

IDEOL

Fondations flottantes pour éoliennes en mer

WHO IS IDEOL ?

1 specialty :

**DESIGN & ENGINEERING OF FLOATING FOUNDATIONS
for the offshore wind industry**

2010

Ideol's year of creation
Location : La Ciotat /
Marseille (France)

60

staff
9/10 engineers
(up from 26 in Jan 2015)

3

patents of which
« **Damping Pool** »

WHO IS IDEOL ?



THE floating technology behind **FRANCE'S FIRST OFFSHORE WIND TURBINE**



THE floating technology :

- ▶ identified by a leading Japanese consortium as the solution most likely to dramatically impact the LCOE of floating offshore wind
- ▶ selected for 2 full-scale demonstrators off the coast of Japan in partnership with

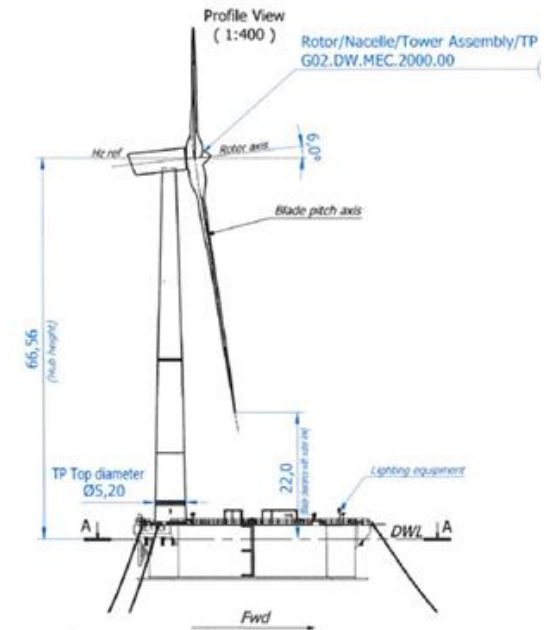
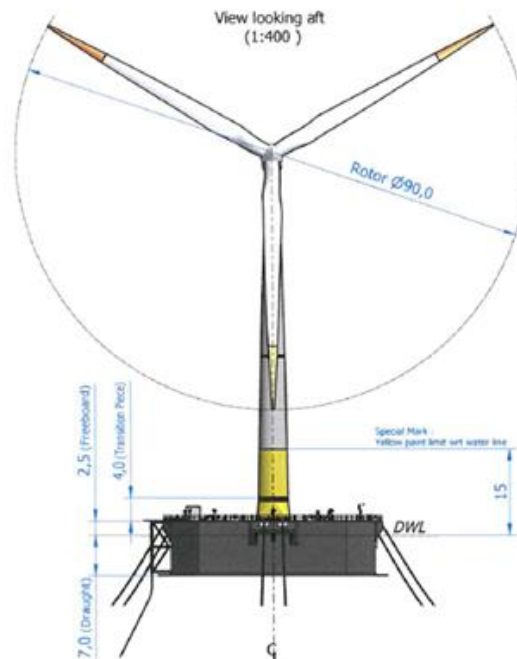


THE floating technology :

- ▶ selected for a demonstrator as part of a bottom-fixed pilot farm developed by



IDEOL'S « DAMPING POOL »



MAIN COMPONENTS OF A FLOATING WIND TURBINE

▶ WIND TURBINE

- ▶ Large scale wind turbines (more than 5MW, diam 130m)
- ▶ 3-bladed, 2-bladed, variable power conversion systems
- ▶ Dependent on client selection and turbine manufacturer's will to enter floating market
- ▶ Simple solutions enable adapting the wind turbine to its floating condition (tower redesign and controller fine-tuning)

▶ HULL

- ▶ Material dependent on local construction capabilities and costs (concrete in some areas, steel in other areas)
- ▶ Potential for use of other materials in the future (fibre-reinforced concrete, composites) but qualification required

▶ STATION KEEPING SYSTEM

- ▶ Anchors are dependent on soil conditions and environmental regulations
- ▶ Mooring lines of 3 first demonstrators differ (chain, polyester or nylon ropes)
- ▶ Local regulatory conditions and clients' risk perception impose different solutions

▶ EXPORT CABLE

- ▶ Regular export cables as used in oil fields
- ▶ As critical as in oil industry : it is the link to the grid

WHERE IS THE MARKET GOING?

