Block Island Wind Farm CVA

Status of verification activities at FDR and FIR submittal miletone

Presented by
Rain Byars
Senior Engineer

April 24, 2015

ABS Group

Overview

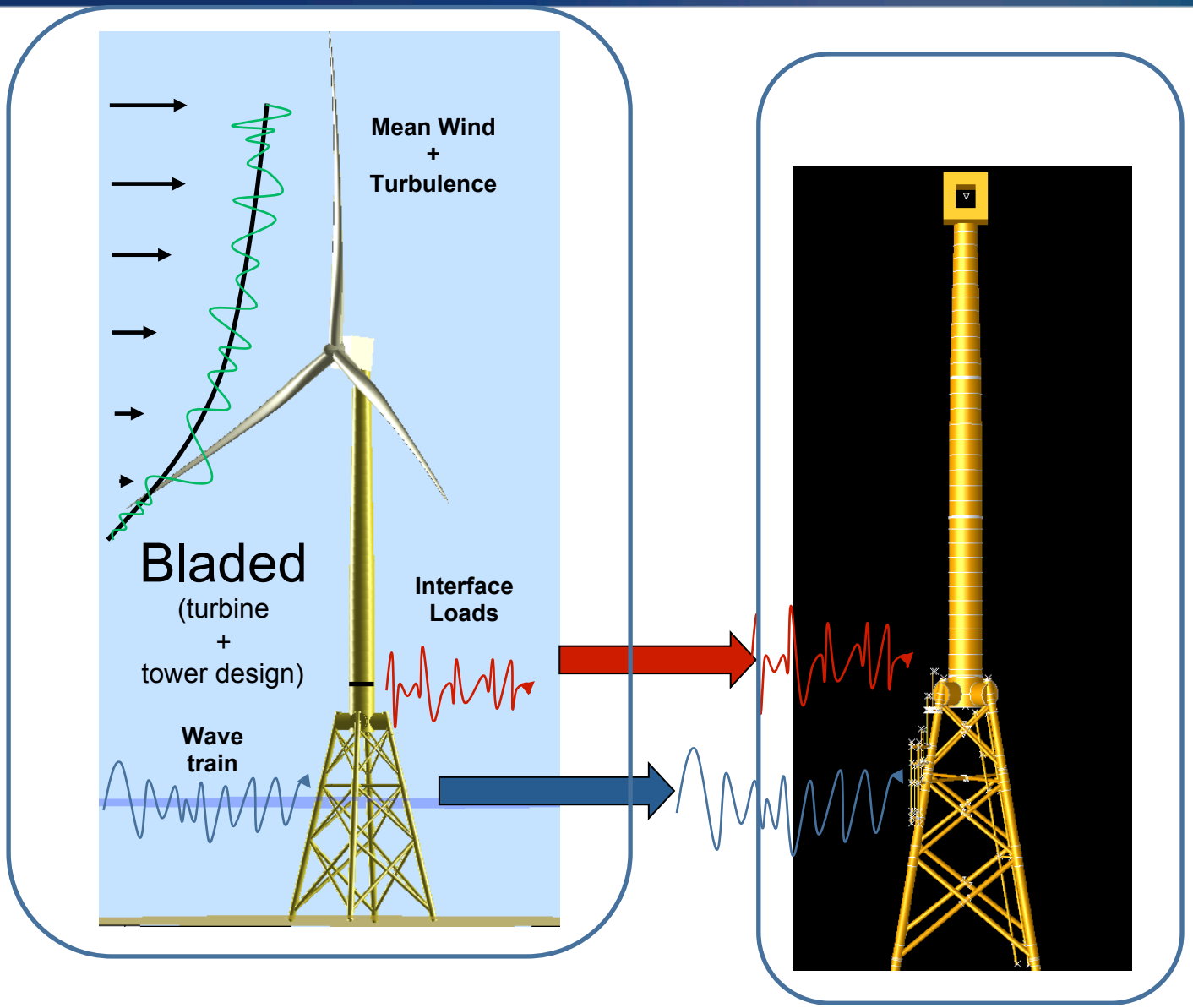
Last Update – March 10

- Site Assessment
- Design Basis
- Loads Simulation
- Manufacturing Surveillance to Date

Current Update – April 23

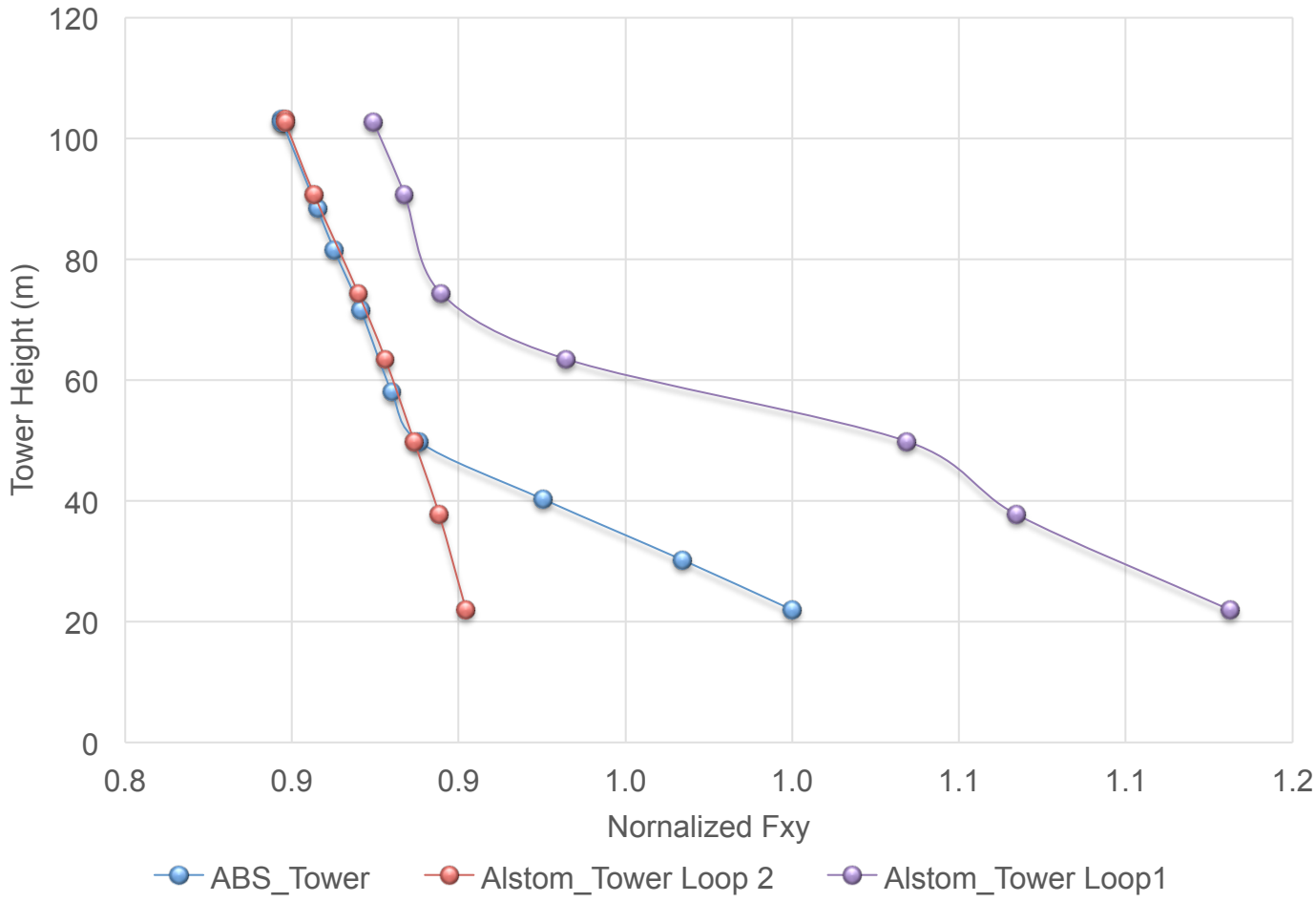
- Completion of Loads simulation
- Facilities Design Report
- 2015 Fabrication and Installation Report
- Update on Manufacturing Surveillance

