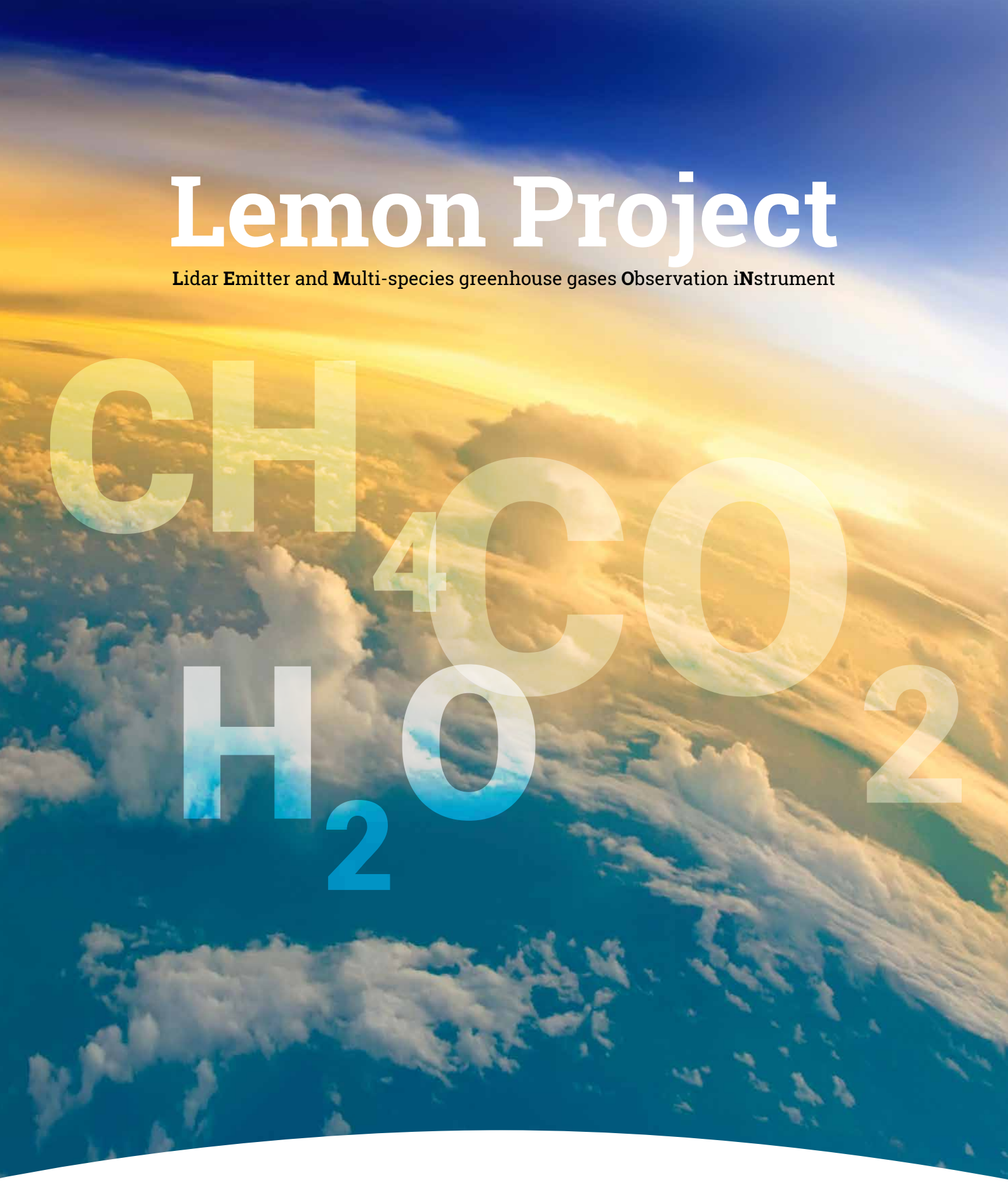
Lemon Project

Lidar **E**mitter and **M**ulti-species greenhouse gases **O**bservation i**N**strument



lemon

8 partners / 4 countries / Lidar sensing 2 greenhouse gases and water vapour elements / 48 Months - **Total budget : 3 374 725€**

Lemon Project

Objectives

Lemon aims at developing a LIDAR emitter for airborne and future space applications to monitor greenhouse gases and water vapour.

