EOS AM:
Progress, Plans, and Promise

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Presented at the
48th Congress of the International Astronautical Federation

Torino, Italy
6-10 October 1997

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What and Where?

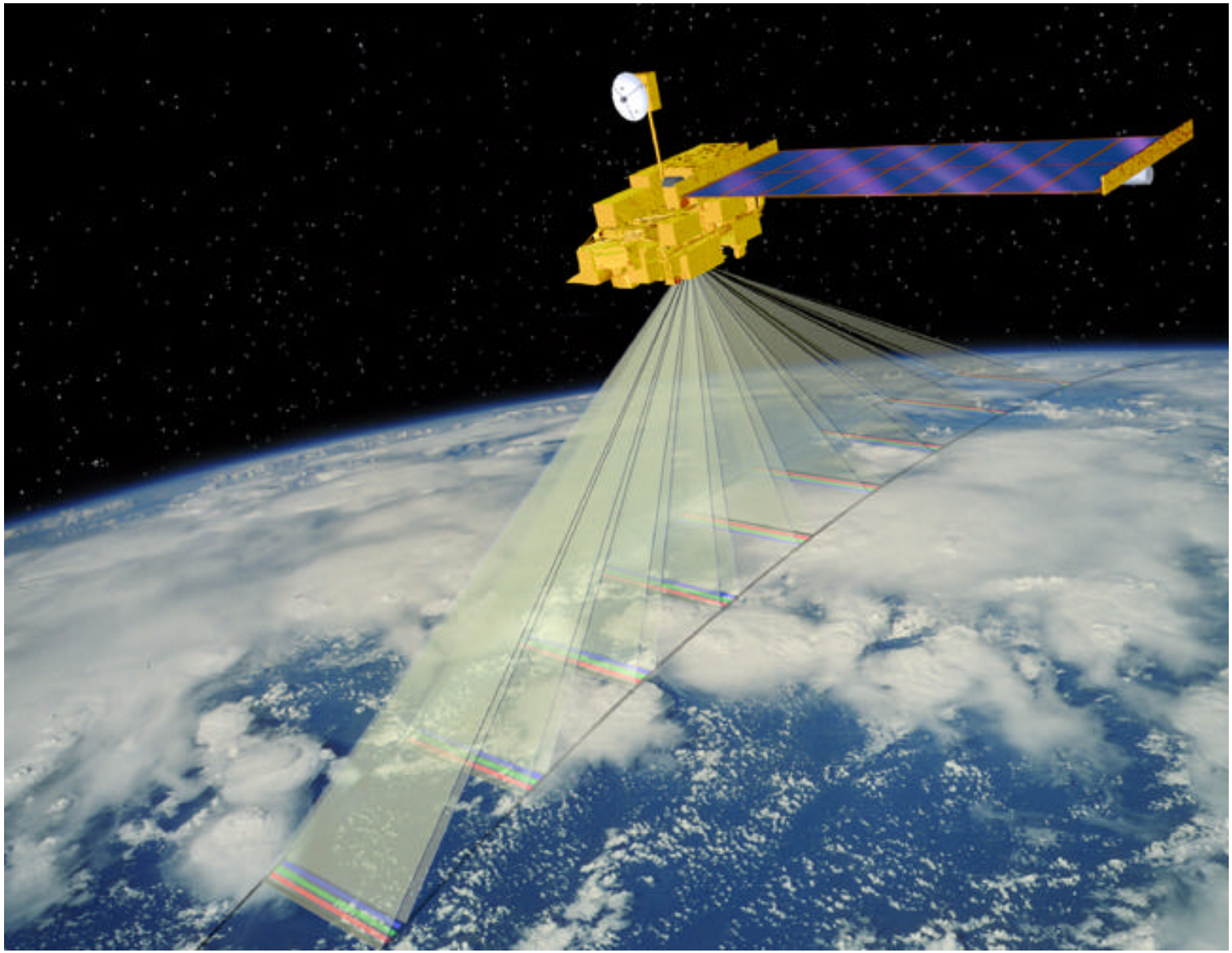
EOS AM-1 Mission Overview

Launch date:	June 1998
Orbit:	705 km altitude, polar
Orbit period:	98.88 minutes
Equator crossing:	10:30 AM descending
Ground track repeat cycle:	16 days

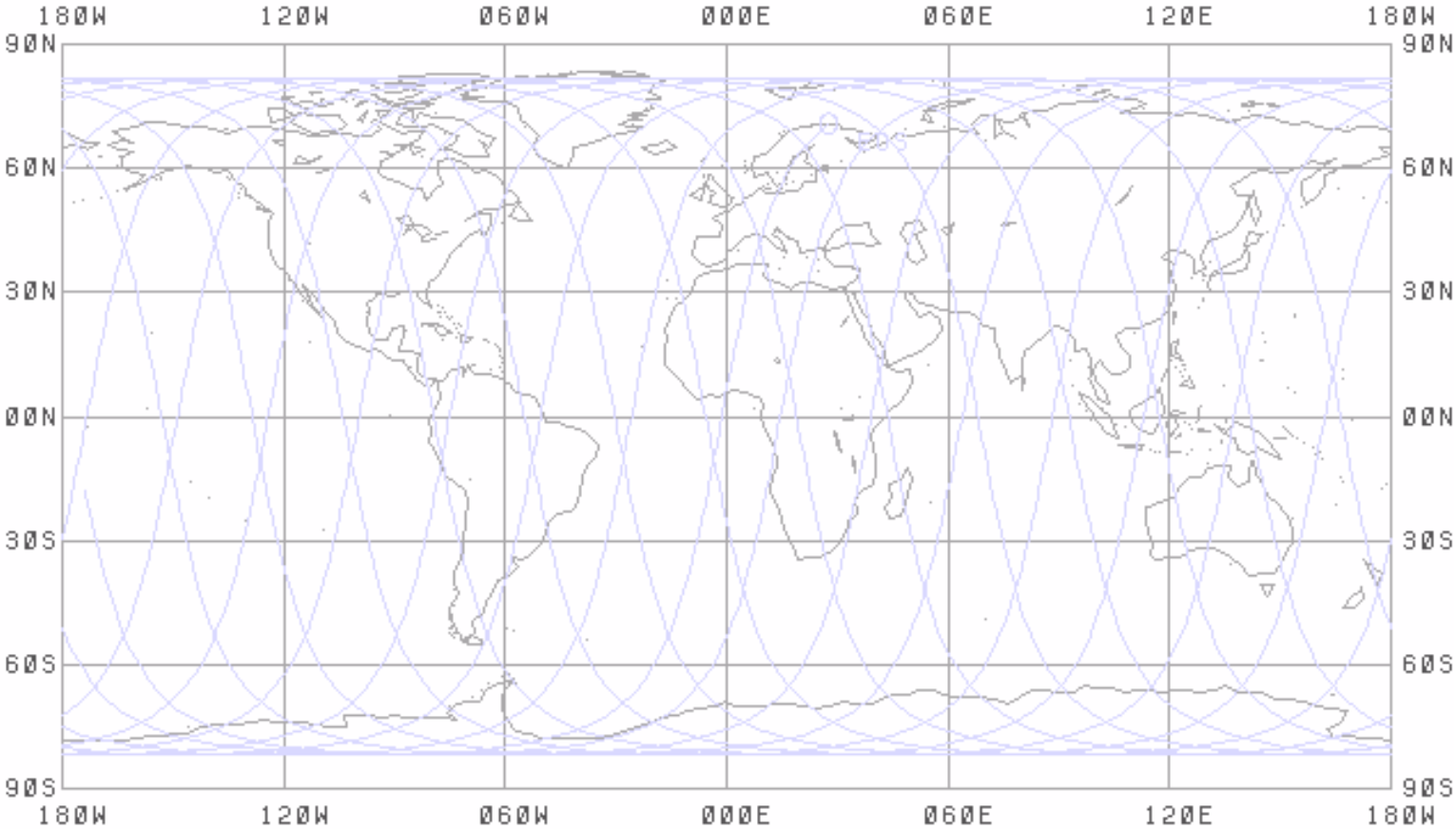
Instruments:

