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## A fully submersible NDT inspection robot

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**EMRA'19**

**Workshop on EU-funded  
Marine Robotics and Applications  
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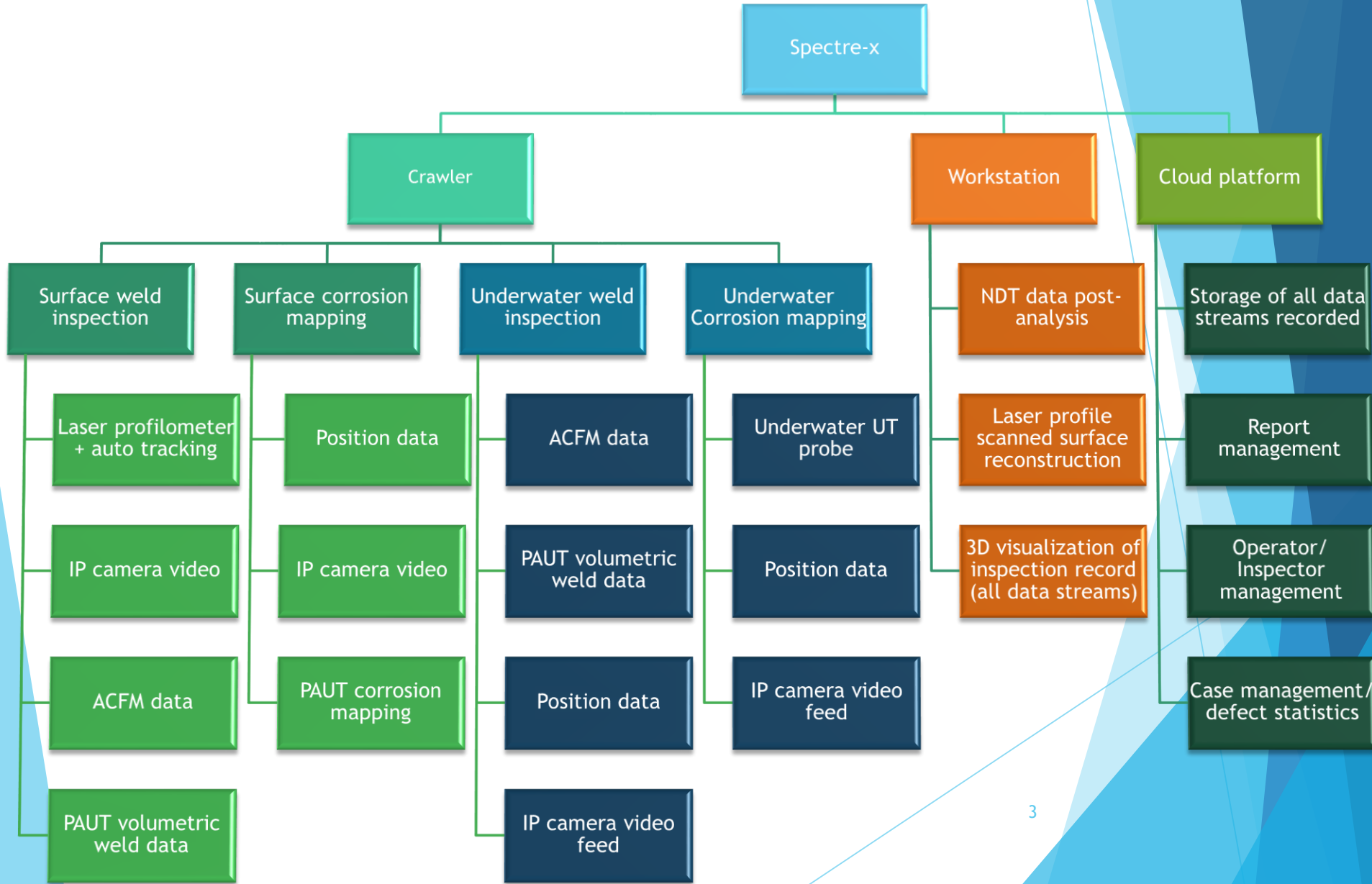
## Project Shiptest

- **Shiptest** is a collaborative project of 5 partners aiming to produce an NDT robotic semi-autonomous inspection system focusing on inspecting ships' hulls.
- The partners involved in the project are:



- Shiptest follows the successfully completed **X-Scan** demonstrator robot
- **Spectre-x** is the name given to the robotic NDT inspection system developed within the framework of the Shiptest project.
- Shiptest is an FTI project funded by the EU under the H2020 scheme.

