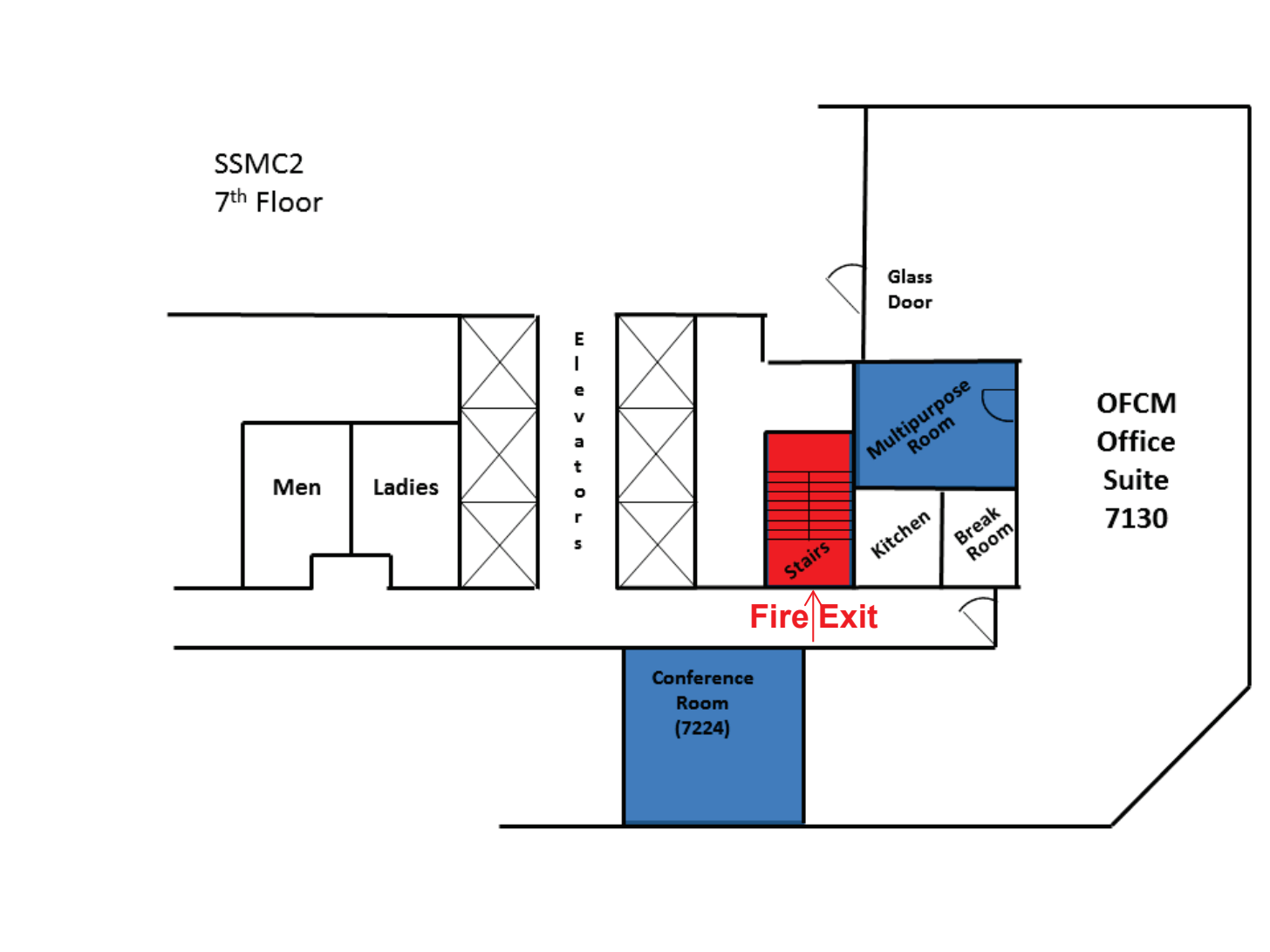
Committee on Operational Environmental Satellites

Meeting 2017-4

Dec 8, 2017

Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM)

OFCM Floor Plan



Opening Remarks

COES Co-Chairs:

Mr. David McCarren (DOD-USN)

Mr. Joseph Pica (NOAA-NWS)

COES Executive Secretary:

Mr. Michael F. Bonadonna (OFCM)

Meeting is being recorded to help produce an accurate Record of Action (ROA)

Agenda

- Opening Remarks: …….COES Cochairs
- Action Item Review: ……Executive Secretary
- Federal Coordinator's Remarks: …….. William Schulz (OFCM)
- Highlights from the JPSS-1 Launch: ……..Steve Walters (NOAA-JPSS)
- NOAA's Center For Satellite Applications And Research (STAR): ……Mike Kalb (NOAA)
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OFCM

FEDERAL COORDINATOR'S UPDATE TO COES

Bill Schulz

Federal Coordinator

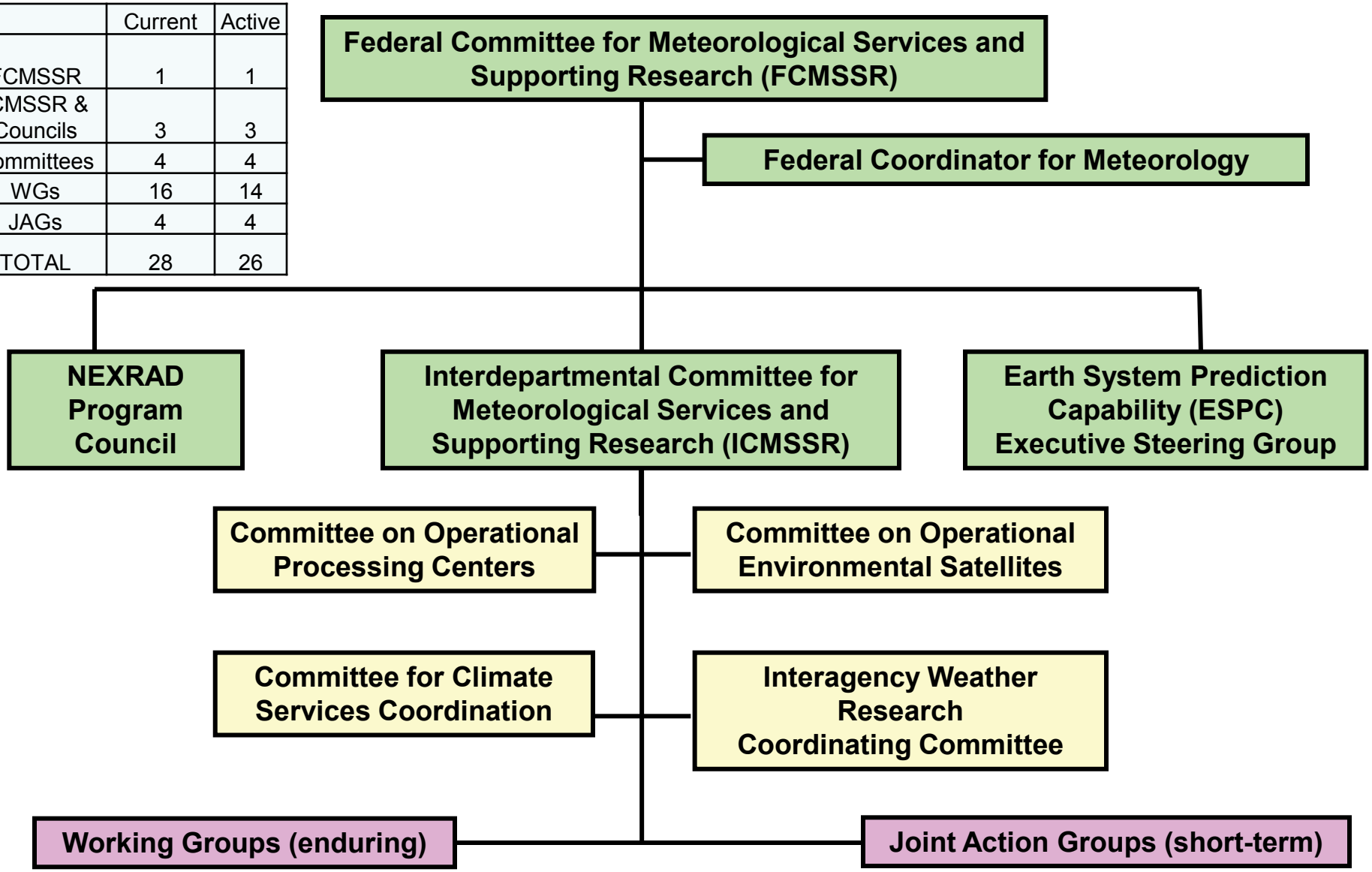
Dec 8, 2017

Federal Coordinator's Update

1. FCMSSR and ICMSSR Meetings
2. Tropical Cyclone Operations and Research Forum/Interdepartmental Hurricane Conference 2018
3. Update on the Weather Act section 402
4. Released the "Federal Weather Enterprise Budget and Coordination Report."
5. Strategic Plan and COES required actions

Federal Weather Enterprise Infrastructure

	Current	Active
FCMSSR	1	1
ICMSSR & Councils	3	3
Committees	4	4
WGs	16	14
JAGs	4	4
TOTAL	28	26



FCMSSR and ICMSSR

FCMSSR (Federal Committee for Meteorological Services and Supporting Research)

- **Met October 24, 2017:**
  - **Reviewed Federal Coordination activities, next steps to the section 402 of the Weather Act 2017, and the new Strategic Plan for Coordination/Federal Plan.**
  - **Spectrum Efficient National Surveillance Radar (SENSR) Update.**
- **Next meeting (April 24, 2018).**

ICMSSR (Interdepartmental Committee for Meteorological Services and Supporting Research)

- **Met September 27, 2017:**
  - **Reviewed Federal Coordination activities, next steps to the section 402 of the Weather Act 2017, and the new Strategic Plan for Coordination/Federal Plan.**
  - **Committee for Operational Environmental Satellites (COES) update.**
- **Met Nov 28, 2017:**
  - **Feedback/guidance on Weather Act section 402 proposals**

Tropical Cyclone Operations and Research Forum

- Tropical Cyclone Operations and Research Forum/Interdepartmental Hurricane Conference 2018
  - Florida International University, 13-15 March 2018 (first time at this venue)
  - Agenda in draft
    - Challenges encountered in 2017 season
    - GOES-16 data usage
    - Joint Hurricane Testbed updates
    - Modeling and Observing System issues
  - Supplemental funding from NSF, ONR, NWS/OAR
  - Expecting/planning for involvement from many the COES agencies (NWS, NESDIS, Navy, and Air Force.)
  - National Hurricane Operations Plan working group meets during TCORF

Weather Act of 2017 § 402

402. Interagency weather research and forecast innovation coordination

(a) Establishment

The Director of the Office of Science and Technology Policy shall establish an Interagency Committee for Advancing Weather Services to improve coordination of relevant weather research and forecast innovation activities across the Federal Government. The Interagency Committee shall—

> **(1) include participation by the National Aeronautics and Space Administration, the Federal Aviation Administration, National Oceanic and Atmospheric Administration and its constituent elements, the National Science Foundation, and such other agencies involved in weather forecasting research as the President determines are appropriate;**
>
> **(2) identify and prioritize top forecast needs and coordinate those needs against budget requests and program initiatives across participating offices and agencies; and**
>
> **(3) share information regarding operational needs and forecasting improvements across relevant agencies.**

(b) Co-Chair

The Federal Coordinator for Meteorology shall serve as a co-chair of this panel.

(c) Further coordination

The Director of the Office of Science and Technology Policy shall take such other steps as are necessary to coordinate the activities of the Federal Government with those of the United States weather industry, State governments, emergency managers, and academic researchers.

Implementing Weather Act of 2017 § 402

Challenge: **The 2017 Weather Act directs OSTP to establish "an Interagency Committee for Advancing Weather Services (ICAWS)," with duties including identifying, prioritizing, and coordinating top forecast needs, and sharing needs and improvements across agencies.**

Recommendations:

- **Use a similar construct as that used in 1962 when OMB was tasked by law to produce an annual meteorological services budget report – have EOP (OMB) assign the task to an existing relevant agency (DoC).**
- **Since the FCMSSR and the supporting Federal weather enterprise coordination structure cover most ICAWS duties, assign the duties formally to FCMSSR, without creating another organizational entity.**
- **Have OSTP leadership issue this plan; adjust the FCMSSR charter to accommodate.**

Implementing Weather Act of 2017 § 402

FCMSSR guidance for the next steps:

- **FCMSSR members discussed the proposal and had questions/concerns about possible Chairs and Co-chairs (including OSTP) for the modified FCMSSR.**
- **They agreed with the JAG recommendations of having the FCMSSR assume the duties assigned to ICAWS (and thereby not creating another new committee).**
- **OFCM was tasked to reconvene the JAG in order to draft a modified charter for FCMSSR that implements the provisions of the Act, and to present options regarding the Chair/Co-Chair selections/arrangements.**
- **The ICMSSR should review the proposed changes and provide their recommendations to the FCMSSR.**

New Federal Coordination Documents

Old:

- Single publication
- Produced annually
- 200+ pages
- Multiple detailed spreadsheets
- Released in October
- No formal review

New :

First publication (proposed):

- Strategic Plan
- Published every four years
- Composed by interagency group
- Approved by FCMSSR

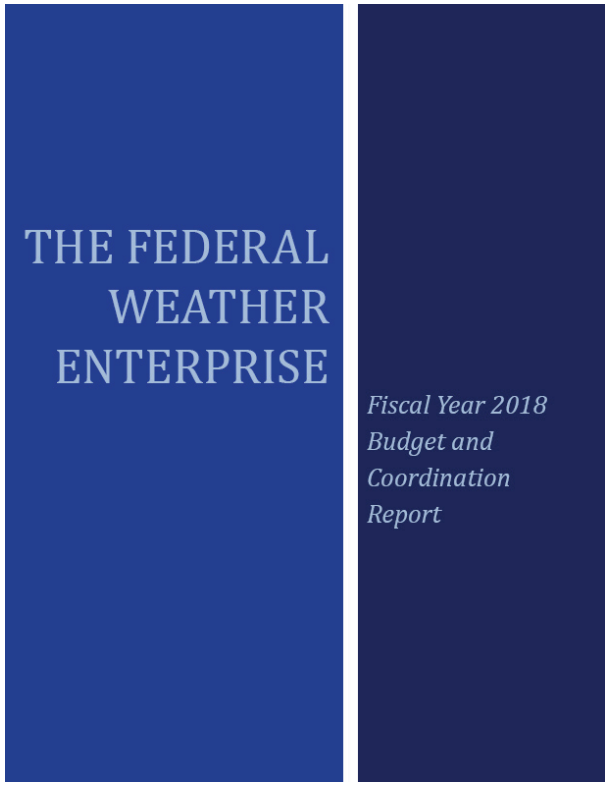
Second publication (published):

- Annual Report
- Smaller (~50 pages)
- Few tables (satisfies PL 87-843)
- ***Progress towards Strategic Goals and Objectives (Agencies, Committees)***
- Released in March (normally, but not FY18 version)
- OMB Review

New "FedPlan": Budget and Coordination Report

FY18 Federal Weather Enterprise Budget and Coordination Report ("BCR") posted to OFCM publically available web site on 22 September 2017.

- Replaces the annual "Fed Plan."
- Reviewed by OMB, who provided edits and requested additional information.
- President's Budget Request (PBR) for FY18 was submitted on 24 May 2017.
  - This BCR was the initial run to get the format understood by all
  - 90 days from PBR to OMB
  - Goal for FY19: To OMB by PBR plus two weeks.
- For FY19 edition, OFCM will consult with OMB to generate guidance on reporting and comparing FY18 CR numbers.
- **Compilation team will be formalized as a Working Group.**



Strategic Plan: Proposed Way Ahead

- **FCMSSR approved the Strategic Plan for Federal Weather Enterprise Coordination FY 2018-2022.**
- **Federal Weather Enterprise Committees and Working Groups will be asked to ready a report of ongoing actions and existing plans within their subject matter areas that support the objectives of the Strategic Plan. Individual agencies will be given opportunity to add and/or comment.**
- **Include these summaries in FY19 Annual Report. (Recurs annually.)**
- **ICMSSR (OFCM) conduct gap analysis and issue directions to Committees/Working Groups as appropriate.**
- **Beginning CY20, revise/review Strategic Plan (via Joint Action Group), issue in CY21 for FY 22-26.**

Strategic Plan for Federal Weather Enterprise Coordination

Through interagency collaboration and cooperation, including both formal and informal partnerships:

1. Improve the resolution, frequency, information content, and sustainability of global observing capabilities.

2. Make Federal forecasting processes more resilient for all relevant time and spatial scales.

3. Improve interagency collaboration to support effective and consistent decision-support products, information, and services.

