How to reduce maintenance costs by means of innovative lifting solutions?

1st Stakeholders Showcase Event

08/09/2016

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leanwind

Project supported within the Ocean of Tomorrow call of the European Commission Seventh Framework Programme

OWA

Offshore & Wind Assistance

Service and Maintenance in the Offshore & Wind Industry

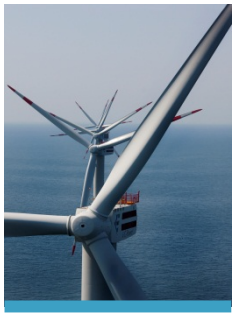
Company Profile

leanwind

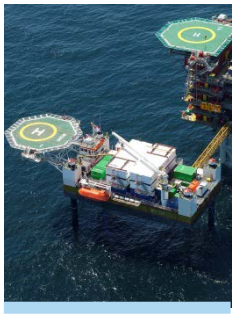
GeoSea

Geotechnical & Offshore Solution

SITE INVESTIGATION



RENEWABLES



OIL & GAS

CIVILS

High wind

rebo

OWA

Offshore & Wind Assistance

Company Profile

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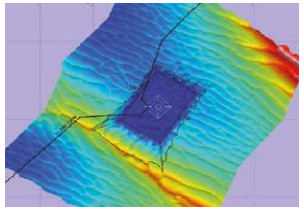
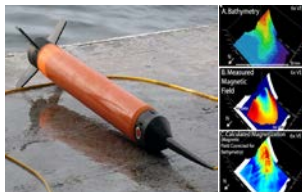
Customer

OWA
Offshore & Wind Assistance

Survey & Inspection Services	Monitoring & Maintenance Management	Maintenance & Repairs	Transportation & Logistics	Major Repairs, Retrofits & Decommissioning

