New Thermal Analysis Tool <u>and</u> New Smart Structural Fiber-cement Panel for Near Zero Energy Buildings (NZEB)

A revolution in smart houses A4 class NZEB building, now closer to the passive house !

Lagertha

SI.SA Immobiliare

EXEDRA system

Casa Ehitus

A new patented structural fibercement panel for building +
a new software for transmittance measurement from satellite images

- We estimate savings up to 20-25% building costs, compared to traditional reinforced concrete building, and savings up to 40% of assembly time on-site and insulation wall section

Construction Panel Stratigraphy:

1. Fiber-cement slab - 12,5 mm
2. Wooden fiber insulation (50x50 mm wooden sleeps) - 50 mm
3. Fiber-gypsum slab - 18 mm
4. Mineral wool insulation (U-shaped profile in steel 250x50x3 mm) - 250 mm
5. Fiber-gypsum slab - 18 mm
6. Plasterboard slab with steam barrier (0,20 mm) - 12,7 mm
7. Mineral wool insulation (U-shaped profile in steel 50x50x2 mm) - 50 mm
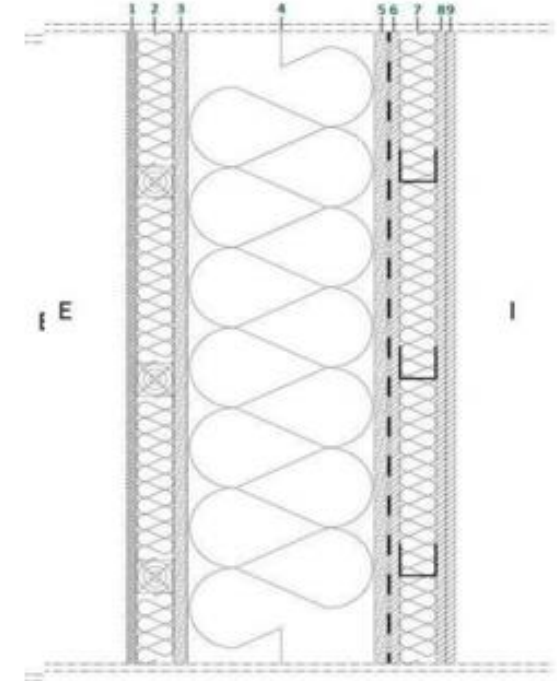8. HD plasterboard slab - 12,5 mm
9. HD plasterboard slab - 12,5 mm

Figure1: Stratigraphy Panel for Construction

Analysis of high quality satellite building pictures

The planned analysis tool, developed with LabVIEW 2020 Vision and Motion functions, will be used to assess pre- and post-construction building parameters, and classify the building upgrade using EXEDRA SYSTEM smart panels.

If a good quality updated picture of the building is not available, analysis can be performed through a traditional thermal camera (drone).