LEMON multispecies DIAL Instrument development

INSTRUMENT VALIDATION

- Airborne demonstration
- CO_2, CH_4, H_2O isotopes mesurements

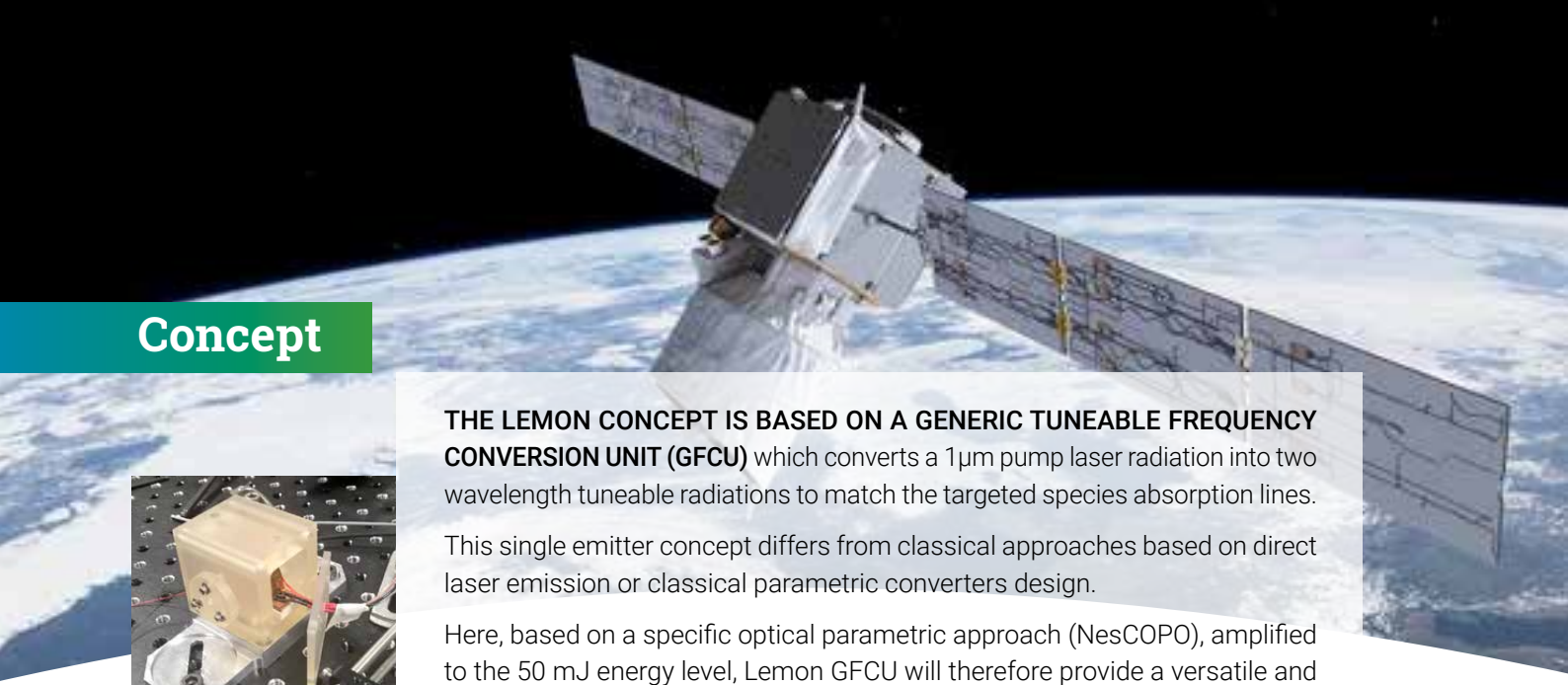
IMPACT

- Dissemination
- Exploitation

TOWARDS A SPACEBORNE DIAL

- Roadmap analysis
- Sub-units environmental testing
- Critical components radiation testing
- Future mission proposals

- **Demonstrate** unprecedented versatility in greenhouse gases detection with a single instrument.
- **Perform** the first range resolved water vapour and isotopes LIDAR measurements, leading to a better understanding in meteorology.
- **Achieve technical breakthroughs** in laser emitter output energy and wavelength tunability.
- **Demonstrate** unprecedented reactivity by the possibility of multi-species LIDAR emitter design.
- **Elaborate** a roadmap to integrate Lemon Generic Frequency Conversion Unit in a future space mission.
- **Disseminate** our concept to space agencies and future end-users to sustain Lemon exploitation.



Concept

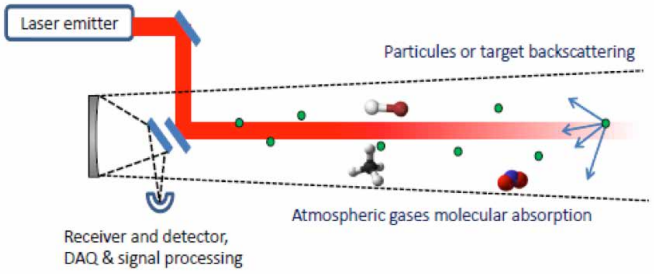
THE LEMON CONCEPT IS BASED ON A GENERIC TUNEABLE FREQUENCY CONVERSION UNIT (GFCU) which converts a 1µm pump laser radiation into two wavelength tuneable radiations to match the targeted species absorption lines.

This single emitter concept differs from classical approaches based on direct laser emission or classical parametric converters design.

