



BLOCK ISLAND WIND FARM

America's First Offshore Wind Farm

Presentation to RI CRMC

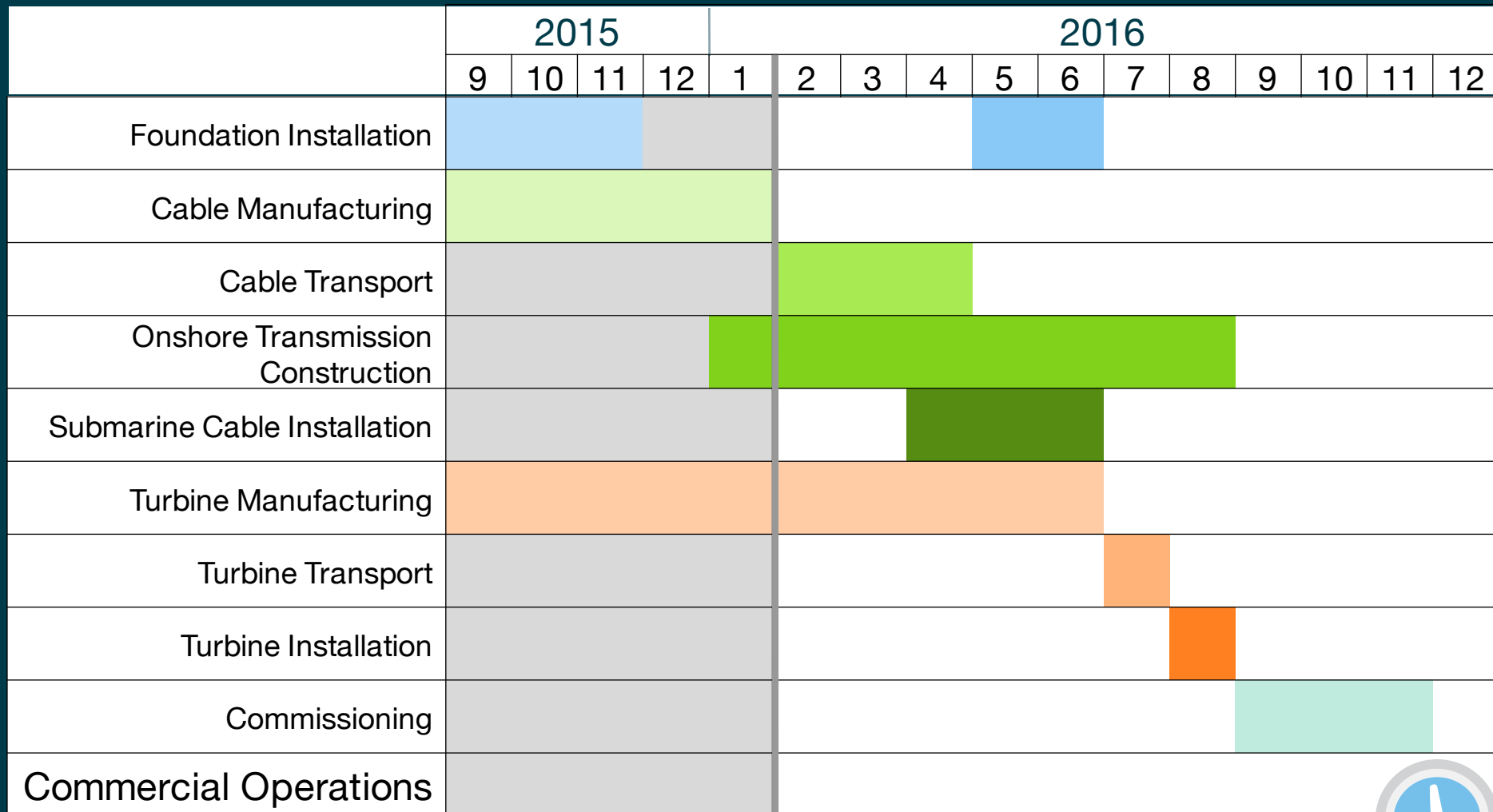
February 23, 2016

Presenters

- Jeff Grybowski, CEO
- Chris van Beek, President

Agenda

- 2015 - 2016 Schedule Overview
- Status and Schedule of Submittals
- Health, Safety, Environment
- Foundations
- Transmission
- Turbine Manufacturing
- Vessels
- Turbine Installation
- Commissioning



Status and Schedule of Submittals

- Queries by ABS as a result of the FDR and FIR review are being answered by DWW
- Witness and Inspection program by ABS has been established

Report	Component	Status
FDR	Substructure	Complete
FDR	Submarine Cable	Complete
FDR	Turbine	Complete
FIR - Fabrication	Substructure	Complete
FIR - Fabrication	Submarine Cable	Complete
FIR - Fabrication	Turbine	Complete
FIR - Installation	Substructure	2015 - Complete 2016 - March
FIR - Installation	Submarine Cable	Complete
FIR - Installation	Turbine	2016 - May
FIR - Commissioning	Turbine	2016 - June

FDR: Facility Design Report

FIR: Foundation and Installation Report

300 Local Jobs

Local firms and workers involved in every phase of project

- Design and development
- Fabrication
- Installation
- Service

Four RI ports used

Spin-off opportunities a reality



Excellent Safety Record

2.05 – Total Project Recordable Incident Rate

3.60 – U.S. Construction Average Rate

4.80 – Fabricated Metal Manufacturing Average Rate

- Total man hours on project to date: 571,107
- No serious injuries

Detailed project plans:

- BIWF HSE Plan
- BIWF Emergency Response Plan
- Offshore Minimum PPE Requirements
- Offshore Minimum Training Requirements
- HSE Bridging Plan between all Major Contractors
- Major Contractor HSE Plans
- Major Contractor Emergency Response Plans

Perfect Environmental Compliance Record

- Extensive permit and environmental compliance plans
- No deviations from approved plans in 2015
 - Expectation is zero deviation in 2016
- Third Party environmental compliance monitor in place



Protected Species Observer (PSO)
Block Island Wind Farm Foundation Installation

Precedent-setting Offshore Species Mitigation Program

Number of PSOs: 10

Hours worked: 2,311

All Foundations Installed

- Each foundation placed within 0.5 meters of planned location
- All welds 100% tested and confirmed
- All repairs completed and verified
- Inspections confirm that all work performed according to design criteria



