



SATELLITE OPERATIONS

# Latest Status of National and International Low-Earth Orbiting (LEO) Satellites – NOAA Updates on Data Processing, Distribution, and Product Generation to Users

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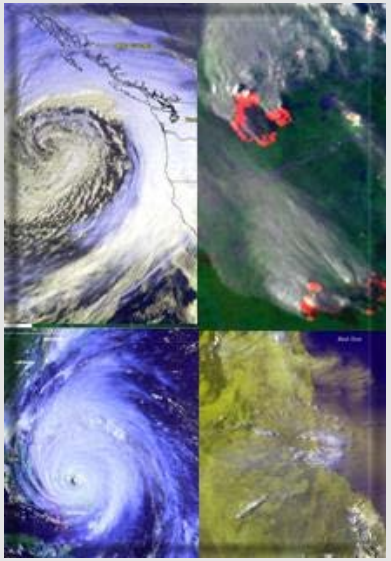
***15th Annual Symposium on***
***New Generation Operational Environmental Satellite Systems***
***Session 4B - January 9, 2019***

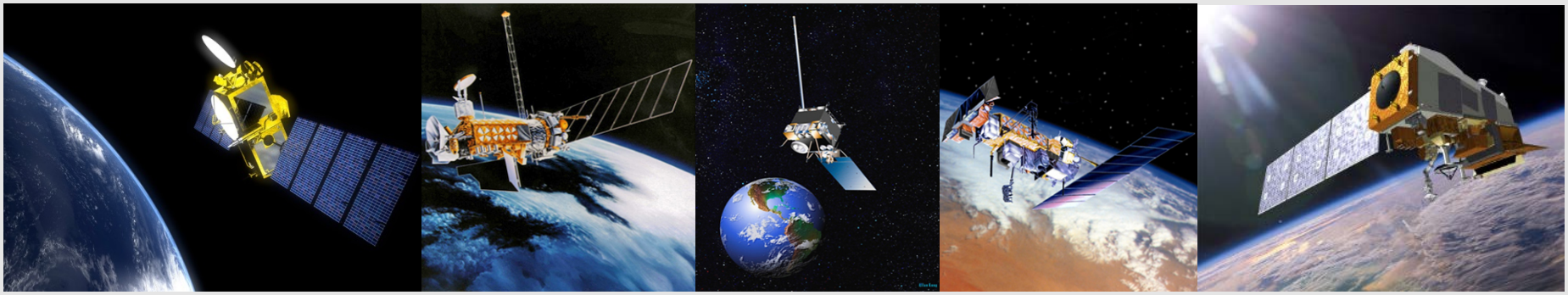
# Presentation Outline

- Introduction
- Status of POES, Jason-2/3, DSCOVR
- S-NPP/NOAA-20 Updates
- Meteosat Second Generation Service Updates
- Himawari-8/9 Updates
- Questions/comments



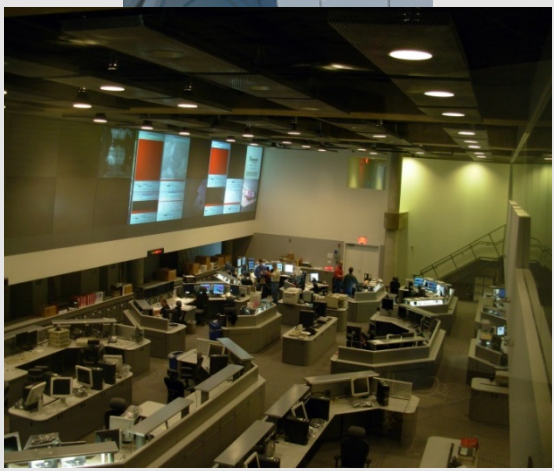
# NESDIS Office of Satellite and Product Operations (OSPO)

- Operates the Nation's 18 environmental satellites:
  - 5 Geostationary (GOES) by NOAA
  - 2 Joint Polar Satellite Systems by NOAA + NASA (NOAA-20, Suomi-NPP)
  - 3 Polar-Orbiting (POES) by NOAA
  - 5 Defense Meteorological Satellite program (DMSP) operated by NOAA
  - 2 OSTM Jason-2 & Jason-3 (Ocean Surface Topography Mission) - Joint NOAA, NASA, CNES, EUMETSAT effort
  - 1 DSCOVR (Deep Space Climate Observatory) by NOAA



# OSPO's Key Roles

- Ground System Command & Control, Ingest, Generation, and Distribution
- Pre-Launch and Post-Launch Testing
- Operational Testing, Validation, and Verification
- User Readiness for Broadcast Services and Product Delivery
- Long-Term Continuity of Products and Services



# NOAA Operational Facilities

Suitland, MD

Over 500 staff supporting or operating the satellites, receptors, and processing systems