Load Simulation



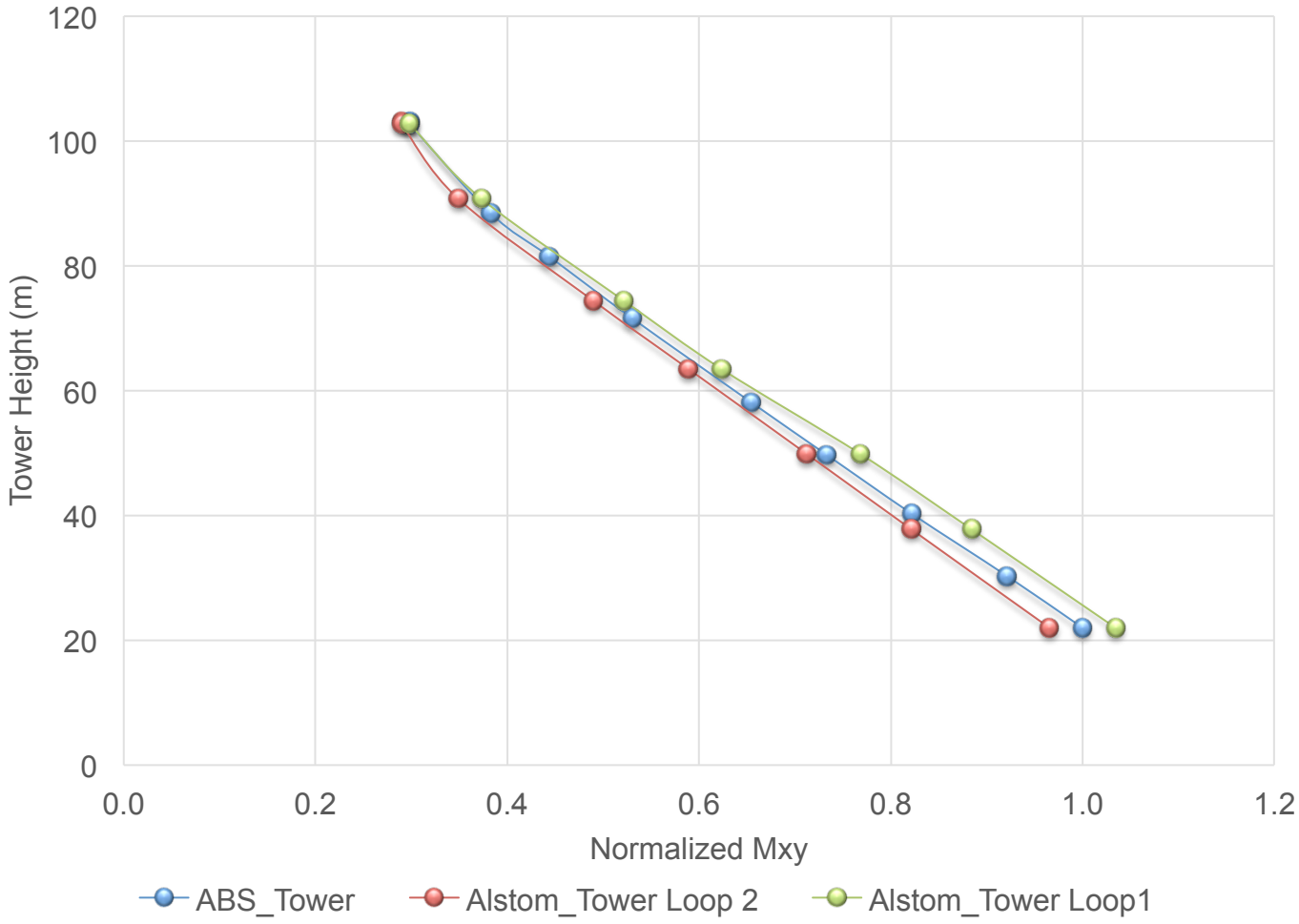
ULS Tower Loads Comparison – Combined Shear Force

$$F\downarrow xy = F\downarrow xy / F\downarrow xy, 22m \uparrow ABS$$



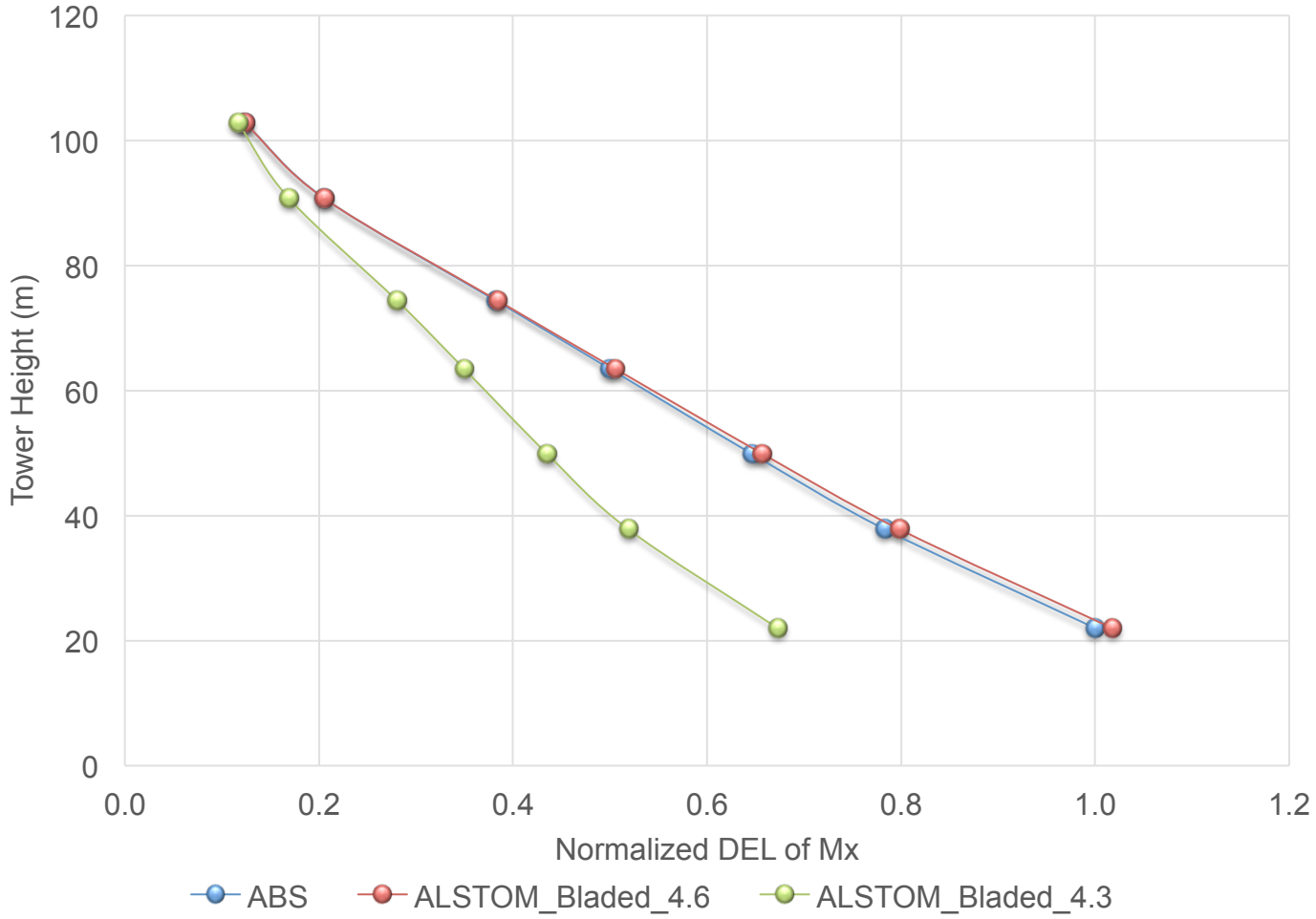
ULS Tower Loads Comparison
Combined Overturning Moments

$$M{\downarrow}xy = M{\downarrow}xy / M{\downarrow}xy, 22m \uparrow ABS$$



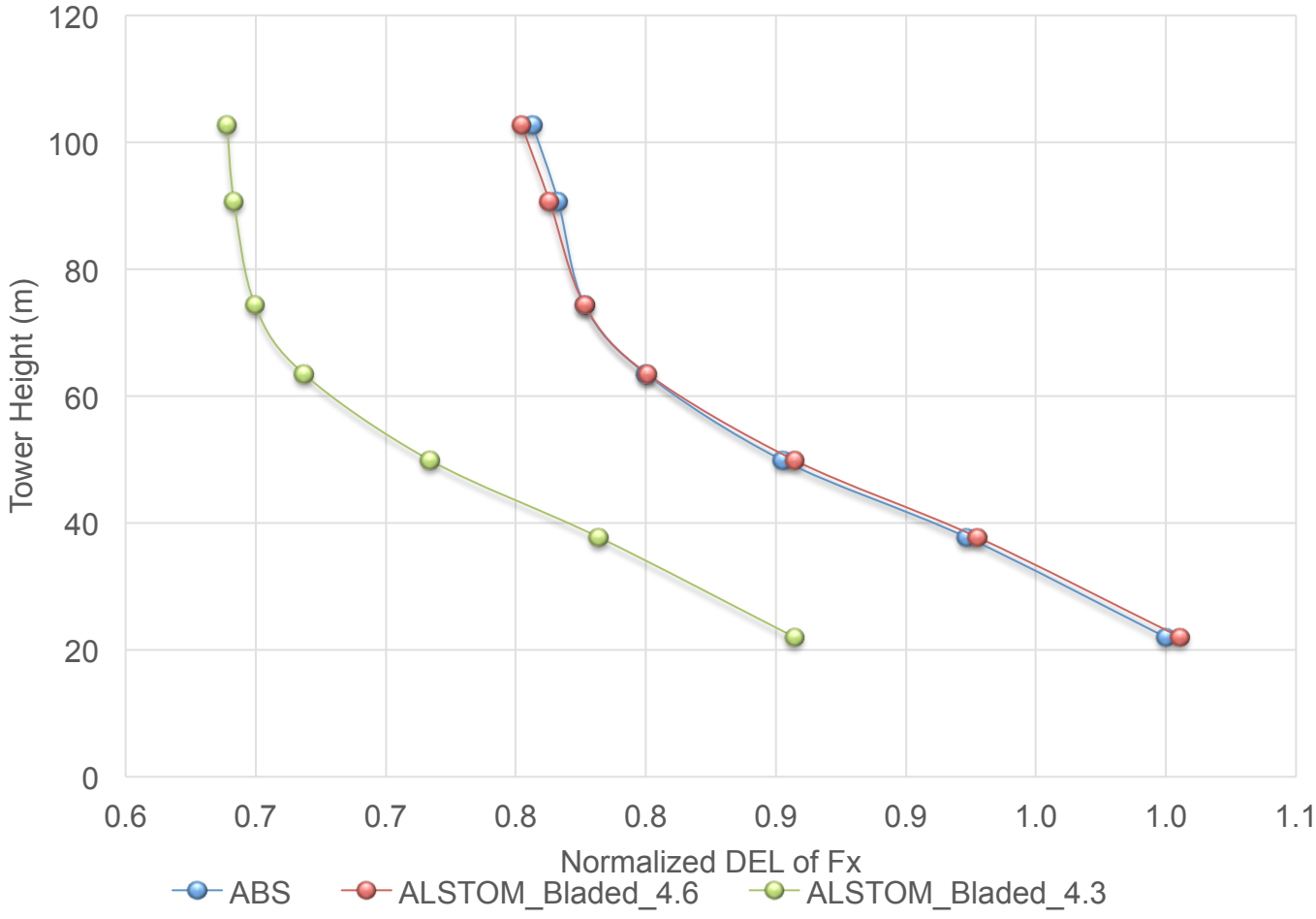
FLS Tower Load Comparison
Side-Side Bending Moments