EXEDRA SYSTEM smart panels reach, in the actual version, an astonishing **0.159** W/m²K, whereas the standard minimum limit is **0.33** W/m²K.
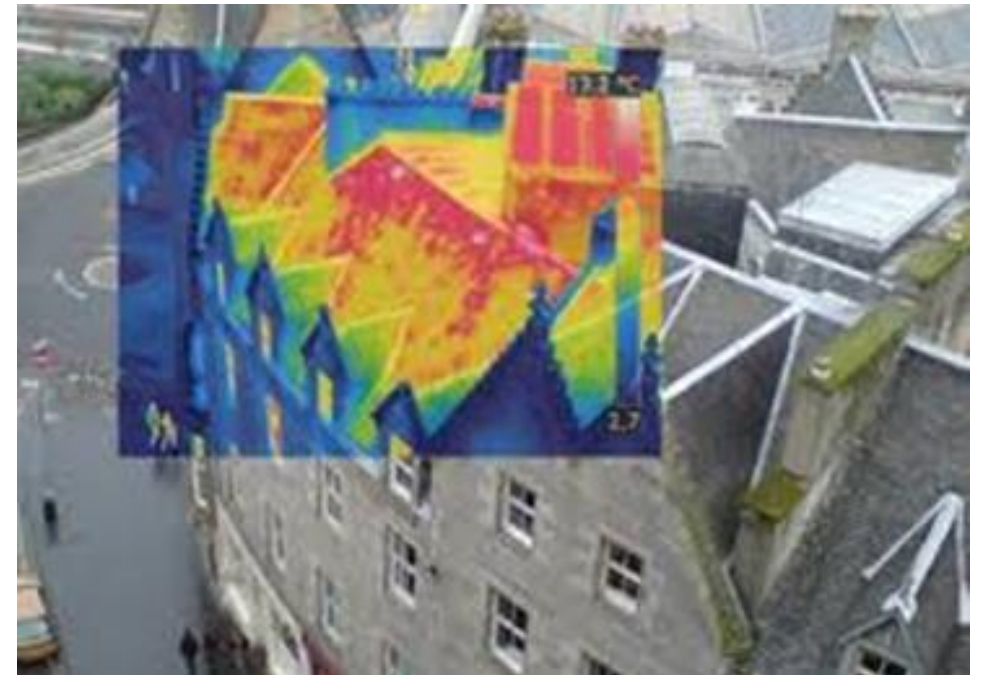
Fast, clean assembly

- Almost 9 times lighter (80 kg/m^2) than traditional cement or fiber-cement plates, allowing the same insulation with 60% of the traditional wall section, and 40% savings in building assembly time.

- Perfect solution for floor elevation and extensions in existing buildings, fiber-cement thickness 12 mm.

- Residential building emissions count for 40% of annual global GHG emissions. We aim to reduce this parameter significantly.


Exedra System OÜ
8 April ·

Fast assembly on site

Why smart?

1. We plan to embed miniaturized IoT **sensors** into the panel, allowing ==dynamical== measurement of **temperature, humidity** and **transmittance** gradients, allowing output to HVAC devices.

2. Including a low-power (< 200W) infrared radiation flat element embedded in the panel would improve the well-being inside, lowering negative energy by irradiation.

