

# Block Island Wind Farm CVA

Final Report Design, Fabrication, Installation

Presented by  
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# Topics

- CVA Summary
- Final FDR and FIR Report
- Final Fabrication Report
- Final Installation Report
- O&M Verification Plan

# CVA Summary

The Certified Verification Agent (CVA) shall use good engineering judgment and practices in conducting an independent assessment of the design, fabrication and installation of the facility. The CVA shall certify in the Facility Design Report to the Council that the facility is designed to withstand the environmental and functional load conditions appropriate for the intended service life at the proposed location.

- Duration 2014 - 2017
- Team of 30 Engineers and Inspectors in 11 countries
- Document Review and Periodic on-site surveillance
- Substructures, wind turbines, and subsea cable from the wind turbines up to the beach landing
- Many “Firsts” and high public scrutiny resulted in high level of verification effort

# Project Roles

<b>Role</b>	<b>Company</b>
Project Developer	Deepwater Wind Block Island, LLC (DWBI)
Permitting Authority	Rhode Island Coastal Resources Management Council (CRMC)
Certified Verification Agent	ABSG Consulting (ABSG)
Wind Turbine Manufacturer	GE/Alstom
Substructure Designer	Keystone Engineering
Substructure Manufacturer	Gulf Island Fabricators
Cable Manufacturer	LS Cable
Primary Installation Contractors	Weeks/ Manson (WMJV), Fred Olsen Renewables, Kokosing Industrial

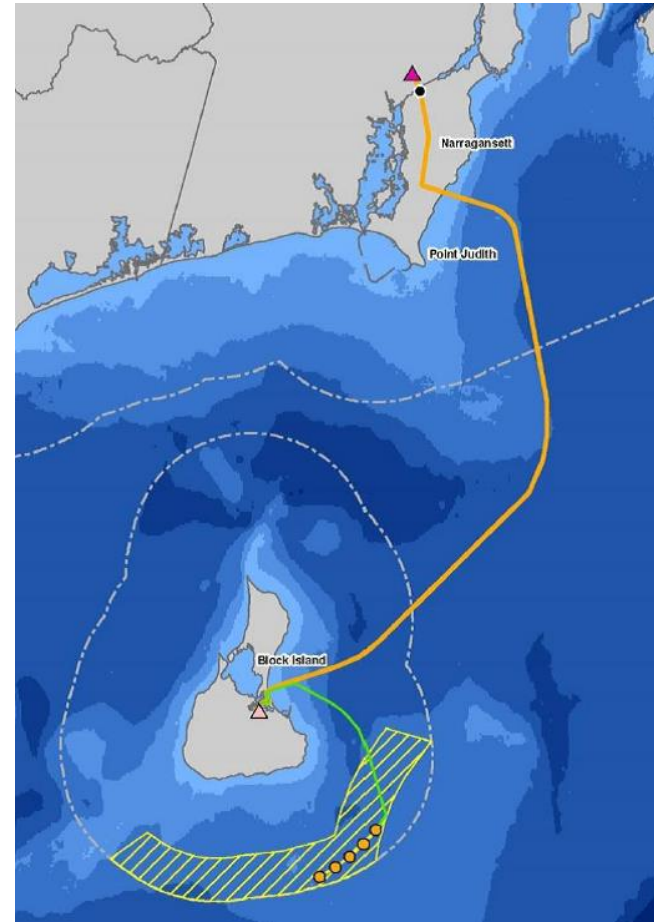
# CVA Methodology

- According to Rhode Island OSAMP and relevant Rhode Island and federal laws
- According to standards listed in the Design Basis and approved by ABSG
- Document Review
  - Documentation provided by DWBI was reviewed by ABSG engineers who are specialized in offshore wind or in disciplines specific to the subject matter.
  - ABSG reviewed and approved over 1500 Documents or files
  - ABSG generated 53 Design Comment Sheets
- On Site Surveillance
  - Risk based inspection plans based on review of DWBI and suppliers' risk assessments, work processes, QC and EHS
- Continuous Reporting to CRMC