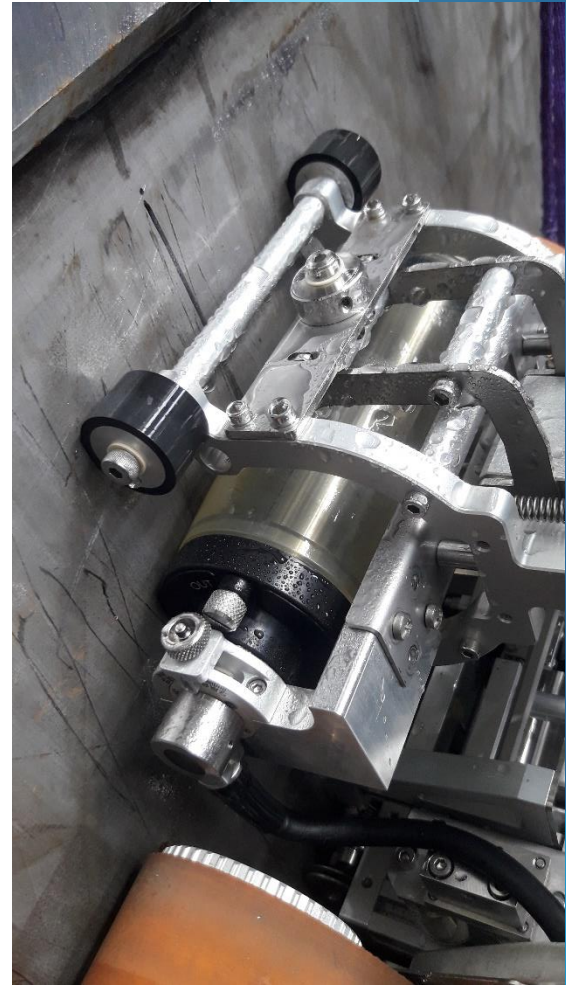
# SPECTRE-X



# SPECTRE-X

## NDT technologies - Phased Array Ultrasonic Testing (PAUT)

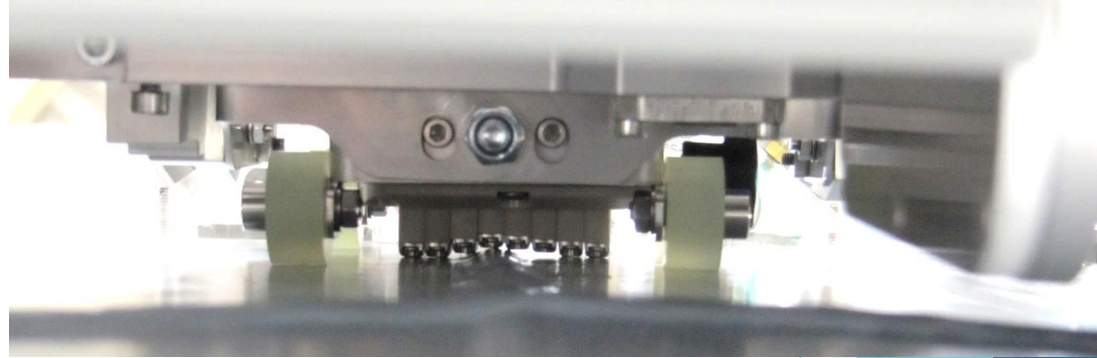
- ▶ Board-level electronics
  - + Light and small
  - + Short distance from unit to probe
  - Increased cost
- ▶ Volumetric welding scanning
  - ▶ Weld data acquisition is system agnostic. Allows for data to be saved in the file format of the assessment software the operator is familiar with.
- ▶ Corrosion mapping
  - ▶ 128 element wheel/roller probe
  - ▶ Active width of probe is ~96 mm
  - ▶ Data is saved in a format to be used with 3D software platform for full mapping.