3. The study should also include the analysis of other parameter related to the inside **air quality,** i.e. bacteriological, and activate specific devices for air purification (UV, ozonisers, ...), functionality especially relevant after COVID-19 pandemic, with specific air quality sensors.
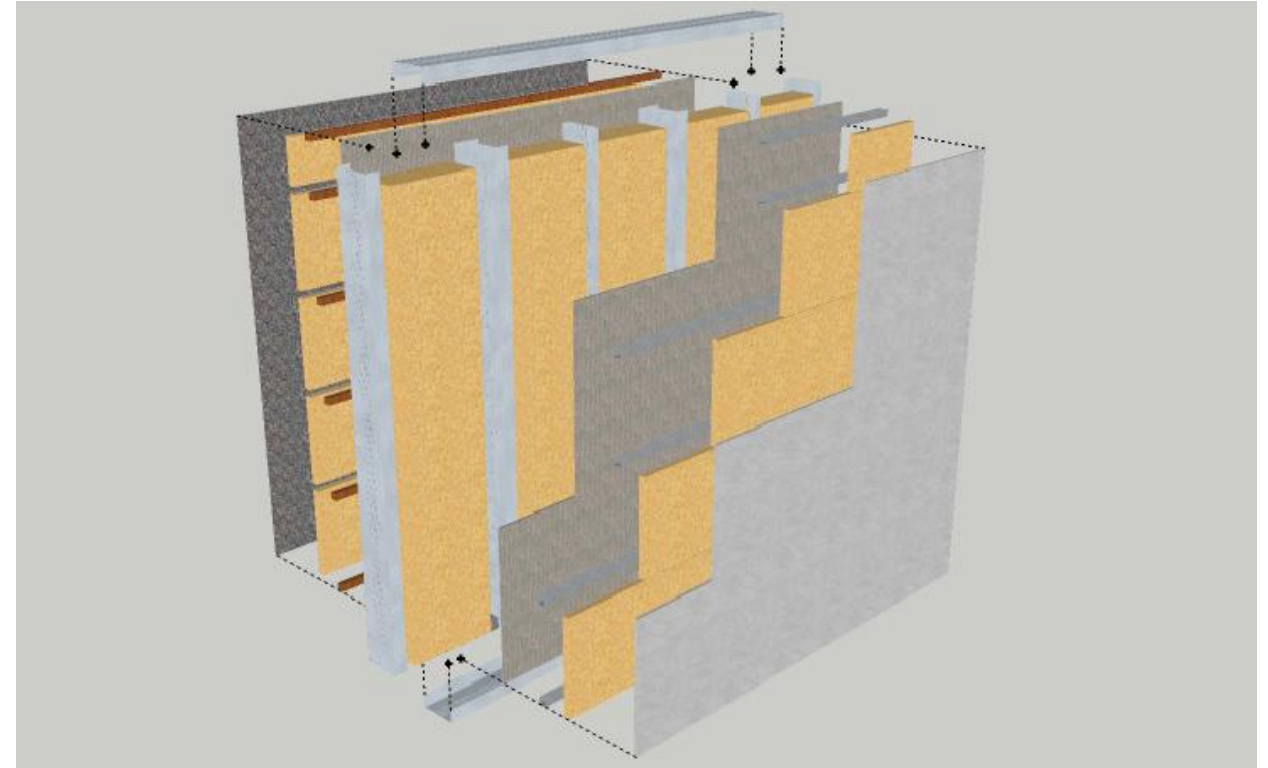
Possible solutions?

The easiest way is to use multiple 3-wire digital (3.2 V, GND, data) integrated **temperature + humidity** sensors like DHT11, along the wall section, connected to an extreme low power WiFi MCU board (Arduino nano, Raspberry nano) through I2C (synchronous, multi-master, multi-slave, packet switched, single-ended, serial communication bus), with data made available to the IoT.

We will try try to measure **dinamically**, at the lowest possible cost, what has already been evaluated with software simulations.
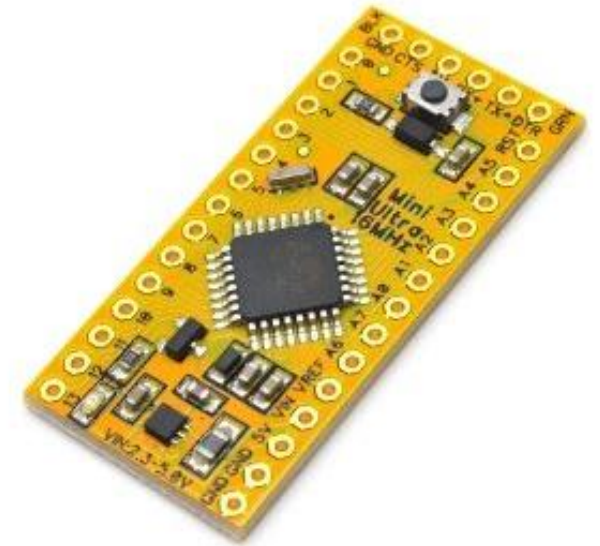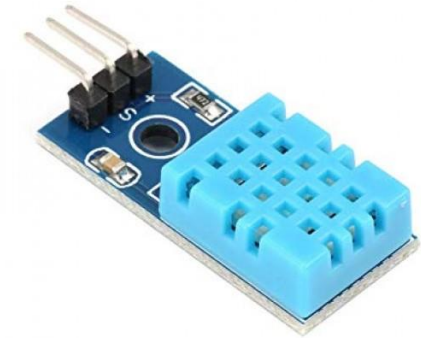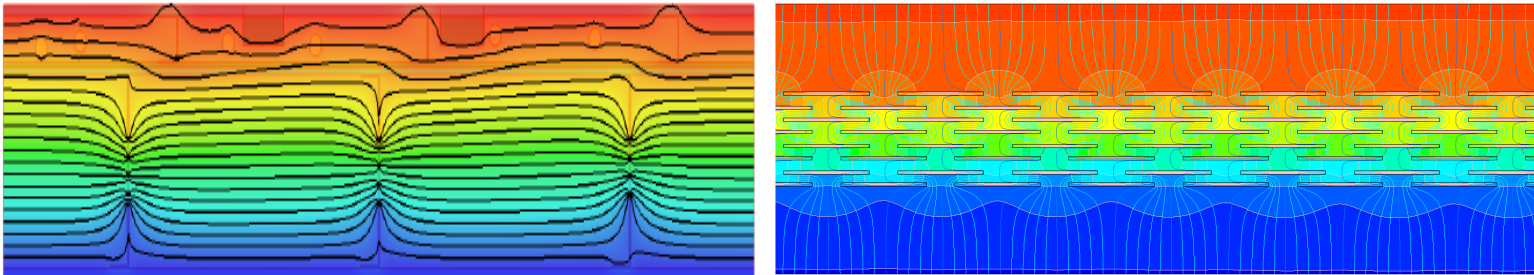
Data are collected on a free cloud web server (many available) to draw graphs, set alarms when condense is forming, control HVAC appliances….

