



NESDIS: NOAA's Satellite & Information Service

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Maryland Space Business Roundtable

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Where did we come from?

- Current state of NOAA's Satellite Earth Observation System

Where are we now?

- Upcoming great transition

Where are going?

- Opportunities & challenges of the future for NESDIS and NOAA



Current State of NOAA's Earth Observation System

Supporting NOAA's Mission

NOAA is a science-based services agency engaged with the entire Earth system science enterprise.

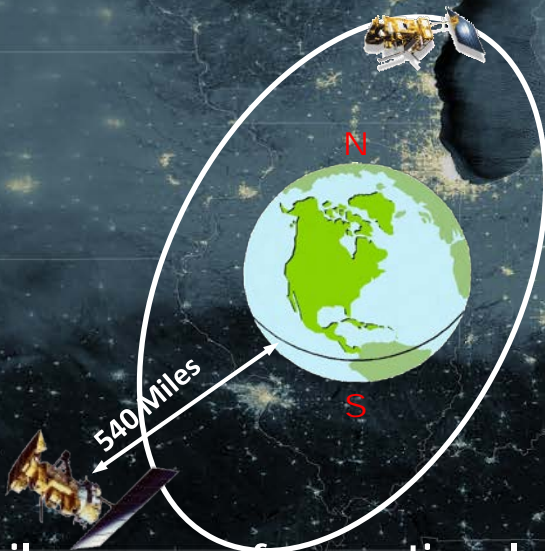
NOAA's Top Four Priorities:

1. To provide information and services to make communities more resilient
2. To evolve the National Weather Service
3. To invest in observational infrastructure *50% of NOAA's Budget*
4. To achieve organizational excellence



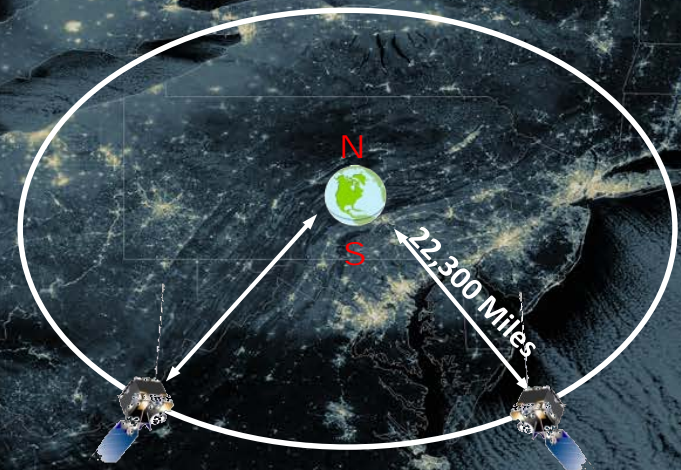
NOAA's Observational Paradigm Has Been: Two Orbits, One Mission

Polar-orbiting Operational
Environmental Satellites (POES)
Operating since 1970



Primarily source of synoptic, global
observations feeding Numerical Weather
Models and forecasts

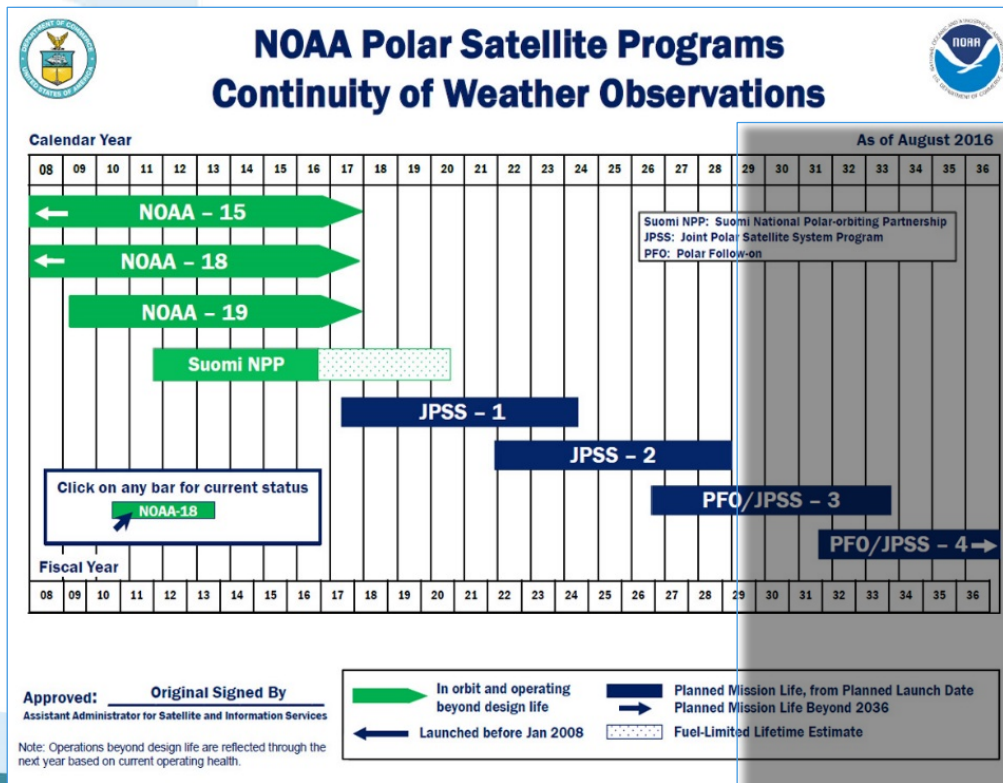
Geostationary Operational
Environmental Satellites (GOES)
Operating since 1975



Primarily source of near real time
observations for nowcasting and imaging
of severe weather events

Tracking the “Two Orbit” Program

Our historical “Flyout” charts have reflected the polar and geostationary, fixed platform program approach