$$DEL{\downarrow}Mx = DEL{\downarrow}Mx / DEL{\downarrow}Mx,22m{\uparrow}ABS$$



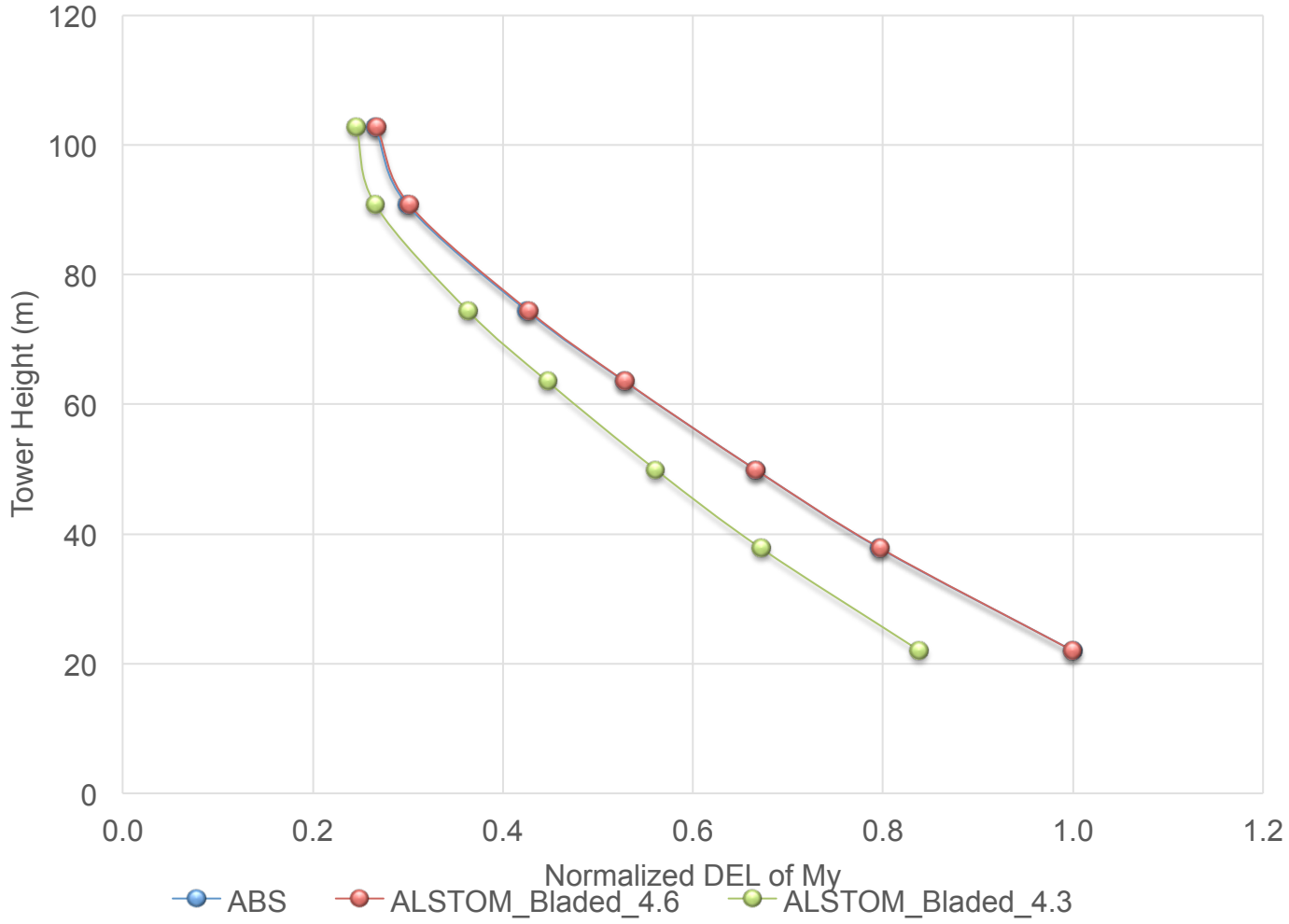
FLS Tower Load Comparison
Fore-Aft Shear Forces

$$DEL{\downarrow}Fx = DEL{\downarrow}Fx \,/ DEL{\downarrow}Fx, 22m \uparrow ABS$$



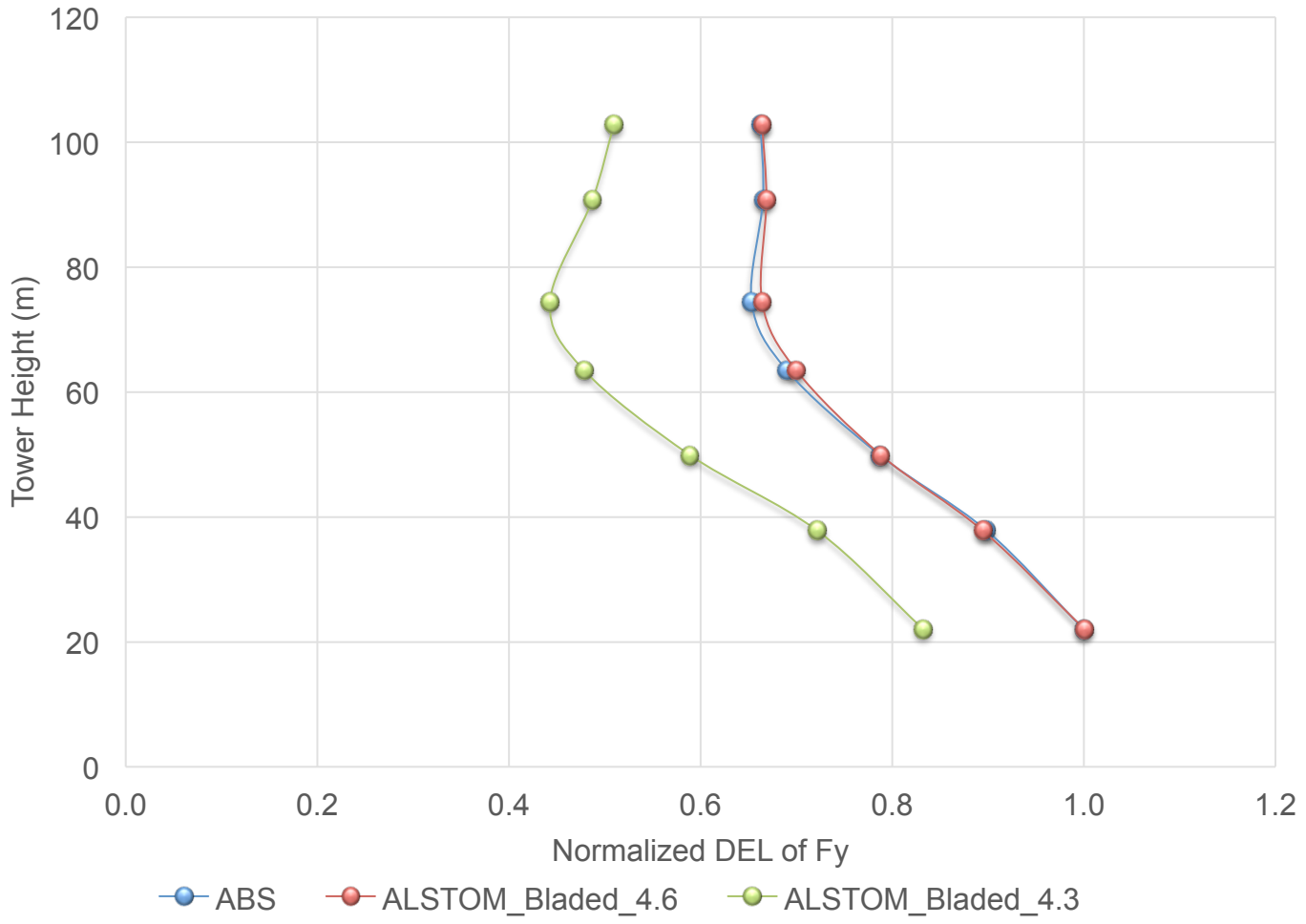
FLS Tower Load Comparison
Fore-Aft Overturning Moments

$$DEL{\downarrow}My = DEL{\downarrow}My \,/\, DEL{\downarrow}My,22m{\uparrow}ABS$$



