

## **Marcus A. Watkins**

Director of the Joint Agency Satellite  
Division, Science Mission Directorate,  
NASA HQ, Washington DC

**Leads the Joint Agency Satellite Division (JASD) at NASA HQ in Washington, DC and is responsible for all reimbursable programs within the Science Mission Directorate including JPSS (formerly NPOESS), GOES R, Landsat follow-on and DSCOVR. As director, he is primary point of contact with NOAA, DoD, OMB, the OSTP, the National Research Council, the Office of Legislative Affairs, the Office of External Relations, the USGS, the Dept of Interior as well as other HQ organizations and NASA Field Centers.**

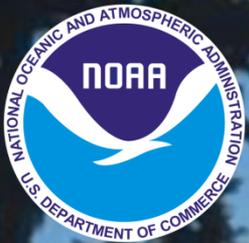
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**Has spent over 20 years at NASA in different leadership positions including the Director of Safety and Mission Assurance at the NASA Goddard Space Flight Center providing executive leadership, guidance, and institutional support to all GSFC programs, projects, and research activities in support of the US Space Exploration Policy and NASA's strategic goals.**

**Associate Director of the Sun-Earth Connection Division and Deputy Director of Flight Programs within the Office of Space Science**

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**George Washington University, School of Engineering and Applied Sciences awarded Engineering and Administration MS degree 1987.**



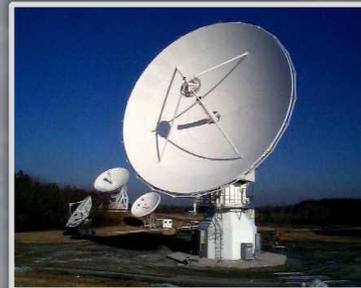
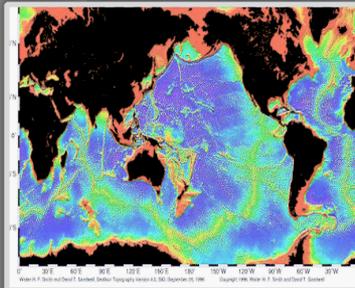
**Ajay Mehta**  
**JPSS Deputy Program Director**  
**NOAA/NESDIS**

**Responsible for the day-to-day operation of NOAA's Joint Polar Satellite System (JPSS) Office, NOAA's next-generation polar-orbiting environmental satellite. Provides leadership and management of resources including financial, human and information technology.**

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**Previous duties included Deputy Director of the Office of Satellite and Product Operations where he was responsible for the line management of five Divisions comprising more than 300 employees and 250 contractors. The responsibilities for the Office included the command and control of more than 18 geostationary and polar-orbiting environmental satellites, provision of products and services to national and international users, management of the NOAA Satellite Operations Facility as well as two Command and Data Acquisition Stations, and leading programmatic partnerships for satellite-aided search and rescue, data collection systems, and the National Ice Center.**

# Joint Polar Satellite System (JPSS)



*Ajay Mehta, NOAA  
Deputy Director  
Joint Polar Satellite System*

*Marcus Watkins, NASA  
Director  
Joint Agency Satellite Division*



# Overview

- Introduction
  - Policy Drivers
  - Management
- System Description
  - Space Segment
  - Ground Segment
- Partnerships
- User Engagement
- Status
- Benefits





# Introduction (Policy Drivers)

- National Space Policy
  - NOAA, working with NASA, Department of Defense (DoD), and international partners, ensure uninterrupted polar-orbiting environmental satellite observations
  - NOAA responsible for the requirements, funding, acquisition and operation of civil environmental satellites
  - Full sharing of data from all systems
- Administration's Plan for Polar-orbiting Environmental Satellites
  - NOAA contribution will be to the afternoon orbit and called Joint Polar Satellite System (JPSS)
  - DoD contribution will be to the morning orbit and called Defense Weather Satellite System (DWSS)\*
  - Share a common ground system
  - Rely on European contribution for mid-morning orbit

\* FY2012 Defense Appropriations funded DWSS cancellation and definition of a new program to follow DMSP