4. Conduct productive, synergistic interagency research efforts.

5. Develop, recruit, and sustain a diverse Federal weather workforce.

6. Coordinate messaging about FWE priorities and needs.

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LAUNCHING NOAA-20: A RECAP

JPSS Leadership Team

Director: Greg Mandt
Deputy Director: Jacqueline Townsend
Assistant Director: Steve Walters
Budget Officer: John Longenecker
Program Chief Systems Engineer: Jose Davis
Program Scientists: Dr. Mitch Goldberg, Dr. James Gleason

Spacecraft and Launch Vehicle Preparation

Spacecraft and Launch Vehicle Preparation

- During the month of September, the spacecraft was housed in an Astrotech Payload Processing Facility, where it was put through a variety of system and instrument checks and tests.
- On completion of those inspections, the spacecraft was wrapped in a protective covering (shown here) and then placed in a protective container for pairing with the launch vehicle.

Photo credit: NASA

Photo credit: Ball Aerospace

Spacecraft and Launch Vehicle Preparation

Photo credit: NASA

Photo credit: NASA

(Above) In its protective container, the spacecraft is hoisted atop the Delta II Launch Vehicle

(Left) Spacecraft encapsulated in payload fairing

Spacecraft and Launch Vehicle Preparation

- In late October, the satellite was successfully powered for the first time at the launch pad
- Data successfully flowed to NSOF for real time evaluation of their Launch readiness products
- In early November, the Launch Vehicle team successfully completed the Delta II Payload Fairing (PLF) encapsulation operations at SLC-2.

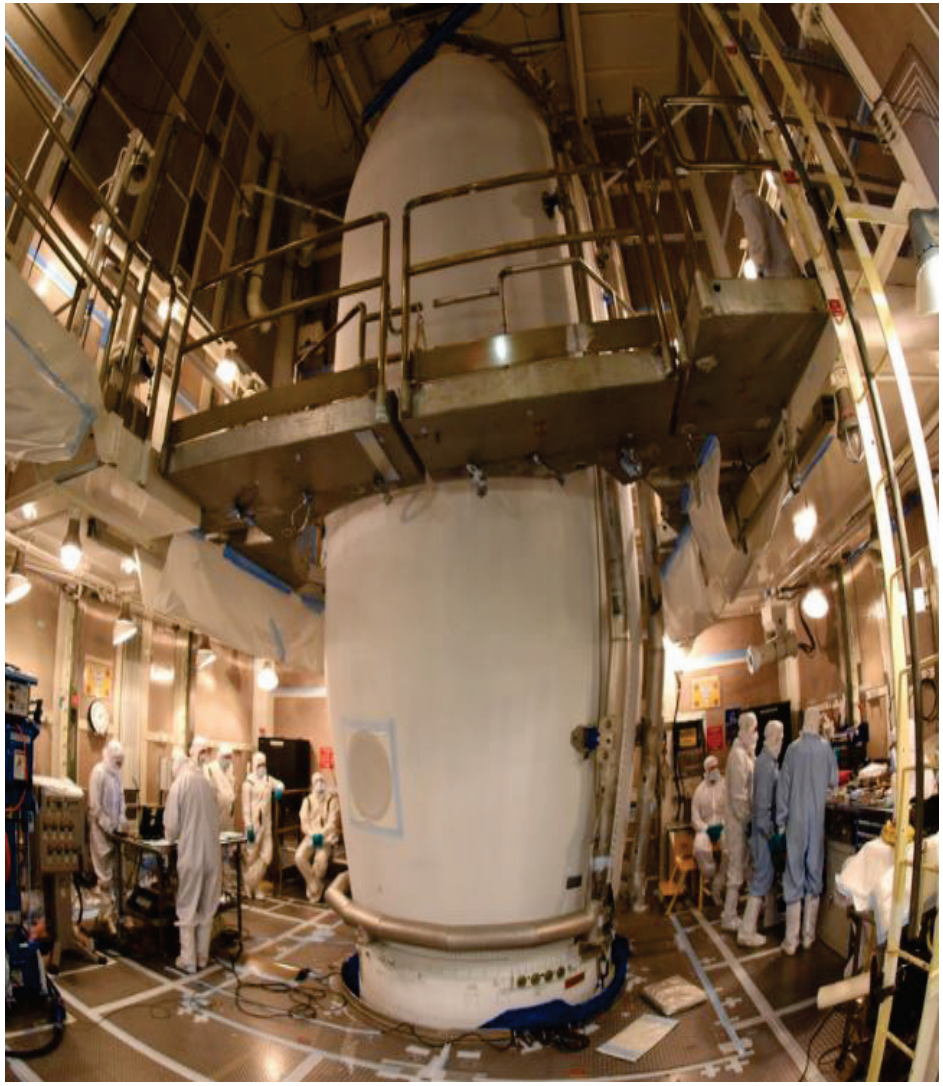


Photo credit: NASA

Launch Delays

Photo credit: NASA

- On November 6, the United Launch Alliance (ULA) determined that one of the launch vehicle Flight Termination System Batteries experienced a cell short. Following consultation with NASA, a replacement battery was prepared to support removal and replacement of the anomalous battery.
- On November 7, NASA Launch Services Program accepted the ULA's recommendation to proceed with the replacement battery. This led to a new launch date of November 14, 2017 (with a backup day of November 15, 2017).
- On November 10, a battery was shipped from Cape Canaveral to Vandenberg Air Force Base and the new battery was installed on the launch vehicle.

Launch Delays (cont.)

- On November 14, launch was scrubbed when the count coming out of the T-4 hold was dropped due to two Launch Vehicle Alarms.
- In addition, there were two Range Safety issues being worked at the time of the hold call, including a couple of boats in the restricted zone and wind effects on the air-lit nozzle covers' drop zone.
- On November 15, launch was scrubbed for the second time due to unfavorable upper-level winds and the Range being NO-GO for debris and Solid Rocket Motor Nozzle enclosure impacts beyond VAFB property.
- Launch rescheduled for Sat., November 18 at 01:47 am PST with a backup opportunity on Sun., November 19.

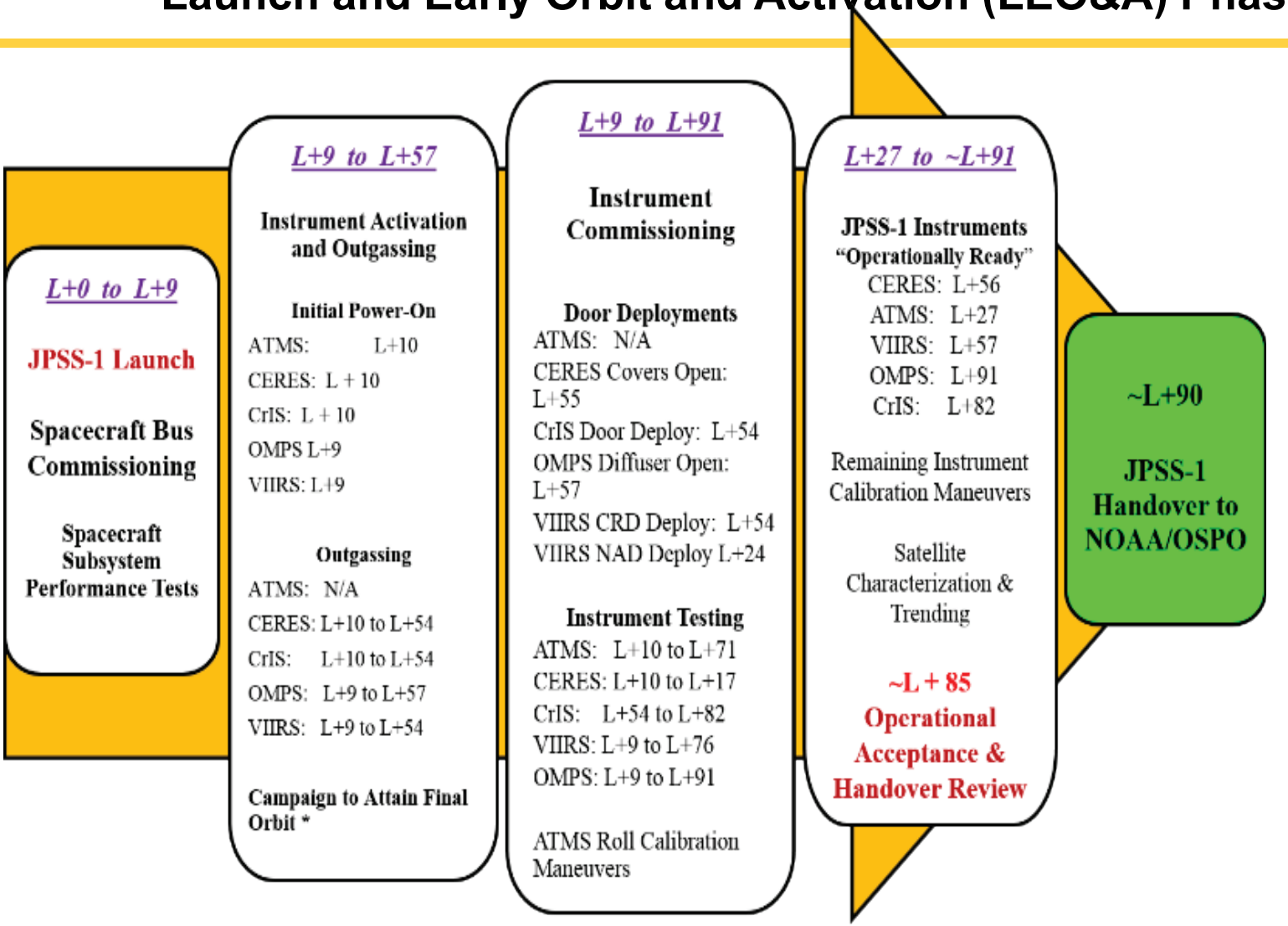
Photo credit: NASA

We Have Liftoff!

Credit: NASA

- Countdown proceeded without issue and successful lift-off was achieved at 09:47:36 UTC on Saturday, November 18, 2017.
- Spacecraft separation occurred at 10:45:03 UTC.
- The solar array deployed and the sun was acquired.
- Spacecraft, Ground System, and the Team are working well; no anomalies being worked!

Launch and Early Orbit and Activation (LEO&A) Phases

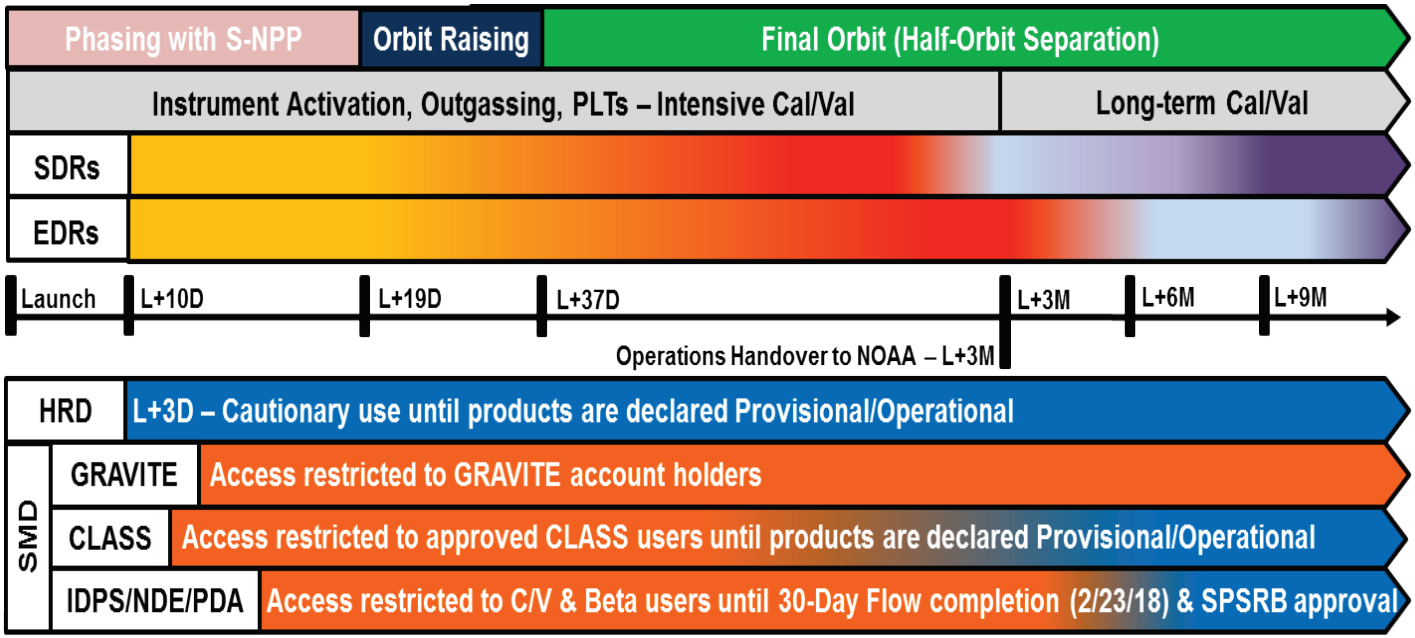


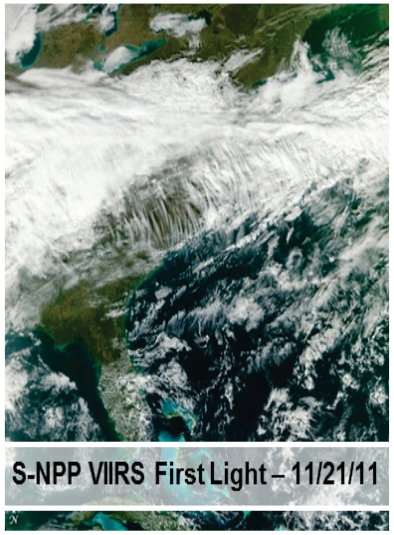
- Dependent on JPSS-1 final orbit attainment campaign

Phase 1	Phase II A	Phase II B	Phase III

LEO&A Phases Defined And Similar to SNPP

JPSS-1 (NOAA-20) Data Release Plan




S-NPP VIIRS First Light – 11/21/11

Approximate Times for JPSS-1 First Public Images

Advanced Technology Microwave Sounder	L+11 Days
Visible Infrared Imaging Radiometer Suite (VIS/NIR, DNB Day)	L+25 Days
Cross-track Infrared Sounder	L+48 Days
Visible Infrared Imaging Radiometer Suite (IR, DNB Night)	L+48 Days
Ozone Mapping Profiler Suite	L+48 Days

Phasing	Outgassing	Validated Maturity
Orbit Raising	Initial Checkout	External Distribution
Final Orbit	Provisional Maturity	Internal Distribution

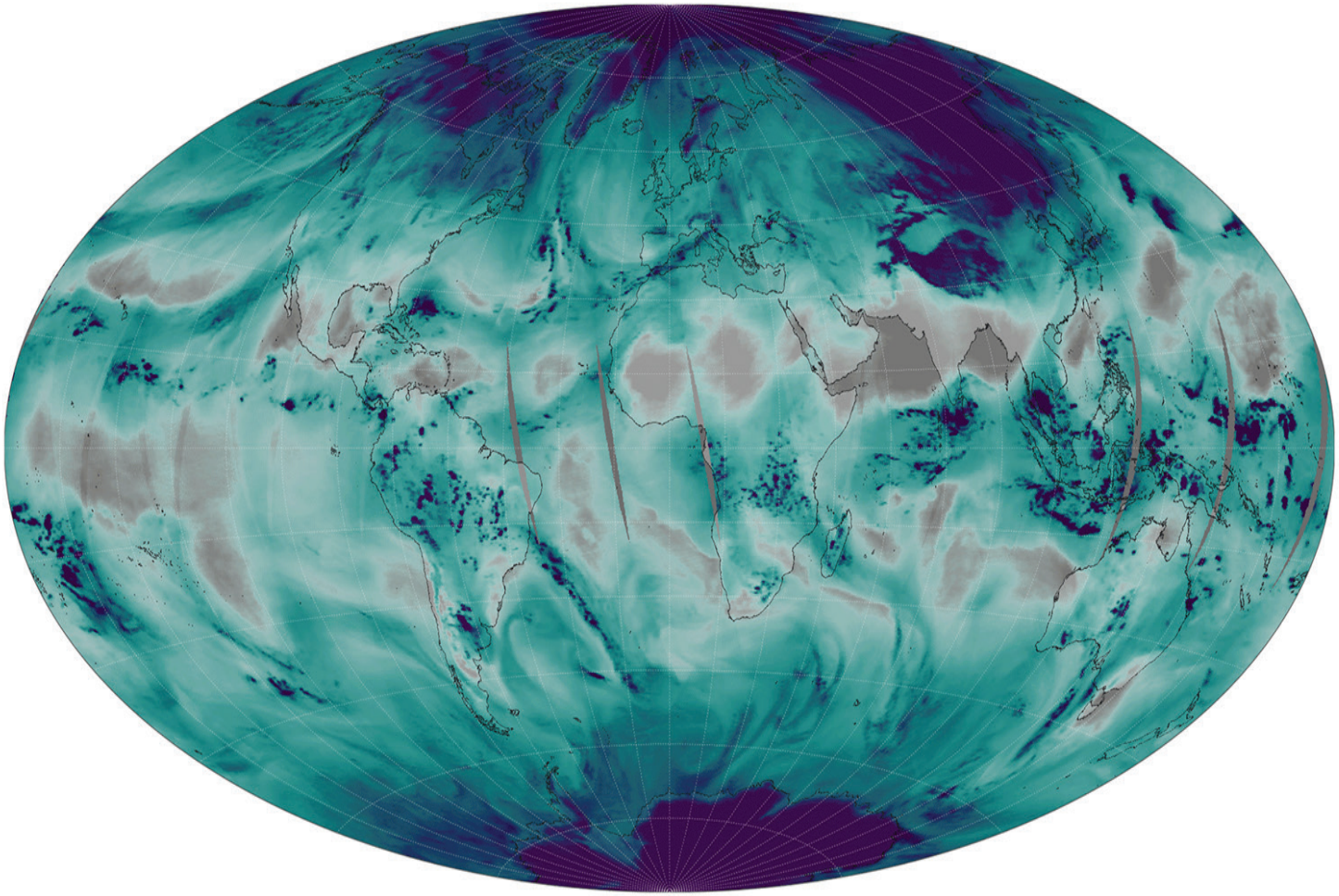
Updated 12/4/2017, based on 11/18/2017 Launch Date

