Joint Polar Satellite System: The United States Next Generation Civilian Polar Orbiting Environmental Satellite System

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Joint Polar Satellite System
National Environmental Satellite, Data, and Information Service
National Oceanic and Atmospheric Administration
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How JPSS Advances Weather Forecasting & Climate Monitoring

JPSS supports all four key NOAA mission areas

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

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

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

Improved understanding of ecosystems to inform resource management decisions
The JPSS Program

JPSS is the next generation of U.S. civil operational polar-orbiting satellites. The JPSS program is a partnership between NOAA and NASA, including agreements with EUMETSAT, JAXA and DoD. JPSS consists of:

- Suomi NPP satellite, JPSS-1 satellite, and JPSS-2 satellite
- Four primary instruments
- Global ground system (Alaska, Colorado, Maryland, West Virginia, Norway, Antarctica)

NOAA Responsibilities:
- Operations, data product science, enterprise ground services
- End-to-end responsibility, requirements, funding, data delivery to National Weather Service, international and inter-agency agreements

NASA Goddard Space Flight Center Responsibilities:
- Systems Engineering lead
- Acquisition, Launch, Safety and Mission Assurance

International Partnerships:
- EUMETSAT
- JAXA

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<th>JPSS Schedule</th>
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<td><strong>Launch Dates</strong></td>
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<td>No later than 2nd Quarter FY 2017 (JPSS-1); 1st Quarter FY 2022 (JPSS-2)</td>
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<td><strong>Program Architecture</strong></td>
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<td>3 Satellites (Suomi NPP, JPSS-1, JPSS-2)</td>
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<td>Suomi NPP: 5-year operational design life; JPSS-1: 7-year operational design life</td>
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Why JPSS?

- Polar satellites, like JPSS, are critical for the accuracy of forecasts three to seven days in advance of a severe weather event.
- JPSS represents significant technological and scientific advances in environmental monitoring and helps advance weather forecasting, environmental assessments and climate monitoring.
- JPSS provides continuity of Earth’s key observations, including oceans, clouds, ozone, snow, ice, vegetation and atmosphere—ensuring a continuous series of global weather data. JPSS is the follow-on for the NOAA Polar-orbiting satellites (POES) and NASA Earth-observing satellites (EOS).
- Data from JPSS instruments provide more than 30 years of consistent observations that have allowed scientists to monitor the climate.
- NOAA’s environmental satellites are the backbone of life-saving weather forecasts and advance hazardous outlooks. There is no substitute for the role they play in the U.S. and around the world.

Without JPSS, the Nation will experience an immediate degradation in weather forecasting capability.
Operational Use of S-NPP Data

S-NPP is now NOAA’s Primary Satellite

- May 1, 2012, VIIRS imagery used to support local warning and forecast operations throughout the NWS Alaska Region.
- May 22, 2012, the Advanced Technology Microwave Sounder (ATMS) radiances were operationally assimilated in the National Centers for Environmental Prediction’s (NCEP)/ NWS Global Forecast System (GFS).
- September 25, 2012, ATMS data was assimilated operationally into the European Centre for Medium-Range Weather Forecasts (ECMWF) weather forecast models.
- April 2013, the United Kingdom Meteorology Office began assimilating operational data from the Cross-track Imaging Radiometer Suite (CrIS) and ATMS into its weather forecast models.
- August 20, 2013, NCEP began incorporating S-NPP CrIS satellite data operationally into the GFS.
- October 31, 2013, NCEP/CPC started to use OMPS Ozone operationally
- November, 2013, NRL started to use ATMS operationally in their global forecast model.
## SNPP Algorithm Maturity Status
### Sept 2014 vs. Sept 2013