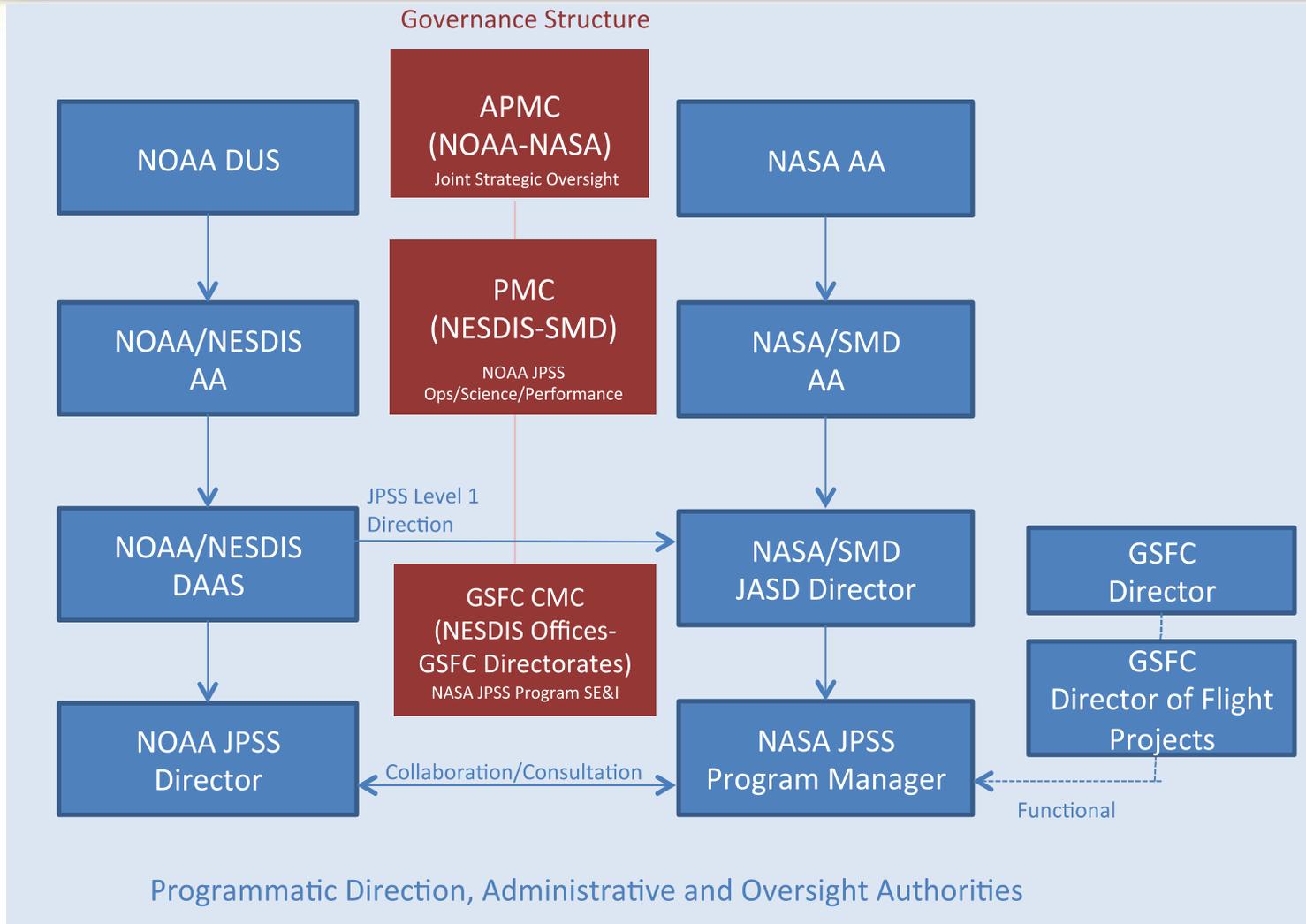


# Introduction (Management)

- Roles and Responsibilities
  - Requirements generated and approved by NOAA
  - NASA primary acquisition agent and system integrator
  - NOAA responsible for operations, science (algorithms and calibration and validation), integration with partners, and user engagement
  - DoD stakeholder in all phases
- System acquisition and development follow NASA procedural requirements and mission assurance requirements
- Continuity of polar observations in afternoon orbit is achieved through use of NOAA-19, NPOESS Preparatory Project (NPP) and JPSS-1/2 satellites



# Introduction (Management)





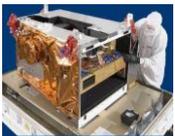
# System Description (Space Segment)

- JPSS space segment comprises two satellites (JPSS-1/2) and Free-Flyers
  - JPSS-1 similar to NPP satellite - Differences are: a) Increased mission assurance requirements and b) Increase lifetime to seven years
- Instrument suite for JPSS-1 will include:
  - Advanced Technology Microwave Sounder (ATMS)
  - Cross-track Infrared Sounder (CrIS)
  - Visible/Infrared Imager Radiometer Suite (VIIRS)
  - Ozone Mapping and Profiler Suite (OMPS)
  - Clouds and Earth's Radiant Energy System (CERES)
- Free-flyer spacecraft will accommodate:
  - Total Solar Irradiance Sensor (TSIS), Advanced Data Collection System (A-DCS) and Search and Rescue (SARSAT) instruments



# System Description

## (Space Segment)

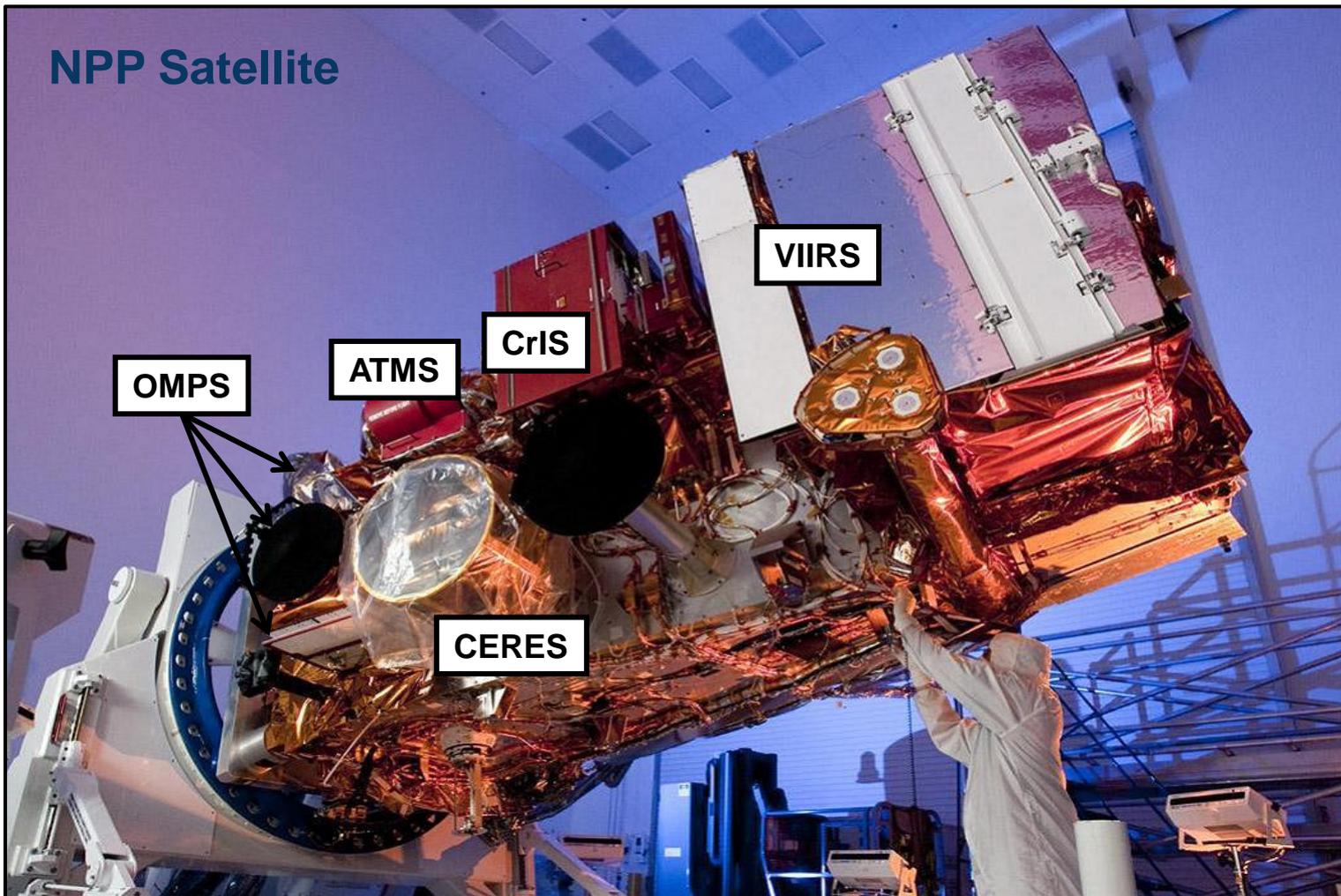
NOAA Heritage	NASA Heritage	JPSS Instrument		Measurement
AMSU	AMSU		ATMS	ATMS and CrIS together provide profiles of atmospheric temperature, moisture, and pressure
HIRS	AIRS		CrIS	
AVHRR	MODIS		VIIRS	Provides daily high-resolution imagery and radiometry across the visible to long-wave infrared spectrum
SBUV-2	OMI		OMPS	Spectrometers with UV and IR bands for ozone total column measurements
ERBE	CERES		CERES	Scanning radiometer which supports studies of Earth Radiation Budget



