International Federation of Hydrographic Societies

E-positioning

Presentation December 12th, 2019
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iXblue

High-Technology Independent Company

640+
employees

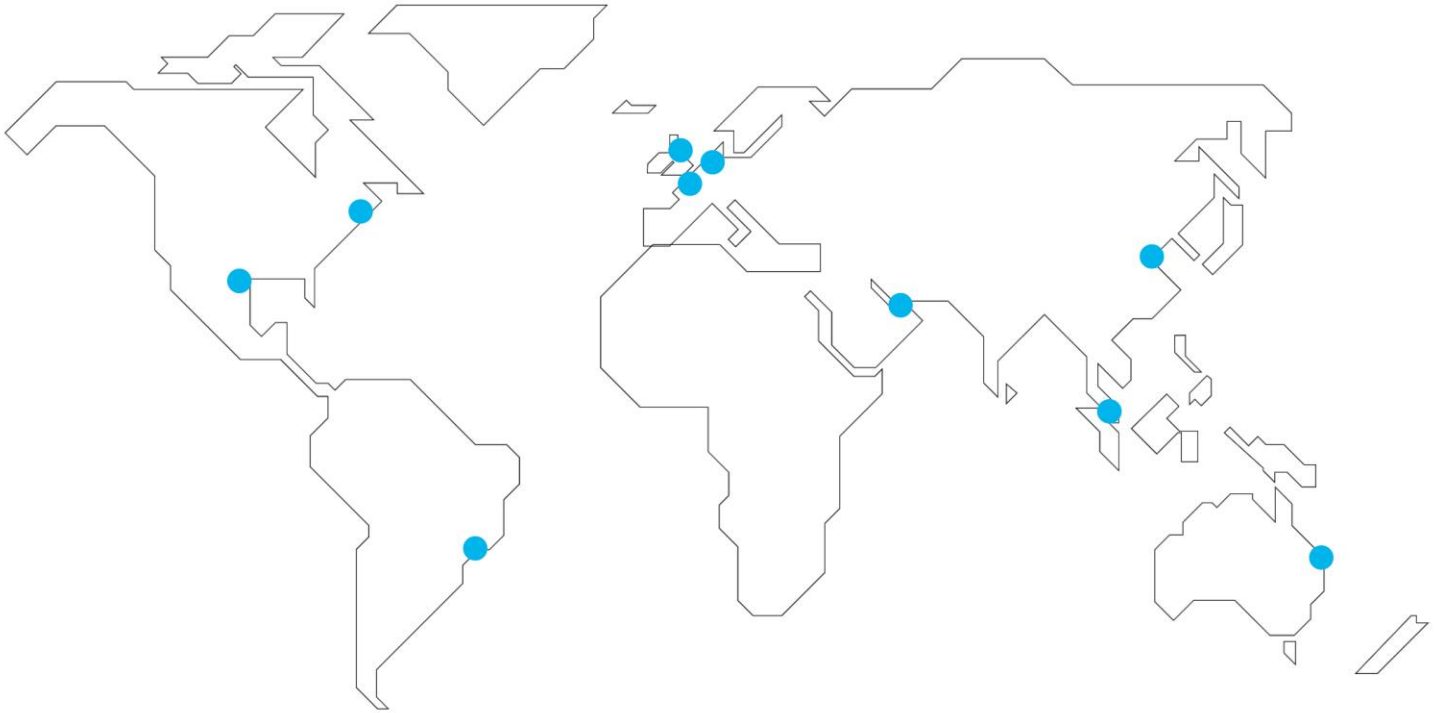
110+ M€
turnover

80%
export

Founded in 2000

iXblue

Global Footprint

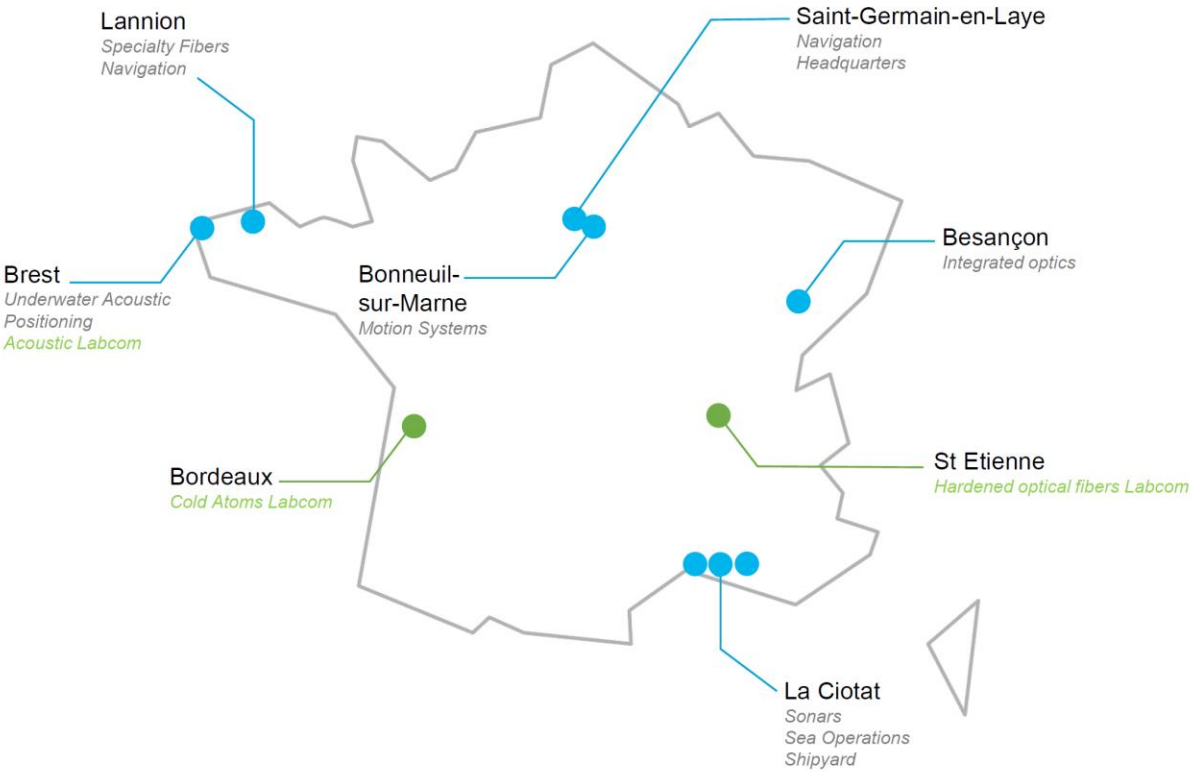


24/7
support

11 offices
Worldwide

iXblue

iXblue in France



8 industrial sites

100% of R&D and production as well as **90%** of suppliers located in France

Joint Research Laboratories

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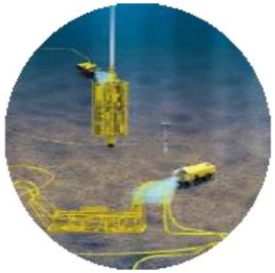
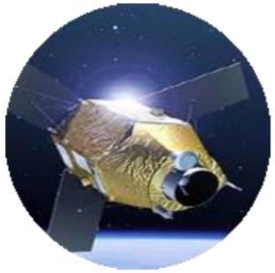
Applications



Energy and Renewables

Hydrography



Space

Defense

Navigation

Autonomous vehicles

Science

Fishing and fishery research

