



# Marine Energy meets Space virtual workshop

8<sup>th</sup> September 2020

[business.esa.int](https://business.esa.int)

[dutchmarineenergy.com](https://dutchmarineenergy.com)

ESA UNCLASSIFIED

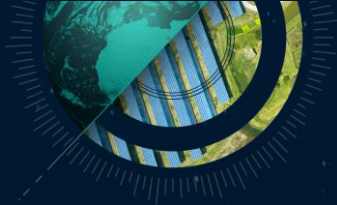




## WELCOME TO THE WORKSHOP!

Before we start...

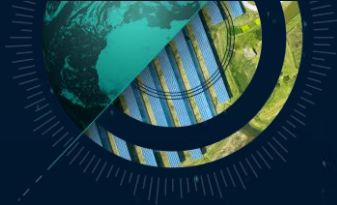
- Due to the number of attendees, please keep your microphones muted at all times and switch off the webcam function
- You can use the conversation function anytime to submit your questions. They will be addressed during the Q&A at the end of the webinar



## AGENDA

- DMEC and ESA presentation, and launch of the collaboration
- Introduction to the Invitation To Tender (ITT)
- Challenges of the marine energy sector
- Pitch session: challenges (marine energy companies) and space contribution (space technology companies)
- Questions and remarks





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# Dutch Marine Energy Centre (DMEC)

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represented by ...

**Benjamin Lehner**

*Business and Innovation Advisor*

**Dedicated to making marine energy  
the next big thing in energy!**





# About DMEC

DMEC is an **accelerator for marine energy solutions**

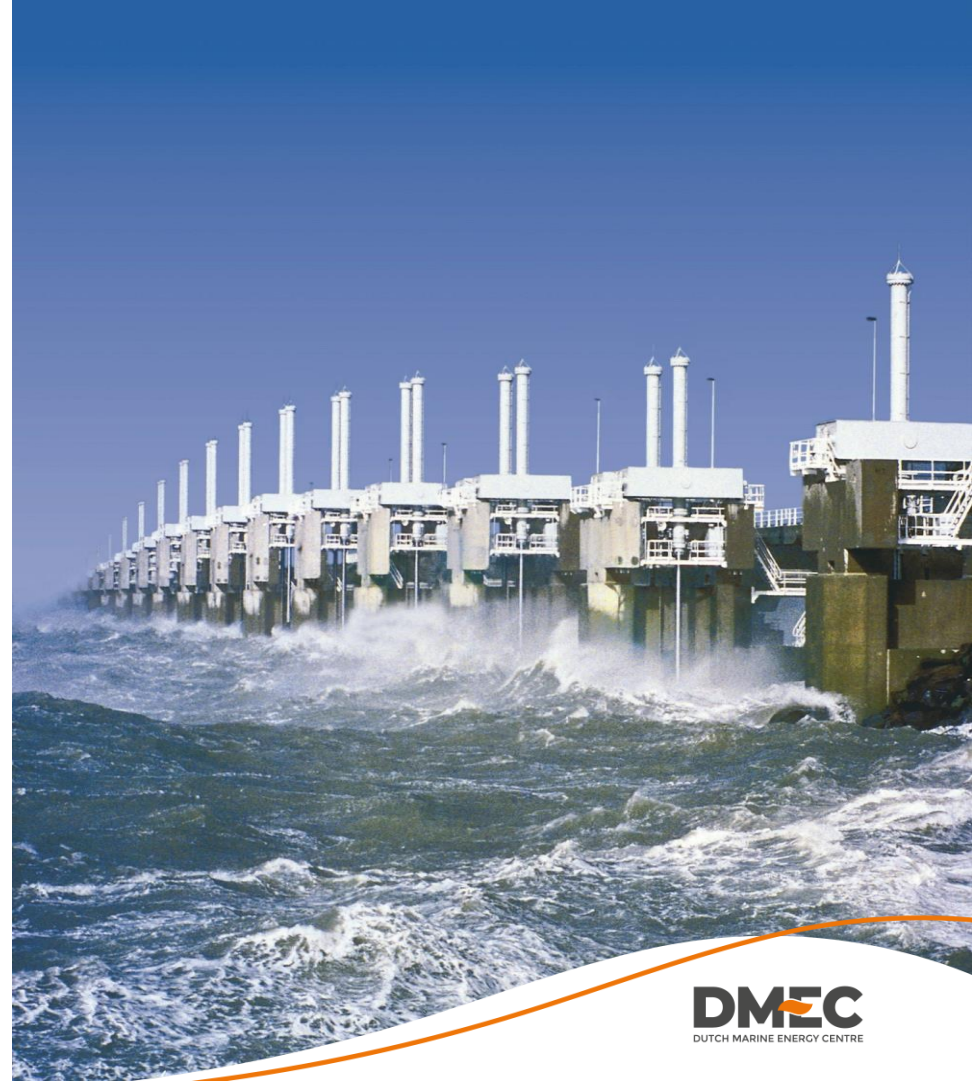
## Facts & figures

Accelerated companies > 75

International partners > 80

Public Private Investments > €57M

**Dedicated to making marine energy  
the next big thing in energy!**



# Marine energy potential

## Energy Transition

**300 GW** global energy generation for ± 350 million households

## Climate Action

**5.2 BN** tonnes of CO<sub>2</sub> reduction by 2030

## Sustainable Growth

**€ 100 BN** global market value and 650,000 new jobs



# Marine energy technologies



Wave Energy



Salinity Gradient  
Energy



Tidal Energy



Ocean Thermal  
Energy Conversion  
(OTEC)