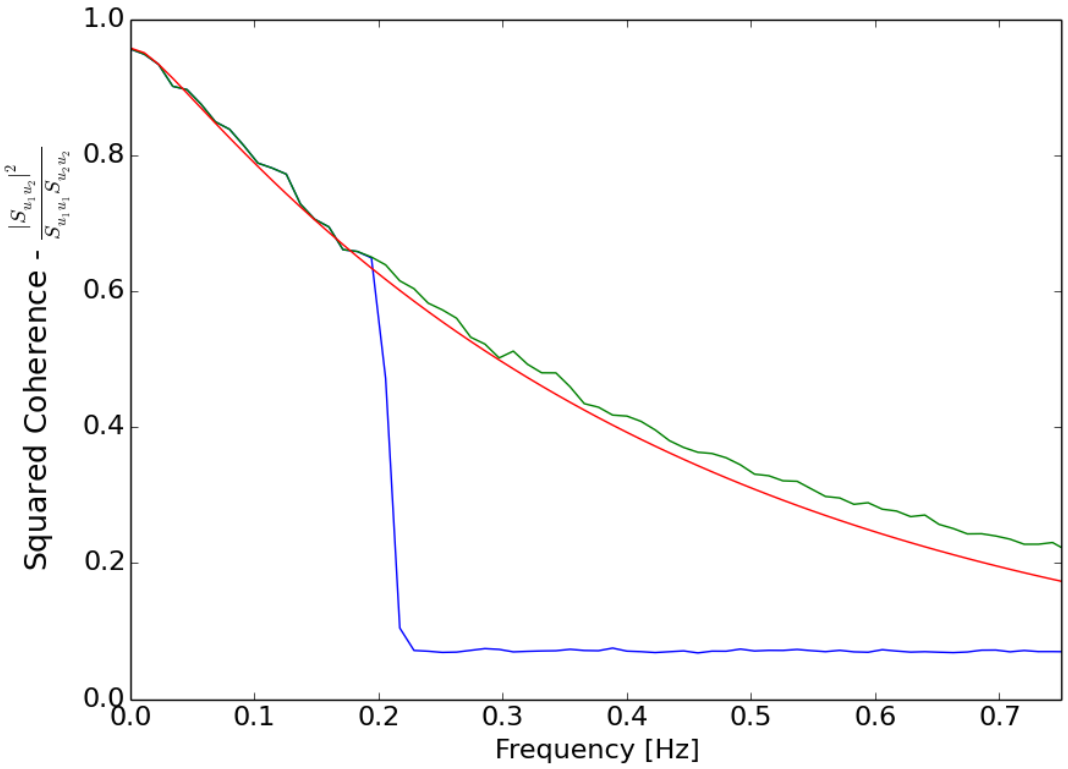
FLS Tower Load Comparison
Side-Side Shear Force

$$DEL{\downarrow}Fy = DEL{\downarrow}Fy \,/ DEL{\downarrow}Fy, 22m \uparrow ABS$$