Our Weather Observations Involve Much More than NOAA



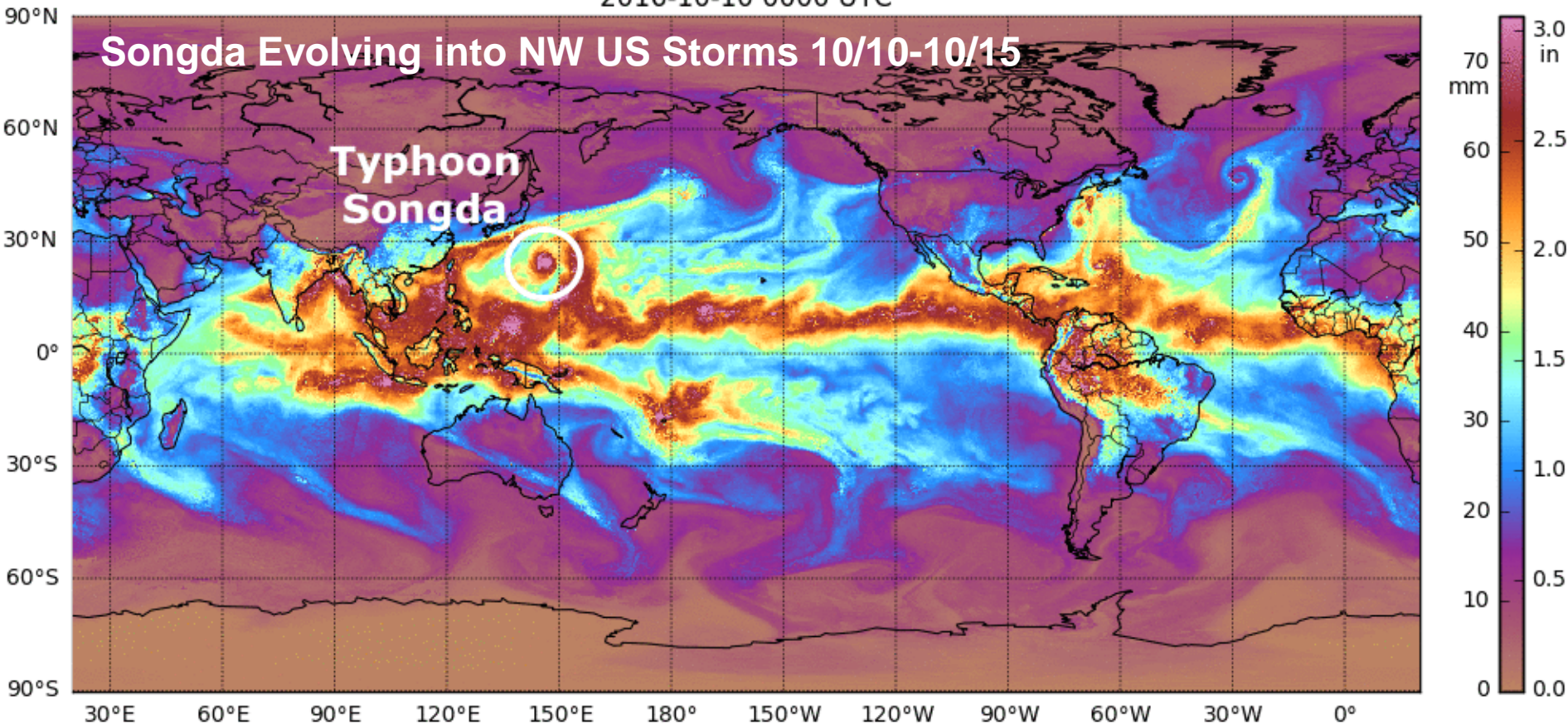
- NASA and ESA research satellites
- DOD, EUMETSAT & JMA operational satellites

Regional Storms Require Global Observations

2016-10-10 0000 UTC

Songda Evolving into NW US Storms 10/10-10/15

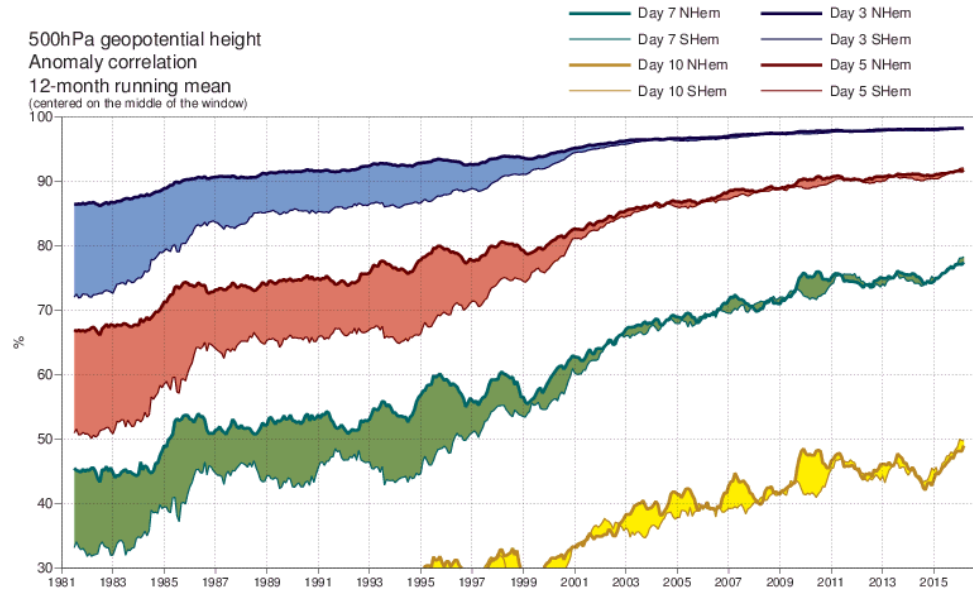
Typhoon
Songda



Total precipitable water from a constellation of microwave sounders (AMSU, ATMS) - NOAA-18, 19, MeTOP-A, -B, and SNPP.

This approach has produced great returns over the years

- Significant Improvements in 3-7 day Weather forecasts
- Improved NRT severe storm warnings & alerts
 - 20% increase in hurricane track and intensity forecasts from 2010-2015
- Companion Satellite Services
 - SARSAT: >30,000 lives saved worldwide and >7,000 saved in the USA since the program start
 - Argos Data Collection Services (A-DCS): 14,000 environmental platforms, almost 50% used by NOAA