# Final FDR and FIR Report

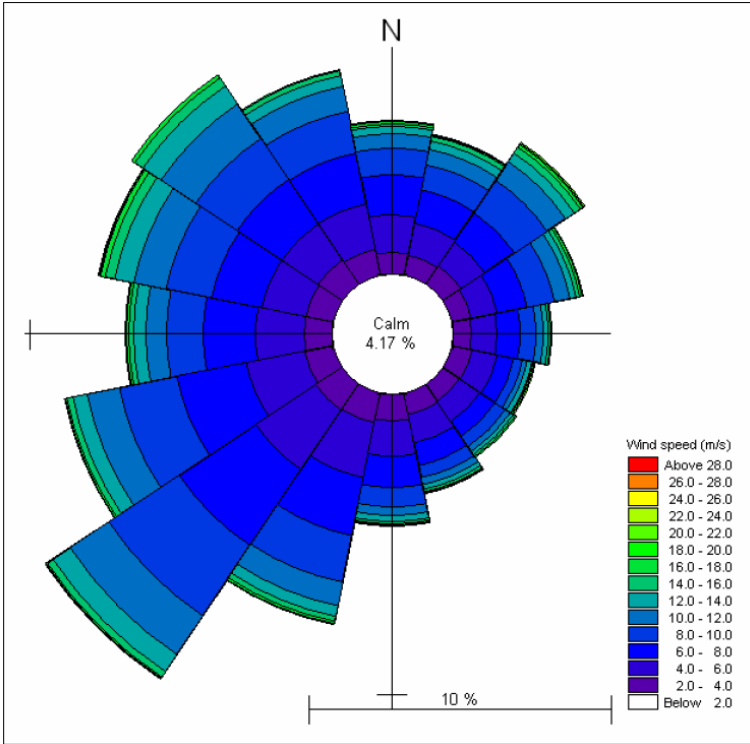
Facility Design report (FDR) and Fabrication and Installation Report (FIR)

- Site Assessment
- Design Basis
- Independent Load Simulation
- Design Calculations
- Manufacturing Drawings and Specs
- Manufacturing, Transportation, and Installation Plans and Procedures

