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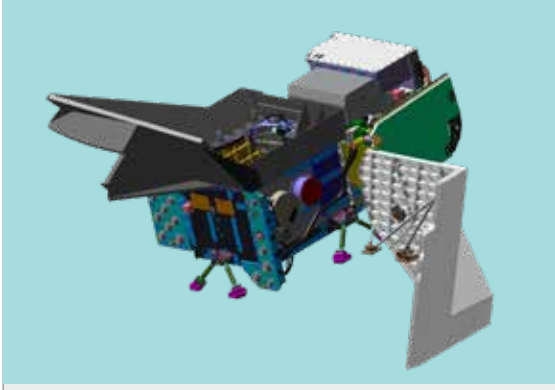
TANSO-FTS-2 INSTRUMENT



With a direct impact on billions of human beings every day, the Earth's environment is among the most vital systems science investigates. L3Harris technology provides cornerstone data for that science with the Thermal and Near Infrared Sensor for Carbon Observation-Fourier Transform Spectrometer-2 (TANSO-FTS-2). The instrument takes global measurements of greenhouse gas concentration in the atmosphere and is the main payload of the Greenhouse Gases Observing Satellite-2 (GOSAT-2).

ADVANCING THE MEASUREMENT OF GREENHOUSE GASES

TANSO-FTS-2 provides very high signal-to-noise levels, very accurate onboard calibration and an agile intelligent pointing (IP) system that increases useful data collections in the presence of clouds.

The instrument measures greenhouse gas concentrations with extremely high accuracy covering the entire globe over a six-day revisit rate. This information is critical to climate monitoring and modeling.

TANSO-FTS-2 measures carbon dioxide, methane and carbon monoxide simultaneously, allowing scientists to discriminate between natural and man-made emissions.

GOSAT-2 is a joint project of Japan's Ministry of the Environment, the Japan Space Exploration Agency and the country's National Institute for Environmental Studies. L3Harris developed the TANSO-FTS-2 under a subcontract to Mitsubishi Electric Corporation.

DESIGN FEATURES ENABLE IMPROVED MISSION PERFORMANCE

GOSAT-2 DESIGN FEATURE	MISSION BENEFITS
Cross-track Infrared Sounder (CrIS)-based passive detector cooler	Achieves needed temperatures with inherent reliability
New intelligent pointing function	Detects cloud-free areas and maximizes measurements
Highly accurate and stable scanner	Minimizes scene-induced interferogram fluctuations
Very linear signal outputs	Minimize radiance errors due to nonlinearity effects
Interferometer improvements	Provide more stable laser outputs; zero path difference position
Target for iterated local search (ILS) characterization	Delivers accurate on-orbit characterizations in two spectral bands
Multiple solar calibration target spectralon surfaces	Excellent knowledge of solar calibration target radiances over life
Flight-proven high-emissivity infrared calibration target	Provides emissivity >0.995 and temperature errors <100 millikelvin for precise calibration accuracy
Temperature stabilizers	Deliver enhanced calibration accuracy
Glint shield	Prevents Earth radiance, spacecraft glints from impacting solar calibration accuracy
ILS integrating sphere	Ensures excellent target uniformity for best ILS calibration
Scanner disturbance minimizers	Avoids zero-velocity points of interferometer turnaround using scanner peak torques
Light baffles	Ensure stray light does not negatively impact calibration
Accurate temperature sensors	Improve calibration corrections using large number of sensors
Fixed-rate sampling	Simplifies onboard processing while ensuring low noise

BENEFITS

- Better greenhouse gas data for climate monitoring and modeling
- Real-time scanner repointing away from clouds doubles the amount of useful data compared to previous technology
- High-resolution spectra measurement in five spectral bands for more detailed data
- Carbon dioxide, methane and carbon monoxide measured simultaneously, enabling estimates of natural versus man-made emissions

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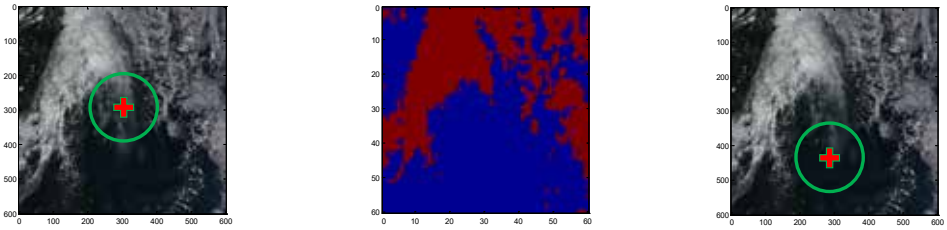
INTELLIGENT POINTING SIGNIFICANTLY INCREASES DATA YIELD

The L3Harris TANSO-FTS-2 features an intelligent pointing system that increases useful data collection in the presence of clouds, which can block the view of infrared sensors.

Before each measurement, a high-resolution red/green/blue (RGB) infrared camera takes a picture of a larger area around the greenhouse gas sensor's line of sight (Figure 1). Onboard processing then uses the raw camera image to create a cloud mask and repoint the sensor to the best cloud-free spot before the interferogram is collected. The whole process only takes about half a second.



1. Raw camera image **2. Derived cloud mask** **3. Sensor repoint to cloud-free area**

Figure 1: TANSO-FTS-2 cloud-free region identification

The percentage of usable cloud-free data collected (Figure 2) increases from 20 percent (green locations) to 46 percent (green plus blue locations), which is an improvement of 130 percent.

Globally, IP is expected to provide a substantial improvement in cloud-free data yield.

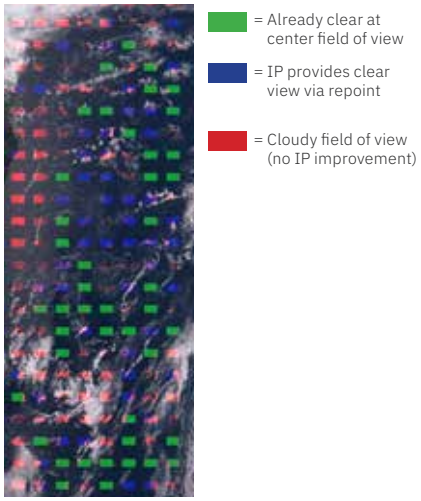


Figure 2: Derived cloud mask data comparison

Japan Aerospace Exploration Agency GOSAT-2

GOSAT-2 DETAILS

- Launched in October 2018
- Weighs about 1,800 kilograms
- Orbits at 613 kilometers in altitude
- Designed for a five-year mission
- Known also as IBUKI-2
- Followed the original 2009 GOSAT carbon dioxide and methane measuring satellite mission
- Improves observation accuracy
- Measures carbon monoxide

TANSO-FTS-2 Instrument for GOSAT-2

L3Harris Technologies is an agile global aerospace and defense technology innovator, delivering end-to-end solutions that meet customers' mission-critical needs. The company provides advanced defense and commercial technologies across air, land, sea, space and cyber domains.

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