Floating Solar  
Energy



Floating Wind  
Energy



# DMEC is accelerating marine energy solutions



## Markets

Realise marine energy solutions



## Innovation

Advance marine energy innovations



## Capital

Mobilise investments



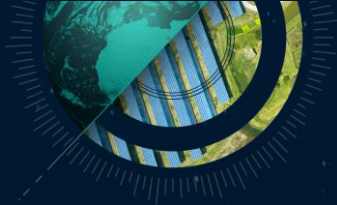
## Policy

Support policy development



**Davide Coppola**

Project Manager



## THE EUROPEAN SPACE AGENCY

### Purpose of ESA

To provide for and promote, for exclusively peaceful purposes, cooperation among European states in space research and technology and their space applications.

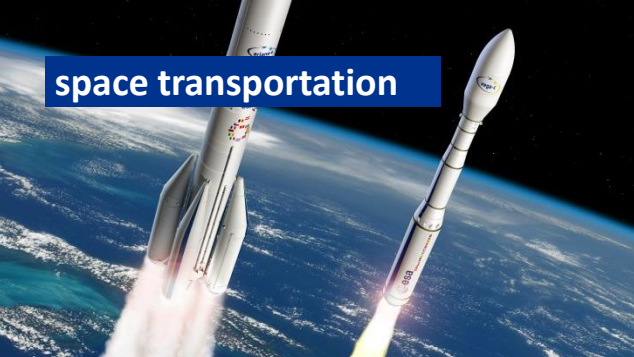
### Facts and figures

- Over 50 years of experience
- 22 Member States
- 8 sites across Europe and a spaceport in French Guiana
- Over 80 satellites designed, tested and operated in flight





**space transportation**



**science**



**human spaceflight**



**earth observation**



**telecommunications  
and applications**



**navigation**



**exploration**



**operations**



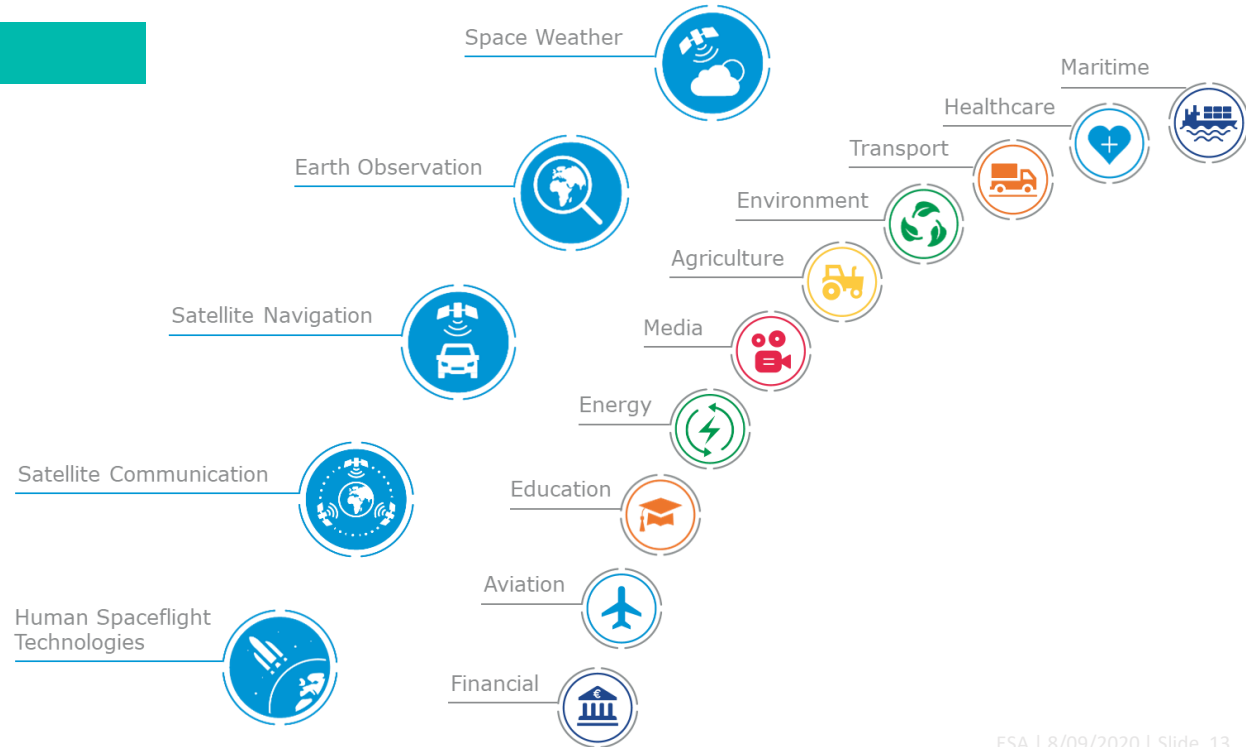
**technology**





## ESA SPACE SOLUTIONS

Could you be leveraging  
Space technology and data  
for the benefit of life on  
Earth?