# System Description

## (Space Segment)

NPP Satellite





# System Description (Space Segment)

## JPSS-1 Satellite



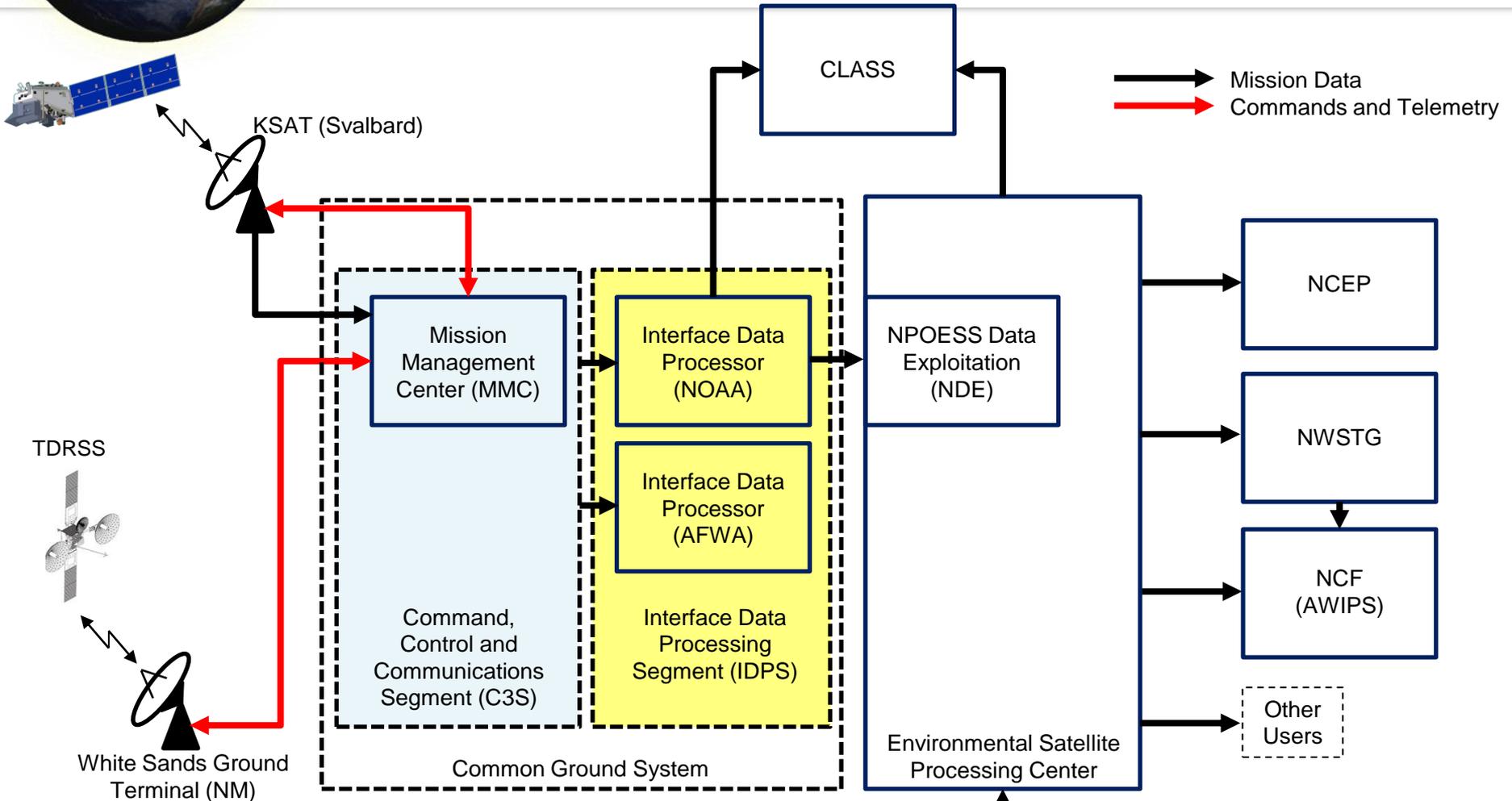


# System Description (Ground System)

- Common Ground System for NOAA and DOD – Currently comprises:
  - Command, Control and Communications Segment (C3S)
    - Includes mission planning, enterprise management, antenna resource scheduling, satellite operations, data relay and spacecraft and instrument engineering
  - Interface Data Processing Segment (IDPS)
    - Processing at one NOAA and three DoD sites
    - Transformation of raw data streams into Environmental Data Records (EDRs)
  - Field Terminal Segment (FTS)
    - Local processing of direct broadcast data into EDRs