College Park, MD

Fairmont, WV*

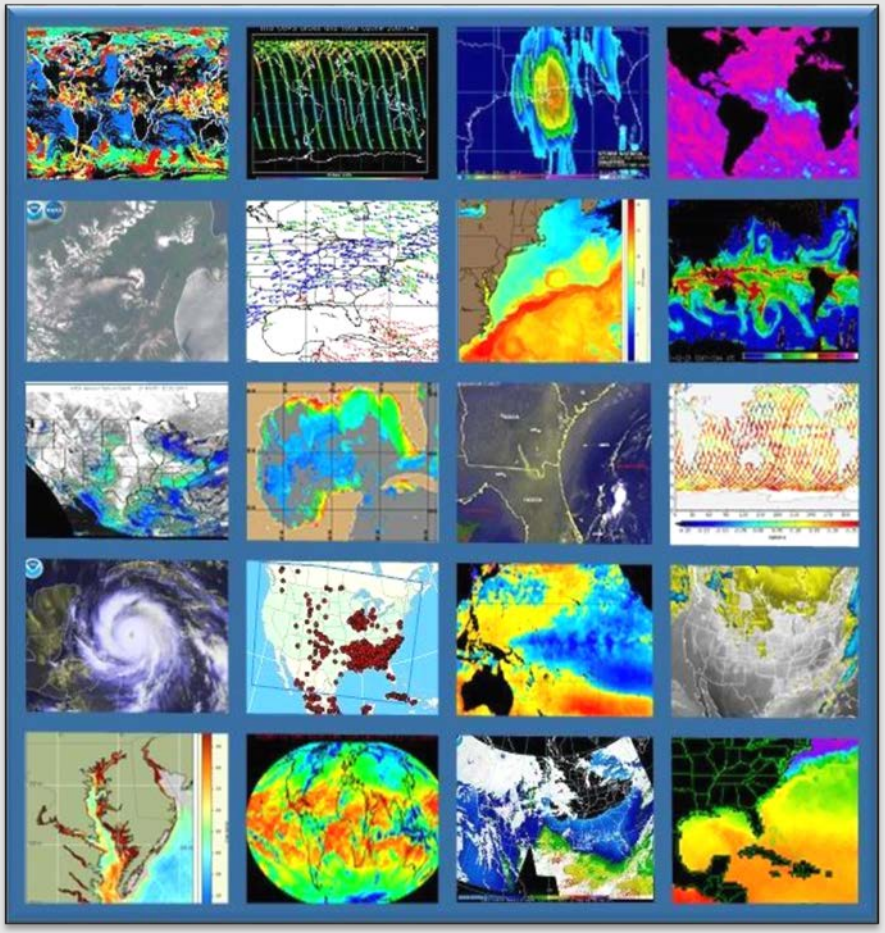

Wallops, VA


Fairbanks, AK

* GOES-R and JPSS Backup Facility

# OSPO's Satellite Products and Services Division

- Provides 24x7 interpretive analyses of satellite data
  - Atmospheric temp/moisture
  - Hurricane intensity & position
  - Volcanic Ash
  - Fire and Smoke
  - Oil Spills
  - Significant Precipitation (20x7)
- Manages automated environmental products
- Collaborates with partners to support transition of research products into operations



# Polar Operational Environmental Satellite (POES) Performance Status

**December 19, 2018**

| Spacecraft Subsystems | METOP-A | METOP-B | NOAA-19 | NOAA-18 | NOAA-15 |
|---|---|---|---|---|---|
| Launch Date | Oct 2006 | Sept 2012 | Feb 2009 | May 2005 | May 1998 |
| Operational Date | May 2007 | April 2013 | Jun 2009 | Aug 2005 | Dec 1998 |
| Mission Data Category | Secondary (AM) | Primary (AM) | Prime Services Mission (PM) | Secondary (PM) | Secondary (AM) |
| Payload Instruments | | | | | |
| AVHRR | G | G | G | G | Y(19) |
| HIRS | Y(40) | P(32) | O (31) | R (3) | R (5) |
| AMSU-A1 | O (30) | Y(36) | G | P (33) | Y(20) |
| AMSU-A2 | G | G | G | G | |
| AMSU-B | N/A | | N/A | N/A | R (11) |
| MHS | G | G | Y (6) | R(42) | N/A |
| SEM | Y(38) | G | Y(39) | Y(37) | G |
| SBUV | N/A | | S/C (9) | R(27) | N/A |
| Spacecraft Subsystems | | | | | |
| Telemetry, Command & Control | G | G | G | G | G |
| ADACS | G | G | G | Y (41) | O (10) |
| EPS | G | G | G | G | G |
| Thermal Control | G | G | G | G | Y(21) |
| Communications | Y (1) | G | G | G | Y(22) |
| APT/LRPT | R (2) | G | G | G | G |
| DCS | N/A | N/A | N/A | G | G |
| ADCS | G | O(29) | Y(34) | N/A | N/A |
| SAR: SARR & SARP | G | Y(35) | G | G | Y(23) |

| | |
|---|---|
| Operational | G |
| Spacecraft Issue but No User Impact | S/C |
| Investigating Performance Issue which will Impact Users | P |
| Operational with Limitation | Y |
| Operational with Degradation | O |
| Non-Operational | R |
| Not Applicable | |