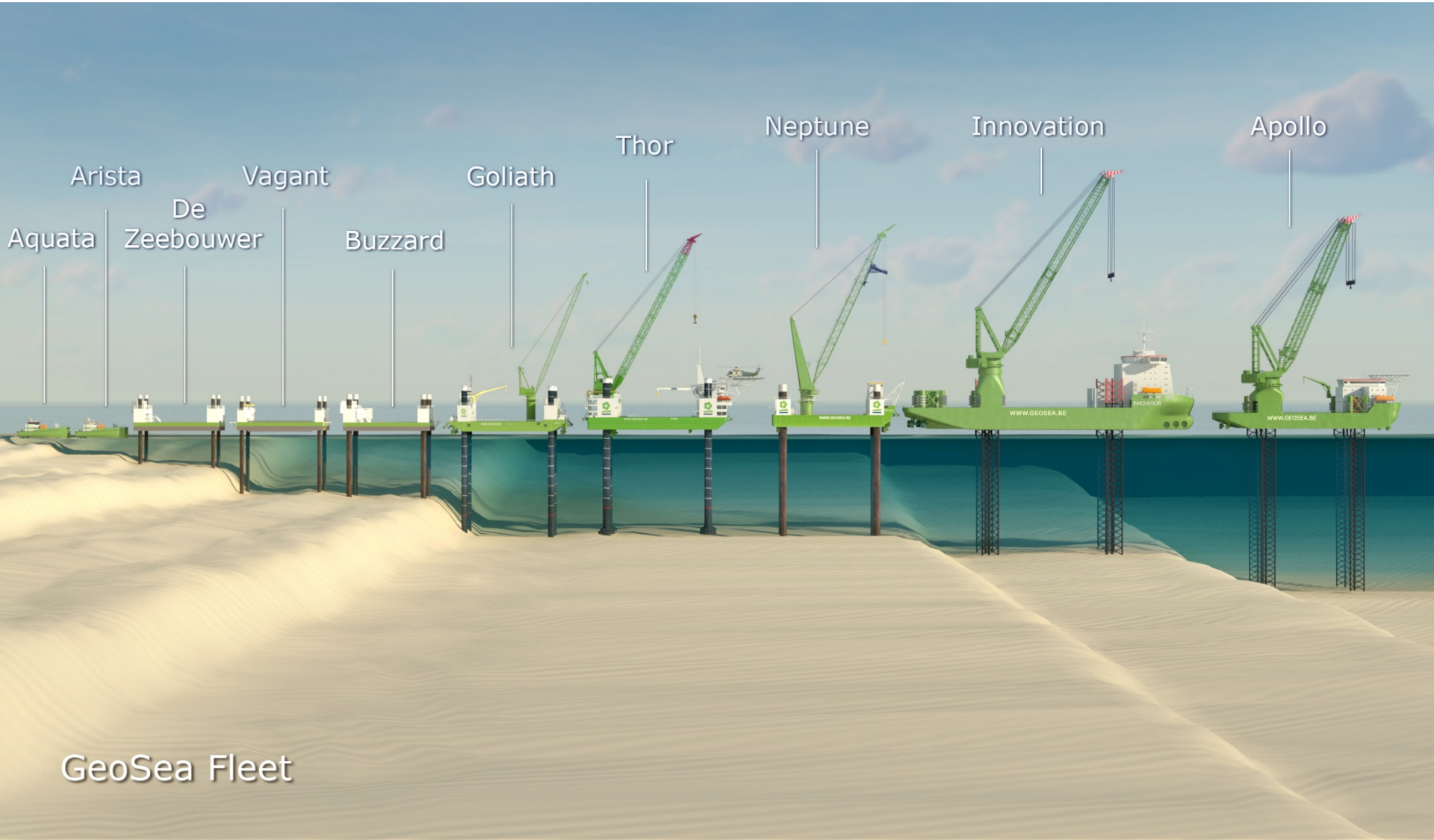






Meet the fleet

GeoSea



OWA, partner in the LEANWIND project

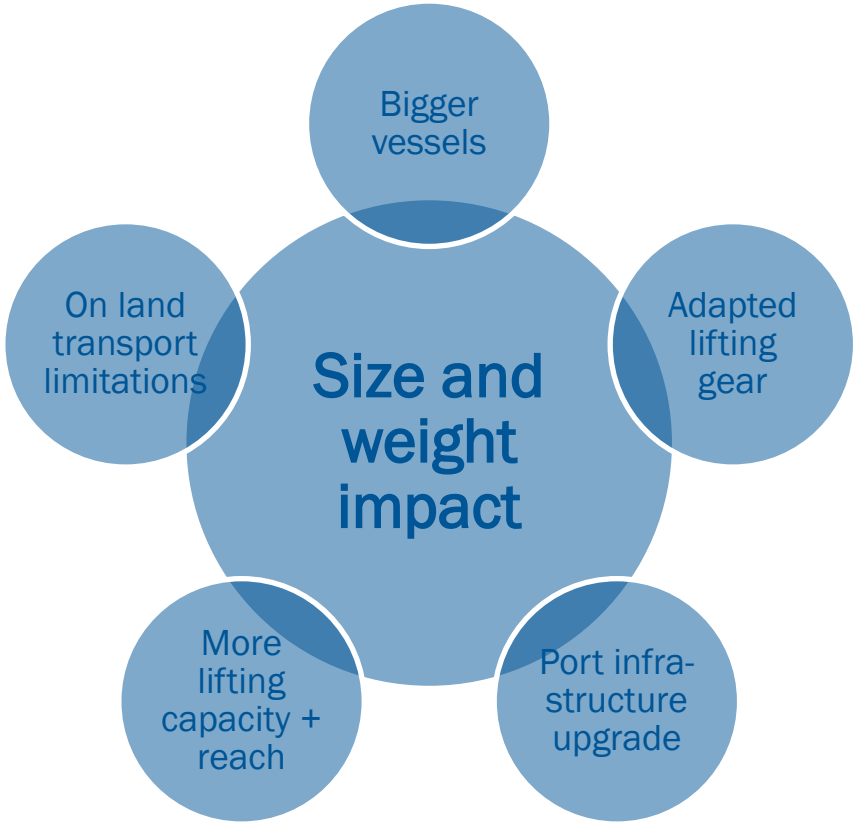
OWA involved in work packages 2 to 9

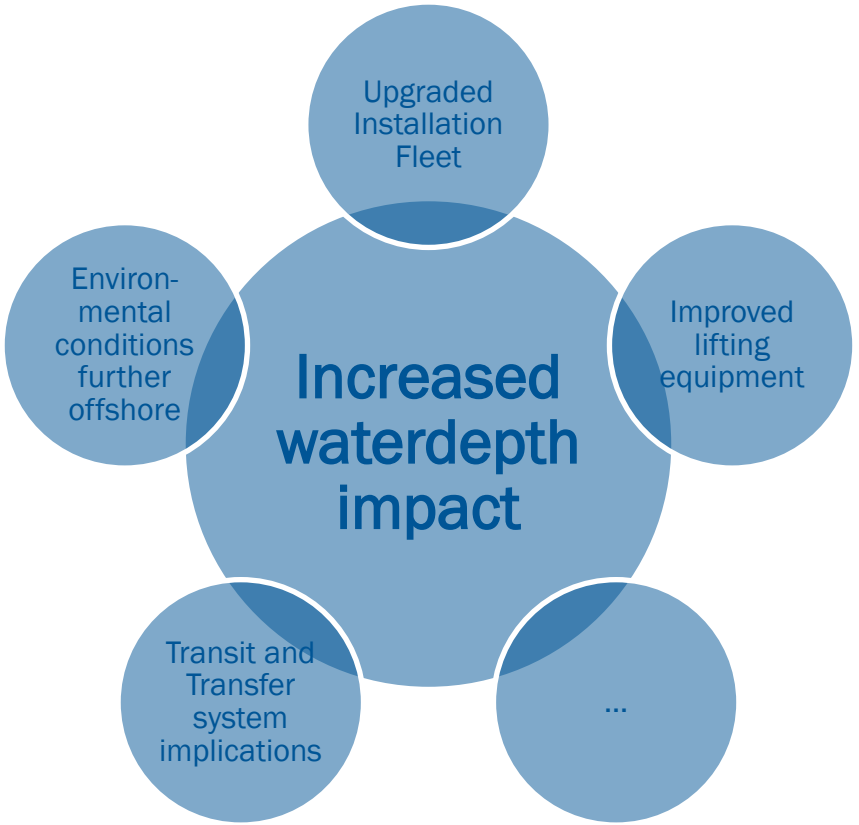
WP1

WP2	• Construction, Deployment & Decommissioning
WP3	• Novel Vessels & Equipment
WP4	• Operation & Maintenance
WP5	• Integrated Logistics
WP6	• System Integration
WP7	• Testing and validation of tools & technologies
WP8	• Economic & Market Assessment
WP9	• Dissemination and Exploitation

