Joint Polar Satellite System (JPSS)

New capabilities in satellite observations

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Why JPSS?
JPSS provides...

...the most critical data for numerical weather prediction to enable accurate 3-7 day ahead forecasts, giving high confidence to emergency managers in advance of severe weather events

...operational weather and environment satellite observations for Alaska and Polar Regions operational forecasting

...global coverage and unique day and night imaging capabilities in support of civilian and military needs

*Without JPSS, the Nation will experience an immediate degradation in weather forecasting capability*
Improvements in forecasting

From ECWMF
JPSS: Supporting the Advanced Forecast Enterprise

“2011” Irene Forecast
Advanced Forecast Enterprise
Observations + Models + Supercomputers + Expert Forecasters

“2001” Irene Forecast

Without JPSS data in the models, Irene’s path would have been less accurately predicted, resulting in more evacuations and greater economic impact to coastal communities.
Measurements from polar satellites enabled forecasters to predict Sandy’s infamous “left hook.” Without this data, weather models would not have identified this left-hand turn and forecasts would have placed the storm out to sea.

Hurricane Sandy’s path with and without polar satellite data

Suomi NPP VIIRS Day/Night Band image of Sandy
Credit: CIMSS

NOAA satellite imagery reveals the intensity of the storm.
Credit: GOES-13
JPSS: Integral to 3-Orbit Global Polar Coverage

• JPSS implements U.S. Space Policy and international agreements to ensure:
  Global coverage Observational continuity for the afternoon orbit

• Orbits:
  Early Morning: DoD
  Mid Morning: EUMETSAT
  Afternoon: NOAA

• 3-orbit coverage provides vast majority of data critical to 3-7 day ahead forecast and environmental monitoring

• JAXA provides microwave imagery
<table>
<thead>
<tr>
<th>JPSS Instruments</th>
<th>Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATMS - Advanced Technology Microwave Sounder</td>
<td>ATMS and CrIS together provide high vertical resolution temperature and water vapor information needed to maintain and improve forecast skill out to 5 to 7 days in advance for extreme weather events, including hurricanes and severe weather outbreaks</td>
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<tr>
<td>CrIS - Cross-track Infrared Sounder</td>
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<tr>
<td>VIIRS – Visible Infrared Imaging Radiometer Suite</td>
<td>VIIRS provides many critical imagery products including snow/ice cover, clouds, fog, aerosols, fire, smoke plumes, vegetation health, phytoplankton abundance/chlorophyll</td>
</tr>
<tr>
<td>OMPS - Ozone Mapping and Profiler Suite</td>
<td>Ozone spectrometers for monitoring ozone hole and recovery of stratospheric ozone and for UV index forecasts</td>
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<tr>
<td>CERES - Clouds and the Earth’s Radiant Energy System</td>
<td>Scanning radiometer which supports studies of Earth Radiation Budget (ERB)</td>
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</tbody>
</table>
JPSS-1 Spacecraft

Clouds and the Earth’s Radiant Energy System

Ozone Mapping Profiler Suite

Advanced Technology Microwave Sounder

Cross-track Infrared Sounder

Visible Infrared Imaging Radiometer Suite
JPSS provides a wide range of capabilities

- **Microwave** – provides temperature and moisture soundings in cloudy conditions and rainfall rates, sea ice, snow, surface temperature.

- **Infrared** – provides high vertical resolution temperature and moisture soundings in clear and cloud corrected regions; atmospheric chemistry - CO, CH4, SO2, ... and cloud products.

- **Visible (day & night) and Infrared Imagery** (including deep blue channels) – chlorophyll, cloud imagery, cloud products, SST, Active Fires, Smoke, Aerosols, land products, Snow, Ice, oil spills... at exceptional resolution/global coverage.

- **UV** - ozone - Aerosols over bright surfaces, SO2 plumes, NOx (air quality)...
JPSS Supports NOAA’s Mission

- JPSS supports all four key NOAA mission areas

Improved understanding of a changing climate system that informs science, service, and stewardship

Reduced loss of life from high-impact weather events while improving efficient economies through environmental information

Improved coastal water quality support that enables coastal communities to effectively manage resources and improve resiliency

Improved understanding of ecosystems to inform resource management decisions
**JPSS Program Data Products**

**VIIRS (26 EDRs)**
- RDR & SDR (for each of 22 bands)
- EDRs: Active Fires, Albedo (Surface), Aerosol Optical Thickness, Aerosol Particle Size Parameter, Cloud Base Height, Cloud Cover Layers, Cloud Effective Particle Size, Cloud Optical Thickness, Cloud Top Height, Cloud Top Pressure, Cloud Top Temperature, Cloud Mask, Ice Surface Temperature, Imagery, Land Surface Temperature, Ocean Color/Chlorophyll, Sea Ice Characterization, Snow Cover, Surface Type, Suspended Matter, Vegetation Indices, Green Vegetation Fraction, Polar Winds, Sea Surface Temperature, Vegetation Health Index Suite