The Coming Leap Forward

GOES-R
JPSS

Recent and Upcoming NESDIS Launches

JASON-3

OPERATIONAL JULY 1, 2016

DSCOVR

OPERATIONAL JULY 27, 2016

COSMIC-2

COSMIC-2A - 2017
COSMIC-2B - 2020

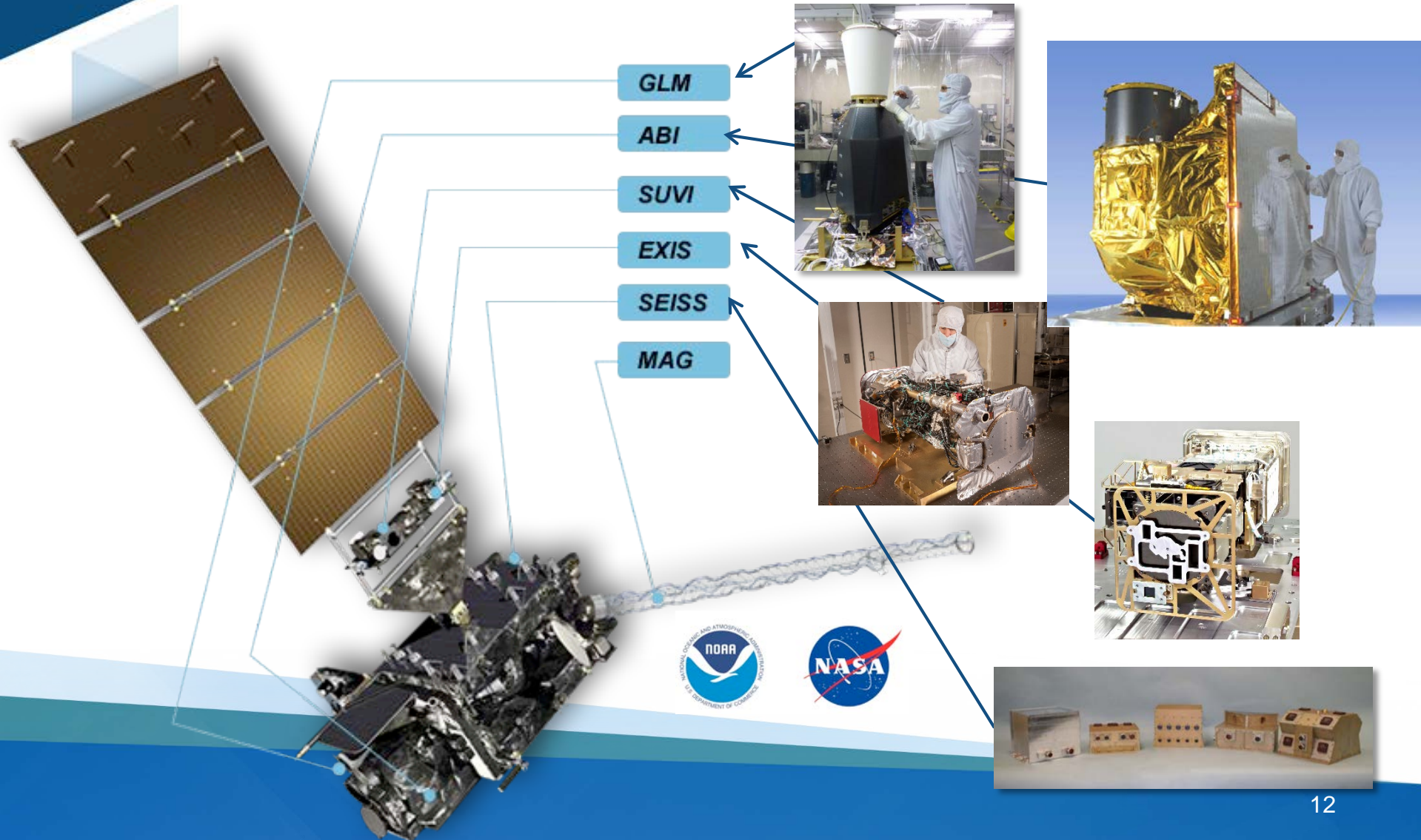
GOES-R SERIES

GOES-R - 2016
GOES-S - 2018
GOES-T - 2019
GOES-U - 2025

JPSS SERIES

JPSS-1 - 2017
JPSS-2 - 2021
JPSS-3 - 2026
JPSS-4 - 2031

GOES-R Series Geostationary Satellite Launching November 2016 (Series will extend through ~2036)





GOES-R: The Future of Forecasting

Launching in November 2016
(exact date still TBD)