# POES Instrument Status Changes

- **NOAA-18 MHS**
  - On October 21, 2018, the NOAA-18 reflector drive motor current became irregular causing scan control errors. This resulted in all 5 MHS channels developing channel striping.
  - Microwave Humidity Sounder (MHS) data degraded impacting the Microwave Integrated Retrieval System (MiRS)
  - Impact seen to NOAA-18 products, especially rain rate and moisture profile.
  - A detailed quality impact assessment was been performed by the MiRS science team (recommendations made)
  - MHS was turned off December 19, 2018. Further analysis scheduled for mid-January 2019.

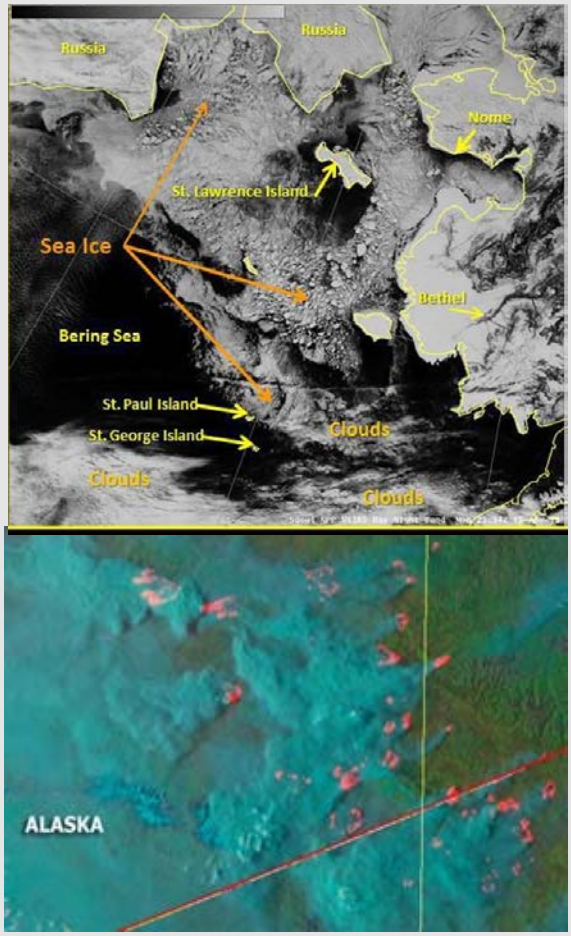
# POES Instrument Status Changes (cont'd)

- **Metop-A**
  - There has been no instrument status change to **AVHRR**, **HIRS, AMSU-A** and **MHS**.
  - All the **HIRS** IR channels have their noise levels out of Spec. However, the **HIRS** instrument radiometric performance is stable.
- **Metop-B**
  - There has been no instrument status change to **AVHRR, HIRS, AMSU-A** and **MHS**.
  - **HIRS** radiometric performance has been good, though a few channels have their noise levels out of Spec.
- **Metop-C**
  - **Launched successfully on Nov 7, 2018. AMSU, AVHRR, MHS instruments on. Data is being evaluated.**