- Moderate Resolution Imaging Spectroradiometer (MODIS)
- Advanced Spaceborne Thermal Emission Radiometer (ASTER)
- Multi-angle Imaging Spectroradiometer (MISR)
- Measurement of Pollution in the Troposphere (MOPITT)
- Clouds and the Earth Radiant Energy System (CERES)

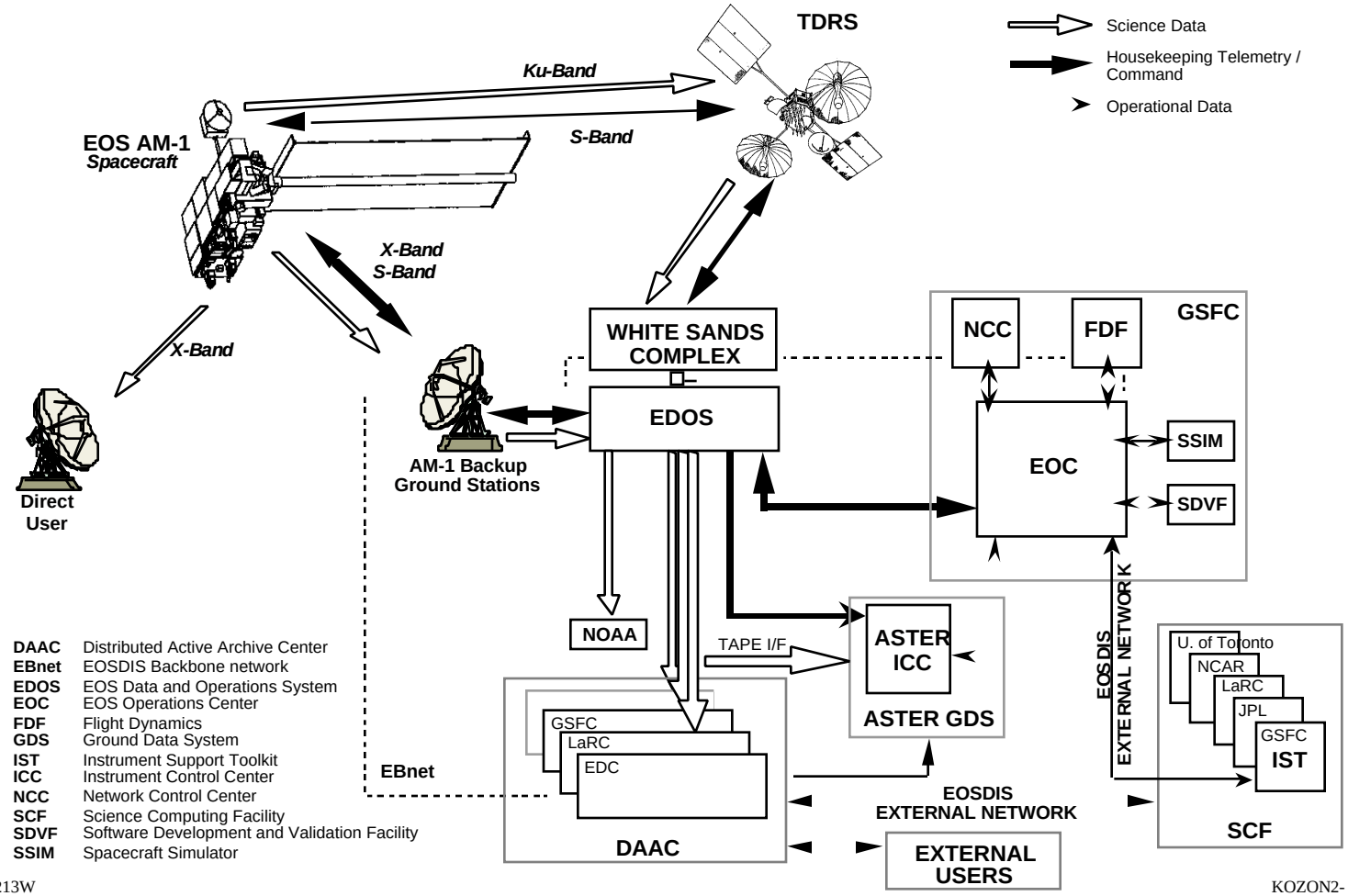
EOS AM-1 in orbit



EOS AM-1 Orbit Groundtrack

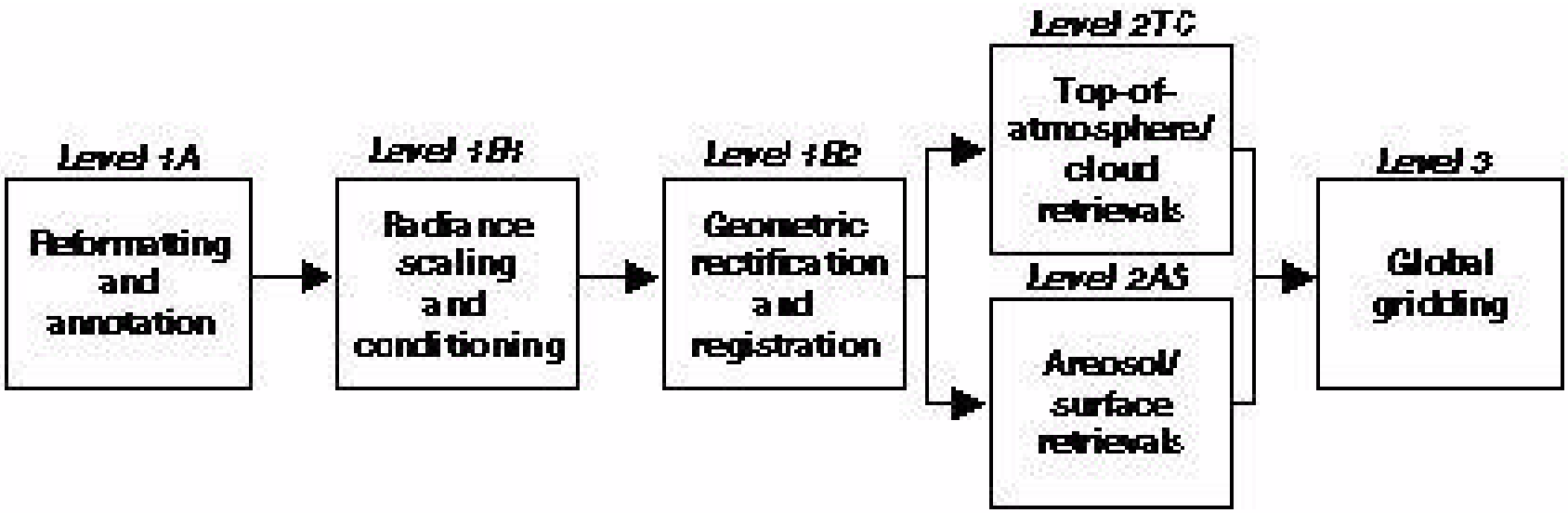


EOSDIS Ground System Context



DAAC	Distributed Active Archive Center
EBnet	EOSDIS Backbone network
EDOS	EOS Data and Operations System
EOC	EOS Operations Center
FDF	Flight Dynamics
GDS	Ground Data System
IST	Instrument Support Toolkit
ICC	Instrument Control Center
NCC	Network Control Center
SCF	Science Computing Facility
SDVF	Software Development and Validation Facility
SSIM	Spacecraft Simulator

Science Data Processing



Why?

