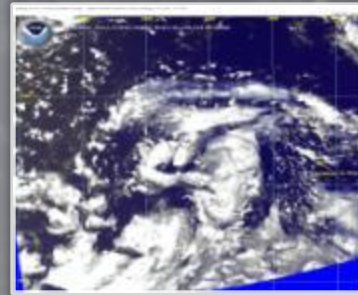
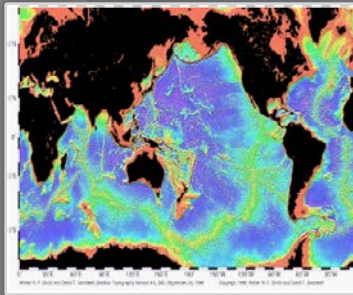
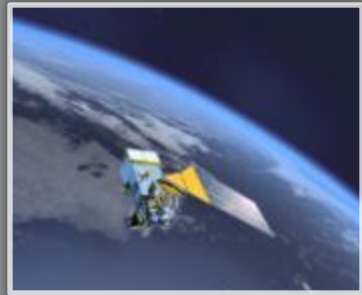
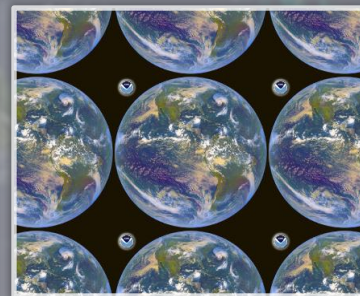
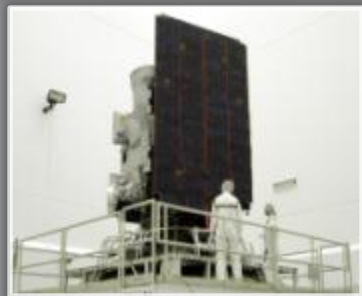


# National Environmental Satellite, Data, and Information Service (NESDIS)



**The Nation's Operational Environmental  
Satellite Agency**



# National Capabilities: Space-Based Earth Observation

## CIVIL SPACE SECTOR



Focus on Earth system research

Usually no more than one satellite per new research area. No backup satellites and less demanding reliability requirements

Large, changing array of research observations dictated by national research priorities

Partners with both NOAA and USGS to leverage satellite building expertise



Focus on atmospheric, climate, ocean, and space weather observations and applications

Operational, continuous satellite missions – 2-4 satellites per block purchase, spares on ground or in space

Core set of observation requirements, with requirements increasing in response to operational needs

History of relying on NASA for space segment development



Focus on land remote observations and land use applications

Operational, continuous missions – utilizing capabilities provided by NASA (Landsat series)

Core set of observation requirements, with requirements increasing in response to operational needs

History of relying on NASA for overall mission development

## DEFENSE SPACE SECTOR



Focus on intelligence gathering and weather and environmental applications to support military operations

Operational, continuous missions – block purchase of satellites, spares on ground or in space

Core set of observation requirements, with requirements increasing in response to operational needs

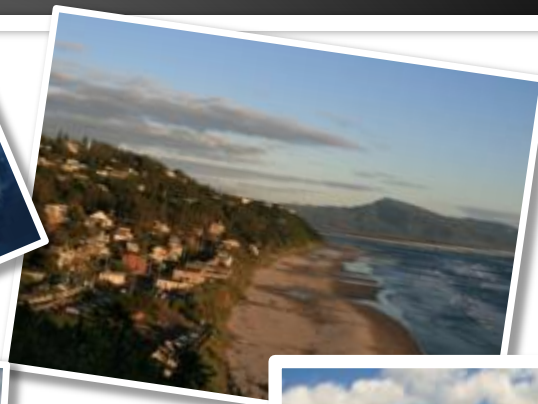
Independent space and ground segment development capability







# NESDIS Mission

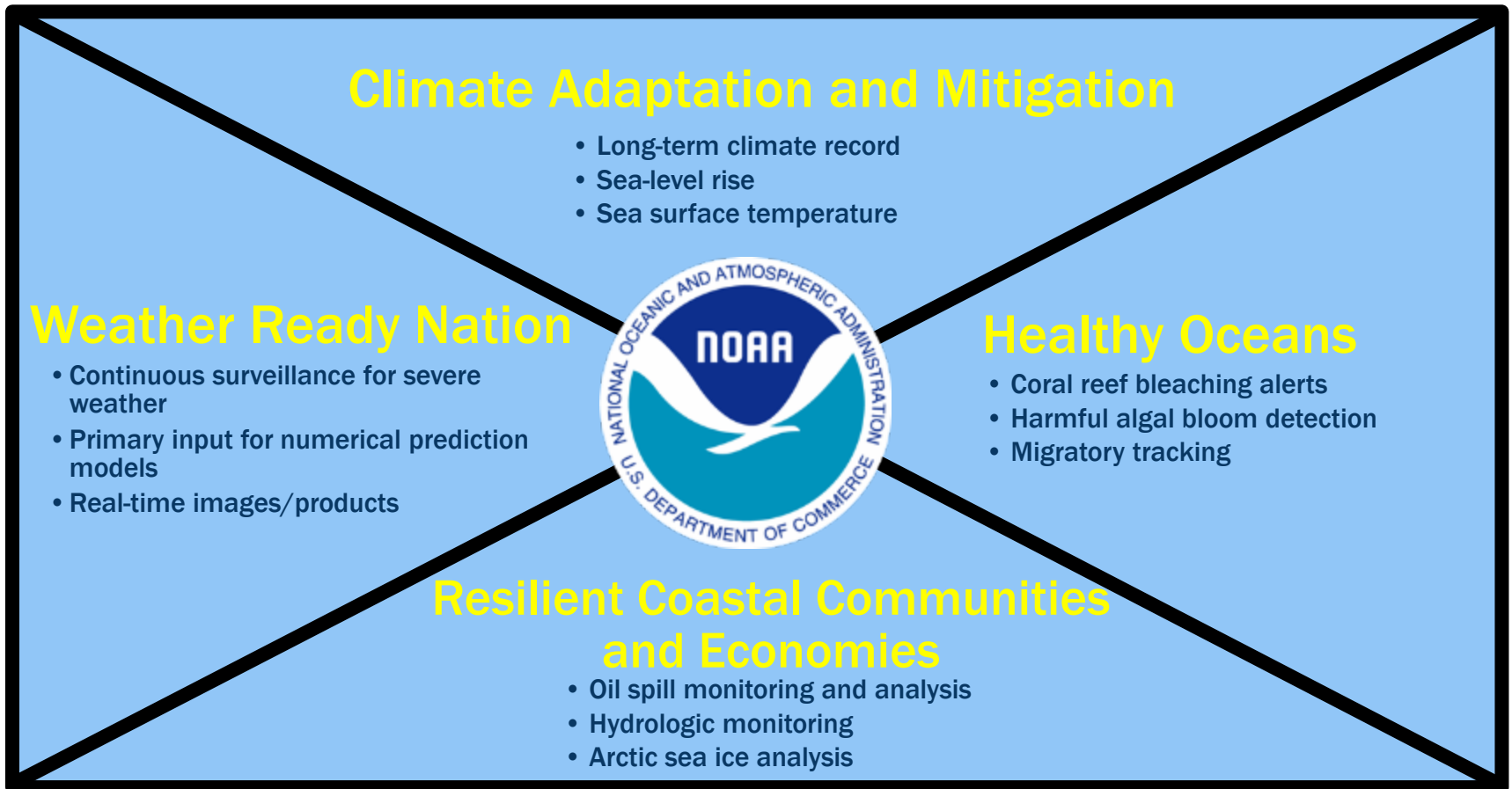


**Our mission is to deliver accurate, timely, and reliable satellite observations and integrated products and to provide long-term stewardship for global environmental data in support of the NOAA mission.**



# NESDIS Mission Supports NOAA's Mission and Goals

NOAA/NESDIS data products and services underpin and support NOAA's mission of Science, Service, and Stewardship





# **Department of Commerce's Primary Mission Essential Functions**

**Collect and provide the Nation with intelligence data, imagery, and other essential information for predictive environmental and atmospheric modeling systems and space-based distress alert systems by operating NOAA-controlled satellites, communications equipment, and associated systems**