## WHAT ESA OFFERS



Zero-Equity  
Funding  
(€60k-€3M+)



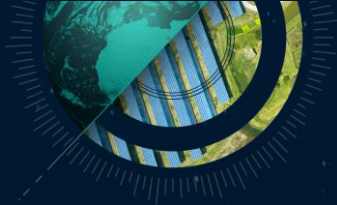
Tailored Project  
Management  
Support



Access to  
Our Network  
& Partners



Use of the  
ESA Brand for  
Credibility



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**Giulia Manzetti**

Space Applications Engineer





# Marine Energy

Planned ESA's funded invitation to tender



## Planned ESA-funded invitation to tender on Marine Energy

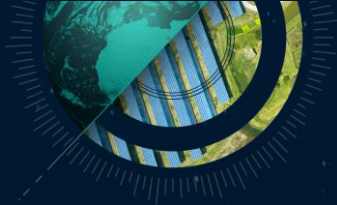
ESA Space Solutions is planning on issuing an open competitive tender for a feasibility study to investigate the technical feasibility and economic viability of space based applications for marine energy solutions, and define a roadmap for services implementation and demonstration.

Invitation to tender planned to be issued in September 2020

**Funding up to € 150K per activity (100% ESA funded)**

Duration 9 months



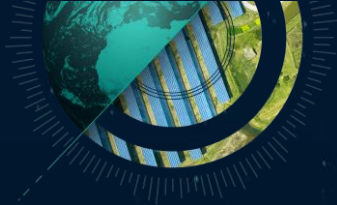


## OBJECTIVES

- Assess **technical** feasibility and **economic** viability of **space** based services in support of **marine energy**;
- Identify and assess the **technical and non-technical risks** associated with the implementation, commercialisation and operations of the services;
- Consolidate the business plan for supporting an informed decision for investment in further activities;
- Define a **roadmap** for services **implementation** and **demonstration** (potentially through a follow-up ESA co-funded demonstration project).







## VALUE OF SPACE



Satellite Navigation

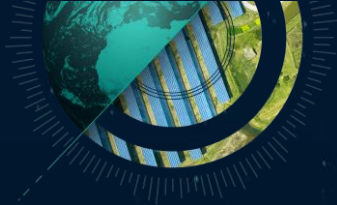


Satellite Communications



Earth Observation





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## CHALLENGES OF THE MARINE ENERGY SECTOR



**Logistics and operation** of marine energy installations (including commissioning, monitoring, maintenance, decommissioning)



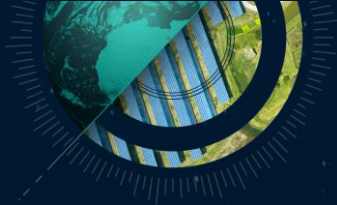
**Increase durability and survival** of marine energy installations



**Resource assessment at different sites** (including hence- and forecast, risk analysis, bankability)



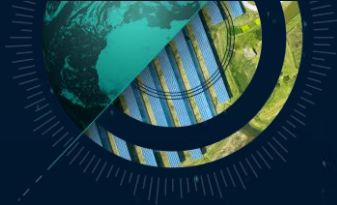
**Supporting environmental impact assessment** of marine energy



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## PITCH SESSION 1/2

### Marine Energy companies (pitches)

- Oceans of Energy (floating solar)
- REDstack (salinity)
- SolarMarinEnergy (floating solar)
- TWEFDA (wave)
- Intertek(consultancy)
- Verdant Power (tidal)
- EC-OG (battery)
- Sabella (tidal)
- Q&A session

Brigitte Vlaswinkel

Rik Siebers

Eamon Howlin

Javier Dominguez

Paul Evans

Dean Corren

Paul Slorach

Marlène Moutel

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Innovation Network

OPIN - a European collaboration fostering  
cross sectoral business development.  
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other events?

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**Interreg**   
North-West Europe  
**OPIN**  
European Regional Development Fund



# Oceans of Energy

*Looking for partnerships for*

- Remote Monitoring Solutions
- Remote Sensing Ecological Research

Brigitte Vlaswinkel, PhD  
Oceans of Energy B.V.  
Wassenaarseweg 75, Building #396  
2223 LA Katwijk, The Netherlands  
[www.oceansofenergy.blue](http://www.oceansofenergy.blue)

*First Offshore Floating Solar Modules  
in North Sea since November 2019*



## Marine applications with ESA technology

- Useful application in Blue Energy Technology
  - Blue energy is energy, harvested from differences in salt concentration of 2 waterflows
  - Blue Energy is a source of sustainable energy, predictable, full continuous available, potential up to 15% of world power demand
- Just a few examples of possible mutual benefit from interactions:
  - Determine season patterns from runoff of rivers
  - Finding the best water intake points
  - Monitoring environmental impact of Blue Energy systems
- Company name: REDstack [www.redstack.nl](http://www.redstack.nl)
- Contact: Pieter Hack (founder and owner): [p.hack@redstack.nl](mailto:p.hack@redstack.nl)  
and Rik Siebers (CEO): [r.siebers@redstack.nl](mailto:r.siebers@redstack.nl)

**Eamon Howlin** MSc CEng CMarEng MIMarEST

**Project Manager/CEO**

**Ballina, County Mayo, Ireland**

Mobile: +353 86 8071394 \* Office: +353 96 22114

[Eamon@solarmarinenergy.com](mailto:Eamon@solarmarinenergy.com)

[www.solarmarinenergy.com](http://www.solarmarinenergy.com)



**WWW.SOLARMARINEENERGY.COM**

TWEFDA is developing an Energy Device called ES-Wave with dual functionalities, addressing the 2 biggest challenges the Energy Market is facing right now with one single device (Energy Storage and Wave Energy Production).