EOS Science Themes

- Land cover and land use change research
- Seasonal-to-interannual climate variability
- Natural hazards research and applications
- Long-term climate: natural variability and change research
- Atmospheric ozone research

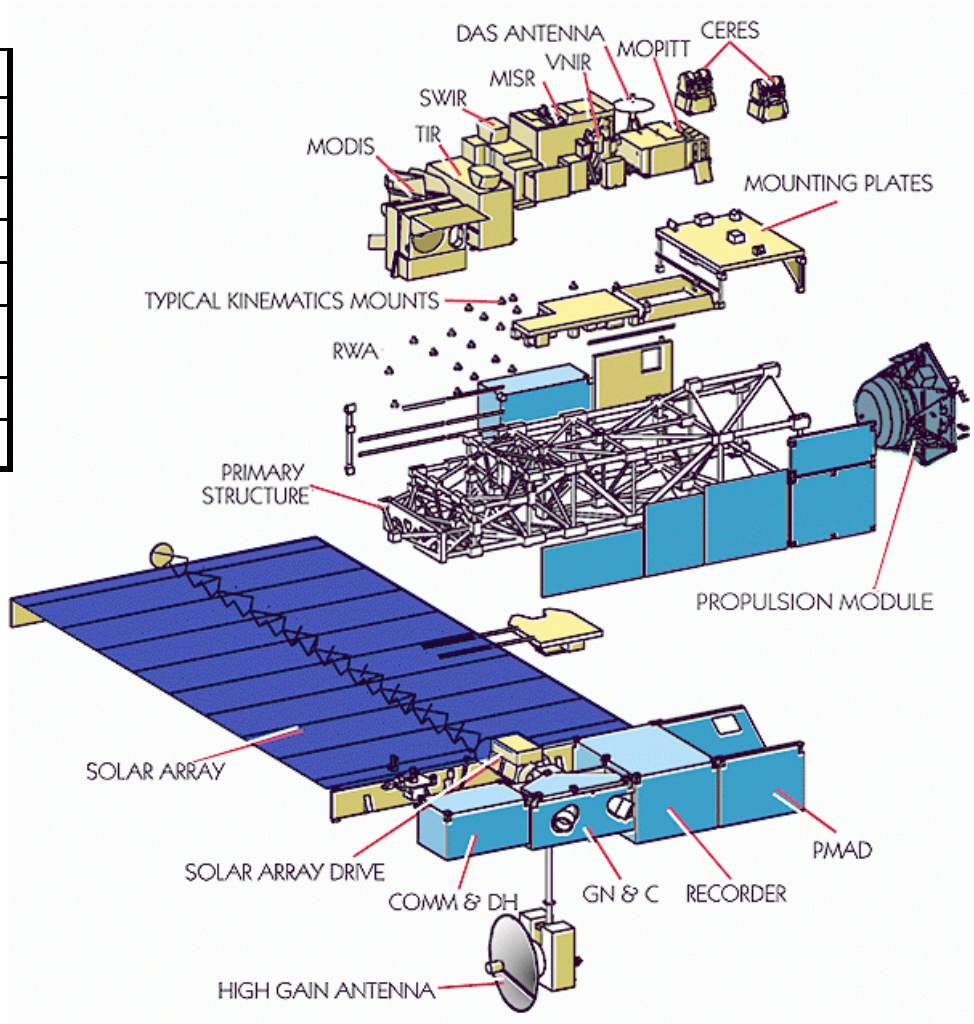
EOS AM-1 Science Objectives

- Provide the first state distribution of the main Earth-atmosphere coupled parameters
- Improve our ability to detect human impacts on climate, identify “fingerprints” of human activity on climate, and predict climate change
- Provide observations that will improve forecasts of the timing and geographical extent of transient climatic anomalies
- Improve seasonal and inter-annual predictions
- Develop technologies for disaster prediction, characterization, and risk reduction from wildfires, volcanoes, floods, and droughts.
- Start long-term monitoring of the change in global climate and environmental change.

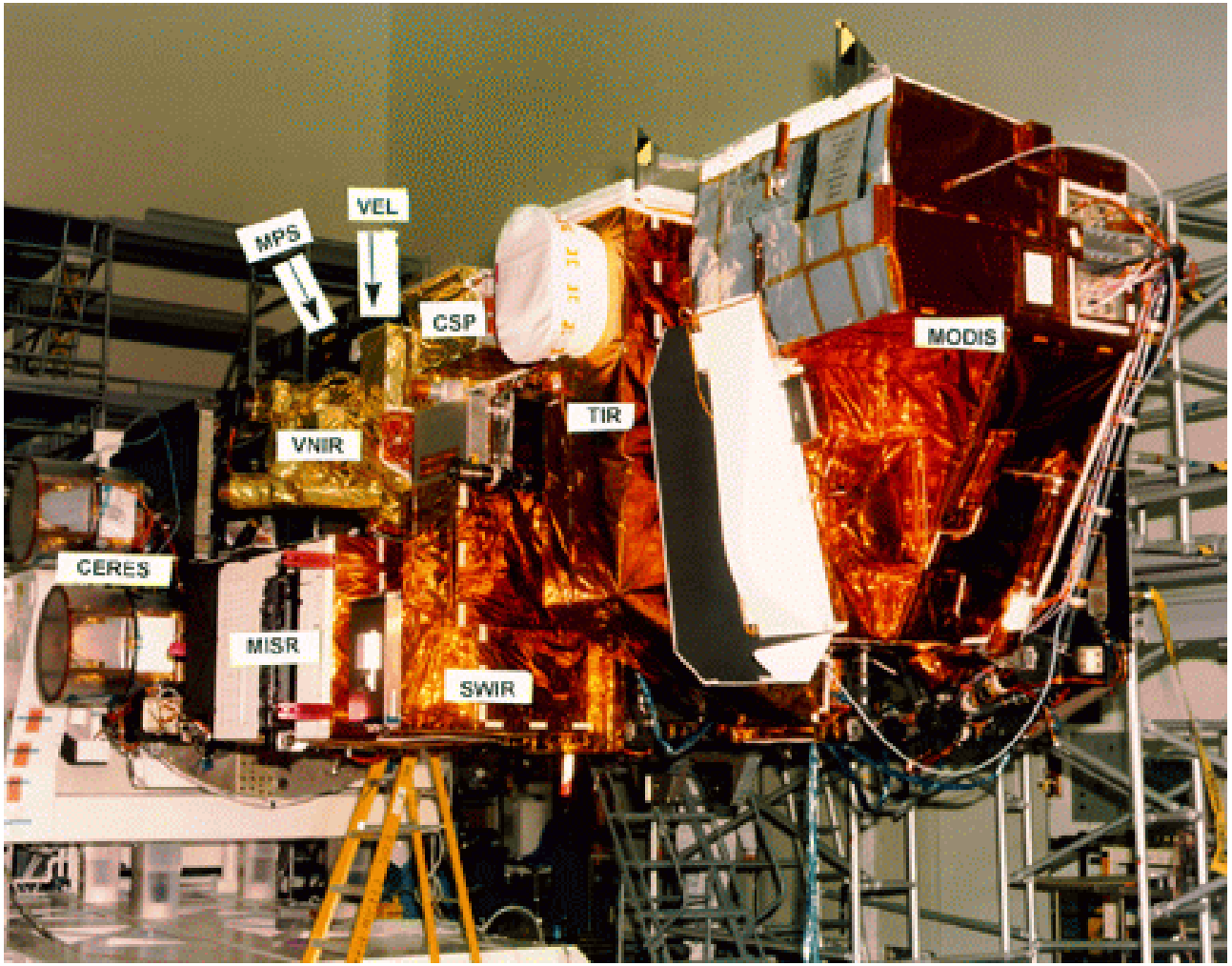
How?