**Provide the Nation with environmental forecasts, warnings, data, and expertise critical to public safety, disaster preparedness, all-hazards response and recovery, the national transportation system, safe navigation, and the protection of the Nation's critical infrastructure and natural resources**





# Supporting the Nation's Priorities

Hazards, Severe  
Weather, Watches,  
Warnings

Climate

Oceans and  
Coasts

Defense

Transportation

Industry

Agriculture

Commerce

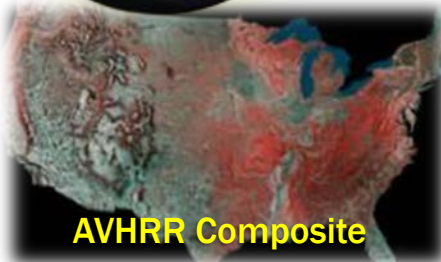
Environmental  
Monitoring







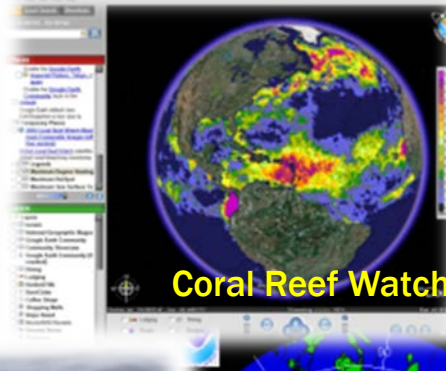
# Supporting NOAA's Mission



AVHRR Composite



DART Tsunami Buoy



Coral Reef Watch



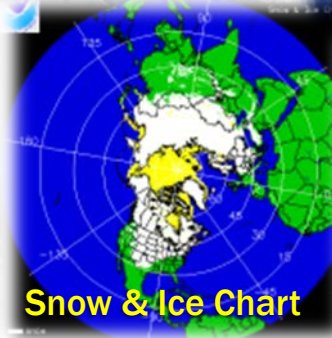
Abby Sunderland Stream gage



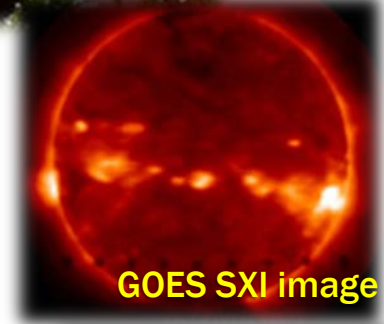
Montage of 2010 Hurricane Season



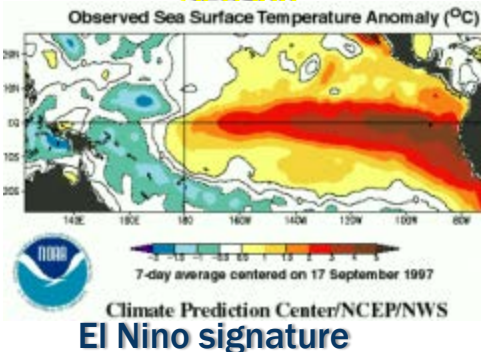
Satellite-tagged Dolphin



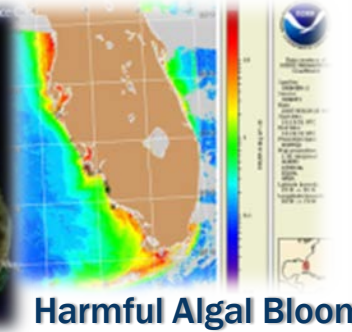
Snow & Ice Chart



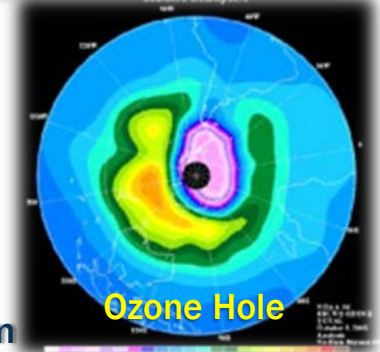
GOES SXI image



Deepwater Horizon



Harmful Algal Bloom



Ozone Hole







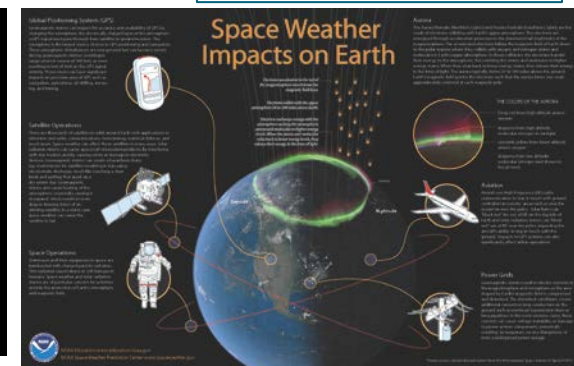
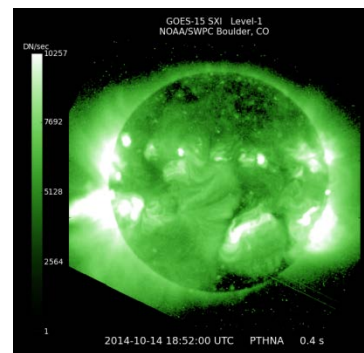
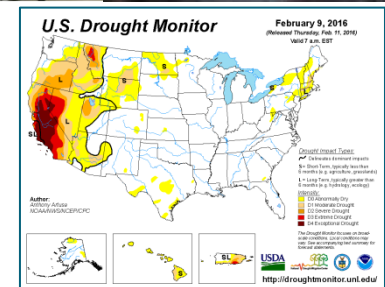
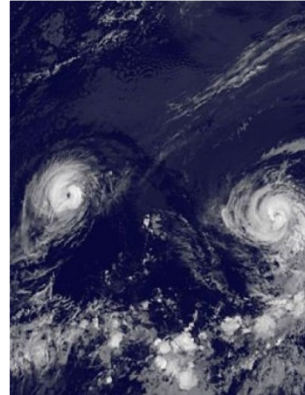
# Environmental Intelligence: NOAA Products and Services Support To the Public's Decision-making

Environmental decisions can impact lives, property and segments of the economy for years.

Environmental intelligence includes weather warnings or forecasts, tsunami and flood alerts, space weather, fire and drought reports and predictions, ice monitoring or harmful algal bloom assessments.

Critical information is tied to observations, modeling and computer resources.

Decision support tools are essential to effectively convey information.





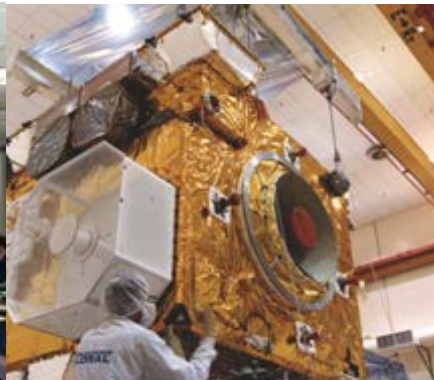


# NESDIS End-to-End Responsibility

Requirements & Planning



System Acquisition



Launch



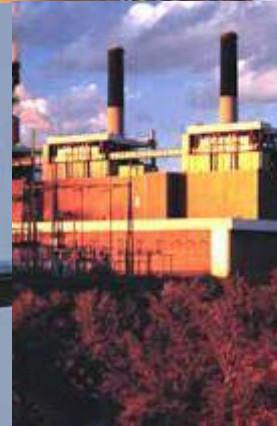
Command & Control



Real-Time Product Development & Distribution



Data Archive & Access



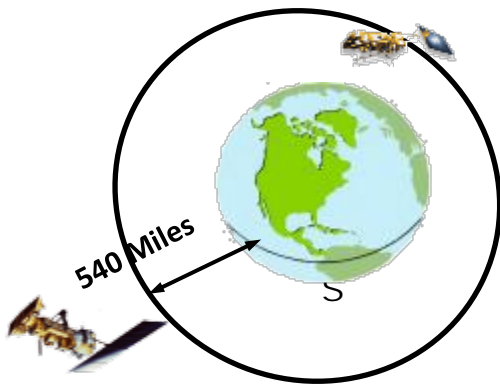
Products & Services





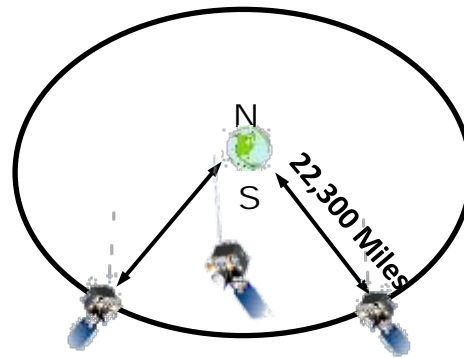
# Three Observation Points

## Polar-orbiting Operational Environmental Satellites



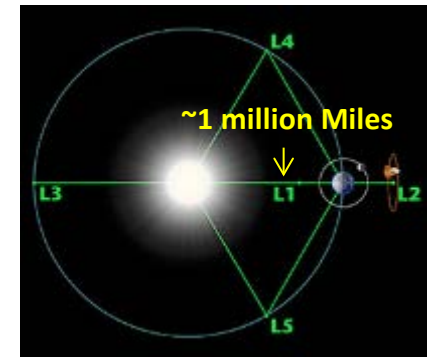
- Each satellite covers the Earth twice per day
- ✔ Pole-to-pole orbit is 102 minutes and views each location at the same time of day
- ✔ Global coverage every 12 hours with one satellite
- ✔ EUMETSAT in the mid-morning orbit; NOAA in the early afternoon orbit

