Taking the strain: cranes and lifting equipment for offshore vessels

9 September 2021 • 15:00-15:45 BST

Panellist documents

Part of
Offshore Energy
Webinar Week

6-10 September 2021

#offshoreenergy

osj offshore support journal

Offshore Wind Journal

CHARLOTTE ROODENBURG

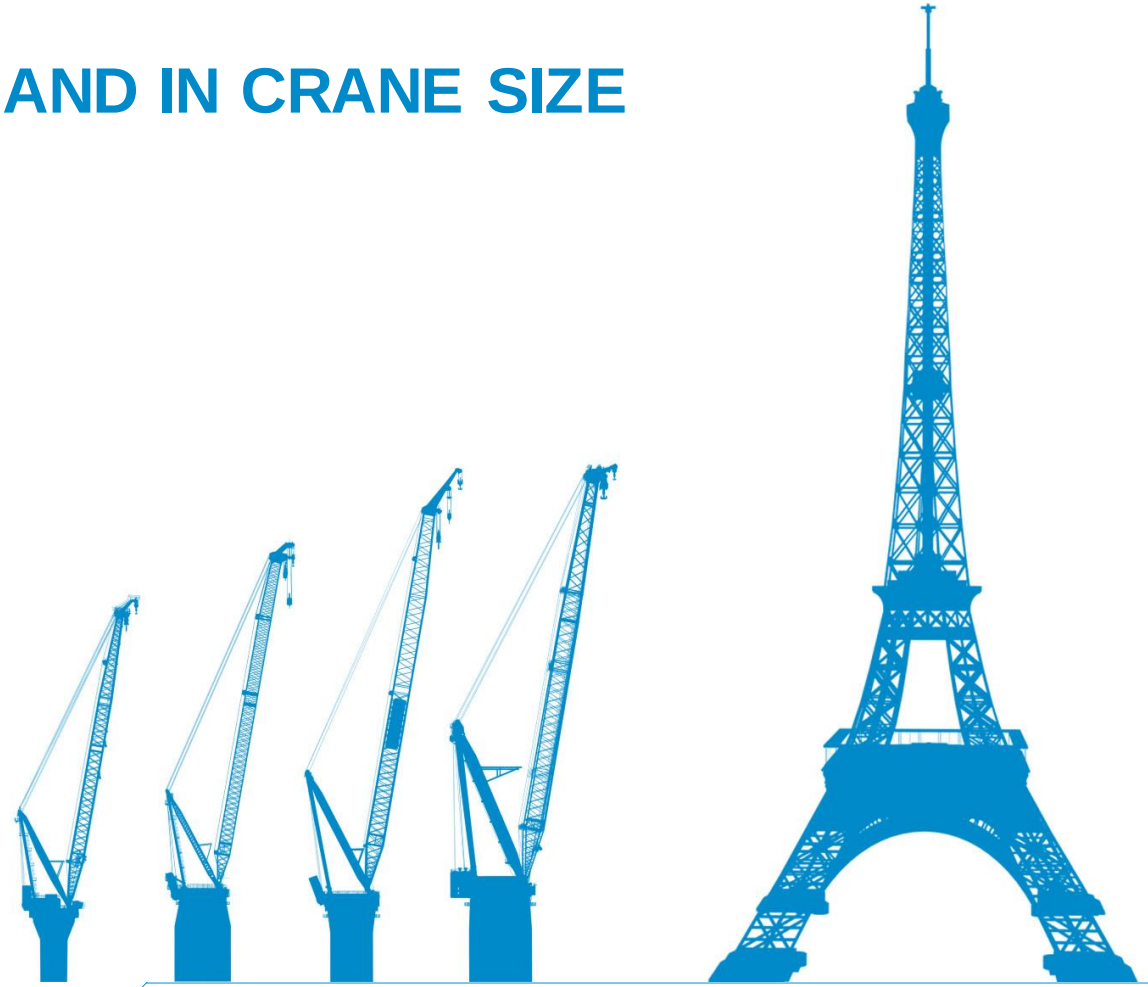
MANAGER NEW BUILD SALES

HUISMAN EQUIPMENT

CRODENBURG@HUISMAN-NL.COM

FROM CONCEPT TO STEEL

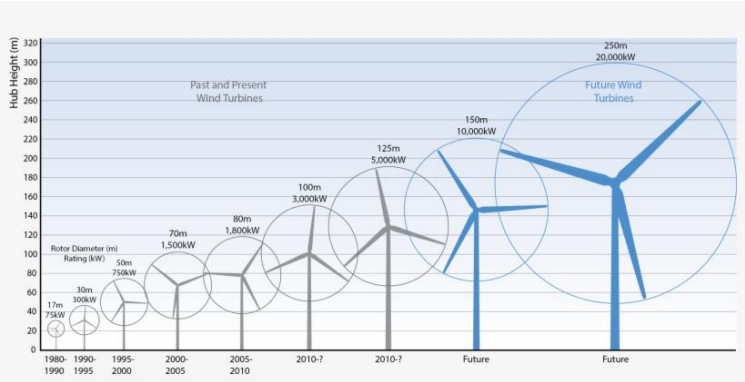
GROWING DEMAND IN CRANE SIZE



GROWING DEMAND IN REQUIREMENTS

- Operation to be done in a minimal time frame
- Operations done at more complex and remote locations
- Operations are more challenging and need to be safe
  - High redundancy
  - Hands off
  - Adequate emergency procedures
- Components are heavier and bigger leading tougher handling
- Operational costs to be minimized
- Equipment delivery times are short
- Stringent terms and conditions

EFFECT?



Source: png

Source: Art UK

Huisman

HOW TO GET FROM CONCEPT TO STEEL?

- Cherish your clients
- Trust your workforce
- Test, test, test…
- Turn key delivery
  - In house design
  - In house production

HUISMAN INNOVATIONS THAT HAVE TURNED INTO STEEL *CRANES*

KEY FIGURES

305
CRANES BUILT AND STILL 90% IN SERVICE

20
CRANES ON ORDER

142
FULL ELECTRIC CRANES

>51
ACTIVE AND PASSIVE HEAVE COMPENSATION

184
HEAVY LIFT CRANES

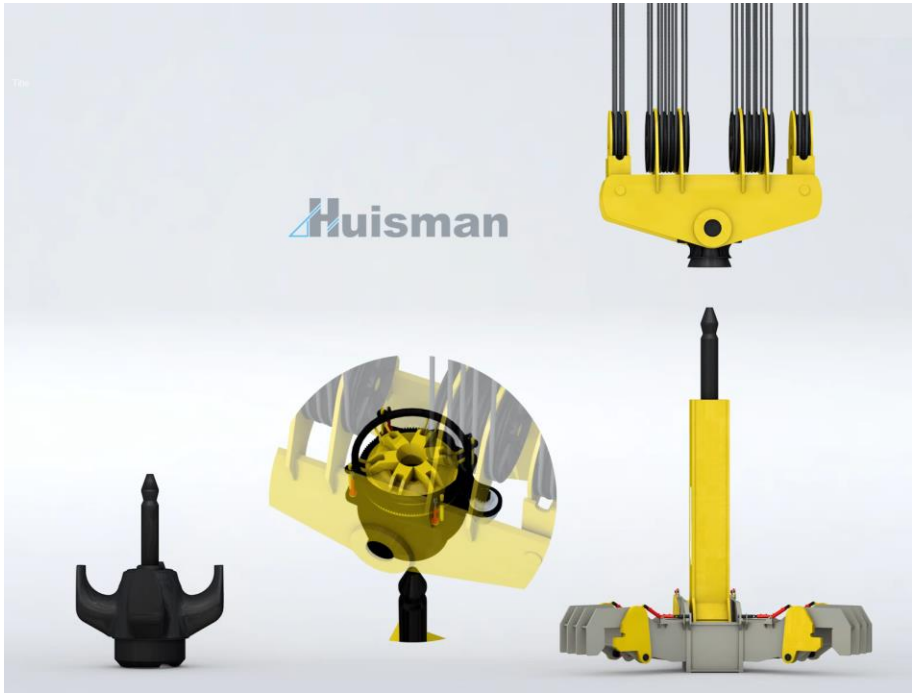
>209.250MT
TONNAGE BUILT BY HUISMAN

>35,770MT
ON ORDER

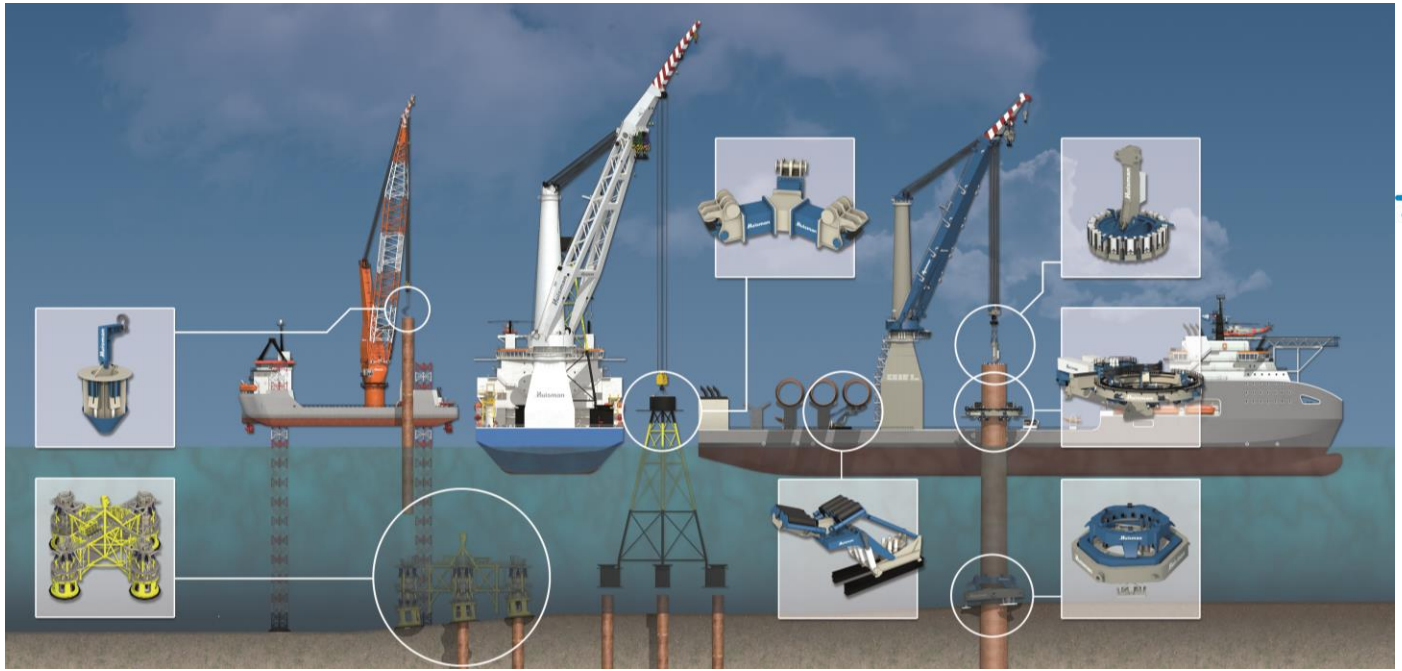
853
PATENTS AND 265 PATENT FAMILIES

HUISMAN INNOVATIONS THAT HAVE TURNED INTO STEEL
WIND TOOLS

HUISMAN INNOVATIONS THAT HAVE TURNED INTO STEEL
UNIVERSAL QUICK CONNECTOR



MISSION: OPTIMAL INTEGRATION TO MEET REQUIREMENTS



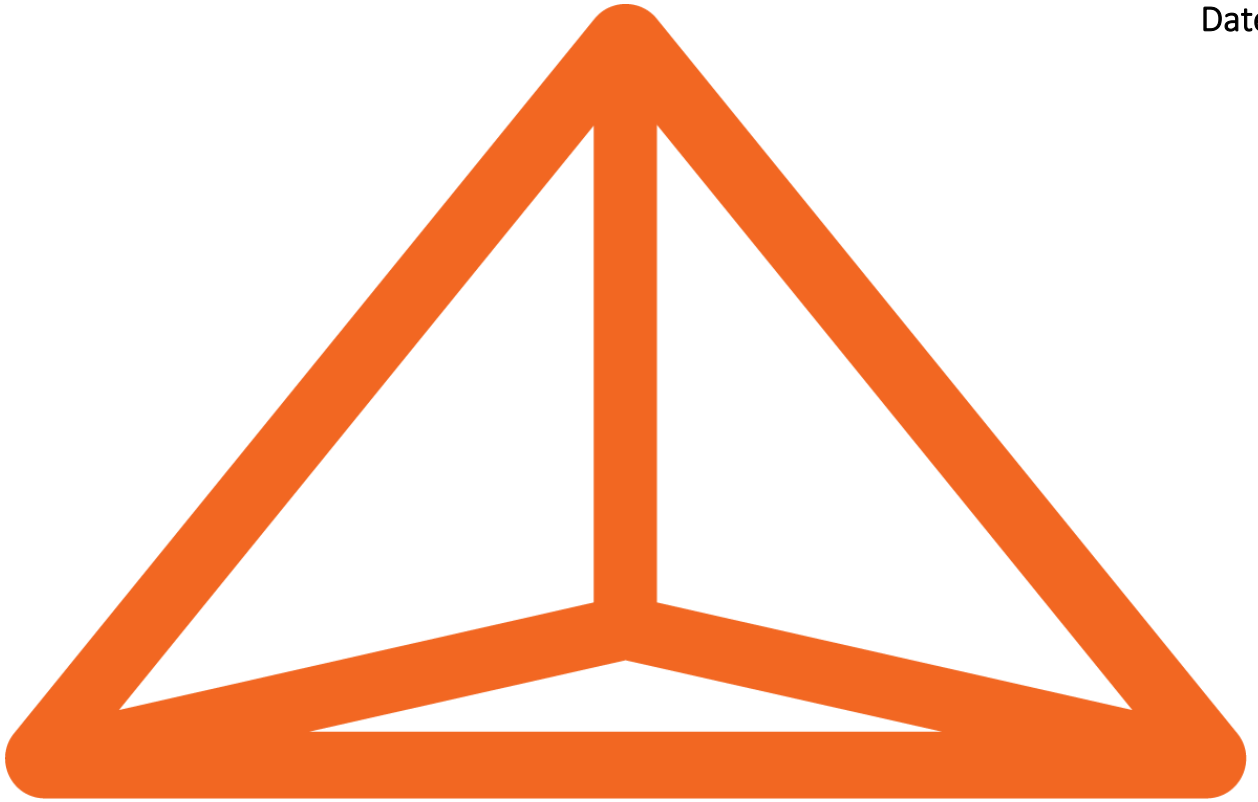
- Mitigate safety risks
- Reduce cycle time
- Increase workability

FOLLOW OUR WEBINARS FOR UPCOMING INNOVATIONS

Equipped for impact.