The EOS AM-1 Satellite (exploded view)

Dimensions (primary structure)	5.9 m x 1.7 m x 2.0 m
Payload mounting area	9.7 m^2
Total mass	5190 kg
Payload mass	1172 kg
Total power	2.5 kW avg, 3.0 KW peak
Payload power	1.2 kW avg, 1.7 kW peak
Data transmission	2 Ku-band channels, 75 Mbps each X-band channel, 12.5 Mbps
Orbit position knowledge (3σ)	150 m
Pointing performance (3σ)	90 arcsec knowledge 150 arcsec accuracy



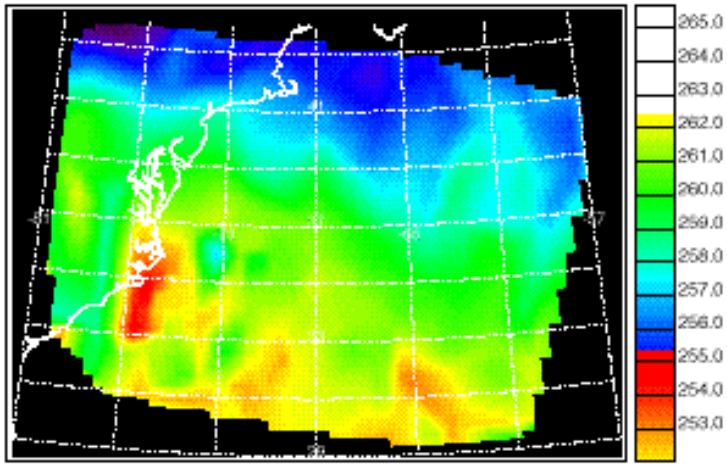
EOS AM-1 in the Clean Room

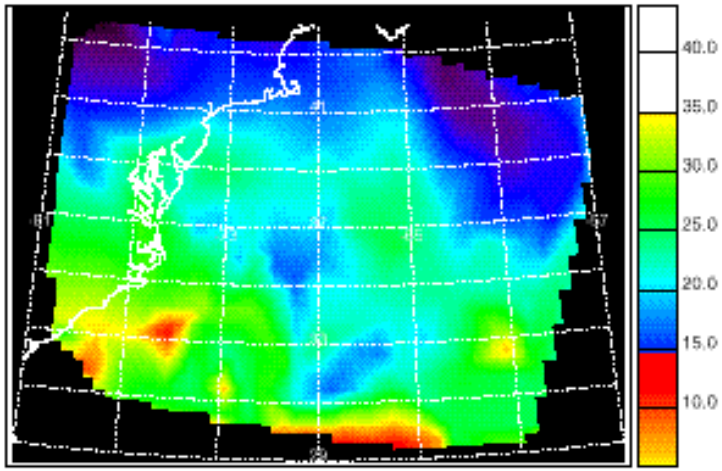


Moderate Resolution Imaging Spectroradiometer (MODIS)

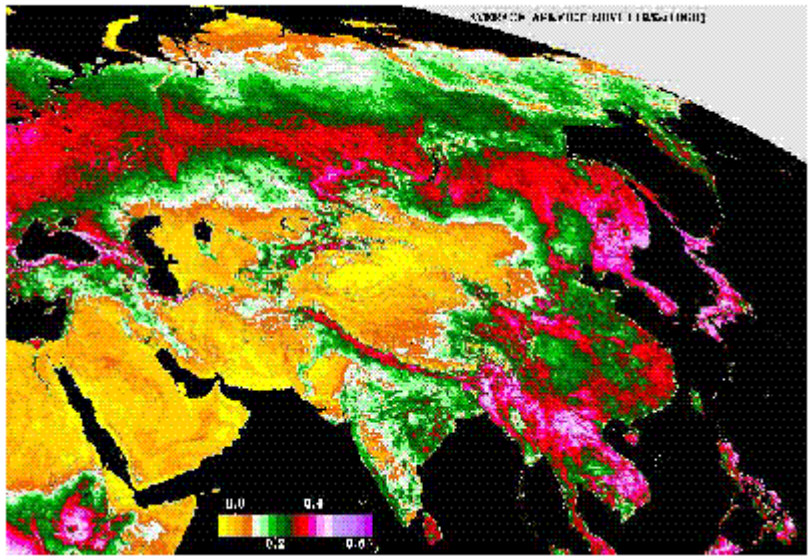
- Provided by NASA Goddard Space Flight Center and built by Hughes SBRS.
- Measurement of comprehensive global biological and geophysical processes including: surface temperature (land and sea), ocean color, global vegetation and deforestation, clouds and aerosols, and snow cover.
- Cross-track scanning imaging radiometer with 36 bands from visible to thermal IR and spatial resolutions of 250m, 500m, and 1km at nadir. 2330 km swath for global coverage in 2 days.

Sample MODIS Data Products





MODIS Atmospheric Profiles.



Growing Season Average NDVI of Asia Derived from the Advanced Very High Resolution (AVHRR) Pathfinder Data Set. Monthly NDVI was calculated as the average of three 10-day composites. The monthly values were further averaged over the 9-year period of record before Mount Pinotubo eruption (1982-1990) to obtain long-term average monthly NDVI values.

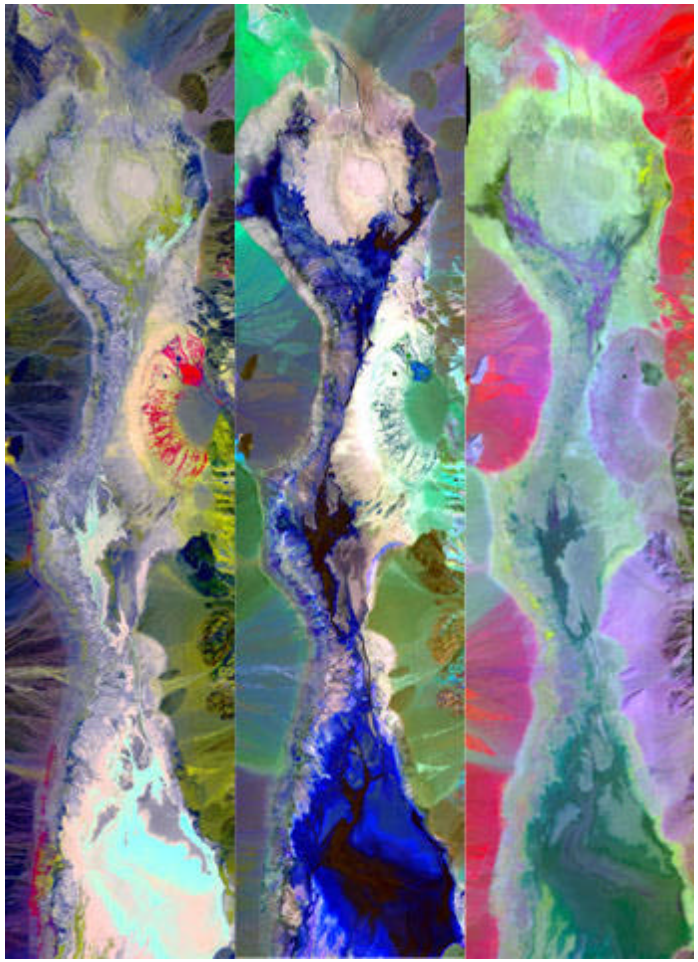
Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER)

- Provided by the Ministry of International Trade and Industry (MITI) of Japan, managed by JAROS, and built by NEC, MELCO, FUJITSU, and HITACHI.