## Geostationary Operational Environmental Satellites



- Continuous monitoring of the Americas
- ✔ Same geographic image over time
- ✔ Full image every 30 minutes and Northern Hemisphere images every 15 minutes
- ✔ Usable images between 60°N and 60°S

## Deep Space at Lagrange 1 Point



- Continuous monitors the surface of the Sun
- ✔ Uninterrupted view of the sun
- ✔ Located ~1 million miles from Earth, at the Lagrange Point 1 position of the Sun-Earth system





# NESDIS Principal Activities

## Providing On-Orbit Satellite Operations

- ✓ Geostationary satellites (GOES)
- ✓ Polar-orbiting satellites (POES; Suomi NPP)
- ✓ Defense Meteorological Satellite Program (DMSP)
  - DMSP is operated by NOAA for the U.S. Air Force
- ✓ Jason-2 Altimetry Satellite and Jason-3 Altimetry Satellite (*Post-launch check-out*)
- ✓ DSCOVR (Solar Wind Continuity; *Post-launch check-out*)

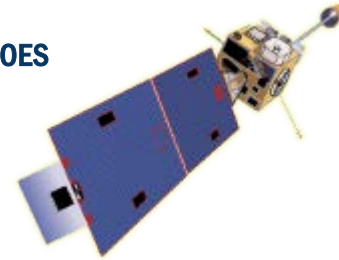
## Acquiring Next Generation Satellites

- ✓ GOES-R Satellite Series
- ✓ Joint Polar Satellite System (JPSS) and Polar Follow On (PFO)
- ✓ COSMIC-2 Radio Occultation
- ✓ Space Weather Follow On
- ✓ Cooperative Data and Rescue Services (CDARS)

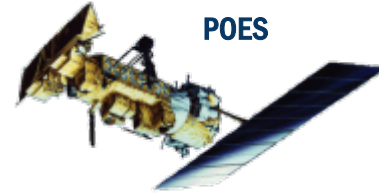
## Providing Long Term Data Stewardship

- ✓ National Centers for Environmental Information

GOES



POES



GOES-R



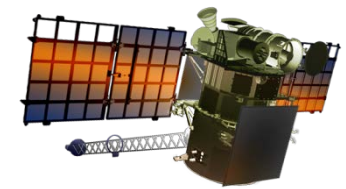
Suomi NPP



Jason-2



DSCOVR





# NOAA Satellite Operations

24 hours a day, 7 days a week,  
365 days a year

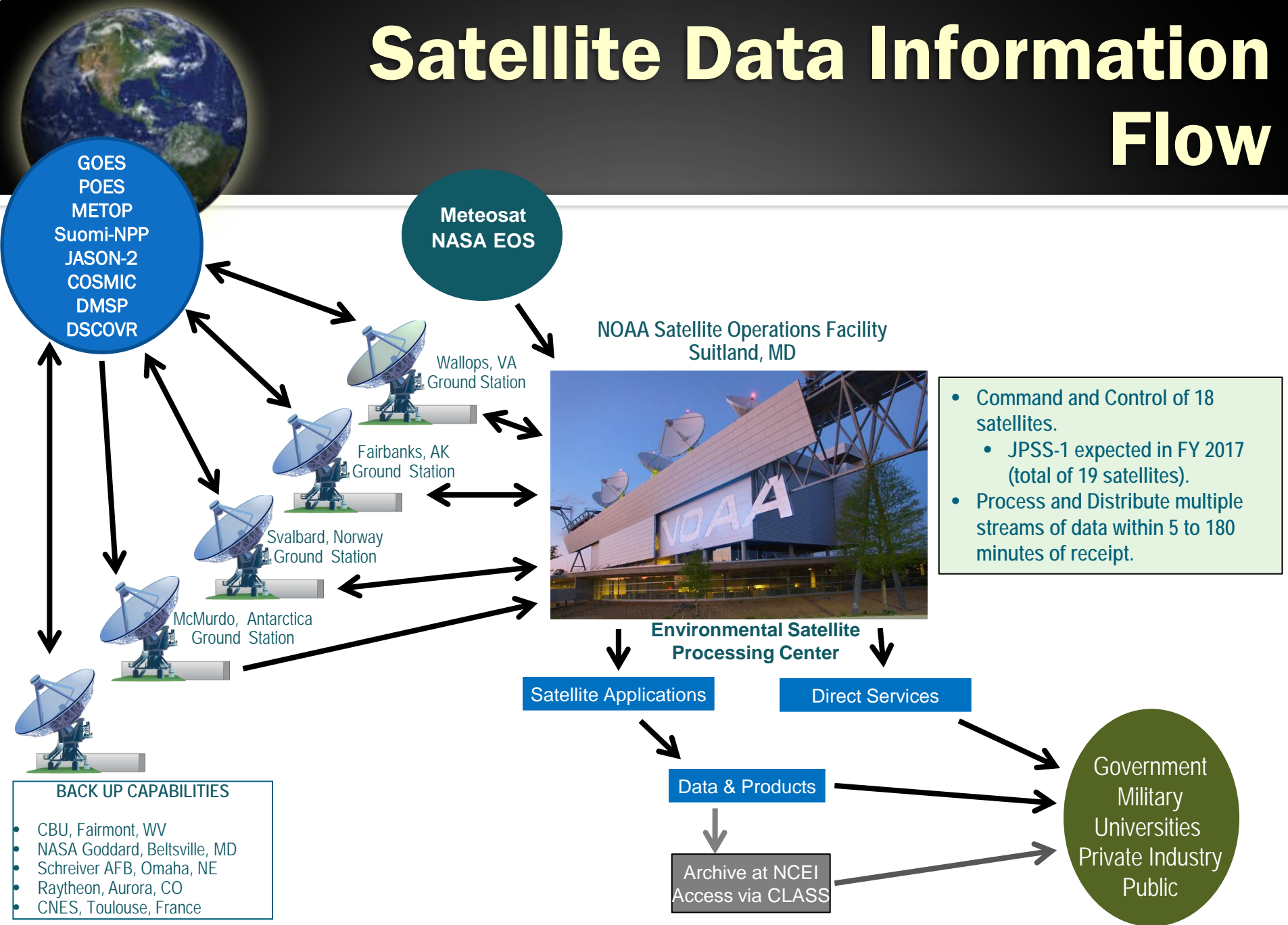
## Functions include:

- ✔ Orbit Determination
- ✔ Spacecraft Navigation
- ✔ Data Acquisition
- ✔ Product Development and Distribution
- ✔ NOAA supports over 18 satellites daily
- ✔ Satellite-assisted Search and Rescue
- ✔ National Ice Center
- ✔ Product Processing and Distribution





# Satellite Data Information Flow



- BACK UP CAPABILITIES**
- CBU, Fairmont, WV
  - NASA Goddard, Beltsville, MD
  - Schriever AFB, Omaha, NE
  - Raytheon, Aurora, CO
  - CNES, Toulouse, France



# Other Programs

## Group on Earth Observations (GEO)

- Collaborate globally in the Earth observation intergovernmental partnership with 100 governments and 93 international organizations to foster EO data sharing

## Commercial Remote Sensing Licensing and Compliance

- Regulatory Authority and Enforcement

## Office of Space Commerce

- Advocate for commercial space industry
- Entry point for NOAA Commercial Space Policy queries



GEO Ministerial meeting. November 2015. Mexico City, Mexico.