Or, better, identify a single sensor able to measure all parameters along the section (basically a needle, 25 cm long, able to provide the required information).

A **nano-timer** can play an important role in minimizing sleep current and managing the go-to-sleep and wakeup phases of a IoT sensor.

The energy supply has to be investigated, human motion and triboelectricity are also being investigated as potential energy sources: one particular design harvests **thermal energy** and is based on the **Seebeck effect**.

The Seebeck effect was discovered in 1821 by T.J. Seebeck and describes the voltage difference that occurs between two connected electrical materials when there's a temperature gradient across them.

A thermoelectric generator (TEG) uses the Seebeck effect to generate an electrical current proportional to this temperature difference, avoiding the use of batteries.

Extremely small and power effective miniaturized **air quality** sensors such as GY-SGP30 can also be implemented.

If not possible, a battery will have to be used. We would prefer to avoid transformers and connection to the home 220V AC power supply.
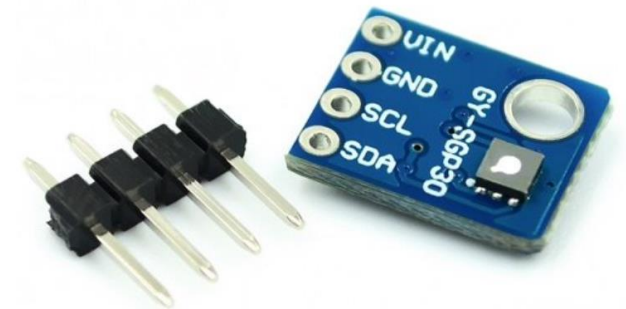
Summarized expected savings

- We estimate savings up to 20-25% building **costs**, compared to traditional reinforced concrete building

- savings up to 40% of assembly **time** on-site

- same overall insulation with 60% of the wall **thickness** (25 cm instead of 40 cm wall thickness)