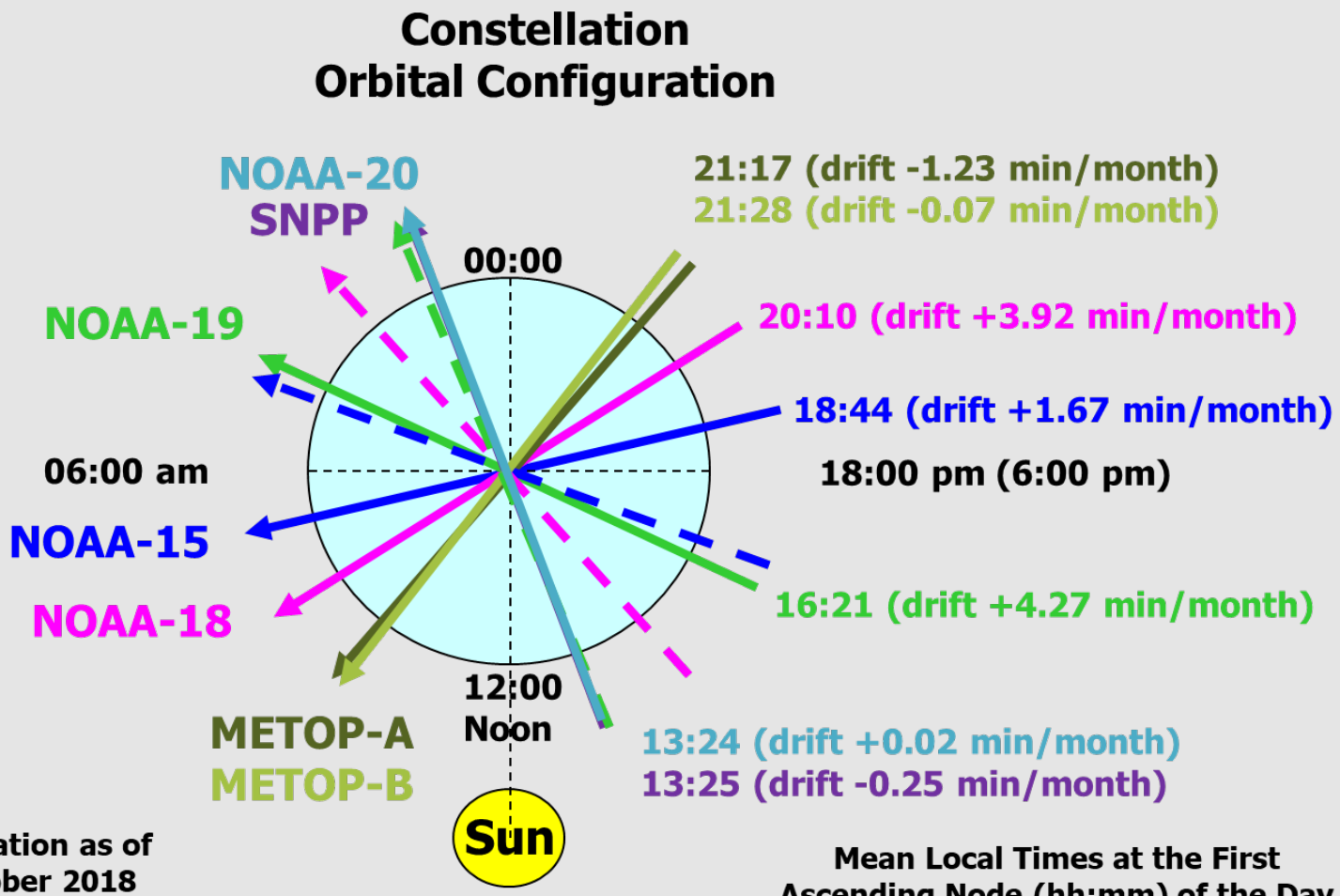
# POES AVHRR Seasonal Channel 3A/3B Switching on NOAA-15 & 19 over Alaska

**To seasonally optimize the fire weather & cryosphere observing posture for Alaska:**

- Deactivated May 15th – Sep 15th
  - Channel 3B (3.7 um) to support fire detection
- Activated Sep 16th – May 14th
  - Channel 3A (1.6 um) to support snow and ice mapping.
  - Initiated as a collaborative effort between:
    - NESDIS/OSPO
    - NWS Alaska Region
    - University of Alaska - Geographic Information Network of Alaska (GINA)
    - NWS Fire Weather Service Manager