Our products are used from the depths of the oceans to outer space in very diverse applications. We encourage strong cross-fertilization, technical and methodological synergies between those applications.

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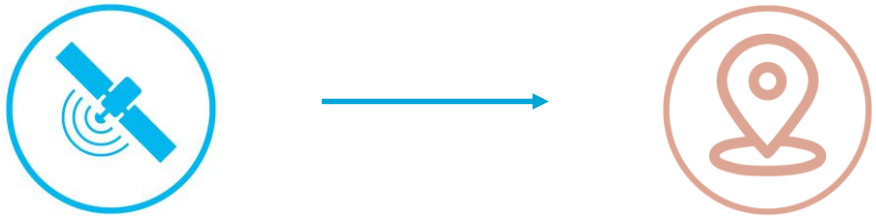
E-positioning

Why use e-positioning?

Simple and cheap architecture
but some drawbacks...



GPS

Jammed, Spoofed, …

Position

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E-positioning

Why use e-positioning?

Still non resilient architecture

GPS

Jammed, Spoofed, …

INS

No drift

Can be jammed or spoofed through GPS
Need to implement GPS rejector

Cannot be jammed or spoofed
But drift

Position

Non resilient position

E-positioning

How to compensate the INS drift today?

GPS
Jammed, Spoofed, …

Compass
Time consuming
Human error

Bathymetric positioning
Needs a bathymetric gradient

Not fully resilient architecture
manual, long, mistakes are possible

INS
Drifting

Position

E-positioning

What is e-positioning ?