Tetrahedron

Event: Taking the strain: cranes and lifting equipment for offshore vessels
Date: 9 September 2021

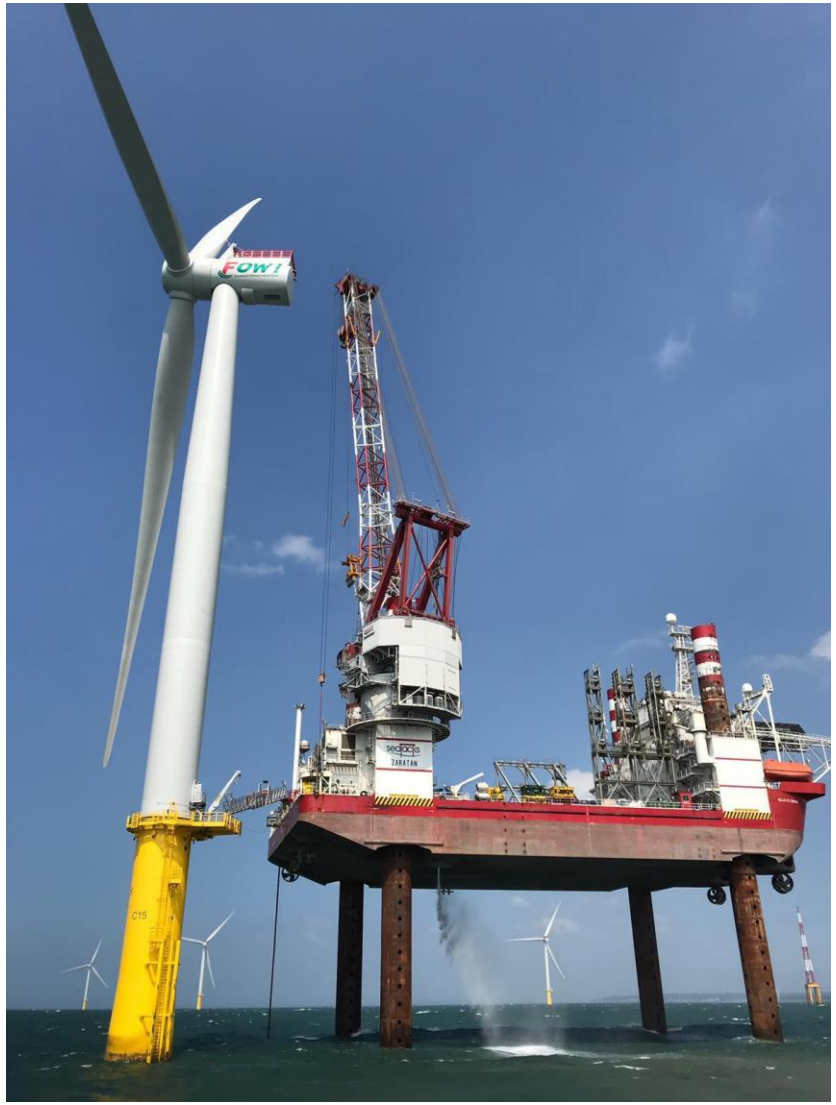


Simply lifting high

Presenter: Wilco Stavenuiter

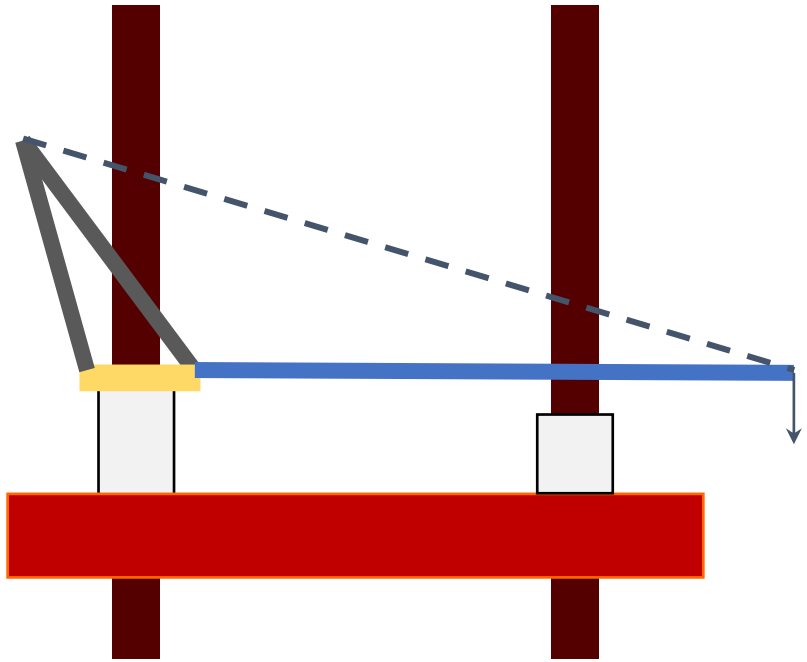
Tetrahedron

Question: how to increase the lifting height of an existing jack-up-vessel?



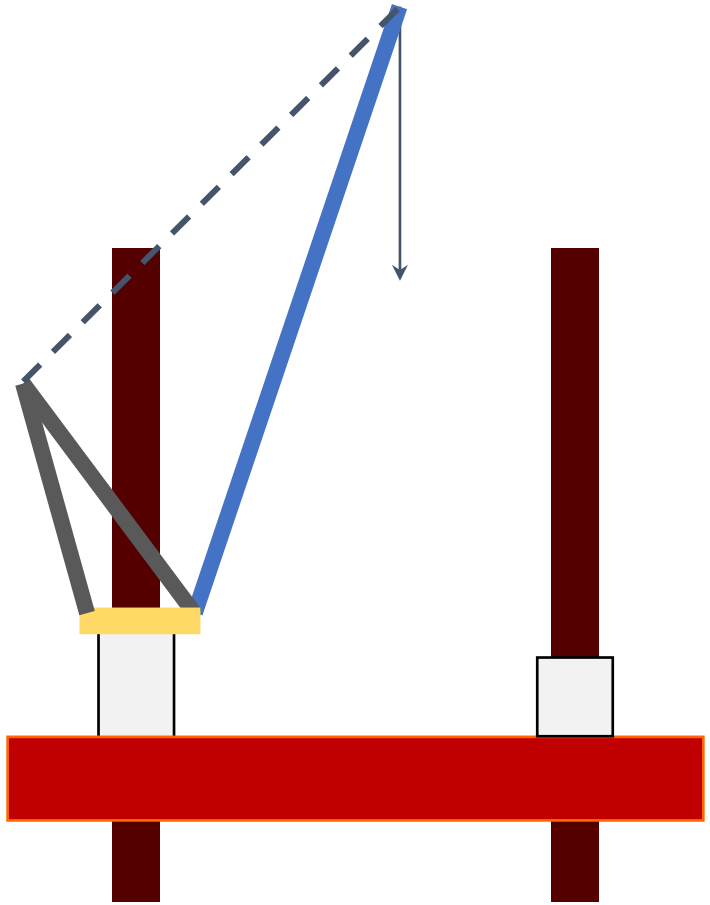
Tetrahedron

Problem explanation (1/2):
Conventional/oil&gas-offshore technology: due to boom length in rest position you can’t lift higher than the length of vessel



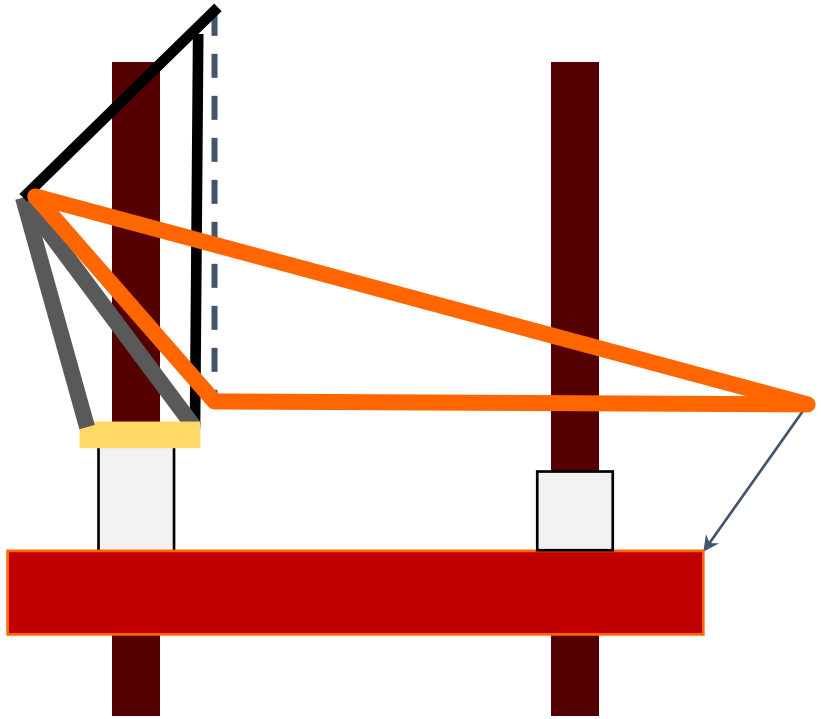
Tetrahedron

Problem explanation (2/2):
Conventional/oil&gas-offshore technology: due to boom length in rest position you can’t lift higher than the length of vessel



Tetrahedron

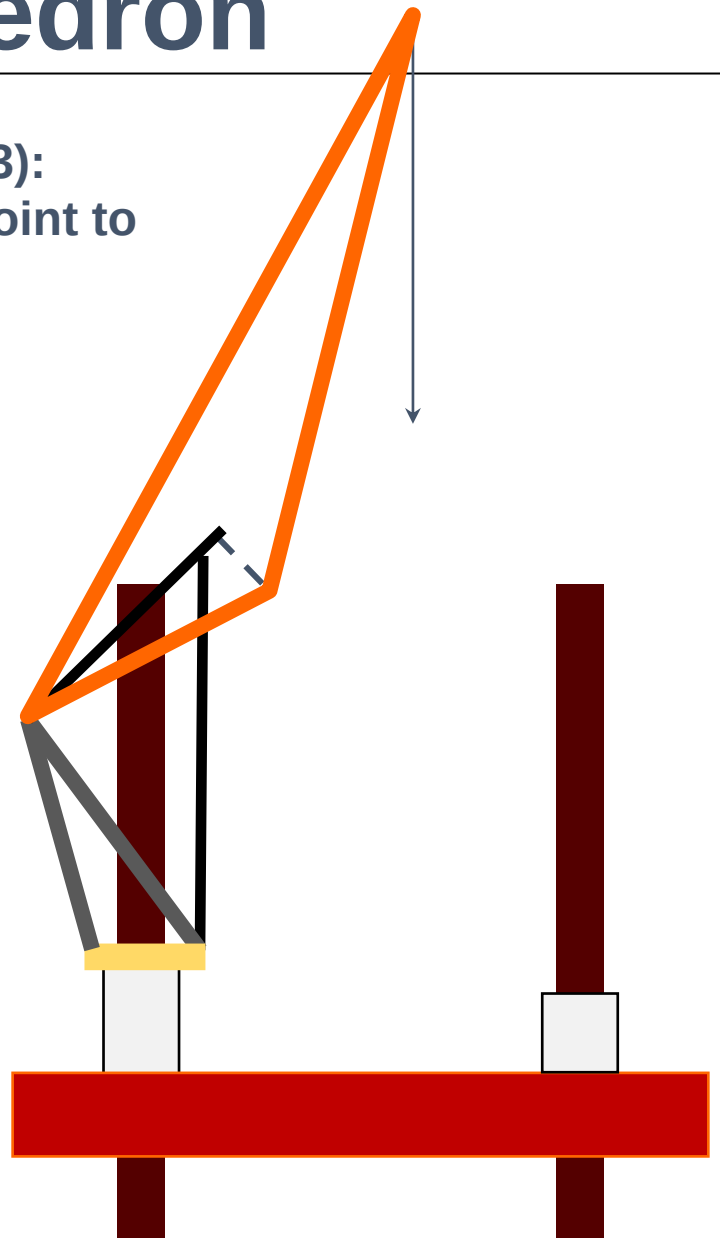
Tetrahedron solution (1/3): reposition the rotation point to reach more height