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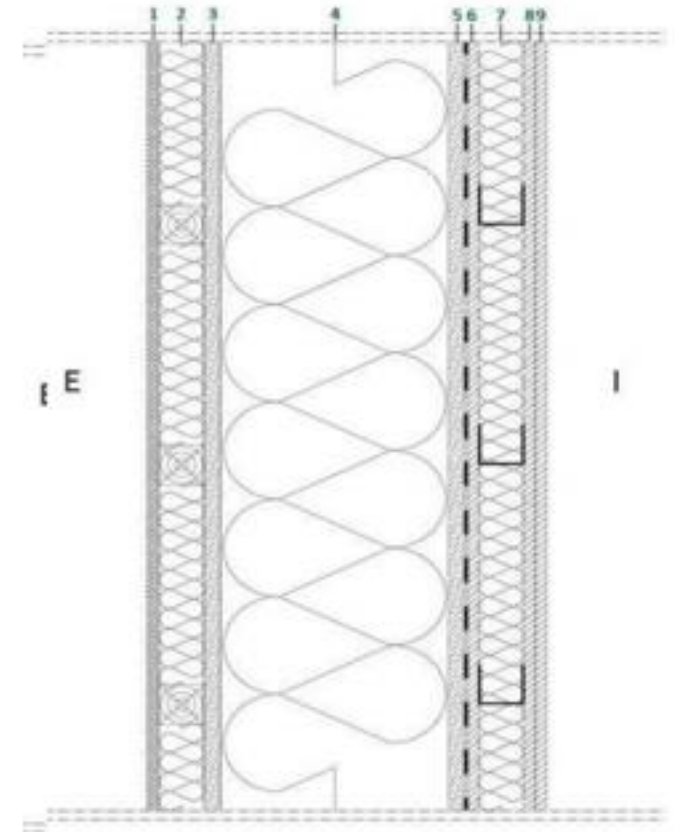8. HD plasterboard slab - 12,5 mm

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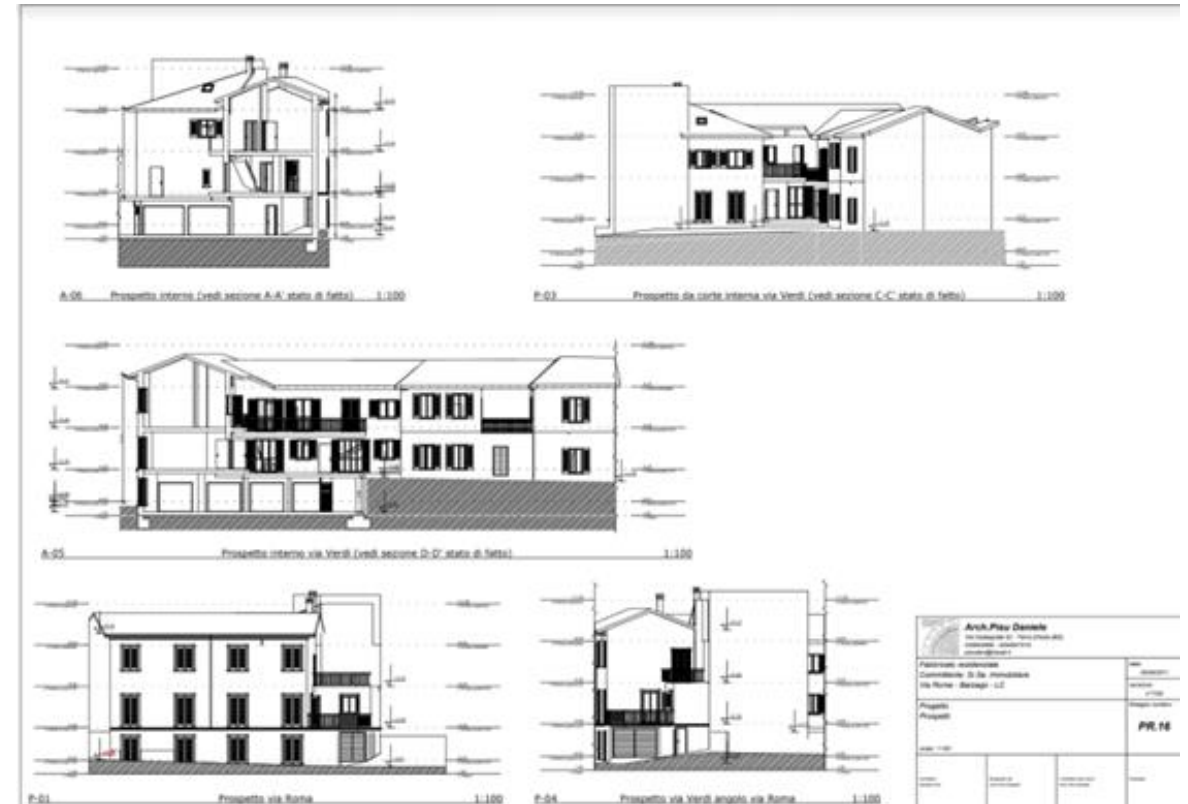Figure1: Stratigraphy Panel for Construction

