



“Case studies
for sustainable development
based on SITAEL space assets”
UN-Space - 19th Open Session

Brindisi - October 19, 2023





SPACE



SURVEY



RAILWAY



CYBER
SECURITY

ANGEL



STEEL



ARTIFICIAL
INTELLIGENCE



IOT



AVIATION



SITAEL

SITAEL S.p.A., part of the Angel Group, is the largest Italian company of the space sector with 100% Italian shares. Thanks to its portfolio of proprietary technology and vertically integrated products, Sitael growth is focused on innovation and reflected in partnerships with key industrial players in the aerospace sector as well as collaborations with leading Space Agencies worldwide. Sitael promotes the growth of its supply chain, transforming its industrial ecosystem in an attracting environment for a Space Economy Made in Italy.

Main Lines of Business of the company

- Satellites from 50 to 500 kg
- Electric Propulsion Systems
- Onboard electronic equipment





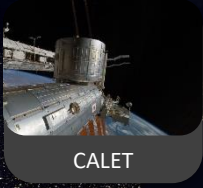
SITAE GROWTH

BOARDS AND ELECTRONIC EQUIPMENT

SATELLITES AND MISSIONS



AMS-01



CALET



PAMELA



GAIA



SWARM



AMS-02



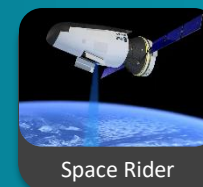
CSG



MTG



JUICE



Space Rider



INTEGRAL



CURIOSITY



Sentinel 1



Sentinel 3



ASIM



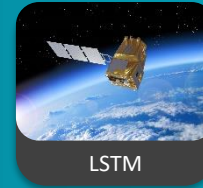
Solar Orbiter



K7A



CHIME



LSTM



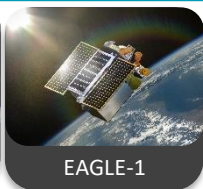
ESEO



uHETsat



PLATINO 1



EAGLE-1



IRIDE HYP



PLATINO 2 - MAIA

Staff

5

10

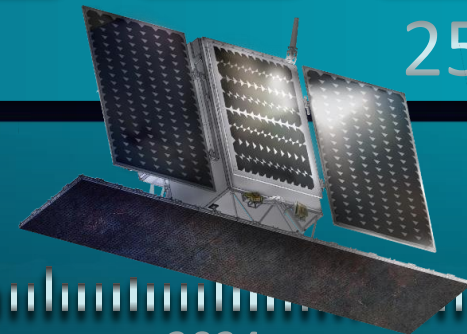
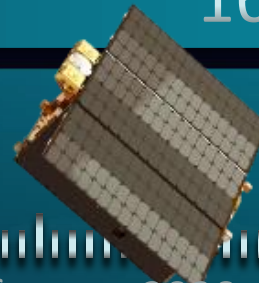
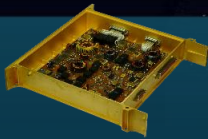
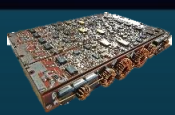
50