WP10

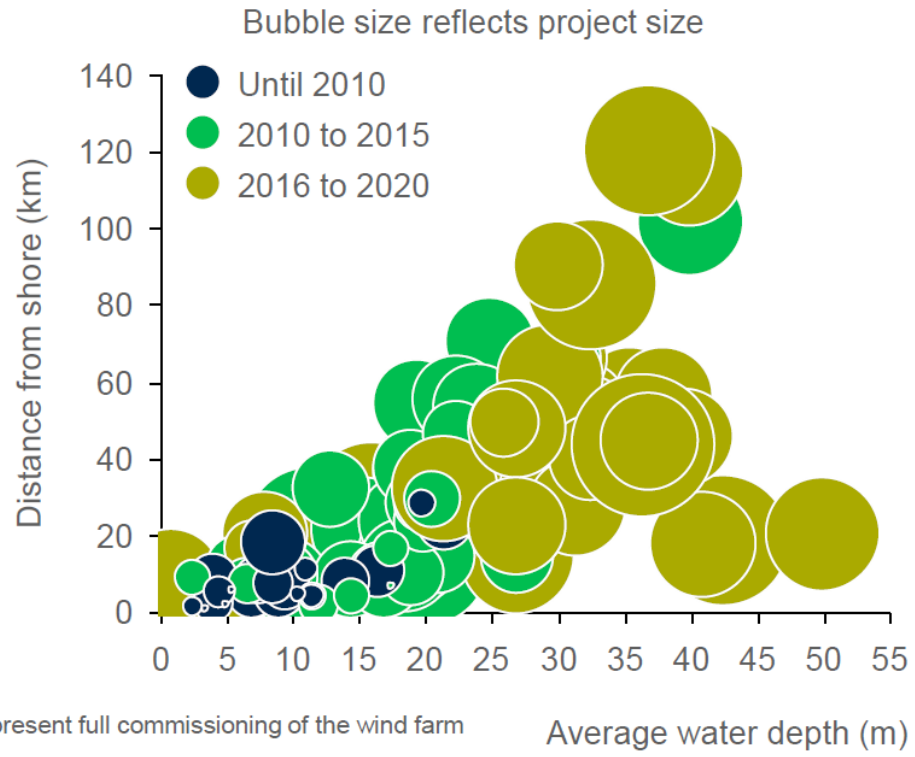
Offshore Wind Challenges & Trends



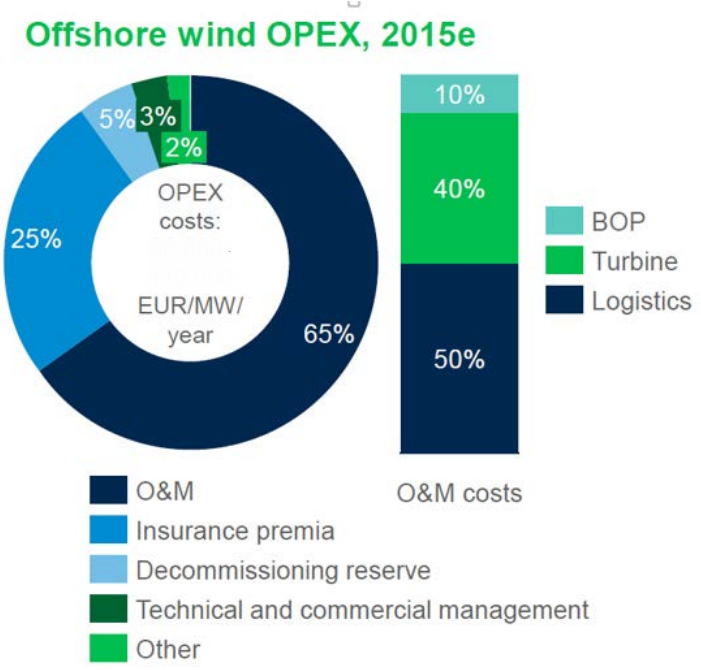


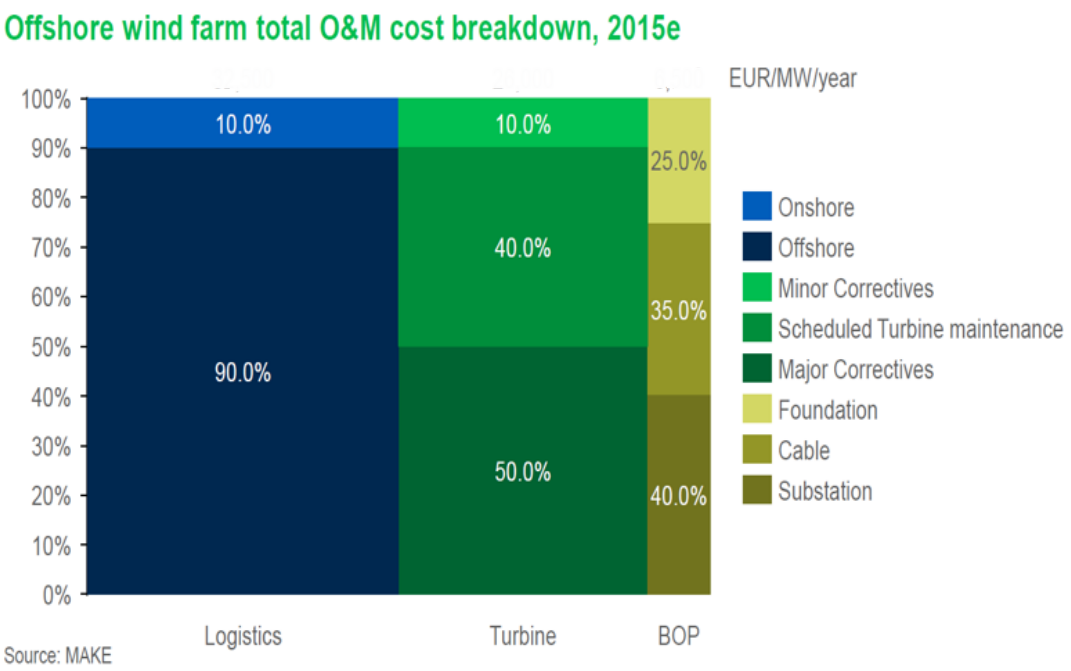
O&M Challenges & Trends

- **OWF farther from shore:**
  - Focus on remote monitoring
  - Reduced more efficient site visits
- **Larger projects:**
  - Economies of scale
  - Reduced risk adversity
- **Larger turbines:**
  - Higher downtime costs
  - Heavier components
  - More capable O&M vessels
- **Higher availability:**
  - Technology Innovation
  - Expected increased reliability
- **Deeper waters**
  - Floating solutions being developed
  - Need for larger jack-ups