45th Anniversary of Earth Day on the National Mall in Washington, D.C. on April 18, 2015. Image credit: DigitalGlobe.com, captured by WorldView-3

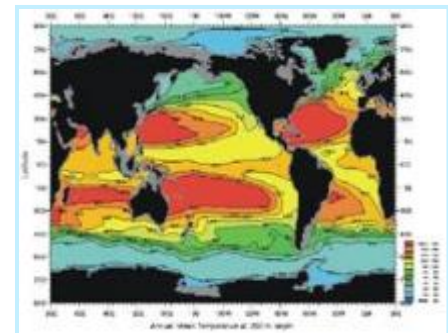
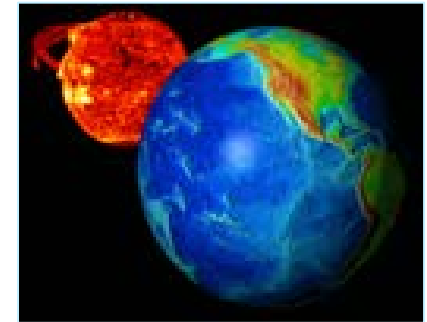
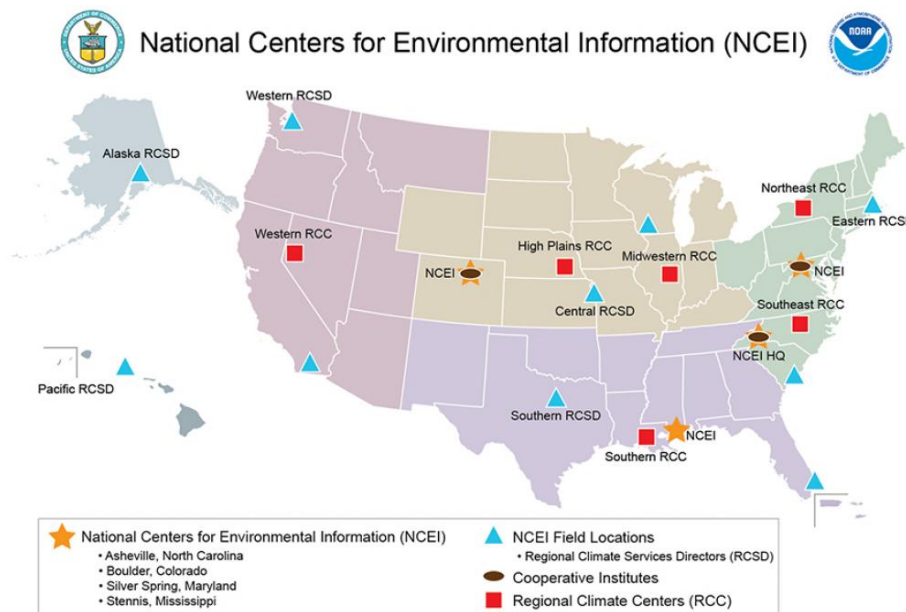
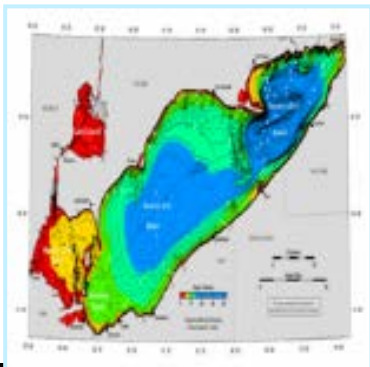
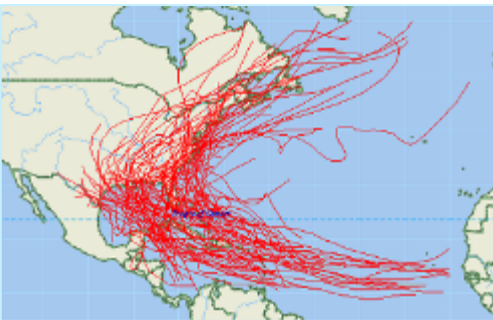




# National Centers for Environmental Information (NCEI)

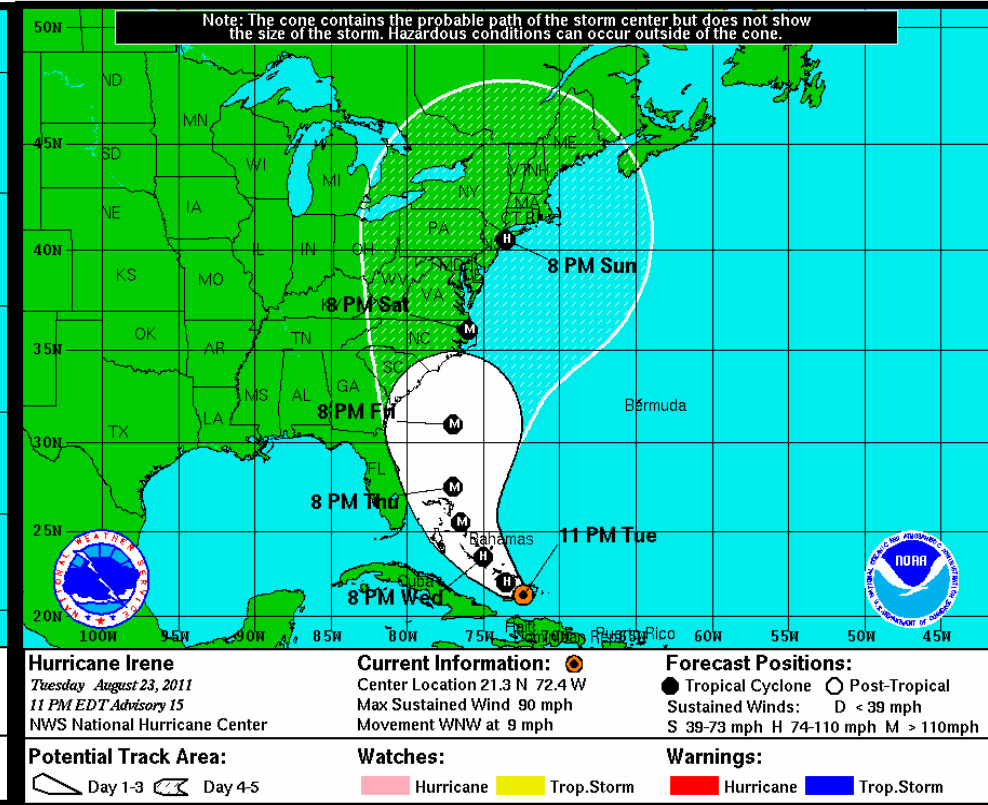
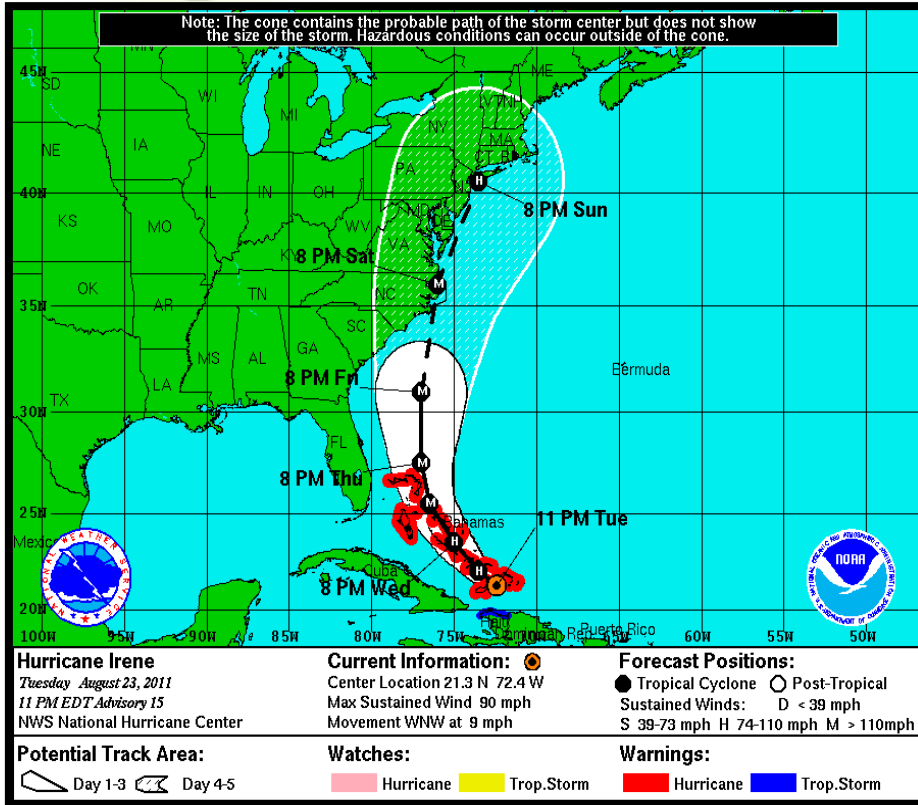
## Archive, Access, and Assessment