100

160

250

PRODUCTS



1994

2000

2004

2008

2012

2016

2020

2024

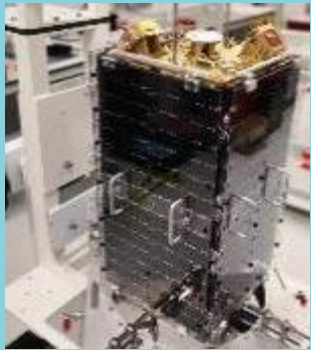
2028



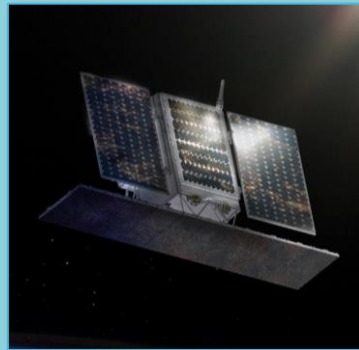
8 SATELLITES under development



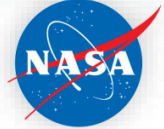
MICROHETSAT



Agenzia Spaziale Italiana
PLATINO-1



PLATINO-EAGLE-1



Agenzia Spaziale Italiana

PLATINO-2-MAIA



IRIDE HYP #1



#2



#3



#4





EARTH OBSERVATION - CASE STUDY 1

PLATiNO 2/MAIA FOR AIR POLLUTION-RELATED HEALTH STUDIES



The MAIA Mission – a joint NASA-ASI science program



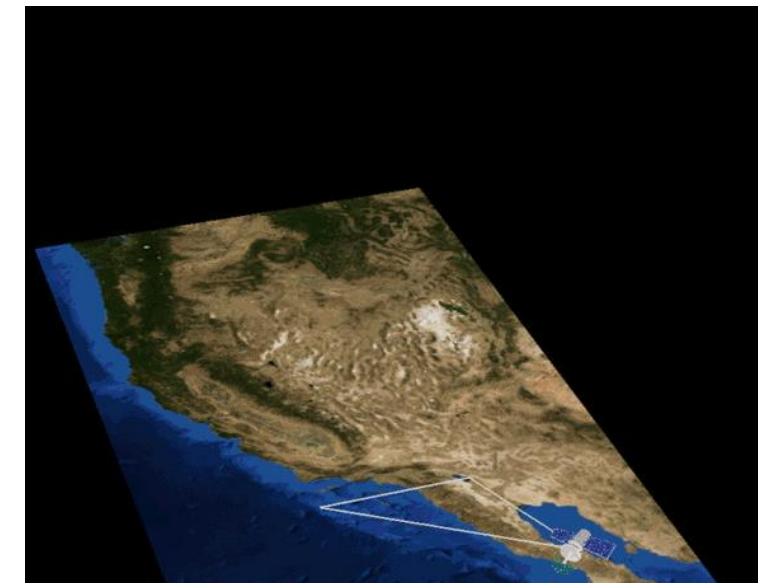
SITAEL is the industrial prime of the **spaceborne Observatory** (NASA's MAIA instrument and ASI's PLATiNO-2 spacecraft). The Mission includes also **networks of surface-based pollution sensors, systems to launch and operate the Observatory, uplink and downlink commands and data, and generate data products for people to use.**

- Data collected by Observatory from Target Areas will be combined with measurements from air pollution monitors on the ground and outputs from computer models. The results will be used to create **daily maps of particulate matter air pollution (PM) in the Primary Target Areas.**
- These maps and health records will be used by epidemiologists to conduct **health studies.** The findings from these studies will provide information about **which types of PM are most harmful.**



Primary Target Areas

- USA-Los Angeles
- USA-Atlanta
- USA-Boston
- ESP-Barcelona
- ITA-Rome
- ZAF-Johannesburg
- ISR-Tel Aviv
- ETH-Addis Ababa
- IND-Delhi
- CHN-Beijing
- TWN-Taipei