# System Description (Ground System)

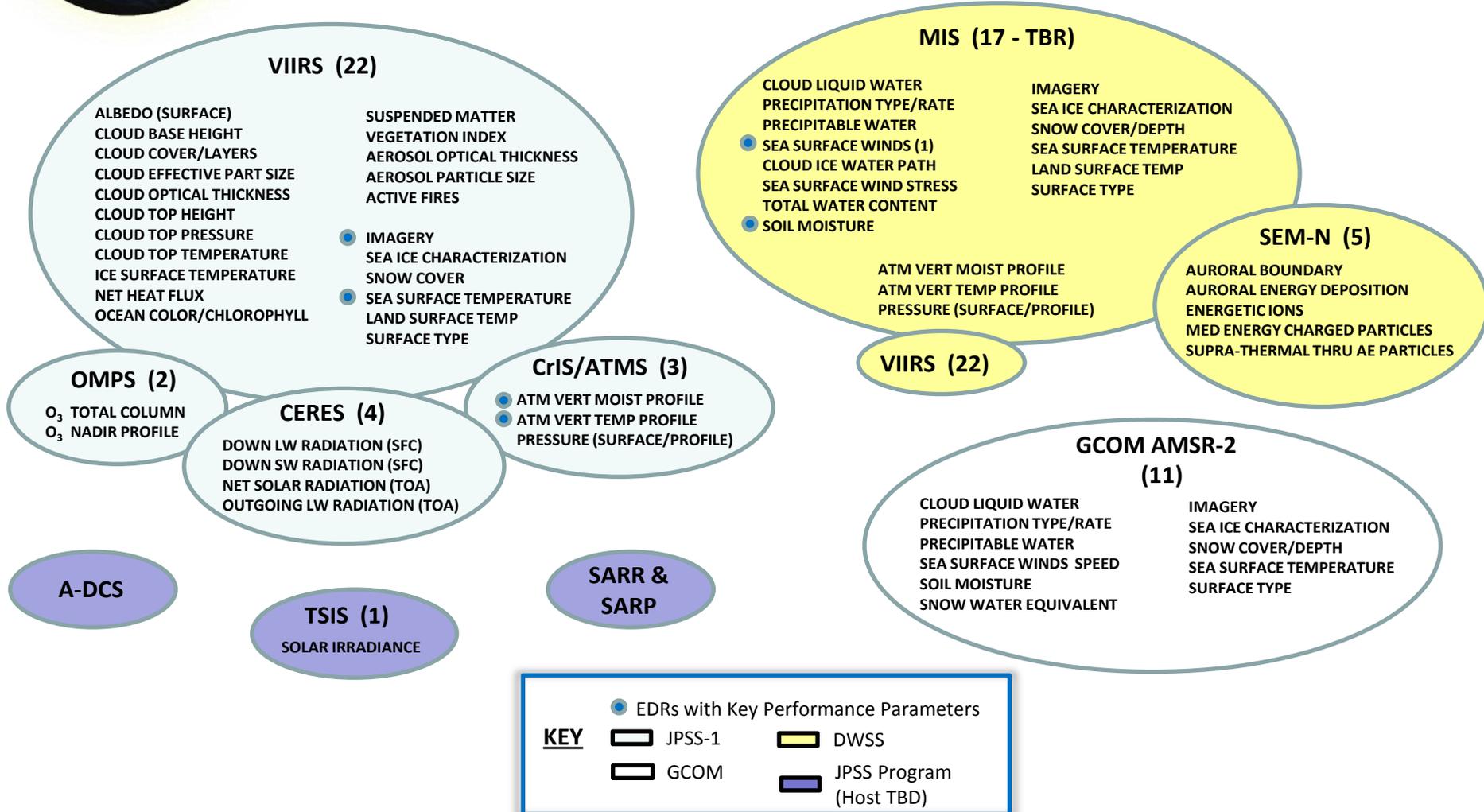


## NOAA Interface Data Processing Segment (IDPS)

Other Satellites (GOES, POES, Jason)



# System Description (Ground System)





# Partnerships

- EUMETSAT
  - EUMETSAT provides mid-morning orbit
  - Both support planning and operations (e.g., Antarctic Data Acquisition)
- Japan (Japan Aerospace Exploration Agency)
  - Global Change Observation Mission – Water (GCOM-W1) provides AMSR-2 data – continuity for NASA’s Aqua satellite
  - NOAA provides ground system services in exchange for data from AMSR2
- Norway (Norwegian Space Centre)
  - Satellite tracking and environmental data acquisition
- Canada (DND) and France (CNES) for SARSAT Program
- France (CNES) – Argos Program



# User Engagement

- JPSS Proving Ground – Maximize the benefits of JPSS data to users
  - Detailed characterization of data attributes and long term stability
  - New and enhanced applications
  - Facilitating transition of improvements (new algorithms / applications)
  - Feedback from users
- Education and training (e.g., UCAR/COMET)
- User readiness
  - Assimilation of data into numerical weather prediction models
  - Facilitate use of direct broadcast capabilities (e.g., in Alaska for cloud products, volcanic ash, snow/ice)



# Status

- NOAA JPSS Office and NASA JPSS Program established and are co-located
- Level-1 Requirements signed
  - Defines high-level requirements on the program
- Agreements and Management Plans being developed
  - Agreements (Program and Ground System) with DoD under review
  - Interagency agreement in coordination
  - MCP drafted and in final review. Program plans are being drafted.
- NPOESS Contracts transitioned from DoD to NASA
- Preparations for JPSS continue
  - Spacecraft and instrument development for JPSS-1
  - Ground system enhancements



# Status (Calibration/Validation)

- NPP launched on October 28, 2011
  - Satellite commissioning underway
- Validation activities required for data products from IDPS and NDE – Multiple levels of maturity
  - Beta – products are minimally validated; available to users to verify formats and parameters
  - Provisional – product quality may not be optimal; ready for operational evaluation
  - Validated – product performance is well for three different stages; ready for operational use