JPSS-1 (NOAA-20) Pre-Handover Data Release Plan

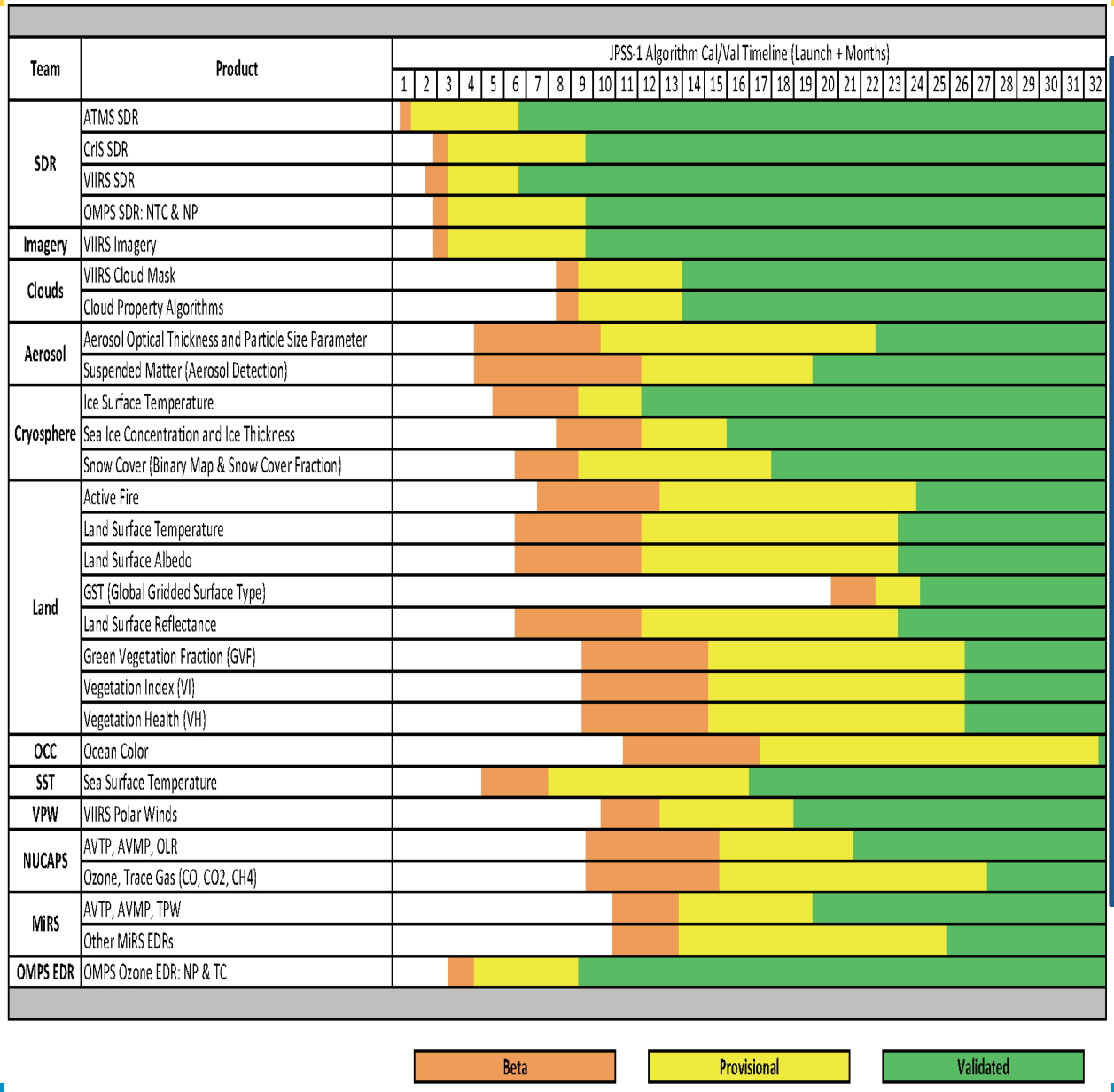
(Updated 12/1/2017; Based on Nov 18, 2017 Launch Date)

- First Light Images
  - Release managed by NESDIS HQ. Candidate images need to flow through the JPSS Program Office. Expected to be released within a few days of each instrument turn on/door opening.
- Stored Mission Data (SMD) Distribution
  - GRAVITE: Access controlled by accounts. CalVal users primary access starting from instrument turn-on.
  - CLASS: Restricted access until data reaches provisional maturity. Users can request early access through the CLASS help desk. AMP Lead is approver of early-access requests.
  - IDPS/NDE/PDA:
    - Data will flow on the I&T system from Instrument Turn On
      - Approved CalVal Users (STAR, EMC, NCO, OSPO/PALs, EUMETSAT) have access once products are generated
      - Approved Beta Consumers (557th WW, Navy OPCs, AWIPS, AWIPS-DD) have access on completion of the beta validation period.
    - Data will flow on the Operational system at the completion of the 30 day post launch performance test (late Feb)
      - Products will be promoted to Ops upon SPSRB approval (starting with KPP's) in a phased approach as defined by OSPO
- High Rate Data (HRD)/Direct Readout downlink started 11/30/2017
  - Restricted use until NOAA releases First Light, Cautionary use until products are declared provisional/operational

JPSS-1 (NOAA-20) ATMS First Light image



NOAA-20 Cal Val Timeline



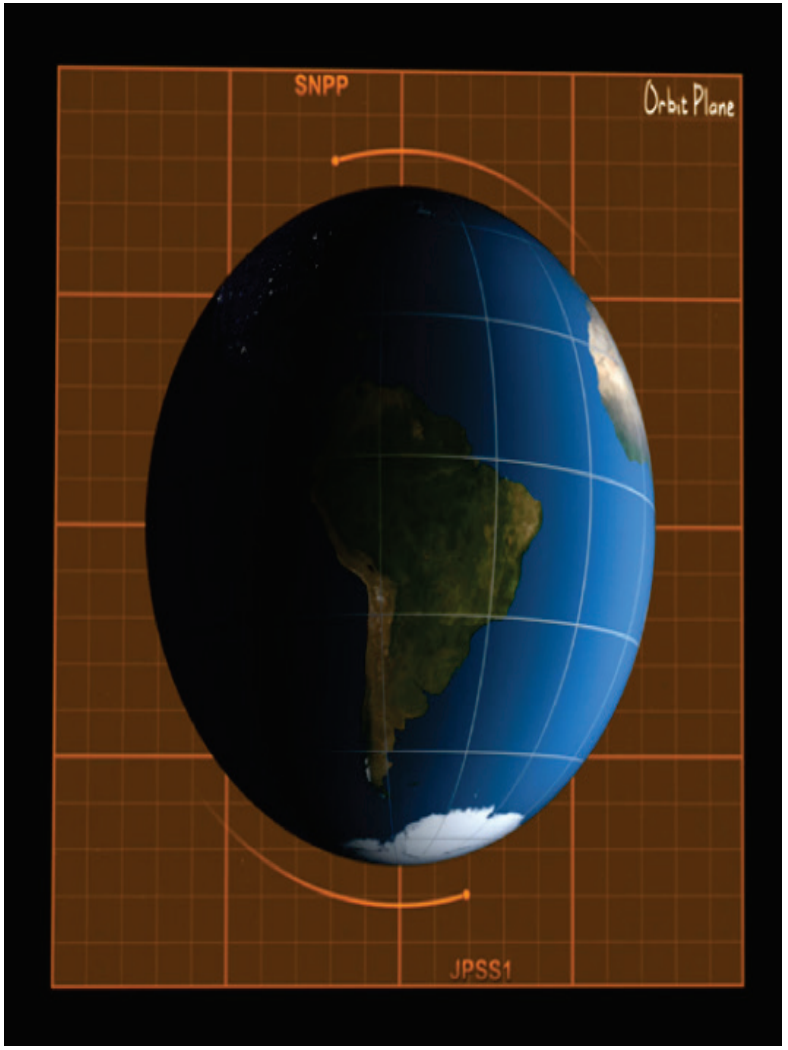
All Products follow the NESDIS Satellite Products and Services Review (SPSRB) process to be made Operational to the user community.

EDRs will be made available operationally once they reach Provisional Maturity.

Figure courtesy of NESDIS/STAR

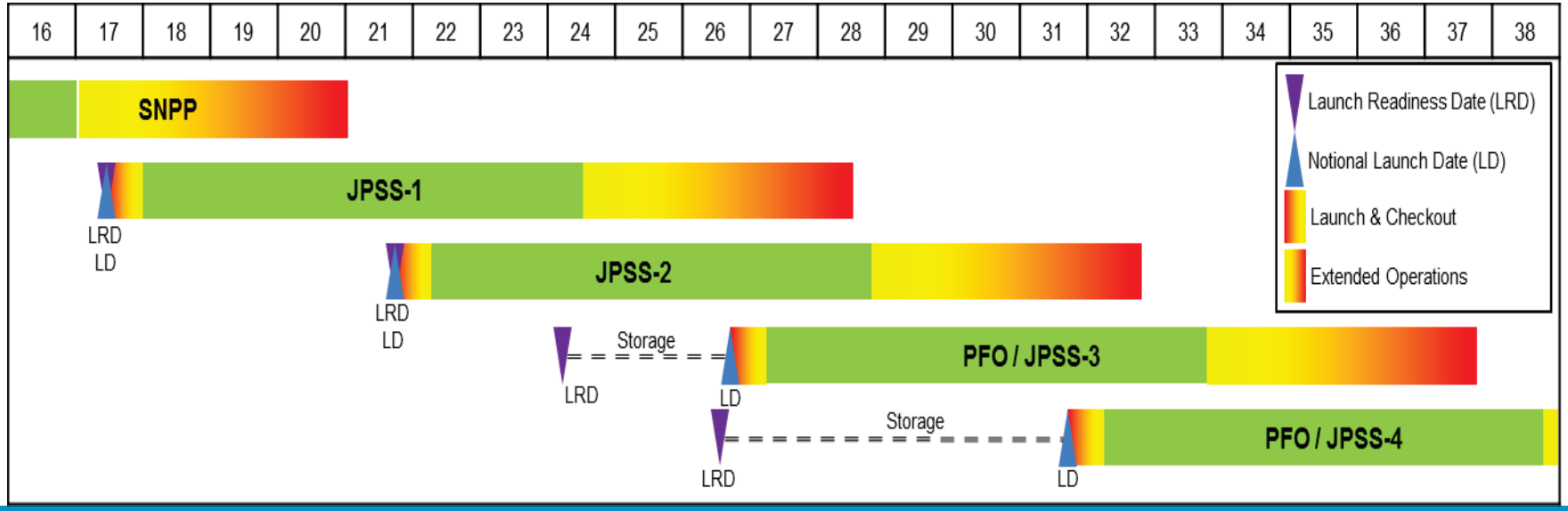
JPSS-1 (NOAA-20) will be 50 minutes ahead of SNPP

- SNPP will continue to downlink mission data once an orbit at Svalbard (X band, 140 min latency)
- NOAA-20 will downlink data twice an orbit at Svalbard and McMurdo (Ka band, 87 min. latency)
- Benefits demonstrated by EUMETSAT with their 50 minute separation between MetOp-A and –B.
  - Forecast Improvements by 20% noted by UK Met Office



JPSS Program: Future Plans

- JPSS-2 Development well underway, Flight CDR upcoming
- Polar Follow On (JPSS-3 and JPSS-4) Instruments on contract & in production
  - Spacecraft available as options on JPSS-2 contract
- Partnering with NSF to increase McMurdo “Off Ice” communications capacity
  - Needed to support JPSS and EUMETSAT Post-2020 requirements
  - System Requirements Review in Jan 2018
  - Additional user bandwidth requirements need to be communicated soon to be included



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NOAA Center for SaTellite Applications and Research

WHO WE ARE, WHAT WE DO, WHERE WE ARE GOING, and WHY

An Office of NESDIS at

NOAA Center for Weather and Climate Prediction, NCWCP
College Park MD

Harry Cikanek — **Director**

Michael Kalb — **Dep. Director**

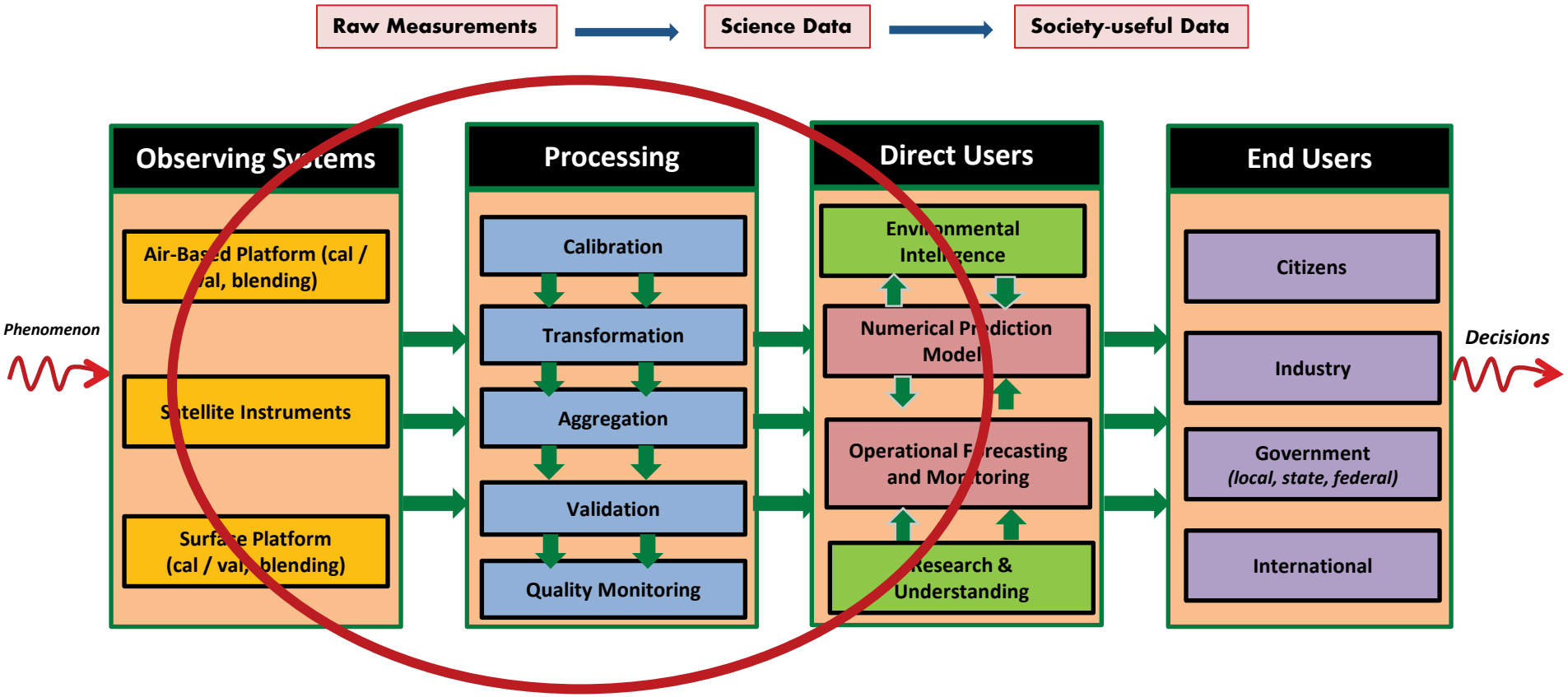
Science Services & Program Commitments

- R&D for satellite-based environmental data products and applications**;**
- Develop algorithms and delivery of pre-operational codes to implement**;**
- Support Calibration (Sensors) & Validation (Products);
- Life-Cycle Monitoring & Anomaly Resolution for NOAA Satellite products
  - ***GOES-R, S, T, U***
  - ***JPSS - NPP, J1, J2, PFO (3, 4)***
  - ***JASON 2, 3 Satellite Altimetry***
- Inter-agency partnerships
  - ***Joint Center for Satellite Data Assimilation NASA, NOAA, USN, USAF***
- International Commitments
  - ***Supporting numerous bilateral and multi-lateral collaborations***
  - ***WMO Global Satellite Inter-Calibration System***