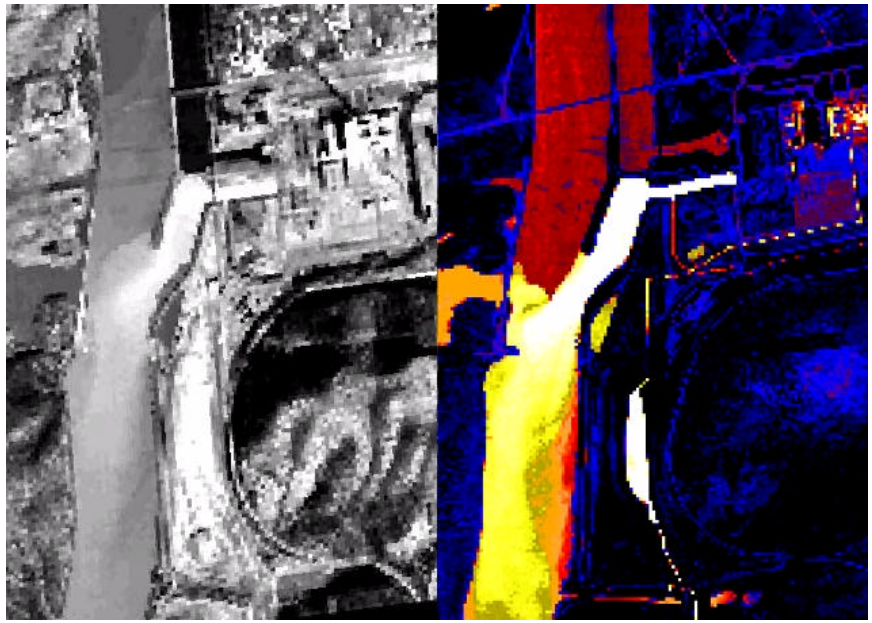
- High resolution images of land surface, water, and clouds from visible through thermal infrared for climatological, hydrological, biological, and geological studies.

- Three telescope subsystems: VNIR, SWIR, TIR . VNIR-three channels in visible and near IR with 15m resolution stereo. SWIR-six channels in shortwave IR with 30m resolution. TIR-five channels in thermal IR with 90m resolution. 60km swath pointable x-track $\pm 8.55^{o}$ (SWIR/TIR) , $\pm 24^{o}$ (VNIR).

Sample ASTER Data Products



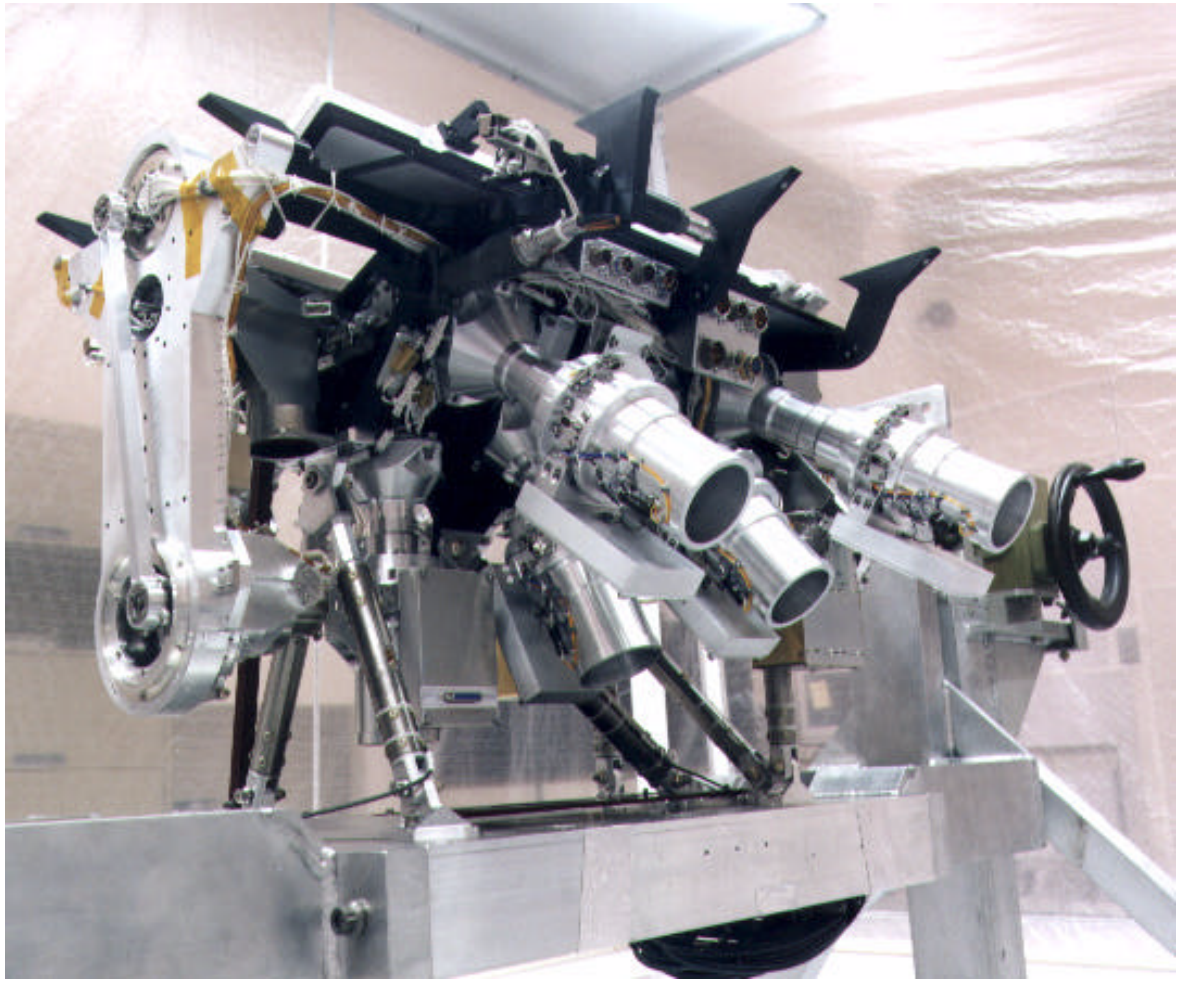
Simulated ASTER images of Death Valley, California. The left image displays data from the visible bands, the center image from the short wave infrared bands, and the right image from the thermal infrared bands.



