ▶ *300 m resolution*
- ▶ *Imagery every 3 hours*
- ▶ *Selective 1 hour imagery*





HES-CW



GOES-R GROUND SYSTEM

- ▲ *Harris Corporation has been awarded a one- year study contract by NOAA for ground segment work supporting the GOES-R program.*
- ▲ *Harris will study the application of its advanced ground data processing and command and control technologies to the overall satellite ground system architecture, and provide end-to-end system integration solutions.*
- ▲ *At the completion of the study phase in May 2005, NOAA will select the winning companies to compete for the prototype phase of the program. The prototype phase will end with a "fly-off" competition in 2006, with NOAA selecting a single company for development and production of the GOES-R ground segment.*