DSCOVR
JASON-3
OPERATIONAL JULY 27, 2016
COSMIC-2
OPERATIONAL JULY 1, 2016
COSMIC-2A - 2018
COSMIC-2B - TBD
GOES-R SERIES
GOES-16 - LAUNCHED NOVEMBER 19, 2016
GOES-S - 2018
GOES-T - 2019
GOES-U - 2025
JPSS SERIES
JPSS-1 - 2017
JPSS-2 - 2021
JPSS-3 - 2026
JPSS-4 - 2031
Planned NOAA Missions

STAR in the Value Chain

STAR provides the satellite remote sensing science and software basis for transforming raw satellite observations into data / information products for the processing chain from phenomena to decisions

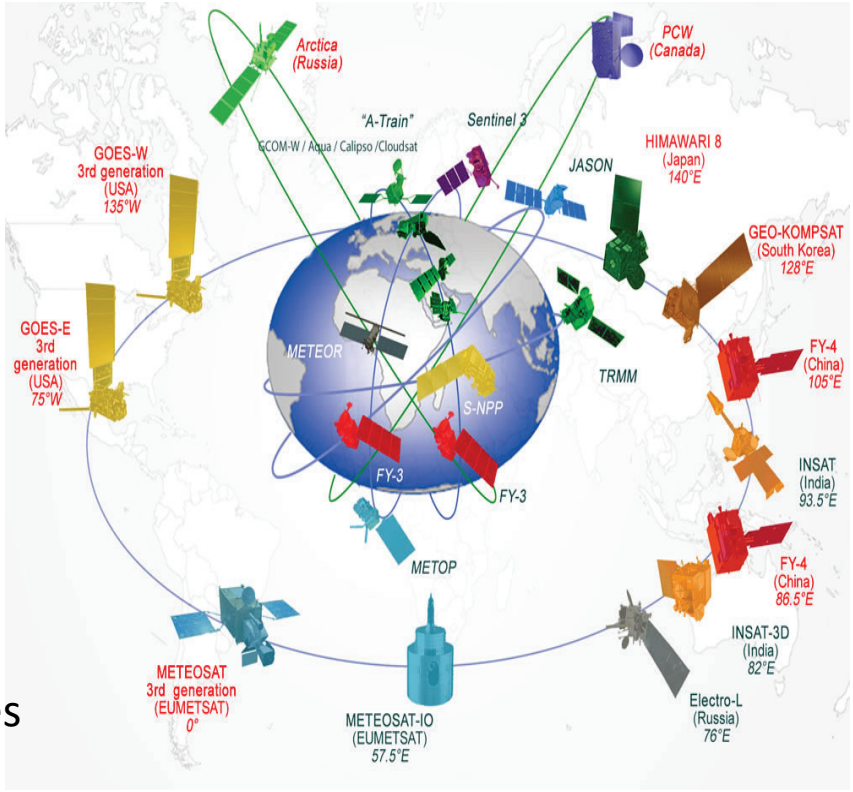


STAR bridges between instrument providers and NESDIS users

Changes impacting how & what we do

Deployment world-wide of complementary sensors and satellite systems and consistent channel selections across systems & orbits

- Data Sharing and Exchange
- Inter-Calibration and Standards
- Int'l Collaboration and Partnering
- New Technologies and Architectures
- Commercial Data
- New Computing algorithm methods



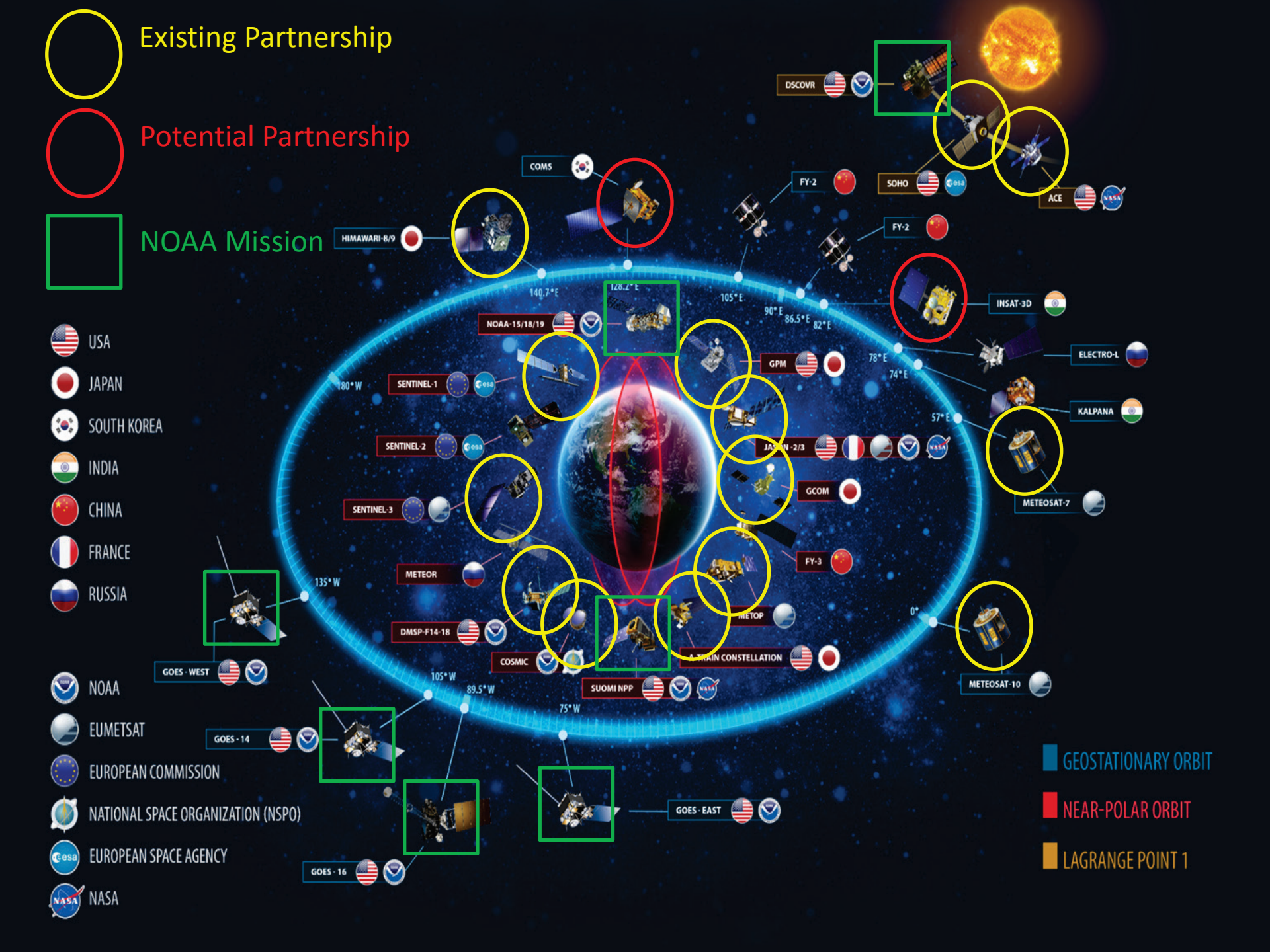
NESDIS Strategic Plan

- Enterprise Ground System
- Enterprise Algorithms and Products
- Blended Products Across Orbital Perspectives

Next Generation Global Prediction System

- Multi-scale NOAA operational and research model / JEDI

NOAA Observing System


Existing Partnership
Potential Partnership
NOAA Mission
USA
JAPAN
SOUTH KOREA
INDIA
CHINA
FRANCE
RUSSIA
NOAA
EUMETSAT
EUROPEAN COMMISSION
NATIONAL SPACE ORGANIZATION (NSPO)
EUROPEAN SPACE AGENCY
NASA
DSCOVR
SOHO
ACE
COMS
HIMAWARI-8/9
FY-2
FY-2
INSAT-3D
ELECTRO-L
KALPANA
METEOSAT-7
METEOSAT-10
NOAA-15/18/19
GPM
SENTINEL-1
SENTINEL-2
SENTINEL-3
JASON-2/3
GCOM
FY-3
METEOR
METOP
DMSP-F14-18
COSMIC
A-TRAIN CONSTELLATION
SUOMI NPP
GOES - WEST
GOES - 14
GOES - 16
GOES - EAST
140.7°E
128.2°E
105°E
90°E
86.5°E
82°E
78°E
74°E
57°E
0°
180°W
135°W
105°W
89.5°W
75°W
GEOSTATIONARY ORBIT
NEAR-POLAR ORBIT
LAGRANGE POINT 1

Satellite Product R&D Capacities that underpin the Future Enterprise

Development of technical methods among NOAA, allied agencies and communities of practice to ensure **Traceable calibration and inter-calibration process standards among remote observing sensors, platforms and systems** necessary for NOAA to maintain long term consistency among remote sensing satellite and in situ observations and *for ensuring reliable and well-characterized global and regional Environmental Data Records across current, past and future generations of observing systems.*

Integrated Observing Systems and Data Fusion – Development of internally consistent multi-variate, and multi-scale 4D environmental state descriptions (initially atmospheric and surface state variables) to provide improved situational awareness for forecasting and other decision support, **based on** adaptation of advanced dynamical-mathematical **optimization methods employed in NOAA's hydro-dynamical model data assimilation system.**

Development of NOAA enterprise technical means for **Leveraging non-NOAA U.S. inter-agency and international satellite observations and capabilities** into service to NOAA's global and regional observing missions and operational decision support needs.

Development of physically consistent satellite data products across orbits and sensors (e.g. Blended GEO & LEO) using common scientific retrieval algorithms built and implemented more effectively **within a single (Enterprise) development, testing and processing framework built on consistent physics, radiative transfer, software and analysis utilities --** and consistent repeatable business processes.

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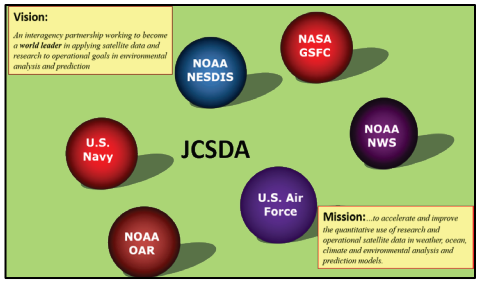
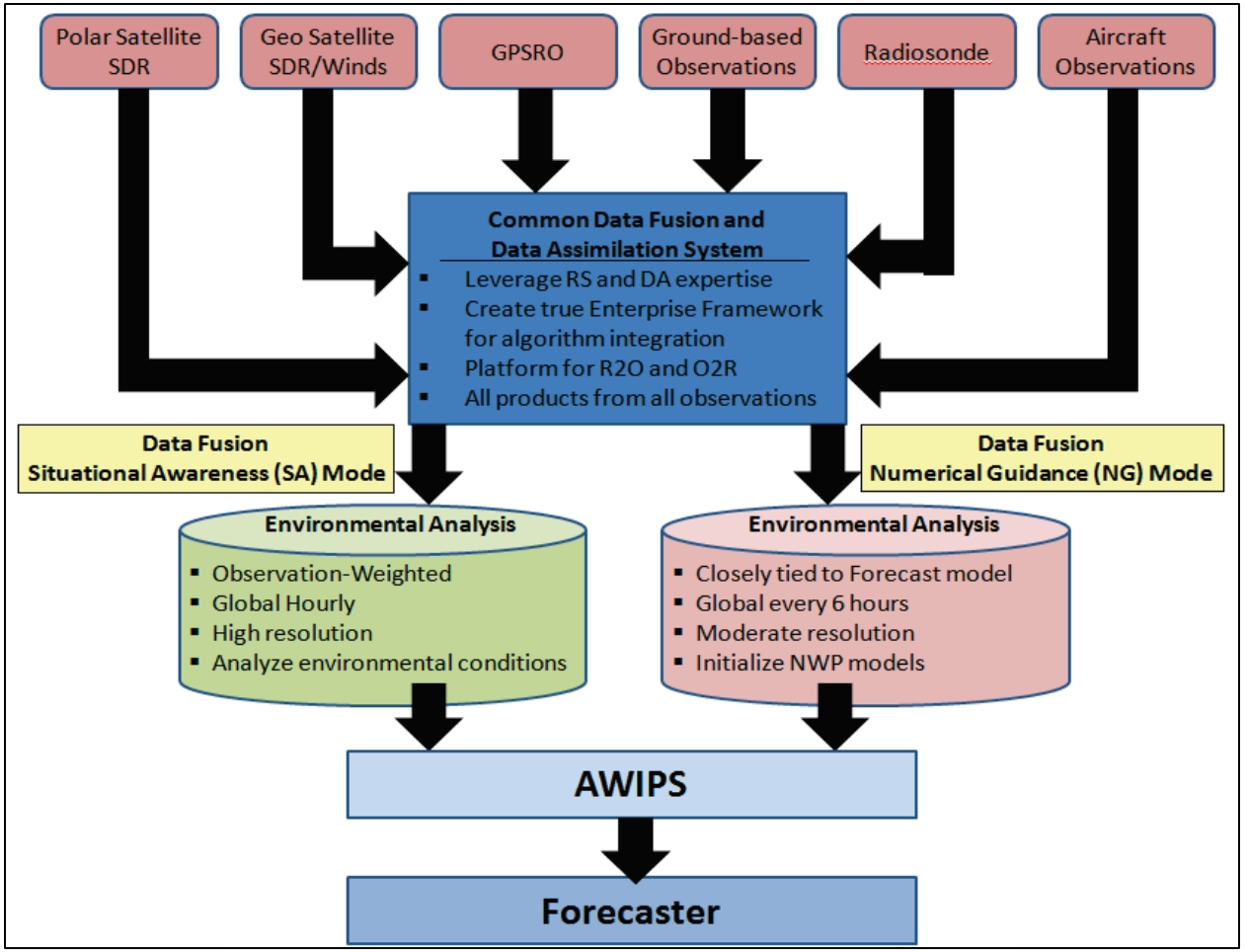
Artificial Intelligence





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Motion Vector Winds – **GOES-R ABI, Himawari-8, S-NPP VIIRS, GOES, AVHRR, SEVIRI, MODIS**

Clouds – **GOES-R ABI, Himawari-8, S-NPP VIIRS, GOES, AVHRR, SEVIRI, MODIS, MTSAT -** Cloud Mask, Cloud Top Phase, Cloud Type, Cloud Top Height, Cloud Cover Layers, Cloud Top Temperature, Cloud Top Pressure, Cloud Optical Depth, Cloud Particle Size Distribution, Cloud Liquid Water, Cloud Ice Water Path

Volcanic Ash – **GOES-R ABI, Himawari-8, S-NPP VIIRS, AVHRR -** Volcanic Ash Mass Loading, Volcanic Ash Height

Cryosphere / Ice – **GOES-R ABI, Himawari-8, S-NPP VIIRS -**Binary Snow Cover, Fractional Snow Cover, Ice Concentration and Cover, Ice Surface Temperature, Ice Thickness/Age

Aerosol – **GOES-R ABI, Himawari-8, S-NPP VIIRS** -Aerosol Detection, Aerosol Optical Depth, Aerosol Particle Size

ACSPO - **A**VHRR **C**lear-**S**ky **P**rocessor for **O**ceans – SST for polar satellites, currently process **ABI and AHI** data

MiRS - **M**icrowave **I**ntegrated **R**etrieval **S**ystem – Microwave product suite for most microwave instruments