- NOAA's National Centers for Environmental Information (NCEI) are responsible for hosting and providing public access to one of the most significant archives for environmental data on Earth with over 20 petabytes of comprehensive atmospheric, coastal, oceanic, and geophysical data.
- By preserving, stewarding, and maximizing the utility of the Federal government's billion-dollar investment in high-quality environmental data, NCEI remains committed to providing products and services to private industry and businesses, local to international governments, academia, as well as the general public.





# Building on 10+ years of Forecast Improvement



2011 Irene Forecast

Irene "2001" Forecast

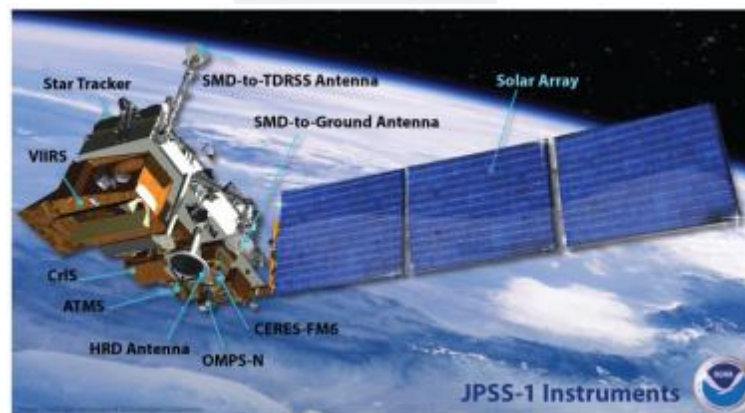




# JPSS & PFO Overview

## Benefits

- Ensures continuity of global weather observations and critical environmental data around the world
- Delivers real-time data to the National Weather Service, improving the quality of forecasts and enabling improved consistency in public warnings, 3 days and beyond, in advance of a severe weather event
- Provides critical monitoring for hurricanes, droughts, floods, snowstorms and other severe weather events, allowing for the time to protect lives and property through evacuations and other preparations
- Advances weather, climate, environmental and oceanographic science through technological improvements in satellite instruments and capabilities over legacy NOAA satellites








JPSS Launch Commitment Dates	No later than 2Q FY 2017 (JPSS-1)*; 4Q FY 2021 (JPSS-2)
JPSS Program Architecture	JPSS Program: 3 Satellites (Suomi NPP, JPSS-1, JPSS-2) PFO: 2 Satellites (PFO/JPSS-3, PFO/JPSS-4)
Program Operational Life	JPSS: FY 2012 - FY 2025; PFO extends to 2038
JPSS Program Life-cycle (FY 2017 President's Budget)	JPSS: \$11.322 billion; PFO: TBD

\*Launch Date based on FY 2015 President's Budget Request



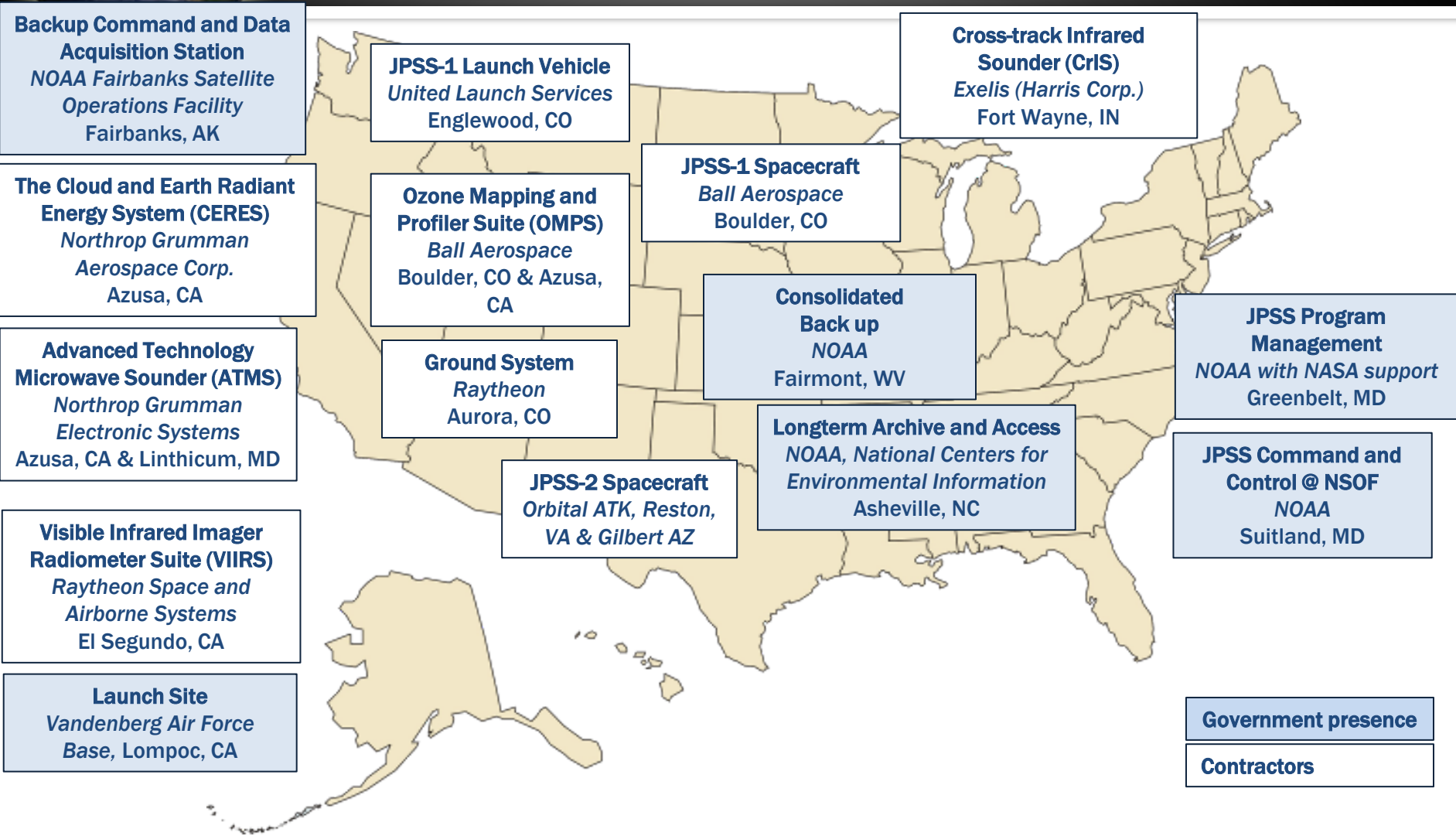
# JPSS-1 Instruments

JPSS-1 Instruments (PFO instruments *)		Measurements
	<b>ATMS</b> - Advanced Technology Microwave Sounder *	ATMS and CrIS together provide high vertical resolution temperature and water vapor information needed to maintain and improve forecast skill out to 7 days in advance for extreme weather events, including hurricanes and severe weather outbreaks
	<b>CrIS</b> - Cross-track Infrared Sounder*	
	<b>VIIRS</b> - Visible Infrared Imaging Radiometer Suite*	VIIRS provides many critical imagery products including snow/ice cover, clouds, fog, aerosols, fire, smoke plumes, vegetation health, phytoplankton abundance/chlorophyll
	<b>OMPS</b> - Ozone Mapping and Profiler Suite Nadir*	Ozone spectrometers for monitoring ozone hole and recovery of stratospheric ozone and for UV index forecasts
	<b>CERES</b> - Clouds and the Earth's Radiant Energy System	Scanning radiometer which supports studies of Earth Radiation Budget (ERB)