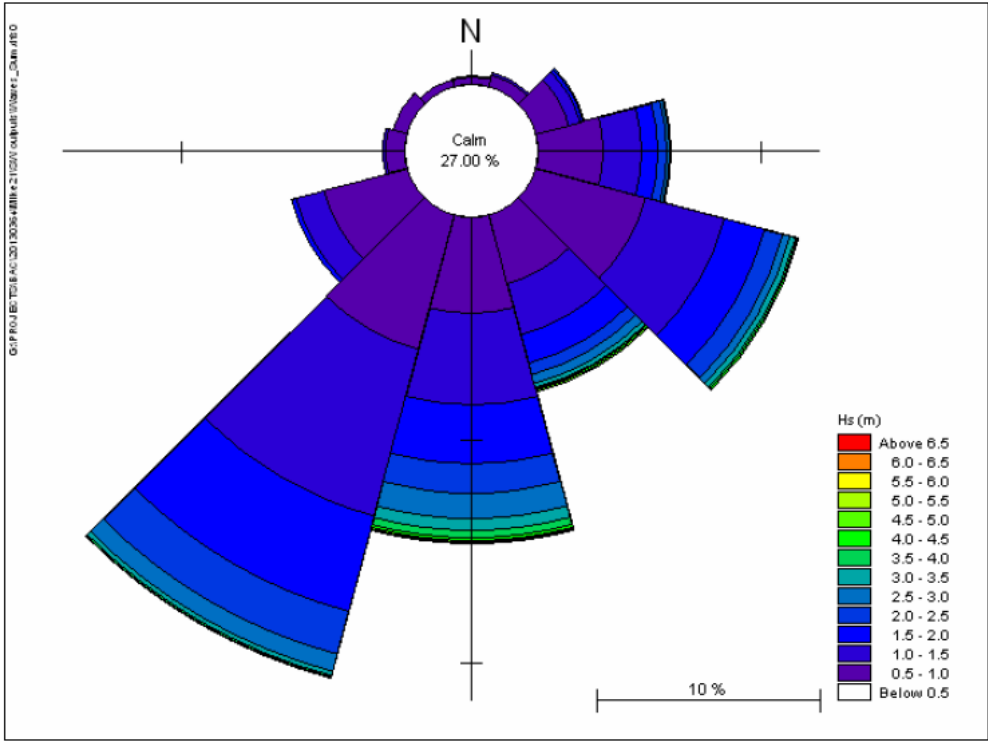


# Site Assessment

## Wind Rosette

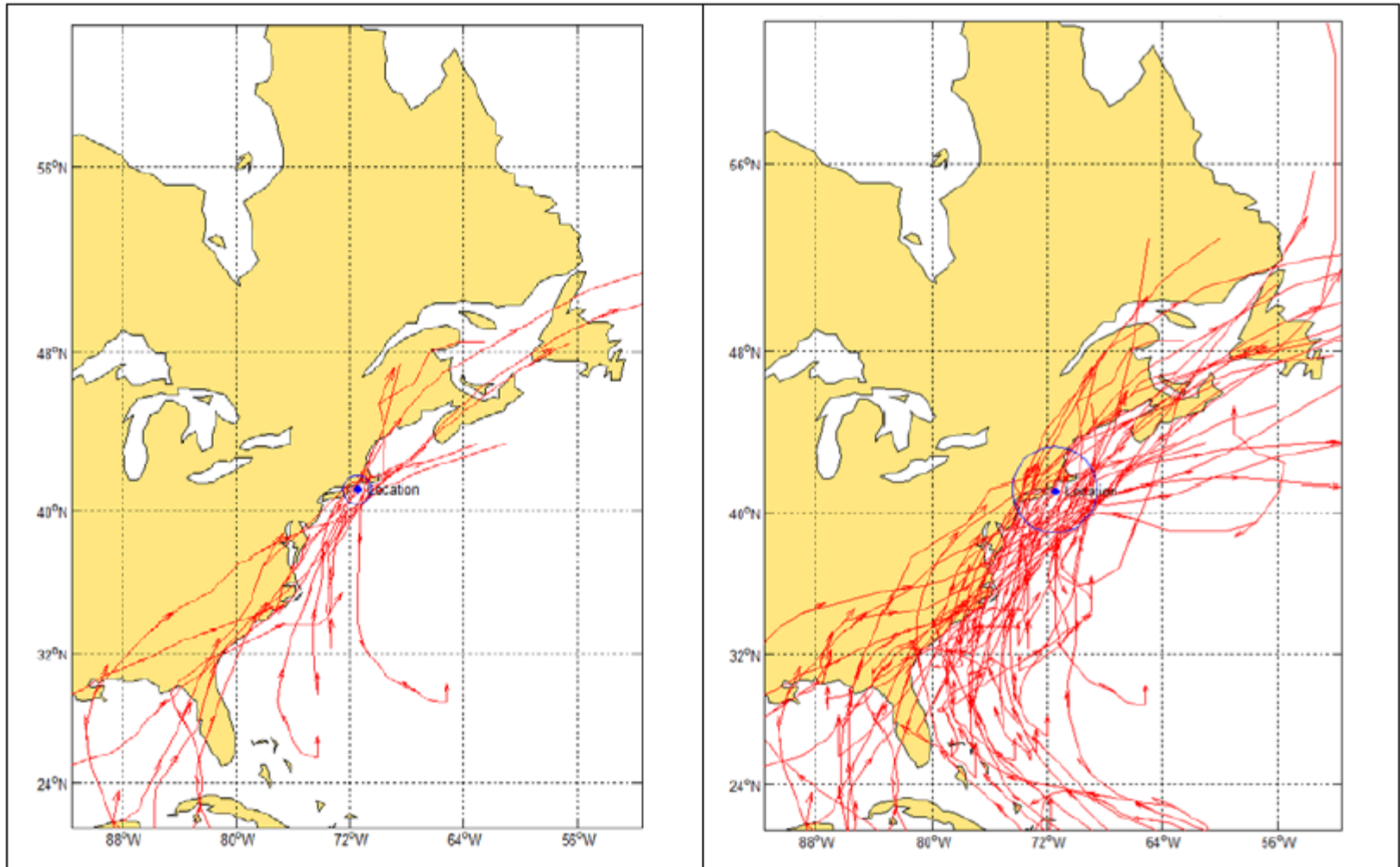