« E-Positioning is the computation of a resilient navigation solution by correlating every sensors available »

E-positioning

What is e-positioning ?

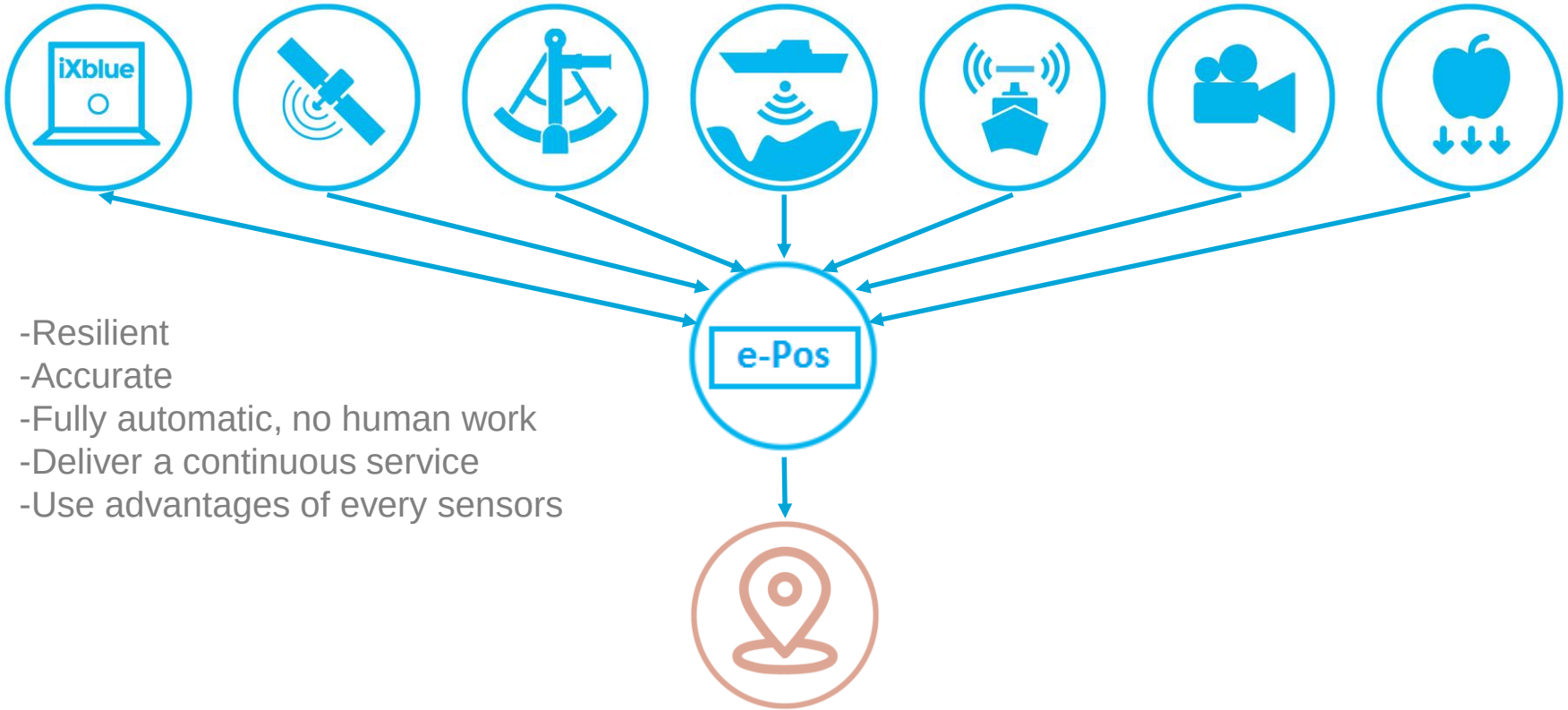
1 Every piece of information about the ships surroundings can be used for position determination

2 Each sensor has advantages and drawbacks and they are all complementary

3 Every piece of data must be used to compute a resilient position

E-positioning

e-positioning architecture



-Resilient
-Accurate
-Fully automatic, no human work
-Deliver a continuous service
-Use advantages of every sensors

Resilient position

E-positioning : vision

How can we use vision to enhance INS position?

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E-positioning

What does iXblue do ?