EXEDRA system

Pilot buildings ready to start (new or upgrades)

Worlwide emission of residential buildings has been estimated as **40%** of the world GHG (greenhouse effect) figure.

We aim to reduce that figure, increasing the number of new passive house and re-adapting parts of existing buildings with this technology.

Further development within EU calls

We plan to develop further the panel, using different EU calls for proposals related to 'smart home', 'smart buildings' and 'GHG reduction'.

H2020 & ICT already closed.

NZEB-SAT - Developing **satellite thermal imagery analysis**, as a benchmark tool to evaluate improvement in thermal emissions before and after the use of EXEDRA SYSTEM panels for floor elevation.

InCubed is an ESA programme managed by φ-lab

InCubed stands for 'Investing in Industrial Innovation' and is a Public Private Partnership co-funding programme run by the ESA φ-lab. InCubed focuses on developing innovative and commercially viable products and services that exploit the value of Earth Observation imagery and datasets. The programme has a very wide scope and can be used to co-fund anything from building satellites to ground applications and everything between or to develop new EO business models.

Is InCubed right for me?

If you have an activity in mind, for example, a constellation, a satellite, an instrument, a technology, software, a service or an application related to the Earth observation sector and you want to develop it with ESA's help and then roll it out commercially then InCubed could be the programme for you. The ultimate aim of InCubed is for your development to reach, at least, the minimum viable product stage and be robust from a technical, commercial, programmatic and financial point of view. Your Intellectual Property Rights, 100%, stay with you. The programme can also support further roll out and scale up if appropriate or can provide a solid demonstration capability for you to seek further funding for scaling and expansion.

esa
Open Space Innovation Platform
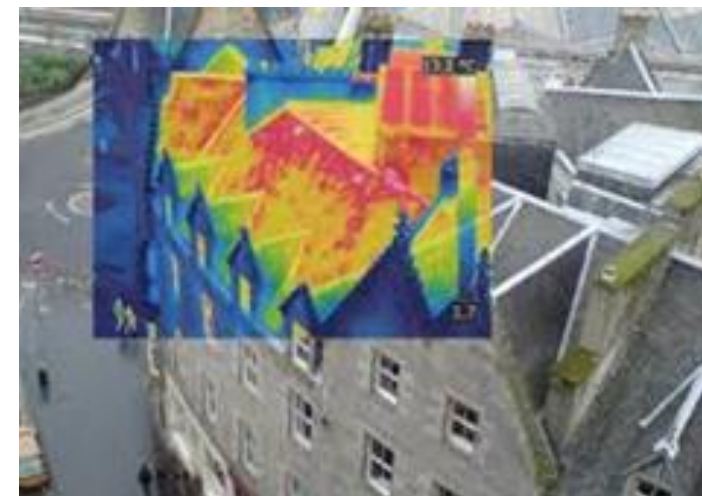
Hello Luca Giorgio

Thank you for submitting your idea!

NZEB-SAT Evaluation of transmittance of buildings using thermal satellite images and certification of a new smart fiber-cement SIP (Structural Insulated Panel) for floor elevation

Your idea has entered the qualification phase and is therefore eligible for the Campaign or Channel. Please use the Comments or Private Discussion in case you have any questions.

