GEI-SAT
for advanced & reliable observations of CH$_4$
20 June 2022
GEI-SAT
For the challenge

Detection threshold
Smallest concentration a system detects & quantifies $50\%$ of CH4 emissions

Coverage
Global vs targeted

Pixel size
Identification of smallest sources and geolocation

GEI-SAT constellation
Satlantis’ solution for CH4 observations from EDF, small sources 2020
GEI-SAT

Key technological innovations

- Filters
  - Optimized for methane detection

- Resolution
  - Maximize spatial resolution

- Agility
  - Pointing towards specific targets
GEI-SAT Constellation: Key technological innovations

- Filters
- Resolution 3.7 m
- Higher contrast of the signal
- Non-linear increase of signal

Sanchez-Garcia et al. (2022)

Own

Sentinel

GEISAT
GEI-SAT

Key technological innovations
Perform atmospheric CH4 measurements with high spatio-temporal resolution and simultaneous geolocation of source emitters, to be used for the monitorisation and quantification of methane emissions in the Oil&Gas industry.

**GEI-SAT Missions**

**Constellation deployment roadmap**

- **Q2 2023**
  - **GEI-SAT Precursor**
    - 16U CubeSat (17.4 kg)
    - iSIM-90 VNIR + SWIR
    - ~150 kg/h
    - VNIR 1.65m; SWIR 13m
    - up to 1700 nm

- **Q4 2023**
  - **GEI-SAT Plus**
    - Microsat (92 kg)
    - iSIM-170 VNIR + SWIR
    - ~100 kg/h
    - VNIR 0.8m; SWIR 7m
    - up to 1700 nm

- **2024/25**
  - **GEI-SAT Constellation**
    - 3 Microsats (92 kg)
    - iSIM-170 VNIR + SWIR
    - ~50 kg/h
    - VNIR 0.8m; SWIR 9m
    - up to 2300 nm

**Objectives**

- Expanding spectral capabilities & improving detection threshold.
- Satellite Payload
- Detection threshold
- Spatial resolution
- Spectral range

- Perform at 500km
- Reference values
- Orbit to be defined

**Mission**

- Perform atmospheric CH4 measurements with high spatio-temporal resolution and simultaneous geolocation of source emitters, to be used for the monitorisation and quantification of methane emissions in the Oil&Gas industry.
GEI-SAT precursor

Features

Based on the experience of the first Satlantis’ mission URDANETA

- 16U CubeSat sensor-bus
- Bigger solar panels
- Higher bandwidth download 150 to 300 Mbps X-Band
- Improved AOCS (more precise star-trackers)

Payload

- VNIR Channel with 5 bands (PAN+RGB+NIR)
- SWIR Channel with 5 bands
- Spatial Resolution VNIR 1.65m; SWIR 13m
- Spectral resolution up to 1700 nm

Payload delivery for satellite integration Q4 2022
Launch Q2 2023
GEI-SAT precursor

Roadmap

From the ground to space

ENGINEERING MODEL
COTS cameras & lenses
Ad-hoc filters design
Extensively tested (2020, 2021 & 2022)

PLANE MODEL
On ground tests: Q1 2022
Enagás: Q2 & Q3 2022
Madrid: Q3 2022
USA: Q3 2022

SIMULATIONS
Knowledge, planning and design (2021, 2022 & 2023)

FLIGHT MODEL
Payload delivery for satellite integration: Q4 2022
Launch GEI-SAT precursor: Q2 2023
GEI-SAT precursor
Roadmap - EM

From the ground to space

Lab measurements
- Controlled conditions
- Absorption vs. concentration
- Filter testing

Field test
- Short distance
- Simplest observation strategy
- Automated cloud masking

Field test
- (not so) Short distance
- More complex strategy
- Worse background
**GEI-SAT precursor Roadmap**

*From the ground to space*

**ENGINEERING MODEL**
COTS cameras & lenses
Ad-hoc filters design
Extensively tested (2020, 2021 & 2022)

**PLANE MODEL**
On ground tests: Q1 2022
Enagás: Q2 & Q3 2022
Madrid: Q3 2022
USA: Q3 2022

**SIMULATIONS**
Knowledge, planning and design (2021, 2022 & 2023)

**FLIGHT MODEL**
Payload delivery for satellite integration: Q4 2022
Launch GEI-SAT precursor: Q2 2023
GEI-SAT precursor

Roadmap – PM

From the ground
to space

Field test
Medium distance
Simple strategy
Optics and electronics

@1000m

Flight test
Medium distance
More complex strategy
Worse background

@3000m
GEI-SAT precursor

Roadmap

From the ground to space

ENGINEERING MODEL
COTS cameras & lenses
Ad-hoc filters design
Extensively tested (2020, 2021 & 2022)

PLANE MODEL
On ground tests: Q1 2022
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Madrid: Q3 2022
USA: Q3 2022

SIMULATIONS
Knowledge, planning and design (2021, 2022 & 2023)

FLIGHT MODEL
Payload delivery for satellite integration: Q4 2022
Launch GEI-SAT precursor: Q2 2023
**From the ground to space**

**GEI-SAT precursor Roadmap – Simulations**

**Observation**
- At sensor radiance
- Plume
- Background

**Analysis**
- Transmittance
- Column concentration
- Flow rate

**Inputs**
- Emission: 10000 kg/h
- Weather: 3.4 m/s, 334 deg., Mod., Unstable
- Illum.: 45 deg., 0 deg.
- Atmos.: US Standard Continental
- Land cover: Sand
GEI-SAT Constellation
Methane End-to-End Solution

We provide Full Solutions, from scientific-grade payloads to final data products.

ADDED VALUE
PAYLOADS & PLATFORMS

Simultaneous VNIR & SWIR, to aid solving ambiguities in emission detections.

Very High Spatial resolution, to provide precise and instantaneous geolocation, and infrastructure.

DATA CENTRE
Data fusion. Proprietary & third-party data.

Additional datasets
- Public datasets
- Complementary third-party data
- Bottom-Up measurements, ground sensors

USER PLATFORM
Real time data visualization.
Layered maps/thematic mapping.
User-oriented platform.

+ Periodical O&G reports

We provide Full Solutions, from scientific-grade payloads to final data products.