E-positioning using vision :

- 1 position = 1 unique horizon line
- During coastal navigation, the horizon is mainly determined by natural topography
- Worldwide digital elevation models are now available

E-positioning : vision

Principle

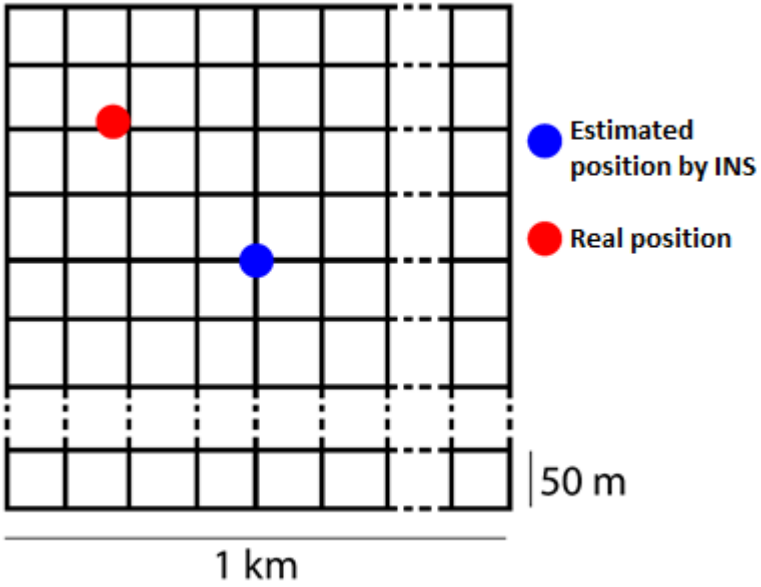
1 Acquire a video panorama and detect the horizon

Deep Learning vision algorithms

2 Define a research area

3 Build a resarch grid

4 Generate the horizon corresponding to each point



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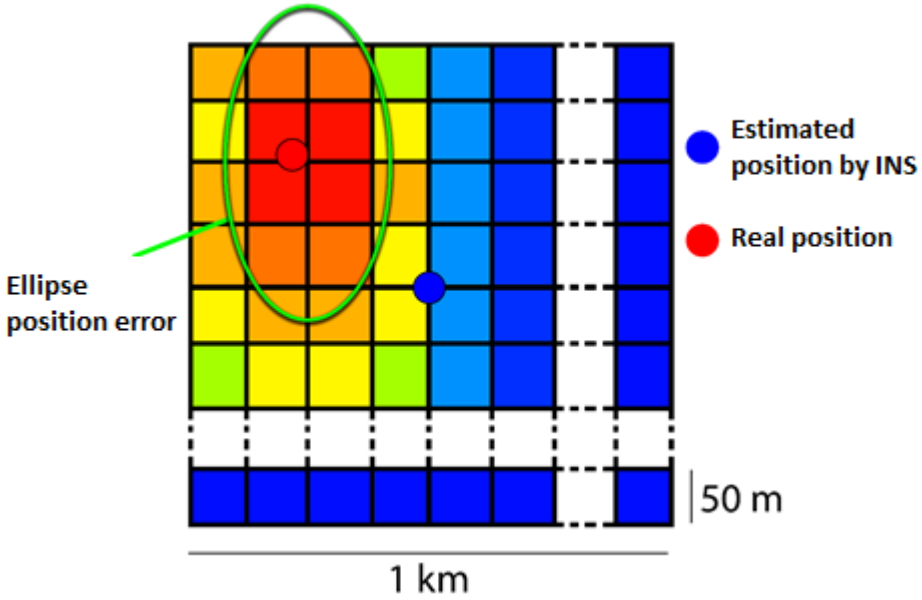
E-positioning : vision