## Wave Rosette



Wind and Wave Distributions

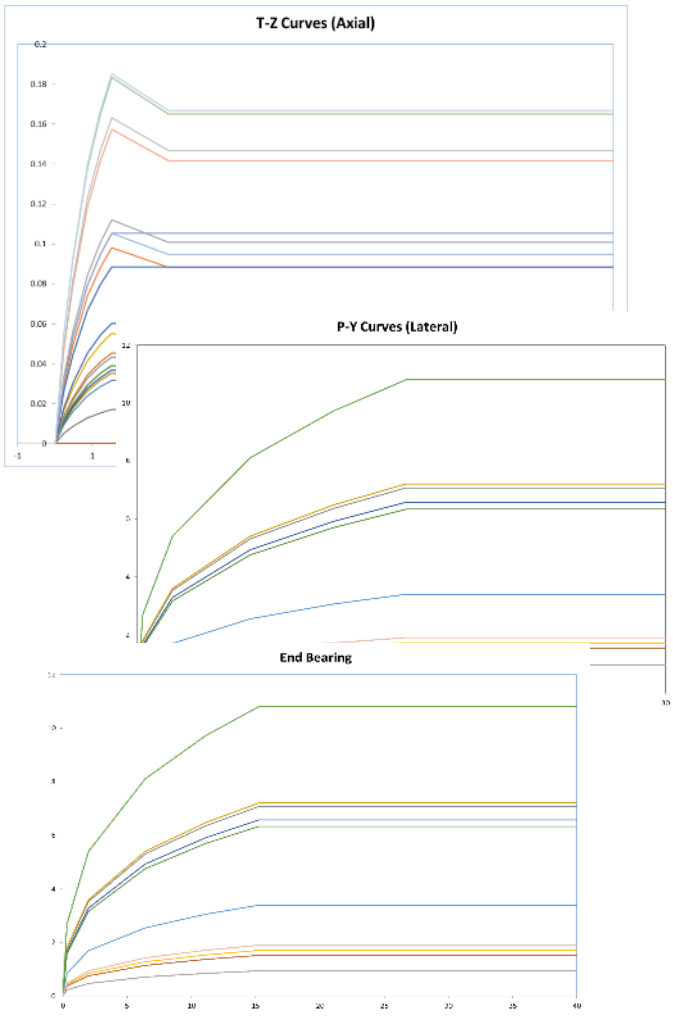
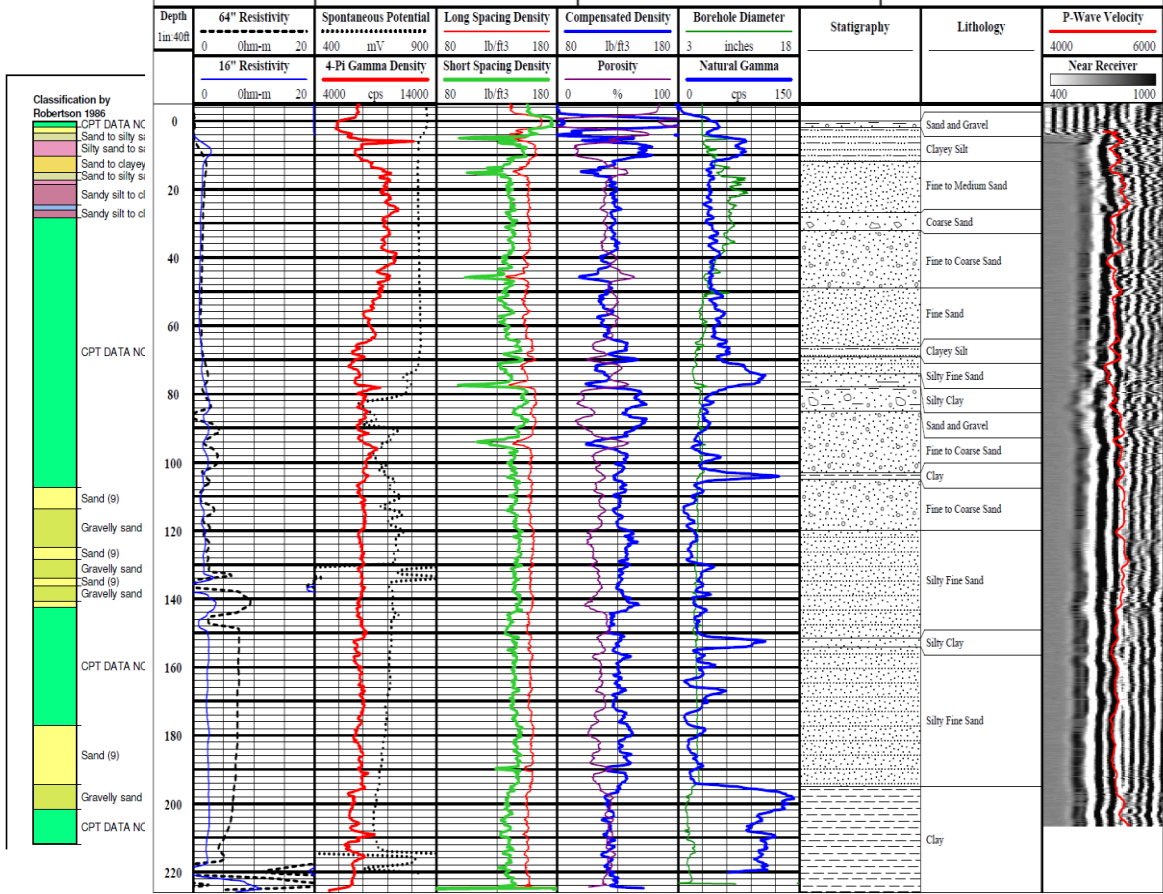
# Site Assessment