09-Aug-2016 22:00:00 UTC

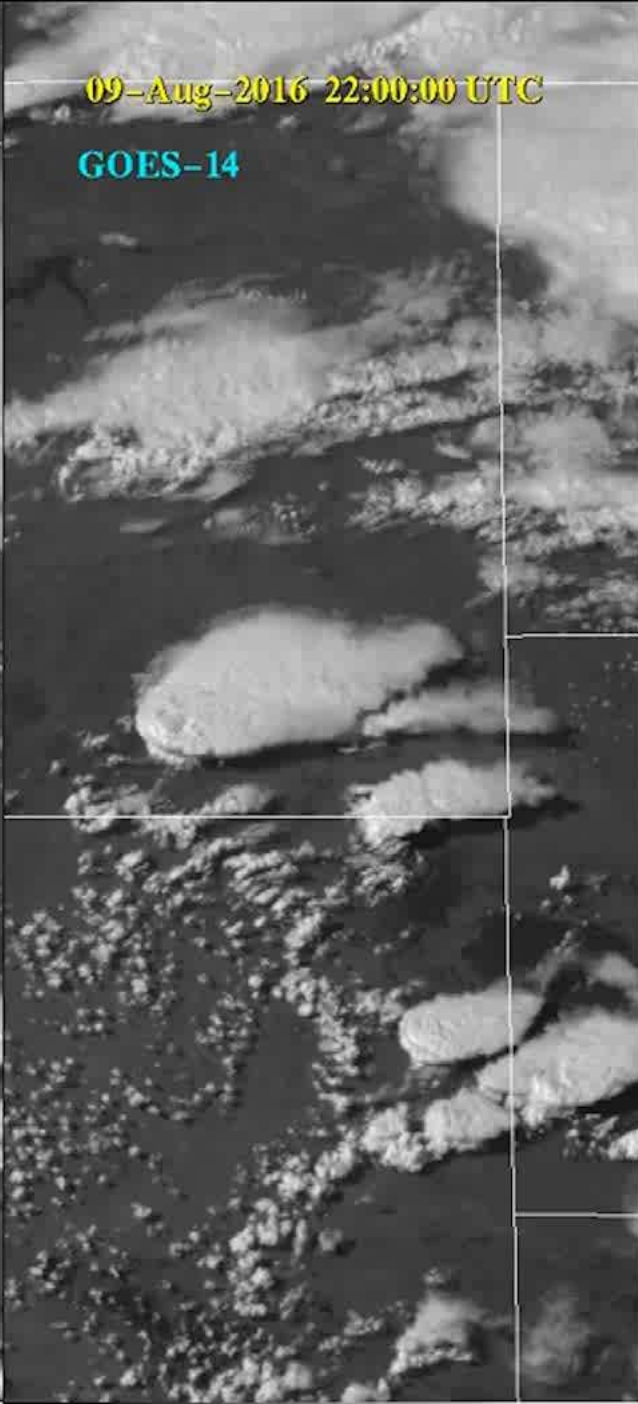
GOES-15



G-15 IMG: 0.62 UM - 22:00 UTC - 09-AUG-2016

09-Aug-2016 22:00:00 UTC

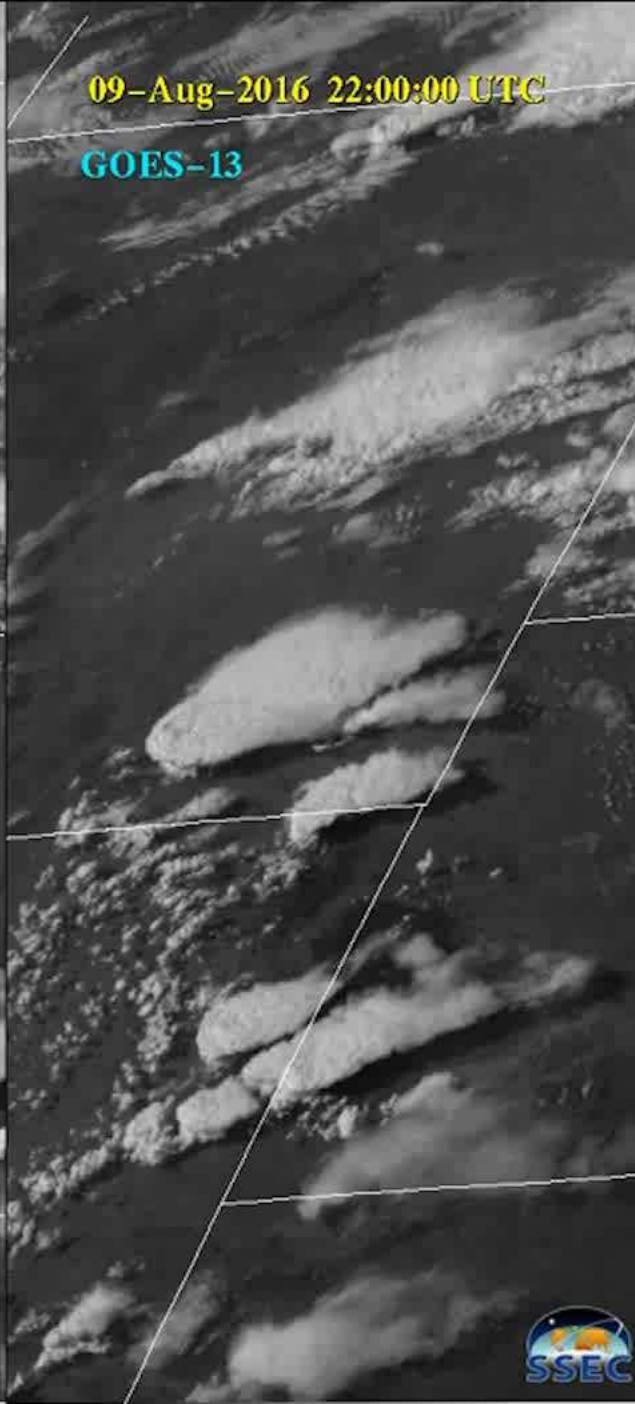
GOES-14



G-14 IMG: 0.62 UM - 22:00 UTC - 09-AUG-2016

09-Aug-2016 22:00:00 UTC

GOES-13



G-13 IMG: 0.63 UM - 22:00 UTC - 09-AUG-2016

JPSS-1 Polar-Orbiting Satellite Coming in 2017 (Series will extend through ~2038)

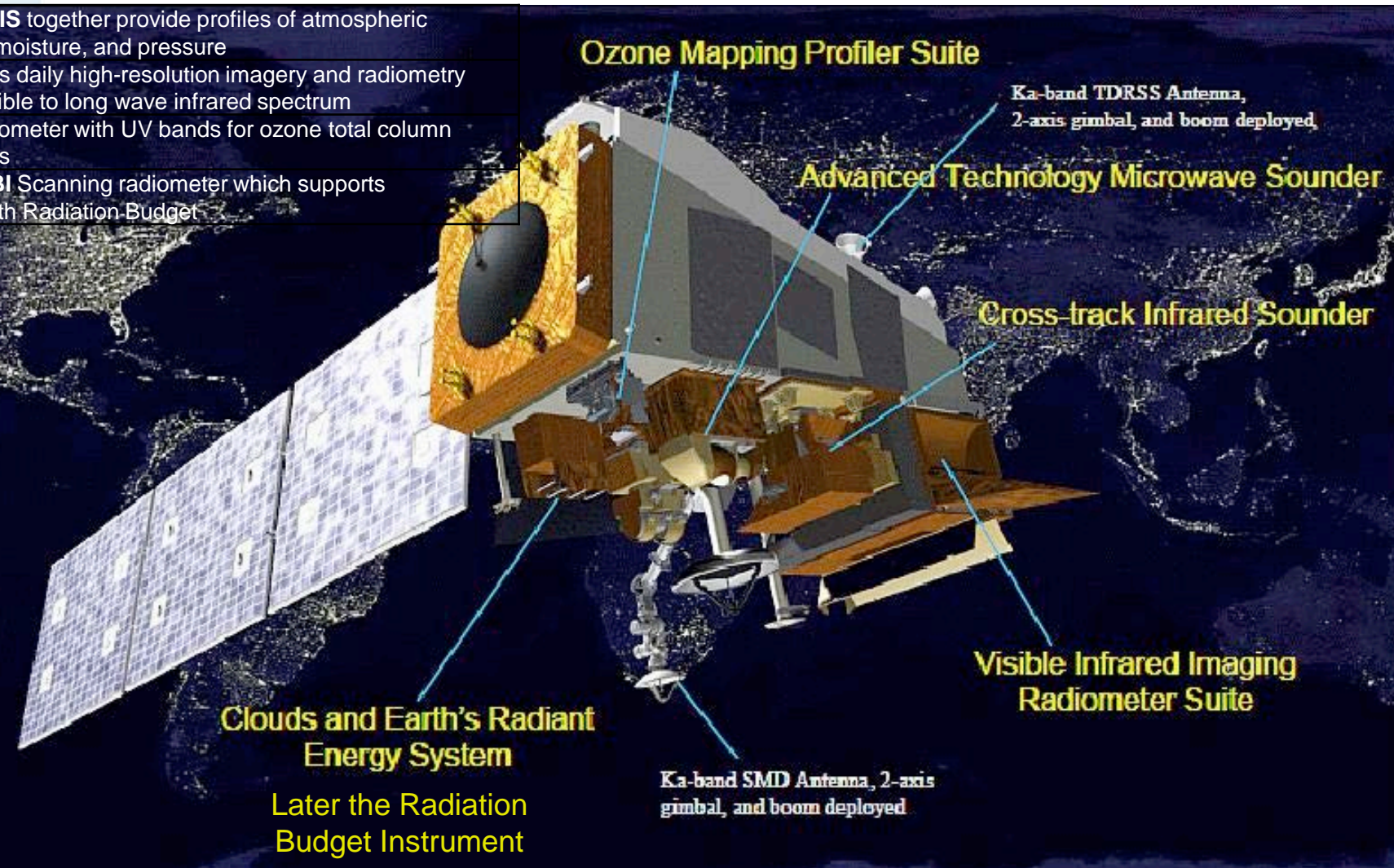


ATMS and **CrIS** together provide profiles of atmospheric temperature, moisture, and pressure

VIIRS provides daily high-resolution imagery and radiometry across the visible to long wave infrared spectrum

OMPS Spectrometer with UV bands for ozone total column measurements

CERES or **RBI** Scanning radiometer which supports studies of Earth Radiation Budget