NUCAPS - **N**ESDIS **U**nique **C**rIS and **A**TMS **P**roduct **S**ystem – Sounding product suite created using **AIRS, IASI and CrIS** hyperspectral sounding data

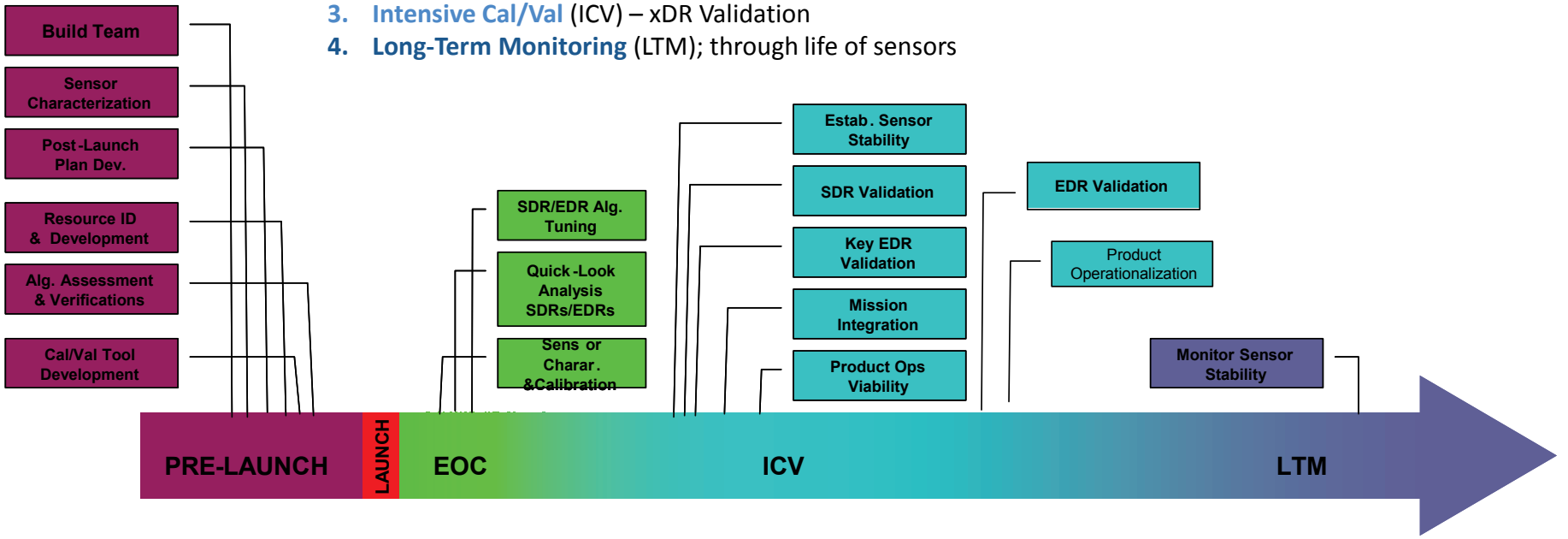
Development of technical methods among NOAA, allied agencies and communities of practice to ensure **Traceable calibration and inter-calibration process standards among remote observing sensors, platforms and systems** necessary for NOAA to maintain long term consistency among remote sensing satellite and in situ observations and *for ensuring reliable and well-characterized global and regional Environmental Data Records across current, past and future generations of observing systems.*

WMO Global Satellite Inter-Calibration System

Integrated Cal / Val System

Four Phases of Cal/Val:

1. **Pre-Launch**; all time prior to launch – Algorithm verification, sensor testing, and validation preparation
2. **Early Orbit Check-out** (first 30-90 days) – System Calibration & Characterization
3. **Intensive Cal/Val** (ICV) – xDR Validation
4. **Long-Term Monitoring** (LTM); through life of sensors



Development of NOAA enterprise technical means for **Leveraging non-NOAA U.S. inter-agency and international satellite observations and capabilities** into service to NOAA's global and regional observing missions and operational decision support needs.

NASA - S-NPP, DSCOVR, GPM, SMAP, ISSCAT

India - ISRO (ScatSat), MegaTropique (Saphir, ~~MADRAS~~), ….

Japan - JAXA (GCOM/AMSR2) ; JMA – Himawari 8/9 AHI & ABI; space Radar

Europe – European Commission (Sentinel 1-9); EUMETSAT (METOP, EPS) ESA (Meteosat 2/3Gen); JASON2,3,CS ; ASCAT

S. Korea KOMPSAT (RO)

Taiwan (GPSRO , COSMIC)

Canada (RadarSat)

Optimizing the National Investment in a Global Earth Observing System SUMMARY

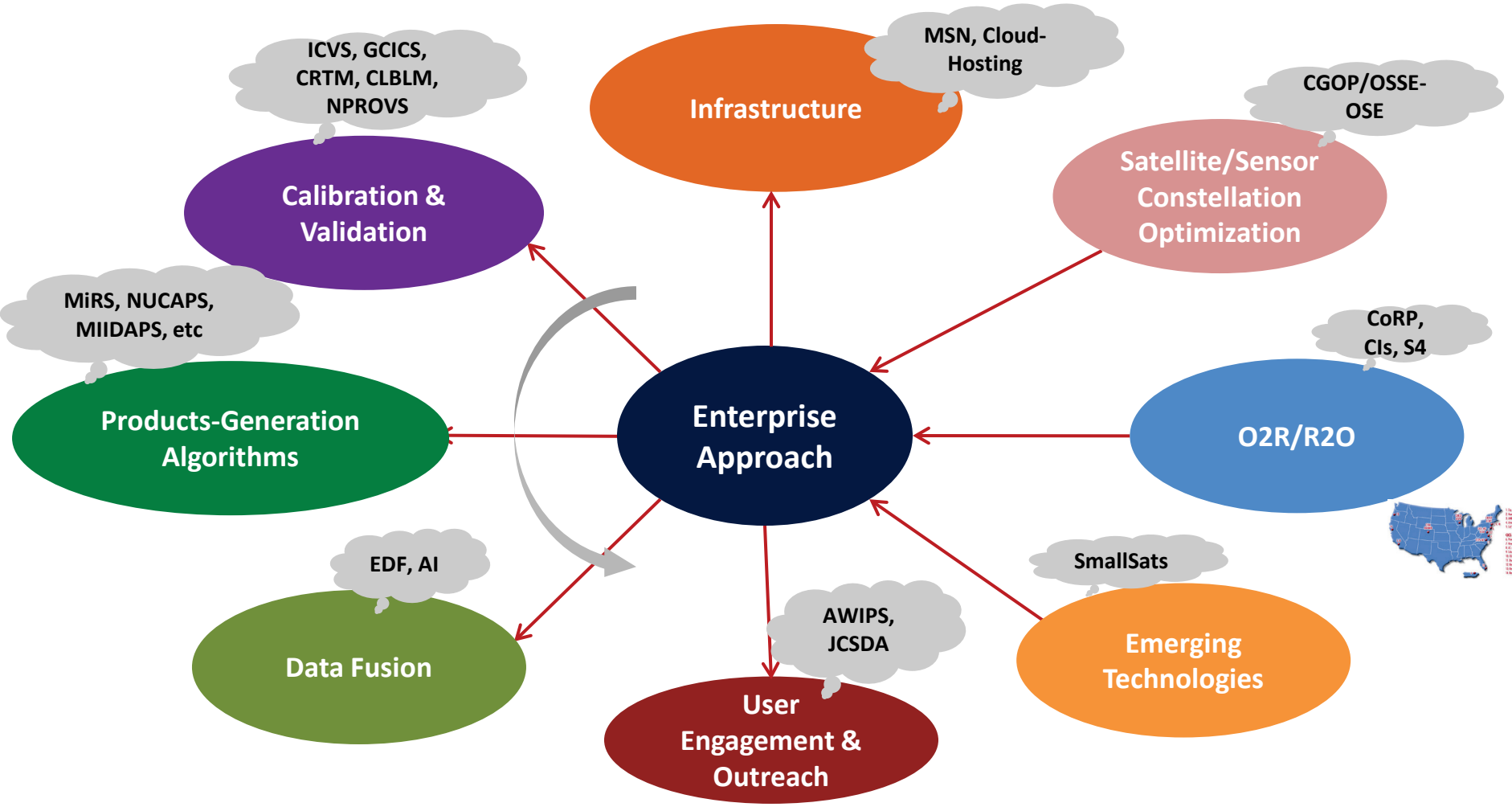
Goals:

- Increase overall capability and capacity to observe, analyze, predict
- Meet real requirements, while advancing scientific understanding
- Beat down individual cost and risk

Practical Strategies:

- Measurement-based vs Mission-based Outputs
- Best Measurement (x,y,z,t)
- Enterprise Algorithms and Systems (multi-satellite and sensor)
- Enterprise inter-operability and cal/val standards
- Moderate Assurance Systems, Data Products and Applications
- Exploit Non-NOAA data and partnerships

Enterprise Approach for Environmental Products Generation & Systems



- **Strategically important features of Enterprise Tools, to fully realize inherent benefits from a GEOSS-like integrated constellation of operational weather satellites.**
  - 1) Flexible: apply to NOAA and leverage non-NOAA commercial, inter-agency and international partner observations
  - 2) Cost-Effective (budget, computer power, maintenance, leveraging open software, leveraging existing tools, etc)
  - 3) Scientific Quality and efficiency: Excellent performances , state of the art algorithms
  - 4) Agile: Adapt to new technologies, new systems, new features
  - 5) Designed to be dual or multi-use, to apply for several applications

BACK-UP

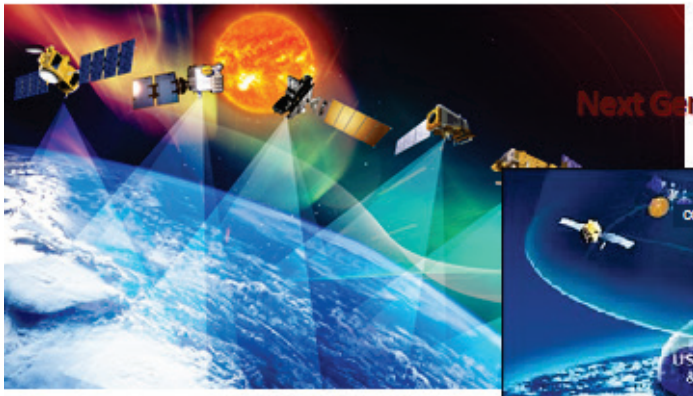
JPSS - GOES-R Mapping

	2.0 JPSS Data Products	Potential Blended Products and Enterprise Algorithms		Day 1 GOES-R+ Advanced Baseline Imager (ABI)
			1	Aerosol Detection (Incl. Smoke & Dust)
	2.1 Imagery Products		2	Aerosol Optical Depth (AOD)
1	2.1.1 VIIRS Imagery (x 16 channels)	Cloud and Moisture Imagery	3	Clear Sky Masks
			4	Cloud and Moisture Imagery
	2.2 Atmospheric Products		5	Cloud Optical Depth
2	2.2.1 Aerosol Optical Depth	Aerosol Optical Depth (AOD)	6	Cloud Particle Size Distribution
3	2.2.2 Aerosol Particle Size	Aerosol Particle Size	7	Cloud Top Height
4	2.2.3 Atmospheric Vertical Moisture Profile	Legacy Vertical Moisture Profile	8	Cloud Top Phase
5	2.2.4 Moisture Profile	Legacy Vertical Moisture Profile	9	Cloud Top Pressure
6	2.2.5 Atmospheric Vertical Temperature Prof	Legacy Vertical Temperature Profile	10	Cloud Top Temperature
7	2.2.6 Temperature Profile	Legacy Vertical Temperature Profile	11	Derived Motion Winds
8	2.2.7 Carbon Monoxide	xxxxxxx	12	*Derived Stability Indices*
9	2.2.8 Carbon Dioxide	xxxxxxx	13	*Downward Shortwave Radiation: Sfc*
10	2.2.9 Methane	xxxxxxx	14	Fire/Hot Spot Characterization
11	2.2.10 Infrared Ozone Profile	xxxxxxx	15	*Hurricane Intensity Estimation*
12	2.2.11 Ozone Nadir Profile	xxxxxxx	16	Land Surface Temperature (Skin)
13	2.2.12 Ozone Total Column	Ozone Total	17	Legacy Vertical Moisture Profile
14	2.2.13 Polar Winds	Derived Motion Winds	18	Legacy Vertical Temperature Profile
15	2.2.14 Rainfall Rate	Rainfall Rate/QPE	19	*Radiances*
16	2.2.15 Aerosol Detection	xxxxxxx	20	Rainfall Rate/QPE
17	2.2.16 Volcanic Ash Detection and Height	Volcanic Ash: Detection and Height	21	*Reflected Shortwave Radiation: TOA*
18	2.2.17 Total Precipitable Water	Total Precipitable Water	22	Sea Surface Temperature (Skin)
			23	Snow Cover
	2.3 Cloud Products		24	Total Precipitable Water
19	2.3.1 Cloud Cover/Layers	Cloud Layers/Heights	25	Volcanic Ash: Detection and Height
20	2.3.2 Cloud Particle Size Distribution	Cloud Particle Size Distribution		
21	2.3.3 Cloud Liquid Water	Cloud Liquid Water		**Day 2 Advanced Baseline Imager (ABI)**
22	2.3.4 Cloud Mask	Clear Sky Masks	26	*Absorbed Shortwave Radiation: Surface*
23	2.3.5 Cloud Phase	Cloud Top Phase	27	Aerosol Particle Size
24	2.3.6 Cloud Optical Depth	Cloud Optical Depth	28	*Aircraft Icing Threat*
25	2.3.7 Cloud Height	Cloud Top Height	29	*Cloud Ice Water Path*
26	2.3.8 Cloud Top Pressure	Cloud Top Pressure	30	Cloud Layers/Heights
27	2.3.9 Cloud Top Temperature	Cloud Top Temperature	31	Cloud Liquid Water

Architecture of the Future

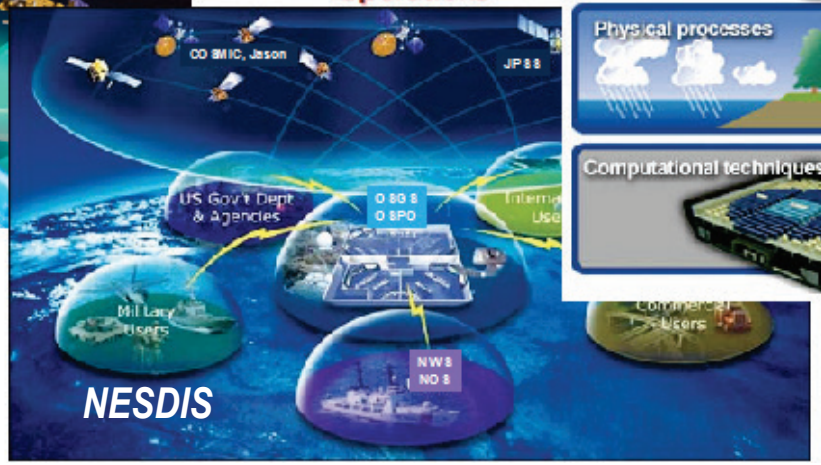
Develop a space-based observing enterprise that is flexible, responsive to evolving technologies, and economically sustainable.
--FY15 NOAA Annual Guidance

Global Earth Observing Satellite System

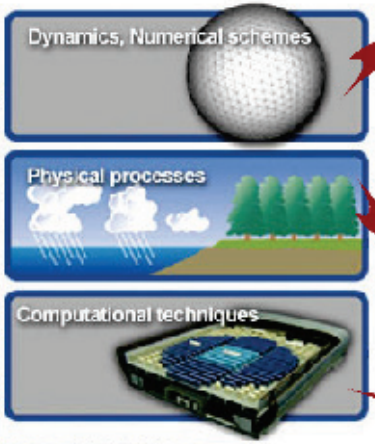


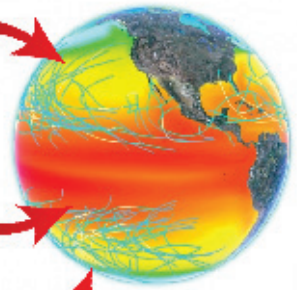
NESDIS & Satellite Partners

Next Generation Integrated & Adap Operations



Integrated & Assimilated Operational Data Flow



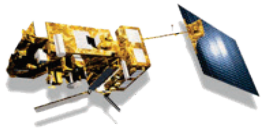


NOAA NWS/OAR & NESDIS & Partners

Algorithm and Product Development

S-NPP& JPSS ATMS/CrIS

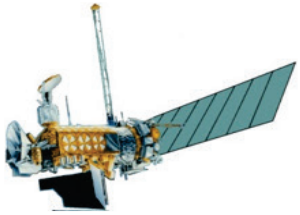
Megha-Tropiques
SAPHIR



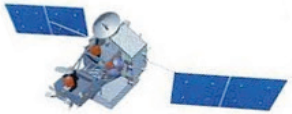
MetOp-A AMSU/MHS/IASI
MetOp-B AMSU/MHS/IASI

NOAA-18 AMSU/MHS/AVHRR
NOAA-19 AMSU/MHS/AVHRR

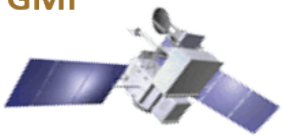
Enterprise Algorithms



DMSP F16 SSMI/S
DMSP F17 SSMI/S
DMSP F18 SSMI/S

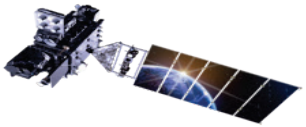


TRMM TMI & GPM GMI



NASA Satellites (MODIS, AIRS..)