## Extreme Value Analysis



# Site Assessment



## Geotechnical Data and Analysis

# Design Basis

## Inputs:

Designers' interpretation of design inputs based on site assessment

## Preliminary Design

### Substructure – Keystone

Substructure Design Basis

Preliminary Design Report

Preliminary Design Drawings

### Wind Turbine – Alstom

Tower Structure Design Basis

Tower Internals Design Basis

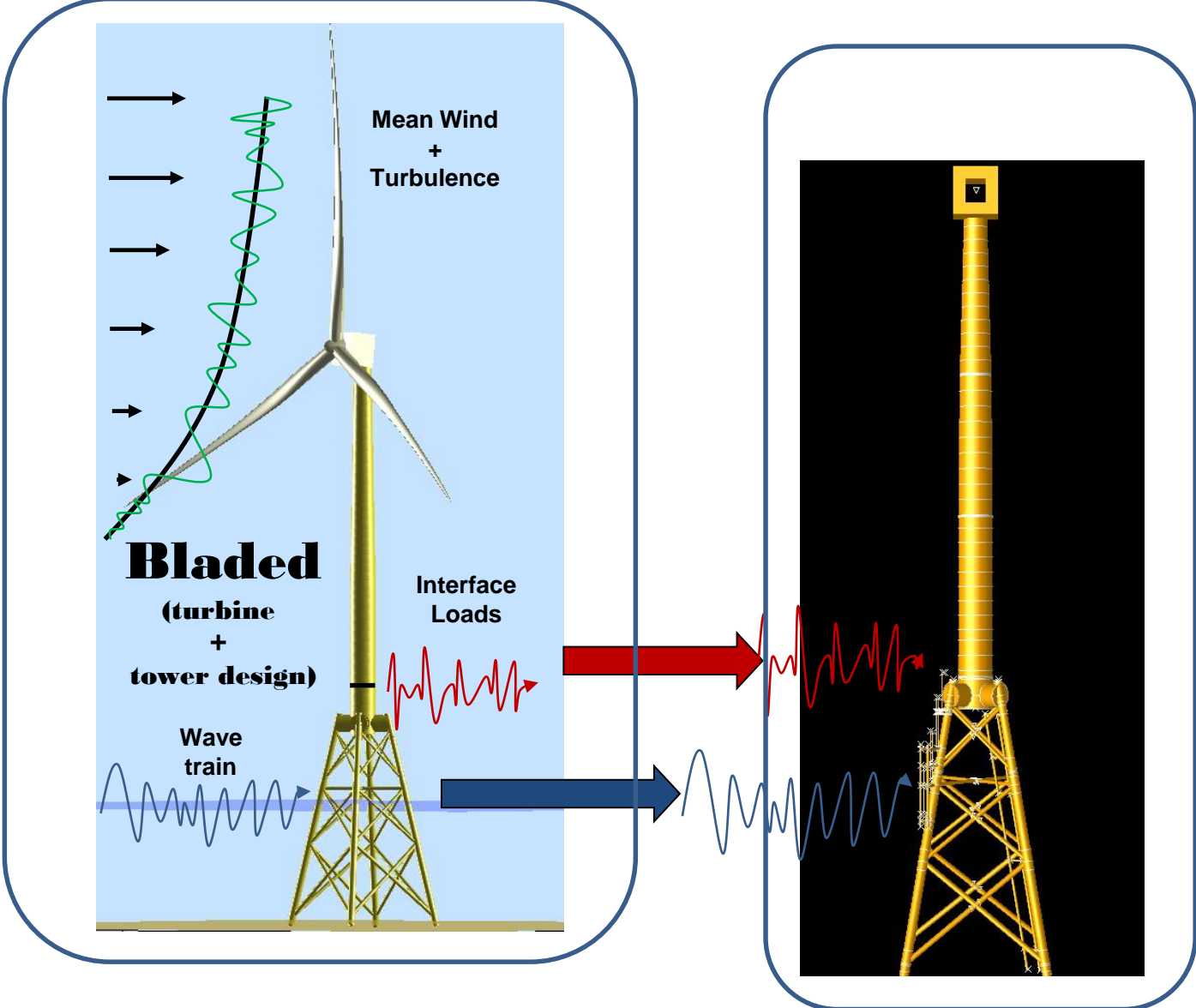
Wind Conditions

Turbine General Description



1	Rotor Nacelle Assembly
2	Tower
3	Interface
4	Jacket
5	Foundation piles

# Integrated Load Simulation



# Final Fabrication Report

## On Site Surveillance

Substructure manufacturing continuous presence

Sample of 1 wind turbine manufacturing (RNA Assembly and component manufacturing)