# JPSS & PFO Program Locations

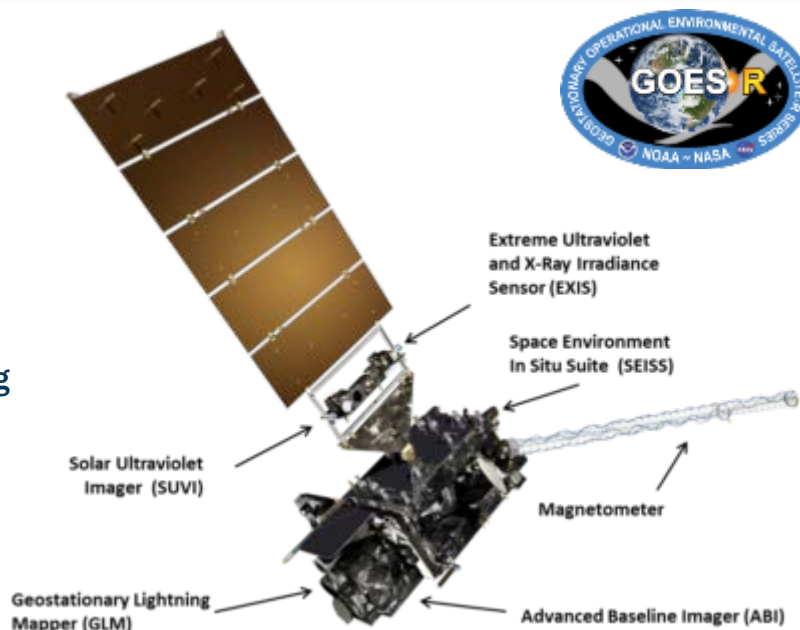




# GOES-R Series Overview

## Benefits

- ☑ Maintains continuity of weather observations and critical environmental data from geostationary orbit
- ☑ Provides faster scanning of entire hemisphere while simultaneously observing individual storms, improving hurricane tracking, aviation flight route planning, air quality warnings and fire detection
- ☑ Provides a new lightning mapping capability for improved warning lead time for severe storms and tornadoes, allowing time to protect lives and property
- ☑ Provides improved warning of solar events to minimize impact to communications, navigation systems, power grids and satellites in orbit



<b>GOES-R Launch Commitment Date*</b>	<b>1Q FY 2017</b>
<b>Program Architecture</b>	<b>4 Satellites (GOES-R, S, T &amp; U) 10 year operational design life for each spacecraft</b>
<b>Program Operational Life</b>	<b>FY 2017 – FY 2036</b>
<b>Program Life-cycle</b>	<b>\$10.829 billion</b>

\*Launch Commitment Date based on FY 2017 President's Budget Request





# GOES-R Instruments

## Terrestrial Weather

### Advanced Baseline Imager (ABI)

### Geostationary Lightning Mapper (GLM)



- ✓ Key for “nowcasting” out to 3 days
- ✓ Improves hurricane track & intensity forecasts
- ✓ Increases thunderstorm & tornado warning lead time
- ✓ Improves aviation flight route planning
- ✓ Data for long-term climate variability studies

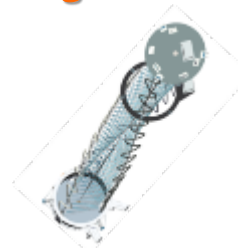
## Solar Weather

### Space Environment In-Situ Suite (SEISS)

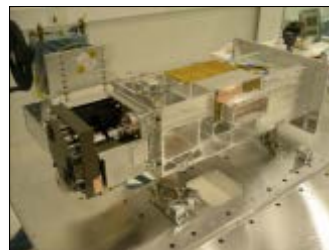
### Solar Ultra-Violet Imager (SUVI)



### Magnetometer



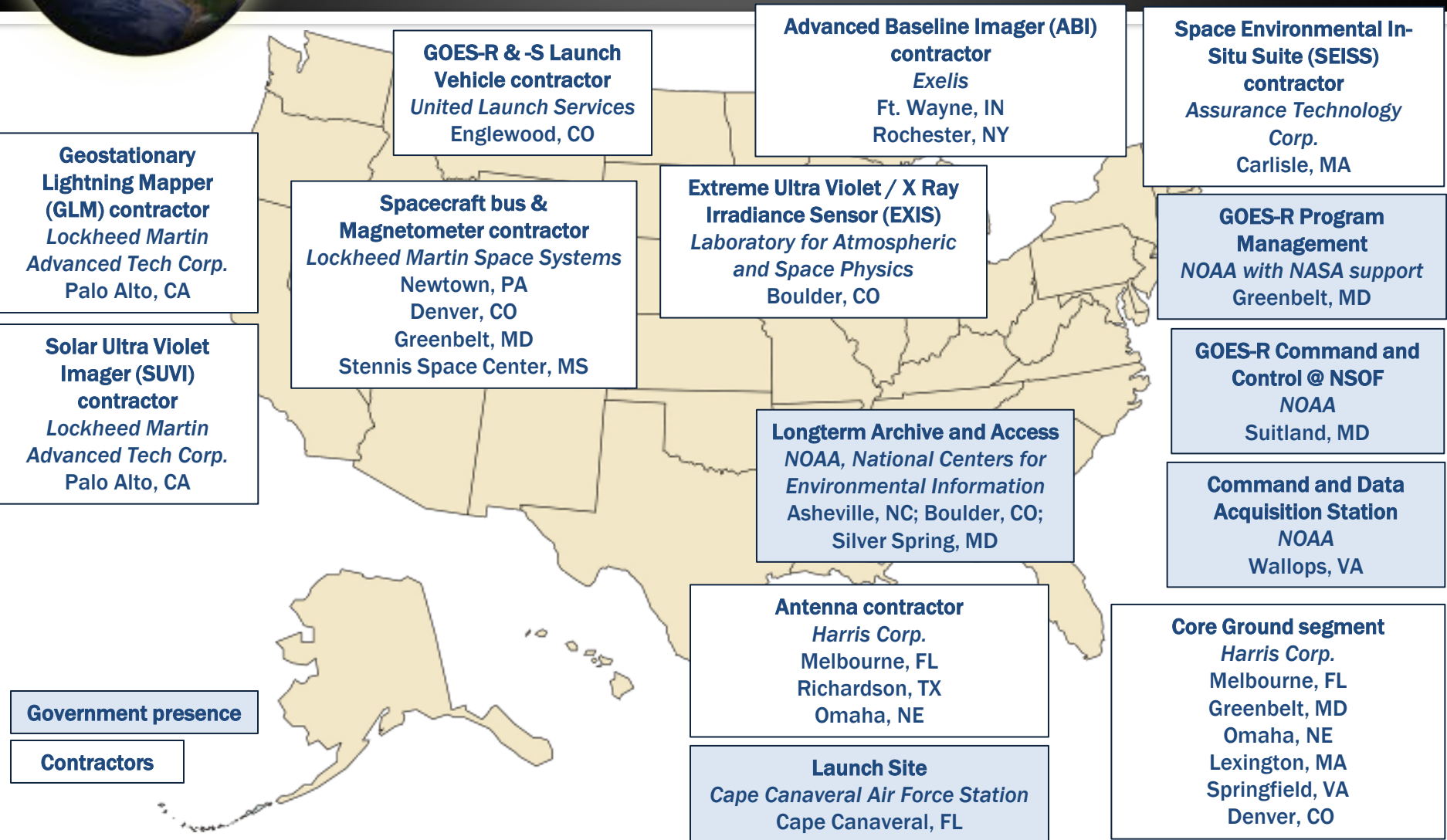
### Extreme UV/X-Ray Irradiance Sensors (EXIS)



- ✓ Improves solar flare warnings for communications and navigation disruptions
- ✓ More accurate monitoring of energetic particles responsible for radiation hazards to humans and spacecraft
- ✓ Better monitoring of Coronal Mass Ejections to improve geomagnetic storm forecasting



