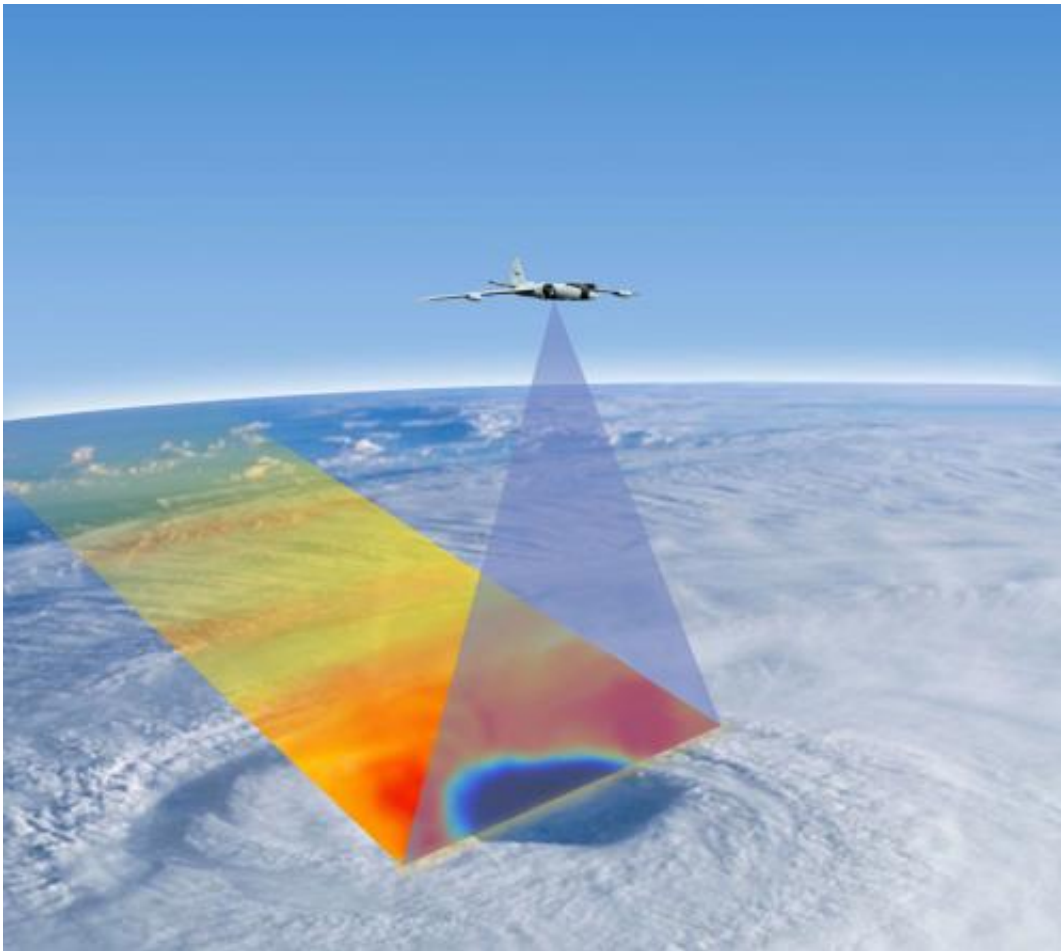


# NASA's HS3 mission spotlight: The HIRAD instrument

July 24 2014

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This is an artist's concept of aircraft with HIRAD scanning a tropical cyclone.  
Credit: NASA

The Hurricane Imaging Radiometer, known as HIRAD, will fly aboard

one of two unmanned Global Hawk aircraft during NASA's Hurricane Severe Storm Sentinel or HS3 mission from Wallops beginning August 26 through September 29.

One of the NASA Global Hawks will cover the storm environment and the other will analyze inner-storm conditions. HIRAD will fly aboard the inner-storm Global Hawk and will be positioned at the bottom, rear section of the aircraft.