Type and factory acceptance test of cable

## ABSG Deliverables

R-BIWF-02011 - Substructure Manufacturing Verification Final Report

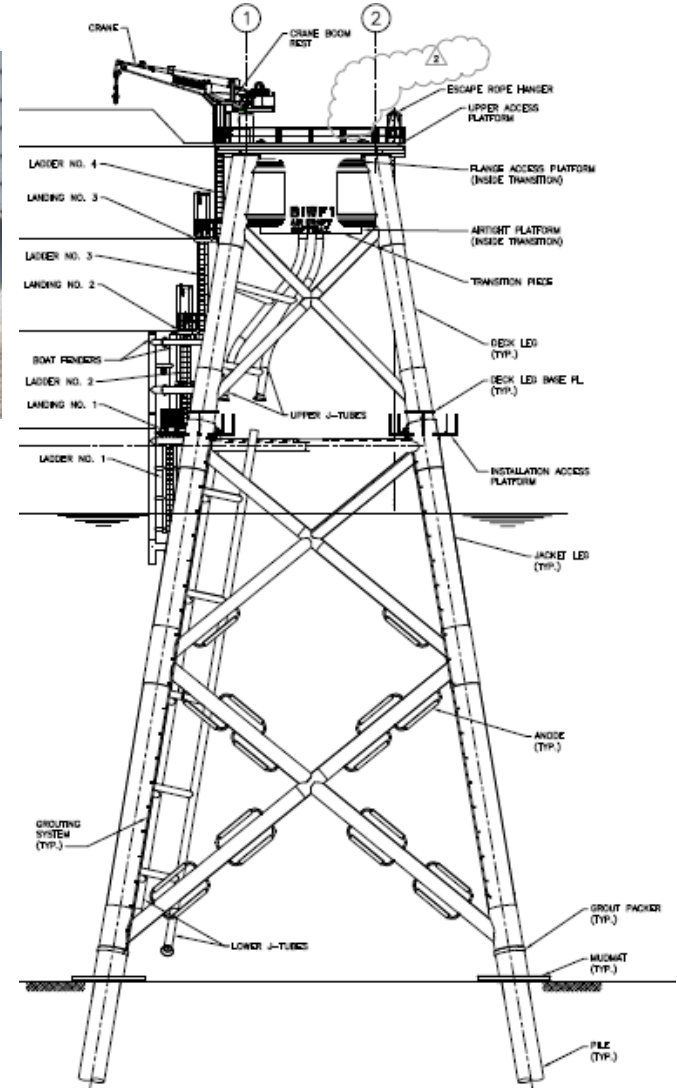
R-BIWF-02028 - Wind Turbine RNA Manufacturing Verification Report

R-BIWF-02026 - Subsea Cable Manufacturing Verification Report

# Manufacturing Surveillance - Substructure



Deck Legs – Gulf Island, Houma, LA





# Manufacturing Surveillance - Substructure



Load-out of Jacket – Gulf Island Marine, Houma, LA

# Manufacturing Surveillance - Substructure

Continuous Surveillance of jacket and deck fabrication Houma, LA

Periodic inspection of

- WTG mounting flange (Euskal, Spain)
- TP (EEW Germany)
- Pile sections (EEW South Korea)

Inspection of incoming components

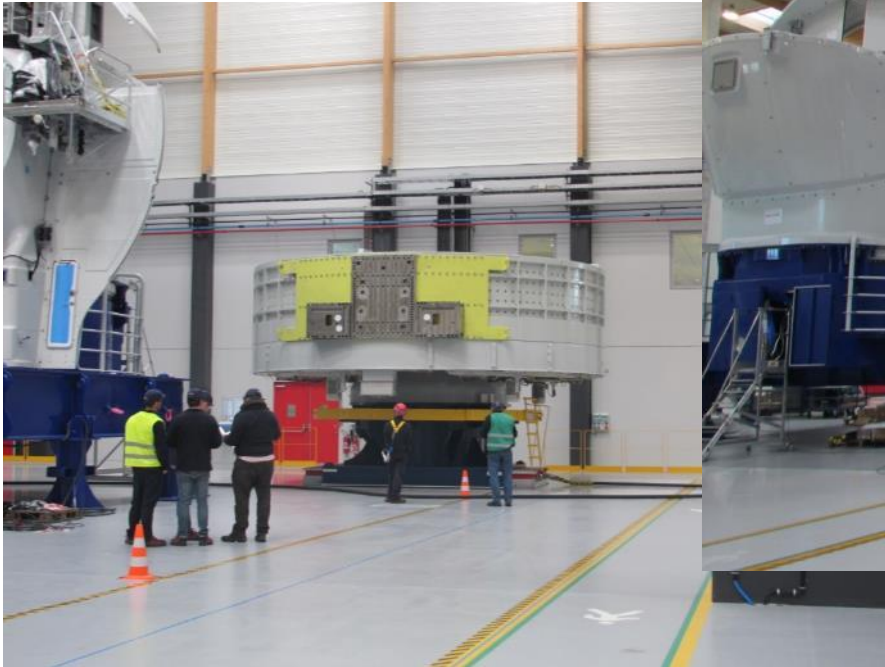
- Secondary Steel (SDS, Rhode Island)