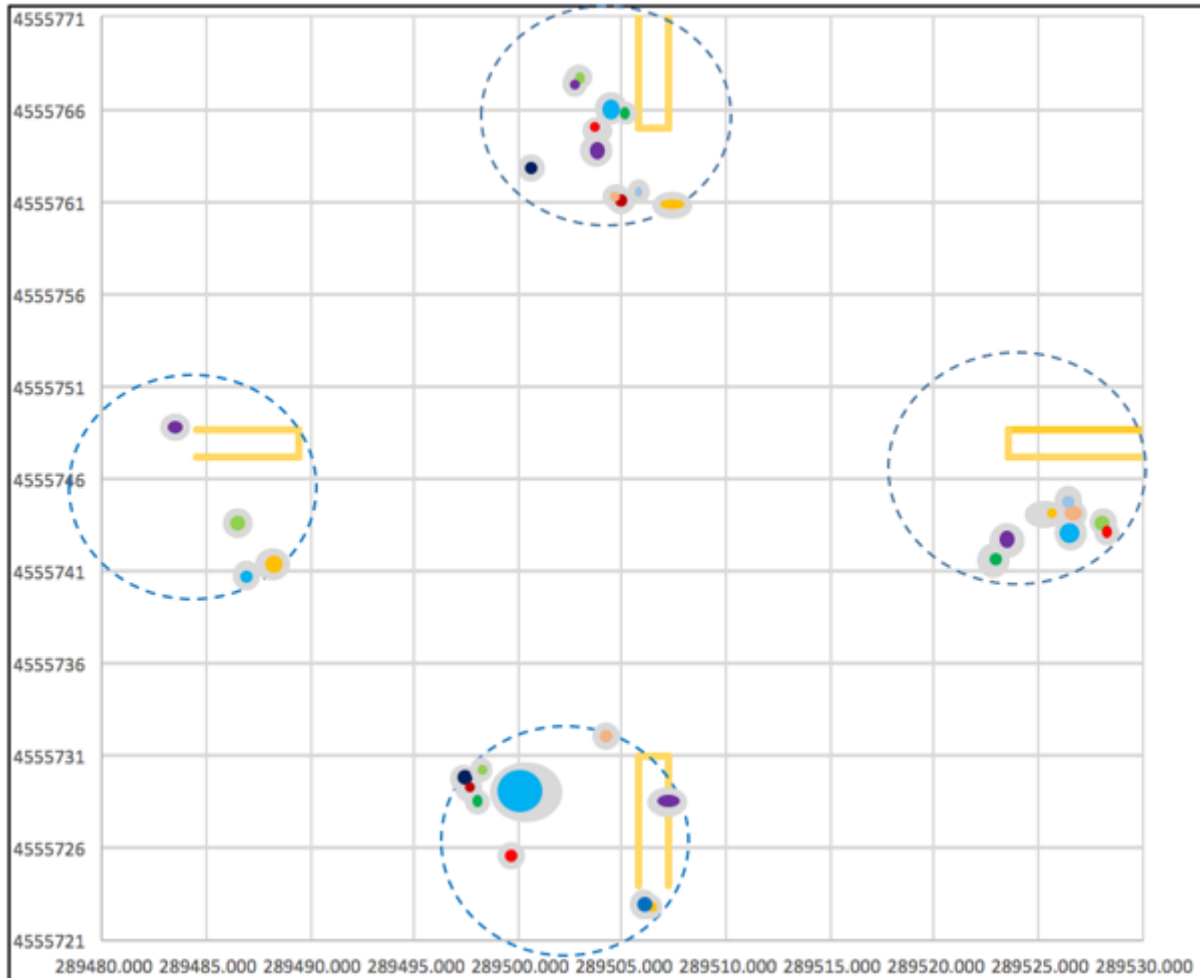
Excellent Fabrication and Offshore Welding Results

- All foundations fabricated and installed according to design and industry standards
- All welds tested and verified
- Overall weld repair rate of 0.5% excellent versus industry standard rate of 2%



Innovating Offshore Methods

Avoiding Boulders



- Innovative buried boulder detection program used latest technology available
- Results critical to final installation plan
- Successfully avoided large buried boulders up to 50 feet deep on multiple locations

1



2



3



U.S. Vessels and Workers Completed Installation

1. Lift and set jacket on sea bed
2. Insert and drive piles into foundation legs
3. Lift and set transition deck on jacket and weld the two pieces together

Foundation Grouting and Painting

- Offshore work begins May 15th & ends July 1st, 2016
- Mobilizing a jack-up vessel for the work
- Grouting & painting spreads on deck
- Detailed schedules, procedures and drawings are under development
- Other minor outstanding completion work on foundations will be done

Transmission Cable Manufacturing Complete

Dimensions

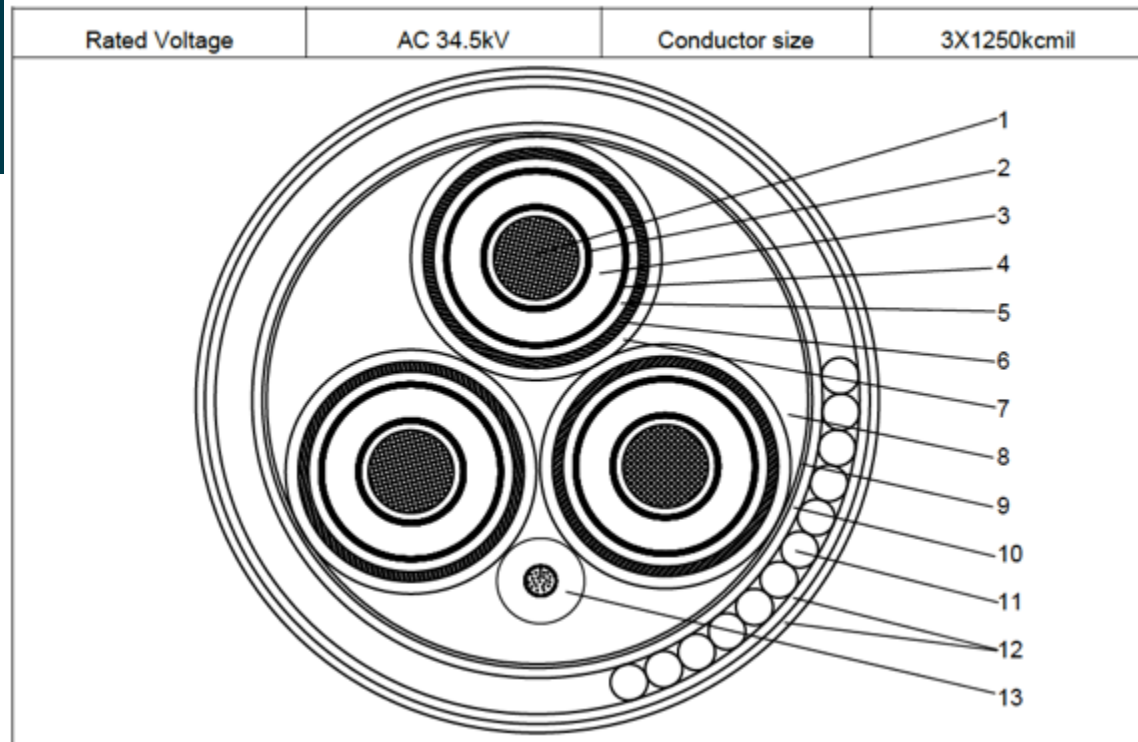
- Length: ~30 miles
- Diameter: 6.77 inches
- Weight: over 3,000 tons