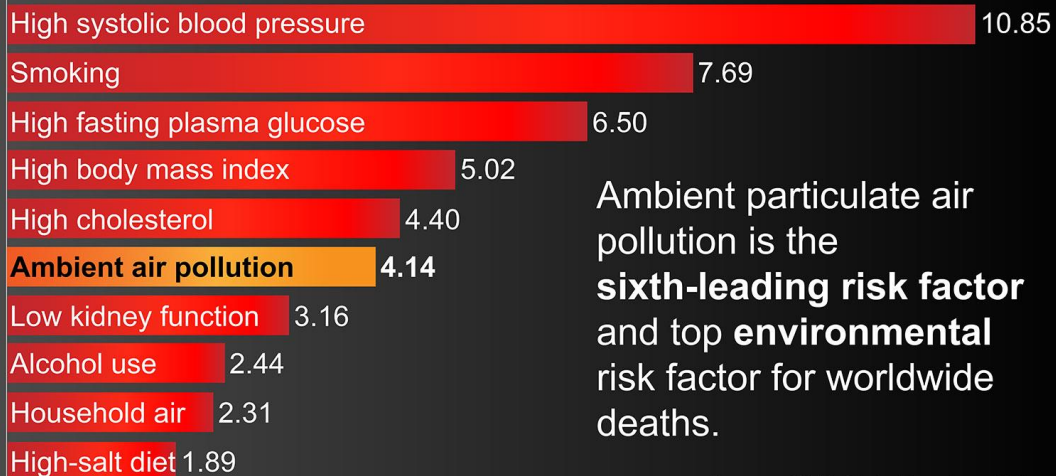




MAIA: Air Pollution, Health and the MAIA Instrument

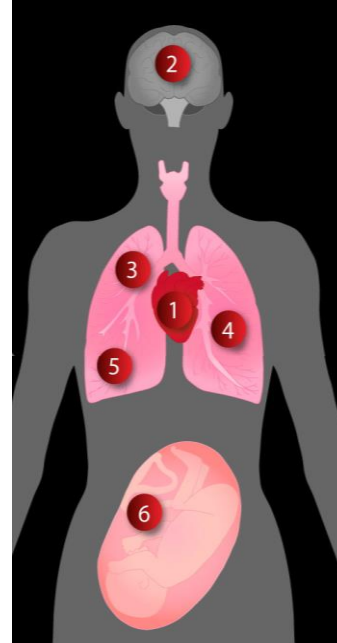
Top 10 risk factors for worldwide deaths, 2019

Deaths in millions, per year



Ambient particulate air pollution is the **sixth-leading risk factor** and top **environmental risk factor** for worldwide deaths.

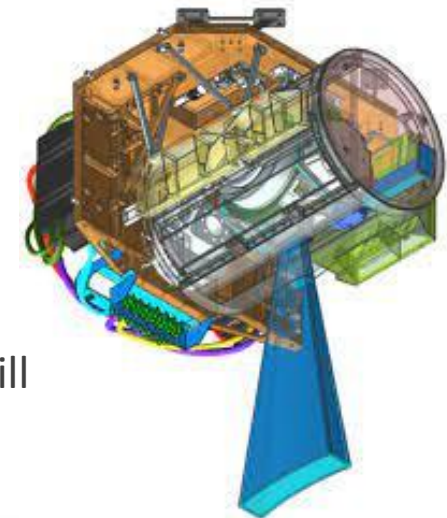
Source: 2019 Global Burden of Disease



1. Heart Disease
2. Stroke
3. Chronic Obstructive Pulmonary Disease
4. Lung Cancer
5. Lower Respiratory Infections
6. Adverse birth outcomes

The Multi-Angle Imager for Aerosols (MAIA) is a multispectral (UV-VNIR-SWIR) Instrument

- It will collect data useful to calculate the physical properties of PM, like their size, shape, and how they reflect or absorb sunlight.
- To determine the chemical composition of tiny particles of air pollution, the MAIA measurements will be combined with information from surface monitors and chemical transport models.