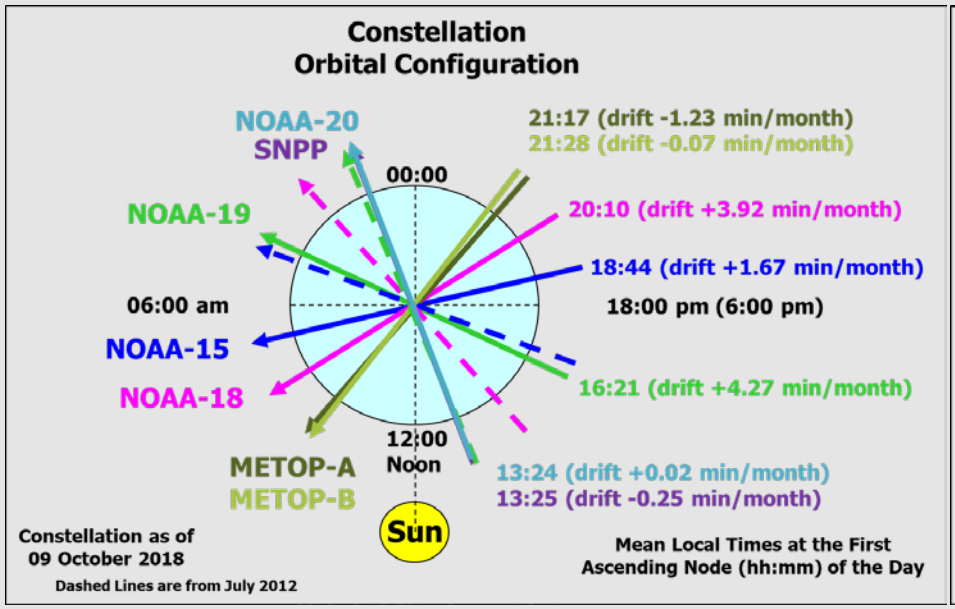


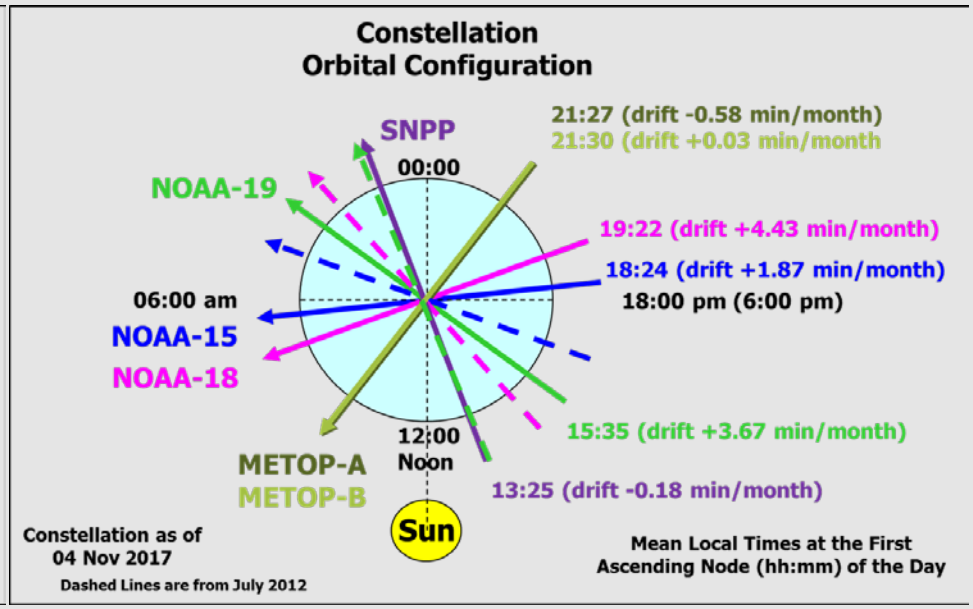
# Constellation Orbital Configuration




Metop-A has started to separate from Metop-B orbit plane

# IJPS Polar Constellation O'clock Orbital Configuration




October 2018 versus November 2017

# Ocean Surface Topography Mission/Jason-2

Surveying Earth's Oceans

- Operations nominal – periodic safe hold events triggered by health of gyros
- 98.52% data capture within 3 hours, requirement 75% within 3 hours (for period June 10, 2018 – January 2, 2019)

**Highlights:**

- **Jun 20, 2018**: Jason-2 marked its 10th year in orbit
- **Jul 16 & 18:** Maneuvers executed to transfer Jason-2 to an Interleaved Long Repeat Orbit
- **Sep 25 - Oct 2:** Jason-2 fuel depletion maneuver burns (some product degradation)
- **Dec 18:** Jason-2 and Jason-3 station keeping maneuvers – no impact to products.
- **January 9:** Deploy TM-NRT patch to correct certain quality flags
- **January 8-15:** NJGS Tech Refresh Factory Acceptance Testing
- **Feb 4-8:** Ground system tech refresh (replacing servers with new Dell systems and updating operating system to RHEL 7.5)


- Operations nominal
- 98.63% data capture within 3 hours, requirement 75% within 3 hours (for period June 10, 2018 – January 2, 2019)

**Highlights:**

- **July 17:** NWS activated Jason-3 wave/altimetry in SBN/AWIPS2
- **December 18:** Jason-2 and Jason-3 station keeping maneuvers – no observable impact to products.
- **January 8-15**: NJGS Tech Refresh Factory Acceptance Testing
- **January 9**: Deploy TM-NRT patch to correct certain quality flags
- **February 4-8**: Tech refresh for TM-NRTs (replacing servers will new Dell systems and updating operating system to RHEL 7.5)

# Deep Space Climate Observatory (DSCOVR) Status – Dec 2018

| Spacecraft | DSCOVR |
|---|---|
| Launch Date | Feb 11, 2015 |
| Activation | June 2015 |

Spurious resetx occur occasionally causing spacecraft to enter safehold. No root cause has been identified. A patch was uploaded to speed up the recovery time from spurious resets. NASA ACE is used as a backup to mitigate impacts of data loss to users.