Witness factory acceptance test

- Final Dimensions deck, jacket, piles
- WTG mounting flange survey
- Level survey

# Manufacturing Surveillance - WTG

## Wind Turbine (GE/Alstom)



Generator #1



Nacelle Assembly



# Manufacturing Surveillance - WTG



Five blade sets, LM Windpower, Denmark – completed March 2014

# Manufacturing Surveillance - WTG

Castings – Faw Foundry, China, Feb 2015



Diameter	width	weight
4 m	4.5 m	48.9 T

# Manufacturing Surveillance - Cable



Test of Sub-sea Cable, LS Cable, South Korea – completed January 2016

# Manufacturing Surveillance - Cable

Witness final inspection

Witness type test

- Partial discharge
- Lightning/ surge
- Power, frequency, voltage test

Witness factory acceptance test

- HV test
- Resistance
- Attenuation of FO cable
- Dimensions

# Final Installation Report

## On Site Surveillance

- Two seasons – 2015 and 2016
- Installation of all substructures
- Installation and commissioning of first wind turbine
- Sample of HHD pull, J-tube pull, trenching and Burying

## ABSG Deliverables

R-BIWF-02024 - Substructure Installation Verification Summary Report  
R-BIWF-02023 - Wind Turbine Installation Report  
R-BIWF-02022 - Subsea Cable Installation Verification Report