Specifications

- 34.5 kV
- Fiber optic included

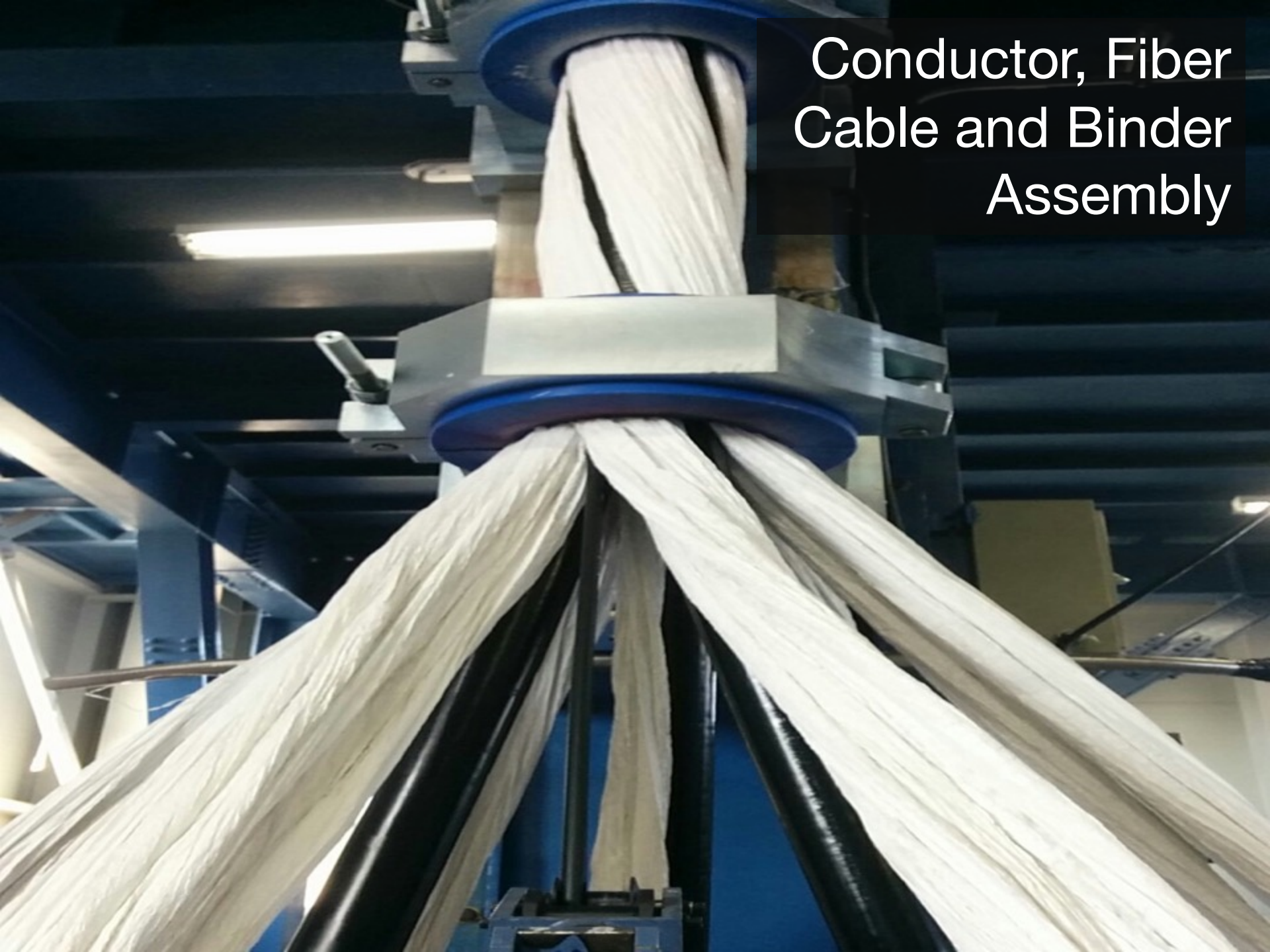
Status

- Manufacturing complete
- All factory quality tests passed
- Cable enroute to RI now (March arrival)



No.	Items	Material	Thickness (mm/inch)	Approx. Diameter (mm/inch)
1	Conductor	Circular compacted, copper, watertight	-	30/1.19
2	Conductor screen	Extruded semi-conducting compound	Min. 0.61/0.02	34/1.34
3	Insulation	Extruded tree-retardant cross-linked polyethylene (TR-XLPE)	Nom. 8.8/0.35	52/2.03
4	Insulation screen	Extruded semi-conducting compound	Min. 0.61/0.02	54/2.11
5	Water blocking layer	Semi-conducting swelling tape(s)	Approx. 0.5/0.02	-
6	Metallic sheath	Extruded lead alloy	Nom. 2.8/0.11	61/2.40
7	Anti-corrosion sheath	Extruded semi-conducting polyethylene	Min. 2.16/0.09	66/2.60
8	Filler	Fillers compatible with sea water	-	-
9	Anti-Teredo	Cu tape(s)	Min. 0.1/0.004	146/5.74
10	Aarmor bedding	Polypropylene yarn	Approx. 2.0/0.08	150/5.91
11	Wire armor	Galvanized steel wires with bitumen	Nom. 6.0/0.24	163/6.42
12	Serving	Polypropylene yarn with black / yellow stripe	Approx. 2 x 2.0/0.08	172/6.77
13	Optical fiber cable	See attached table 2		
-	Net weight of cable in air (kg/m)			Approx. 68
-	Net weight of cable in water (kg/m)			Approx. 44

