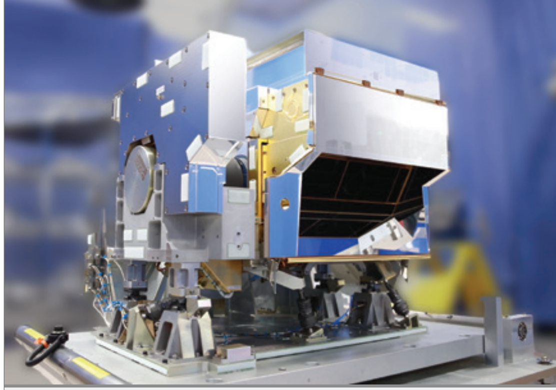
L3HARRIS®
FAST. FORWARD.

CROSS-TRACK INFRARED SOUNDER (CRIS)



A top contributor to weather forecast accuracy worldwide

To produce accurate forecasts, weather prediction models require detailed observations from Earth's surface to the top of the atmosphere. L3Harris' CrIS instrument observes more than 2,000 infrared channels to provide comprehensive information about temperature and moisture from around the globe, improving both the quality and quantity of data collection.

ENHANCING WEATHER FORECASTING

CrIS is the world's most advanced hyper-spectral sounder and a key sensor on the National Oceanic and Atmospheric Administration's (NOAA's) Joint Polar Satellite System (JPSS).

CrIS represents a significant enhancement over the legacy infrared sounder, the High-Resolution Infrared Radiation Sounder, also built by L3Harris. CrIS breaks infrared energy emitted by the atmosphere into more than 2,000 channels compared to 19 previously, resulting in better vertical resolution or more data at more levels of the atmosphere. The more levels of data, the better the weather forecast.

The CrIS instrument, designed and built by L3Harris, is an advanced spectrometer that produces high-resolution, three-dimensional temperature and moisture profiles from space. These profiles improve the accuracy of weather forecasting models, especially for extreme weather three to seven days in advance. CrIS also aids "nowcasting" for severe weather, including thunderstorms and tornadoes, and improves understanding of longer-term weather and climate phenomena, such as El Niño and La Niña.

"While CrIS was developed primarily as a temperature and water vapor profiling instrument for weather forecasting, its high accuracy and extensive information about trace gases, clouds, dust, and surface properties make it a powerful tool for climate applications."

Source: "The Cross-track Infrared Sounder Level 1B Product: NASA's Accurate and Stable Infrared Hyperspectral Radiance Record" by Tobin, et. al., presented at The EGU General Assembly 2024.

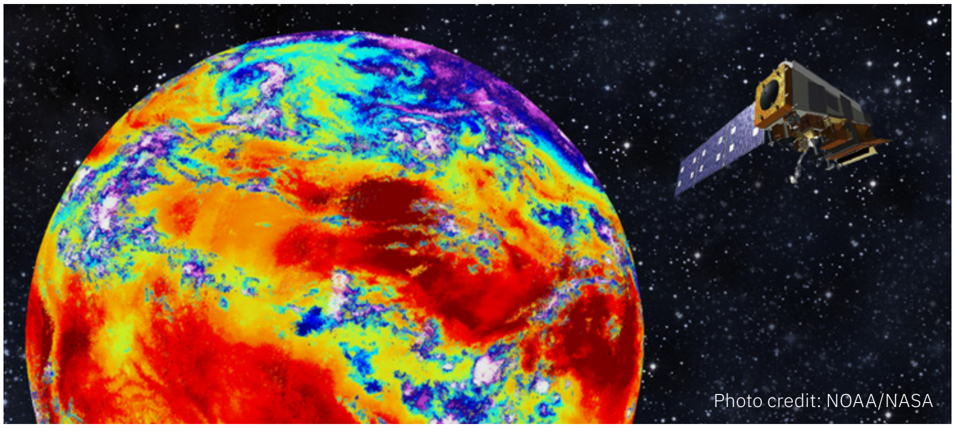


Photo credit: NOAA/NASA

BENEFITS

- 2,211 infrared channels produce three-dimensional profiles of temperature and moisture generating more vertical detail than previous technology
- Data provided by CrIS improves the accuracy of weather models, especially for extreme weather forecasts three to seven days in advance
- CrIS improves short-term forecasts for severe weather and the understanding of longer-term phenomena such as El Niño

A DETAILED LOOK AT CRIS

A Fourier transform spectrometer, CrIS provides atmospheric soundings with 2,211 spectral channels over three wavelength ranges: LWIR (9.14-15.38µm), MWIR (5.71-8.26µm) and SWIR (3.92-4.64 µm). The instrument has an 8-centimeter clear aperture and uses plane mirror interferometer technology.

CrIS scans a 2,200 kilometer swath width, plus or minus 50 degrees, with 30 Earth-scene views. Each view consists of nine fields-of-view (FOVs) with 14-kilometer diameter spots in a 3x3 array. Each scan, with an 8-second repeat interval, includes views of a warm calibration point (the internal calibration target) and a cold calibration point (a deep space view).

The overall instrument data rate is less than 2.41 megabits per second. L3Harris uses only photovoltaic detectors for the CrIS instrument.

The detectors are cooled to approximately 81 Kelvin using a four-stage passive cooler with no moving parts. They have a low-risk heritage design of over 50 space units.

CALIBRATION

Calibration of the interferometer is accomplished with both laser wavelength calibration and a neon bulb spectral calibration. The internal calibration target (ICT) consists of a highly emissive, deep-cavity blackbody, utilizing a flight-proven, Advanced Baseline Imager (ABI) heritage design. Temperature knowledge of the ICT is better than 140 millikelvin. A passive vibration isolation system is included to allow instrument operation in a 50 milli-G environment. The instrument optics are thermally decoupled from both the structure and the instrument electronics. The overall instrument design is modular, which allows for parallel assembly and rapid instrument integration.

PARAMETER	SPECIFICATION
Spectral coverage	2,211 spectral channels from 3.92 µm to 15.38 µm
Resolution	FOV 14 kilometer diameter with 1 kilometer vertical layer
Average data rate	2.41 megabits per second
Mass	147 kilograms
Average power	102 watts

CRIS ON JPSS

CrIS is planned to fly on all five JPSS satellites.

- Suomi-NPP (launched 2011)
- JPSS-1 (launched 2017)
- JPSS-2 (launched 2022)
- JPSS-3 (~2032)
- JPSS-4 (~2027)

MODULAR ASSEMBLY

The CrIS instrument consists of six modular assemblies:

- The optical bench provides a stable structure for mounting all the other assemblies
- The scanner sequentially views the Earth, the internal calibration target, then deep space, and directs the infrared energy into the interferometer
- The interferometer breaks the infrared energy into spectral channels, much like the rainbow from a DVD surface
- The photovoltaic focal plane arrays sense the infrared energy and provide electrical signals corresponding to the intensity of the infrared energy
- The four-stage passive cooler is used to cool the focal plane arrays to minimize detection noise
- The electronics assembly controls the instrument and conditions and formats the detector signals for output to the spacecraft

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