O&M Cost breakdown and cost levers





OWA's fleet and marine experience well positioned to optimize Logistics

Jackups and innovative technologies to optimize major correctives

Highwind

Novel Lifting Equipment

some examples

Liftra **Blade Dragon**

Siemens
B75 Lifting Yoke

Ravestein
Maintenance tower

IHC
Boom Based Blade Manipulator

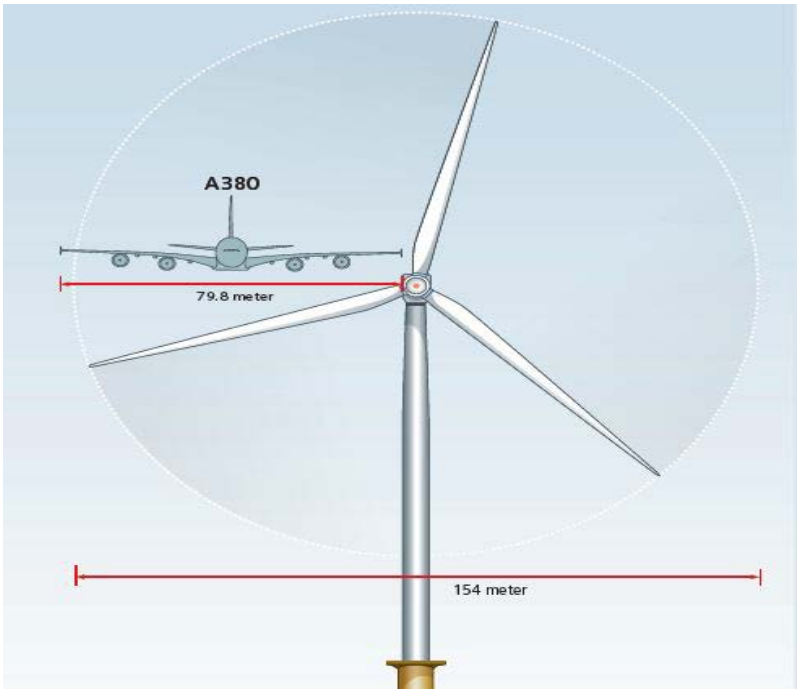
HighWind **Boom Lock**

Boom Lock System

Turbine installation, a seasonal activity?

Turbines have grown fast

Giant leaps are being made in turbine & blade development



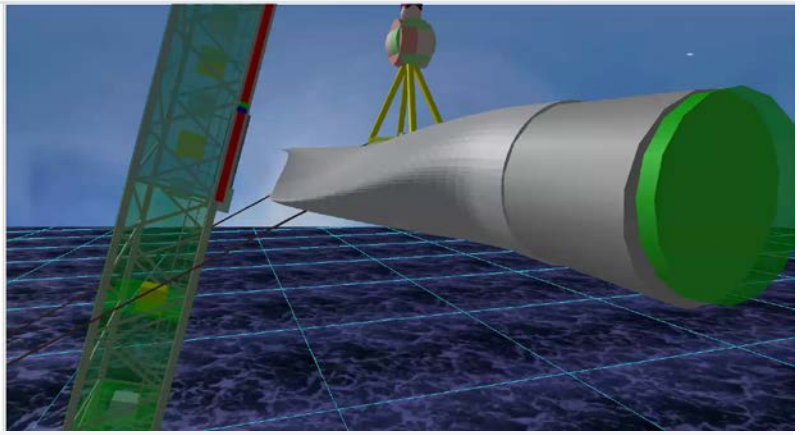
Blade size has grown from 45 to 90 meter – Single blade installation is standard
A solution is needed to uphold current workability limits

Lifting operations: analysis

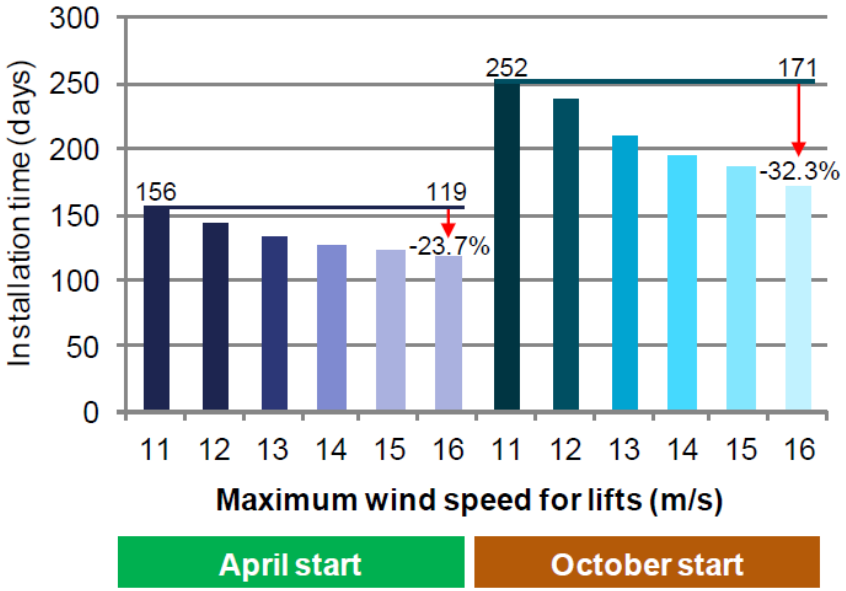
Wind Sensitivity vs. Controllability

- Load is free to move
- Wind is variable in direction and magnitude
- Object orientation cannot be changed in all directions while installing
- Installation requires careful communication, continuous iteration & correction & a lot of experience

➔ Increasing controllability results in:
DECREASED DOWNTIME
DECREASED RISK OF DAMAGE
INCREASED SAFETY



Downtime due to lifting: is it worth anything?