- ▶ **INCREASE IN THE SIZE OF OFFSHORE WIND TURBINES**
 - ▶ increase in the size of (nearly all types of) sub-structures ... leading to logistics issues, cost issues, etc.
 - ▶ limits of offshore installation vessels
- ▶ **HIGHEST LOCAL CONTENT expectations**
- ▶ **Sites with CHALLENGING SEABED CONDITIONS in « low-hanging fruit » areas**
- ▶ **Sites in DEEPER WATERS**
- ▶ **Need for FLOATING SOLUTIONS IN SMALLER MARKETS WITH LESSER NEEDS** (insular & remote environments)

COST-IMPACTING PARAMETERS



- ▶ **DESIGN and ENGINEERING** of the floating structure have to be **FAST**, the **ARCHITECTURE** has to be **SIMPLIFIED** and **COMPACT**
- ▶ Principal **MATERIAL** has to be **ADAPTABLE** (concrete in the EU and the US, steel in some other countries)
- ▶ **CONSTRUCTION** has to rely on proven, cost-efficient and universal methods and know-how
- ▶ **MAINTENANCE** and **OFFSHORE OPERATIONS** have to be **MINIMIZED**
- ▶ **MOORING SYSTEMS** have to be **INNOVATIVE** in order **TO REDUCE COSTS**
- ▶ **COLLABORATION WITH KEY STAKEHOLDERS** (wind turbine manufacturers, marine contractors, etc.) has to be **SYSTEM-ORIENTED AND PRO-ACTIVE** from day 1



**THE HIGHEST POSSIBLE
LEVEL OF LOCAL CONTENT**

ONGOING RESEARCH AND DEVELOPMENT (1)

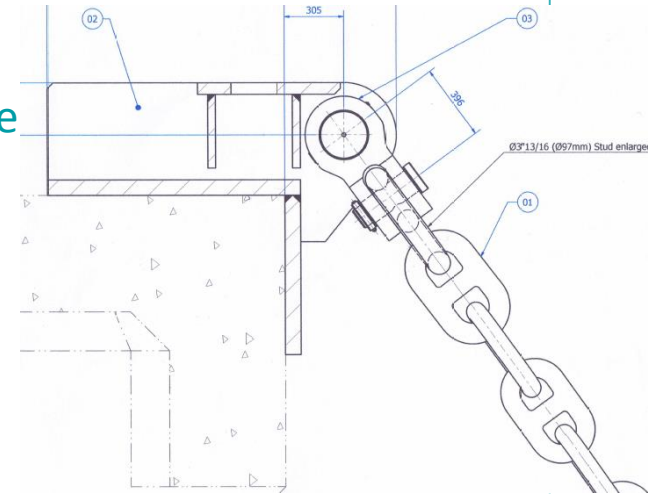
- ▶ Nylon rope qualification for permanent mooring (nearly complete)
 - ▶ Partners: TTI, Bridon, LR, Bluewater
 - ▶ Objectives: provide insight on long term nylon rope behaviour
 - ▶ Broad range of nylon ropes testing
 - ▶ Rope tested up to 20million cycles

- ▶ Steel cable qualification for contact with seabed
 - ▶ Partners: IFSTTAR, ArcelorMittal
 - ▶ Objectives enable using steel cable for permanent moorings in contact with the seabed
 - ▶ Combined bending/tension fatigue tests
 - ▶ Cable wear tests in seabed contacts



ONGOING RESEARCH AND DEVELOPMENT (2)

- ▶ Forged parts interface / tribology
 - ▶ Partners: Le Beon, laboratory to be nominated
 - ▶ Objectives: design mooring lines forged parts in a way that they can be maintained over their life
 - ▶ Qualification of repair methods
 - ▶ Tribology tests of several couples of materials
- ▶ Cast steel parts qualification for interface b/w hull and mooring
 - ▶ Partner: Areva Le Creusot Forges
 - ▶ Objectives: propose cast steel mooring parts to get ready for series construction
 - ▶ Design and fabrication of prototype parts, test of manufacturing tests



ONGOING RESEARCH AND DEVELOPMENT (3)

- ▶ Mooring chains bending behaviour improvement
 - ▶ Partners: Marit, laboratory to be nominated
 - ▶ Objectives: Propose improvement of chains tension/bending fatigue behaviour and quantification
 - ▶ Combined fatigue / bending testing of chains
 - ▶ Development of sizing technique for improved interlink contact