"HIRAD's purpose is to map out where the strongest winds are in a hurricane. During its first deployment in 2010 for the GRIP airborne campaign, HIRAD had two interesting hurricane cases, Earl and Karl," said Daniel J. Cecil, the principal investigator for the HIRAD instrument at NASA's Marshall Space Flight Center, Huntsville, Alabama. "We have made improvements to the instrument since then, and are looking forward to the next good case - out over water, avoiding land of course!"

## **What is HIRAD?**

HIRAD is a passive microwave radiometer that was developed at NASA Marshall. A radiometer is an instrument used to measure the power of electromagnetic radiation. Because HIRAD is a passive microwave radiometer it detects microwave radiation naturally emitted by Earth. The radiation HIRAD detects is then used to infer [wind speed](#) at the surface of an ocean.

The antenna on HIRAD makes measurements of microwaves emitted by the ocean surface that are increased by the storm. As winds move across the surface of the sea they generate white, frothy foam. This sea foam causes the ocean surface to emit increasingly large amounts of microwave radiation, similar in frequency or wavelength, but much lower intensity, to that generated within a typical home microwave oven. HIRAD measures that microwave energy and, in doing so, allows

scientists to deduce how powerfully the wind is blowing. With HIRAD's unique capabilities, the two-dimensional structure of the surface wind speed field can be much more accurately determined than current operational capabilities allow.

## **What information does HIRAD provide?**

HIRAD provides unique observations of sea surface wind speed, temperature and rain. The data HIRAD gathers will advance understanding and predictability of hurricane intensity. HIRAD's data will also help better determine maximum wind speed and structure of the vortex (spinning center). The region of strongest winds are also much better observed with HIRAD than current capabilities.

When HIRAD makes cross track scan, it reads a swath of passive [microwave radiation](#) emitted from Earth. HIRAD obtains measurements of rain rates and hurricane-strength winds, even through heavy rain. HIRAD measures rain rates ranging from ~ 5 to 100 millimeters per hour (0.2 to 3.9 inches per hour) and wind speeds ranging from ~10 to 85 meters per second (22.3 to 190.1 miles per hour / 36 to 306 kilometers per hour).

## **How is the data visualized?**

The HIRAD instrument provides "brightness temperature data" that is color-coded by the HIRAD team at NASA Marshall. That color-coded data shows areas of falling rain and possible moderate-to-strong surface winds.

## **HIRAD's previous HS3 mission performance**

HIRAD flew aboard a Global Hawk in the 2013 HS3 mission. On Sept.

15, 2013, the HIRAD instrument scanned Hurricane Ingrid from its perch on the NASA Global Hawk. "HIRAD data definitely saw most of the strong wind and heavy rain on the northern and eastern sides of Hurricane Ingrid in the area generally near 23 degrees north latitude and 95 degrees west longitude," Cecil said.

## **What is NASA's HS3 mission?**

NASA's HS3 mission is a collaborative effort that brings together several NASA centers with federal and university partners to investigate the processes that underlie hurricane formation and intensity change in the Atlantic Ocean basin. The 2014 flights from NASA's Wallops Flight Facility in Virginia will take place between Aug. 26 and Sept. 29 during the peak of the Atlantic [hurricane](#) season that runs from June 1 to Nov. 30.

The HS3 mission is funded by NASA Headquarters and overseen by NASA's Earth System Science Pathfinder Program at NASA's Langley Research Center in Hampton, Virginia, and is one of five large field campaigns operating under the Earth Venture program. The HS3 mission also involves collaborations with partners including the National Centers for Environmental Prediction, Naval Postgraduate School, Naval Research Laboratory, NOAA's Hurricane Research Division and Earth System Research Laboratory, Northrop Grumman Space Technology, National Center for Atmospheric Research, State University of New York at Albany, University of Maryland - Baltimore County, University of Wisconsin, and University of Utah.

Provided by NASA's Goddard Space Flight Center

Citation: NASA's HS3 mission spotlight: The HIRAD instrument (2014, July 24) retrieved 20 March 2024 from <https://phys.org/news/2014-07-nasa-hs3-mission-spotlight-hirad.html>

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