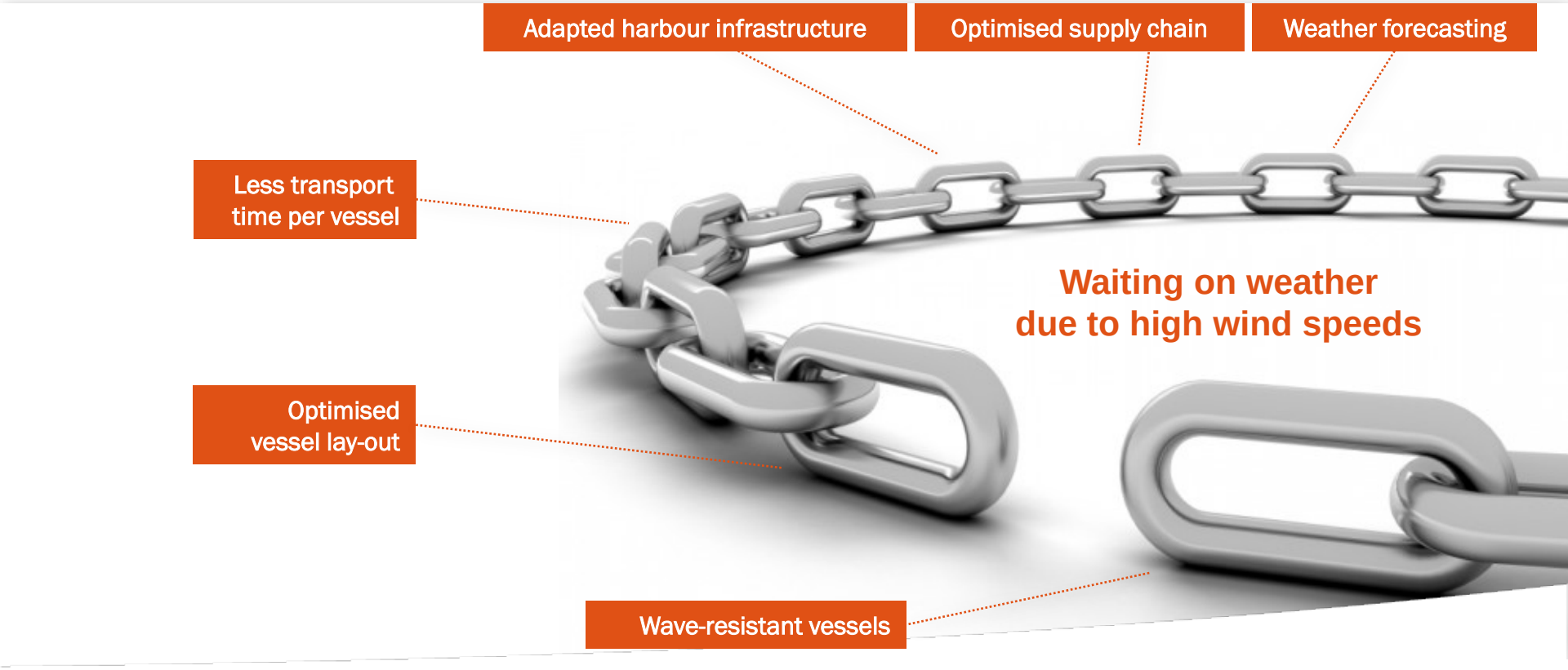


- Improvements in jack-up vessels have pushed weather down-time back to the lifting operation
- 80-90% of Weather Downtime now relates to lifting operations
- As much as 23,7% time can be saved during Summer installation
- As much as 32,3% time can be saved during Winter installation

Souce: BVG Associates

The weakest link: lifting operations

- Weather downtime and installation risk is under pressure
- Installation tools and methods remain sensitive to wind and crane motions
- **A NEW FUTURE PROOF SOLUTION IS REQUIRED**



Finding a solution: The High Wind 'Robot'

How to 'robotize' WTG installation?