# SPECTRE-X

## NDT technologies - Alternating Current Field Measurement (ACFM)

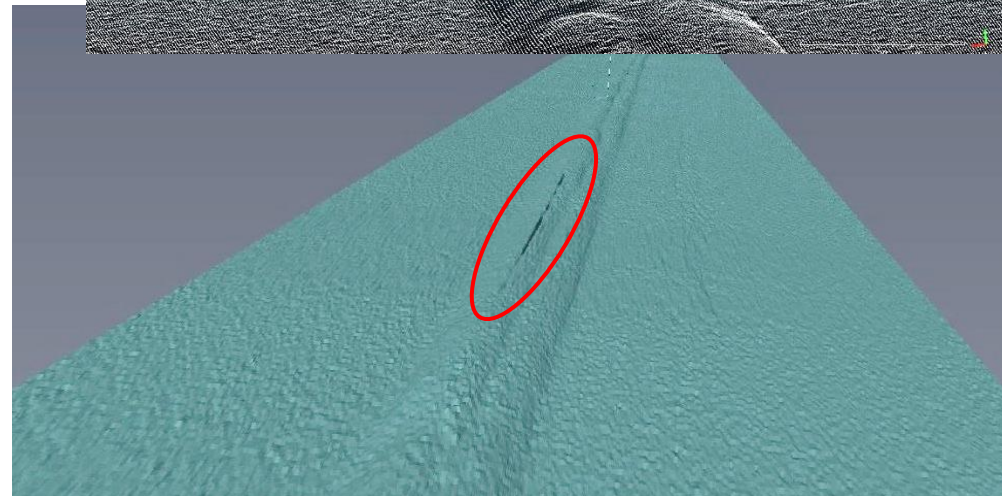
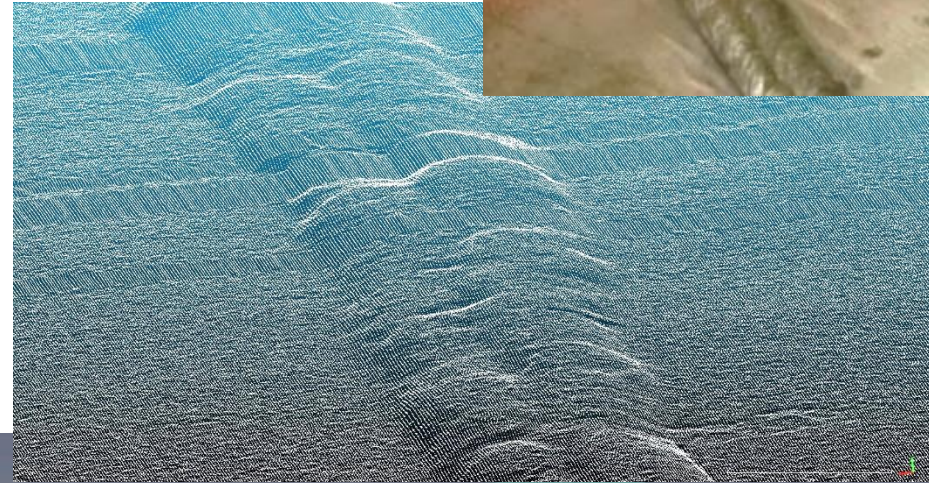
- ▶ Determines crack length and depth (usually anything longer than 10mm and deeper than 2 mm)
- ▶ Provides accurate and auditable inspection records
- ▶ Capable of inspecting on top of several mm thick coatings, corroded surfaces
- ▶ Board-level electronics
  - + Light and small
  - + Short distance from unit to probe
  - Increased cost
- ▶ Underwater multi-channel array probe makes it possible to cover more area in a single pass (weld cap and toes) - requires more time for analysis
- ▶ Familiar ACFM assistant software platform for data acquisition and analysis



# SPECTRE-X

## NDT technologies - Laser profilometer

- ▶ Suitable to surface operation only
- ▶ Produces surface profile of welding
- ▶ Real time centreline tracking for correct sensor placement
- ▶ Data is saved in format to be used with 3D software platform for full mapping
- ▶ Software assessment for defect sizing and acceptance according to relevant code/acceptance criteria