Clouds and Earth's Radiant Energy System
Later the Radiation Budget Instrument

Ka-band SMD Antenna, 2-axis gimbal, and boom deployed

Ka-band TDRSS Antenna, 2-axis gimbal, and boom deployed

Ozone Mapping Profiler Suite

Advanced Technology Microwave Sounder

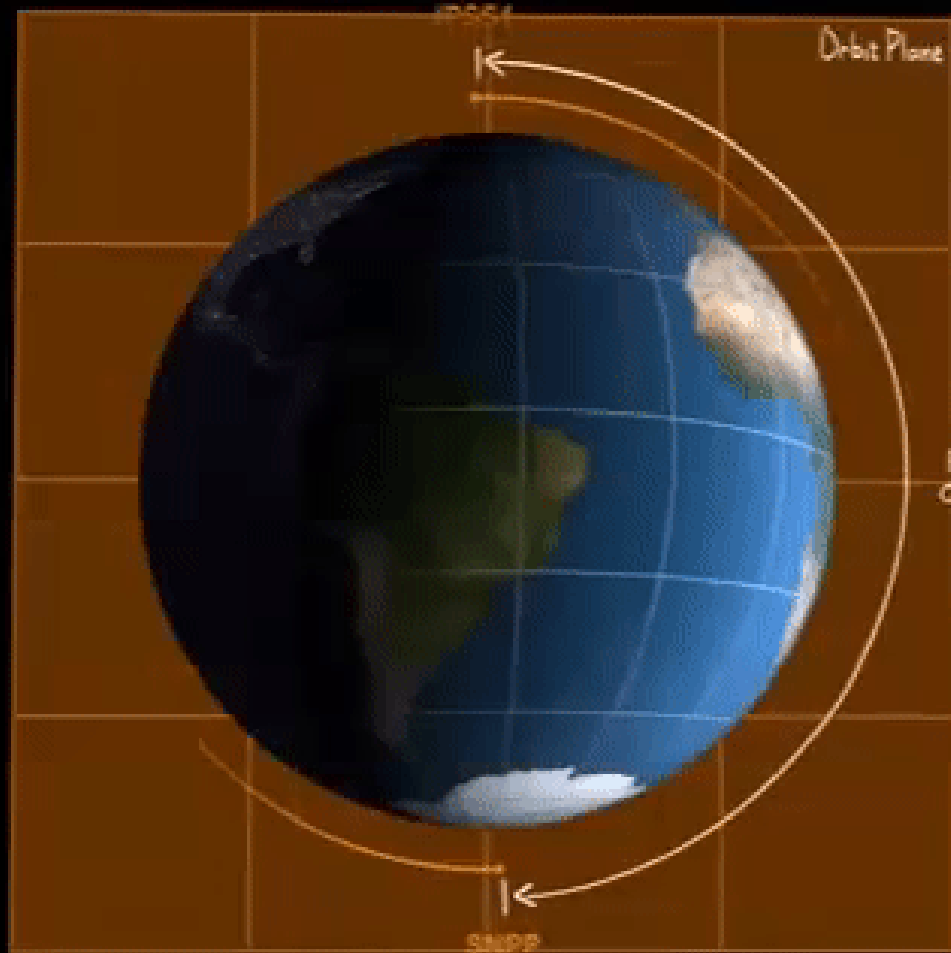
Cross-track Infrared Sounder

Visible Infrared Imaging Radiometer Suite

Suomi-NPP/JPSS in Orbit



- With the launch of JPSS-1 in 2017 we will have two very capable polar satellites operating simultaneously
- The combination, with reduced latency, will further enhance forecasts
- These observations and data will serve the global community of meteorological agencies as well





The Near and Not So Near Future for NESDIS

We Are Moving beyond exploitation of a NOAA-centric Observing System ...



...To greater utilization of a growing global constellation of Earth Observation satellites



The NESDIS Strategic Plan



NESDIS Vision:
To expand
understanding of our
dynamic planet as a
trusted source of
environmental data



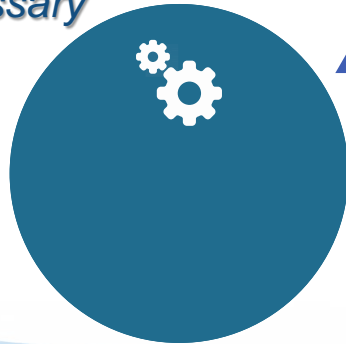
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Released September 2016

The NESDIS Strategic Plan

*We have to deliver without interruption the data and observational products our **Users** require.*


*We must ensure the space and ground assets are current, secure, and delivering the necessary information to meet **User** needs.*



*We must maintain a vibrant and capable workforce within and trusted partnerships globally to meet our **Users'** needs.*



Commitments

- **Continuity**
 - NESDIS must continue to ensure the continuity of our observations over time and anticipate future risks to mission success with the reliability and robustness that have come to define the organization.
 - **Data & Information**
 - NESDIS must not only deliver single-source informational products, but also broad-based data-acquisition and distribution products that utilize and integrate multiple sources of data, allowing a broader spectrum of use.
- 

CONTINUITY

NESDIS must continue to ensure the continuity of our observations over time and anticipate future risks to mission success with the reliability and robustness that have come to define the organization.