Principle

5 Comparing with the true horizon line



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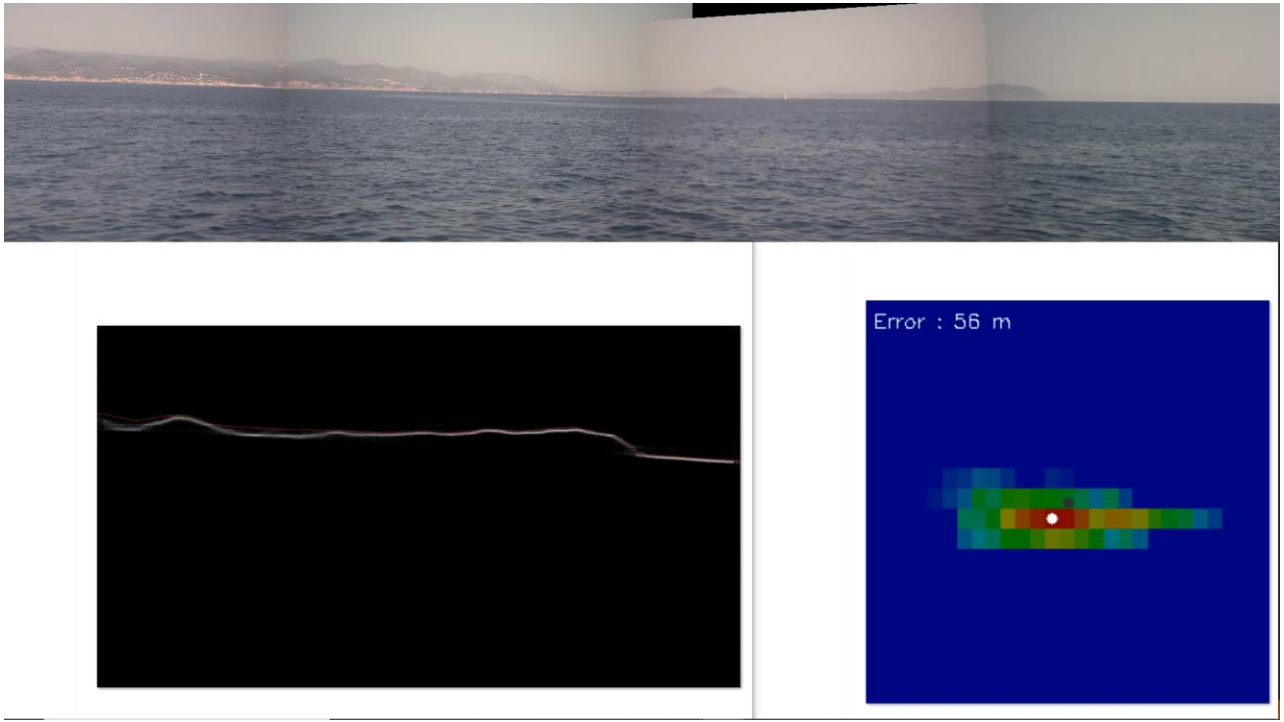
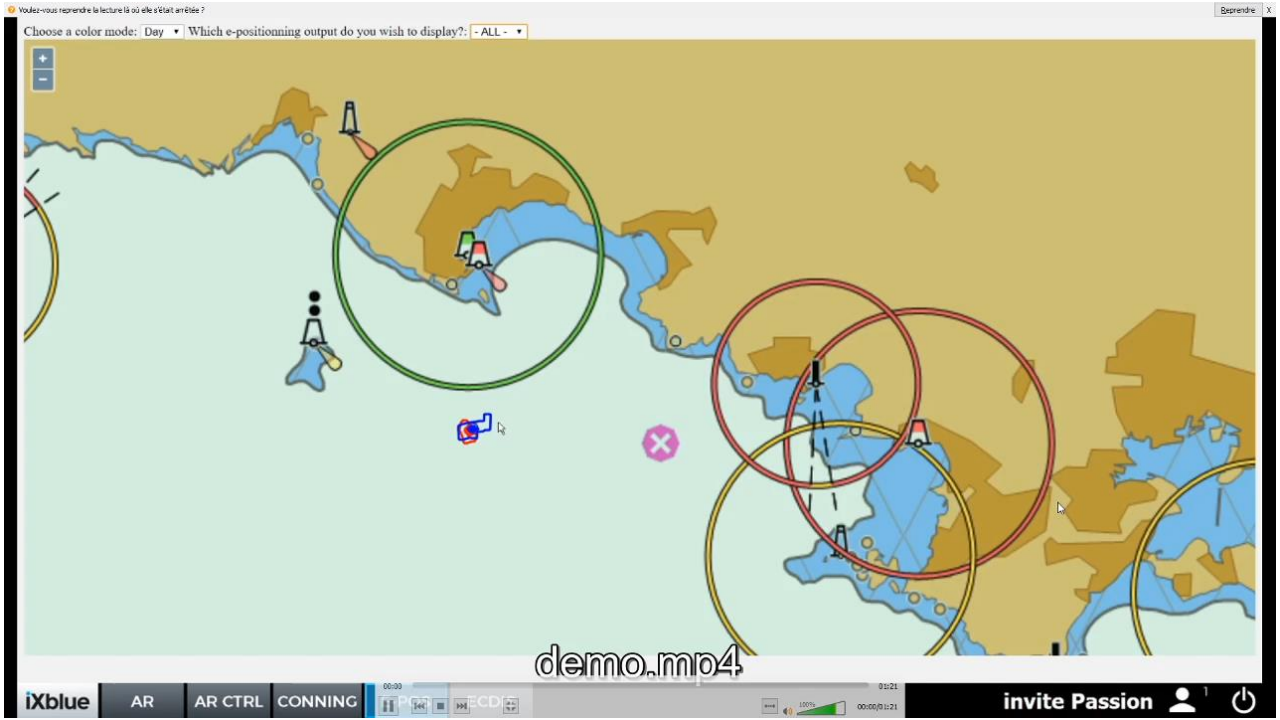
E-positioning : vision

How the algorithm works in video?



