Launch of new satellite will sharpen weather observations

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The 4,700-pound NPP satellite towered over assembly workers preparing it for today's launch into orbit about 500 miles above Earth. Its advanced instruments and programming are a notable step forward for weather and climate monitoring from space. Credit: courtesy NASA

From a launching pad at California's Vandenberg Air Force Base our newest weather satellite rose into orbit last week, buoyed by know-how from the University of Wisconsin-Madison's atmospheric and space science community.

Called NPP, for NPOESS Preparatory Program, the polar-orbiting satellite is a test bed for equipment intended for a generation of planned weather and climate satellites to be jointly operated by NASA and the National Oceanic and Atmospheric Administration.

A polar-orbiting satellite follows a north-to-south, south-to-north path from pole to pole, making the trip in about 100 minutes. The satellite's path means the local time beneath it is always the same — about 1:30 p.m. in NPP's case.

"This is a real advance for NOAA operational systems," says Jeff Key, chief of the agency's Advanced Satellite Products Branch, a NOAA group at the UW-Madison-based Cooperative Institute for Meteorological Satellite Studies. "It's not like anything up there."

Originally intended to pave the way for the National Polar-orbiting Operational Satellite System (a civilian-military partnership dissolved in 2010), the 4,700-pound NPP is now blazing trail for NOAA and NASA's Joint Polar Satellite System intended to enter service in 2015.

Among NPP's new equipment is the Cross-track Infrared Sounder (CrIS), an instrument built by ITT Geospatial Systems and conceived in the early 1990s by Hank Revercomb, director of UW-Madison's Space Science and Engineering Center, and emeritus atmospheric sciences professor Bill Smith.

CrIS takes in energy emitted by Earth in the form of infrared radiation to measure the water vapor, temperature and pressure at increasingly precise altitudes from the ground up to tens of thousands of feet in the air.

"Those are key ingredients for storms, for any weather conditions we'd like to predict," says Revercomb, who began testing CrIS' sounder

ancestors decades before the current fleet of weather satellites reached space. "CrIS will allow us to measure those ingredients with three times the vertical resolution of the old system."

Resolution is a big deal to meteorological satellite operators. Several of NPP's five new instruments offer such a marked jump in detail in the data weather predictors and climate scientists expect to collect that an important part of the satellite's mission is to acquaint its handlers with its capabilities.

"We have to explore what we can do with these new instruments," says Andy Heidinger, a cloud researcher and NOAA physical scientist at UW-Madison. "The overall quality of the imagery should be improved a lot. It's like going from a 13-inch TV to a big, new HD screen."

Key, Heidinger and other scientists at CIMSS and SSEC are working to ensure the NPP satellite's programming — the algorithms written at companies like Northrop Grumman used to translate collected data into useful descriptions of weather conditions in the atmosphere — is accurate and working as anticipated.

NPP itself has a similar role among its orbit-mates, which include four polar-orbiting NOAA satellites that are getting long in the tooth.

"We've been using the same systems — with upgrades, I don't want to short-change the upgrades — since 1978," Revercomb says.

The new satellite and its fresh eyes will sharpen the data still streaming down from earlier platforms.

"These newer, higher resolution instruments become in-flight standards to compare to the data we're still getting from older satellites," Revercomb says. "Knowing a few key things happening in the blind

spots of lower-resolution instruments improves the accuracy of their data and extends their usefulness."

UW-Madison researchers produce the software required to handle a Direct Broadcast link from weather satellites including NPP. Direct Broadcast allows people around the world to set up an antenna and download information from the satellites in minutes, instead of waiting for hours to receive data from NOAA and NASA's own download sites.

"We ought to be proud as a nation to provide to countries that don't have our capabilities," Revercomb says. "This information more than pays for itself in terms of safety and economic value. We know when it's going to freeze, when it's going to flood, when fog will appear. These have real impacts on people's lives every day."

NPP and its follow-on satellites in the JPSS group will have real impact on our weather-prediction ability and accumulating record of Earth's climate.

"The improvements we're making in our understanding of the weather are incremental, but very meaningful," Revercomb says. "The forecast used to be valid for two days. Now we get the same accuracy for four days. NPP will make even better results possible."

Provided by University of Wisconsin-Madison