Tetrahedron, simply lifting high

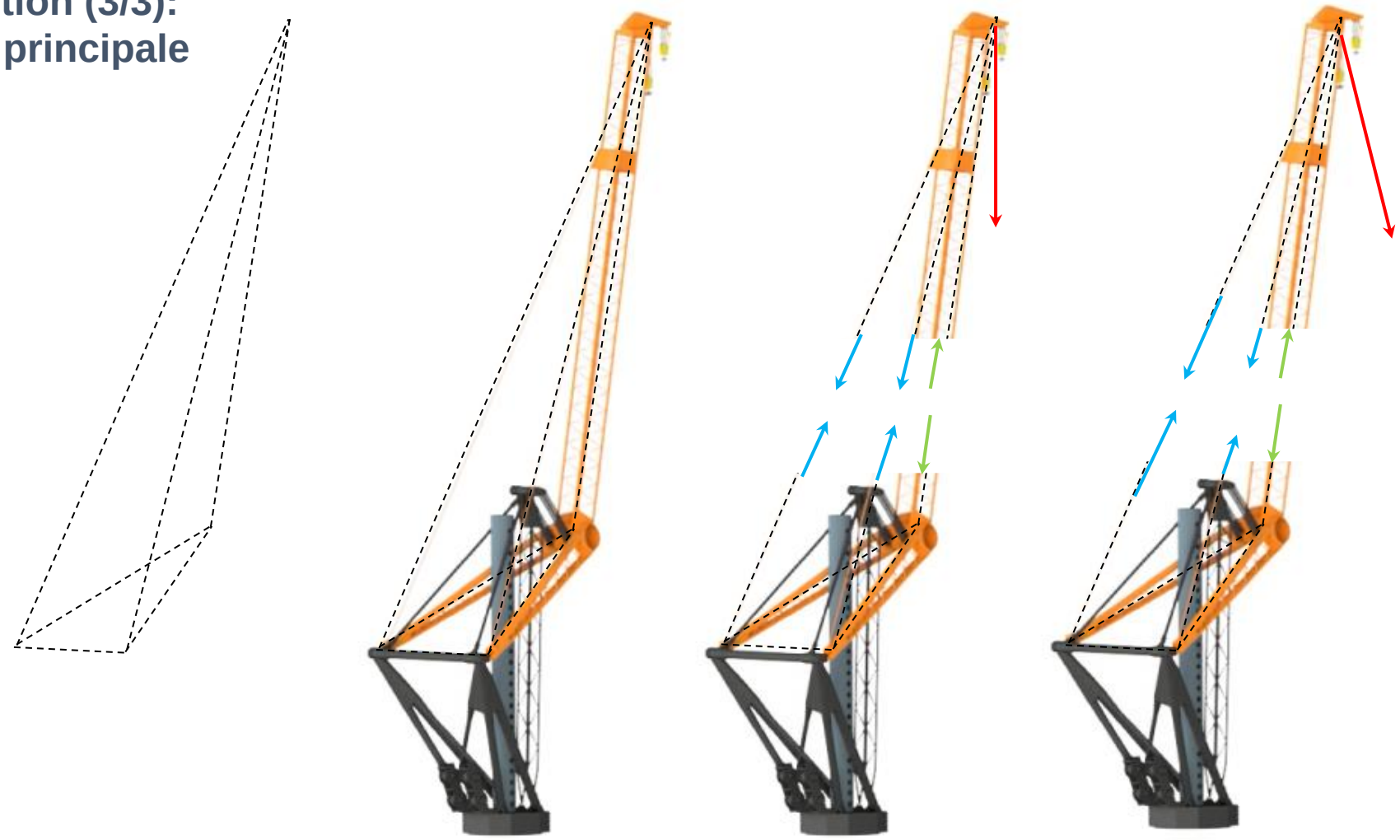
Tetrahedron

Tetrahedron solution (2/3): reposition the rotation point to reach more height



Tetrahedron

Tetrahedron solution (3/3): Uniq 3D-working principale



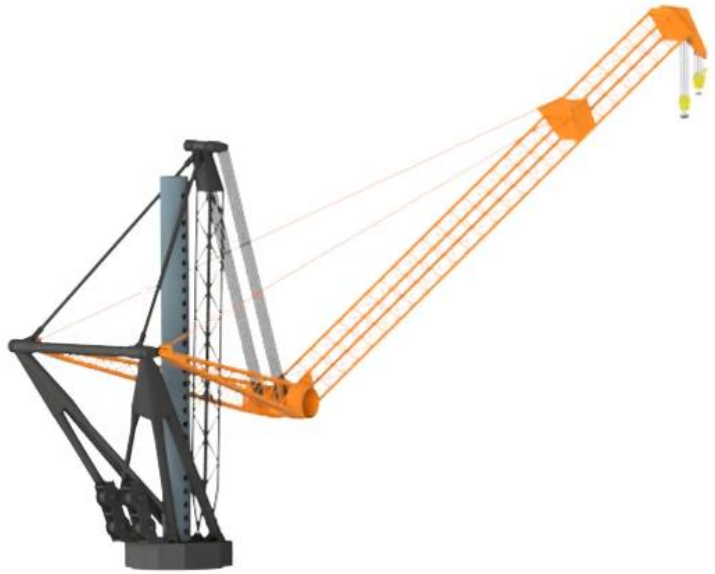
Tetrahedron

Core value proposition:

Simply lift 50m higher

Tetrahedron

Core value proposition:



Simply lift 50m higher

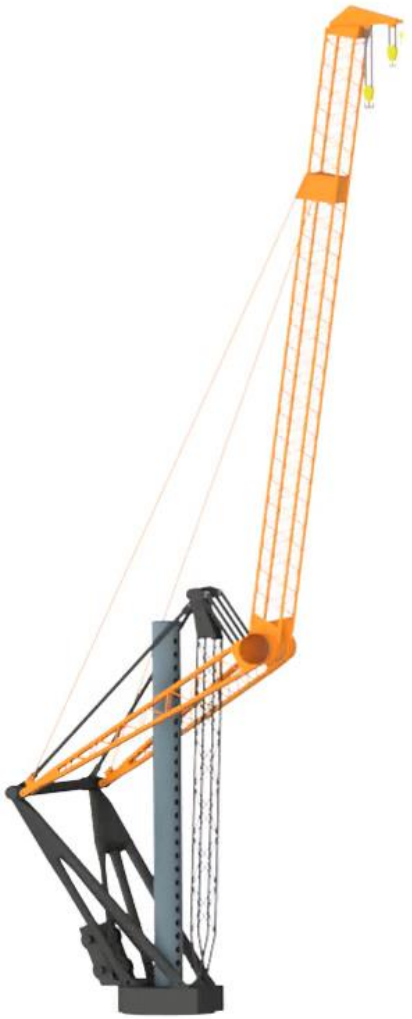
Tetrahedron

Core value proposition:

Simply lift 50m higher

Tetrahedron

Core value proposition:



Simply lift 50m higher

Tetrahedron

Core value proposition:

Simply lift 50m higher

Tetrahedron

Core value proposition:

Simply lift 50m higher

Tetrahedron

Model: Tetrahedron 65	Model: Tetrahedron 45	Model: Tetrahedron 25
Nacelle lift: 1200T at 40m radius - 200m AWL*	Nacelle lift: 900T at 40m radius - 180m AWL*	Blade rack lift: 500T at 35m radius
Blade lift: 400T w/ 6m jib-clearance in top	Blade lift: 300/400T w/ 6m jib-clearance in top	Blade lift: 250T installation at 180m AWL
Suitable to install future 20MW DirectDrive turbines	Suitable to install 15MW turbines, including the Siemens 15MW and GE Haliade-X 13MW	Suitable to maintain 15MW turbines, including the Siemens 15MW and GE Haliade-X 13MW
Including heavy lift mode (at reduced lifting height): 1600T	Including heavy lift mode (at reduced lifting height): 1250T	Including four-point tagline system: improving blade mating
Optional heavy lift mode: 1800T	Optional feeder lifting package	Optional heavy lift mode: 800T

* Based upon 10m airgap, 10m hull-depth, 20m pedestal

Tetrahedron

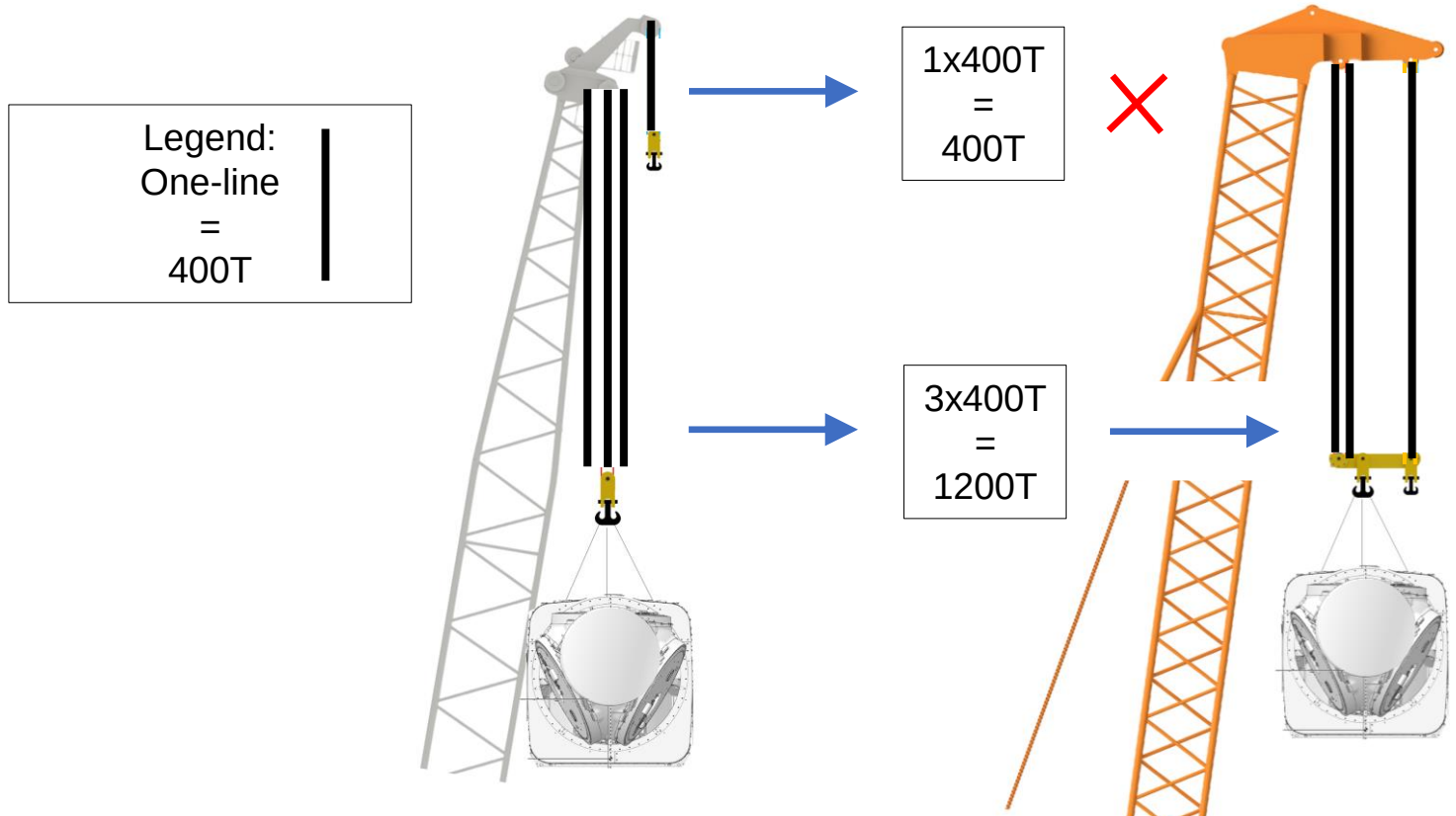
Model: Tetrahedron 65	Model: Tetrahedron 45	Model: Tetrahedron 25
Nacelle lift: 1200T at 40m radius - 200m AWL*	Nacelle lift: 900T at 40m radius - 180m AWL*	Blade rack lift: 500T at 35m radius
Blade lift: 400T w/ 6m jib-clearance in top	Blade lift: 300/400T w/ 6m jib-clearance in top	Blade lift: 250T installation at 180m AWL
Suitable to install future 20MW DirectDrive turbines	Suitable to install 15MW turbines, including the Siemens 15MW and GE Haliade-X 13MW	Suitable to maintain 15MW turbines, including the Siemens 15MW and GE Haliade-X 13MW
Including heavy lift mode (at reduced lifting height): 1600T	Including heavy lift mode (at reduced lifting height): 1250T	Including four-point tagline system: improving blade mating
Optional heavy lift mode: 1800T	Optional feeder lifting package	Optional heavy lift mode: 800T