E-positioning : vision

How the information is displayed to the user?



E-positioning : radar

Principle

E-positioning using radar :

- 1 position = 1 unique radar image
- During coastal navigation, the radar image is mainly determined by natural topography
- Worldwide digital elevation models are now available

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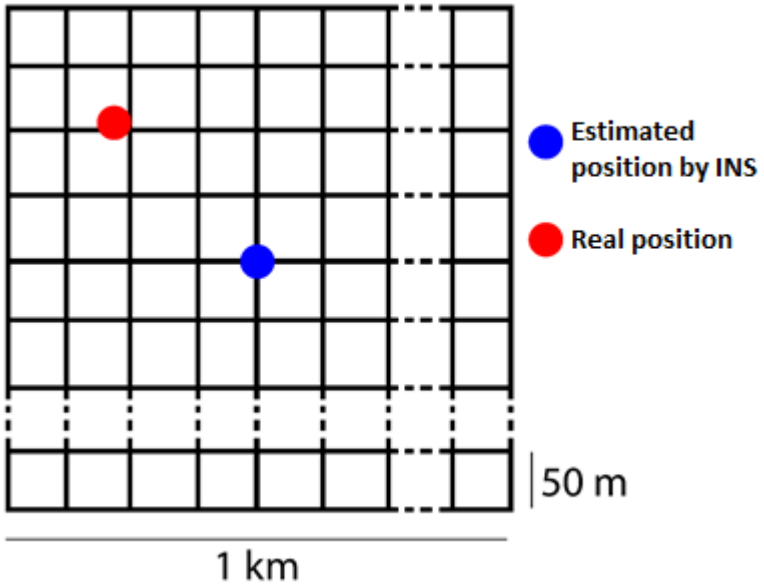
E-positioning : radar

Principle

1. Acquire a radar image
2. Define a research area
3. Build a resarch grid
4. Generate a simulated radar image at each point



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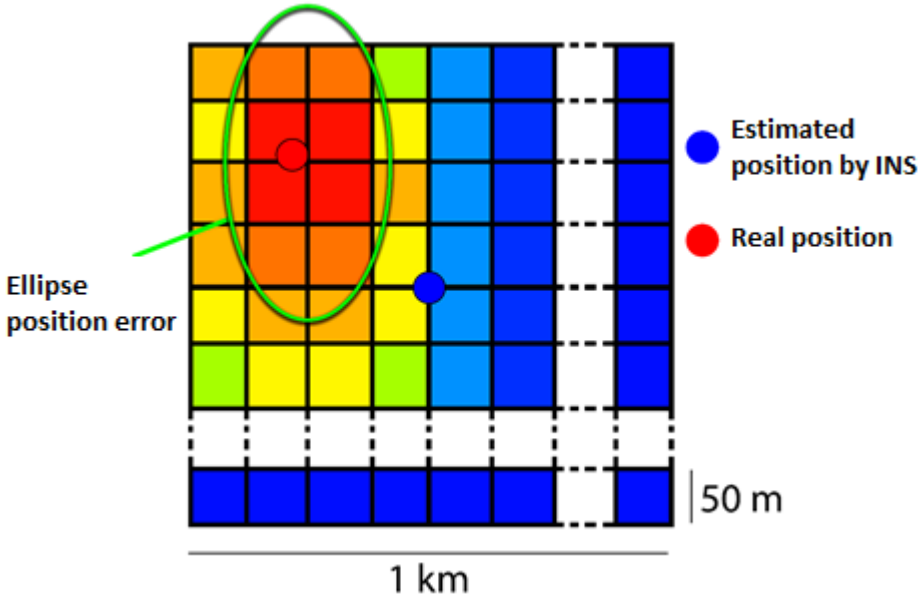
E-positioning : radar