CONTINUITY



GOES-S
2018

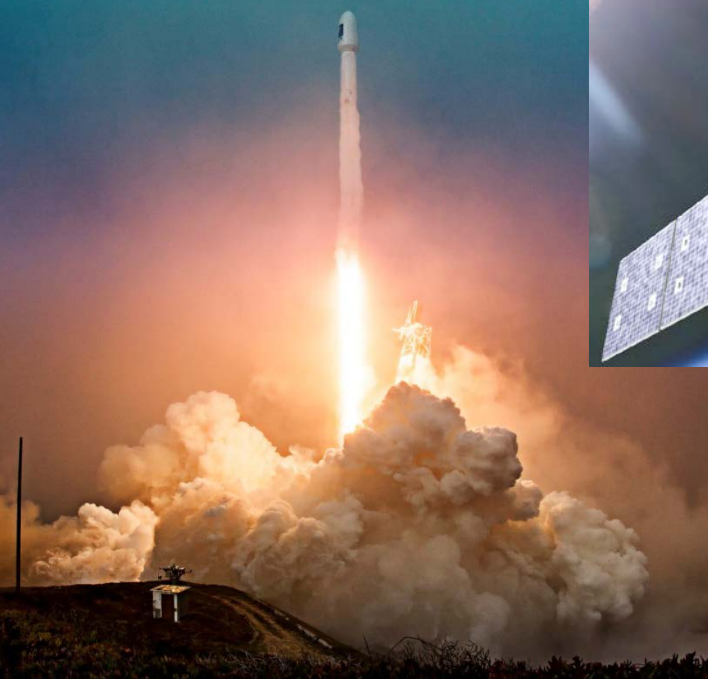


GOES-T
2019



GOES-U
2024

*First Focus:
Return on National
investment!*



JPSS-2
2021

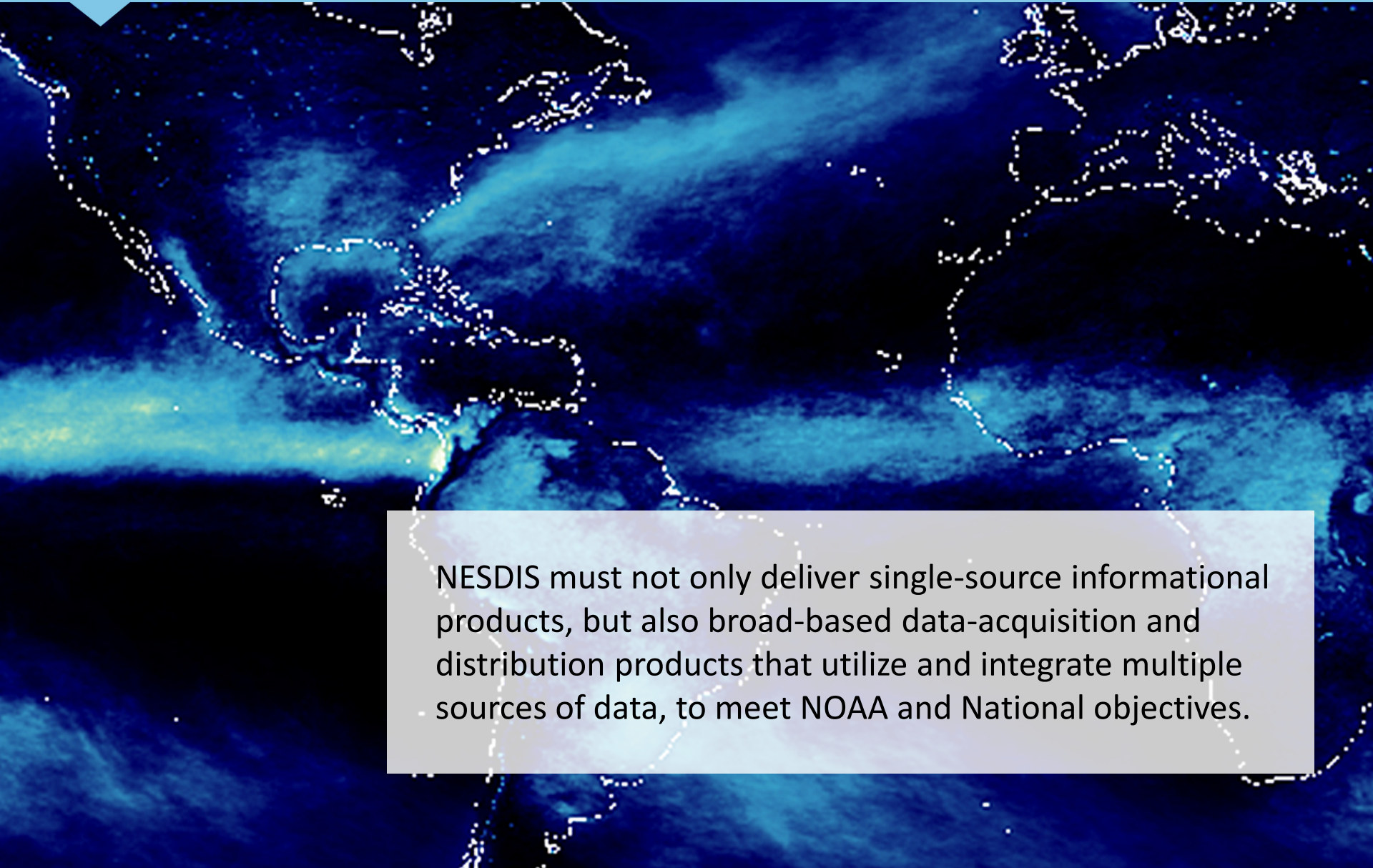


JPSS-3
2026



JPSS-4
2031

DATA & INFORMATION



NESDIS must not only deliver single-source informational products, but also broad-based data-acquisition and distribution products that utilize and integrate multiple sources of data, to meet NOAA and National objectives.

Addressing Needs Across NOAA

WEATHER READY NATION

1. Aviation Weather and Volcanic Ash
2. Fire Weather
3. Hydrology and Water Resources
4. Marine Weather and Coastal Events
5. Hurricane/Tropical Storms
6. Routine Weather
7. Severe Weather
8. Space Weather
9. Tsunami
10. Winter Weather
11. Environmental Modeling Prediction
12. Science, Services and Stewardship

National Weather Service

HEALTHY OCEANS

1. Ecosystem Monitoring, Assessment and Forecast
2. Fisheries Monitoring, Assessment and Forecast
3. Habitat Monitoring and Assessment
4. Protected Species Monitoring
5. Science, Services and Stewardship

National Marine Fisheries Service

RESILIENT COASTS

1. Coastal Water Quality
2. Marine Transportation
3. Planning and Management
4. Resilience to Coastal Hazards and Climate Change
5. Science, Services and Stewardship

National Ocean Service

CLIMATE

1. Assessments of Climate Changes and Its Impacts
2. Climate Mitigation and Adaptation Strategies
3. Climate Science and Improved Understanding
4. Climate Prediction and Projections

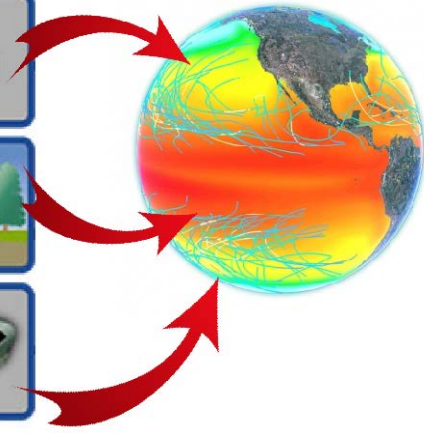
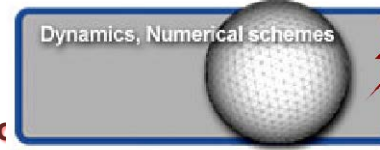
Office of Oceanic and Atmospheric Research

Architecting the Future

Global Earth Observing Satellite System

Integrated & Assimilated Operational Data Flow

Next Generation Integrated & Adaptive Ground System



Merging the data with models to meet user needs

Defining the next observations

Defining the integrated operations and data management system

Building the Space Architecture

Provides USG Senior Leader & Partner critique: NOAA, NASA, DoD, Eumetsat

Identifies User Priorities: SMEs from NOAA Lines, Cooperative Institutes, Private Sector

NOAA Observing System Council

Stakeholder Advisory Board

NESDIS/OSAAP

Space Platform Requirements Working Group (SPRWG)



Architecture Design Team

Model based, and iterated with SPRWG

Input from the community

Instrument Catalog

Objectives Value Model

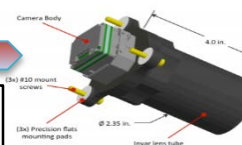
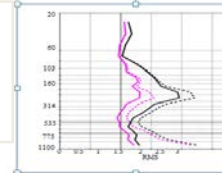
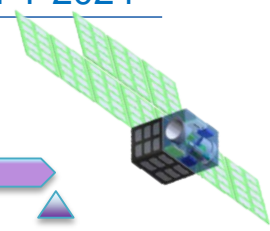
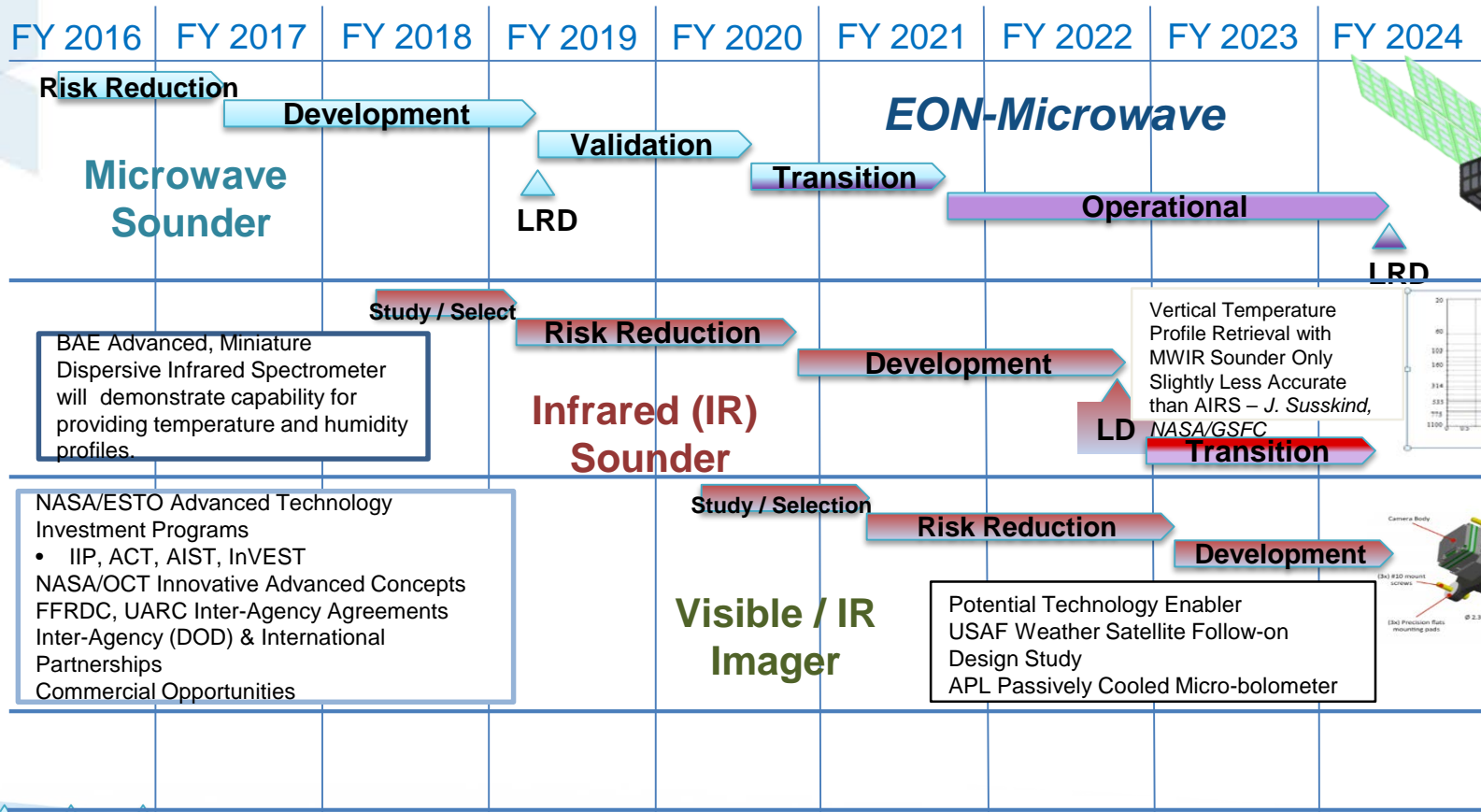
Architecture Integration