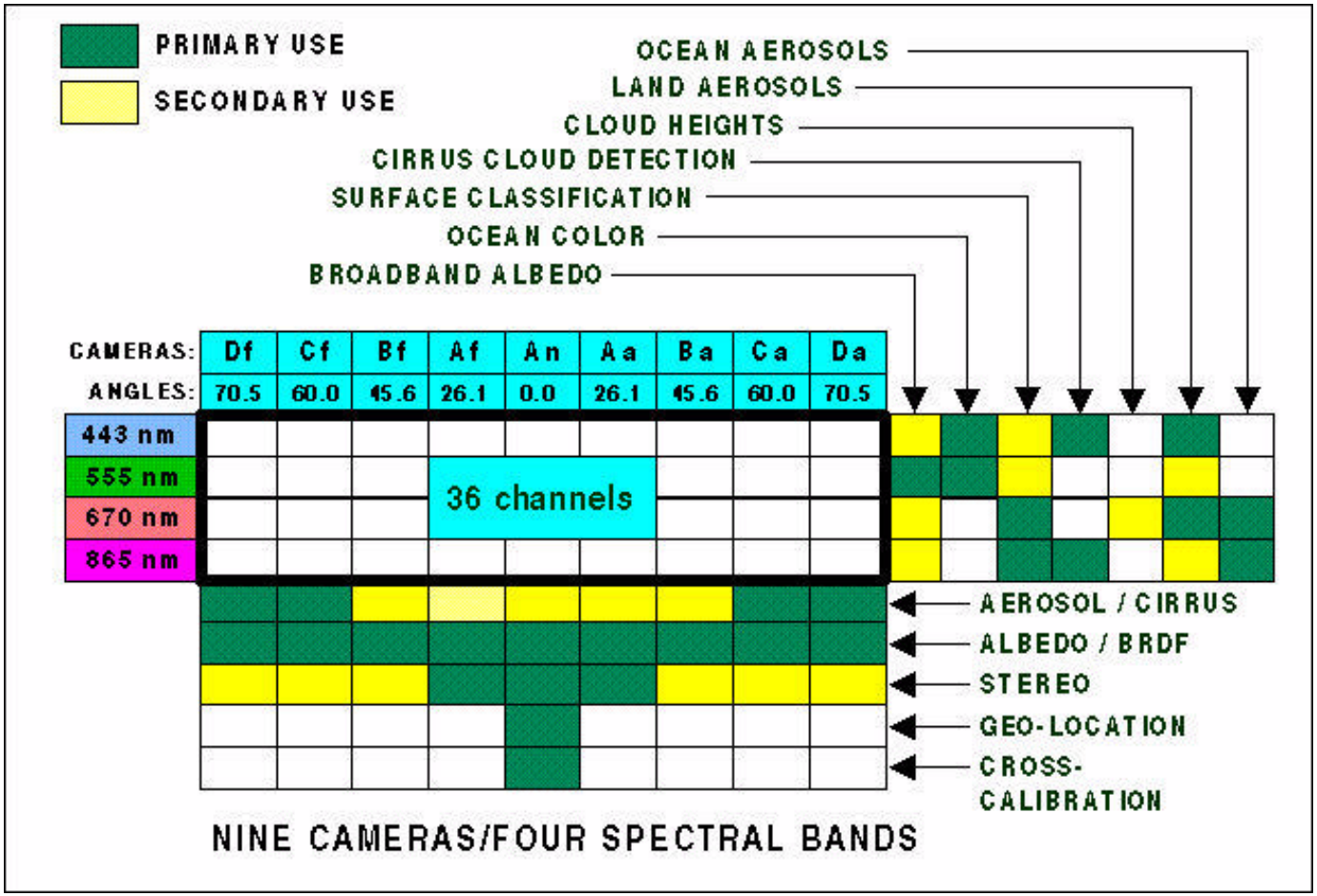
Day visible (left) and night (right) thermal images of a nuclear power plant. Notice the plume of hot water coming from the plant into the river revealed by the color-coded temperature patterns.

Multi-angle Imaging SpectroRadiometer (MISR)

- Provided by the Jet Propulsion Laboratory through in-house build.
- Global maps of planetary and surface albedo, aerosols, vegetative properties, and terrain topography and cloud heights.
- Nine CCD push broom cameras, one nadir , four aft, and four forward. Four channels from blue to near IR. 275m, 550m, 1.1 km, and 275 m x 1.1 km resolution depending on operating mode. Global mode moderate resolution with selected high resolution for cloud screening, image navigation, stereo photogrammetry. Local mode for highest resolution in all channels.