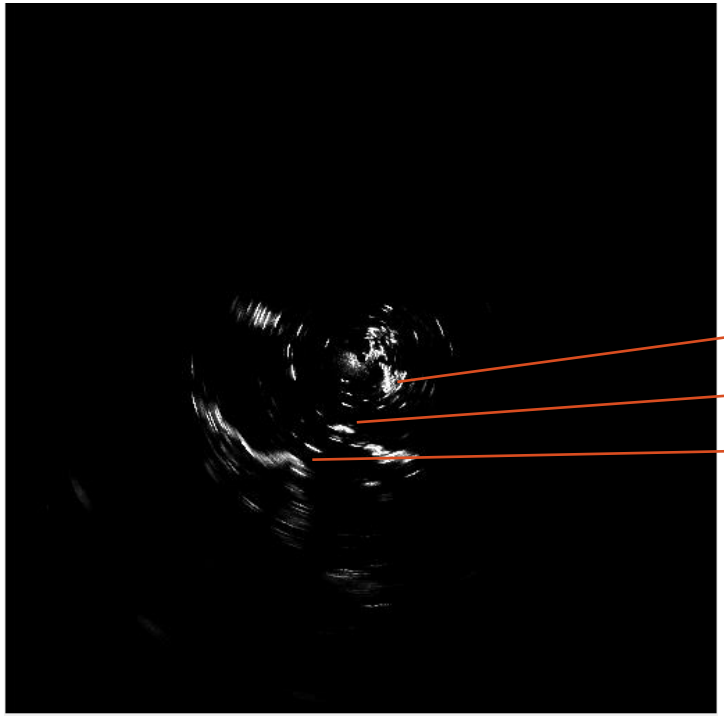
Principle

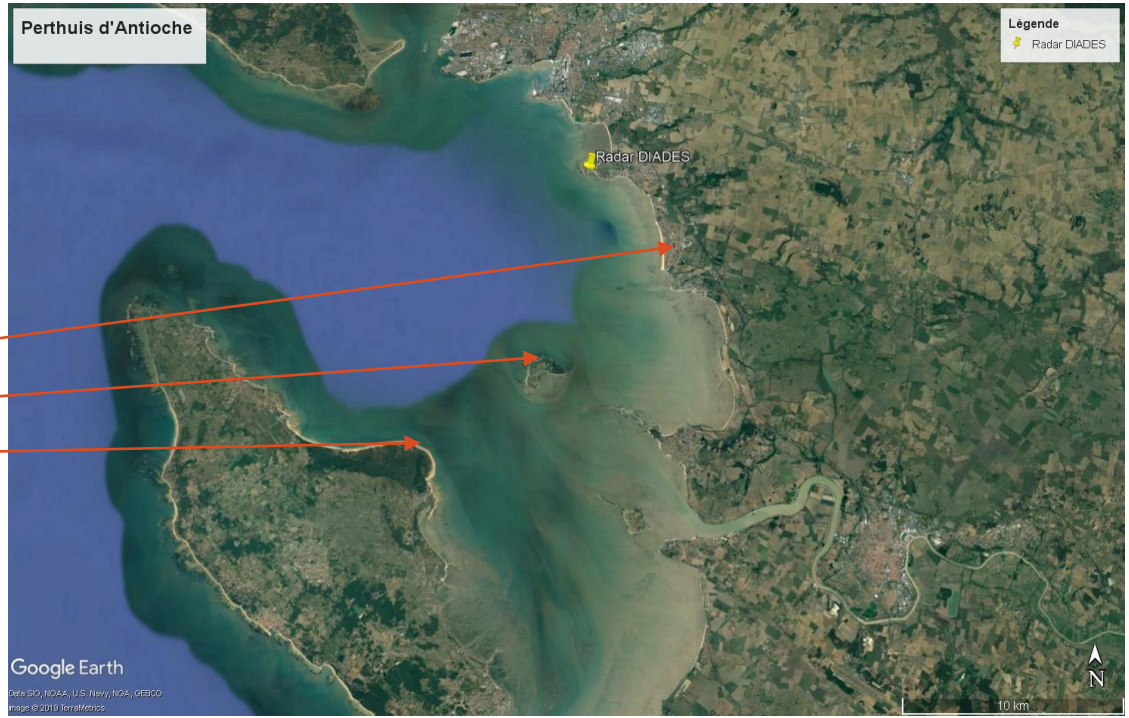
5 Comparing simulated radar image with the real radar image