The technology is sustainable, has very big energy efficiency, can potentially repurpose decommissioning assets or relies on its own, belongs to the low-carbon technologies and contributes to the circular economy both, by using renewable sources, and by helping the National Grid to stabilise without using heavy/rare metals to store electricity.

Furthermore, the technology is required globally, can be working 24/7, is extremely respectful of the environment, and could have the potential to revolutionise the entire energy sector according to its dual business streams.

Our device can work in remote locations but is also portable and can assist natural disasters such as Earthquakes or Tsunamis.

Natural disasters can be observed with sky eyes and there is predictive maintenance to foresee what, when and why the equipment will fail, long before it does but also artificial intelligence that will allow our control system to make decisions based on external data such as measuring waves.

The Satellite Earth Observation can provide the data and the Satellite Communication a means to keep the device communicated when in-transit operations are undertaken as a result of the portability but also in connection with the preventative maintenance and the communication when the device provides power for remote assets.



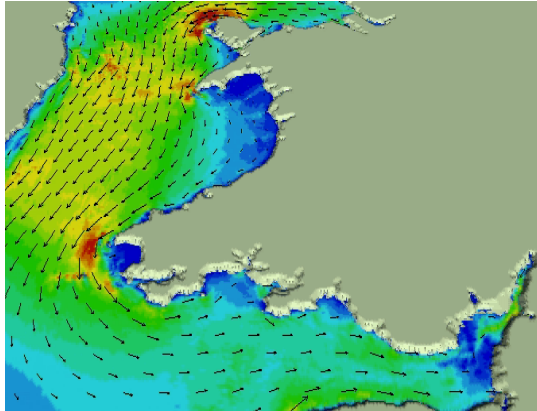


# INTERTEK ENERGY & WATER

- One of the most experienced and established metocean and marine consultants in the UK
- 35 year's experience working in the marine environment
- We provide metocean, site investigation & characterisation, hydrodynamic modelling, cable routing, environmental assessment and consenting / permitting services

## Space Technology has the potential of helping us in a range of sectors and services:

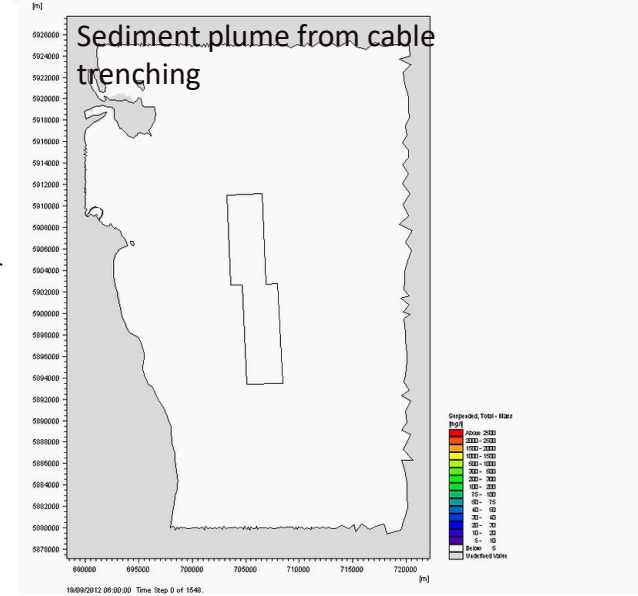
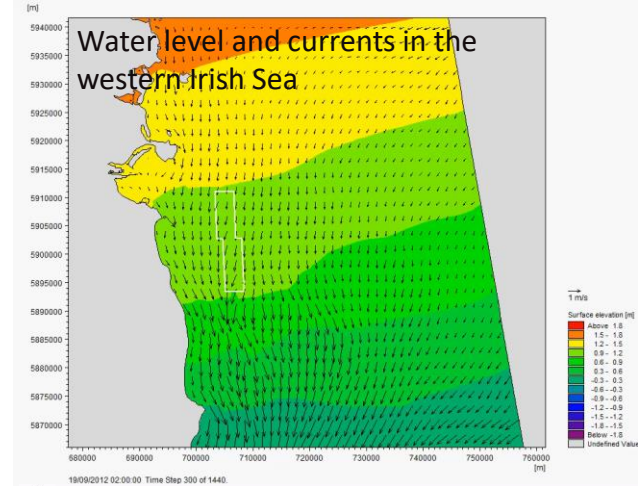
- Site investigation & characterisation
- Oil spill assessments
- Sediment transport
- Metocean design
- Waves and Currents
- Weather downtime
- Habitat mapping
- Real-time monitoring



### Potential Data Usage

Satellite-derived data provides information over a larger spatial and temporal scale:

- Bathymetry in shallow waters
- Sea surface current and wave measurements
- Sea surface temperature
- Tracking of pollution incidents
- Coastal morphological change
- Habitat mapping



# Three Space Tech Opportunities

To Yield Cost-effective Marine Energy

## Three Immediate Applications:

1. **Navigational** – support for precise inertial positioning of TriFrame™ mounts underwater
2. **Testing** – enhanced component and assembly life testing structural and mechanical components under simulated conditions
3. **Resource Assessment** – satellite-based analysis of locations and site characteristics

**Verdant Power:** a leading technology and system developer, using three-bladed, horizontal axis, fifth generation (Gen5) kinetic hydropower system (KHPS) turbines, and low-cost mounting strategies applicable to projects at a range of scales for tidal sites, rivers, and ocean currents.