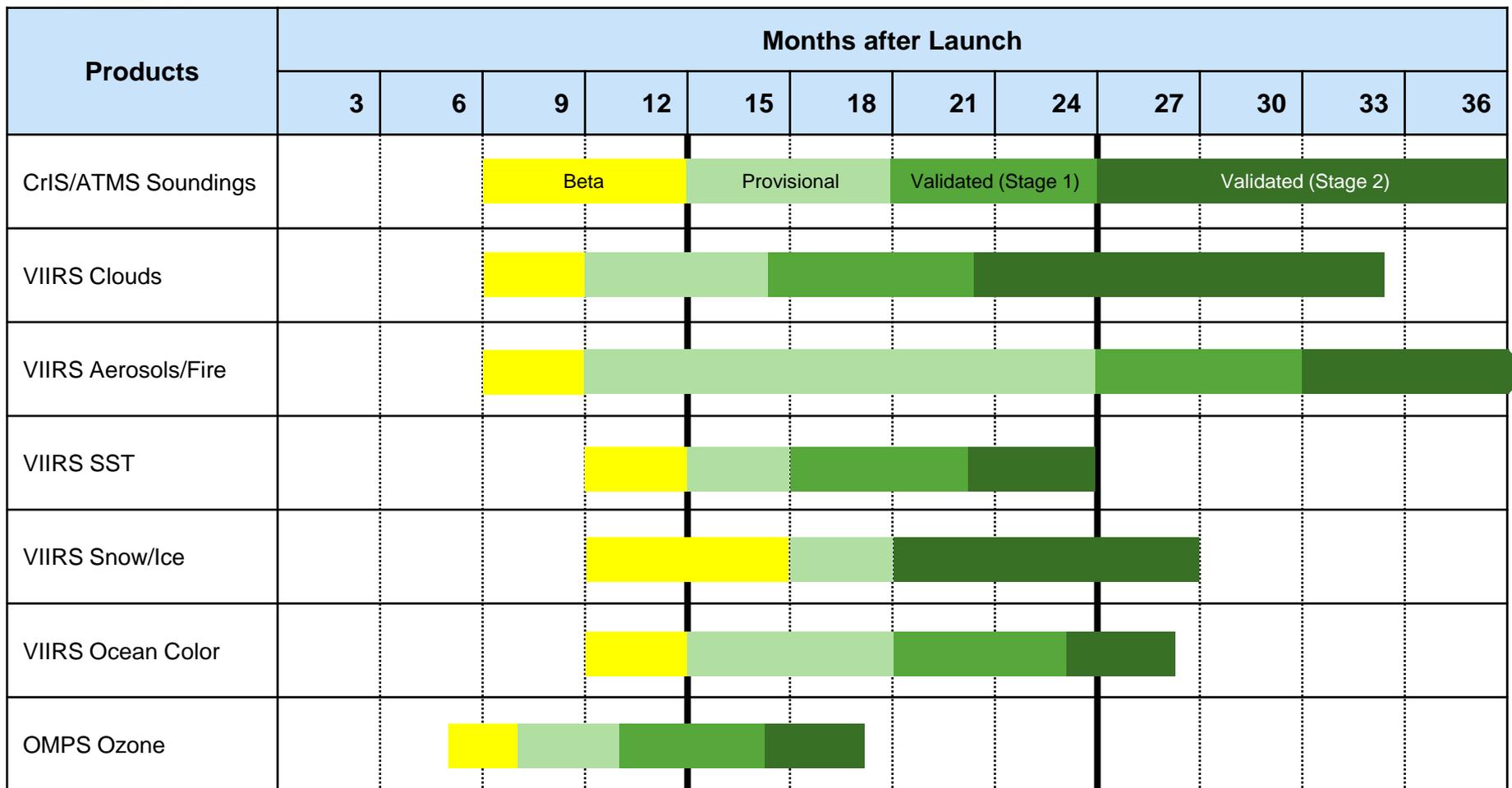


# Status (Calibration/Validation)

- Validation completion ranges from launch plus nine months (e.g., ATMS Sensor Data Records) to launch plus 18 months
  - Limited number of data products may take longer to validate
- All Sensor Data Records (SDRs) available routinely to NOAA users via Environmental Satellite Processing Center (ESPC) / NPOESS Data Exploitation (NDE) by August 2012
  - ESPC/NDE requires provisional stage for routine data distribution to the NOAA community
  - For key operational users such as NWS/NCEP, the data is provided immediately (beta stage) to accelerate operational implementation