E-positioning : radar

Principle





E-positioning : gravimetric

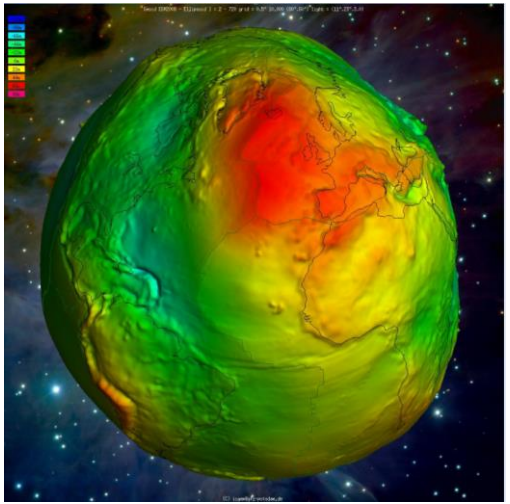
Principle

E-positioning using gravimetric sensors :

1 Acquire several gravity measurements

2 Compare with gravimetric map of the surroudings

3 Inertial coupling for position improvement



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E-positioning : bathymetric

Principle

E-positioning using depth sensors :

1 Acquire several depth measurements

2 Compare with bathymetric map of the surroudings

3 Compute areas with a high probability of presence

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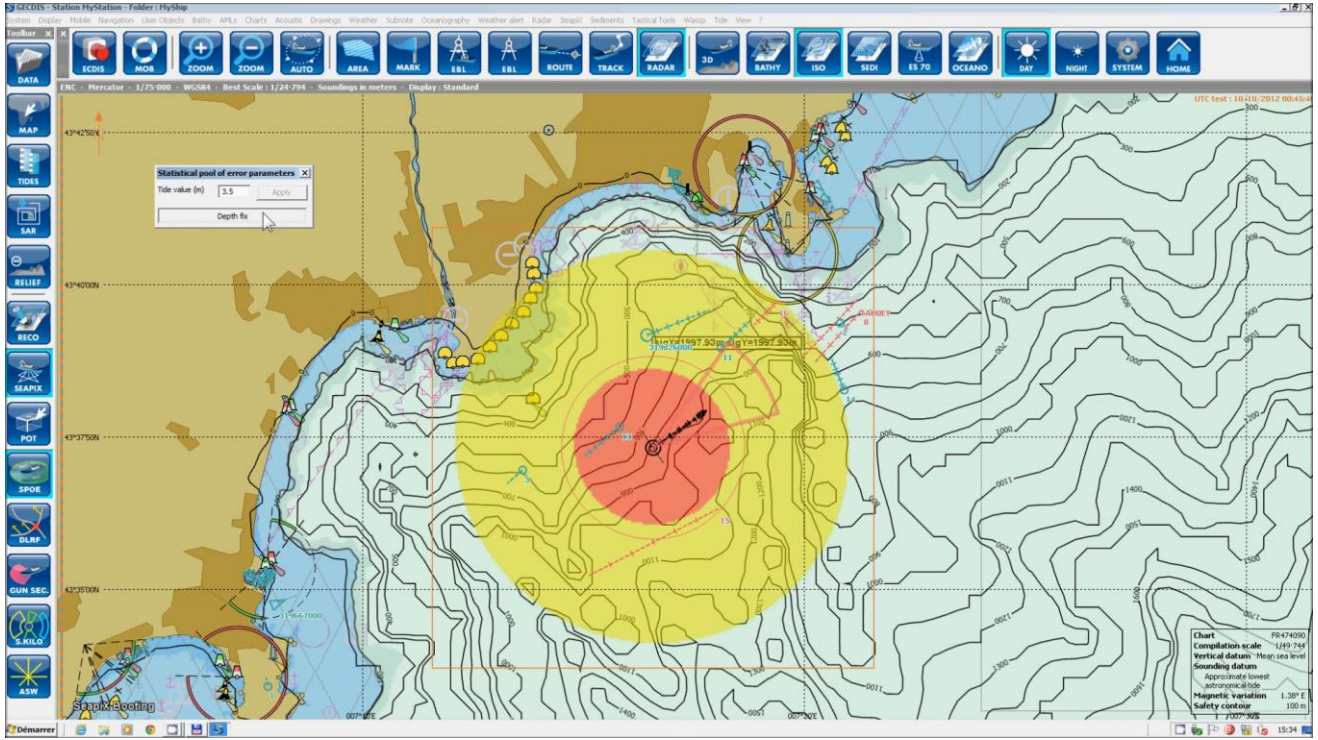
E-positioning : bathymetric

How the information is displayed?



E-positioning

How to go further?

- Every sensor is used for positioning, not only the INS
- Other sensors can be used such as lighthouses detection, astral measurement, …
- Every positioning system performance changes with context: a smart correlation is needed
- The more positionnig systems on-boad, the more robust and resilient the position

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