<table>
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<tr>
<th>Products</th>
<th>Status Sep-13</th>
<th>Status Sep-14</th>
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<td><strong>SDR</strong></td>
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<td>CrIS</td>
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<td>OMPS</td>
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<td>Imagery (non-NCC)</td>
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<td>Imagery NCC</td>
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<td>VIIRS Cloud Mask</td>
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<td>Cloud Properties</td>
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<td>Aerosol Optical Thickness</td>
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<td>Aerosol Particle Size Parameter</td>
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<td><strong>EDR</strong></td>
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<td>Surface Albedo</td>
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<td>Vegetation Indices</td>
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<td>Surface Reflectance IP</td>
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<td>Ocean Color / Chlorophyll</td>
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<td>Sea Surface Temperature</td>
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<td>Ice Surface Temperature</td>
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<td>Sea Ice Characterization</td>
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<td>Snow Cover - Binary Mask</td>
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<td>Snow Cover - Fraction</td>
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<td>Sounding (NUCAPS)</td>
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<td>OMPS Ozone EDR</td>
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**Colors:**
- **Beta:** Red
- **Provisional:** Orange
- **Validated:** Green

AMSU equivalent field of view reduce by factor of 3 ~ 0.09 K

AMSU instrument temperature varies more due to solar heating causing seasonal noise effect
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; two have been delivered for integration
- The spacecraft bus is built and undergoing testing
- Development and implementation of the new ground data processing system are underway

JPSS-2 procurement activities are progressing well
- The VIIRS sensor is under contract and others are in evaluation
- The spacecraft bus procurement is underway
The JPSS Proving Ground and Risk Reduction program’s primary objective is to maximize the benefits and performance of S-NPP/JPSS data, algorithms, and products for downstream operational and research users (gateways to the public) through:

• Engaging users to enhance/improve their applications through the optimal utilization of JPSS data.
• Education, Training and Outreach
• Facilitating transition of improved algorithms to operations.
• Detailed characterization of data attributes such as uncertainty (accuracy and precision) and long-term stability
• Provides user feedback to the cal/val program
JPSS Proving Ground and Risk Reduction Application Areas

- **Weather Forecasting** - Improving Global, Regional forecasts
  - Tropical Cyclones
  - Severe Weather (Nowcasting)
- **Ocean/Coastal** - Coral Bleaching, Harmful Algal Bloom alerts
- **Land** - Droughts, Agriculture
- **Hazards** - Smoke, Fire, Volcanic Ash, Air Quality
- **Hydrological** - Precipitation, Floods, Soil Moisture, Snow/Ice, River Ice
- **Climate** - Integrated products, real-time anomaly products
- **Education and Training**
- **Infrastructure** - Direct Readout + Software (CSPP), Airborne campaigns

**JPSS Proving Ground Partners:**
NWS, NOS, NMFS, OAR, NESDIS, NOAA Cooperative Institutes, NASA, and NRL
Two VIIRS Visible Granules – 12 hours apart
Notice the clarity/resolution from edge to edge.
Entire continent is observed from a single instrument
Kona Gyre
Before and After Hurricane Isselle

Hurricane ISELLE
Advisory #021
8:00 AM PDT Tue
August 05, 2014
Integrating various satellite data is well recognized and emphasized.
LANDSAT 8 (30 meter resolution vs VIIRS (375 meter resolution)

But Landsat has a 16 day repeat cycle – it will not observe this location for another 16 days

VIIRSS 375 meter resolution is adequate for fire behavior modeling – predicting fire movement and smoke direction and speed. GOES-R will tell you where the smoke came from, but difficult to predict because of spatial resolution (need < 500 meter resolution)
Comparing MODIS (250m) to VIIRS (375m) Edge of Scan
Conclusion

• Current suite of instruments on Suomi NPP will be flown on JPSS-1 satellite mission and offer significant improvements in observational capability from the legacy POES satellite series and continue EOS research capabilities.

• The JPSS mission is critical to provide the U.S. and international community with operational continuity of key weather and climate observations established by NOAA and NASA.

• The NOAA satellite climate data records from 1970s will be continued by JPSS.

• JPSS is on track, on budget and schedule for upcoming JPSS-1 satellite mission in early 2017.
QUESTIONS?

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www.jpss.noaa.gov