- 6 Degree of freedom control is required
- Needs to work with all components
- Low impact on vessel capabilities
- Make use of experience built up
- Low threshold for implementation and operation

➔ **CONCEPT???**

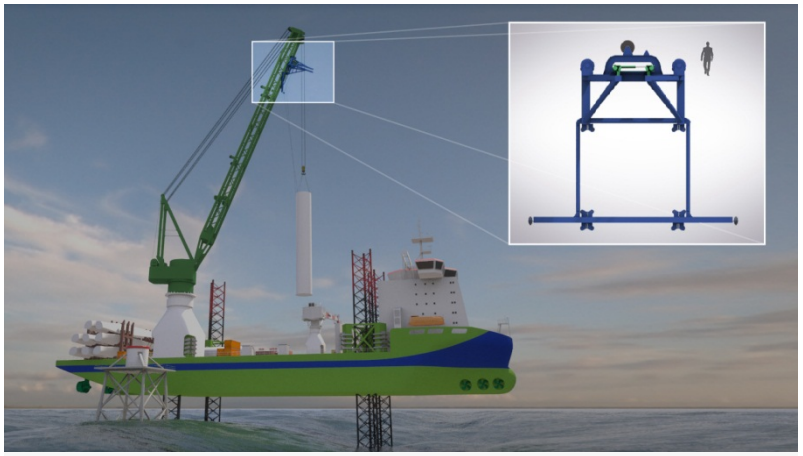
Target

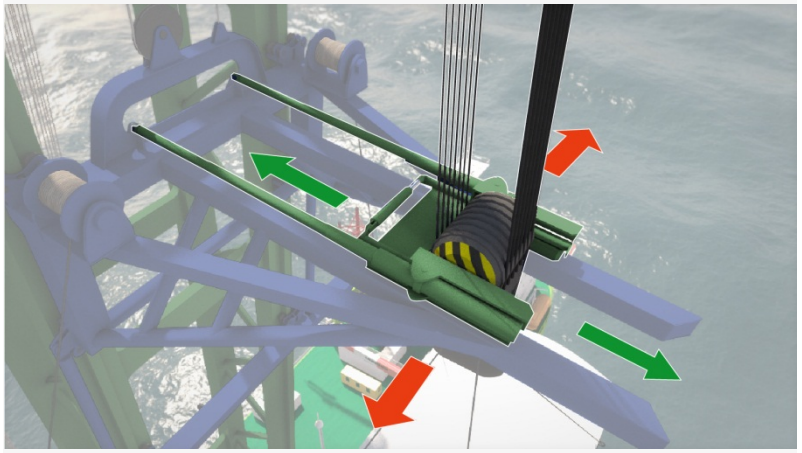
- ✓ Safer
- ✓ More control
- ✓ Less Downtime

“Boom Lock” concept

The Boom Lock is a tool that allows an offshore crane to install WTG components in high wind speeds

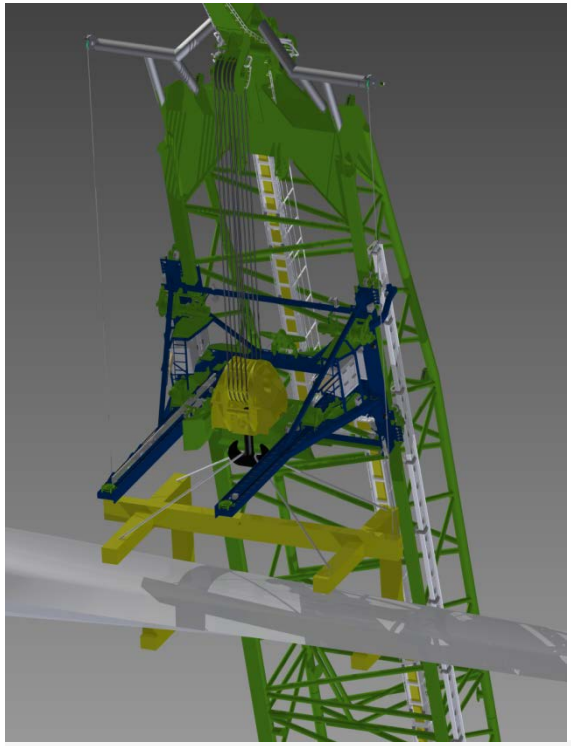
- Improved stability & control
- All turbine components and parts
- Works with any lifting tool
- Easy to operate
- Short installation time
- No hinder to non-WTG operations