# GOES-R Series Program Locations





# Partnered Missions

Future Missions	Legacy System (s)
<p><i>FY 2016 / FY 2017</i></p> <ul style="list-style-type: none"> <li>• <b>First 6 COSMIC-2 satellites</b>, a joint U.S. (NOAA, NASA, U.S. Air Force) and Taiwan mission</li> </ul> <p><i>FY 2020</i></p> <ul style="list-style-type: none"> <li>• <b>Second 6 COSMIC-2 satellites</b>, a joint U.S.-Taiwan mission</li> </ul>	<ul style="list-style-type: none"> <li>• COSMIC-1, launched in 2006</li> </ul>
<p><i>1Q FY 2019</i></p> <ul style="list-style-type: none"> <li>• <b>Metop-C</b>, a joint NOAA and EUMETSAT mission, with NASA acquisition support</li> </ul>	<ul style="list-style-type: none"> <li>• Metop-B, launched in 2012</li> </ul>
<p><i>1Q FY 2021</i></p> <ul style="list-style-type: none"> <li>• <b>CDARS</b>, a joint NOAA, NASA, EUMETSAT, French Space Agency, Canadian Department of Defence mission, with Air Force support               <ul style="list-style-type: none"> <li>• ARGOS-Data Collection Service,</li> <li>• SARSAT</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• NOAA-19, launched in 2009</li> <li>• Metop-B, launched in 2012</li> </ul>
<p><i>Planned by FY 2022</i></p> <ul style="list-style-type: none"> <li>• <b>Space Weather Follow On</b>, to provide solar wind and coronal mass ejection (CME) continuity at Lagrange-1 point</li> </ul>	<ul style="list-style-type: none"> <li>• DSCOVR, launched in 2015 (solar wind)</li> <li>• NASA Solar and Heliospheric Observatory (SOHO), launched in 1995 (CME)</li> <li>• NASA Solar Terrestrial Relations Observatory (STEREO), launched in 2006 (CME)</li> </ul>





# Current Challenges

- ✔ Continuity of critical observations for current weather forecasting needs until future systems come on-line
- ✔ Participate in corporate NOAA gap mitigation strategy development in the event a gap materializes
- ✔ Maintaining an adequate cybersecurity posture without impeding full and open access to our data and information services.
- ✔ Maintaining a brisk pace as we develop the next generation systems
- ✔ Being responsive to stakeholder pressure to make our systems and processes more cost-effective



# Summary

- ✔ NESDIS' mission is to deliver accurate, timely, and reliable satellite observations and integrated products and to provide long-term stewardship for global environmental data in support of the NOAA mission
- ✔ Next generation systems offer significant advantages over the legacy on-orbit systems, and they remain on schedule and within budget as they progress towards launch
- ✔ The NESDIS satellite enterprise benefits from strong partnerships, both domestically and internationally
- ✔ The President's FY 2017 Budget request preserves NESDIS' core functions, focuses on key mission areas, and provides strategic investments for new activities