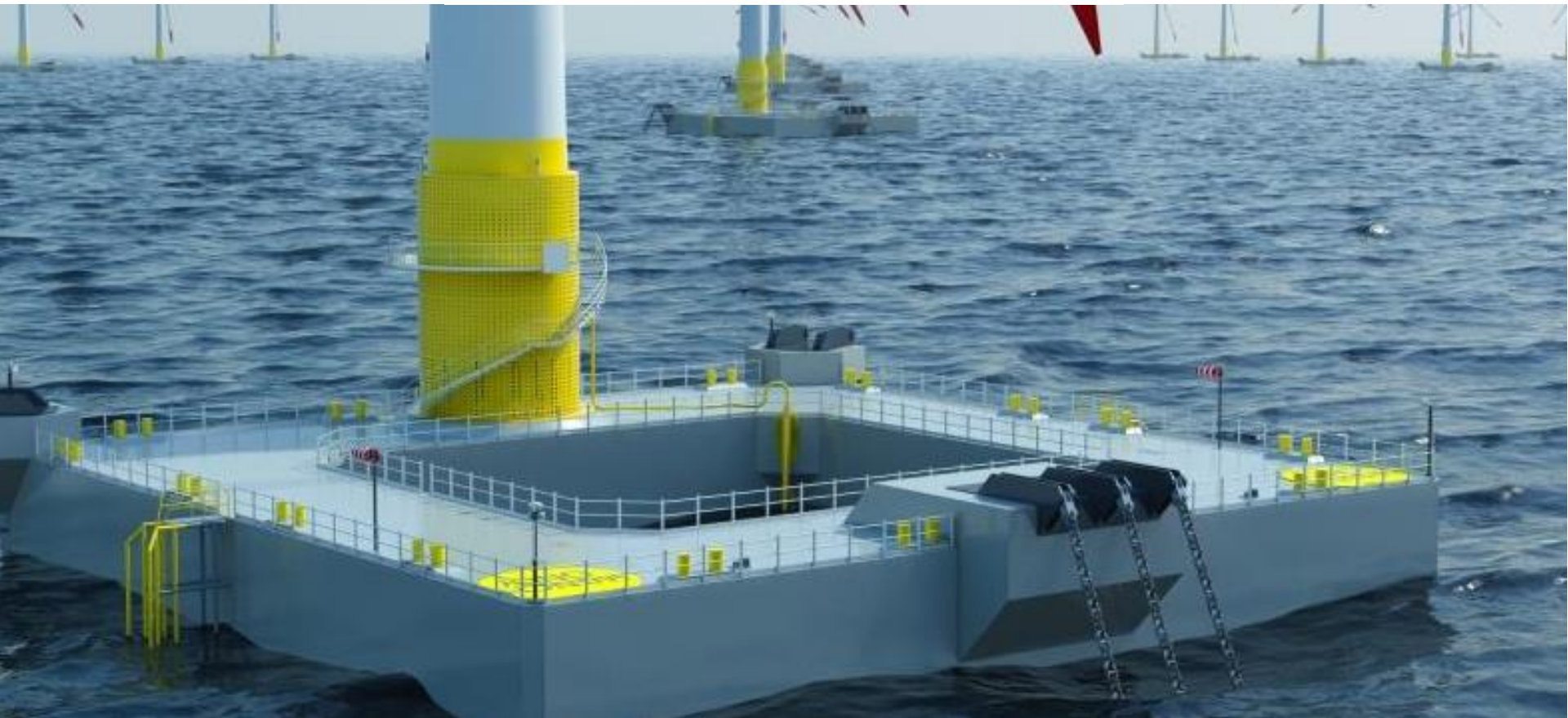
- ▶ JIP on coupled wind turbines / floater simulations recommended practice
 - ▶ Leader: DNVGL
 - ▶ Partners: 10+ including universities, labs, certifiers, engineers
 - ▶ Objectives: Prepare guidelines on coupled wind turbine / floater simulation
 - ▶ Comparison of several wind turbine and floaters concept
 - ▶ Mostly numerical approach, Analysis of model tests data

ONGOING RESEARCH AND DEVELOPMENT (4)

- ▶ Lifes50+ - design of 10MW floating foundation
 - ▶ Leader: Marintek
 - ▶ Partners: 10+ including universities, labs, certifiers, engineers
 - ▶ Objectives: Bring 10MW floating wind turbines to TRL 5, propose evaluation techniques, prepare universal design practice
 - ▶ Design, risk assessment, model testing

AREAS OF INTEREST FOR FUTURE PROJECTS

- ▶ Fluid mechanics and moorings:
 - ▶ Higher-order wave loads
 - ▶ Ice loading on structure and mooring
 - ▶ Slamming loads and coupling with structure dynamics
 - ▶ Aerodynamics of wind turbines in motion, condensed turbine models
- ▶ Materials:
 - ▶ Gluing (secondary structures, then larger structures)
 - ▶ Use of composites in structural members
 - ▶ Concrete fatigue performance assessment
 - ▶ Visco-elastic behaviour of synthetic mooring lines materials
- ▶ Maintenance and controls:
 - ▶ Wind turbine control systems
 - ▶ Non-destructive testing of concrete
 - ▶ Automated monitoring of slender structures (cables, mooring)
 - ▶ Environmental impact assessment methods setting



THANK YOU