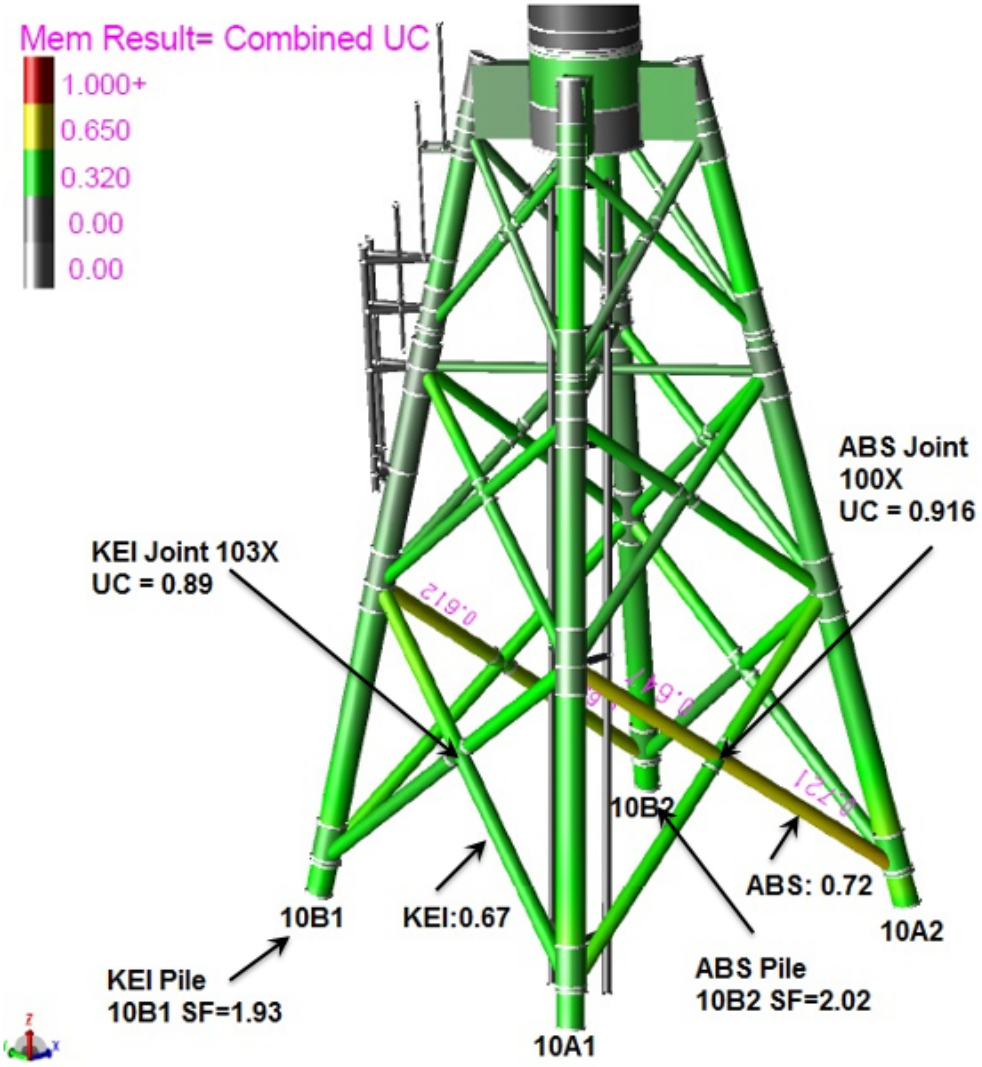


FLS Tower Results
Bladed 4.3 Wind v. Bladed 4.6 Wind

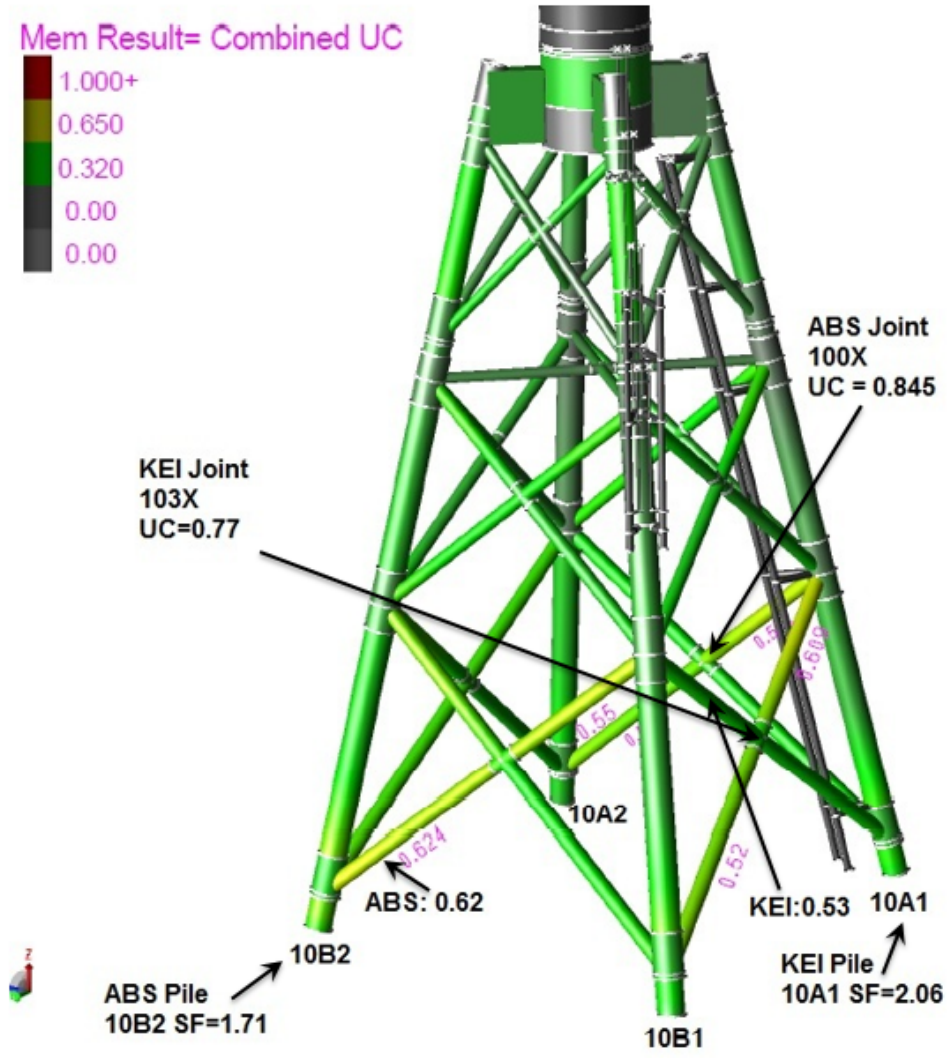
Bladed 4.3 wind was found to be non IEC Compliant



ULS Jacket Load Comparison
Utilization Ratios – Pile Safety Factors – DLC 6.1f

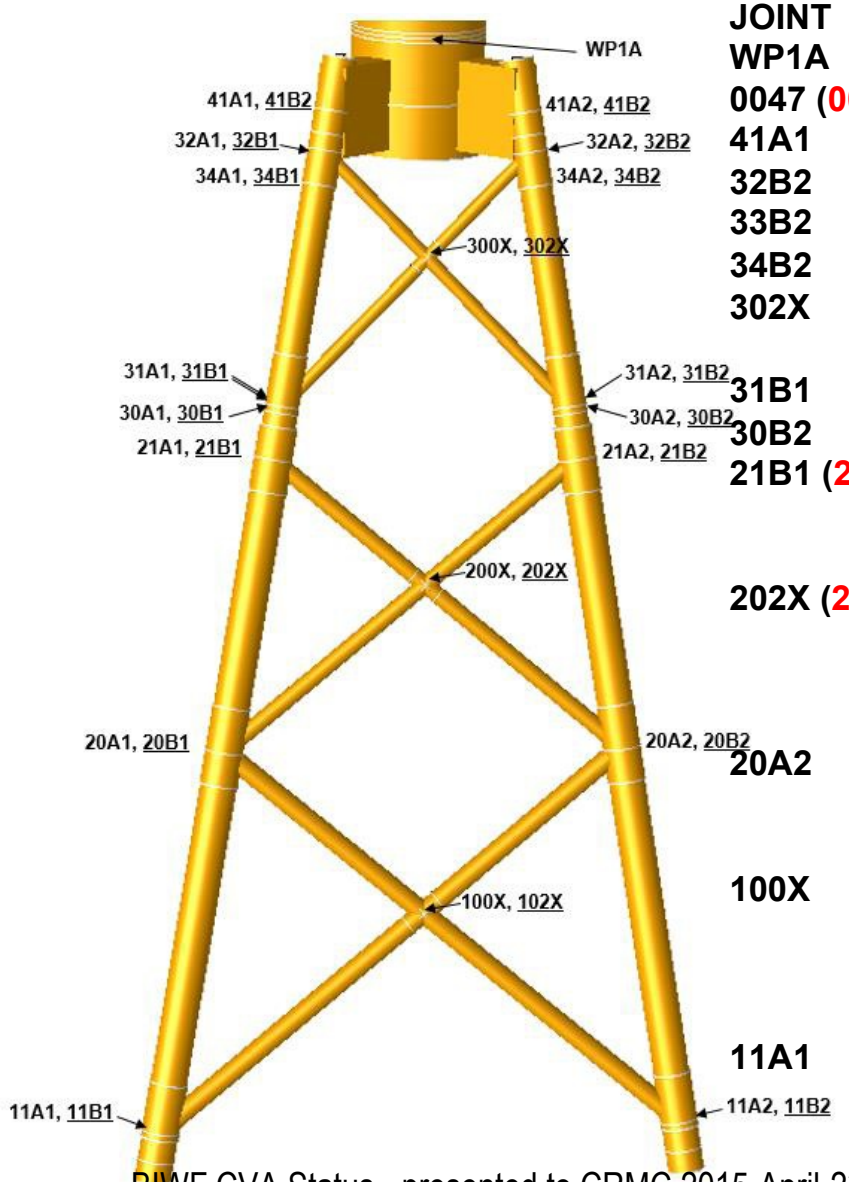


ULS Jacket Load Comparison
Utilization Ratios – Pile Safety Factors – DLC 6.2a



ABS Group

FLS Jacket Load Comparison
Minimum Fatigue Lifetimes



JOINT	JOINT DESC.	LIFE
WP1A	Transition Piece Flange	71 (57)
0047 (0046)	Racetrack at TP	33 (49)
41A1	Deck Leg Upper Can at Racetrack	2,834 (1815)
32B2	Deck Leg Upper Can at Brace Conn.	104 (80)
33B2	Top of Deck Leg Lower Can	99 (76)
34B2	Bottom of Deck Leg Upper Can	94 (85)
302X	Deck X Brace	155 (94)
31B1	Deck Leg Lower Can at Brace Conn.	141 (97)
30B2	Pile to Deck Leg Connection	191 (167)
21B1 (21B2)	Jacket Leg Upper Can	50 (46)
202X (203X)	Jacket Upper X Brace	145 (107)
20A2	Jacket Leg Int. Can	26 (26)
100X	Jacket Lower X Brace	76 (68)
11A1	Jacket Leg Lower Can	125 (126)

Design Comment Sheet (DCS) Register

DCS Number	Subject	Issued to	Issue Date	Engineer	Current Rev	Status	Action
01	Bladed Model	Keystone	22-May-14	JM	3	CLOSED	
02	Metocean and Wind Conditions	Alstom	22-May-14	JM	3	CLOSED	
03	Tower Design Basis	Alstom	23-May-14	RK	6	CLOSED	
04	Wind Design Basis	Alstom	23-May-14	JM	4	CLOSED	
05	Load Simulation Process	Alstom, Keystone	27-May-14	JM	4	CLOSED	
06	DLC List	Alstom, Keystone	27-May-14	JM	4	CLOSED	
07	General Turbine Characteristics	Alstom	27-May-14	PS	4	CLOSED	
08	Load Case Reduction	Alstom	27-May-14	JM	5	CLOSED	
09	Partial Safety Factors	Alstom	27-May-14	PS	6	CLOSED	
10	General Analysis Approach	Alstom	27-May-14	JM	6	CLOSED	
11	Coordinate Systems	Alstom	27-May-14	PS	2	CLOSED	
12	Control and Protection Philosophy	Alstom	15-Jul-14	PS	2	CLOSED	
14	Alstom Bladed-SACS Calibration	Alstom	25-Jun-14	RB	2	CLOSED	
15	DLC Metocean report	Keystone	30-Jun-14	RB	2	CLOSED	
16	Design Briefs ULS and FLS	Keystone	18-Jul-14	PS	2	CLOSED	
17	External conditions and design class	Alstom	29-Jul-14	PS	2	CLOSED	
18	System Dynamic Model description	Alstom	29-Jul-14	PS	2	CLOSED	
19	Load Cases	Alstom	29-Jul-14	RB	4	CLOSED	
20	Load Simulation Methodology	Alstom, Keystone	29-Jul-14	RB	2	CLOSED	
21	Geotechnical Report	Keystone/ Fugro	31-Jul-14	RB	2	CLOSED	
22	Load exchange methodology	Keystone	13-Aug-14	RB	3	CLOSED	
23	Loop1 FLS and ULS	Keystone	11-Nov-15	JM	1a	CLOSED	
24	Alstom Calibration 2 Reports	Alstom	25-Nov-14	KG	2	CLOSED	
25	Alstom Loop 2 Models and Results	Alstom	10-Dec-14	KG	3	CLOSED	
26	Jacket Steel Drawings	Keystone	26-Jan-15	RK	4	Closed in Principal	ABS to Send
27	Substructure FEA	Keystone	26-Jan-15	DS	1	CLOSED	
28	Substructure Fabrication Specs	Keystone	20-Feb-15	RK	1	Closed in Principal	ABS to Send
29	Alstom Load Reports	Alstom	3-Mar-15	KG	4	CLOSED	
30	Alstom Tower Reports	Alstom	6-Mar-15	RK	4	CLOSED	
31	Detailed Design Substructure	Keystone	2-Apr-15	JM	1	OPEN	KS to send results of new secondary steel strength analysis, DWW to send cable info, ABS to review crane and fall arrest documents
32	Substructure Electrical Drawings	Keystone	2-Apr-15	TH	0	OPEN	DWW to reply, provide arc-flash analysis
51	Installation Plan Substructure	Weeks Manson	7-Apr-15	RB	0	OPEN	DWW to provide additional documentation