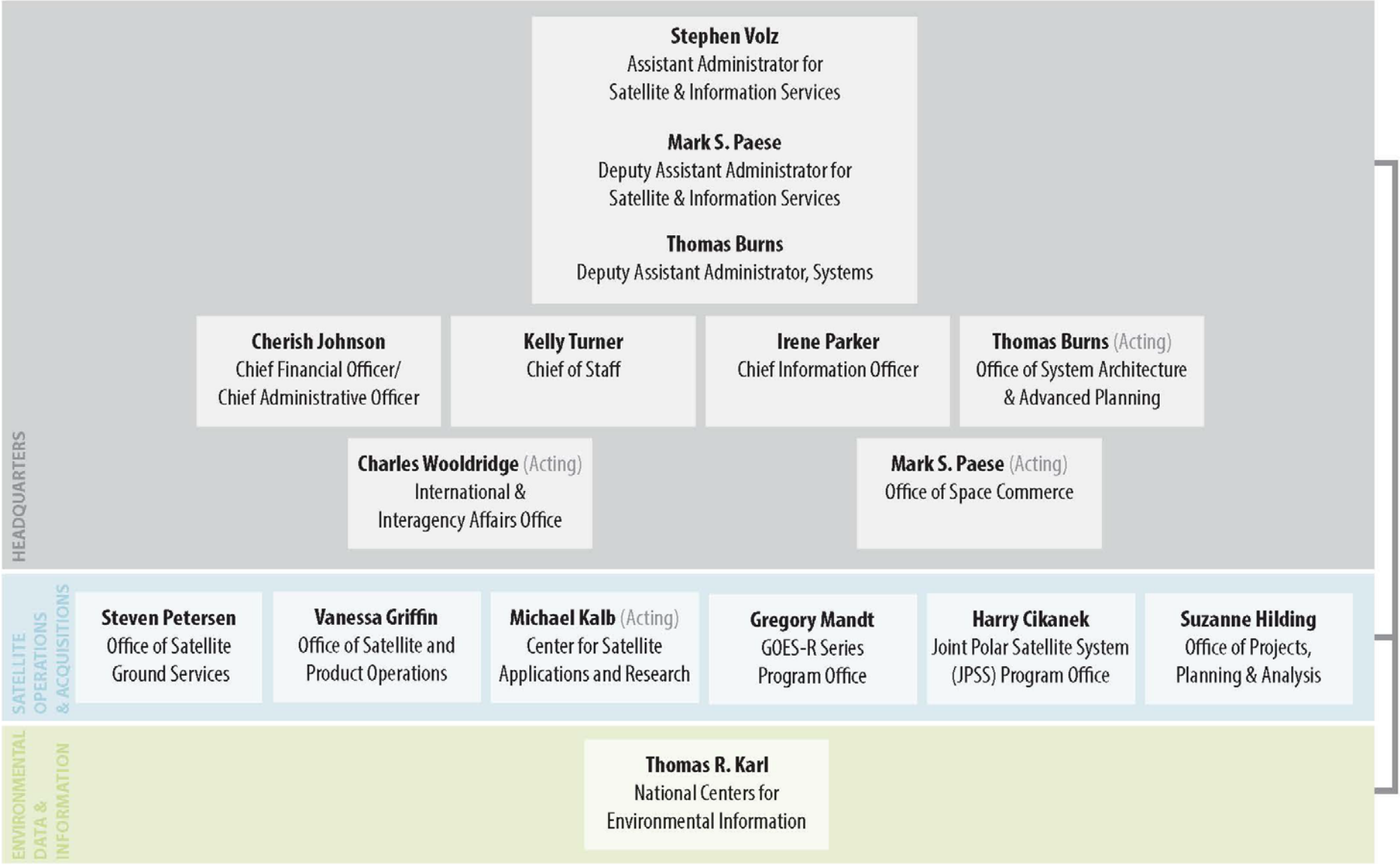


# Back Up Slides





# NOAA Satellite and Information Service Organizational Chart

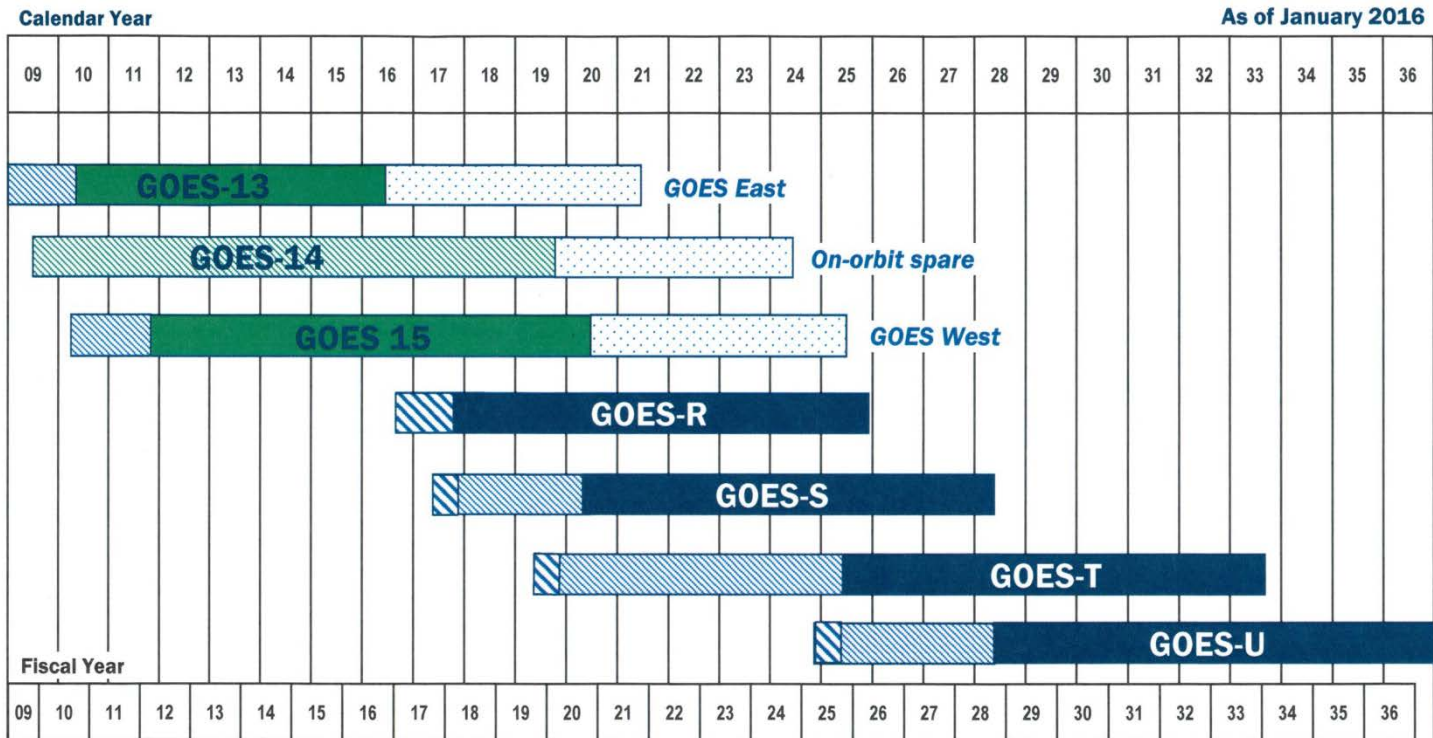




# Geostationary Satellite Chart



## NOAA Geostationary Satellite Programs Continuity of Weather Observations



Approved:   
 Assistant Administrator for Satellite and Information Services





# Geostationary Satellite Chart Updates

## Geostationary satellite flyout chart changes include:

- ✔ A change in April 2015, based on engineering judgment and operational history, showed estimates of lifetime based on current fuel consumption. These projections assume that instruments and critical spacecraft systems continue to perform nominally.
- ✔ Projected operational life for GOES-14 was removed because it is in on-orbit storage and will not be placed into operations unless or until the failure of another vehicle occurs, requiring its service to meet the requirement for both east and west coverage.
- ✔ The GOES-R launch readiness date was adjusted from March 2016 to October 2016 to reflect the need for more time to integrate and test the vehicle before launch.
- ✔ For accuracy, there is a 6-month test & checkout period shown for GOES-S, -T, and -U.
- ✔ Launch schedules for GOES-R series satellite will be evaluated based on orbit performance of GOES satellites, including GOES-S.







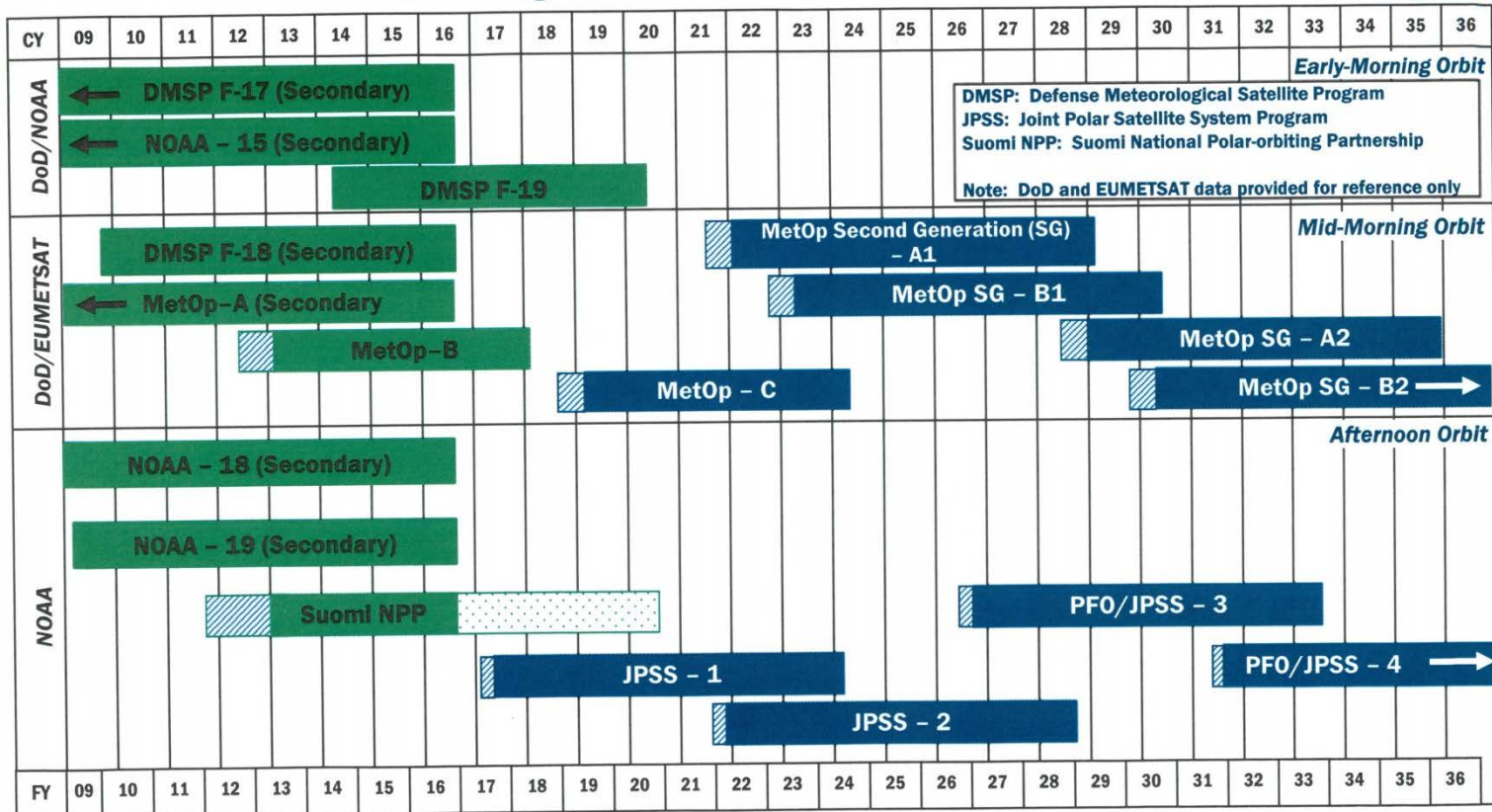
# Polar-orbiting Satellite Chart



## NOAA & Partner Polar Satellite Programs Continuity of Weather Observations



As of January 2016



DMSP: Defense Meteorological Satellite Program  
 JPSS: Joint Polar Satellite System Program  
 Suomi NPP: Suomi National Polar-orbiting Partnership  
 Note: DoD and EUMETSAT data provided for reference only

Approved: Stephens  
 Assistant Administrator for Satellite and Information Services

Note: Extended operations are reflected through the current FY, based on current operating health.

	In orbit		Post Launch Test
	Fuel-Limited Lifetime Estimate		Planned Mission Life, from Launch Readiness Date
	Launched before Oct 2008		Operational beyond Dec 2036





# Polar-orbit Satellite Chart Updates

## Polar satellite flyout chart changes include:

- ✔ NOAA-15, -18, and -19 on-orbit projected life estimates have been extended through October 2016 to reflect our judgment that the aging missions are nearing the end of their useful operational lives.
- ✔ In FY 2016 NESDIS will be completing a systematic review of the health and status of our legacy POES constellation, which may lead to further updates in the lifetime projections for these assets.
- ✔ Suomi NPP (SNPP) extended life has been estimated at 2020 using reliability analyses of the satellite performance to date and the projected estimates for the reliability of electronics, expected fuel depletion, and wear-out mechanisms such as mechanisms and batteries.
- ✔ On-orbit checkout time decreased for JPSS spacecraft based on favorable operational history of SNPP.
- ✔ DMSP and EUMESTAT partner spacecraft are shown for information only and have been updated based on guidance from the U.S. Air Force and EUMESTAT.