Thank you for your participation!

Go to Idea

*This is an automatic notification from ESA's **InCubed Channel** on OSIP, please do not respond.*

If you are a building company or contractor…

- *… and you wish to know more about EXEDRA SYSTEM building and LAGERTHA transmittance measuring technologies, get in touch with the coordinator of the proposal*

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- www.facebook.com/exedrasystem

Lagertha
Lagertha SIA

Σ eureka Clusters AI Call 2021

OPEN NOW!

Submission deadline: 28 June 2021

PXION Italy
EO/IR camera

Feanor, Estonia
encryption

LAGERTHA
Latvia
AI software, mapping

Skudo, Estonia
encryption HW

UNI Napoli

NOVOTECH
platform

PATRAS
University

SIEMENS, BE
Simulation, testing
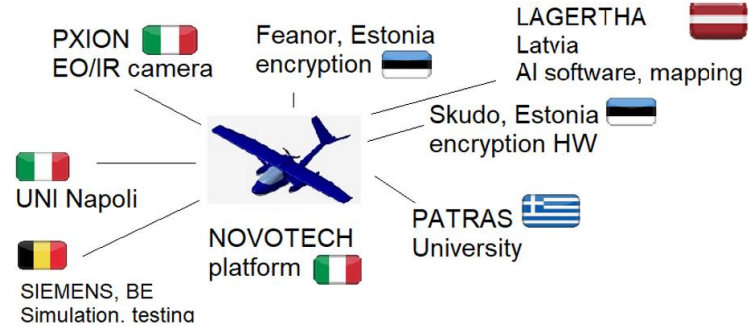
Another recent proposal relates to the improvement of swarm capability for an underwater unmanned vehicle AUV, within the Blue Economy Window call 2020.

BLUE ECONOMY WINDOW
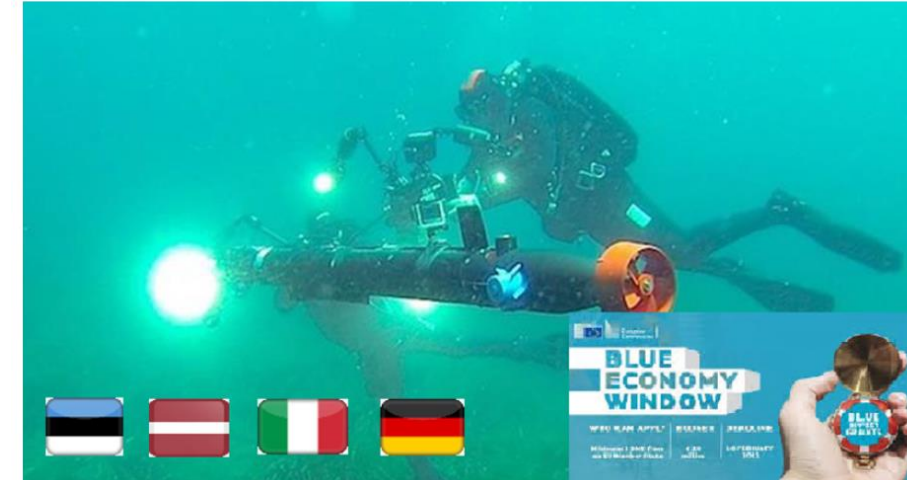
EDIDP-NGPSC-LRIF-2020
A Platform for long range indirect fire support capabilities

PXION
Italy
EO/IR camera, software, geo localisation platform

LAGERTHA
Latvia
AI software, mapping coordination
Fire analysis/control

Tracked Reconnissance Vehicle TRV

SKUDO
Estonia
Encryption HW/SW platform

Main activities:
- FPGA and microprocessor applications,
- cybersecurity,
- machine learning,
- awareness systems with long-range electro-optical- infrared cameras (20 km)