**CERES**
- RDR, SDR
- EDRs: Carbon Dioxide, Carbon Monoxides, Infrared Ozone Profile, Methane, Outgoing Longwave Radiation

**CrIS (5 EDRs)**
- RDR, SDR
- EDRs: Cloud Liquid Water Imagery, Precipitation Type/Rate, Precipitable Water, Sea Ice Characterization, Sea Surface Temperature

**ATMS (11 EDRs)**
- RDR, SDR, TDR
- EDRs: Cloud Liquid Water Imagery, Land Surface Emissivity, Land Surface Temperature, Moisture Profile, Rainfall Rate, Sea Ice Concentration, Snow Cover, Snow Water Equivalent, Temperature Profile, Total Precipitable Water

**OMPS-Nadir (2 EDRs)**
- OMPS-N RDR & SDR
- EDRs: O₃ Total Column, O₃ Nadir Profile

**OMPS-Limb**
- OMPS-L RDR

**AMSR2 (11 EDRs)**
- RDR, SDR, TDR
- EDRs: Cloud Liquid Water Imagery, Snow Cover, Snow Water Equivalent, Soil Moisture, Surface Temperature

**KEY**
- RDR – Raw Data Record
- SDR – Sensor Data Record
- TDR – Temperature Data Record
- EDR – Environmental Data Record
- ◊ – Products with Key Performance Parameters
- **Bold** – Indicates JPSS Ground System xDR
- *Italicics* – Indicates NOAA Polar Legacy (ESPC) xDR

Notes:
1. RDRs for the JPSS-2 Mission are contingent on NASA manifest of the Radiation Budget Instrument (RBI)
2. Not applicable to JPSS-1; contingent on NASA manifest of OMPS-Limb on the JPSS-2 Mission
3. Dependent on the Global Change Observation Mission (GCOM) provided by the Japan Aerospace Exploration Agency

The JPSS Program includes Ground System Support for the Metop, DMSP, and GCOM missions.

December 18, 2014
This chart is controlled by JPSS Program Systems Engineering
JPSS System Architecture

- Svalbard, Norway
- Fairbanks, Alaska
- NWS-National Weather Service
- NOS-National Ocean Service
- NSOF-National Satellite Operations Facility
- McMurdo, U.S. Antarctic Research Station
Polar Satellite Launch Schedule

NOAA & Partner Polar Weather Satellite Programs
Continuity of Weather Observations

As of April 2015

Approved:

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

DMSP: Defense Meteorological Satellite Program
JPSI: Joint Polar Satellite System Program
Suomi NPP: Suomi National Polar-orbiting Partnership

Note: DoD and EUMETSAT data provided for reference only

Operational based on design life
Operational beyond FY 2036
Extended mission life
Launched before Oct 2008
Much improved latency starting with JPSS-1

Polar region latency improved from 2 hours to 10 minutes
95% of the data is within 50 minutes (taking into account BUFR conversion, etc)
Between +- 50 degrees latitude ~ 30 minutes
Actual performance will be 50% better than specification

JPSS-1 uses real-time playback of data at least while still in view of the ground station, which reduces the minimum latency number, while SNPP plays back first the oldest data of the entire orbit.
✓ Launch JPSS-1 by March 2017

✓ Ensure KPP operational readiness (CriS, ATMS and VIIRS Imagery) 90 days after launch

✓ More efficient - use enterprise algorithms to reduce overall costs

✓ Need user plans/engagement to be more aligned with product development and operational availability
Lifecycle

Development
(new or enhanced algorithm)

Validation
(Is the product meeting requirements?)

Long Term Monitoring
(Sustainment)

Application
(why we are in business)
Suomi NPP is producing outstanding data
- The satellite is healthy and producing a high availability of data (~99.99%)
- Operations of the satellite transferred from NASA to NOAA in 2013
- Suomi NPP is the primary operational polar-orbiting satellite for NOAA

JPSS-1 is executing as planned
- Instruments and spacecraft are proceeding well
- Instruments are assembled and undergoing testing; one is prepared for integration
- The spacecraft bus is built and undergoing testing
- Development and implementation of the new ground data processing system are underway

JPSS-2 development underway
- The instruments are progressing well
- Spacecraft has started
Thank you so much!

Excellent feedback from our users - Worldwide

This animation depicts a year’s worth of vegetation data from the VIIRS instrument on Suomi NPP
Thank You

www.jpss.noaa.gov