| Payload Instruments | Status |
|---|---|
| EPIC | G |
| PlasMag | G |
| NISTAR | G |
| Faraday Cup | G |
| ESA | G |
| Magnetometer | G |
| PHA | G |

| Spacecraft Subsystem | Status |
|---|---|
| Telemetry, Command & Control | G |
| Guidance, Navigation and Control | G |
| Attitude Control System | G |
| Propulsion | G |
| Mechanisms | G |
| Electrical Power | G |
| Thermal Control | G |
| Communications Payloads | G |
| Flight Software | G |
| 1394 | G |

- Operational (or capable of)
- Operational with limitations (or in standby)
- Operational with degraded performance
- Not functional
- Functional but turned off
- No status reported

# S-NPP & NOAA-20 Instrument Dashboard Status

| Spacecraft | Suomi-NPP |
|---|---|
| Launch Date | Oct 28, 2011 |
| Mission Category | LTAN 1325 (PM)<br>*Primary Satellite in PM orbit* |

| S-NPP | |
|---|---|
| **Payload - Instruments** | **Status** |
| ATMS | G |
| CERES | G |
| CrIS | G |
| OMPS – Nadir | G |
| OMPS – Limb | G |
| VIIRS | G |

**S-NPP Notes:**

27-Nov-2018: All instruments operating normally and are meeting/exceeding their established performance specifications.

- Extensive monitoring of the S-NPP ATMS scan drive motor current loads and temperatures is ongoing.
- Spacecraft and sub-systems are power positive and operating nominally

| Spacecraft | NOAA-20 (JPSS-1) |
|---|---|
| Launch Date | Nov 18, 2017 |
| Mission Category | LTAN 1325 (PM)<br>*Operational* |

| NOAA-20 | |
|---|---|
| **Payload - Instruments** | **Status** |
| ATMS | G |
| CERES | G |
| CrIS | G |
| OMPS – Nadir | G |
| VIIRS | G |

**NOAA-20 (JPSS-1) Notes:**

27-Nov-2018: All instruments operating normally and are meeting/exceeding their established performance specifications.

Operational (or capable of)

Operational with limitations (or in standby)

Operational with degraded performance

Not functional

Functional but turned off

# Calendar of Events – Summary

Upcoming spacecraft maneuvers and other known events that may impact data distribution are:

- Drag Make-Up maneuver (DMU) for maintaining optimum geo-location:

| S-NPP DMU Schedule |
|---|
| Late Feb-2019 |

| NOAA-20 (JPSS-1) DMU Schedule |
|---|
| 12-Dec 2018 (~1717 UTC) - DMU 002 |

- VIIRS Lunar Roll for VIIRS calibration activities (subject to change):

| S-NPP VIIRS Lunar Roll Schedule | |
|---|---|
| 18 Dec 2018 (~1854 UTC) | 17 Mar 2019 (~0857 UTC) |
| 17 Jan 2019 (~0905 UTC) | 15 Apr 2019 (~1644 UTC) |
| 15 Feb 2019 (~2149 UTC) | 14 May 2019 (~2111 UTC) |

| NOAA-20 (JPSS-1) VIIRS Lunar Roll Schedule | |
|---|---|
| 18 Dec 2018 (~1756 UTC) | 17 Mar 2019 (~0808 UTC) |
| 17 Jan 2019 (~0957 UTC) | 15 Apr 2019 (~1556 UTC) |
| 15 Feb 2019 (~2149 UTC) | 14 May 2019 (~2205 UTC) |

- Inclination Adjustment Maneuver (IAM) to ensure optimum LTAN maintenance:

| S-NPP IAM Schedule |
|---|
| Sep 2019 (TBC) |

| NOAA-20 (JPSS-1) IAM Schedule |
|---|
| Mar 2019 (TBC) |

Last update: 27-Nov-2018

# Calendar of Events – Summary continued…

Other activities:

- VIIRS Day-Night Band (DNB) Calibration Schedule

| S-NPP DNB Calibration Schedule | |
|---|---|
| 7 Dec 2018 | 6 Mar 2019 |
| 6 Jan 2019 | 5 Apr 2019 |
| 4 Feb 2019 | 4 May 2019 |

| NOAA-20 (JPSS-1) DNB Calibration Schedule | |
|---|---|
| 7 Dec 2018 | 6 Mar 2019 |
| 6 Jan 2019 | 5 Apr 2019 |
| 4 Feb 2019 | 4 May 2019 |