# Status (Selected Products)



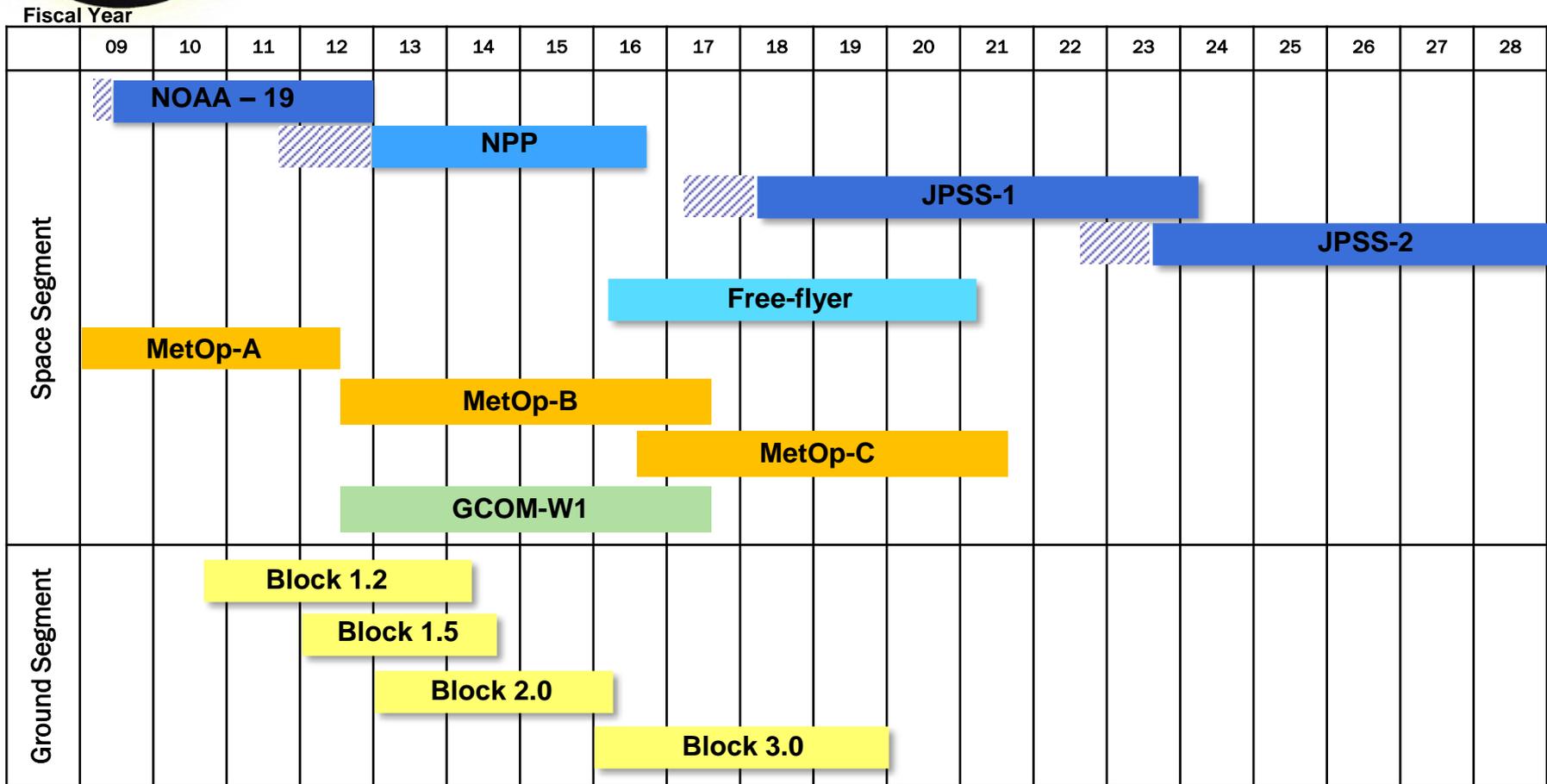


# Status (Data Provision)

- Provision of data consistent with NESDIS Data Access Policy
- Plan to provide data to NWS systems – required to exchange data using secure protocols
  - AWIPS (weather forecast offices) – Test data already flowing. Operational data will be provided in October 2012
  - NCEP (models) – Test data already flowing. Operational data will be provided to supercomputers in March 2012
  - NWSTG/AWIPS (weather forecast offices) – Test data already flowing. Operational data will be provided in January 2013
- NOAA Unique Products will be provided to DoD through COPC
- Delivery of data to EUMETSAT to commence in January with full performance testing to take place in February.



# Status



 Post Launch Testing and Calibration/Validation

 Operational



# Benefits (NOAA Mission)

## Climate Adaptation and Mitigation



## Weather Ready Nation



*To understand and predict changes in climate, weather, oceans, and coasts. To share that knowledge and information with others, and To conserve and manage coastal marine ecosystems and resources*