Open DCSs

DCS Number	Subject	Issued to	Issue Date	Engineer	Current Rev	Status	Action
26	Jacket Steel Drawings	Keystone	26-Jan-15	RK	4	Closed in Principal	ABS to Send
28	Substructure Fabrication Specs	Keystone	20-Feb-15	RK	1	Closed in Principal	ABS to Send
31	Detailed Design Substructure	Keystone	2-Apr-15	JM	1	OPEN	KS to send results of new secondary steel strength analysis, DWW to send cable info, ABS to review crane and fall arrest documents
32	Substructure Electrical Drawings	Keystone	2-Apr-15	TH	0	OPEN	DWW to reply, provide arc-flash analysis
51	Installation Plan Substructure	Weeks Manson	7-Apr-15	RB	0	OPEN	DWW to provide additional documentation

Facilities Design Report (FDR)

Exceptions to Verification of Facilities Design Report (FDR)

- Secondary Steel Strength Calculations (J-tubes, internal platforms, upper access platform)
- Design changes ongoing (piles, secondary steel)
- Vessel Impact Analysis
- Cable Details for evaluation of J-tube design
- Final Platform Electrical Drawings
- Arc Flash Analysis
- Limitation of Scope
- Closing out DCSs

2015 Fabrication and Installation Report (FIR)

Fabrication Plan – Gulf Island Fabricators

- Delivered and Commented
    - Fabrication Plan

Transportation and Installation Plan – Weeks Manson

- Delivered and Commented
    - Fabrication and Installation Plan
- Delivered, Comments being prepared
    - Health and Safety Plan
    - Emergency Response Plan

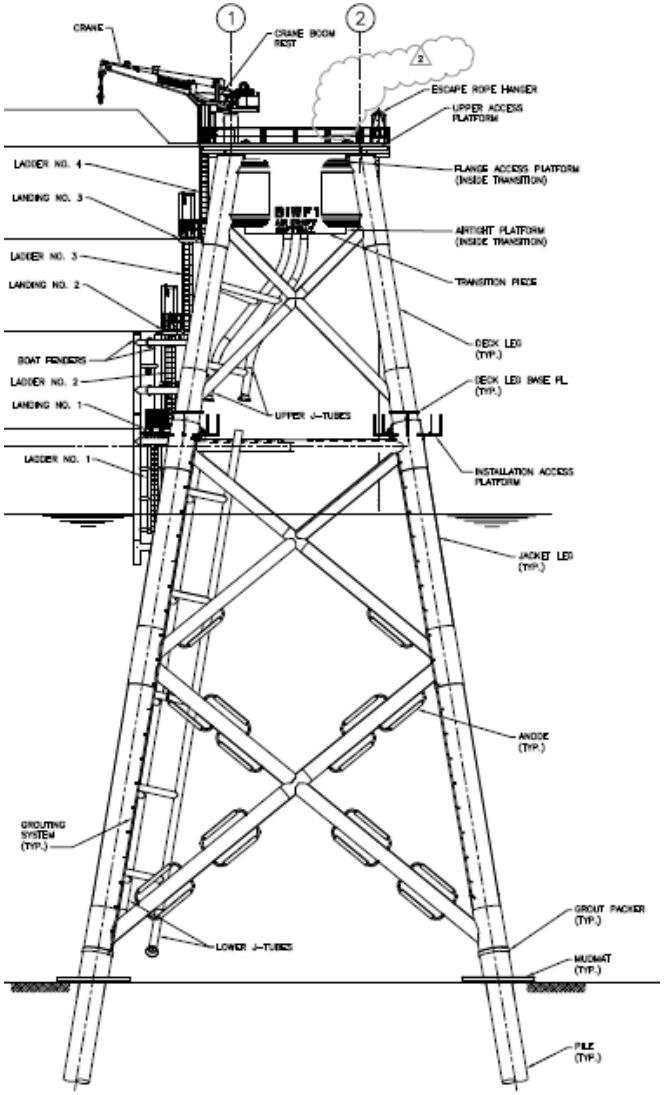
2015 Fabrication and Installation Report (FIR)

Transportation and Installation Plan – Weeks Manson

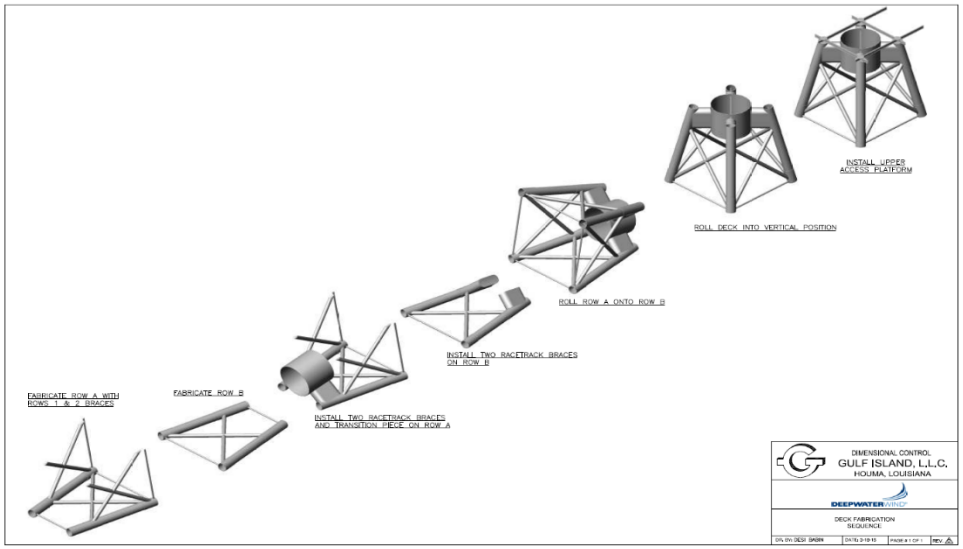
- To be Delivered
  - Sea Fastening Plans – Apr 22
  - Interface Management Plan – May 1
  - Welding Procedure – May 1
  - Coating Procedure – May 1
  - Loadout Plans – May 15
  - Grouting Procedure – May 15
  - Quality Control Procedures – (final) May 21
  - Environmental Requirements DWW