* Based upon 10m airgap, 10m hull-depth, 20m pedestal

Tetrahedron

SmartHoist – a new component solution, by Tetrahedron company

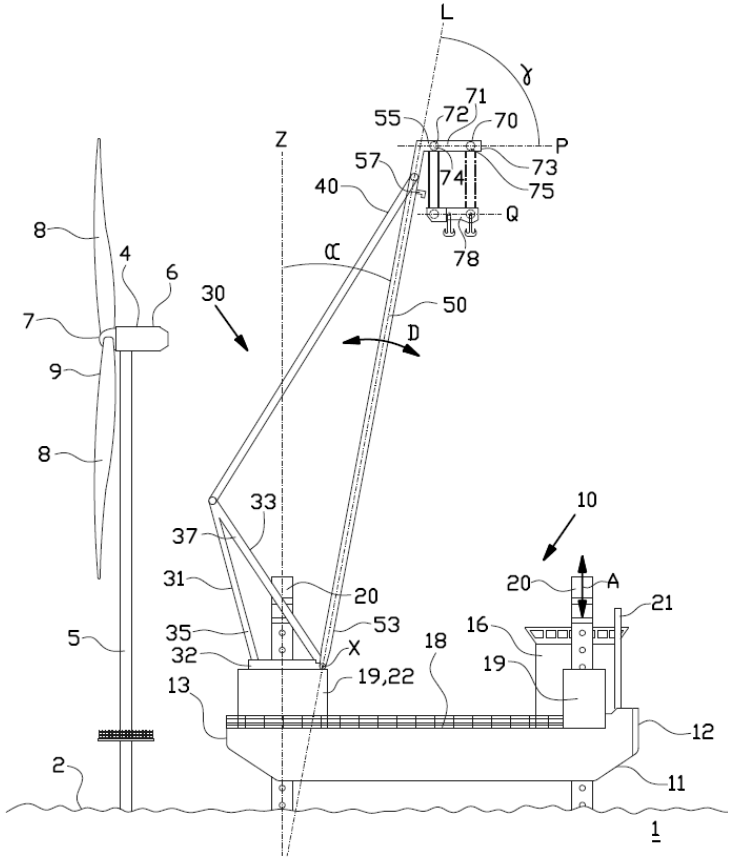
Crane rigging:	Conventional: 1200T MainHoist + 400T AuxHoist	SmartHoist: Single hoist, two hooks
Jib-clearance	Critical	Sufficient
Auxhoist	Included	Eliminated

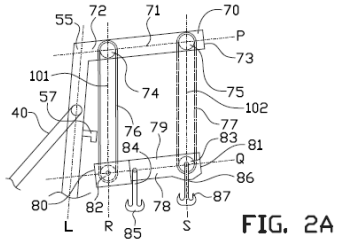


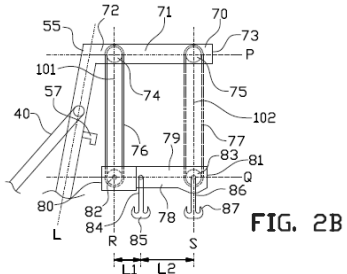
Tetrahedron

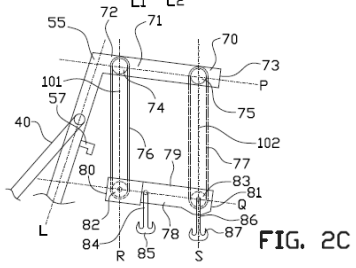
SmartHoist – a new component solution, by Tetrahedron company

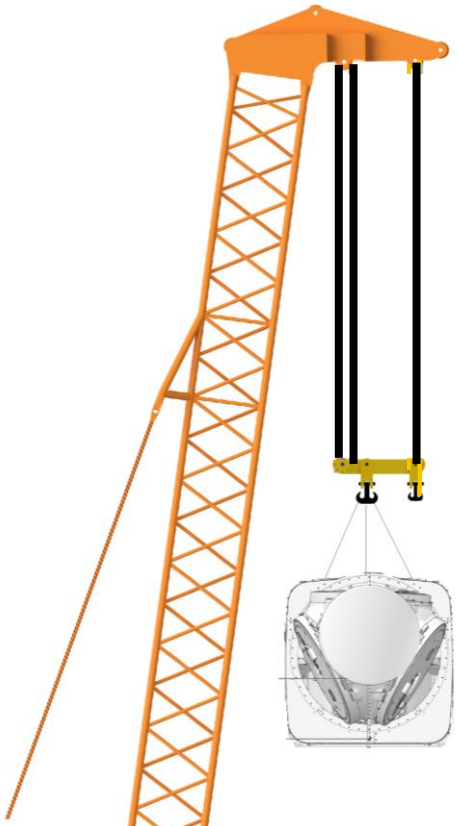
The SmartHoist principle is patented by Tetrahedron-company. The principle is applicable on any WTG-installation crane and actual implementation can be reviewed upon request.





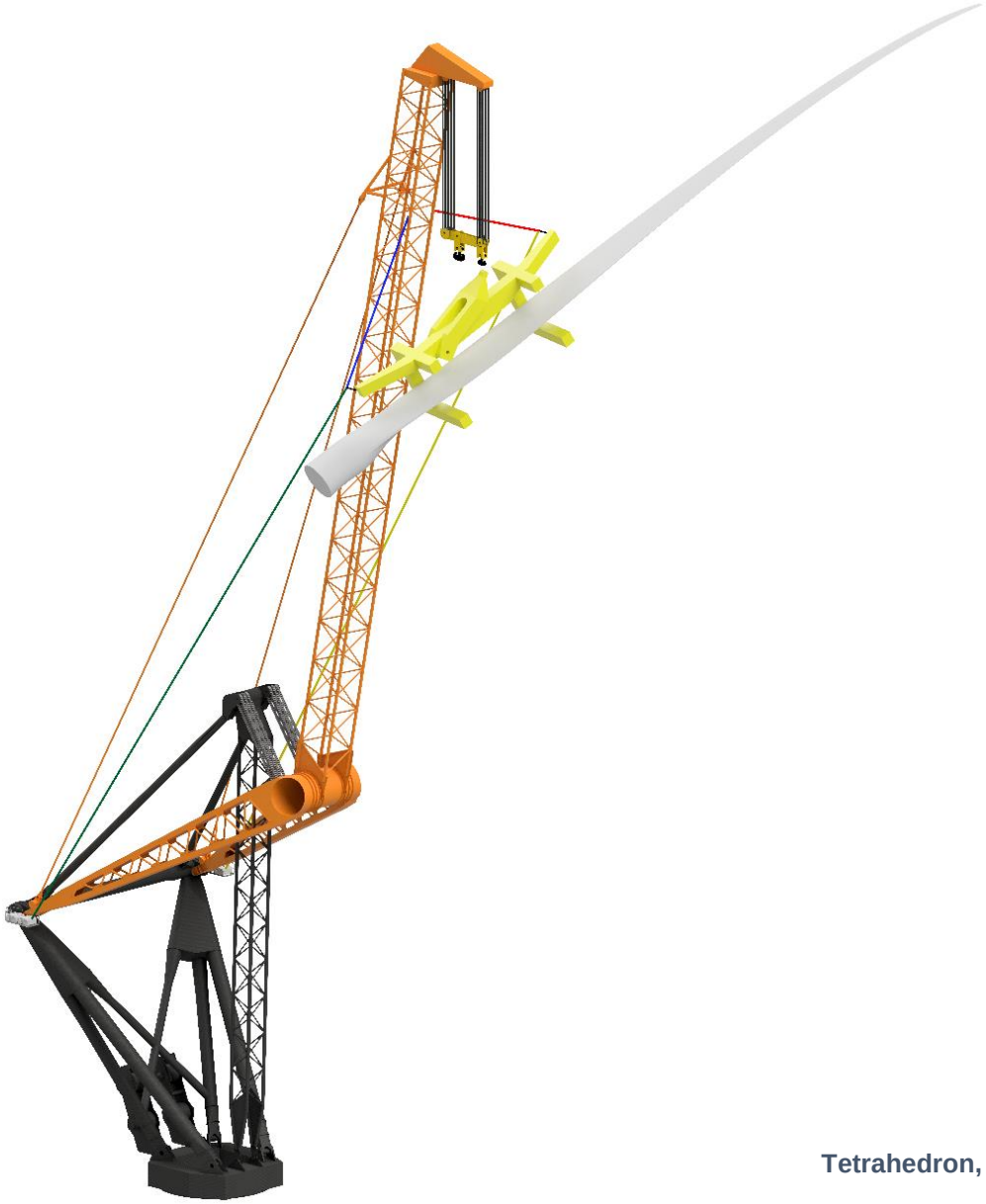






Tetrahedron

Tetrahedron,
simply lifting high



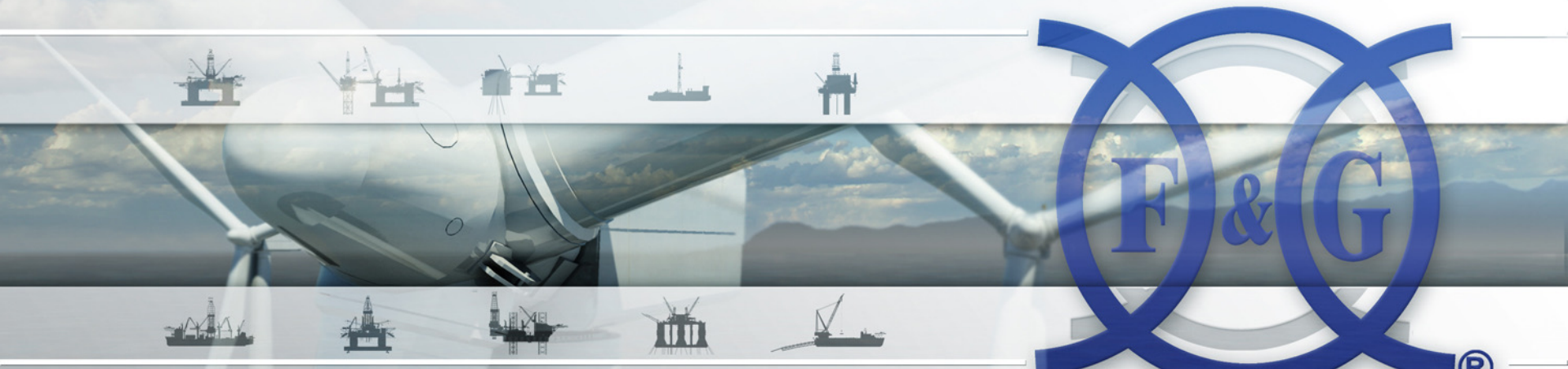
Contact:

Office visit: Rotterdam, the Netherlands
www.tetrahedron.tech
info@tetrahedron.tech
+31 102613038

simply lifting high

RETHINKING THE FEEDER CONCEPT WITH BARGE RACK

FRIEDE & GOLDMAN



Friede & Goldman, Ltd. - Naval Architects and Marine Engineers - September 9, 2021 - www.fng.com

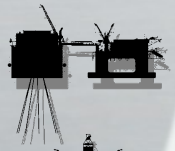
F&G DESIGN HISTORY


Drill Barges – 5


Drill Tenders – 6


Submersibles – 11


Semi-submersible Drilling Rigs – 73


Semi Accommodation Units – 4


Semi Multipurpose Units – 2


Drill Ships – 3


Jack-up Drilling Rigs – 127


Floating Production Vessels – 2


Pipe lay / Crane Vessels – 2


Cargo Ships – 39

Total: 271 rigs and vessels built



These rigs were built in over 33 shipyards and 21 countries

F&G TECHNOLOGY

Serviceable Pinions
- F&G's jacking units are designed with a cantilevered pinion gear and no nose bearing
- Allows for easy maintenance of pinion, saving time and money

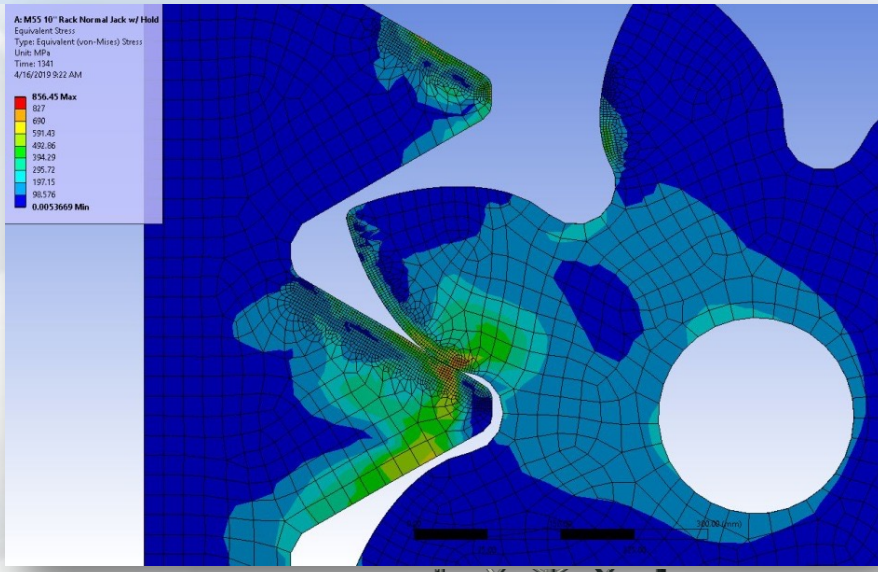
Rack Technology
- Greatly reduces contact stress increasing life of rack and pinion