GCOM-W1 AMSR2



GOES- Series
EUMETSAT Geo Satellites
Himawari-8/9

Enterprise Algorithms Apply to a Multitude of Satellites, generating a Variety of Products

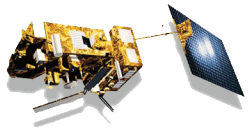
MIIDAPS enterprise algorithm

Multi-Instrument Inversion and Data Assimilation Preprocessing System

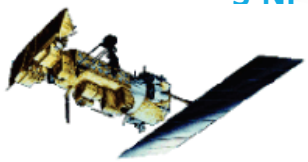
Motivation: Universal retrieval and Data Assimilation preprocessor for all satellite observations

S-NPP& JPSS ATMS/CrIS

Megha-Tropiques
SAPHIR

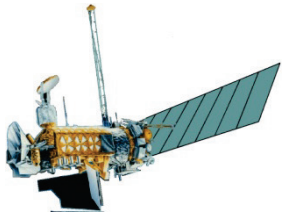


MetOp-A AMSU/MHS/IASI
MetOp-B AMSU/MHS/IASI



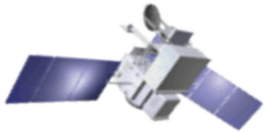
NOAA-18 AMSU/MHS/AVHRR
NOAA-19 AMSU/MHS/AVHRR

MIIDAPS



DMSP F16 SSMI/S
DMSP F17 SSMI/S
DMSP F18 SSMI/S

TRMM TMI



GPM GMI

GCOM-W1 AMSR2

Inversion Process

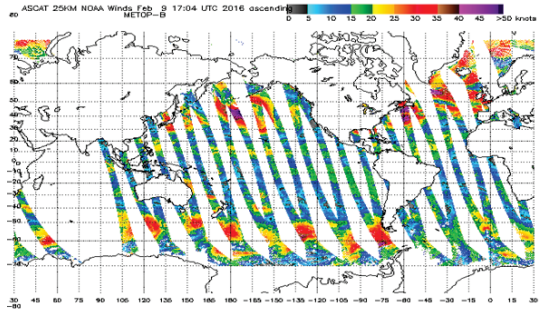
- Inversion/algorithm consistent across all sensors
- All parameters included in state vector
- Uses CRTM for forward and Jacobian operators
- Valid over all surfaces/all-sky conditions
- Use forecast, fast regression or climatology as first guess/background

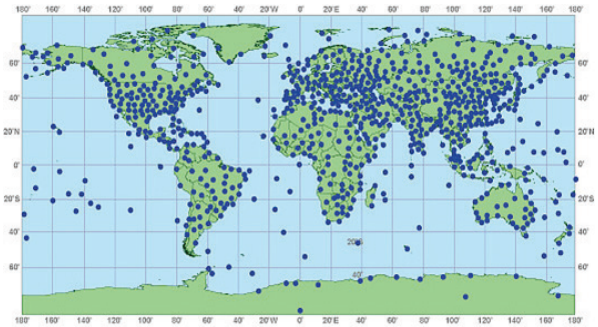
****MIIDAPS also applicable to GOES-15 Sounder, Meteosat SEVIRI, AHI, ABI, MODIS, AIRS, etc**

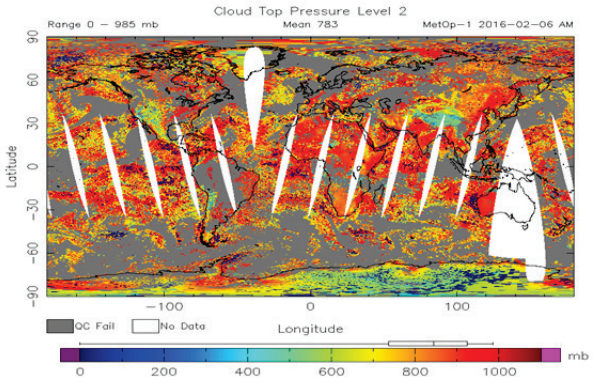
Benefits

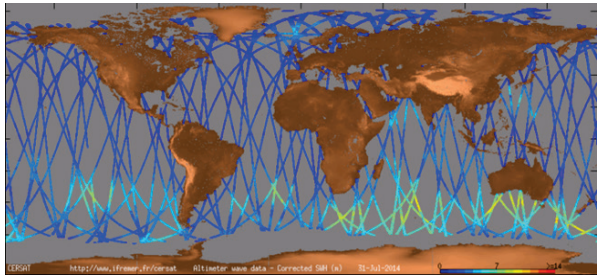
- Consistent Quality Control, error characteristics
- Modular design, scalable
- Use of MPI for HPC
- Highly tunable retrieval

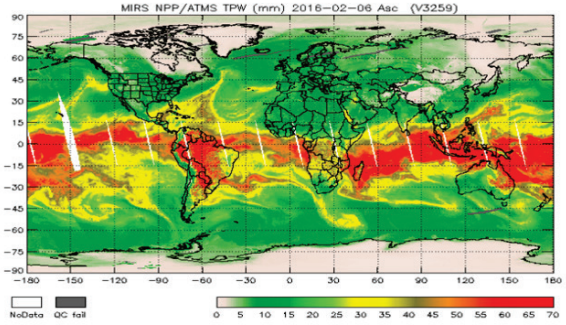
Data Fusion Inputs

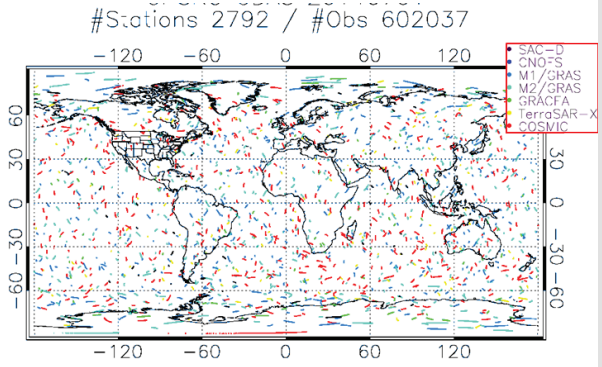












Environmental Data Fusion allows the aggregation of a multitude of observations

<u>From satellites:</u> radiometers, altimeters, scatterometers, etc.,

<u>From ground based sources:</u> radiosondes, dropsondes, radars, etc.

<u>From Forecast Models:</u>
To fill gaps, to produce added-value parameters,etc

With an out put being: A Geophysically-consistent analysis

West Coast Operational Forecast System

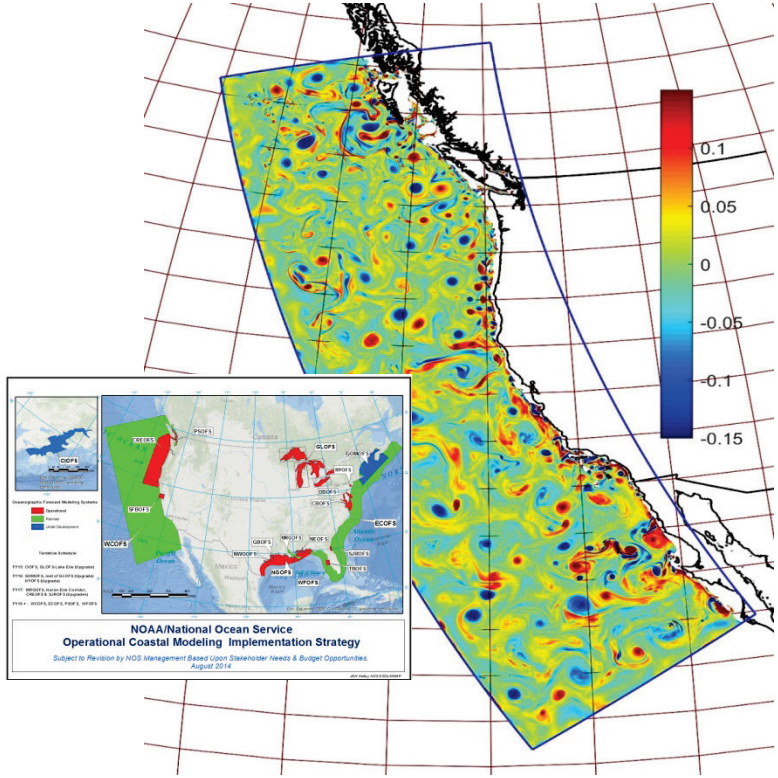
GOAL: 3-7 day forecasts of oceanic conditions, constrained by data assimilation (DA)

STATUS: On track

Target: Sep 2017 transition WCOFS-DA version to NOS/CO-OPS for operational implementation

MODEL:

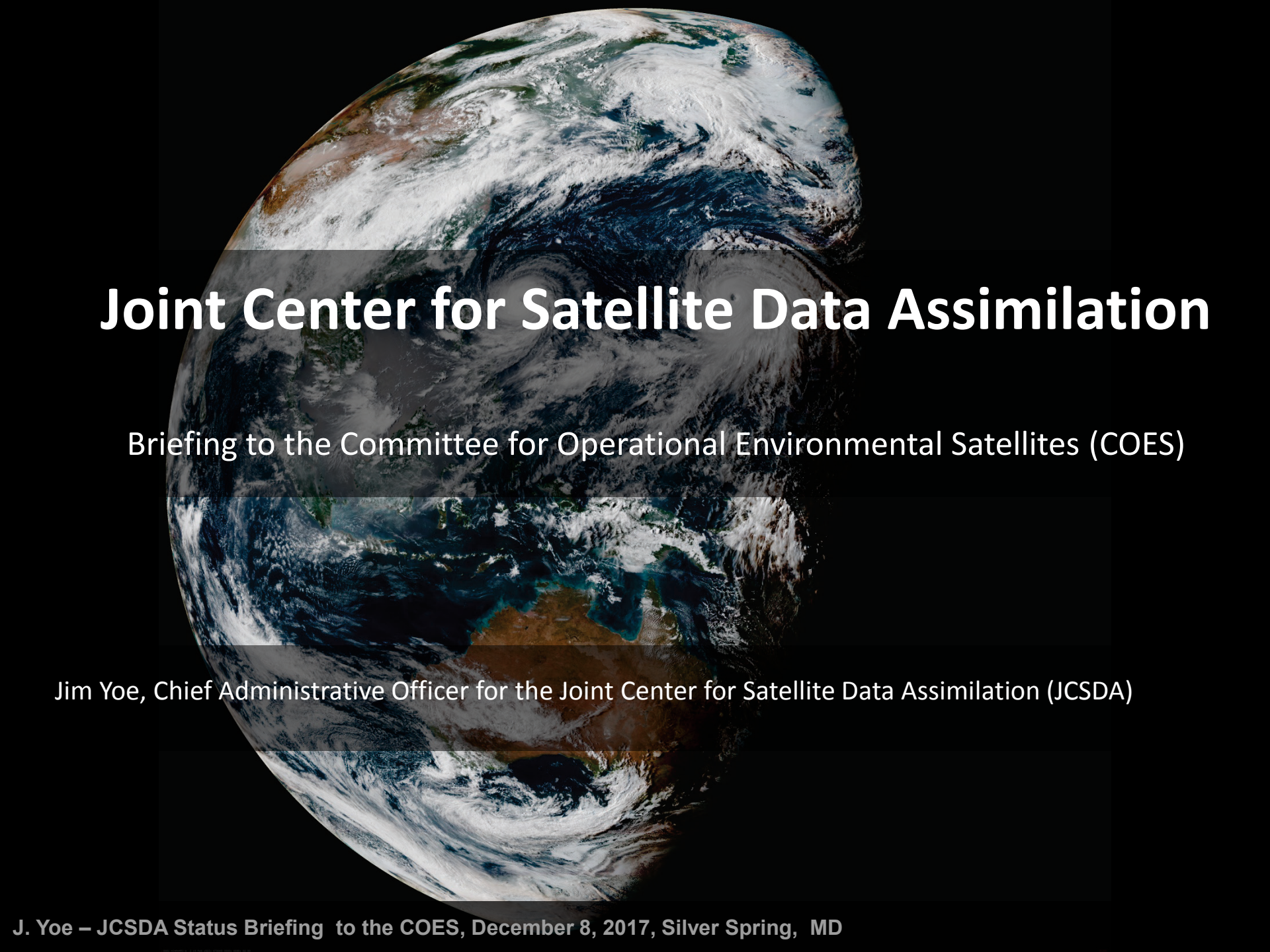
- Horizontal resolution: 2-km
- Vertical resolution: 40 terrain-following layers
- **Currently assimilated parameters:**
  - **VIIRS SST**
  - **Along-track SSH**
  - **HF radar (coastal current vectors)**
- Forcing:
  - Surface winds and heat flux (12-km NOAA NAM)@open boundary from NOAA operational Global-RTOFS (HYCOM)
  - Tides (Oregon State Tidal Inverse Soft.)
  - River inputs: Columbia R., Fraser R., small rivers in Puget Sound



The assimilation of satellite obs constrain eddy variability, impacting both surface and subsurface flows.

Agenda

- Opening Remarks: ……COES Cochairs
- Action Item Review: ……Executive Secretary
- Federal Coordinator's Remarks: …….. William Schulz (OFCM)
- Highlights from the JPSS-1 Launch: ……..Steve Walters (NOAA-JPSS)
- NOAA's Center For Satellite Applications And Research (STAR): ……Mike Kalb (NOAA)
- Joint Center for Satellite Data Assimilation (JCSDA): James Yoe (NOAA)
- Open Discussion: ……COES Members
- Action Item Review / Next Meeting: ……Executive Secretary
- Adjourn: ……The meeting is expected to end by 12:00 PM EST.