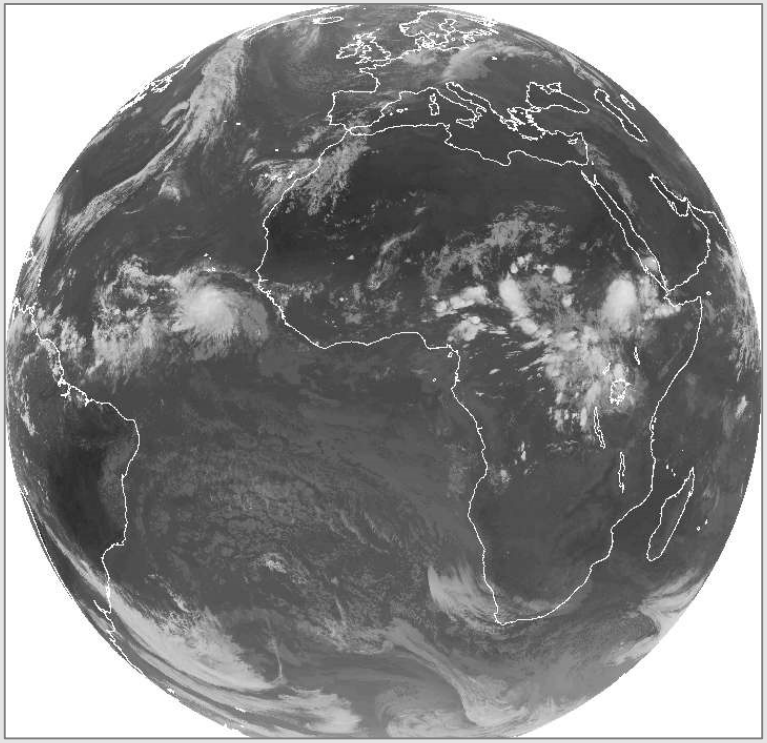
- **Dec 3, 2018**– NOAA-20 HRD/Direct-Readout data/product reduction in order to mitigate HRD buffer overflow conditions that can result in some missing HRD data to direct-readout sites
  - Removal of NOAA-20 VIIRS M07 from HRD transmission is tentatively planned

- **31 Dec 2018** – Planned Distribution Termination JPSS IDPS produced Environmental Data Records (EDR) HDF5 products.

- Annual COOP/Backup Exercise – Fairmont, WV
  - Next planned exercise (TBC): **Apr/May/Jun 2019** time period

Last update: 27-Nov-2018

# Current MSG Constellation



| SATELLITE | LIFETIME | POSITION | SERVICES |
|---|---|---|---|
| **Meteosat-11** | Launched: 15/07/2015<br>Availability lifetime is until 2024 | **0°** | 0º SEVIRI Image Data. Real-time Imagery. |
| **Meteosat-9** | Launched: 22/12/2005<br>Availability lifetime is until 2024 | **3.5° E** | Rapid Scan Service gap filling spacecraft and back-up to prime Met-11 spacecraft |
| **Meteosat-10** | Launched: 05/07/2012<br>Availability lifetime is until 2024 | **9.5° E** | Rapid Scan Service Real-time Imagery. |
| **Meteosat-8** | Launched: 28/08/2002<br>Availability lifetime is until 2020 | **41.5° E** | Full IODC service. Real-time imagery. |

Note – EUMETSAT performs periodic SERVI (imager) decontamination process which requires activation of spare (spare is active for 2-3 weeks )

# NOAA MSG (Prime) DOMSAT Service Cancelled

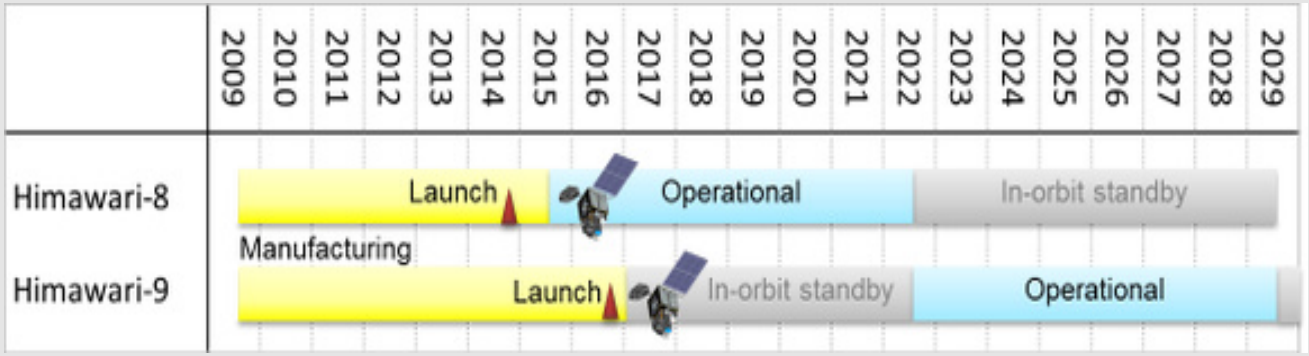
- Due to aging EUMETSAT hardware encryptor/decryptor equipment in the user network chain, the NOAA MSG DOMSAT service was cancelled on November 16, 2018
- DOMSAT users were notified in advance of the cancellation to take the appropriate action to maintain access to prime MSG data at 0 degrees
- Alternate MSG data sources available after DOMSAT service cancellation:
  - PDA (currently in a freeze for new users)
  - STAR
  - EUMETCast Terrestrial and Satellite Broadcast Services
  - GTS