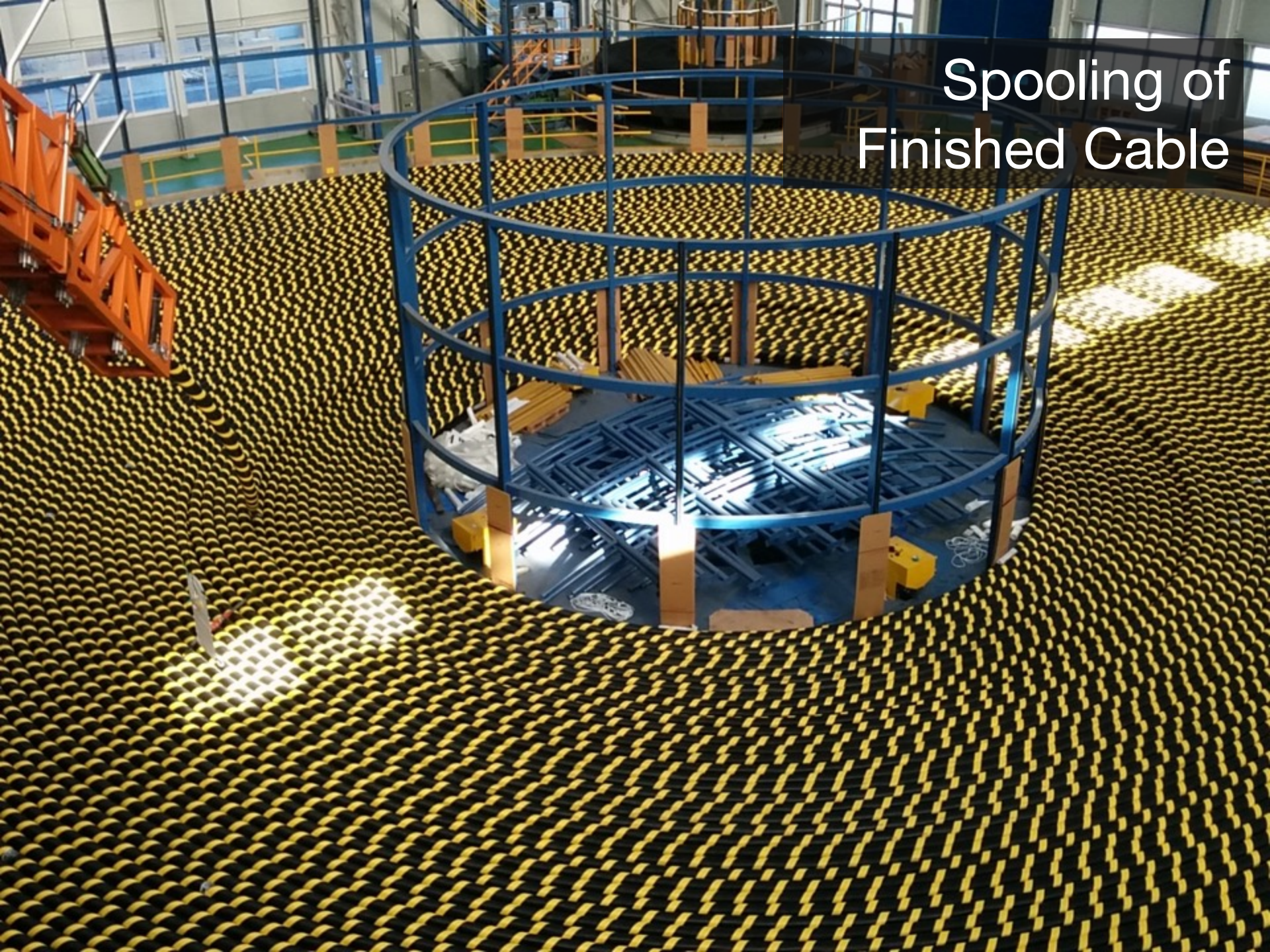
Conductor, Fiber Cable and Binder Assembly