Joint Center for Satellite Data Assimilation

Briefing to the Committee for Operational Environmental Satellites (COES)

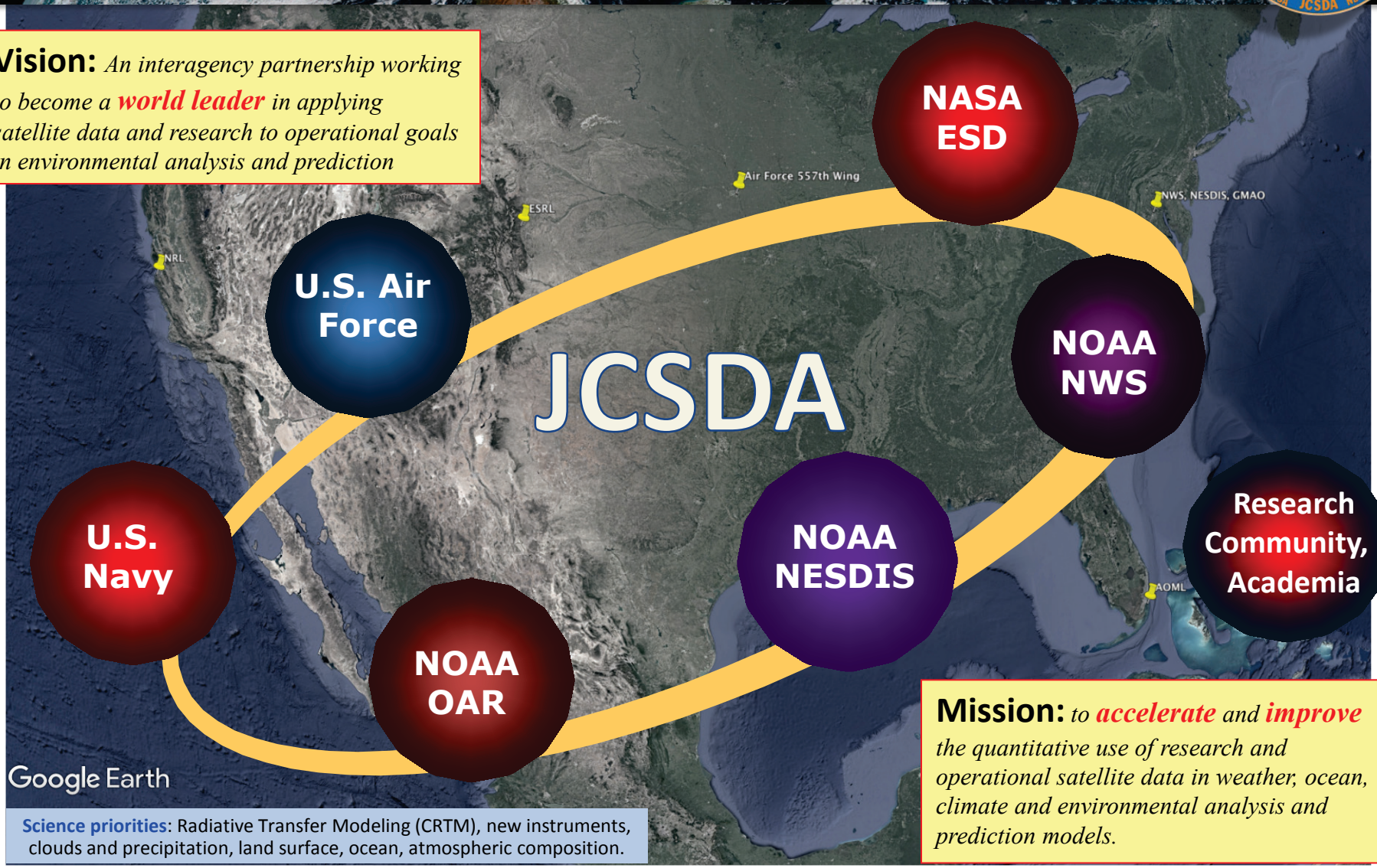
Jim Yoe, Chief Administrative Officer for the Joint Center for Satellite Data Assimilation (JCSDA)

Status Update

- Who Are We?
- What's New ?
  - How We Manage, Plan, & Execute
  - Recent Work and Events - Highlights
- Closing Remarks

Joint Center for Satellite Data Assimilation

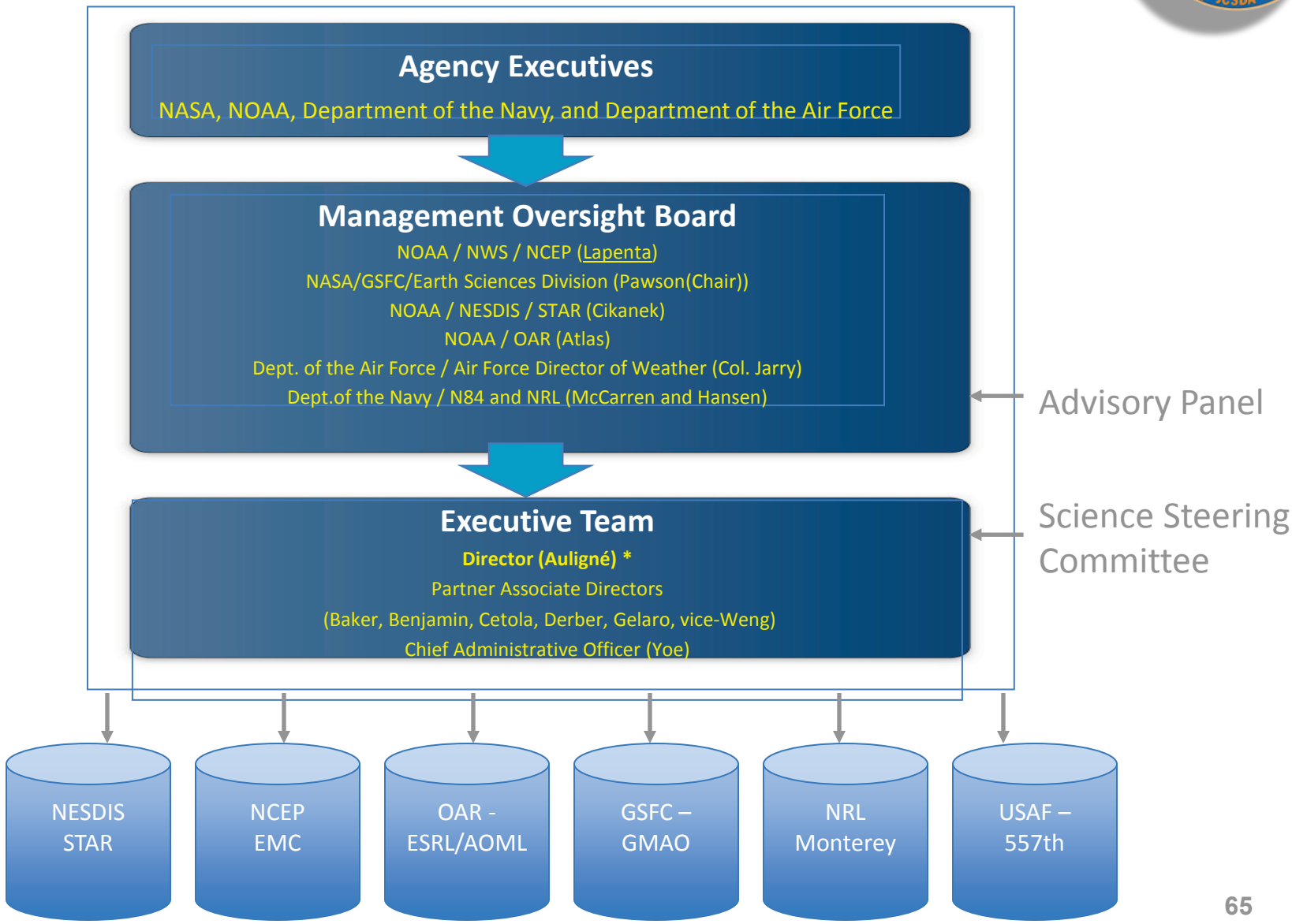
Vision: *An interagency partnership working to become a **world leader** in applying satellite data and research to operational goals in environmental analysis and prediction*



Science priorities: Radiative Transfer Modeling (CRTM), new instruments, clouds and precipitation, land surface, ocean, atmospheric composition.

Mission: *to **accelerate** and **improve** the quantitative use of research and operational satellite data in weather, ocean, climate and environmental analysis and prediction models.*

Management Structure



New: Concept of Operations

• The reaffirmation of the **central role** of the **Executive Team** to guide science activities and ensure high level of collaboration, and of the **Management Oversight Board** to provide management-level oversight and strategic decisions.

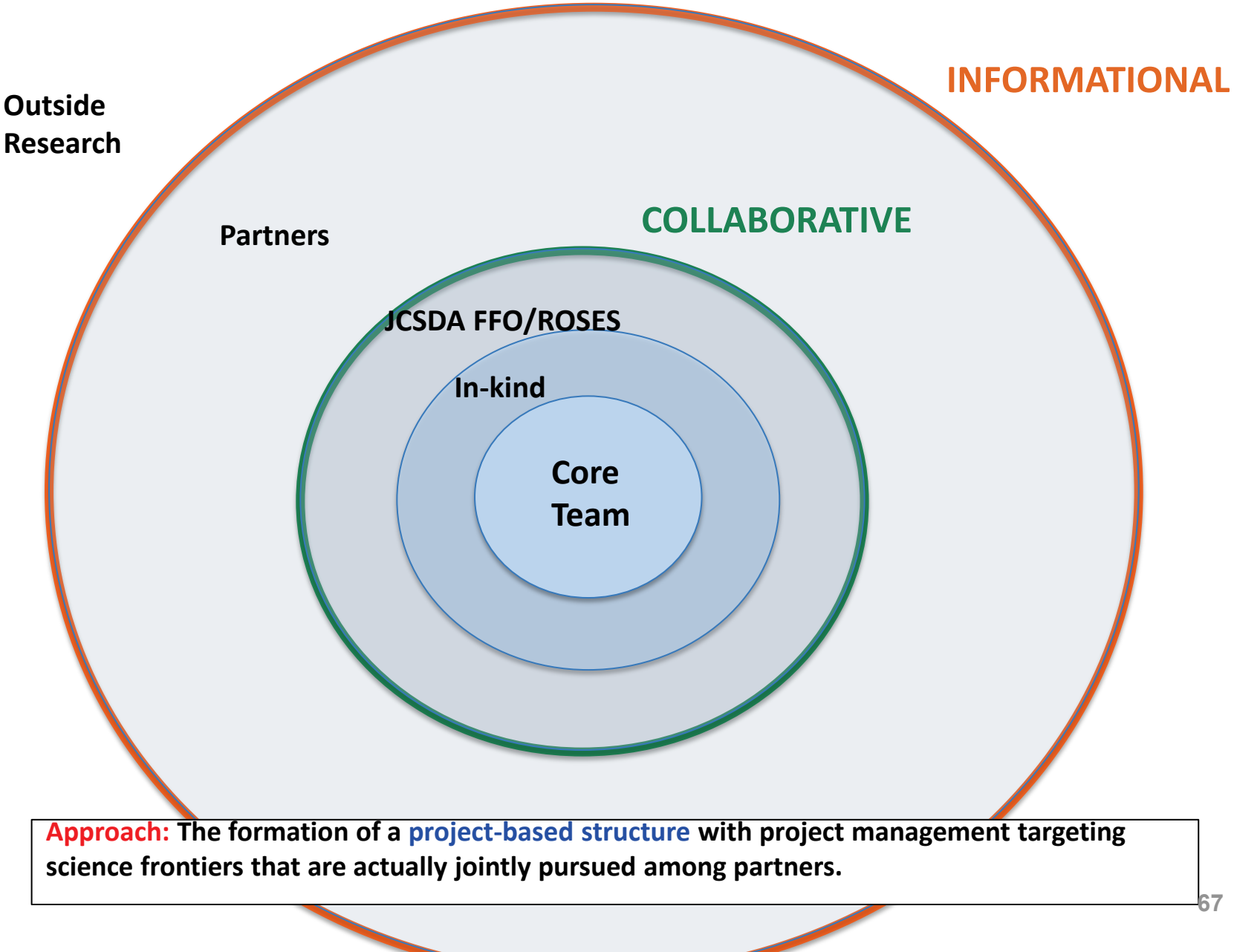
• The **transition of programmatic, administrative, and operational management** to a Non-Government Research Organization (NGRO), which will increase accountability to the JCSDA Director while maintaining close interaction with and oversight from the partner federal agencies.

• The clarification of the **scope of activities** and the associated decision process to determine what constitutes the purview of the JCSDA.

• The formation of a **project-based structure** with project management targeting science frontiers that are actually jointly pursued among partners.

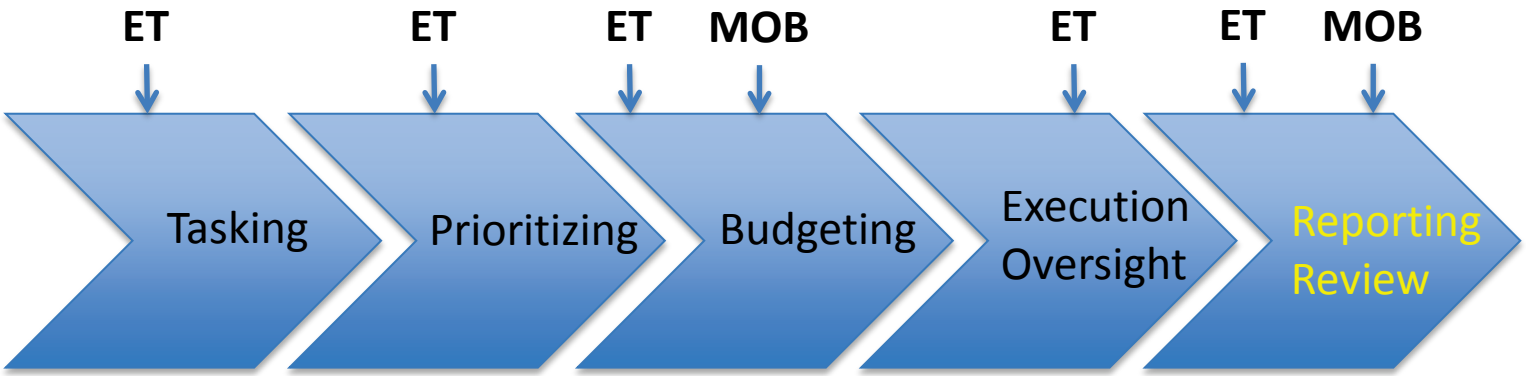
• The establishment of a **formalized annual cycle** to coordinate the planning, budgeting, execution and reporting of JCSDA activities.

Scope of activities of JCSDA: Collaborative, inter-dependent activities inside AOP
Metric of success = *added* value of doing work *jointly* via the JCSDA



Approach: The formation of a project-based structure with project management targeting science frontiers that are actually jointly pursued among partners.

JCSDA Annual Cycle



Jan: Director drafts AOP

Feb: ET prioritizes tasks against resources

Mar: MOB approves AOP

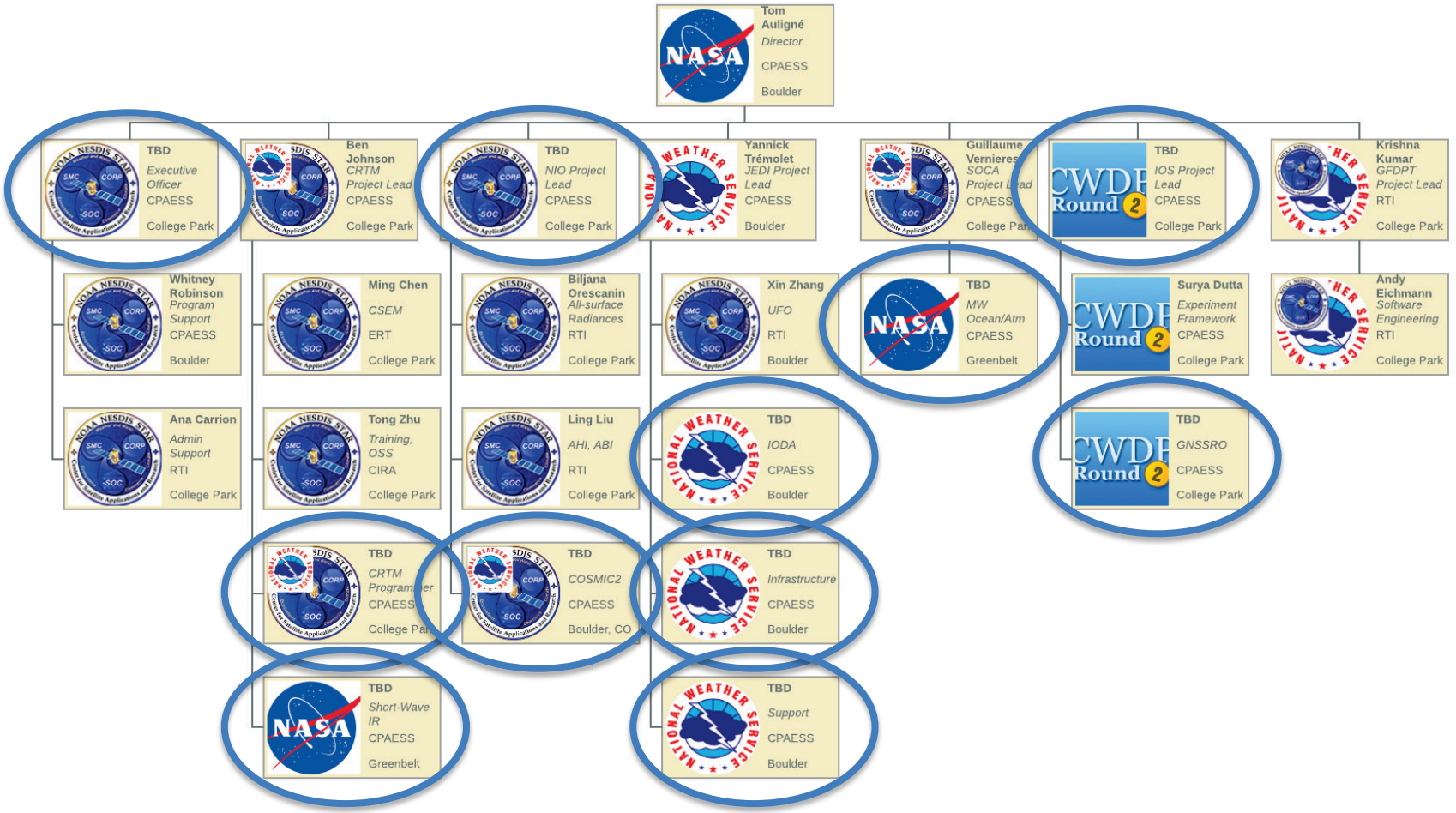
Details regarding processes for planning contributions of staff , $, and other resources, allocation to priorities and Projects, and Agency review and oversight captured in JCSDA Whitepaper.

