

# SCARBOn:

## Advancing Space-Based Monitoring of Greenhouse Gas (GHG) Emissions for More Reliable Climate Insights

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#### Scan to Learn More

Check out for airborne campaign planned for summer 2025 to validate system's performance

**AIRBUS**

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**ABSOLUT SYSTEM**  
INNOVATIVE OPTICAL TECHNOLOGIES

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## The Urgent Need for GHG Monitoring from Space

### Climate Change:

Driven by rising levels of human-made greenhouse gases (GHGs), disrupting global temperatures and ecosystems.

### CO<sub>2</sub>:

Carbon dioxide (CO<sub>2</sub>) is the most significant GHG, responsible for more than two-thirds of current global warming.

### Space-Based GHG Monitoring:

Current efforts primarily focus on detecting methane (CH<sub>4</sub>) leaks, particularly from the oil and gas industry.

### CO<sub>2</sub> Monitoring Challenge:

There is a lack of global, frequent and systematic space-based monitoring of human-caused CO<sub>2</sub> emissions.

**SCARBOn addresses these challenges by leveraging innovative space-based sensors, thereby significantly contributing to climate change mitigation through enhanced data accuracy and reliability.**

## SCARBOn:

Space CARBOn Observatory next step (2024–2026)

- EU Horizon Europe-funded project developing an innovative satellite system for GHG emissions monitoring
- Successor to the HE2020 SCARBO project which laid the technological foundation for SCARBOn
- Coordinated by Airbus Defence and Space (with nine EU-based partners)

### SCARBOn

## Innovation

A conceptual formation of small satellite constellation, carrying the NanoCarb sensor for CO<sub>2</sub> and CH<sub>4</sub> detection and the SPEXone aerosol detector for enhanced accuracy.

- Swath: 200 km and GSD: 2×2 km
- SSO orbits on different orbital planes allowing for different local times of observation
- Complementarity with institutional programs (e.g. CO2M, MicroCarb, TANGO) contributing to a European GHG monitoring system