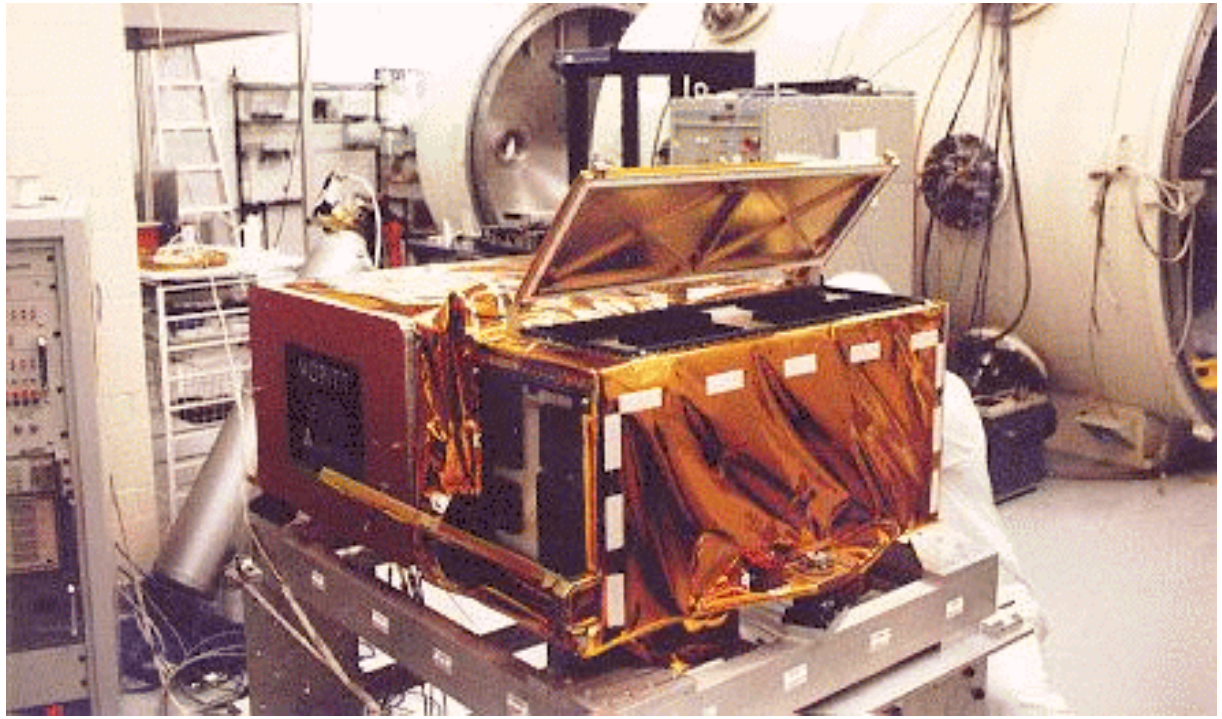


MISR Channels

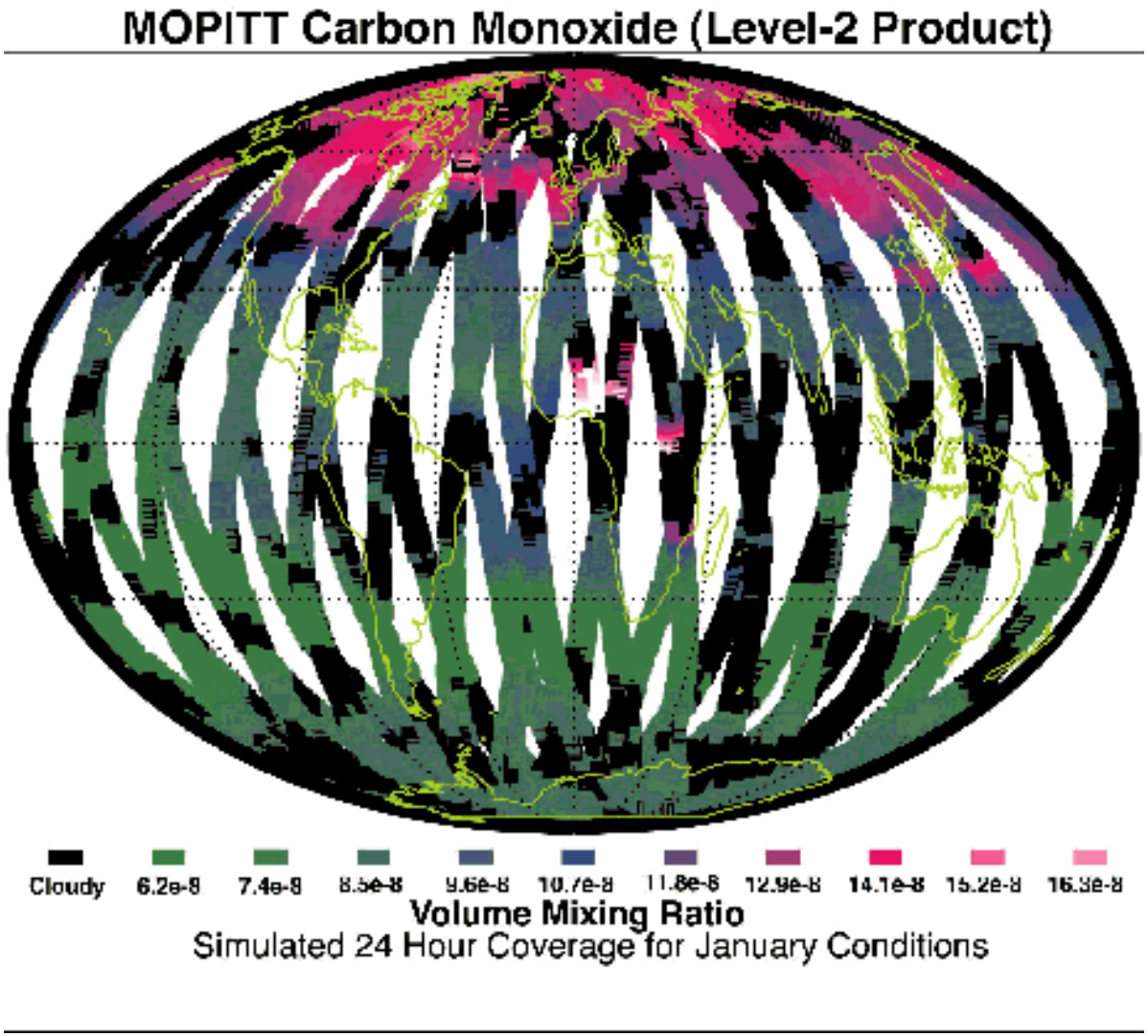


Measurements of Pollution in the Troposphere (MOPITT)

- Provided by the Canadian Space Agency and built by COM DEV.
- Global measurements of CO and CH_4 concentrations (to 10% and 1%, respectively) in the troposphere with 22km horizontal resolution. CO vertical profiles with 3km resolution.
- Scanning radiometer employing gas correlation spectroscopy to measure upwelling and reflected infrared radiance in three CO and CH_4 absorption bands. 22km spatial resolution and 640km swath.