From satellite data to PM Maps

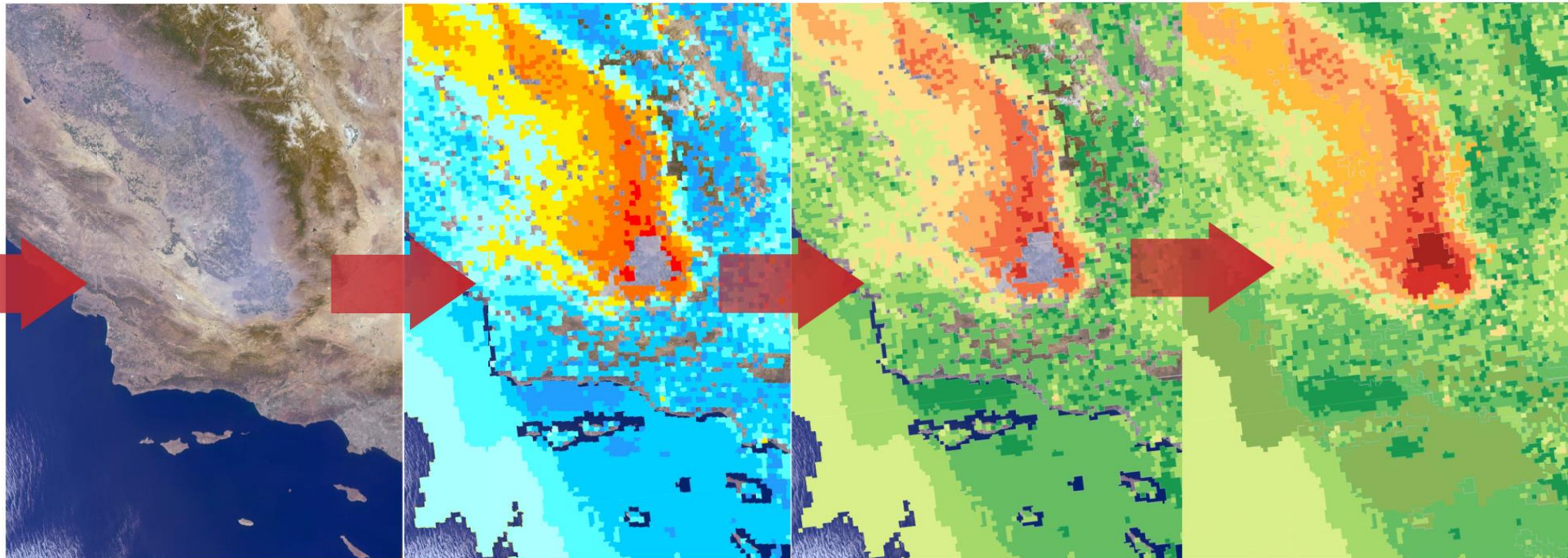
1.
Data to
Radiance

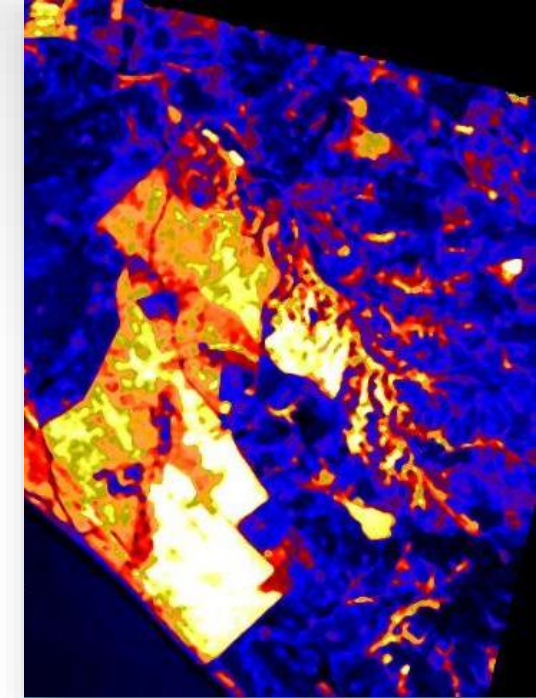
2.
Radiance to
aerosol data

3.
Aerosol to
PM Data

4.
PM Data to
Gap Filled Maps

```
01010100 01101000  
01101001 01110011  
00100000 01101001  
01110011 00100000  
01110100 01101000  
01100101 00100000  
01110010 01100001  
01110111 00100000  
01100100 01100001  
01110100 01100001  
00100000 01100110  
01110010 01101111  
01101101 00100000  
01001101 01000001  
01001001 01000001
```





EARTH OBSERVATION - CASE STUDY 2

IRIDE HYPERSPECTRAL IMAGING FOR AGRICULTURE



PLATINO for IRIDE – The Hyperspectral Segment

SITAEL has been awarded the development of 4 PLATiNO satellites for the IRIDE constellation, embarking a hyperspectral sensor developed by Leonardo (IT).

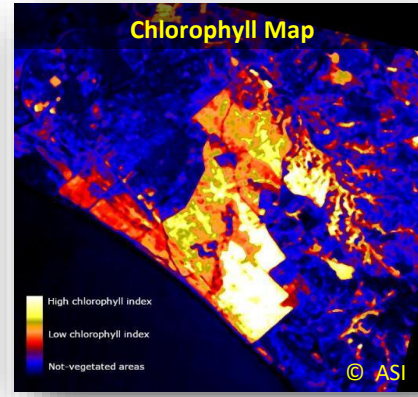
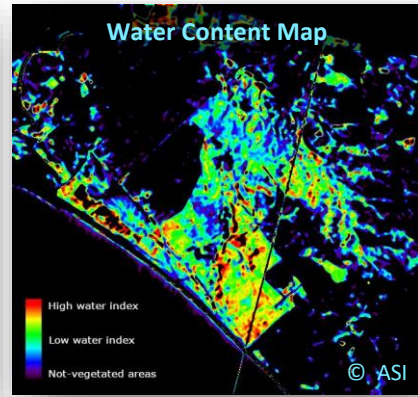
This production series of 4 satellites will consolidate the PLATiNO production line.



IRIDE is the Italian Earth Observation constellation, funded through the National Recovery Funds (PNRR), coordinated by the European Space Agency, in collaboration with the Italian Space Agency, under the mandate of the Italian Government.