Final Outer Armor Application

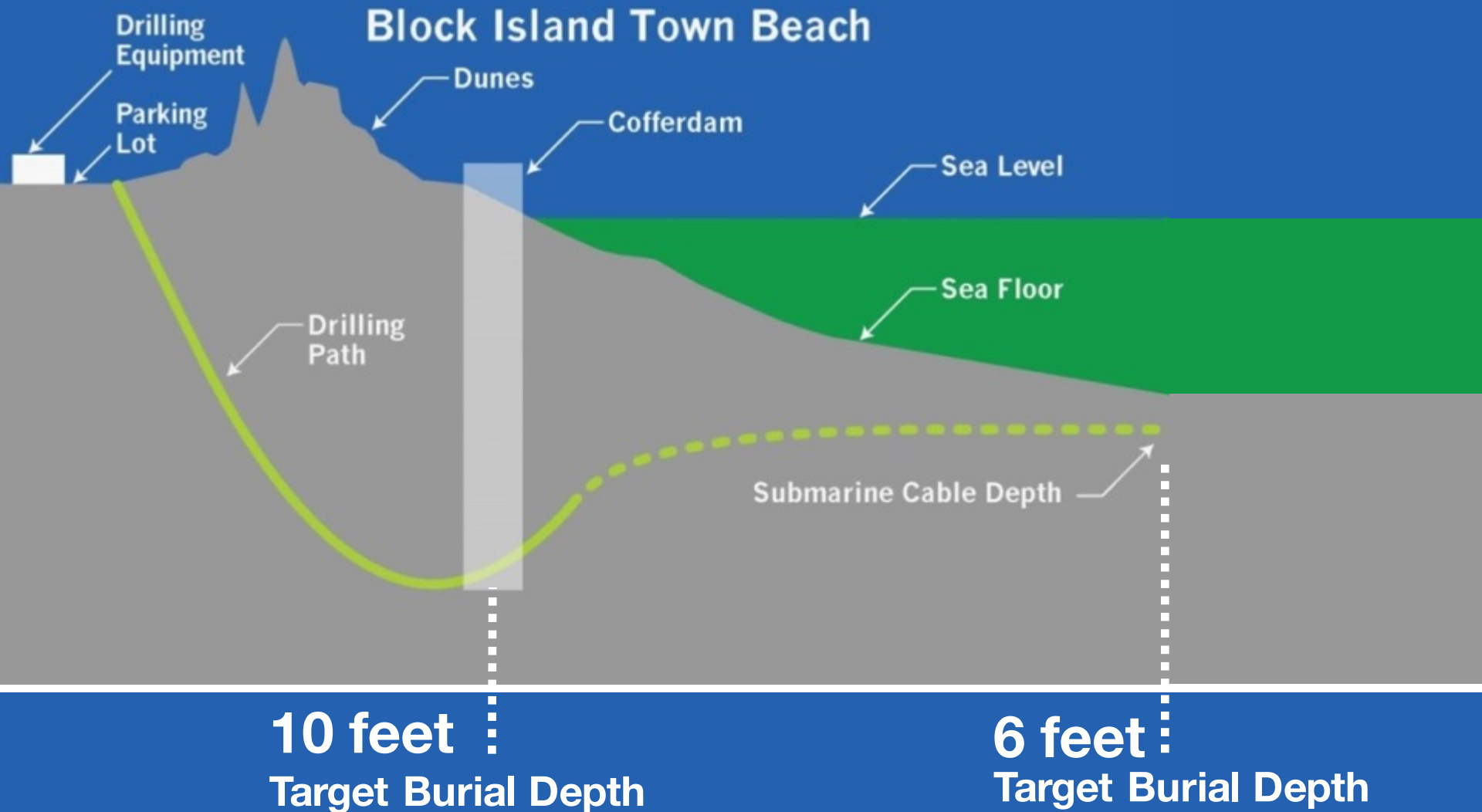


Spooling of Finished Cable



Installing Cable Under Town Beach

- Equipment mobilizing on island now
- Work to be complete in May



Horizontal Directional Drill Rig



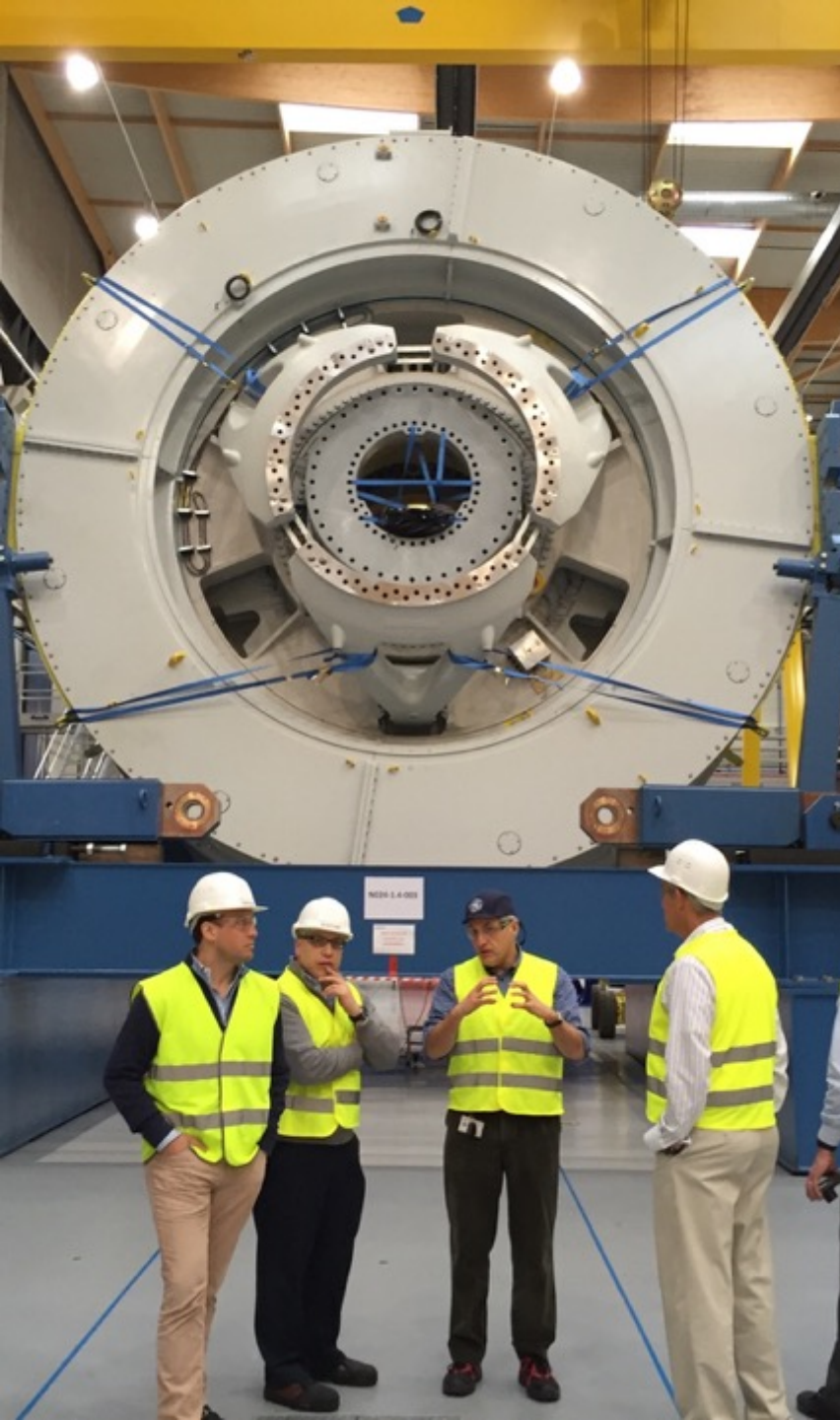


Cable Installation Vessel

- “Big Max” arrived in RI in February
- Final outfitting work in Quonset
- Offshore installation begins in April



Turbine Manufacturing on Schedule



HALIADE™ 150-6MW

ROBUST, SIMPLE, EFFICIENT

BLADE

The Haliade™ 150-6MW is a three-bladed wind turbine. Using 73.5m turbine blades, the 150m diameter rotor combined with 6 MW rated power maximizes the capture of energy.

HUB

The hub supports the rotor blades and houses their pitch assembly. It is designed in such a way as to provide easy, direct access for technicians working from the nacelle.

ROTOR BEARINGS

The rotor bearings directly transfer the unwanted load on the rotor towards the main structure, bypassing the drive train.

SLIP RINGS

PITCH

The pitch system makes it possible to control the blade angle, which optimises the area exposed to the wind and the speed of rotation to, ultimately, increase the yield.