Automatic Lubrication
- Prolongs the life of the vessel's legs and jacking system

Optional Afloat Spud Can Inspection
- Jack case designed to accommodate fully retractable spud can allowing in service inspection

Wear Compensating Guide System
- Adjustable guides for maintaining alignment

Spudcan Flexibility
- Shoes/skirts, rock tips



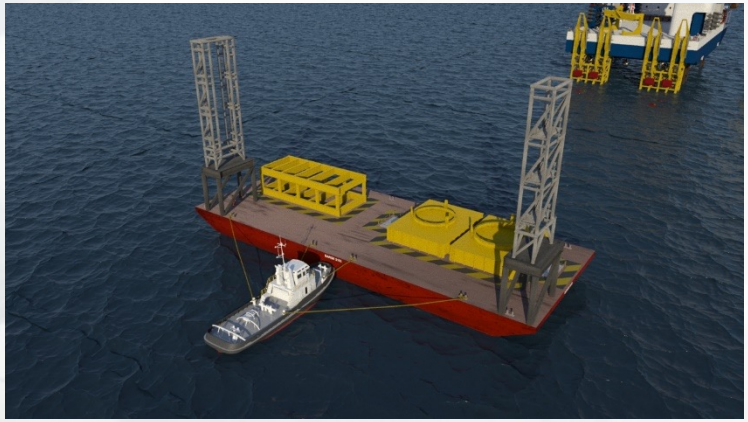
Partial Hull Cross Section at Leg Well

BARGE RACK
FRIEDE & GOLDMAN

U.S. Patent Pending

ADVANTAGES

1. Barge motions COMPLETELY eliminated
   - Superior operations as compared to other feeder solutions
   - Crane lifting operations are safe & simple
   - Increased uptime / extended operations window / reduced time waiting on weather
   - No motion compensating gangways required
2. Utilizes existing US ocean barge fleet eliminating requirements for additional vessel construction
3. Jack-up is built outside US – results in lower CapEx
4. More cost-effective solution when compared to other solutions which require expensive jack-up type feeder transport vessels or customized feeders with motion compensating equipment

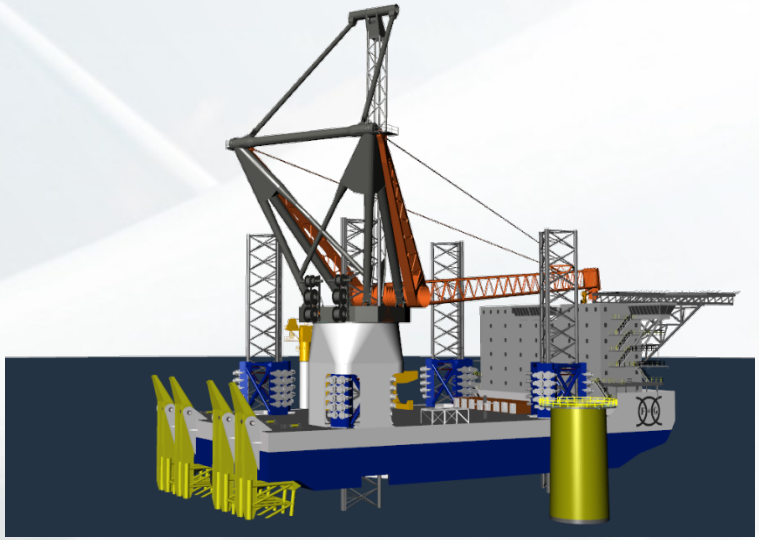


Motion Compensated Deck Feeder Vessel

Jack-up Feeder

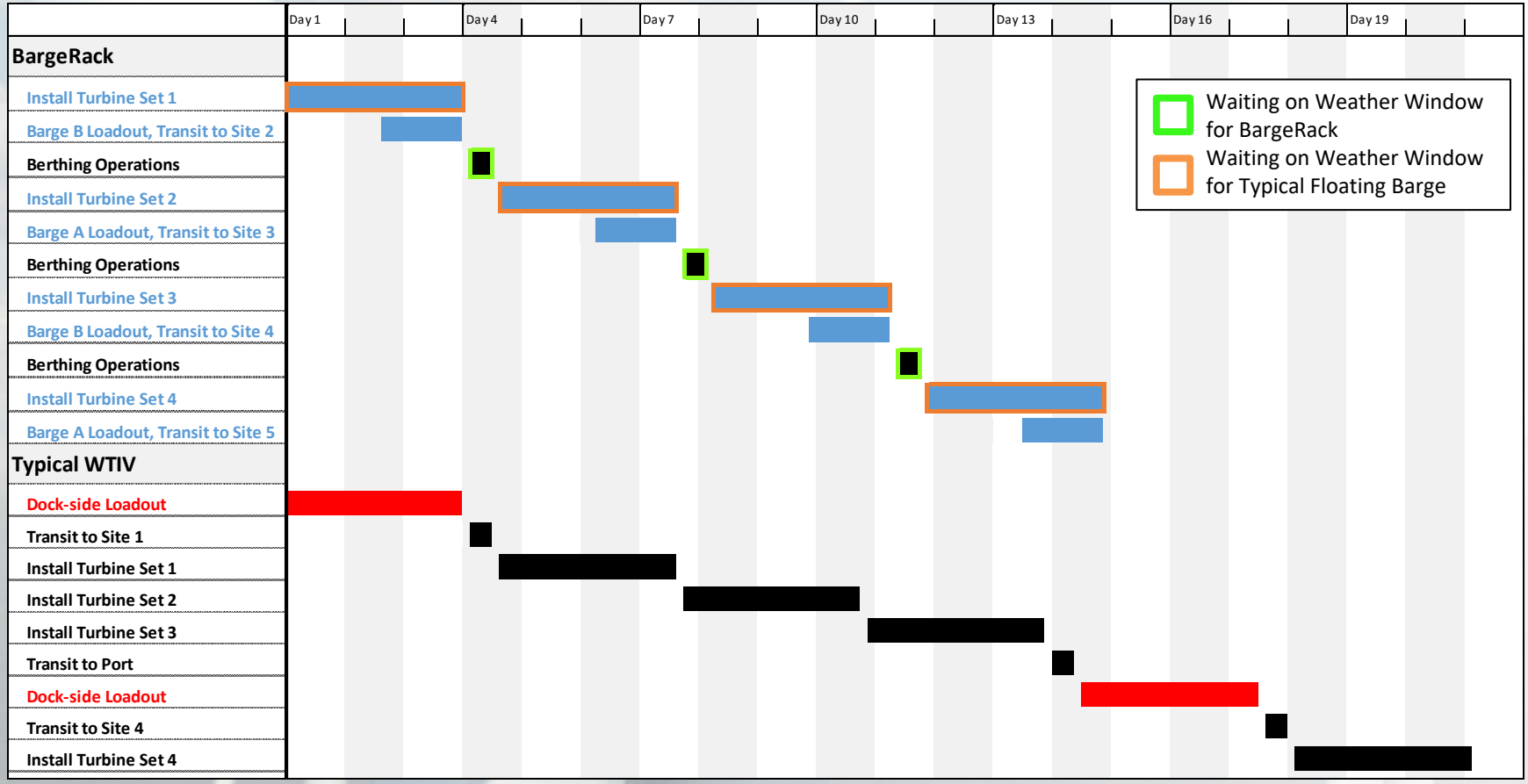
STAGES OF OPERATION

BARGE RACK
FRIEDE & GOLDMAN



U.S. Patent Pending

OPERATIONAL TIME & SAVINGS



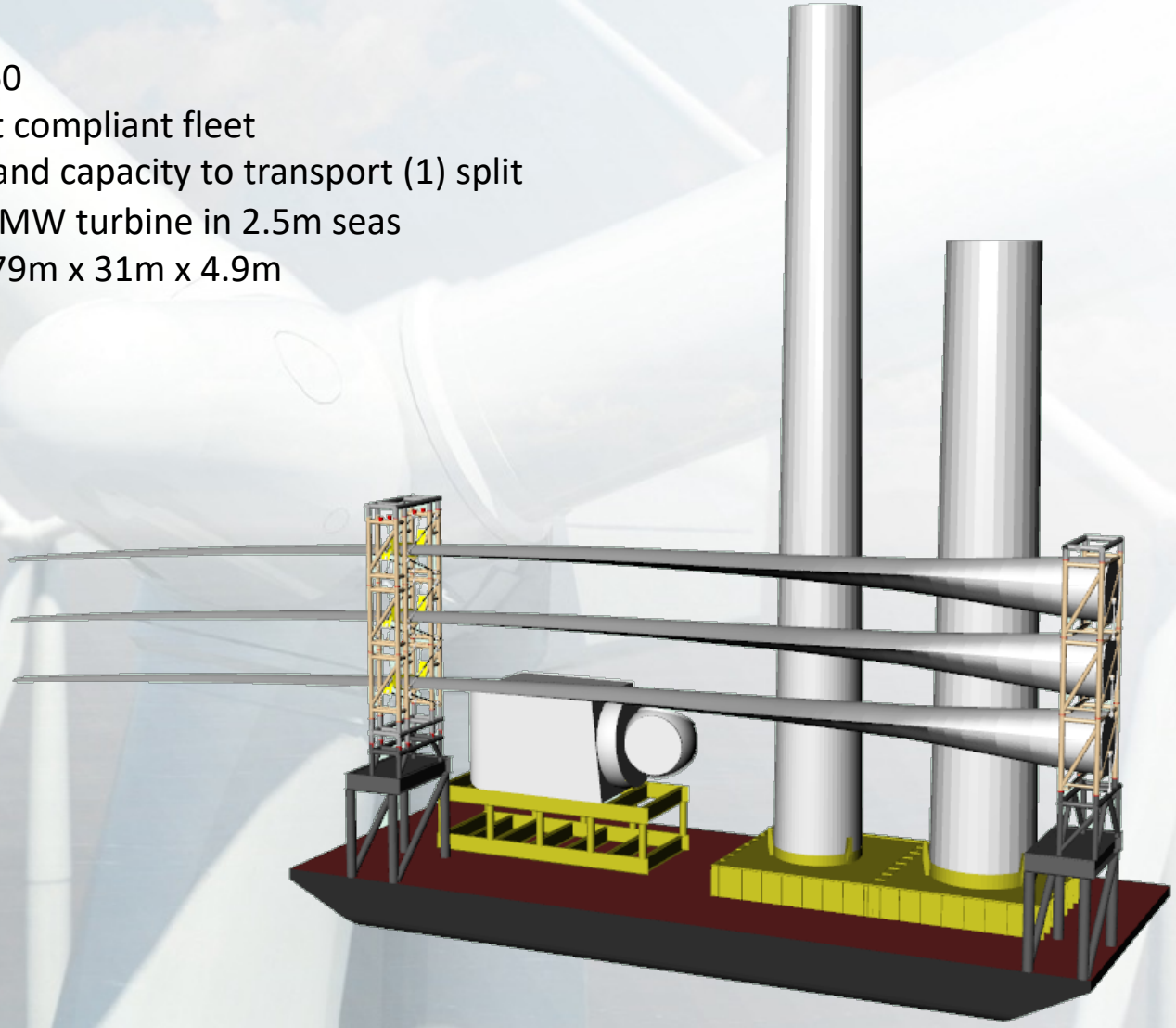
Since dockside loading and turbine installation are concurrent operations, significant time savings are achieved using the BargeRack feeder solution.

**Some operations are hidden for presentation simplicity*

20MW TRANSPORT BARGE

MARMAC 260

- Jones Act compliant fleet
- Stability and capacity to transport (1) split tower 20MW turbine in 2.5m seas
- LxBxD = 79m x 31m x 4.9m



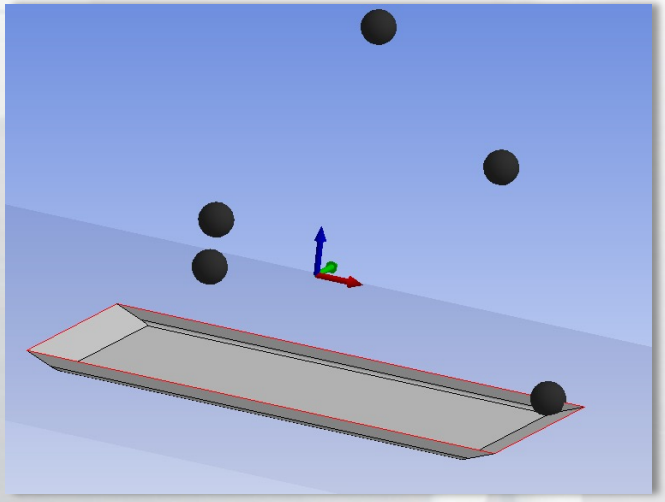
BARGE TRANSIT MOTIONS ANALYSIS

Time series hydrodynamic simulation performed using ANSYS AQWA for MARMAC 260 barge loaded with (1) 20MW turbine set

- Environment:
  - H_s = 2.5 m
  - T_p = 5.59 – 13.35 s
  - Beam, Head, & Quartering Seas

All turbine component accelerations are within the allowable limits shown below.