# Final Installation Report



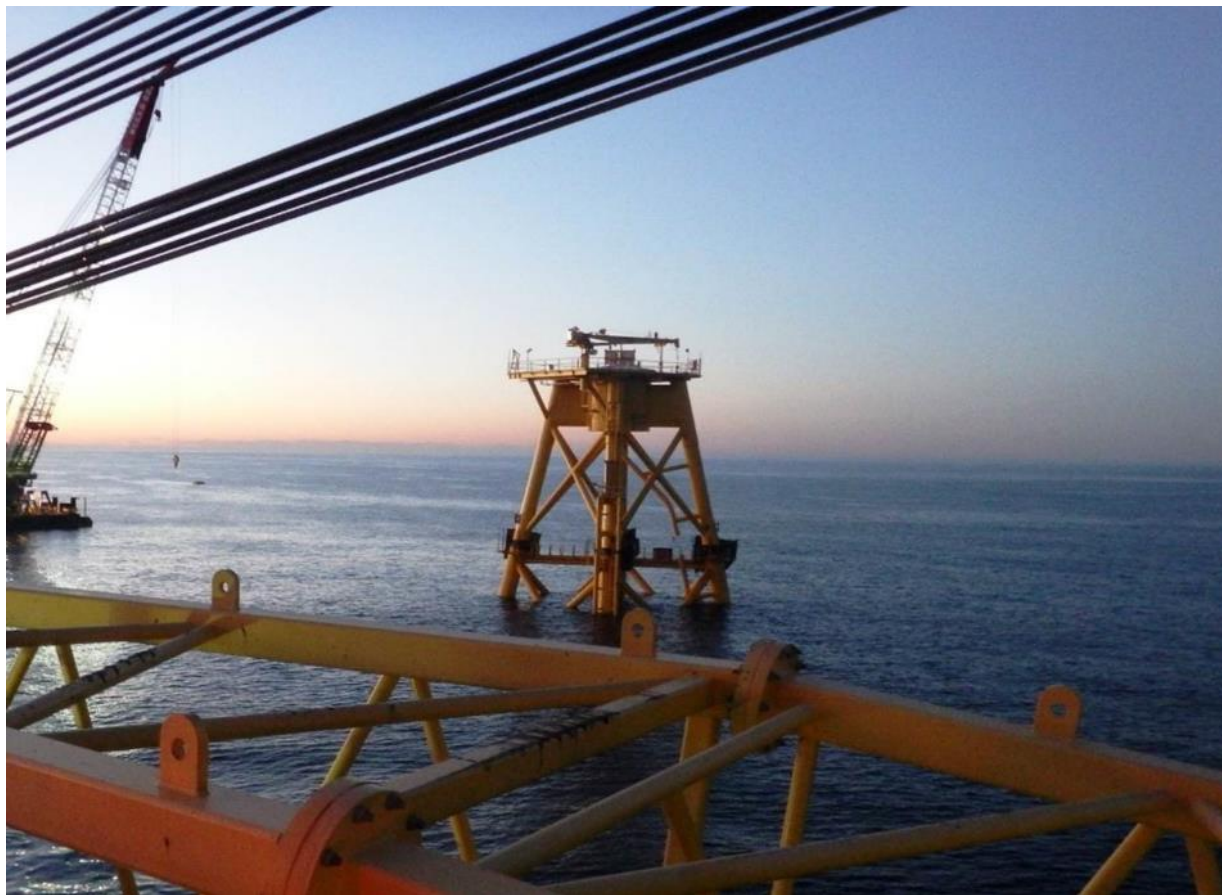
Pile Stabbing and Driving with W533

# Final Installation Report



Pile Stabbing and Driving with Lift Boat Robert

# Final Installation Report



Deck 1 Set and Levelled Nov 2, 2015



# Final Installation Report

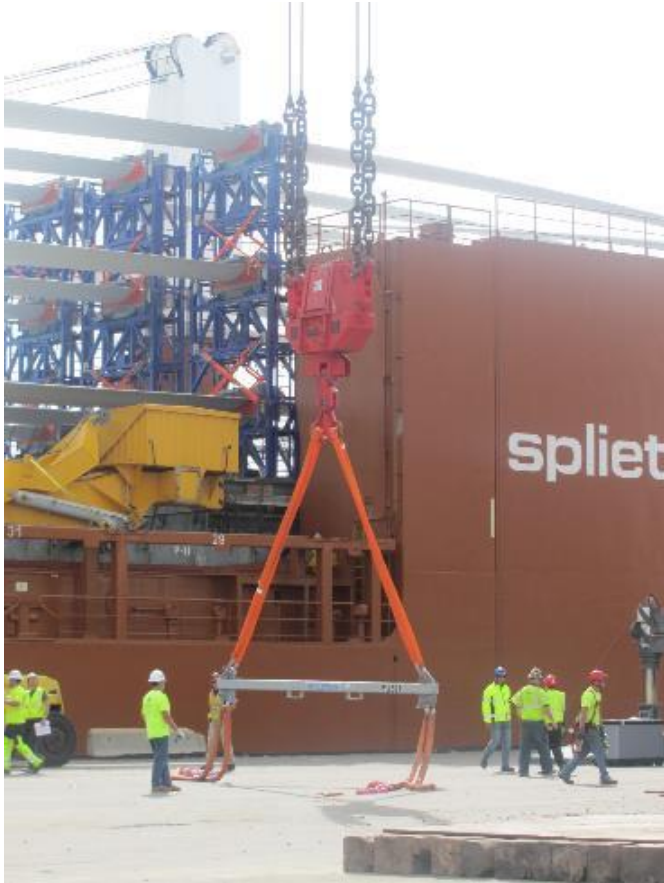


T2 Offloading



T2 Storage at ProvPort

# Final Installation Report



Rigging to lift  
blade assembly



Offloading blade assembly 1 with ProvPort cranes

# Final Installation Report



Tower Lifting and Setting

Tower Flange Bolt Tightening



# Final Installation Report



RNA Lifting and Setting



# Final Installation Report



Blade Lifting and Stabbing

# Final Installation Report



Installation at BI5 and Personnel Transfer at BI2 – from BI1

# Final Installation Report



Routing and Terminating HV Cables



# Final Installation Report



Coffer Dam on Crescent Beach



“Big Max” Cable Lay Barge



# FDR and FIR Certification Statements

## **FDR**

“The design of this structure has been certified by a Council approved CVA to be in accordance with accepted engineering practices and the approved SAP or COP as appropriate. The certified design and as-built plans and specifications shall be on file at the ABSG Consulting Inc. office located at 16855 Northchase Drive, Houston, Texas 77060.

“The facility is designed to withstand the environmental and functional load conditions appropriate for the intended service life at the proposed location.”

## **FIR**

“The fabrication and installation of this structure has been certified by a Council approved CVA to be in accordance with accepted engineering practices and the approved SAP or COP as appropriate.”

# O&M Phase Verification Plan

- Five (5) year verification cycle proposed by ABSG:
  - Years 1-4: O&M document review to confirm compliance with OSAMP and DWBI O&M Plans
  - Year 5: Onsite inspection of all five (5) units and witnessing of key planned maintenance activities
  - Additional coverage if and when needed due to:
    - Material exceptions noted in O&M versus approved plans
    - Severe weather events or natural disasters that could impact installation integrity or expected life
    - Accidents or man-made events that could impact installation integrity or expected life
    - Major component failures, repairs, or installation alterations
- Other verification if directed by CRMC