NAUTILUS
Floating Solutions

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NAUTILUS FLOATING SOLUTIONS

Mission and shareholders
Mission

To Design, Manufacture, Assemble, Install, Operate & Maintain floating platforms for Offshore Wind
An industrial group dedicated to the design and construction of all kind of vessels

The first private R&D entity in Spain and one of the most relevant centers in Europe.

The world leader in the supply of chains and mooring systems for the offshore industry.

An industrial group focusing its activity on engineering solutions from construction to maintenance engineering of industrial facilities.

An international group that operates in the field of electrical networks, electronics and communications. Leader in the supply of MV cells for the offshore wind market.

Collaboration agreement: Feb-2017

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NAUTILUS FLOATING PLATFORM

NAUTILUS concept
Design Concept

NAUTILUS concept
Design Concept

Main features

- Four-columns semisubmersible structure
- Rigid ring pontoon with flat lower surface
- No tubular joints
- Heave plate inside column perimeter
- Symmetrical structure
- Steel construction
- Two types of ballast:
  - Active water ballast
  - Passive concrete ballast
- Standard catenary mooring
- Two column redundant access to WTG
Features, advantages and benefits

- Four-columns semisubmersible structure
- Reduce global dimensions while keeping stability
- Block construction
- Reduce outdoor assembly time
- Passive concrete ballast
- Reduces weight during manufacturing
- No tubular joints
- Simpler manufacturing
- Reducing manufacturing costs
- Rigid ring pontoon with flat lower surface
- Various load-out procedures available
- Reducing load-out costs
- Standard catenary mooring
- Proven mooring system
- Heave plate inside column perimeter
- Easy quay berthing
- Reducing assembly & installation costs
- Symmetrical structure
- Less sensitivity to wind-wave misalignment
- Steel construction
- Well-known material behaviour in the sea
- Active water ballast
- Allows draft adjustment depending on operating conditions
- Reducing O&M costs

Feb-2017

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Our Value Proposition

Conventional construction in port or shipyard

Towing and installation with conventional means

Minimum logistics for Wind Turbine assembly

Reduced Levelized Cost of Energy LCoE
Design Procedure

Basic design

1. Design basis
   - Metoceanic conditions
   - Functional requirements
   - Wind turbine data

2. Sizing
   - Floater
   - Hydrostatics
   - Mooring
   - Scantling

3. Design load cases

4. Stability & seakeeping

5. Structural analysis

6. Dynamic simulations

7. Tank tests

8. Outfitting design

9. Installation

10. Economic assessment

Following DNV-OS-J103, DNVGL-ST-0126, DNVGL-ST-0437 standards
Manufacturing

Offshore industry conventional procedure

Material storage → Steel blocks fabrication → Steel blocks assembly → Outfitting

WT assembly ← Testing ← Load out ← Painting
Load-out

Various procedures available

**Slipway**
Conventional naval industry resource
Easy and cheap load-out procedure

**Dry dock**
Scarce resource for the required widths

**Barge**
Reduced availability for required barge features.

**Cranes (floating or land)**
Cranes mobilization high cost and limited availability.

**Syncrolift**

**Caisson floating dock**
For serial manufacturing, specific load out procedures are being developed.
Mooring installation and floater towing

Mooring lines set up and anchoring drag

2 Sea-going Tug Vessel:
- Bollard Pull 50 tons

1 Sea-going Tug Vessel:
- Bollard Pull 120 tons
Floater installation

1. Mooring aftward lines connection

2. Aftward lines lay down

3. Mooring forward lines connection

4. Forward lines lay down

No need for expensive jack-up vessels to perform installation
Operation & Maintenance

Scheduled maintenance and minor repairs

Major repairs can be done in the port without using jack-up vessels

Weather windows and required vessels quite similar to fixed offshore
Localization in the Basque Country

North of Spain:
- Good suppliers for offshore wind foundations
- Developed value chain
- Cost conscious
- Well located to serve European North Atlantic wind farms
TECHNOLOGY STATUS

Current Developments and R&D Activities
Finishing the basic design

- NAUTILUS filled the European patent application **EP16382658.9**
- NAUTILUS is going through a Critical Design Review performed by RAMBOLL (a well-known specialist engineering firm)
- Starting “a feasibility study” performed by a certification body to show NAUTILUS competence in the design process and focus a future certification process
R&D Activities

Participating in various Regional, National and European R&D Projects

H2020 SME Instrument
- New Floating Platform for offshore wind in deep waters
- Phase 1 awarded
- EU contribution: 50,000 €

H2020 – LCE2: EERA Wind LIFES 50+ Project
- Optimize and qualify to a TRL 5, of two innovative substructure designs for 10MW turbines
- Budget: 7.3 MM€

DNV-GL Joint Industry Project
- Coupled Dynamic Analysis of Floating Wind Turbines

HAZITEK 2016 – Basque Country
- Development of a Structure for Floating Offshore Wind
- Budget: 210 k€

SODERCAN: I+C=+C
- SAFE: Development of a Motion Compensated Gangway to Access Marine Energy devices
- Budget: 1.1 MM€

CDTI – CIEN: FLOCAN2GRID
- New Solutions for Innovative Platforms and Technologies associated to the evacuation and network integration of Floating Offshore Wind Farms.
- Budget: 9.5 MM€
CURRENT DEVELOPMENTS

Strategic Plan and prototype deployment
Company development

2016–2022 Strategic Plan

Technology Readiness Level

Q4–2016

TRL4 1:1 TRL7 TRL9

IDEA TECHNOLOGICAL DEVELOPMENT PROTOTYPE 1:1 SMALL SCALE DEMONSTRATION INDUSTRIALIZATION

1-3 years 1-3 years 1-3 years 1-3 years

R&D Investment
Prototype Investment
Investment for Small Scale
Investment for Industrial

Product for testing, certification and product improvement.

Pre-Serie production. First returns on investment.

Series production.

Business Model Development.

Return on Investment.

Product Technology Development: conceptual design.
Prototype deployment

Various options are being developed

**BIMEP**
- Test site in the Basque Country
- Most developed alternative
- A group of companies (NAUTILUS, utilities & WTG manufacturers) are leading the Project
- Some NAUTILUS shareholders interested in the project
- Negotiating Regional Government support

**BALEA**
- NER300 25MW project in the Basque Country
- EVE (Energy Basque Agency) owns the Project
- NAUTILUS invited to participate

**FLOCAN5**
- NER300 25MW project in Canary Islands
- ACS–Cobra owns the Project
- NAUTILUS invited to participate

Other potential sites
- UK
- Norway
- France
- Japan
Final remarks

- **NAUTILUS** is finishing a **basic design** backed by a “feasibility study” issued by a certification body.
- Next step for **NAUTILUS** is to deploy a **prototype**. Various alternative sites are on the table.
- **NAUTILUS** is focused on **LCOE reduction** from its concept to its manufacturing and installation procedures.
- **NAUTILUS technology has been recognised** by utilities, WTG manufacturers, certification bodies and experienced engineering firms.
- **NAUTILUS vision is to become a world reference** in the development of floating platforms for offshore wind.
Thank you, for your attention

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