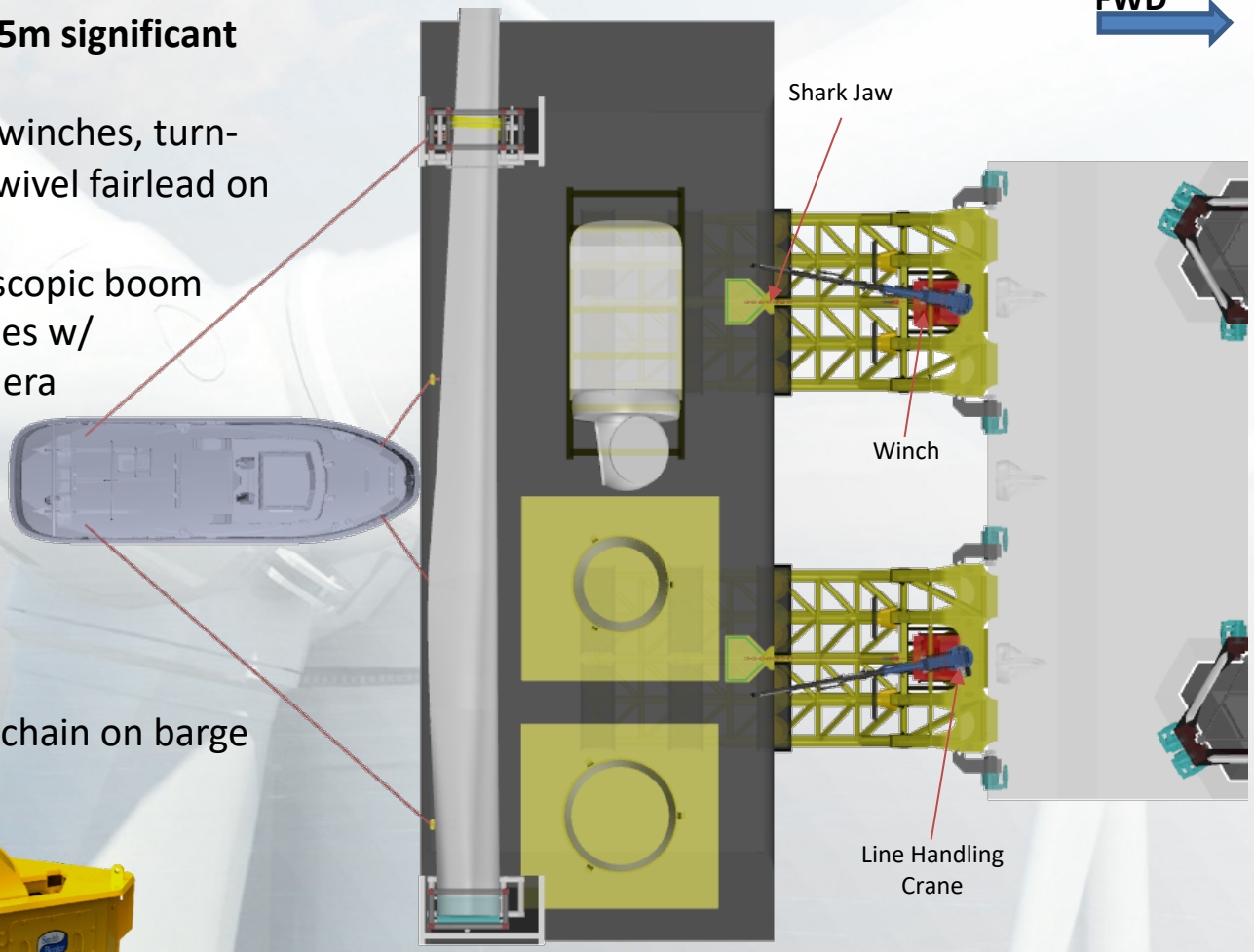
Turbine Component	Longitudinal Accel.		Transversal Accel.		Vertical Accel.	
	Maximum	Allowable	Maximum	Allowable	Maximum	Allowable
Nacelle	0.32g	0.40g	0.30g	0.80g	0.15g	2.0g
Vertical Tower	0.31g	0.80g	0.48g	0.80g	0.17g	2.0g
Blade in Rack	0.26g	0.38g	0.30g	0.75g	0.19g	1.3g



BARGE BERTHING PLAN

BARGE RACK
FRIEDE & GOLDMAN

- Berthing in up to **2.5m significant wave height**
- Two rack-mounted winches, turn-down sheave and swivel fairlead on each rack
- Rack-mounted telescopic boom cranes to handle lines w/ boom tip CCTV camera

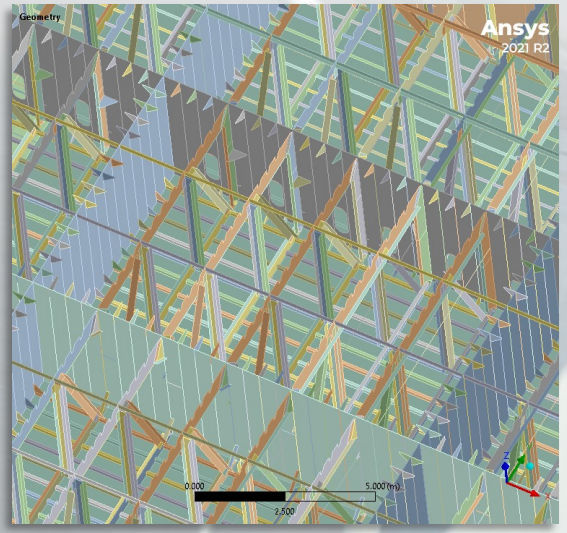


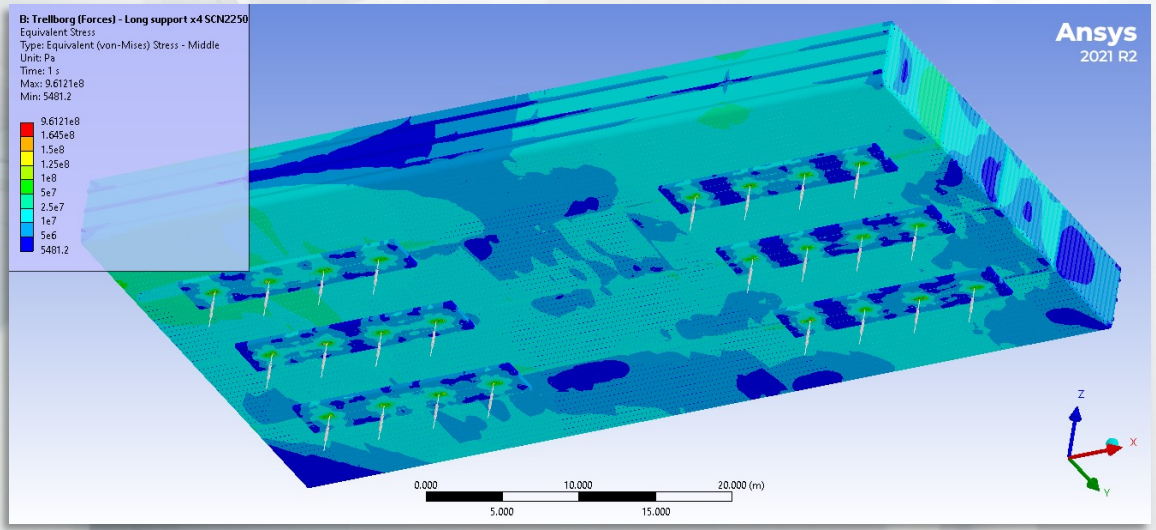
- Shark-jaws capture chain on barge deck

U.S. Patent Pending

BARGE HULL IMPACT FEA

- Detailed ANSYS FEA performed to analyze the strength of the MARMAC 260
  - Maximum fender impact loads during berthing
  - Hull hog/sag conditions while supported by the rack
- Rack arrangement configured specifically to support the MARMAC 260 at its strong points
  - **No hull reinforcements required** to hull bottom or bulkheads





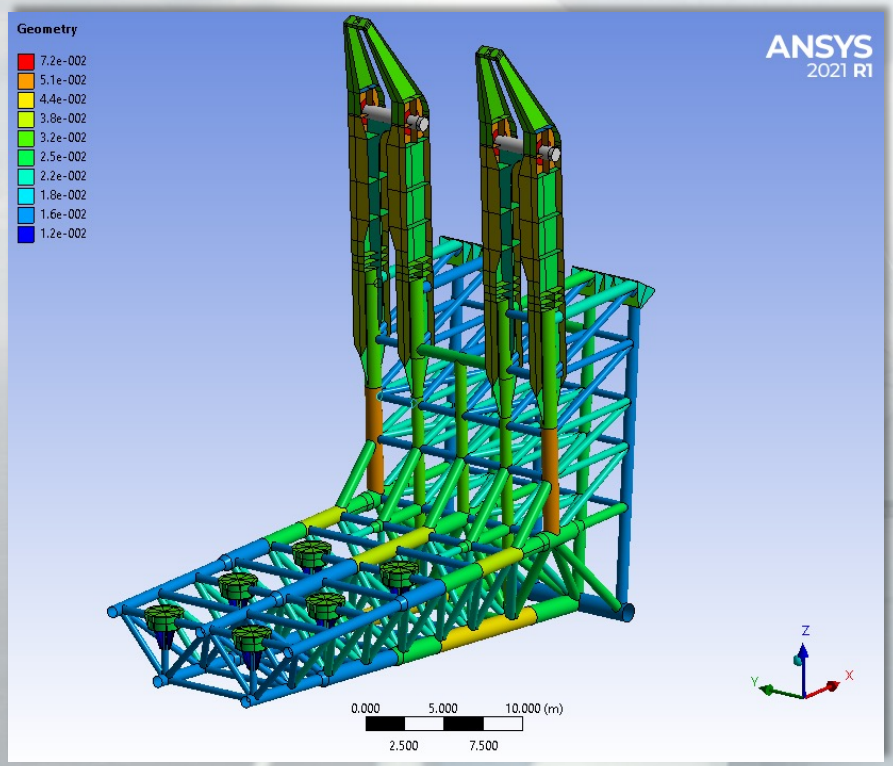
RACK DESIGN

Rack structure analyzed in SACS and ANSYS

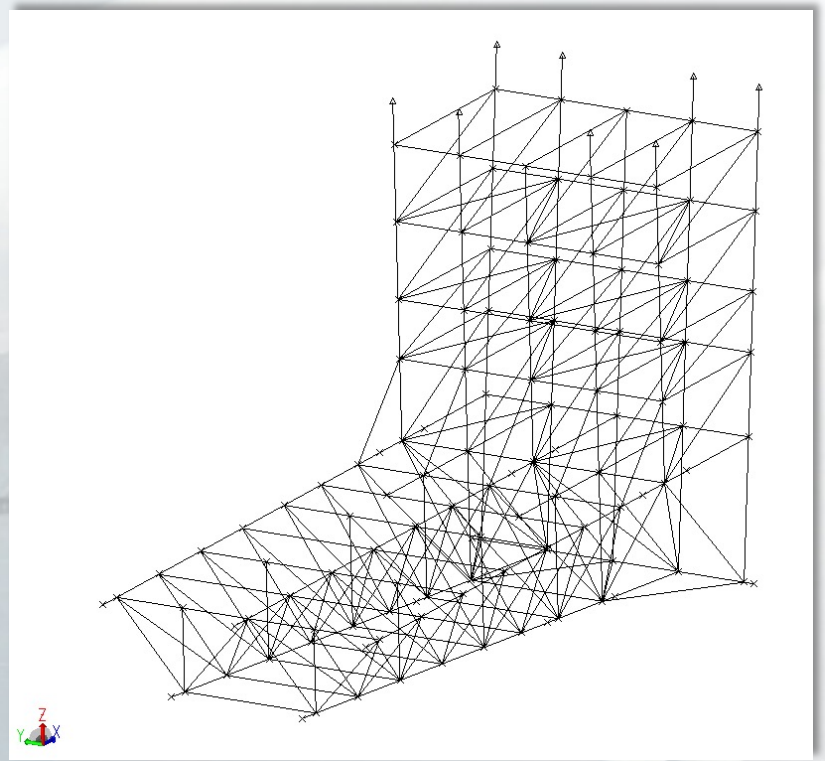
- Static deployed
- Dynamic Impact
- Stowed Transit

Materials

- 85% Tubular Construction
- Majority of tubulars are available from suppliers, remainder is rolled plate