Here, based on a specific optical parametric approach (NesCOPO), amplified to the 50 mJ energy level, Lemon GFCU will therefore provide a versatile and increased function instrument.

DIAL Lidar Principle

EMISSION OF DIFFERENT SUCCESSIVE LASER WAVELENGTHS "ON" AND "OFF" THE ABSORPTION LINES OF A GIVEN SPECIES, to perform a range-resolved measurement or column integrated mesurement of the species concentration.



Lemon Development

1

Technology development of the Lemon LIDAR and the validation of the instrument through an airborne measurement campaign.

DATA ACQUISITION AND INSTRUMENT CONTROL

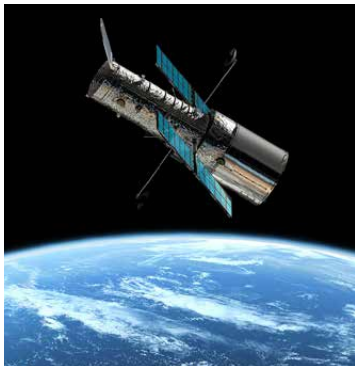
RECEIVER

INNOVATIVE VERSATILE EMITTER

TRL6 INSTRUMENT VALIDATION THROUGH AIRBORNE DEMONSTRATION AND CO_2, CH_4, H_2O ISOTOPES MEASUREMENTS

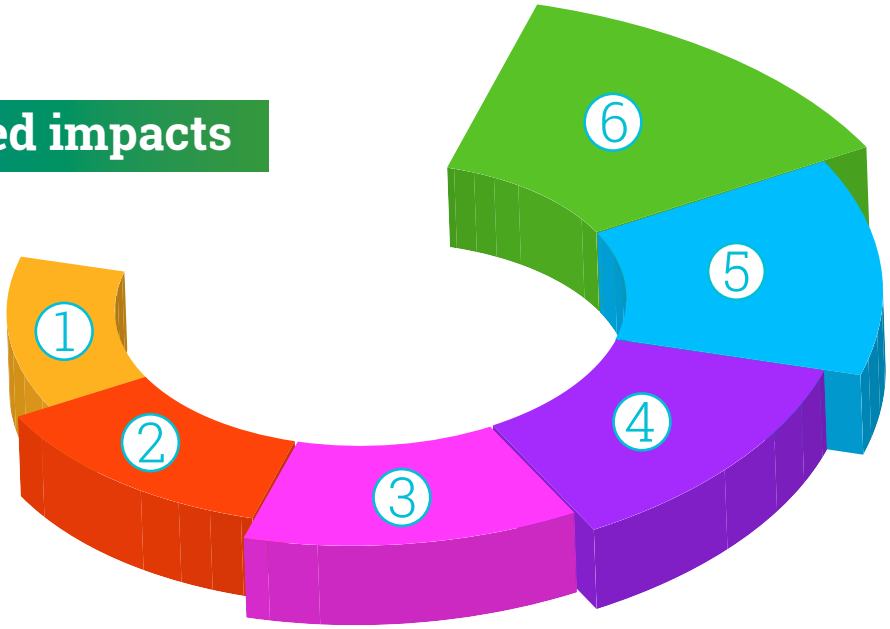
2

Preparation of future satellite missions where the Lemon LIDAR will be launched into space.



- **Roadmaps.**
- **Sub-units environmental testing.**
- **Critical components radiation testing.**
- **Future missions proposals.**

Expected impacts



1. **Improvement** in the capability of disruptive technologies for remote sensing with respect to existing Earth observation missions.

2. Lemon emitter will **allow better gas concentration precision measurement**; moreover, space qualification costs and efforts of future space missions could be reduced, thanks to the Lemon generic architecture.

   TRL improvement of a **versatile LIDAR system for Earth observation**, based on a generic emitter concept, to target several greenhouse gases and water vapour isotopes.

3. **Synergy with current or future Earth observation constellations**, since Lemon's generic architecture can adapt to future mission concepts, like joint missions between passive and active instruments.

4. **Strengthening Europe's position in industrial competitiveness** in technologies for Earth observation payloads and missions, with a strong involvement of European SMEs and European space research institutes.

5. **Fostering links between academia and industry,** accelerating and broadening technology transfer, thanks to the Lemon consortium including SMEs, space research institutes and universities.

6. **Impacts on climate change understanding**. New mission concepts like simultaneous CO_2 and H_20 monitoring could be envisioned.

Lemon Consortium

The Lemon consortium is composed of 8 partners from 4 different countries.

The consortium consists of **ONERA** (FR), **FAUNHOFER** (DE), **CNRS** (FR), **Royal institue of technology** (SE), **SPACETECH** (DE), **Universtity of Bergen** (NO), **INNOLAS** (DE) and **L-UP** (FR).

It has full expertise in Earth observation technologies (from receiver, data acquisition, instrument control and versatile emitter).

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