MAIN FRAME

Made of cast steel, the main structure houses the nacelle inside the central frame, and the PURE TORQUE® system inside the front frame.

ALSTOM PURE TORQUE®

This technology was exclusively developed by Alstom and is found in all of its wind turbines. It protects the drive train from unwanted wind buffeting by deflecting it towards the tower. The PURE TORQUE® system improves turbine efficiency and durability.

GENERATOR

The generator is key component of the wind turbine because it is the component in charge of generating the electricity. The Haliade™ 150-6MW is equipped with a direct-drive permanent magnet generator: with no mechanical gearbox coupled to the generator, the turbine consists of fewer rotating parts, which increases reliability, maximises turbine availability and reduces maintenance costs.

NACELLE

SECONDARY COOLING SYSTEM

HELIPAD

A helicopter winching area allows for quick rescue in case of emergency at sea.

YAW SYSTEM

The yaw system makes it possible to pivot the nacelle and thus orient the wind turbine in the optimal direction, i.e. facing into the wind.

INTERMEDIATE FRAME

ELASTIC COUPLING

Key element of the ALSTOM PURE TORQUE® principle which includes a patented coupling system with rubber elements that avoid any undesired load towards the generator. A hydraulic system embedded in the rubber parts guarantees that misalignments between main rotor and generator rotor are affecting the bearings configuration.

FRONT FRAME

TOWER

The Haliade™ 150-6MW tower is 100m-high and made of tubular steel.

World-Class Technology



GE Turbine Manufacturing Facility in ProvPort

- GE assembling turbine components in ProvPort
- Three levels of electrical and mechanical equipment in each tower
- Subcontractors include significant RI firms:
 - Aladdin Electric
 - Bay Crane
 - VHB
 - GZA
 - E.W. Audet



Offshore Service Vessel Built in RI

- Deepwater contracted with Rhode Island Fast Ferry (Quonset, Rhode Island) to build a state of the art crew transfer vessel
- Rhode Island Fast Ferry contracted with Blount Boats (Warren, Rhode Island) to build the vessel
- The crew transfer vessel is a 70' catamaran with a tier 3 engine and custom bow to safety and efficiently transport workers from the Quonset to the Block Island Wind Farm



Heavy Lift Vessels for Turbine Installation

- No U.S. Vessel has the capacity to install the 6MW GE Haliade turbines
- DWW contracted with Fred Olsen (Norway) to use the Bold Tern to install turbines at the Block Island Wind Farm site
- DWW contracted with Montco Offshore (Houston, Texas) to use two jack-up vessels to shuttle components from the Logistic Hub in ProvPort to the offshore site.



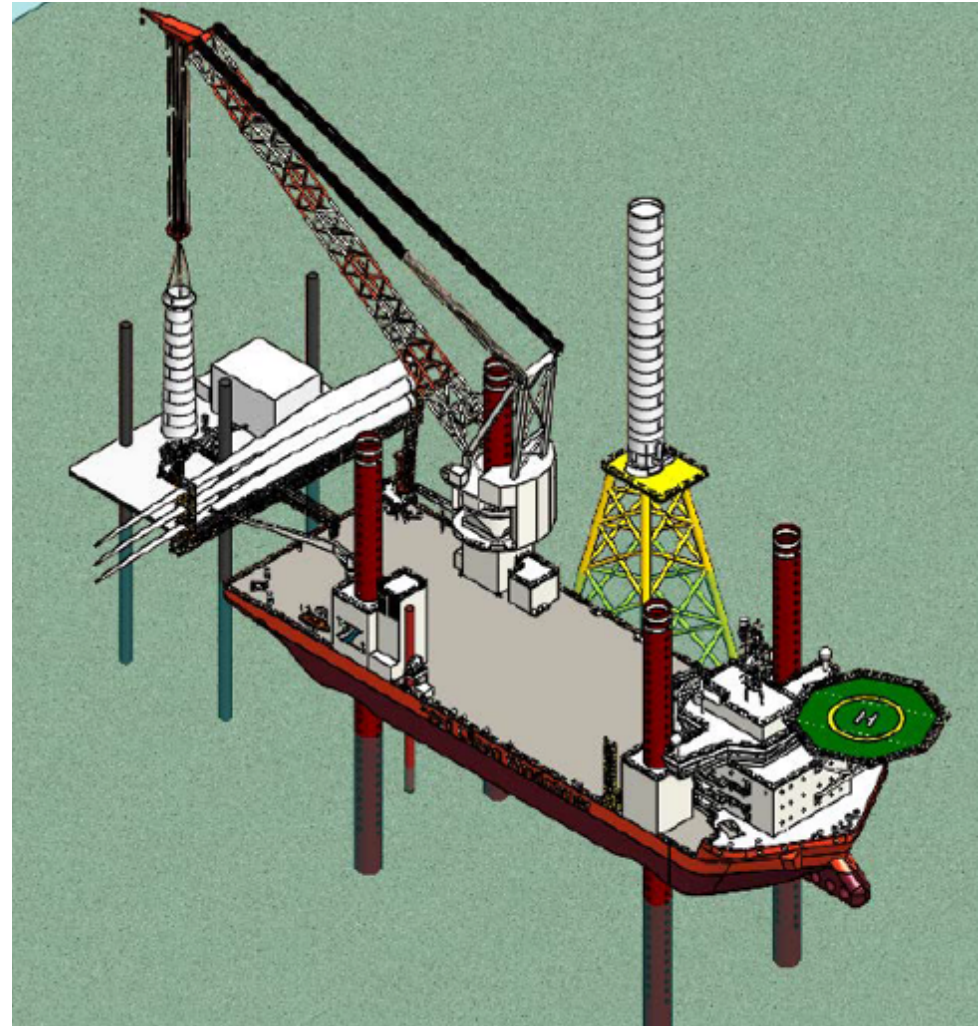
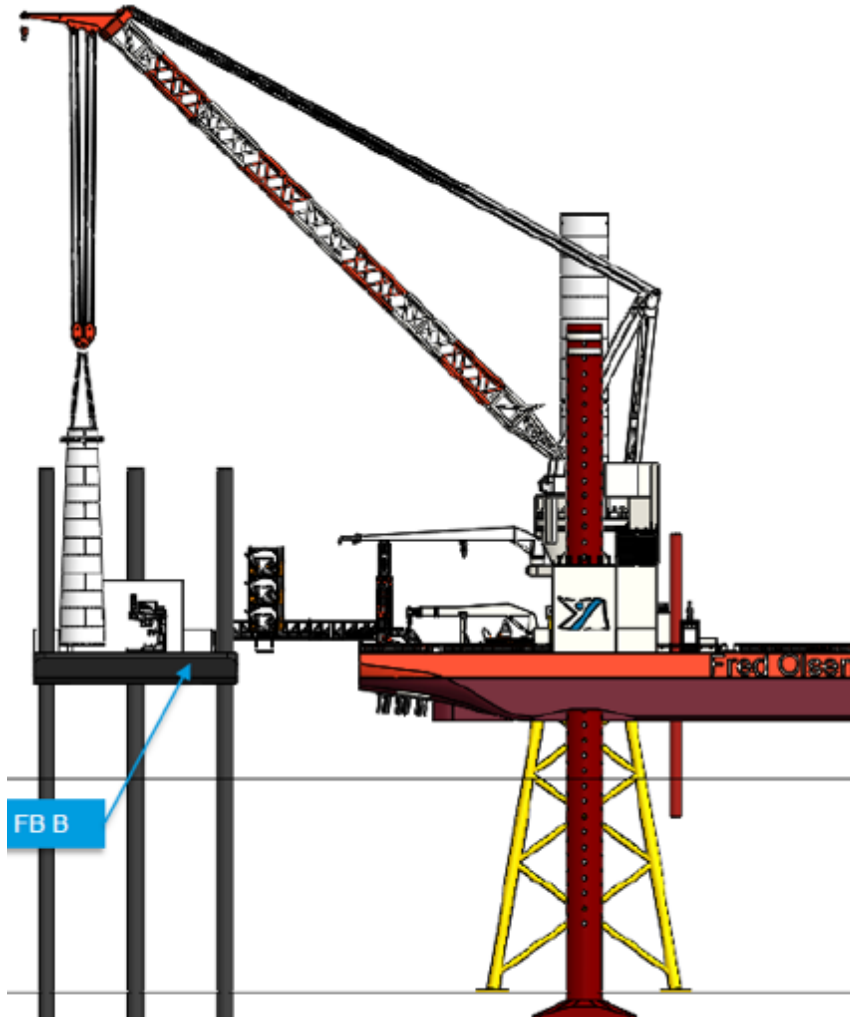
Wind Turbine Installation