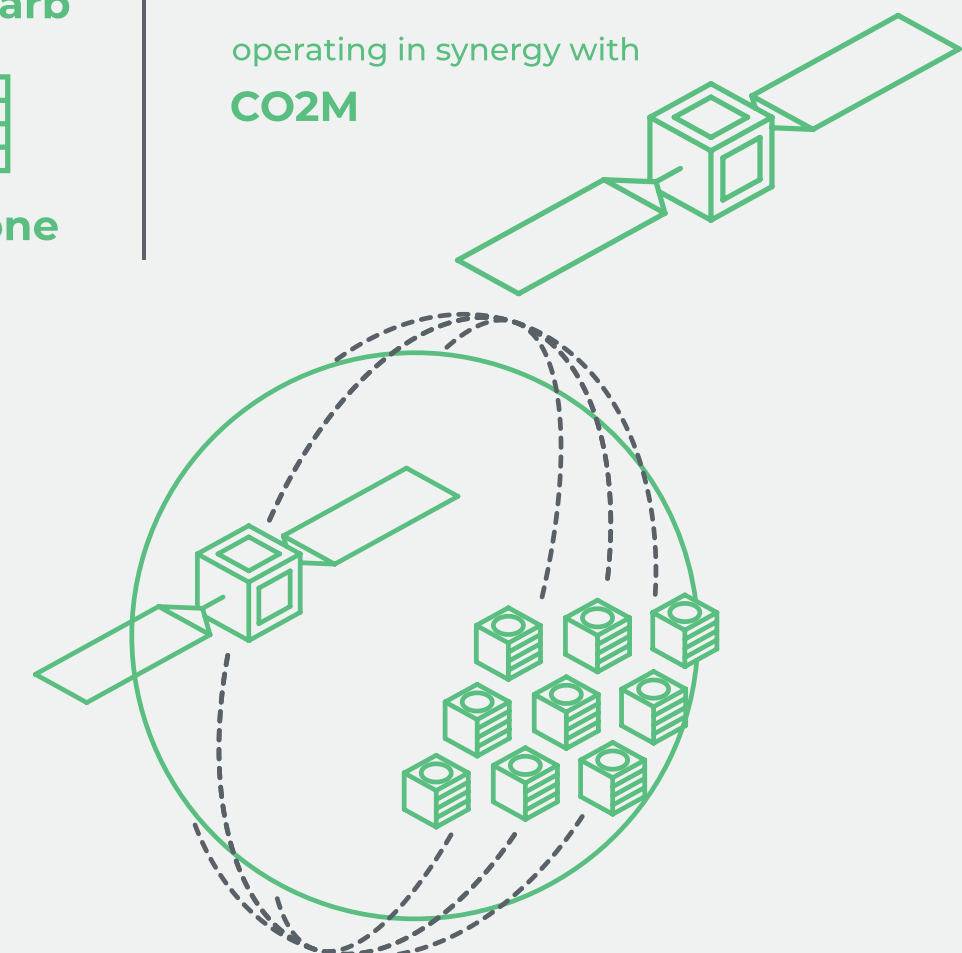
## SCARBOn Technology

**NanoCarb**  
**SPEXone**

**SCARBOn Sat**  
100–150 kg class

**SPEXone + NanoCarb**

operating in synergy with  
**CO2M**



Complementary to the Copernicus Sentinel Mission (CO2M), dedicated to CO<sub>2</sub> measurement, the SCARBOn constellation of small satellites can revisit sites twice a day and obtain reliable data of both CO<sub>2</sub> and CH<sub>4</sub> emissions.

## NanoCarb: Heart of SCARBOn's Mission

Miniaturized (~15×4×4 cm<sup>3</sup>) imaging spectrometer

Full static Fourier Transform Spectrometer

- Each FP thickness chosen to target a particular Optical Path Difference (OPD)
- Focal Plan Array (FPA) intensity modulated by low finesse Fabry-Perot array
- Snapshot acquisition mode



NanoCarb CO<sub>2</sub> camera – prototype



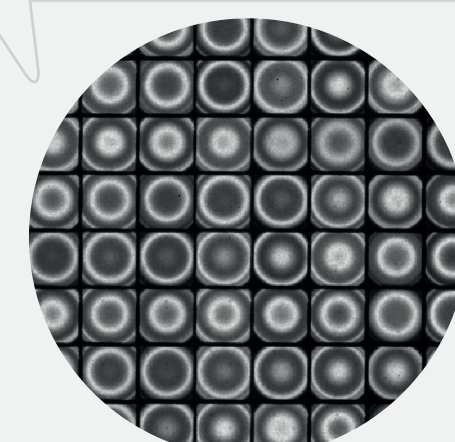
NanoCarb space instrument illustration

## Main SCARBOn NanoCarb Upgrades

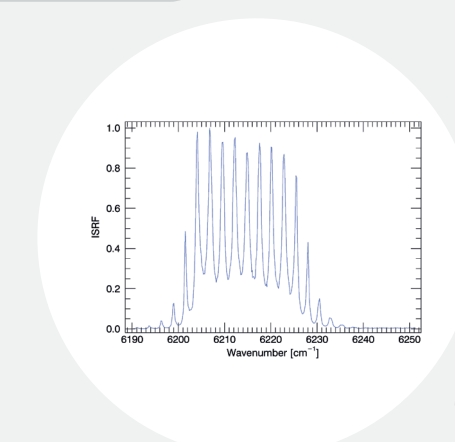
- **Instrument design: interferometer array, narrow-band filter, mecha-thermal housing**
- **Up to 2× sensitivity improvement over the original SCARBO system**
- **Stable performance across varying incidence angles**
- **Reduced correlation between surface albedo and CO<sub>2</sub> retrievals**

### SCARBOn Upgrades on the interferometer array: acquisition of the spectral response function

Frame acquisition at 1607 nm under uniform and monochromatic illumination, showing Fabry-Perot ring pattern collection corresponding each one to one interferometer at a given tickness



Calibration image acquired by the new NanoCarb prototype with the upgraded interferometer array



Single pixel spectral response, showing expected interferometric modulation