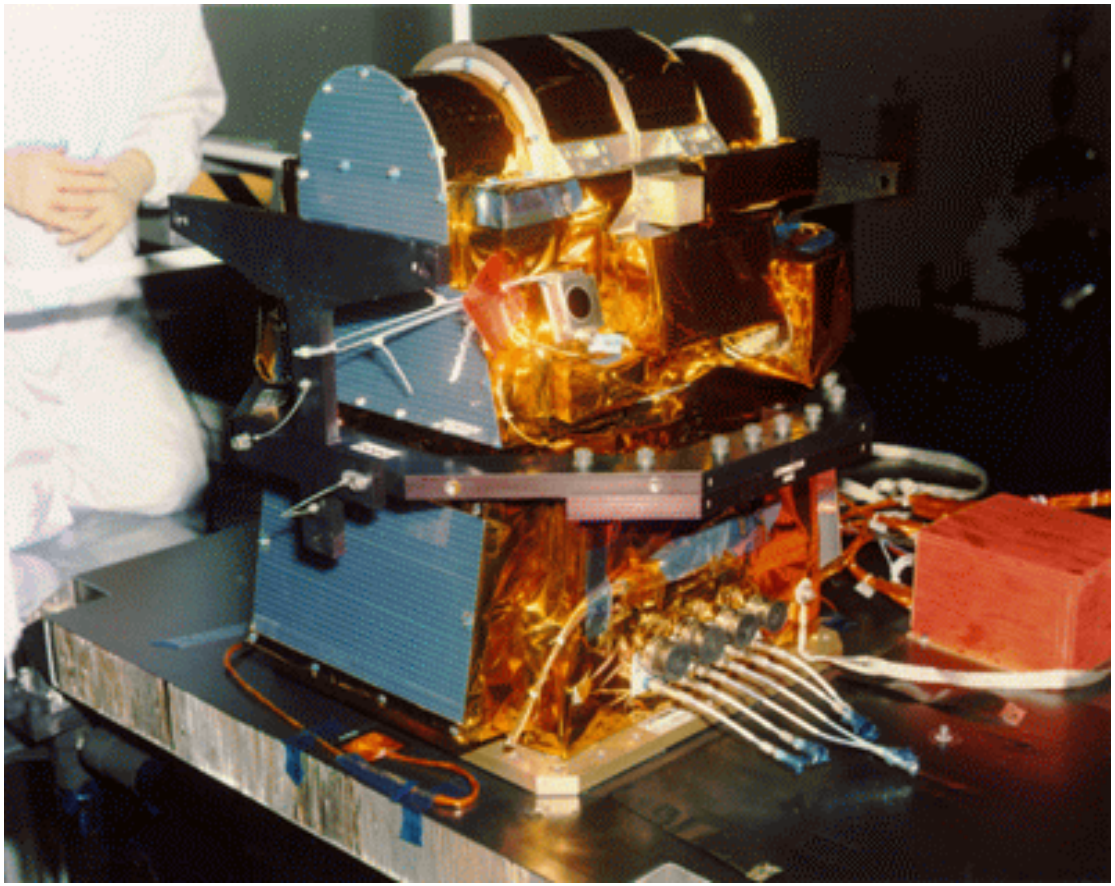


MOPITT Carbon Monoxide concentration

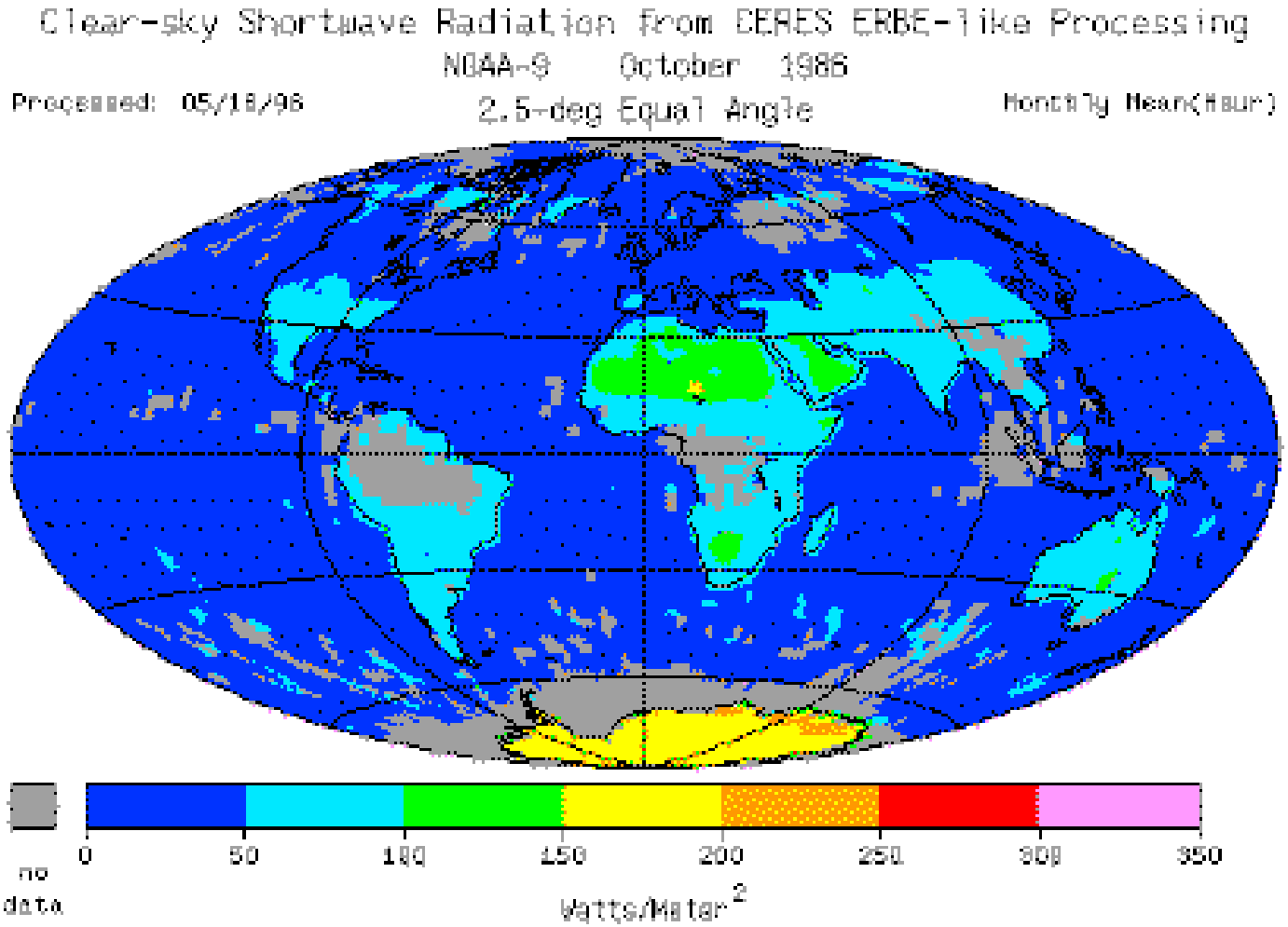


Clouds and the Earth Radiant Energy System (CERES)

- Provided by NASA Langley Research Center and built by TRW.
- Long-term measurements of Earth's radiation budget through observations of short and longwave radiation.
- Broadband scanning thermistor bolometer package with 20 km resolution. Two identical scanners carried to operate in x-track and biaxial scan modes. Each scanner has three channels: shortwave infrared for reflected sunlight, longwave for Earth-emitted thermal IR, and total channel.



Clear-Sky SW Radiation from CERES



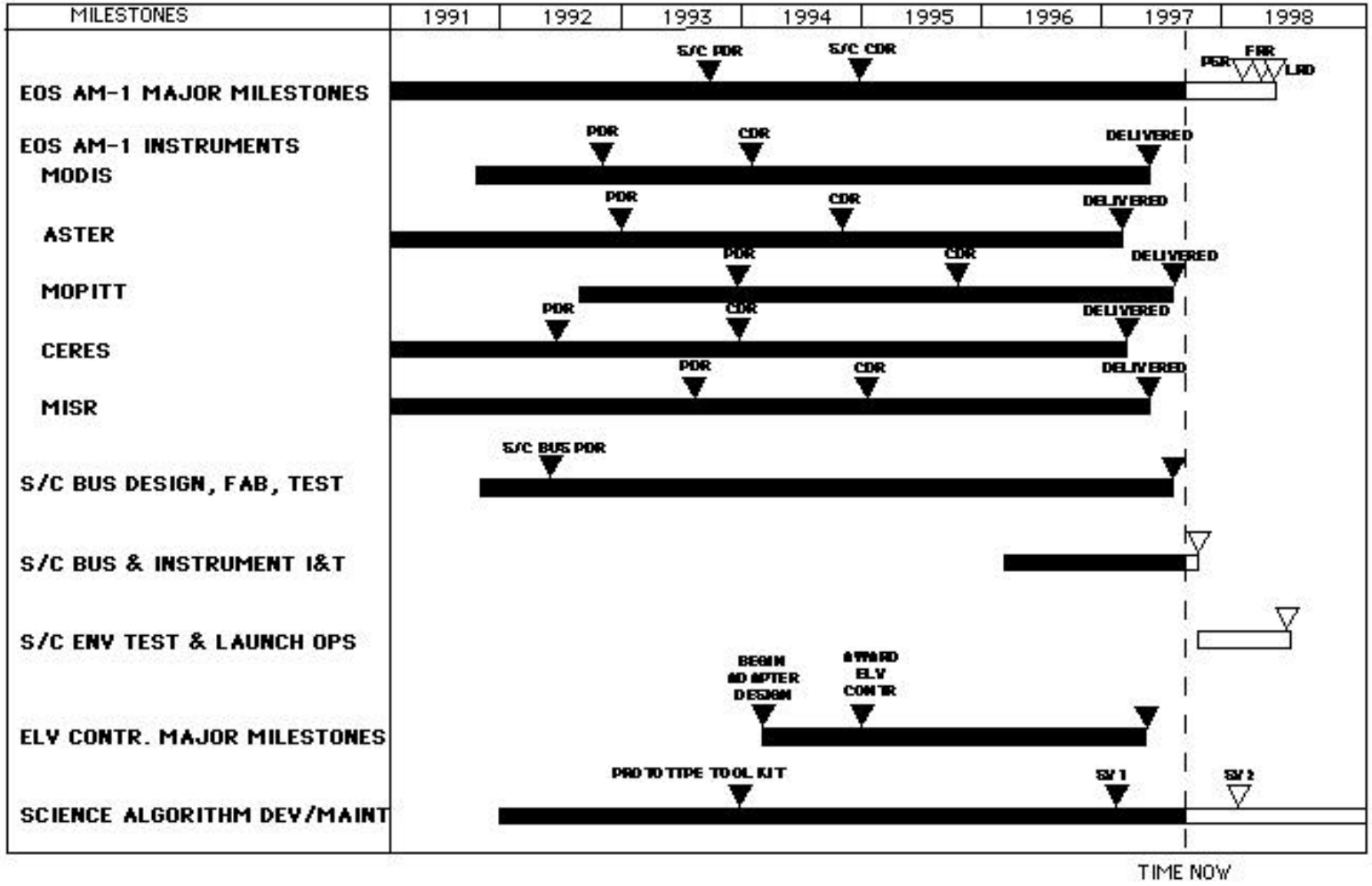
Technology

- Gallium arsenide solar array
- Capillary pumped loop
- TDRSS on-board navigation system
- Automatic fault detection, isolation, and recovery
- High rate data test equipment
- Solid state recorder
- Science formatting equipment

When?

37 weeks

to LAUNCH

...and counting

Master Schedule