# SPECTRE-X

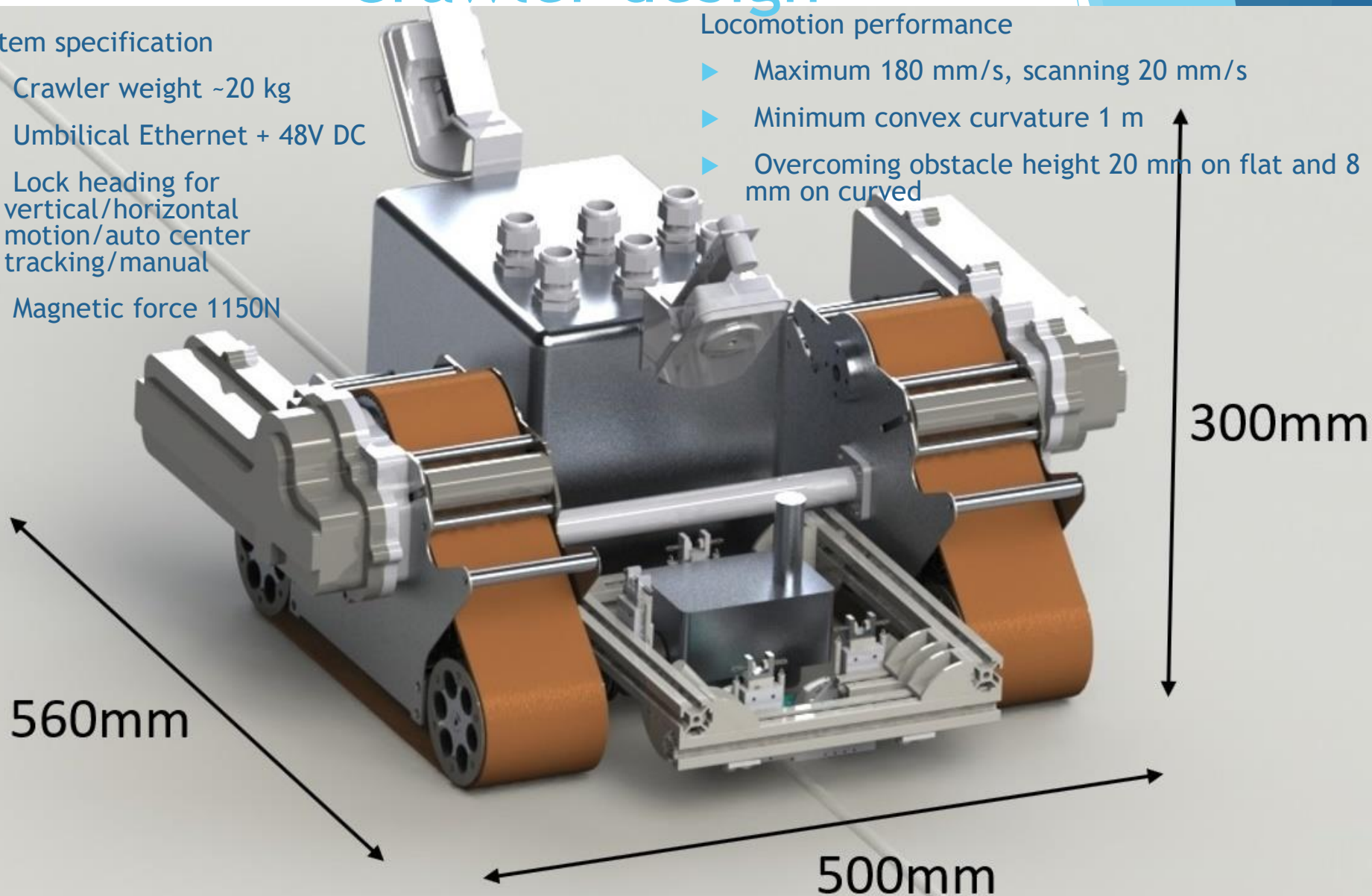
## Crawler design

### System specification

- ▶ Crawler weight ~20 kg
- ▶ Umbilical Ethernet + 48V DC
- ▶ Lock heading for vertical/horizontal motion/auto center tracking/manual
- ▶ Magnetic force 1150N

### Locomotion performance

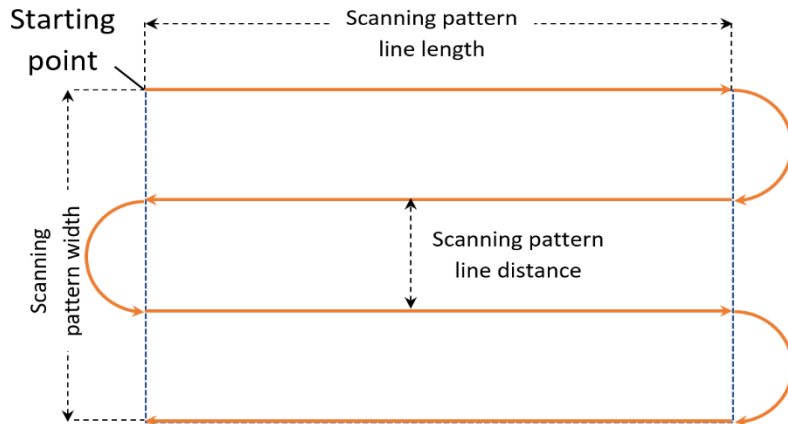
- ▶ Maximum 180 mm/s, scanning 20 mm/s
- ▶ Minimum convex curvature 1 m
- ▶ Overcoming obstacle height 20 mm on flat and 8 mm on curved



# SPECTRE-X

## Field testing

- ▶ Laser auto tracking suitable to surface operation only
- ▶ 5 to 50 mm/s scanning speed





# SPECTRE-X

## Cloud platform

SPECTRE-X



Clients



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+30210-6912010  
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List of Ships

- Explorer  
H: 30 m, L: 200 m
- Paradise  
H: 20 m, L: 100 m
- Paradise III

+ ADD SHIP

### Shanghai Waigaoqiao

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### Duzgit

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### Oshima Shipbuilding

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## Conclusion

- ▶ Full welding/corrosion NDT inspection system
- ▶ Highly adaptable platform
- ▶ Not just a crawler carrying NDT techniques but a complete packaged system
- ▶ [www.shiptest.eu](http://www.shiptest.eu)