## Verdant Power Technical Leads:

Dean Corren, Chief Technology Officer

M.S., Energy Science, New York University

Jonathan Colby, Director of Technology Performance

and IEC TC-114 (Marine Energy) Chair



TriFrame™ Mount with Three KHPS Turbines



Verdant's Test & Demo Facility – NY's East River

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# EC-OG: Clean Power Solutions



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Business Development Director  
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[www.ec-og.com](http://www.ec-og.com)

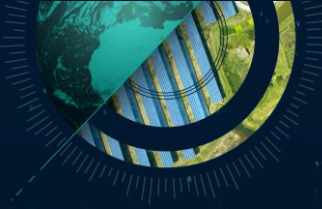


Marine Energy meets Space workshop

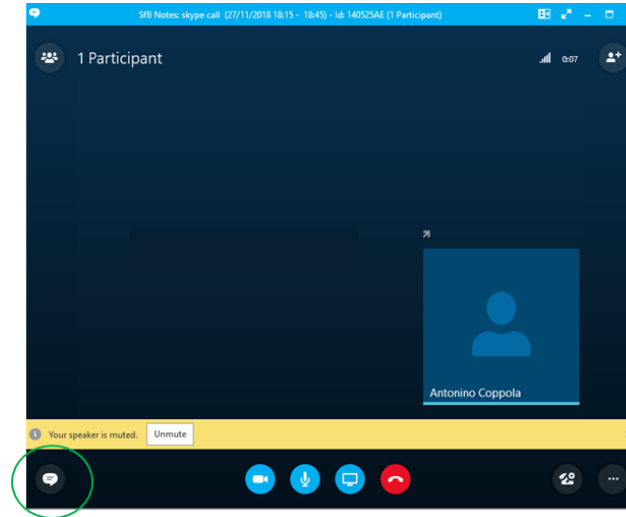
Marlène MOUTEL – [m.moutel@sabella.bzh](mailto:m.moutel@sabella.bzh)  
Business development engineer  
8<sup>th</sup> September 2020







## OPEN QUESTIONS & ANSWERS SESSION 1



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Join via: <https://www.nweurope.eu/projects/project-search/opin-ocean-power-innovation-network/#tab-2>



## PITCH SESSION 2/2

### Space tech companies & consultancies (pitches)

- **Space application services** (robotics, satellites) Shashank Govindaraj
- **Iceye** (earth observation) Fernanda Ledo
- **StormGEO** (earth observation, satellites) Sarah Miller
- **CLS** (earth observation, sat. comm.) Gaetan Fabritius
- **CTC** (robotics, satellites) Maria Campo-Cossio
- **Valispace** (tech. development) Stafan Siarov
- **Q&A session**

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# OUR CAPABILITIES AND INTEREST

Space Applications Services NV/SA  
Leuvensesteenweg 325  
1932 Sint-Stevens-Woluwe (Brussels area)  
BELGIUM



## What are we good at?

- Remote I&M operations using unmanned systems
- Monitoring & control
- Mission planning
- Communications
- Remote Manipulation
- Control Centers setup and operations
- Space to Earth Technology transfer

## Relevant Experience

- Robotics solutions
- Underwater mapping exploration
- Offshore wind energy I&M
- Marine & Land - Search & Rescue
- Fire fighting
- Satellite & RF communications
- > 15 years of continuous operations of space facilities (incl. 24/7)
- Projects : ICARUS, ViewFinder, ATLANTIS, ENDURUNS

## Relevant Solutions

- 3rd Gen Control Center software
- Latency management
- Sensor fusion
- Positioning & mapping

## Areas of Interest

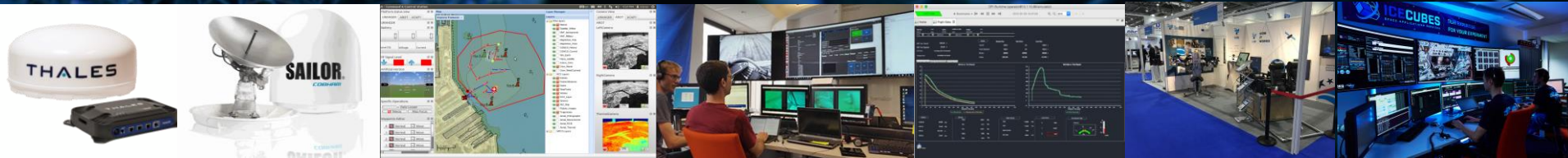
- Increase durability and survival of marine energy installations
- O&M of marine energy installations
- Satellite Navigation & Communications
- Control Centers & Operations

Contact point:

Shashank G., Team Leader Robotics Software

+32-(0)2-416.05.30

shashank.govindaraj@spaceapplications.com



# ICEYE



## BLYTH WIND FARM, UK

Event ID: 24176

Imaged 11-03-2020 14:04:40 UTC

Imaging mode: Spotlight

Orbit Direction: ASCENDING

Look Angle: 23.6 LEFT

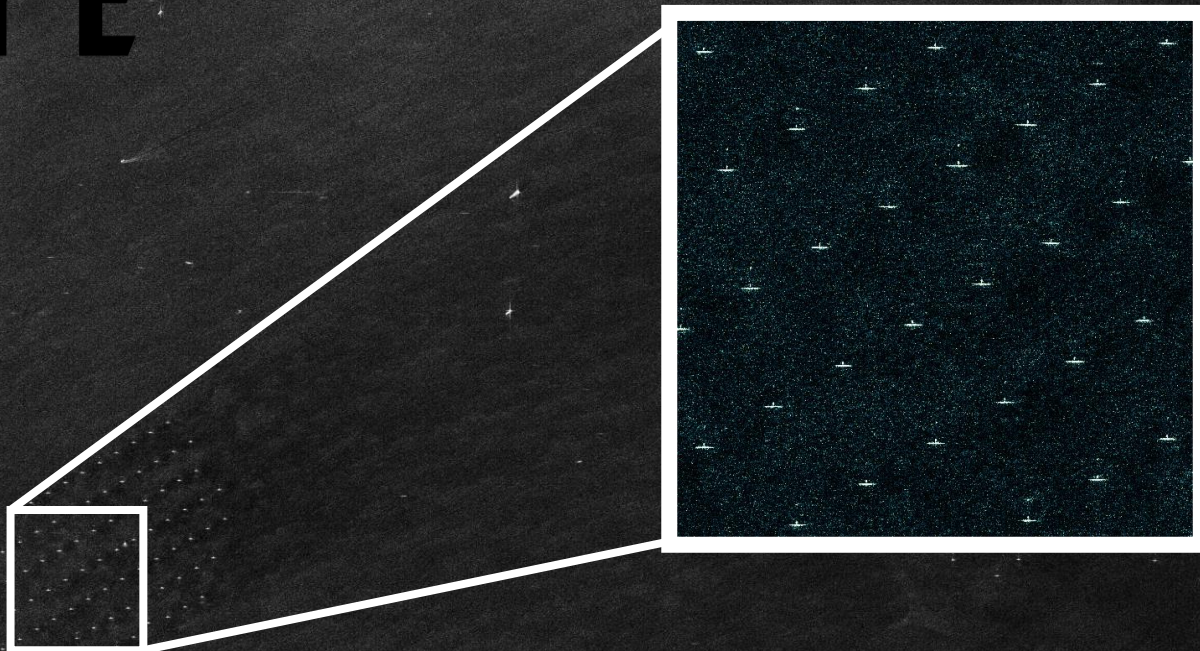
Center coordinates (LAT, LON): 55.127, -1.499