Manufacturing Surveillance - Substructure

Deck Dimension Check
Gulf Island Marine, Houma, LA

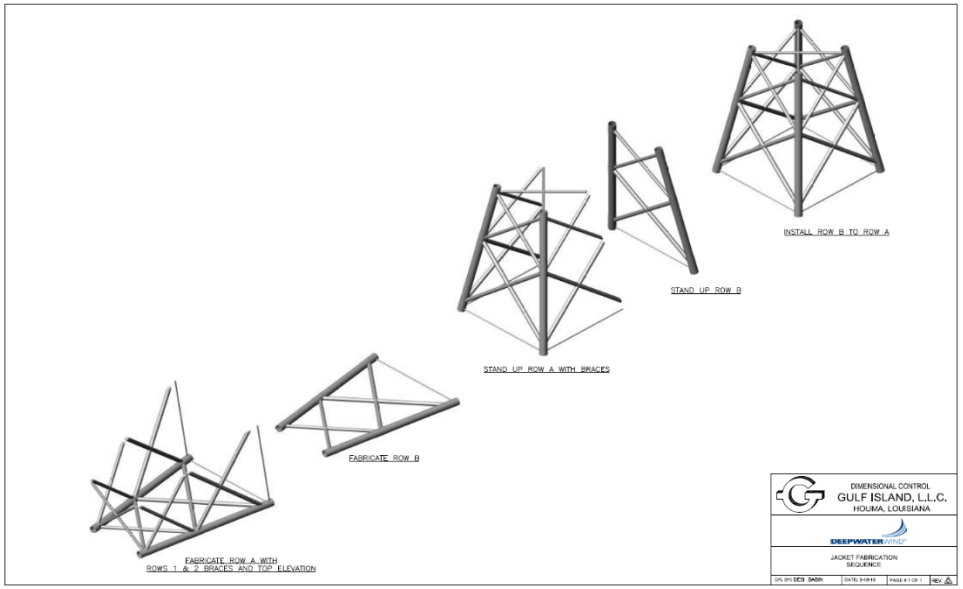


Jacket and Deck Fabrication – Gulf Island LLC, Houma, LA



Deck Fabrication Process

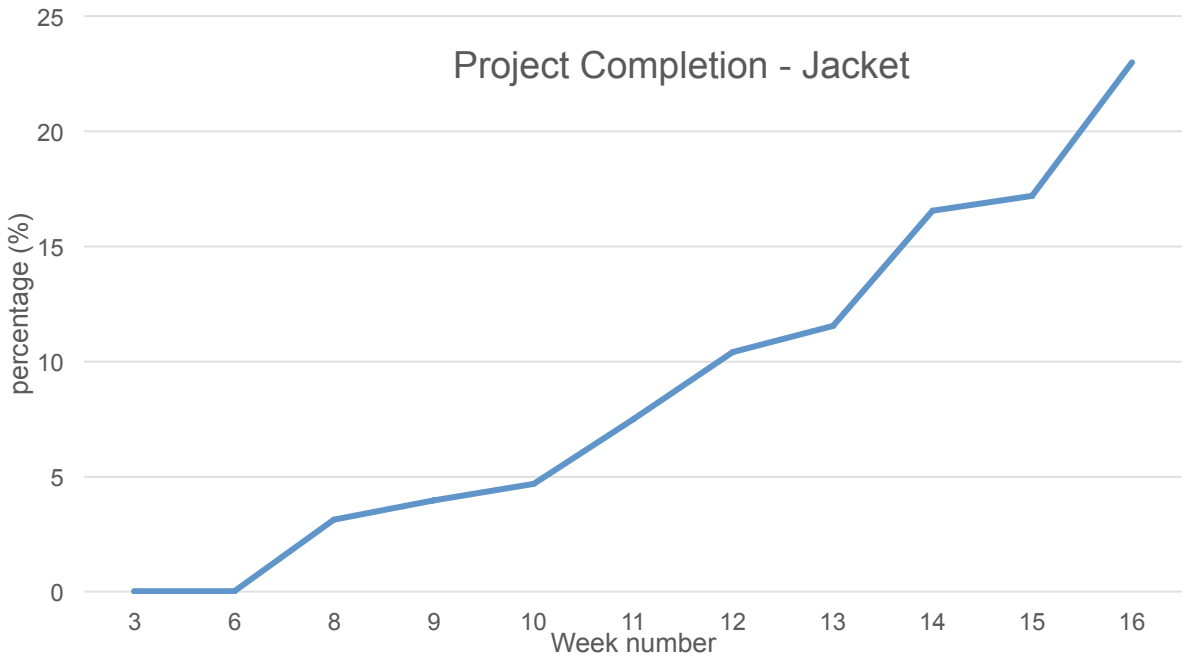
- Fabricate row A w/ rows 1 & 2 Braces
- Fabricate row B
- Install 2 racetrack braces & TP on row A
- Install 2 racetrack braces on row B
- Roll row A onto row B
- Roll deck into vertical position
- Install upper access platform



Jacket Fabrication Process

- Fabricate row A w/ rows 1 & 2 braces and top elevation
- Fabricate row B
- Stand up row A with Braces
- Stand up row B
- Install row B to row A

Jacket and Deck Fabrication – Gulf Island LLC, Houma, LA



Project completion

- Man-hours to date: 28,853
- Project completion to date: 23%
- Safety incidents to date: None