## Resilient Coastal Communities and Economies



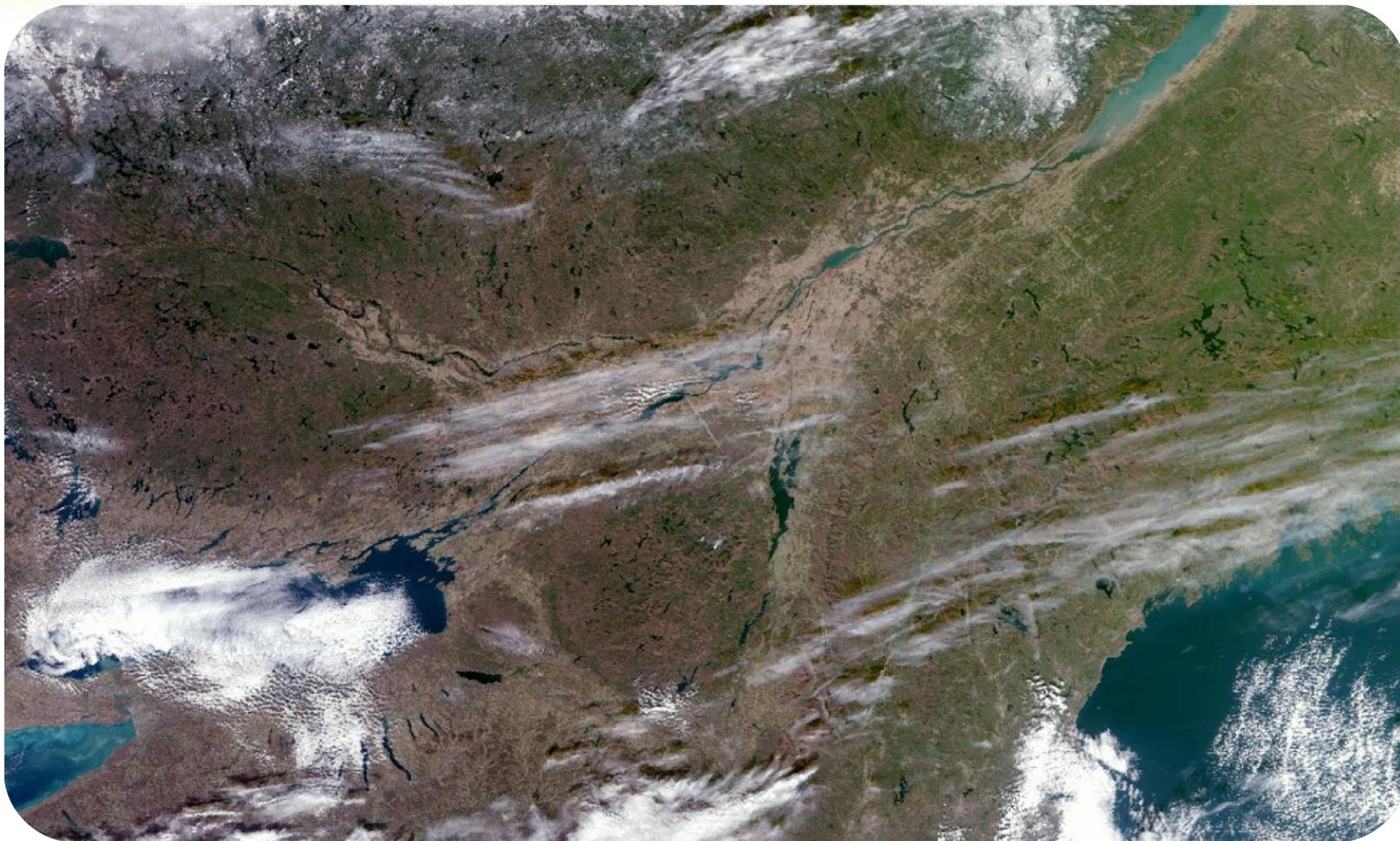
## Healthy Oceans





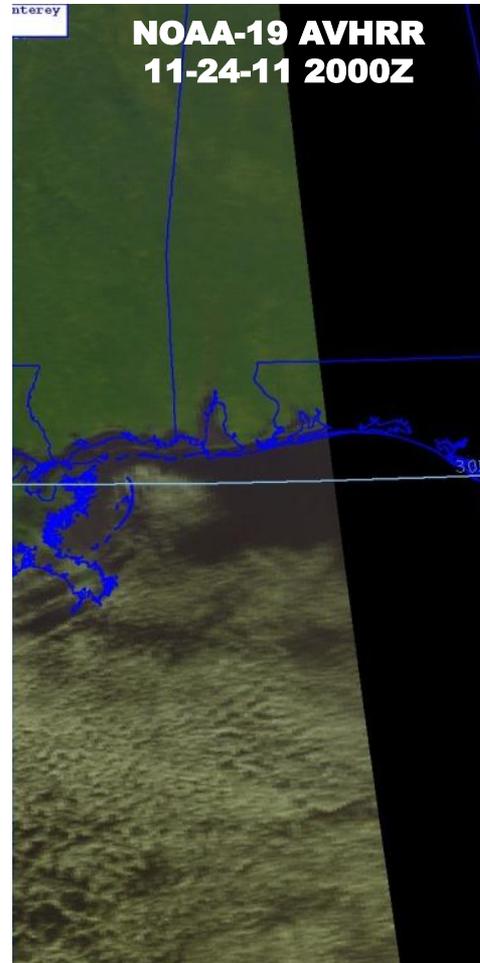
# Benefits (Improvements)

VIIRS Image – November 21, 2011





# Benefits (Improvements)

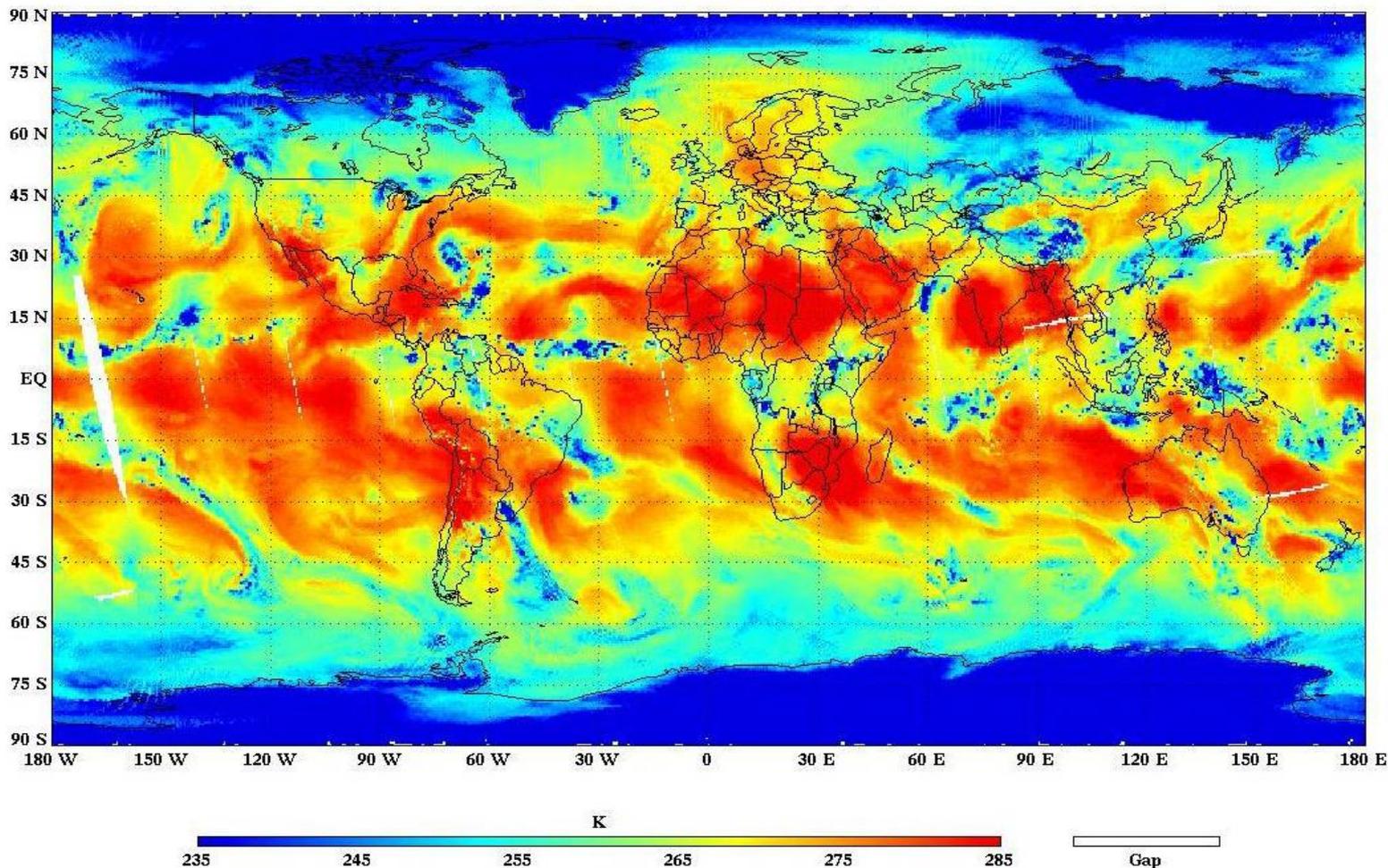


- VIIRS ( with ocean color) significant improvement over AVHRR
- AVHRR prone to large errors in:
  - Discriminating clouds from snow / fog
  - Poor navigation and sensitivity for adequate fire location
  - Poor spatial resolution at edge of scan
- AVHRR in mid-morning orbit suffers from insufficient solar illumination for accurate measurements