Proprietary & Confidential

ICEYE



# ICEYE



## LONDON WIND FARM, UK

Event ID: 19867

Imaged 06-02-2020 21:52:38 UTC

Imaging mode: Spotlight

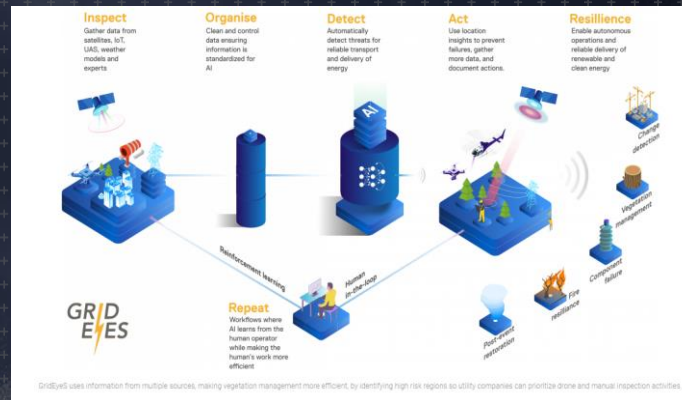
Orbit Direction: ASCENDING

Look Angle: -26.5 RIGHT

Center coordinates (LAT, LON): 51.632, 1.477

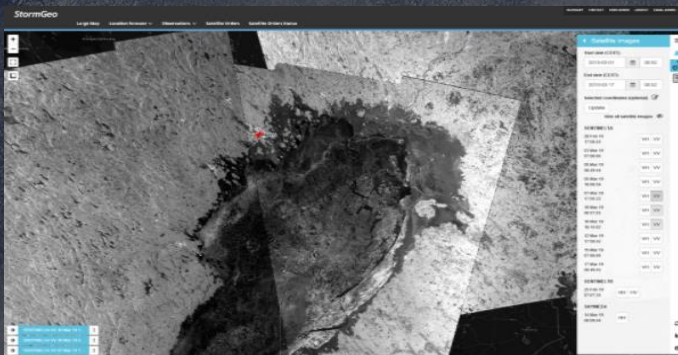
Proprietary & Confidential

ICEYE

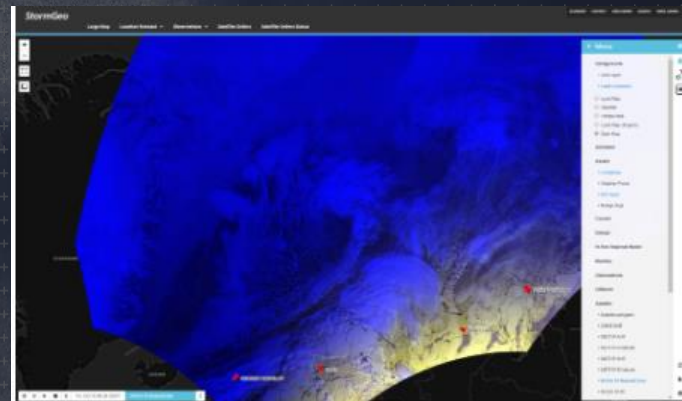


**StormGeo**  
Freedom to Perform

# // Data Science – what can we unlock?



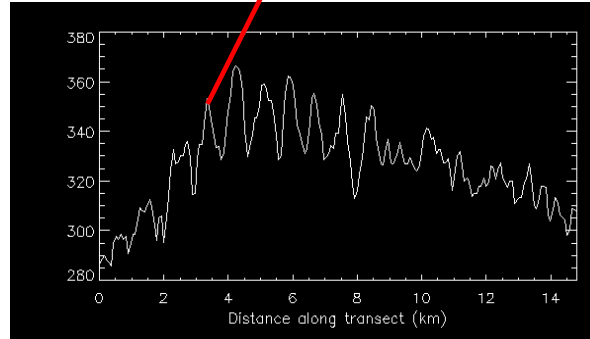
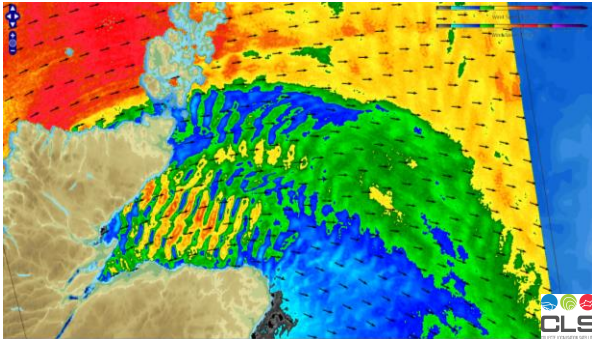
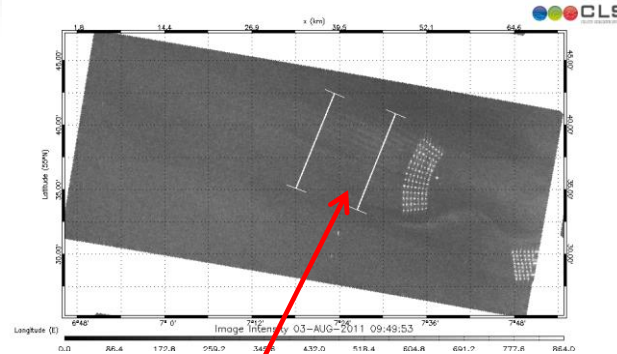
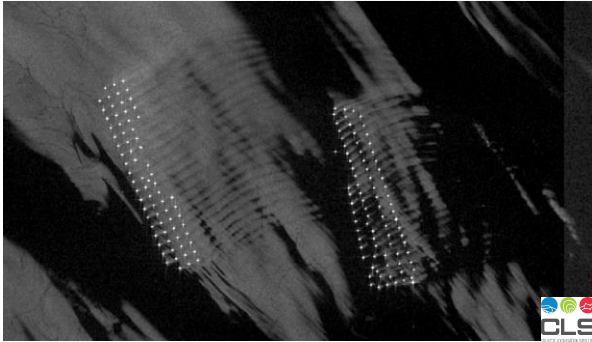
Satellite images of the Bothnian Bay, stitched together by StormGeo. By overlaying SAR images with different polarizations and from different timesteps, it is simpler to evaluate sea ice.



Sarah Miller // +44 (0)771 448 9263 // [sarah.miller@stormeo.com](mailto:sarah.miller@stormeo.com)

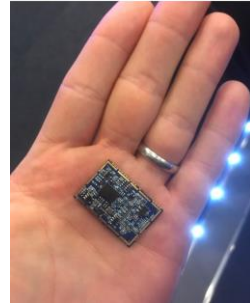
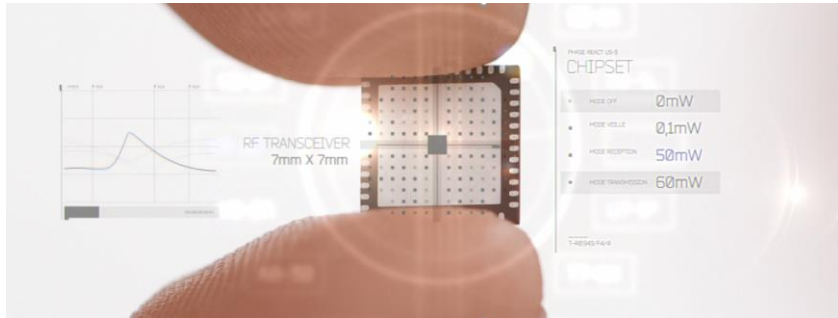


# SARWind: Offshore Wind Data from Satellite Imagery



- Satellite Imagery (SAR) provide high resolution & precise offshore wind field information => SARWind
- Combination of SARWind data with atmospheric numerical models and in situ data enhance the knowledge on the wind energy potential
- SARWind => High Resolution Dynamical Information from topography interaction and turbines interference (wake effects) in the wind field
- Artificial Intelligence to provide offshore wind production forecasts
- Global Studies, Nowcasts, Hindcasts

# Space-based IoT : opening up new horizons



- IoT – very low data rate
- very low power / energy efficient
- ultra low cost / consumable
- truly global & real time