Jacket and Deck Fabrication – Gulf Island LLC, Houma, LA

Start of rolling of 2-1/2” plate

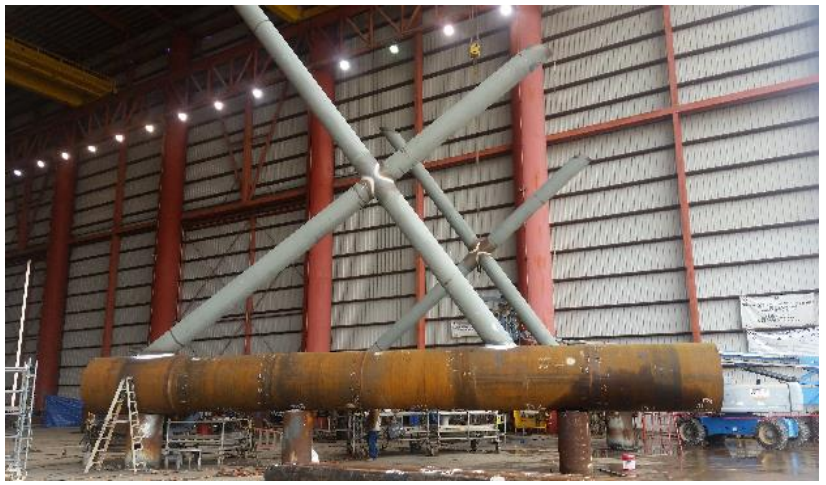
Welding of the 2-1/2” thick can

UT performed on deck X-braces

MT performed on the deck X-Braces

Jacket and Deck Fabrication – Gulf Island LLC, Houma, LA

Brace being installed to first two deck legs for site 1

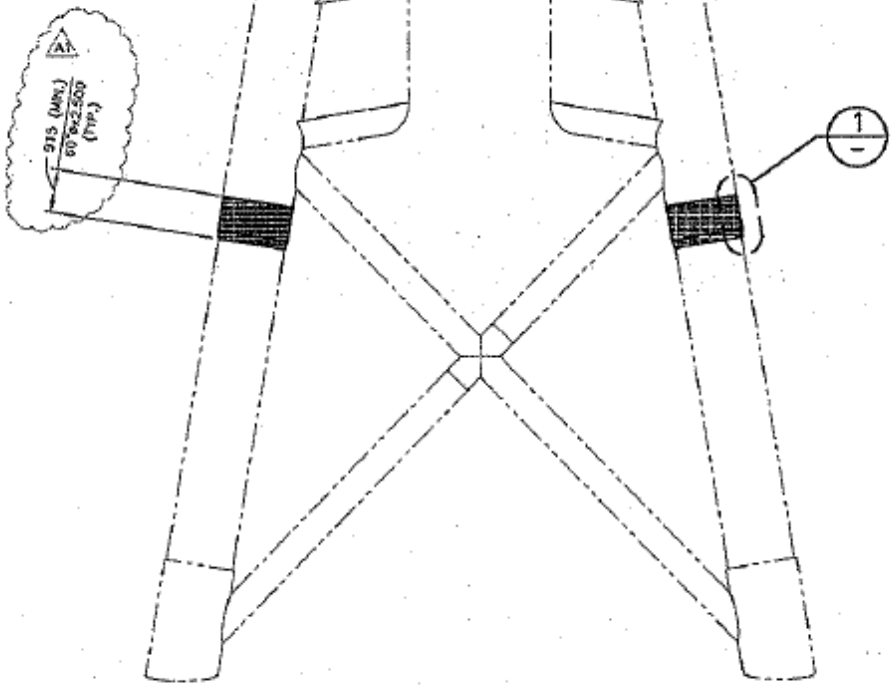


36” X-Braces installed to leg A1 and A2

Race track braces being prepared to be welded

Dimensional inspector surveying deck legs A1 and A2 for site 1

Deck Leg Rework



TYPICAL DECK VERTICAL FRAMING
MODIFICATION STEP 3

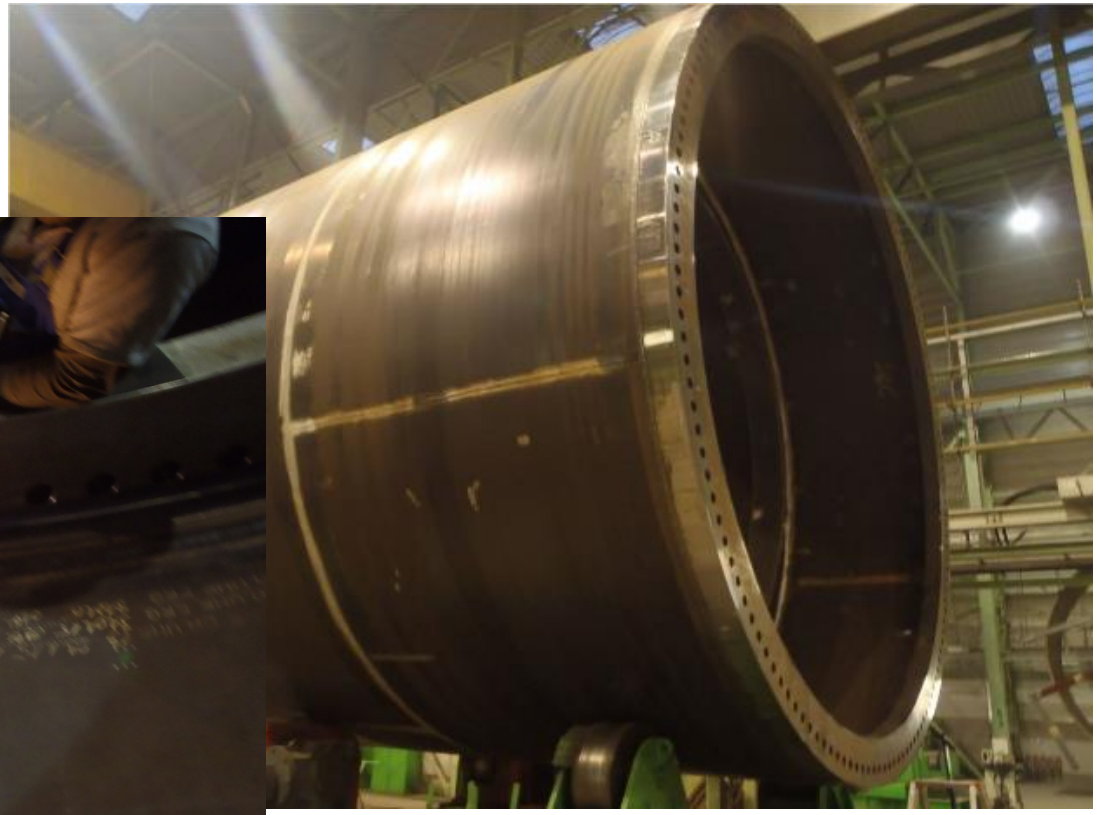
Brace to Leg

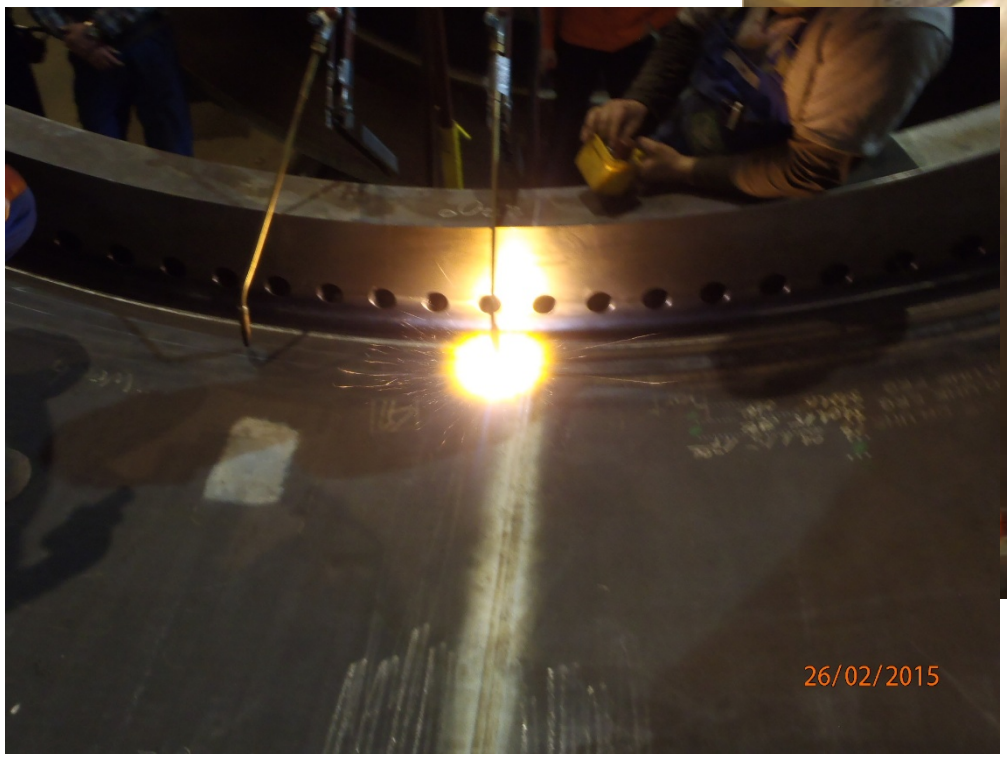
Deck Leg

Deck Leg Rework

TP – Tower flange union – EEW, Germany

Flame straightening to correct flange deformation





Manufacturing Surveillance - Substructure

TP loadout, Rostock, Germany

Manufacturing Surveillance - Substructure

Jacket Piles – EEW, Korea

Roundness

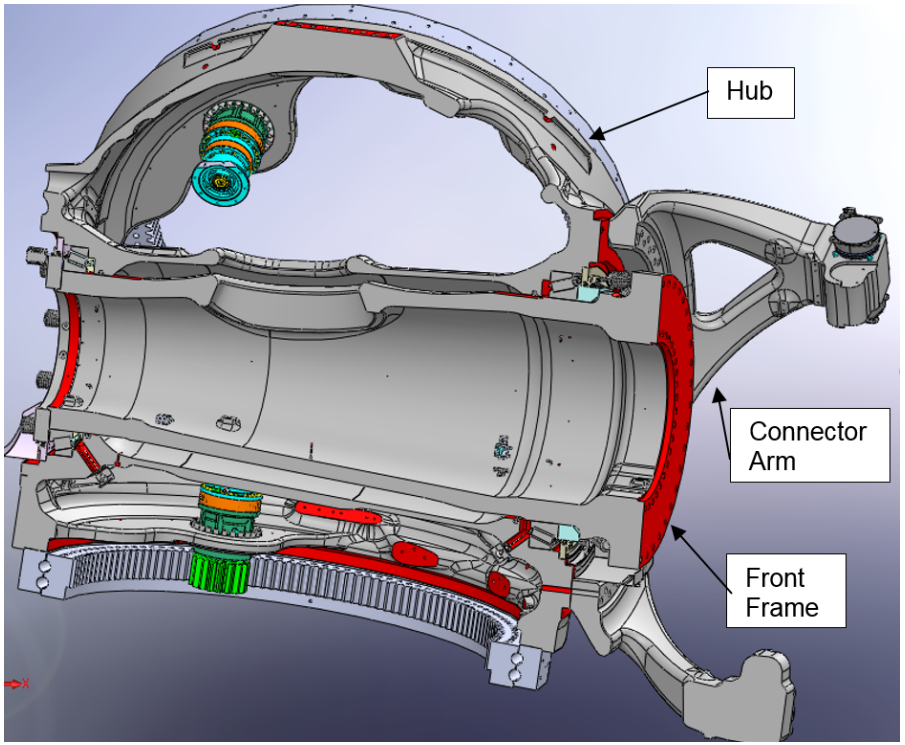
UT Check

MT Check

Wind Turbine Component Casting - China

Inspection Criteria

1. Quality control procedures and implementation
2. Manufacturing instructions
3. Material quality and identification systems
4. Manufacturing record keeping systems
5. Serial production test procedures and results
6. Defects identified and corrective actions
7. Repair procedures
8. Post manufacturing inspection procedures
9. NDT procedures
10. Production and Quality documentation after final acceptance by manufacturer QA department
11. Component storage requirements



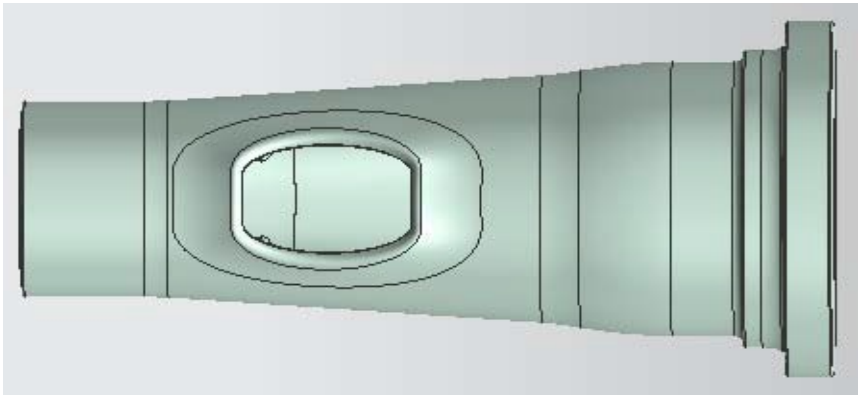
Wind Turbine Component Casting - China

Cast hub rendering

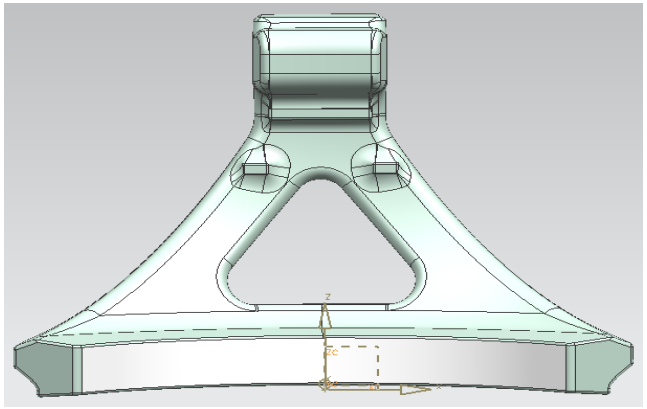
Hub for first set

Hub during pour

Wind Turbine Component Casting - China



Front Frame rendering



Coupling Arm rendering

Front Frame casting

Coupling Arm casting

Status of Activities

Load Simulation

- Complete – Report to be released

Verification of Facilities Design Report (FDR)

- Complete with Exceptions

Verification of Fabrication and Installation Report (FIR)

- 2015 FIR Review and Comments Ongoing

Manufacturing Verification

- Jacket Fabrication – in process, load-out June 27
- Wind Turbine Manufacturing – in process Q1 2015 – Q2 2016

Transportation and Installation Verification

- In planning stages for load-out June, start of installation July

Next Steps

May

- Close Exceptions to FDR
- Continue Review and Comment of FIR
- Continue Manufacturing Verification of Jacket
  - – additional shifts
- Continue Manufacturing Verification of WTG

June

- Complete Manufacturing Verification of Jacket
- Loadout and Transportation of Jacket
- Continue Manufacturing Verification of WTG

July

- Start Installation of Jacket
- Continue Manufacturing Verification of WTG…