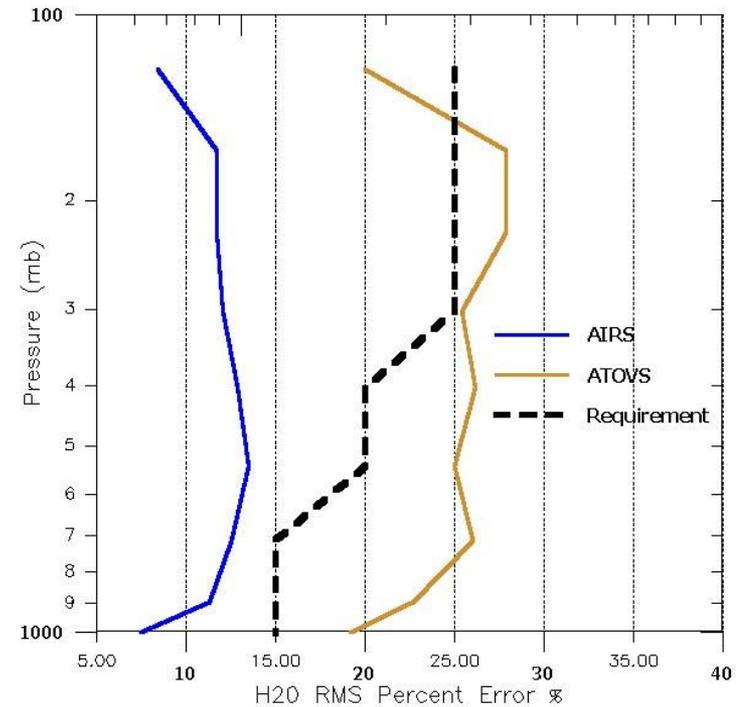
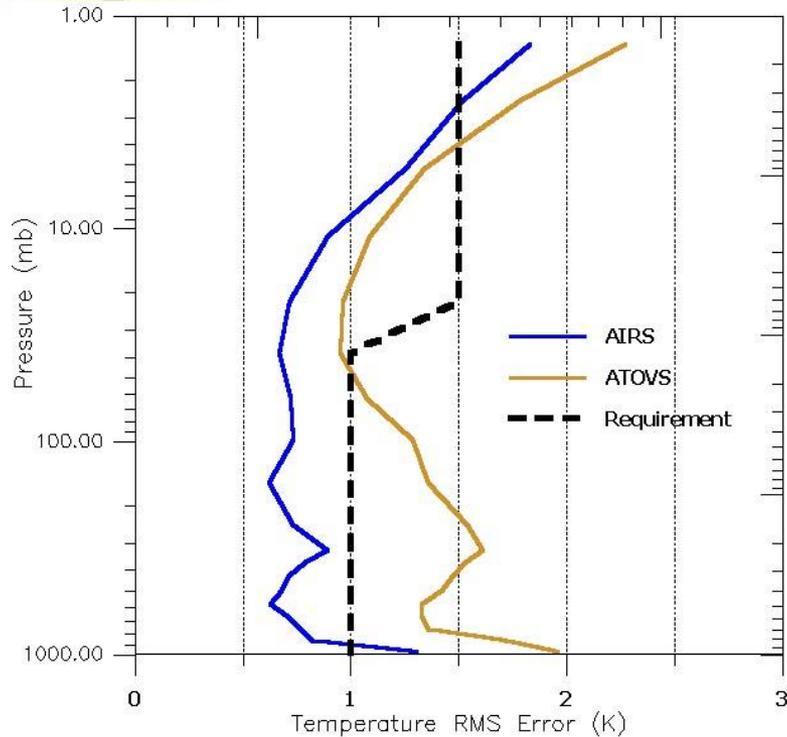
# Benefits (Improvements)

First Global ATMS Image – November 8, 2011





# Benefits (Improvements)



- CrIS (AIRS as proxy) provides significant improvements in temperature and moisture soundings over older generation instruments
  - Vertical resolution has improved from 3-5 km to 1-2 km
  - Improves accuracy of forecasts



# Benefits (Summary)

- Maintains continuity of critical environmental data for weather forecasting, climate analysis and environmental monitoring
- Improvement in data latency
  - Increases timeliness and accuracy of severe weather event forecasts
- VIIRS will provide advanced imaging will improve weather and oceanographic support, fire and volcano analysis, and surface oil monitoring
- CrIS and ATMS will provide advanced atmospheric temperature, moisture and pressure profiles for support of improved NWP forecasts



# Questions





# Backup (Instrument Description)

- **Visible/Infrared Imager Radiometer Suite (VIIRS) J1 and J2**
  - An electro-optical imager having multi-band imaging capabilities which collects calibrated visible/infrared radiances to produce data products for cloud and aerosol properties, land surface type, vegetation index, ocean color, land, ice and sea surface temperatures, and low light visible imagery.
- **Cross-track Infrared Sounder (CrIS) J1 and J2**
  - A Michelson interferometric sounder capable of sensing upwelling infrared radiances from 3 to 16  $\mu\text{m}$  at very high spectral resolution ( $\sim 1300$  spectral channels) to determine the vertical atmospheric distribution of temperature, moisture, and pressure from the surface to the top of the atmosphere across a swath width of 2200 km.
- **Advanced Technology Microwave Sounder (ATMS) J1 and J2**
  - A cross-track high spatial resolution microwave sounder; supports temperature and humidity sounding generation in cloud covered conditions.
- **Ozone Mapping and Profiler Suite (OMPS) J1 and J2**
  - Monitors ozone; collect total column and vertical profile ozone data and continue the daily global data produced by the current ozone monitoring systems, the Solar Backscatter Ultraviolet radiometer (SBUV)/2 and Total Ozone Mapping Spectrometer (TOMS).
- **Cloud and Earth Radiant Energy System (CERES) J1 and J2**
  - Seeks to develop and improve weather forecast and climate models prediction, to provide measurements of the space and time distribution of the Earth's Radiation Budget (ERB) components, and to develop a quantitative understanding of the links between the ERB and the properties of the atmosphere and surface that define that budget.



# Backup (Instrument Description)

- **Total Solar Irradiance Sensor (TSIS)**
  - Measures variability in the sun's solar output, including total solar irradiance. TSIS consists of two instruments: the Total Irradiance Monitor (TIM) that measures the total light coming from the sun at all wavelengths; and the Spectral Irradiance Monitor (SIM) that will measure how the light from the sun is distributed by wavelength.
- **Search and Rescue Satellite Aided Tracking (SARSAT)**
  - Receives signals from emergency position indicating radio beacons (EPIRBs) on the international distress frequency activated by aviators, mariners, and land-based users in distress.
- **Advanced Data Collection System (A-DCS)**
  - Relays meteorological and other data (e.g., temperature, humidity, pressure, velocity, salinity) transmitted from in-situ and ground-based data collection platforms including buoys, free floating balloons, and remote weather stations.