⇒ Surface and pop-up tags  
⇒ Drone-deployable units  
⇒ Collaborative science





# CTC - Navigation and Robotics Unit

Maria Campo-Cossío, [mcampo@centrotecnologicoCTC.com](mailto:mcampo@centrotecnologicoCTC.com)  
[www.centrotecnologicoCTC.com](http://www.centrotecnologicoCTC.com)

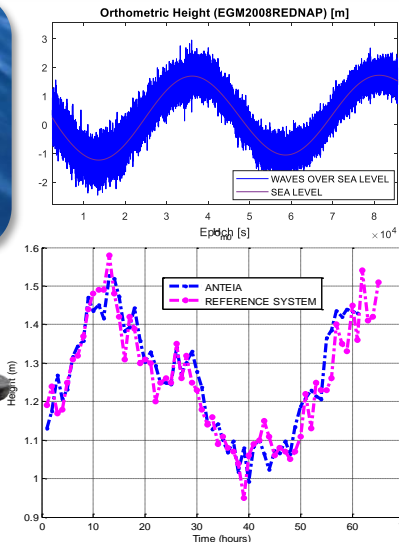
## Precise Positioning and Attitude

- Precise positioning techniques based on GNSS (eg. PPP, RTK)
- Attitude based on GNSS (Roll, Pitch, Yaw)
- Navigation sensors data fusion (GNSS, INS, odometer, etc)
- Indoor navigation solutions (Bluetooth, UWB, etc)

## Wave and Sea Level Buoys



ANTEIA Buoy



## Preventive Maintenance

- Structural Health Monitoring algorithms exploiting GNSS
- Sensing, modelling and prediction (damages detection and classification)
- Integrity and risk assesment



H2020 MooringSense

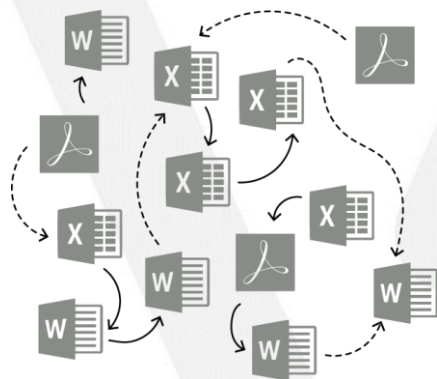
## Guidance, Navigation and Control

- SLAM techniques (navigation, mapping) for autonomous vehicles navigation
- Adaptive navigation, path planning and obstacle avoidance

## Autonomous vehicles



# Concurrent Engineering for the Marine Energy sector



document driven  
engineering



data-driven  
engineering

# VALISPACE

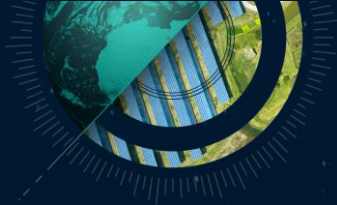
- **save 15-30%** in development costs
- lead concept studies **in days** instead of months through fast iteration cycles
- **trade-off** different alternatives easily
- **collaborate** simultaneously, even in distributed and interdisciplinary teams
- automatic propagation of changes ensures **full traceability**
- smart documentation and simulations

some of our customers you can learn  
from

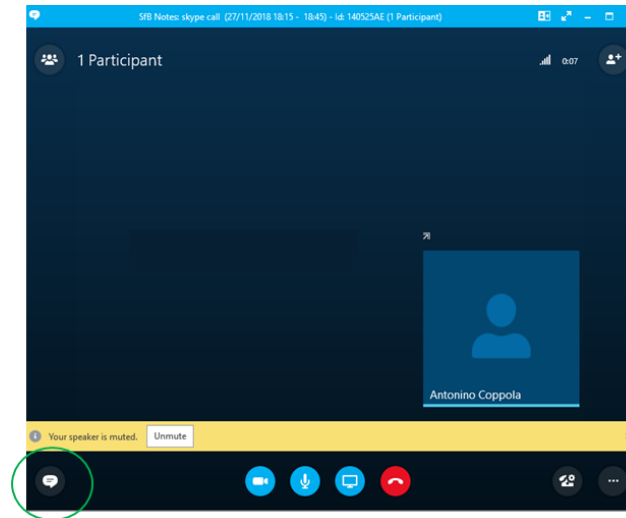


# AIRBUS

Interested? contact  
[stefan@valispace.com](mailto:stefan@valispace.com)

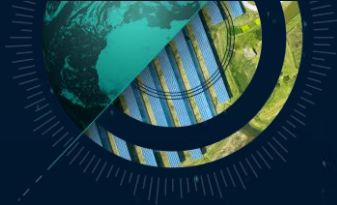


## OPEN QUESTIONS & ANSWERS SESSION 2



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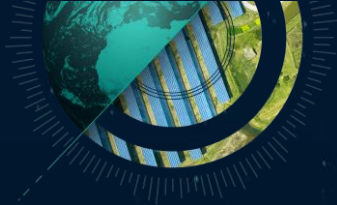


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## NEXT WEBINAR

### Marine Energy webinar

15 September 2020, 11:00 CEST

Register here:

[business.esa.int/funding/intended-tender/marine-energy](https://business.esa.int/funding/intended-tender/marine-energy)





→ **THANK YOU!**

[business.esa.int](https://business.esa.int)

[dutchmarineenergy.com](https://dutchmarineenergy.com)