Hyperspectral Imaging Potential Applications in Agriculture (1)



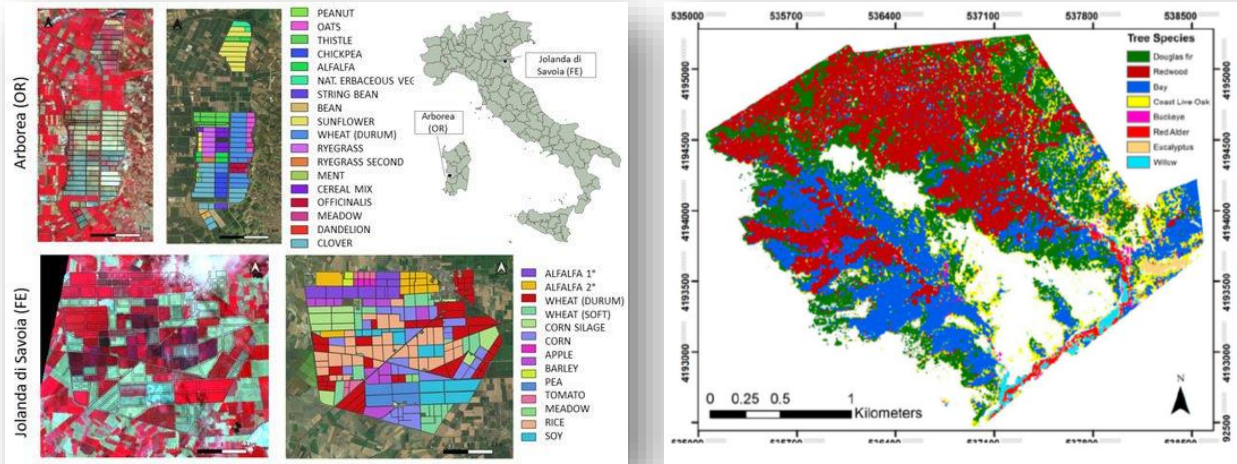
Analysis of the biophysical properties (e.g. leaf area index, **water content**, biomass, yield, density) and biochemical properties (e.g. Anthocyanins, Carotenoids, **Chlorophyll**) of the vegetation



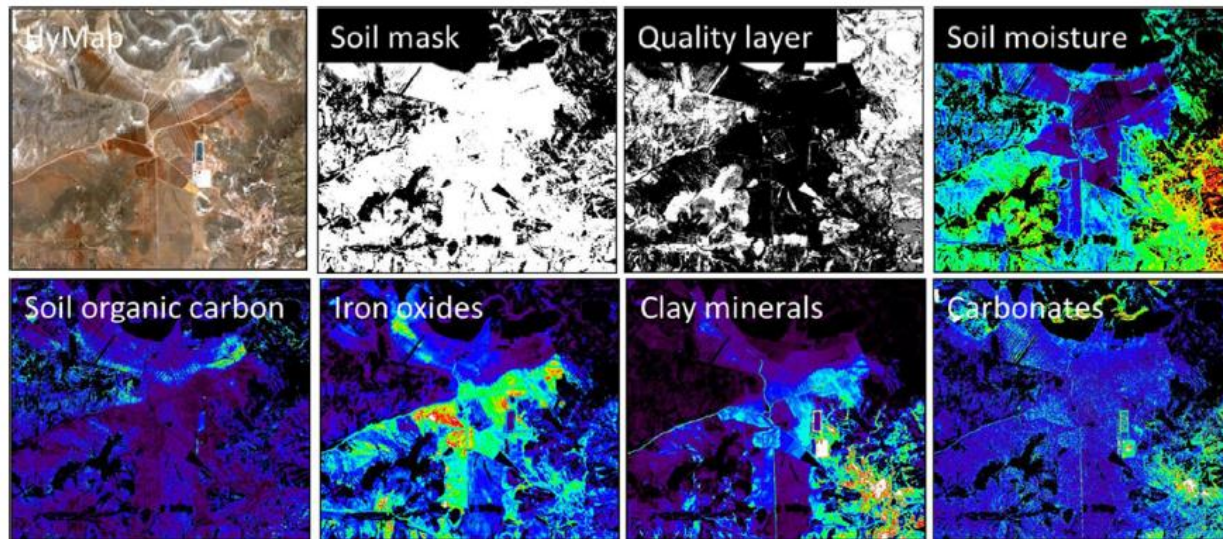
Early diagnosis of diseases and stress (e.g. yellow rust, **xylella**)