April 1: Begin Execution AOP

May: Annual Science Workshop

>> Project Leads present Quarterly Reviews (to ET), followed by Quarterly Reports (to MOB)

JCSDA 'Core Team' Org Chart



Goal Alignment in 2017

- **Director's Office (DOF)**
  - Annual Operating Plan with Quarterly reports
  - Reinstate Science Advisory Committee
  - "Critical path" project planning to optimize operational transitions

- **New and Improved Observations (NIO)**
  - Prepare for the assimilation of JPSS, GOES-16, COSMIC-2, evaluate Satellite Commercial data
  - Assimilation of radiances over land and sea-ice with improved estimation of surface emissivity
  - Improved use of all-sky radiances

- **Community Radiative Transfer Model (CRTM)**
  - Release 2.3.0 and CRTM Users Workshop
  - Acceleration via software optimization
  - Improved scattering tables for clouds and precipitation

Goal Alignment in 2017 (cont.)

- **Joint Effort for Data assimilation Integration (JEDI)**
  - Unified Data Assimilation Planning Workshop
  - Prototype of Unified Forward Operator
  - Requirements and initial prototype of standardized observation access

- **Sea-Ice, Ocean, Coupled Analysis (SOCA)**
  - Build Sea-ice DA components following JEDI standardized observation access
  - Initial integration into unified forward operator

AOP 2017: Planned Tasks

Project DOF: Director's Office (Director: Tom Auligné)

- Task DOF1: JCSDA management and coordination
- Task DOF2: Communication, education, and outreach
- Task DOF3: JCSDA External Research Program
- Task DOF4: Visiting Scientist Program

Project CRTM: Community Radiative Transfer Model (Lead: Ben Johnson)

- Task CRTM1: Release of CRTM version 2.3.0 and future release support
- Task CRTM2: Acceleration of CRTM computations via software optimization
- Task CRTM3: Improved physical representation for aerosols, clouds, precipitation, and land surface

Project NIO: New and Improved Observations (Lead: TBD, Ben Johnson acting)

- Task NIO1: Assimilation of Radiance Data Over Land and Sea-Ice
- Task NIO2: Prepare for the assimilation of AHI, JPSS, GOES-16, COSMIC-2

Project JEDI: Joint Effort for Data assimilation Integration (Lead: Yannick Trémolet)

- Task JEDI1: Infrastructure
- Task JEDI2: Abstract Code Layer
- Task JEDI3: Encapsulated interpolations
- Task JEDI4: Encapsulated observation operator (link to GSI code)
- Task JEDI5: Interface for observation data access (IODA)
- Task JEDI6: Background and Observation Error Covariance matrices

Project SOCA: Sea-ice, Ocean, Coupled Assimilation (Lead: Guillaume Vernieres)

- Task SOCA1: Implementation of initial Sea-ice DA
- Task SOCA2: Develop plan for unified Ocean DA

Directed Project IOS: Impact of Observing System *(Lead: TBD)*

- Task IOS1: Standing capability to assess observation impact
- Task IOS2: Toward real-time FSOI intercomparison
- Task IOS3: Evaluation of Commercial Weather Data Pilot (CWDP)

Directed Project GFDPT: Global Forecast Dropout Prediction Tool *(Lead: Krishna Kumar)*

- Task GFDPT1: Transition to NCEP

Community Radiative Transfer Model

CRTM Mission Satellite radiance simulation and assimilation for passive MW, IR, & Visible sensors of NOAA, NASA, DoD satellites, and others (200 sensors). Simulation of clear/cloudy/precipitating scenes

Highlights

- Generated CRTM coefficients for CubeSat MicroMAS2 and CIRAS; INSAT3DR IMGR and SNDR; JPSS1 VIIRS and GOES-S/T/U ABI; updated SSMI/S F16.
- Implemented CRTM-OSS alpha release for future unapodized radiance assimilation.
- Prepare CRTM Rel-2.3.0, including CrIS FSR, AIRS NLTE, MHS ACC coefficients, bug fixes, etc.

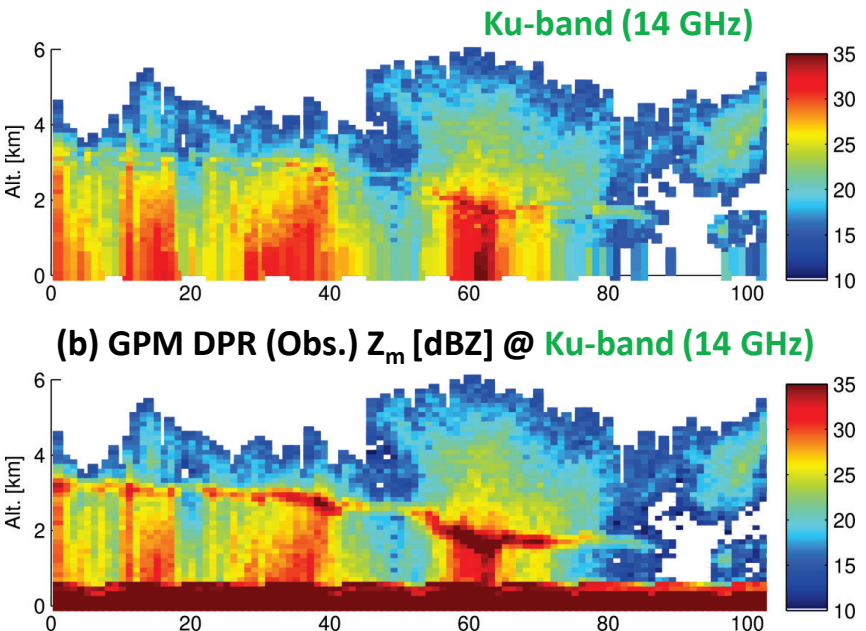
CRTM On-going/Future Development

- New sensors: CERES, EPIC-DISCOVR, JPSS-1
- Expand CRTM capability to CMAQ aerosols
- Implement CSEM surface emissivity model
- CRTM with cloud fraction capability

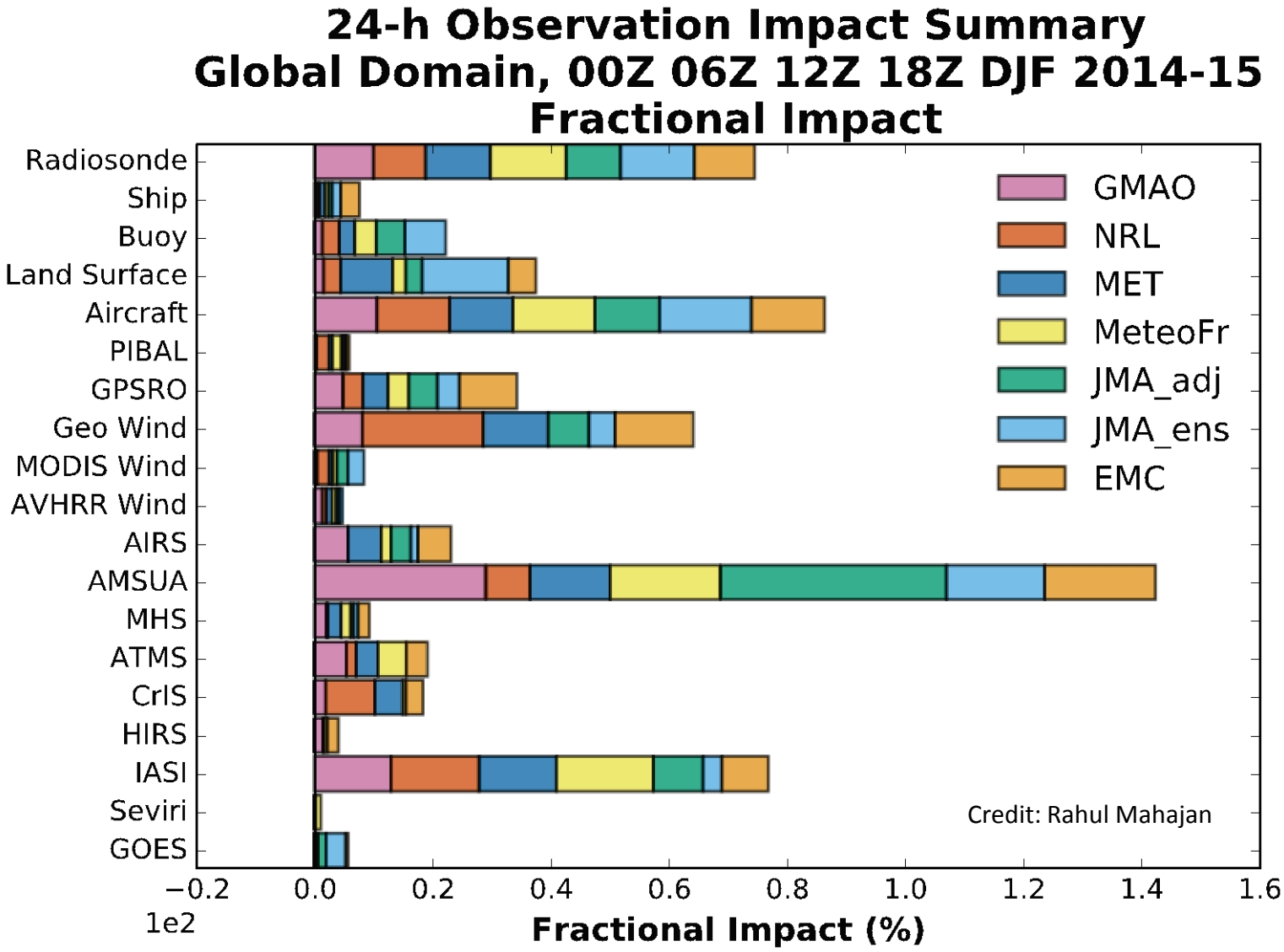
Community Line-By-Line Model (CLBLM)

- Refactor the LBLRTM in modern Fortran
- Redesigned, simplified and enhanced LBL algorithm to facilitate future expanded sets of spectroscopic parameters

Community Active Sensor Module (CASM)



Obs. Impact Inter-Comparison



DA Science Grand Challenges

Observations

- Big Data paradigm (volume, variety, velocity): most of total error reduction comes from a large number of observations with **small or moderate individual impacts**

Models

- Better value for society: forecast model for more components of Earth system (Ocean, Waves, Cryosphere, Land, Hydrology, Aerosols, Atmospheric composition, Ionosphere, etc.)
- Models are getting coupled to better account for interactions

Data Assimilation Algorithms

- DA systems becoming increasingly complex as science progresses: comparing algorithms almost impossible. Optimum may be application/machine dependent

Joint Effort for Data assimilation Integration (JEDI)

1. Collective path toward Nation Unified Next-Generation Data Assimilation
2. Modular, Object-Oriented code for flexibility, robustness and optimization
3. Mutualize **model-agnostic** components across
    - Applications, Models & Grids, Observations (past, current and future)

Roadmap

Stage 1: Unified Forward Operator (UFO). Interpolation from various model grids, comprehensive suite of observation operators, refactoring of operational Quality Control.

Interface for Observation Data Access (IODA). Standardized file format + API for observations in memory.

Stage 2: Covariance matrices, linearized UFO, 3D solvers, bias correction
Stage 3: Optimized components, 4D solvers
Stage 4: Multi-scale, coupled DA

Education and Outreach

15th JCSDA Tech Review and Science Workshop + 1st CRTM Users and Developers Workshop

Unified DA Planning Meeting

Joint DTC-EMC-JCSDA GSI/EnKF Tutorial

Joint Workshops with Partners

- JCSDA Symposium @AMS: Austin, TX

Summer Colloquium on Satellite DA

- Summer 2018: Bozeman, MT

JCSDA Newsletter and Web site

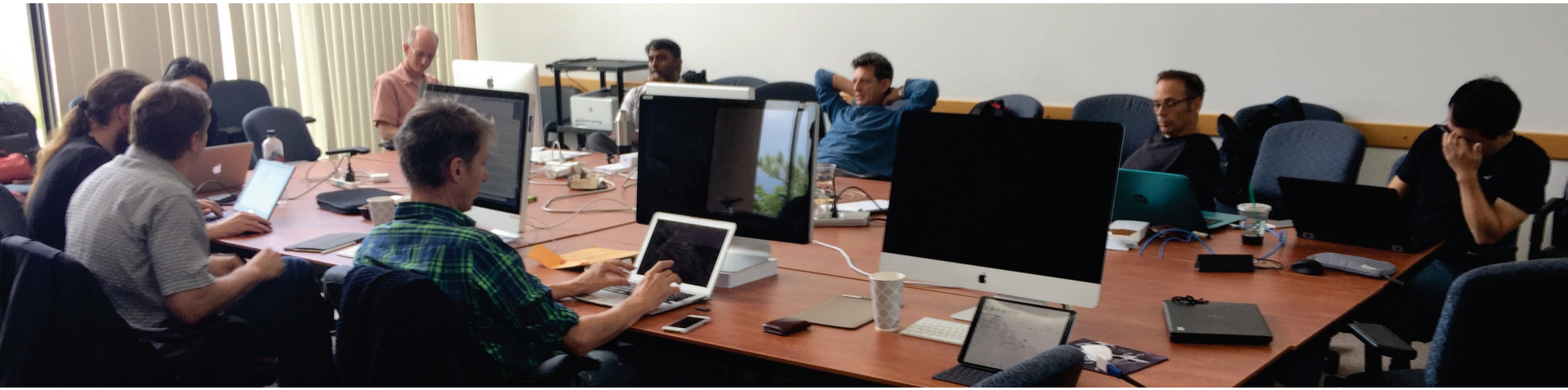
- Highlight achievements by scientists
- Promote collaboration

Visiting Scientist Program

'B Matrix' Bootcamp – 01-21 Aug 2017 – Boulder, CO

Participation: JCSDA, NCAR, GMAO, OAR, EMC, Météo-France, Met Office

Scope: Design, develop, and test a prototype software for modeling background error covariances in research and operations. The code needs to be self-contained, portable, accurate, efficient, scalable, readable, non-redundant, extensible, documented, tested, with the vision to integrate into the JEDI framework.



Closing Remarks

JCSDA improving its operations

- AOP improving up-front coordination and accountability
- Targeting inter-dependent activities with clear added value
- Project-based structure focusing on measureable deliverables
- JCSDA staff committed to collaboration
- **Enhancing satellite DA to support the OCs**
- **Working to ensure, improve satellite data access via COPC WG**

Agenda

- Opening Remarks: ……COES Cochairs
- Action Item Review: ……Executive Secretary
- Federal Coordinator's Remarks: …….. William Schulz (OFCM)
- Highlights from the JPSS-1 Launch: ……..Steve Walters (NOAA-JPSS)
- NOAA's Center For Satellite Applications And Research (STAR): ……Mike Kalb (NOAA)
- Joint Center for Satellite Data Assimilation (JCSDA): James Yoe (NOAA)
- Open Discussion: ……..COES Members
- Action Item Review / Next Meeting: ……Executive Secretary
- Adjourn: ……The meeting is expected to end by 12:00 PM EST.

Action Item Review

AI #	Text	Responsible Office	Comment	Status	Due Date
2017-2.1	Prepare a one-page summary of NOAA, USAF, and NASA commercial weather data procurement projects and plans for ICMSSR information.	Dave McCarren	9/18/17: Briefed at COES Mtg 2017-3	Closed	07/30/17
2017-3.1	Request NOAA STAR and the JCSDA provide any reports on progress in evaluating the quality of INSAT and other ISRO data	ExecSec	12/5/17: Presentation and infor amtion requested	Closed	09/30/17
2017-3.2	Provide any comments on the COES overview briefing reviewed during the meeting to the Executive Secretary.	COES Members	9/21/17: Cooments received and incorporated	Closed	09/21/17
2017-3.3	Review commercial data initiatives in NOAA, NASA, and AF then provide a summary to ICMSSR.	ExecSec		Open	10/30/17

Action Item Review / Next Meeting

- **The Executive Secretary will document any action items taken during the meeting**
- **The Executive Secretary will coordinate with the cochairs and schedule the next meeting.**
  - **Our goal is to conduct 4 COES meetings in 2018 (March, June, September, and December)**
    - Mar 23, 2018, 1-3pm (TBD)
    - Jun 22, 2018, 1-3pm (TBD)
    - Sep 21, 2018, 1-3pm (TBD)
    - Dec 14, 2018, 1-3pm (TBD)

BACK-UP