Arch Design; CONOPS; Perf. / Cost; Investment Roadmap

We will be doing these studies in an iterative fashion, engaging NOAA and External stakeholders at each cycle, completed over the next 12 months.

Notional Technology Insertion Plan

May be replicated for high value observation targets



ATMS
(Flight)

HyMAS
(Ground)

SMAP
(Flight)

Leveraged Technologies
already demonstrated



Building the Ground Architecture

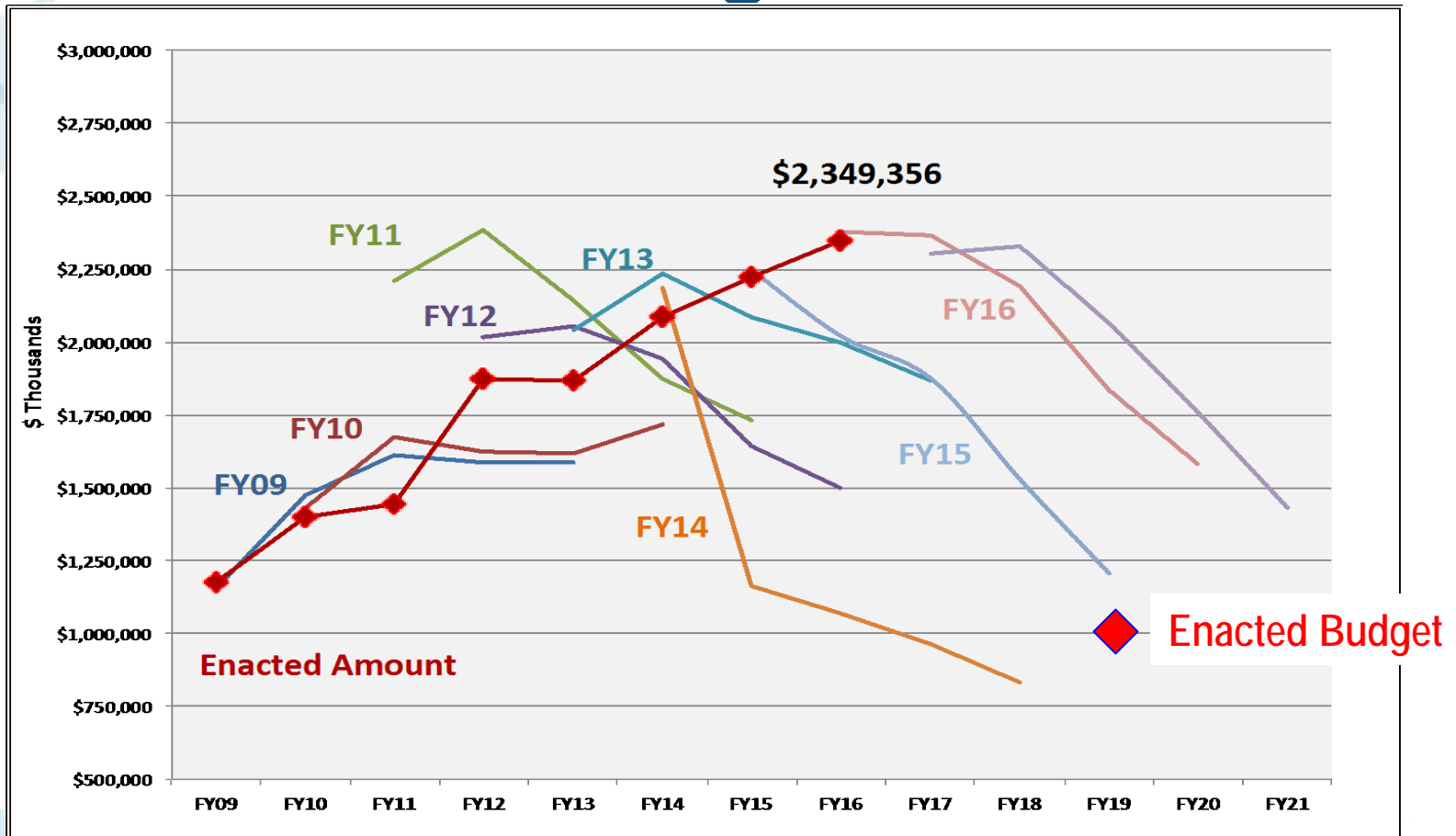
Bringing the Data into NESDIS

Security and **Validation** are essential elements of our information system



Opportunities & Challenges

History of NESDIS Requested and Enacted Budgets: 2009 - 2016



Challenge #1: Generating Stakeholder advocacy to sustain the satellite observing system for the long run