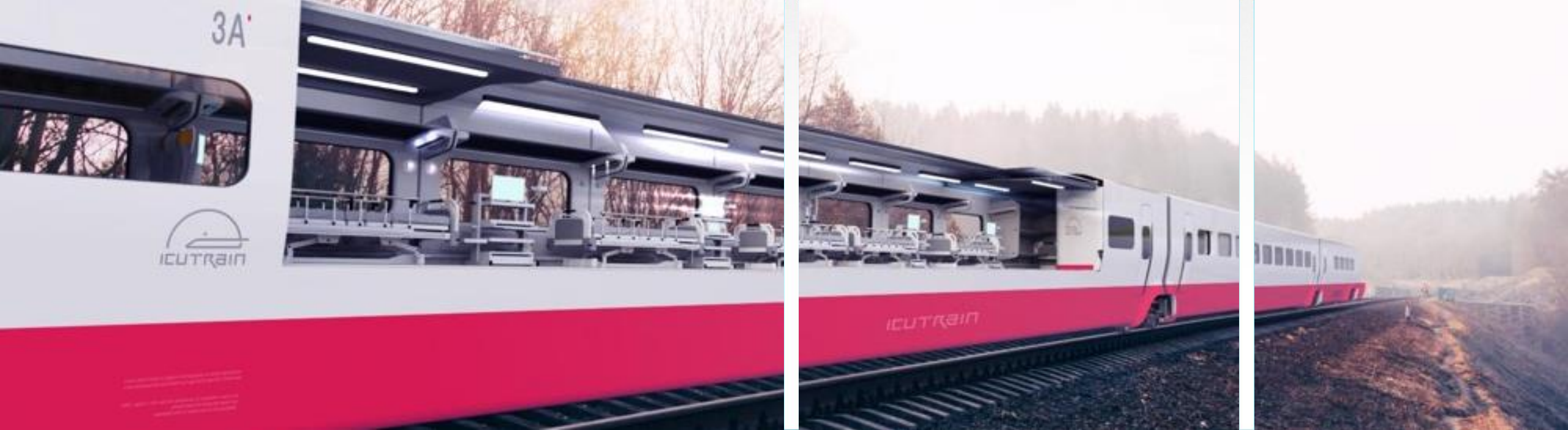
Hyperspectral Imaging Potential Applications in Agriculture (2)



Discrimination of plant species, vegetation types and their genotypes for mapping of the different types of cultivation or forest type classification



Analysis of soil properties (organic matter content, humidity, clay, silt) and evaluation of the nutritional and fertilization status of crops, including macro and micronutrients (P, K, Mg, Mn, Cu, Mn, Zn)



INTEGRATED APPLICATIONS - CASE STUDY 3

ICUTRAIN: Leveraging railways to enhance Europe's medical emergency response





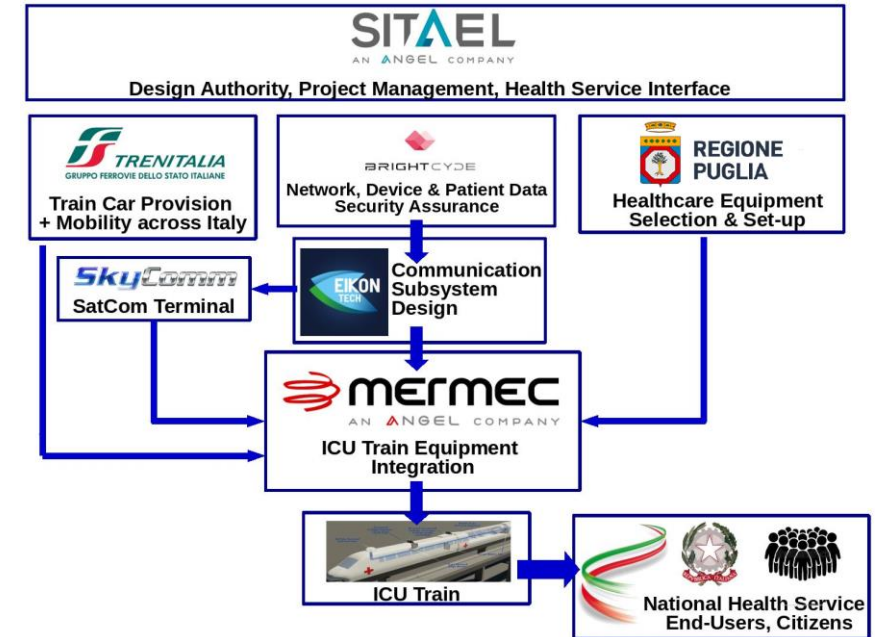
ICUTRAIN's Reason Why and Teaming

The Covid-19 outbreak made it very clear that major medical emergencies requires the ability to **rapidly and effectively deploy** healthcare **assets** and **personnel** to affected **areas**, as well as means to **promptly relocate** them once a surge has been contained and other necessities manifest **elsewhere**.