# Future Meteosat Third Generation (MTG) Series

- **MTG-I1**
  - Launch scheduled for Q3, CY2021
  - 16 channel imager (FCI)
  - Lightning imager (LI)
- **MTG-S1**
  - Launch scheduled for Q1, CY2023
  - Infrared sounder (IRS)
  - Ultraviolet, Visible and Near-Infrared Sounder (UVN)
- Operational delivery options for MTG data are in the process of being determined
  - Current use: High-speed/capacity trans-Atlantic comm links between EUMETSAT and NOAA (called JEUNO)

# Himawari-8/9 Constellation

- Himawari-8 is operational at 140E
- Himawari-9 is in standby at 140.7E
  - Slated for prime 140E operations in 2022
  - Himawari-9 end of life around 2031



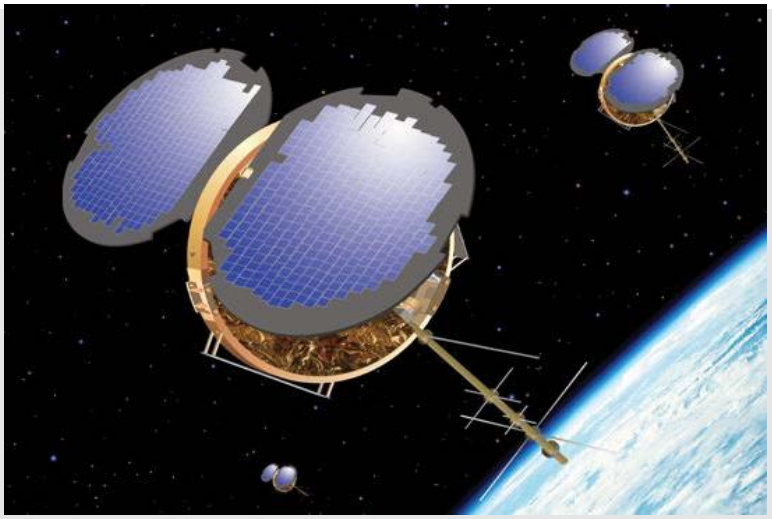

*NESDIS plans to distribute Himawari-8 data through Product Distribution and Access (PDA) In February-March 2019 timeframe (operationally 24x7 support)

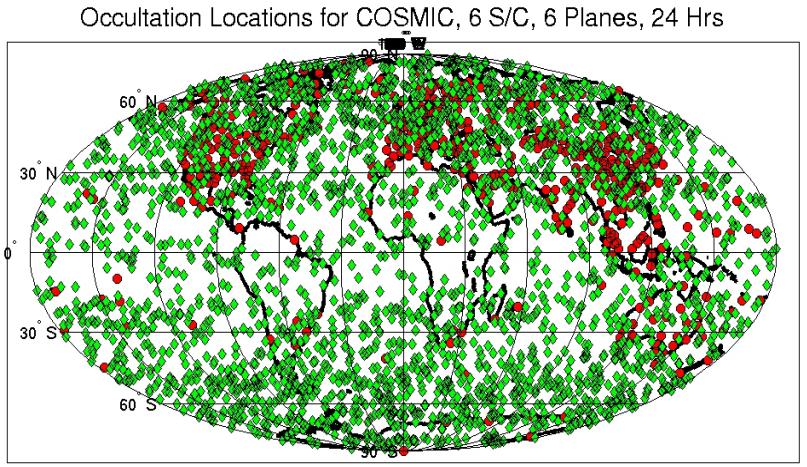
# Questions?

# Backup

# COSMIC (Constellation Observing System for Meteorology, Ionosphere and Climate)

- 6 Satellites launched in Apr 2006
- Joint effort - U.S. and Taiwan
- 2 of 6 COSMIC-1 satellites operational
  - ✓ GPS radio occultation data (among best sources of data for improving forecast accuracy)
  - ✓ 3-D profiles of temperature, humidity, and pressure, as well as electron density in the ionosphere
- COSMIC-1 issues with battery failing – data is intermittent and sunlight dependent
- COSMIC-2A, a new set of 6 satellites, is to be launched no earlier than Apr 2019
- Development of a 2nd set of 6 COSMIC satellites, known as COSMIC-2B, not supported due to funding issues.






UCAR COMMUNITY PROGRAMS | COSMIC

http://www.cosmic.ucar.edu/index.html

# DMSP Polar Mission Status

- DMSP is the longest running production satellite program ever
- 5 s/c in Polar Orbit
- Program is in Fly-out Status
- Air Force is working on new Constellation to replace DMSP