NESDIS 5 yr Budget Picture

President's FY2017 Budget Proposal



FY 2017 PROPOSED OPERATING PLAN (\$ in Thousands)	FY 2016 President's Budget	FY 2016 Omnibus	FY 2017 PB Submit	FY 2018	FY 2019	FY 2020	FY 2021
Environmental Satellite Observing Systems							
Satellite and Product Operations	93,081	93,000	123,424	123,424	123,424	123,424	123,424
Facility Operations	9,000	9,000	14,250	14,250	14,250	14,250	14,250
Product Development, Readiness & Application	26,316	26,000	34,270	34,270	34,270	34,270	34,270
Commercial Remote Sensing Regulatory Affairs	1,200	1,000	2,065	2,065	2,065	2,065	2,065
Office of Space Commerce	1,000	600	2,000	2,000	2,000	2,000	2,000
Group on Earth Observations (GEO)	500	500	500	500	500	500	500
National Environmental Information Office	59,247	58,986	63,478	63,478	63,478	63,478	63,478
Total, NESDIS - ORF	190,344	189,086	239,987	239,987	239,987	239,987	239,987
Geostationary Systems - R	871,791	871,791	752,784	518,532	335,879	214,674	148,588
Jason-3	7,458	7,458	4,357	7,651	5,338	4,648	4,648
Joint Polar Satellite System (JPSS)	808,966	808,966	787,246	745,777	572,240	445,082	376,061
Polar Follow On	380,000	370,000	393,000	594,000	581,000	579,000	469,000
Cooperative Data and Rescue Services (CDARS)	500	500	500	48,950	32,800	18,550	2,400
DSCOVR	3,200	3,200	3,745	3,622	3,579	3,579	3,579
Space Weather Follow On	2,500	1,200	2,500	53,700	186,100	154,500	81,500
COSMIC 2/GNSS RO	20,000	10,100	16,200	16,200	16,400	8,800	8,800
Satellite Ground Services	58,525	54,000	59,025	57,325	57,325	57,325	57,325
System Architecture and Advanced Planning	4,929	3,929	4,929	4,929	4,929	4,929	4,929
Projects, Planning and Analysis	30,488	25,200	33,488	33,488	33,488	33,488	33,488
Commercial Weather Data Pilot	0	3,000	5,000	tbd	tbd	tbd	tbd
Subtotal, NESDIS Systems Acquisition	2,188,357	2,159,344	2,062,774	2,084,174	1,829,078	1,524,575	1,190,318
Total, NESDIS - PAC	2,189,283	2,160,270	2,063,700	2,085,322	1,827,776	1,523,273	1,189,016
GRAND TOTAL NESDIS	2,379,627	2,349,356	2,303,687	2,325,309	2,067,763	1,763,260	1,429,003

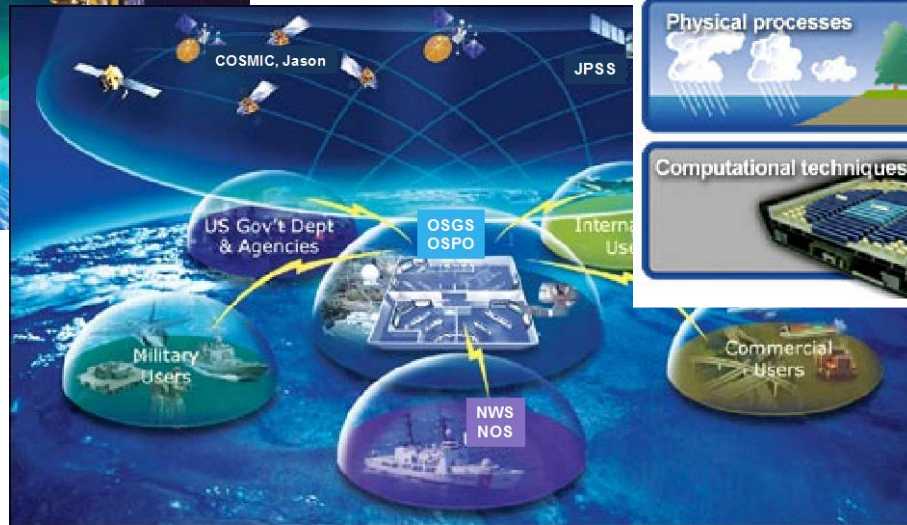
Challenge #2: Managing the Budget to Support and Integrated Observing System

Architecting the Future: *Engaging the Community*

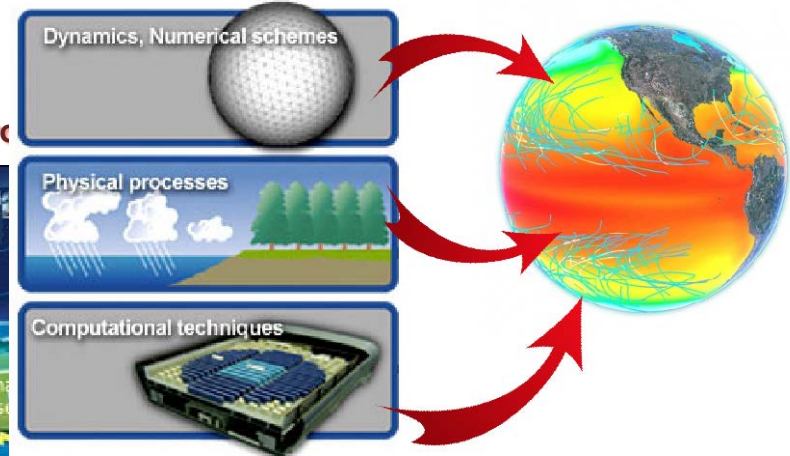
Global Earth Observing Satellite System



Next Generation Integrated & Adaptive Ground System



Integrated & Assimilated Operational Data Flow



Challenge #3: Maintaining Active Engagement with US & International Partners, and with the commercial and industrial community

Navigating the Public Private Partnership in Earth Observations

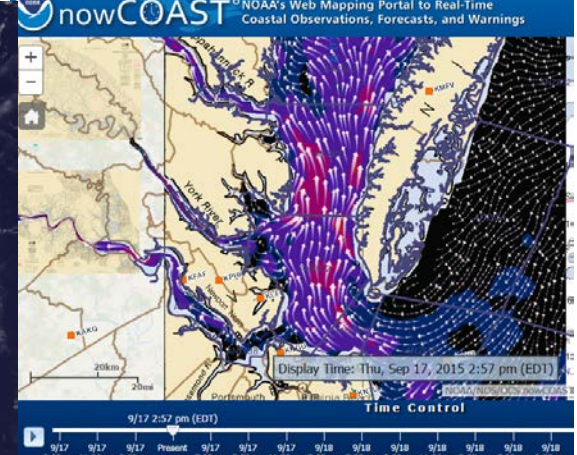
- Commercial Sector is expected to grow significantly in the coming years
 - Likely to be providing a broad spectrum of observational services
- NOAA has a long heritage of providing critical services
 - Long history of operations
 - Established and productive data and operations sharing practices with other Met agencies
- Government & Commercial have different cultures with **some** different metrics for success
 - Government: low risk tolerance, priority on reliability
 - Commercial: innovative, with focus on earlier ROI



Challenge #4: Establishing a productive, mutually supportive relationship between NOAA and the emerging commercial sector.

Focused on Meeting User Needs

NOAA's products and services protect lives and property



Thank you!






Community

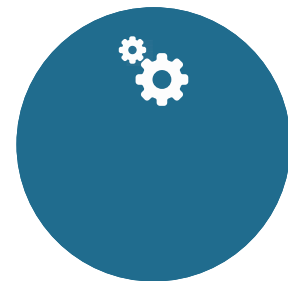
- **Partnerships**

- Successful partnerships allow us to meet our mission cost-effectively and to be more responsive to the needs of our users and stakeholders. Under this strategic plan, our international and interagency partnerships will remain a priority for NESDIS.

- **People**

- As the scope, breadth and level of expertise of services and information provided by NESDIS expands in the years to come, we will continue to rely on a workforce that is engaged, diverse, dedicated and nationally and internationally recognized as authorities in their fields.
- 

Capabilities



- **Architecture**

- NESDIS will work to evolve its ground and space architecture and move away from stand-alone systems in order to improve observational capabilities, resiliency and efficiency.

- **Use-Inspired Science**

- NESDIS has an opportunity to help better inform future environmental assessments through innovative science and meaningful engagements with stakeholders and decision makers. These engagements will also help develop the next generation of science-based product and services.