Approximately 30
days in ~August 2016



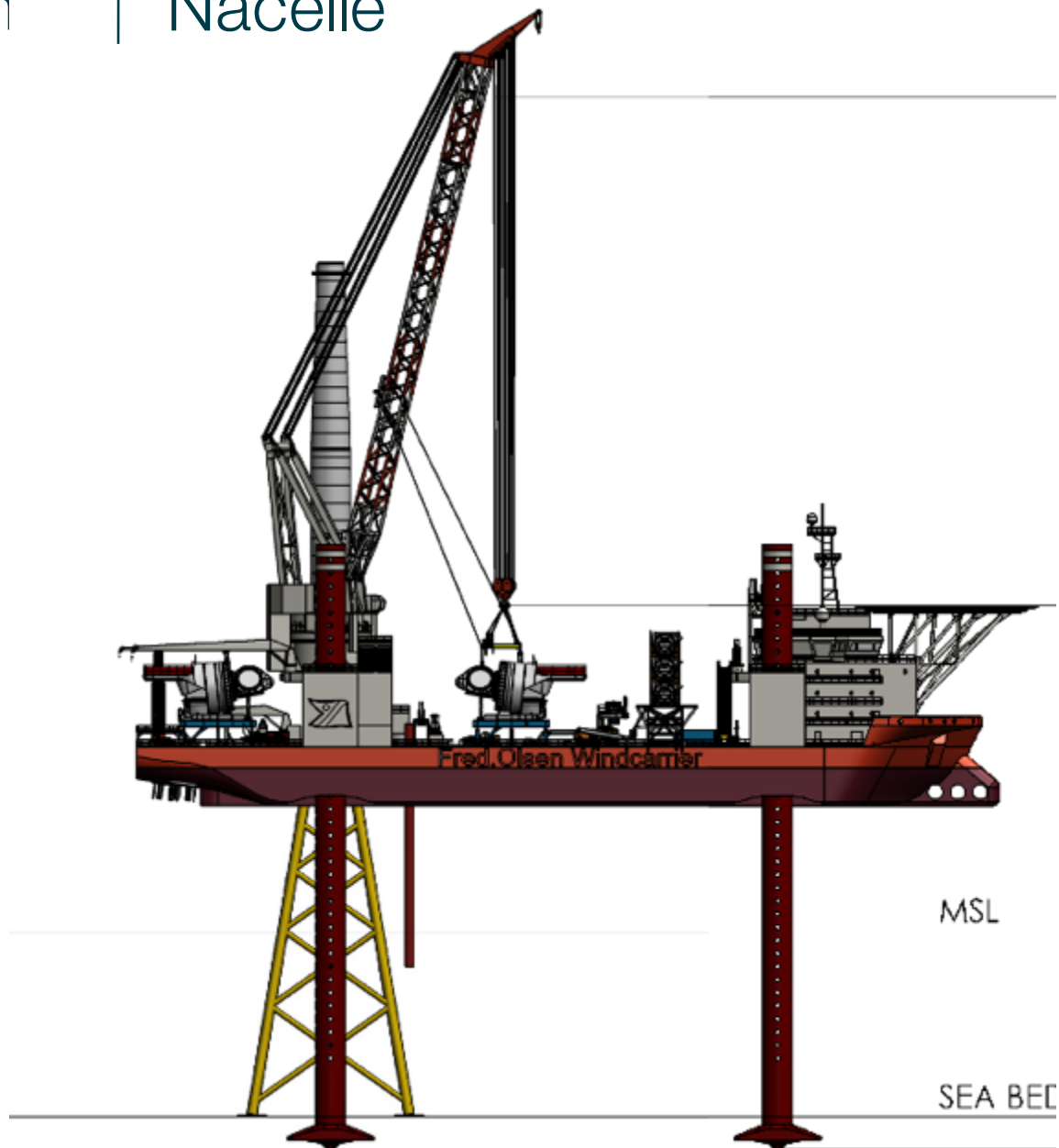
Wind Turbine Installation

Setting Towers



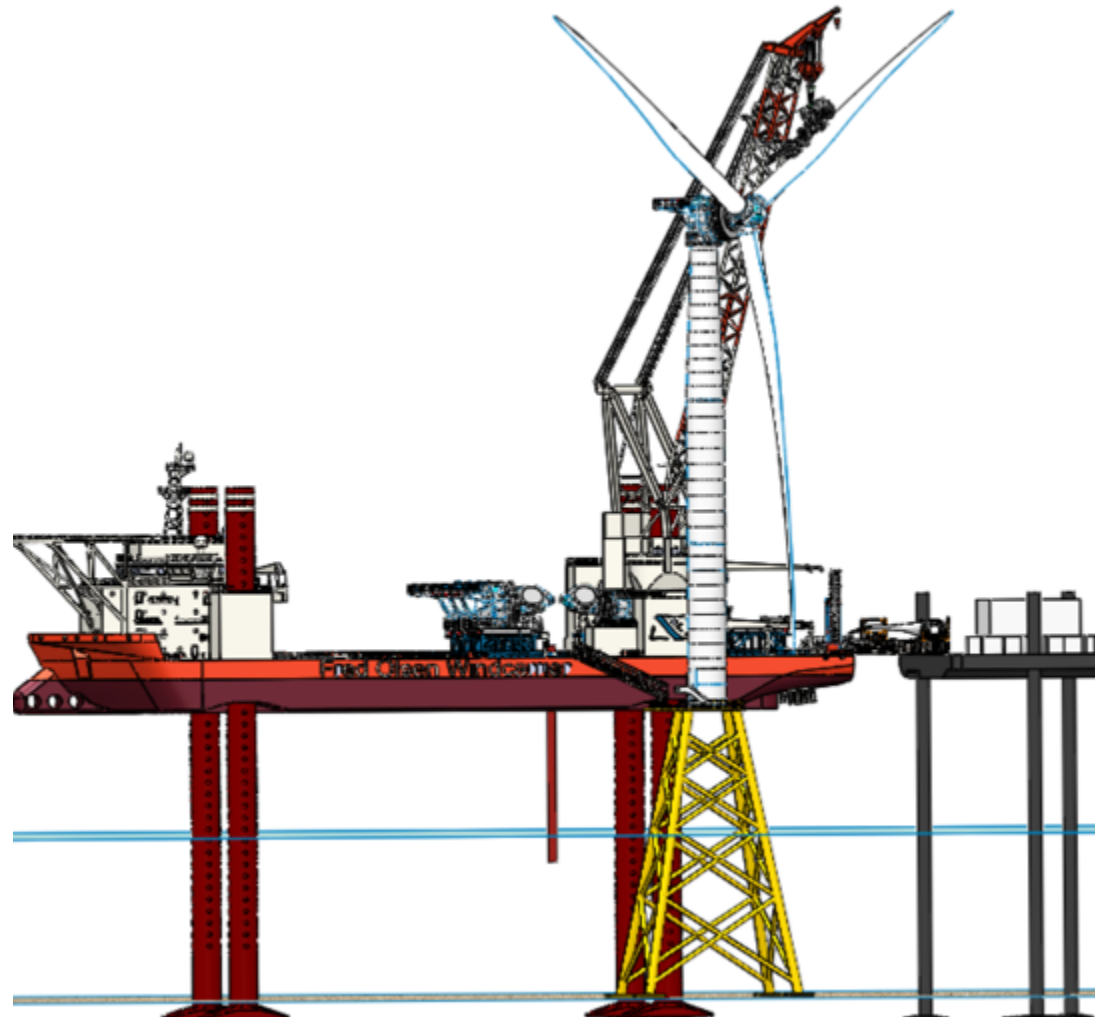
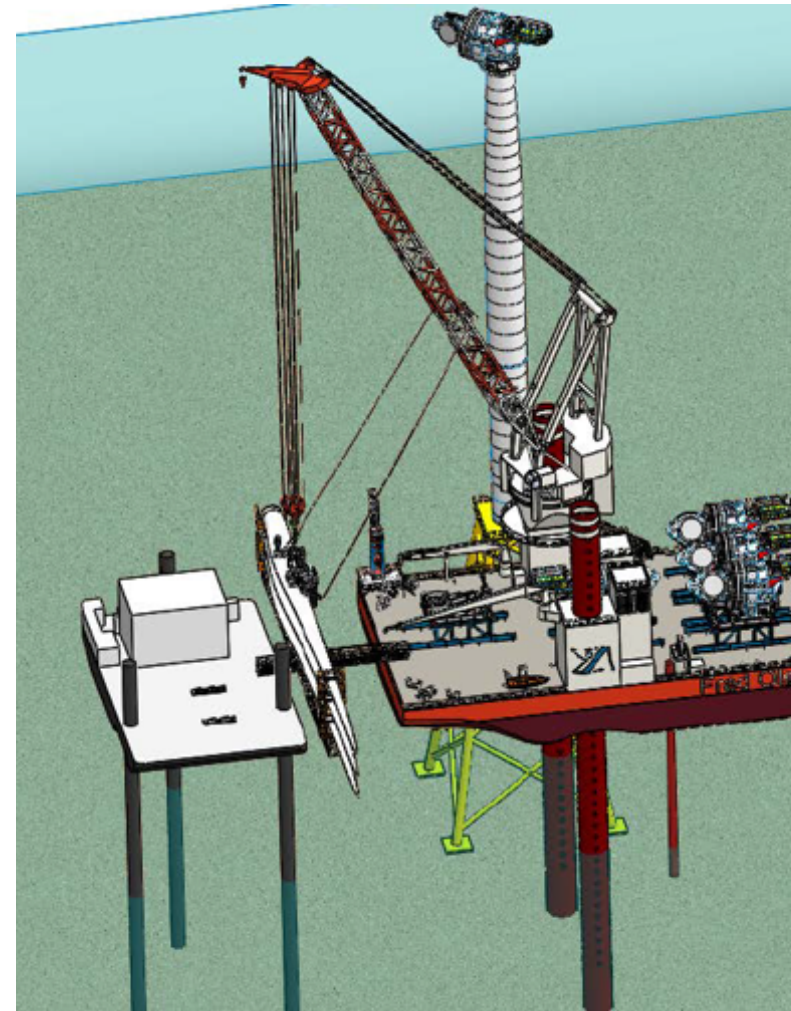
Wind Turbine Installation

Lifting the Nacelle



Wind Turbine Installation

Installing Blades



Wind Turbine Commissioning

Commissioning activities to take place after mechanical completion of wind turbines prior to start of commercial operations.