ICUTRAIN project proposition:

- Help develop **European, railway-based rapid response capacity** to confront **medical emergencies**
- Be **pathfinder** to **regular** emergency response systems and services leveraging **railway rapidity** and **reach** as well as strategic **space assets**
- **Demonstrate** a few **use cases, well rooted** into the **actual needs** of **emergency managers** and **medical staff**, namely space-assisted **medical evacuation (MEDEVAC++)** and **"hospital strain relief"**

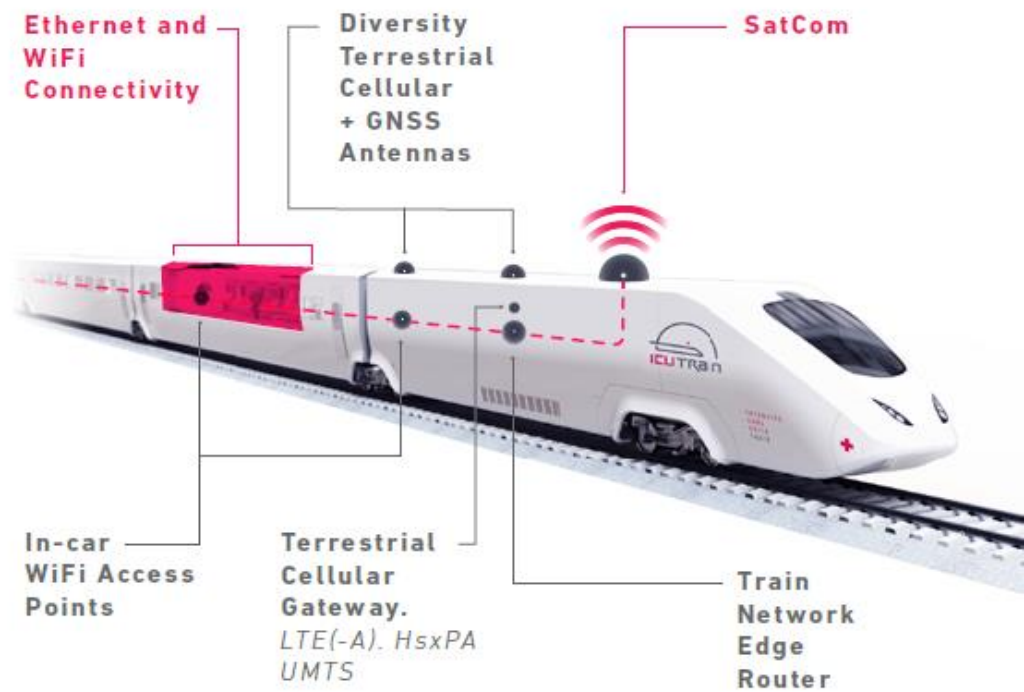




ICUTRAIN – INTENSIVE CARE UNIT TRAIN : SATCOM & GNSS TECHNOLOGIES

Cellular-Terrestrial + Satellite IP-based communications for **telemedicine** and **telediagnosics** allowing constant **coordination** between **on-board** and **ground**-based medical personnel to manage both patient transfers and treatment.

GNSS satellites enable **direct access** to real-time **position** of the train for all users involved
(e.g. logistics planners, medical personnel & paramedics, ambulance drivers, hospital staff)





ICUTRAIN Medical Use Cases

How could a train help amidst a pandemic?

MEDEVAC++ Use-Case - Safe Relocation of multiple patients

Develop & Demonstrate key enablers of a **safe, railway-based** and **space-asset-enhanced patient relocation capacity** to assist overwhelmed **healthcare facilities** and territories.

Key Advantages:

- much lower **cost** compared to **airborne** transportation means recently used during the COVID-19
- **air** transportation **often** simply **unfit** for **patient** conditions
- **multiple** patient **rendez-vous** can be organized in **multiple cities** along the train journey, if needed
- **easy to stop** and procure further resources, should the need arise for any of the patients
- **relieves** local **ambulances** from long distance travel burden and spares much-needed **local capacity**



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