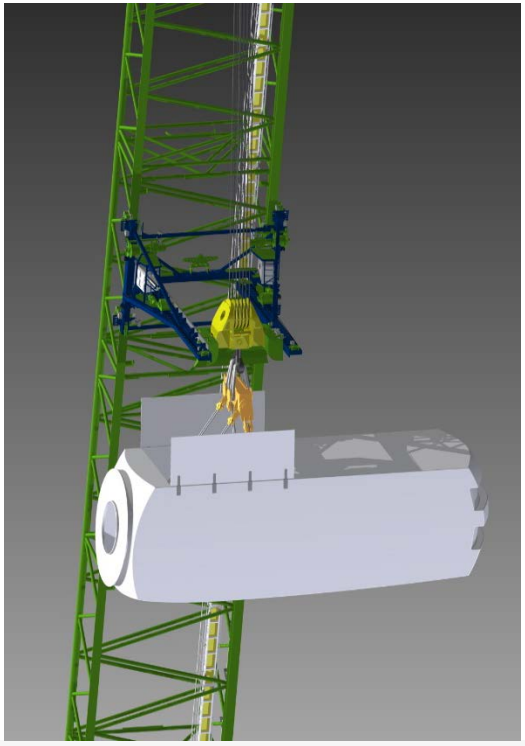




The “Boom Lock”

All turbine components and parts, all turbines





- Large heavy objects with large inertia make will **not stop moving.**
- Actions of the crane cause unwanted and **potentially dangerous** motion of crane and load

➔ **BOOM LOCK SYSTEM BRINGS MAJOR BENEFITS FOR ALL TURBINE COMPONENTS**

First project finalized

Installation of turbines at Kentish Flats

- 15 x 3.3 MW V112 turbines
- 45 x blades + 15 nacelles
- Vattenfall, MHI Vestas and GeoSea joined hands in supporting this new technology
- High Wind provided training, support and data logging

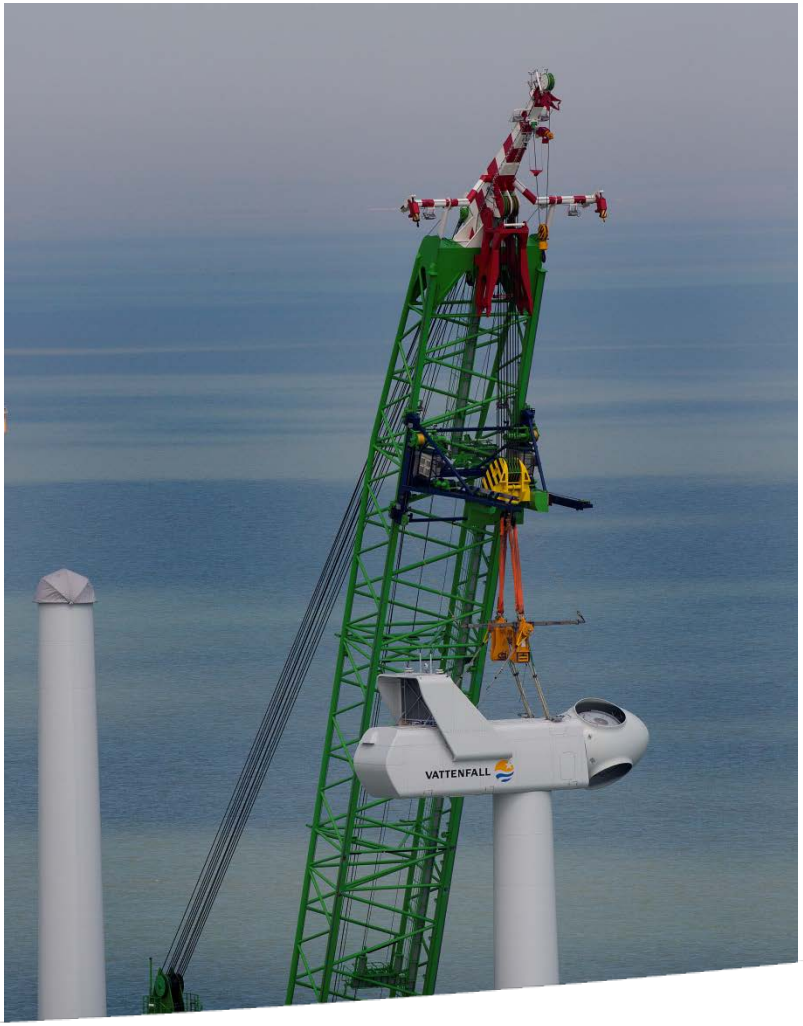
Kentish Flats: conclusions

Successful first project finalized

- The Boom Lock lived up to its expectations (however limited to <12 m/s due to the blade yoke design)
- Proven to be technically reliable
- Increased safety for installation
- New technology was adopted fast

➔ **NEXT STEPS**

- ➔ **Simulations of larger blades sizes in higher wind speeds**
- ➔ **Offshore trails with new blade yoke designs**



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QUESTIONS?

Thank you very much
for your attention