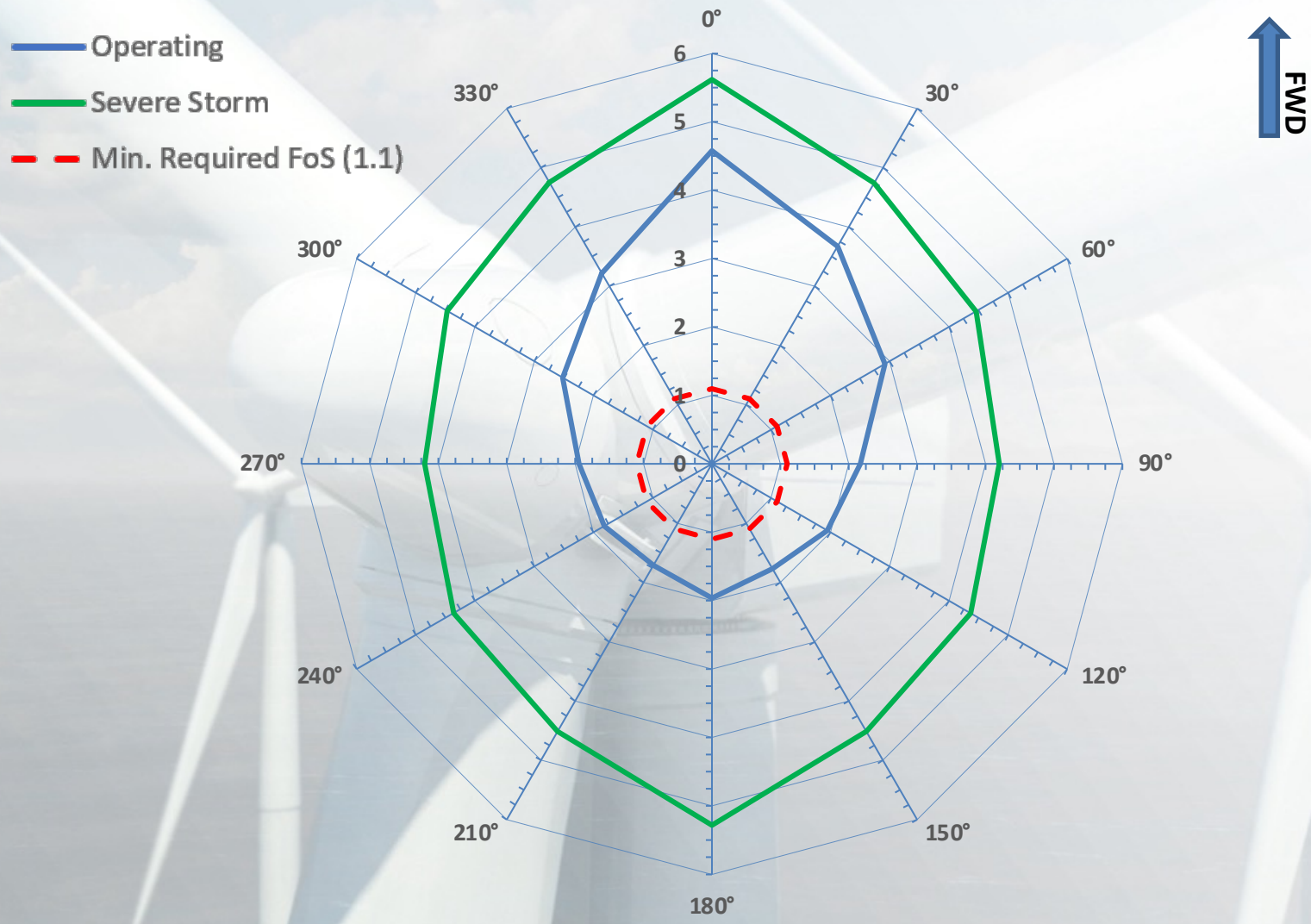
ANSYS Detailed FEA



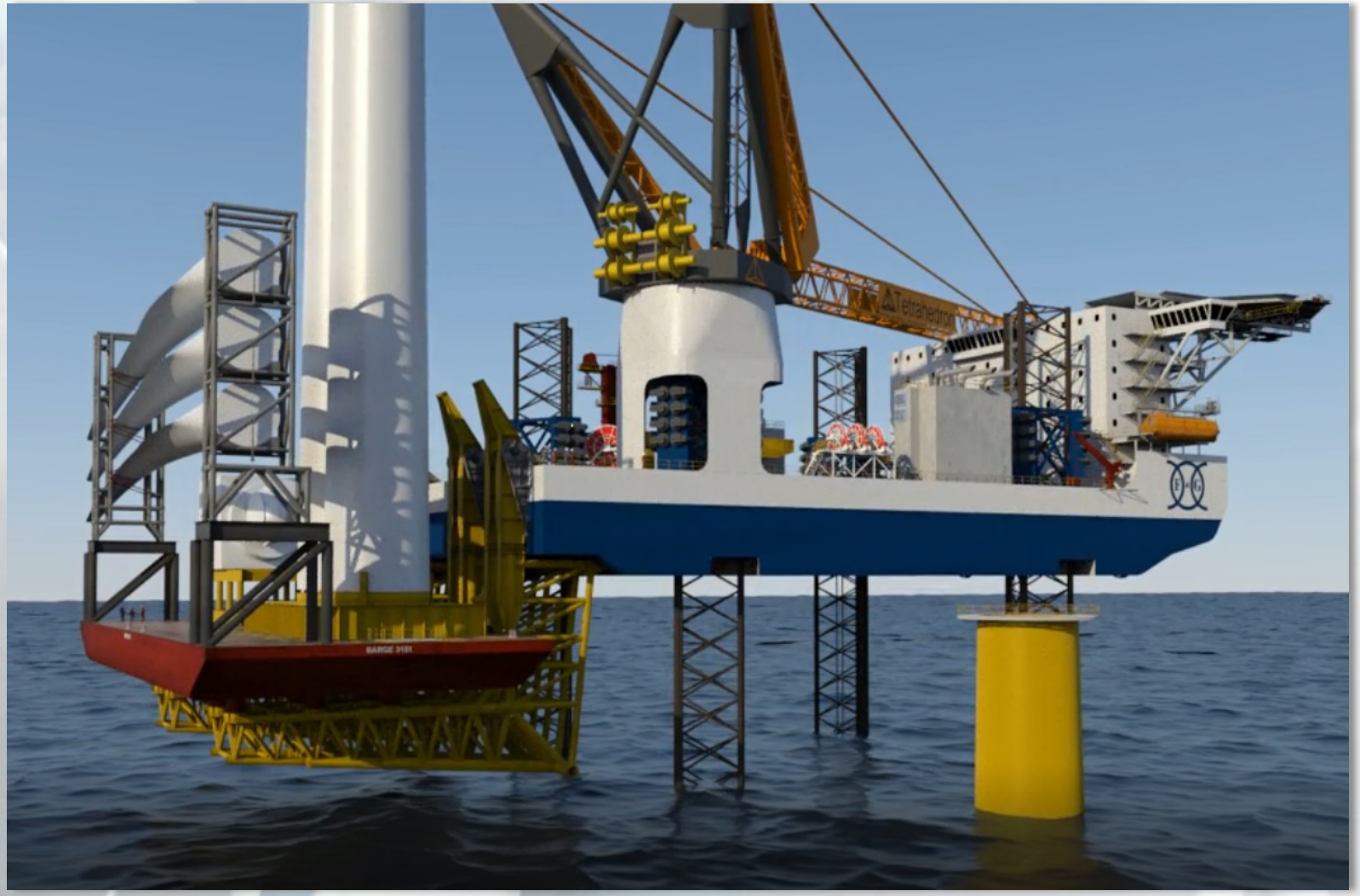
SACS Space-frame FEA

U.S. Patent Pending

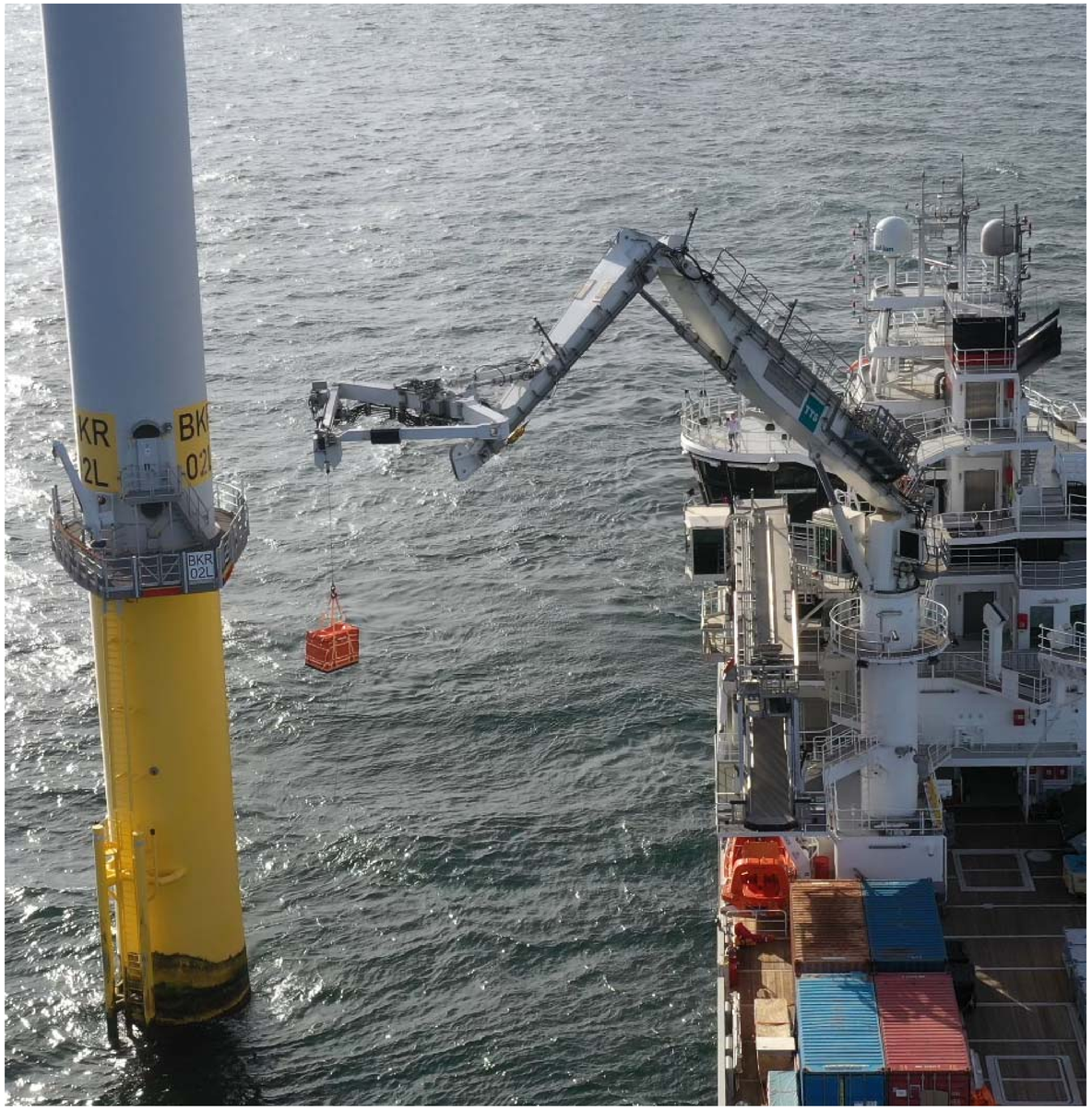
OVERTURNING STABILITY SAFETY FACTOR



BARGE RACK
FRIEDE & GOLDMAN



U.S. Patent Pending



OFFSHORE LIFTING

COLIBRI 3D KNUCKLE BOOM CRANE

MACGREGOR
Designed to perform with the sea

Agenda

What we are going to be covering in the next 5 minutes

- Developing 3D compensated systems for SOV
- The role of motion compensation
- Crane Free lifting solutions - What are the advantages
- Recap
- Discussion Points

MACGREGOR
Designed to perform with the sea

Colibri

Design Criteria

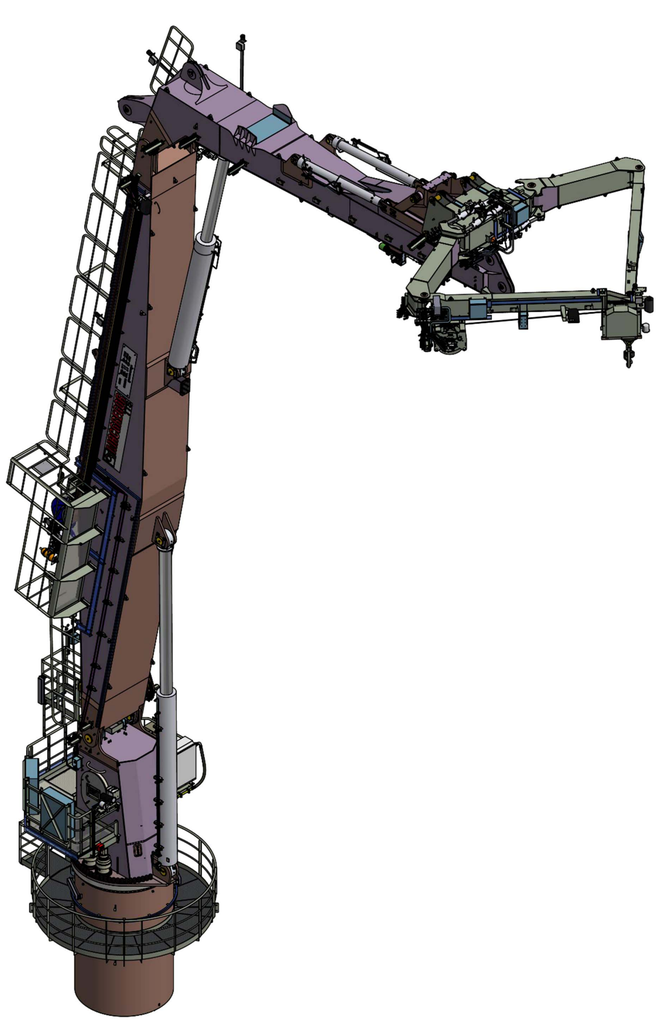
Colibri 3D Cranes shall be at the cutting edge of sustainability without compromise to safety or reliability. The governing design principles are as follows:

- **Lowest possible overall energy consumption**
- **Low Noise Pollution**
- **Match or exceed performance of rival systems**
- **24/7 Remote Monitoring & Predictive Maintenance**

MACGREGOR
Designed to perform with the sea

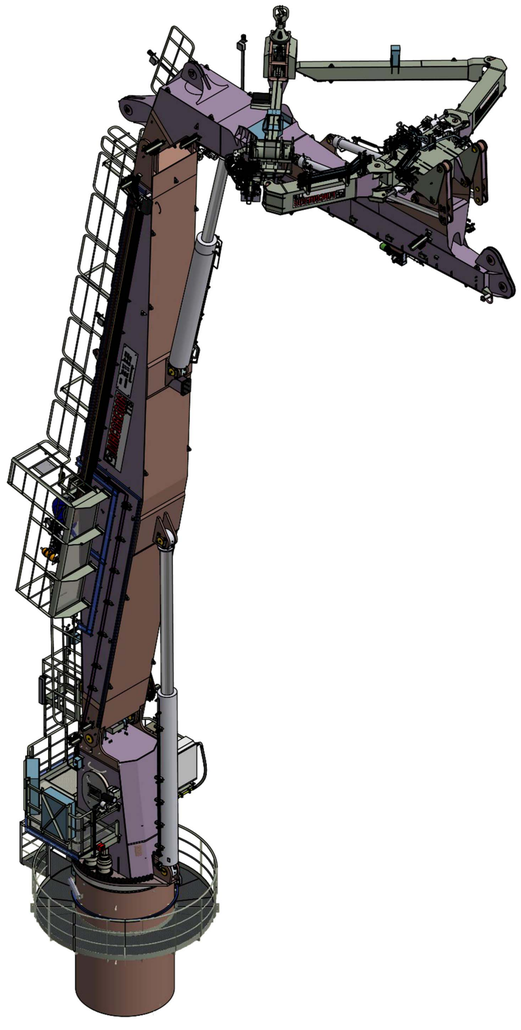
Developing 3D compensated systems for SOV

Colibri
Concept



3D Mode

Lifting with Colibri Winch



Normal Mode

Lifting with Main Winch

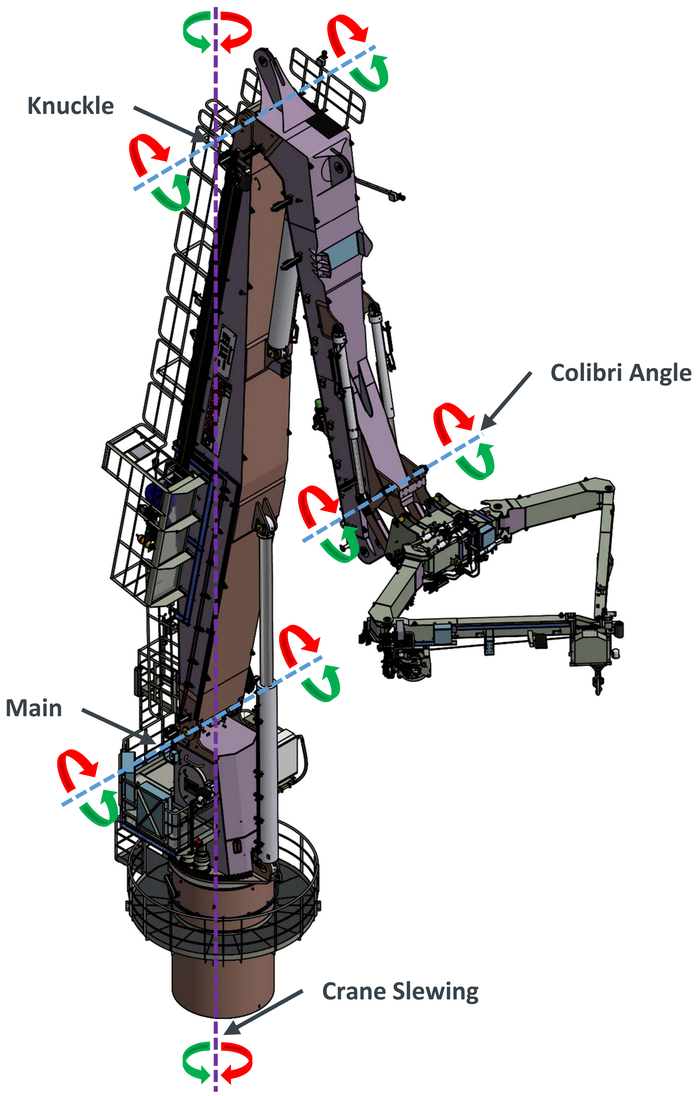
- Conventional knuckle boom crane
- Colibri - own system, own winch
- Seperat unit, fully integrated system
- Knuckle Boom Crane
- Switching Standard to 3D – less then 5min

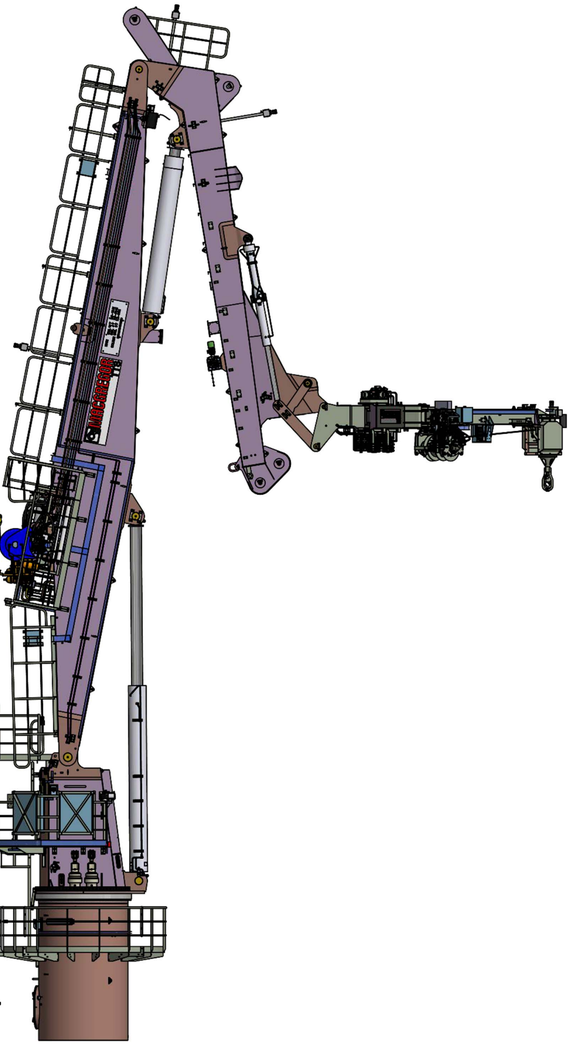
MACGREGOR
Designed to perform with the sea

Developing 3D compensated systems for SOV

Colibri

Articulations Summary

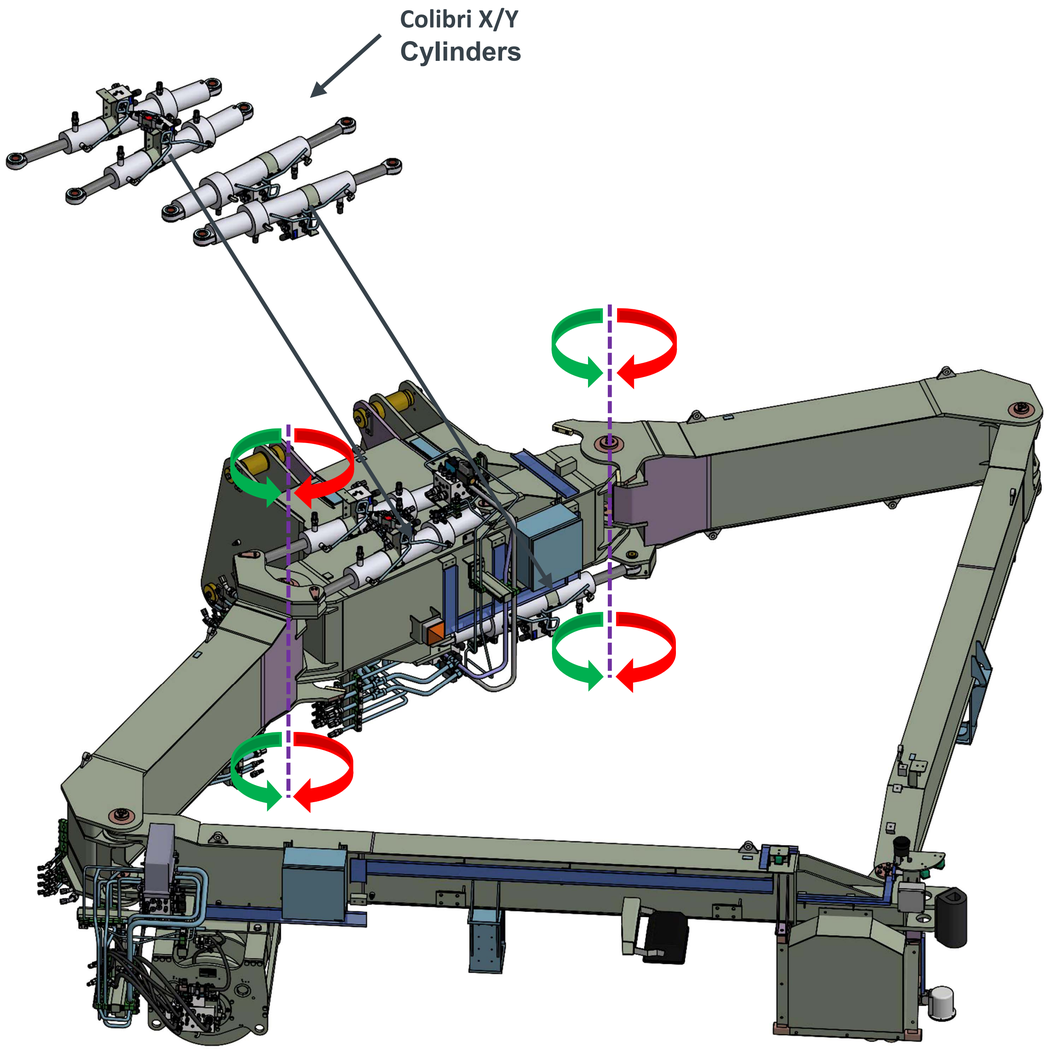




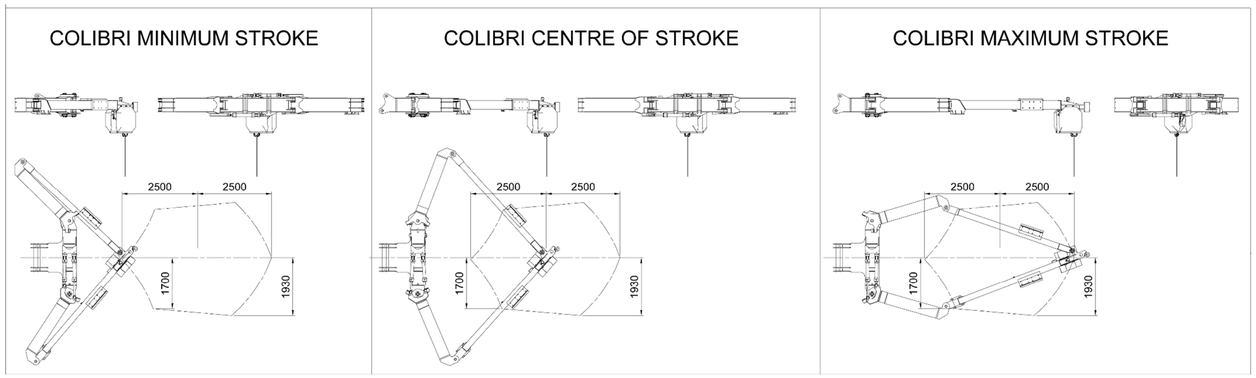
Main Boom:	Luff up / down
Knuckle Boom:	Knuckle out / in
Colibri Tilt:	Stowed / Active
Slewing:	Clockwise / Anti-Clockwise

MACGREGOR
Designed to perform with the sea

Colibri
Colibri Motion



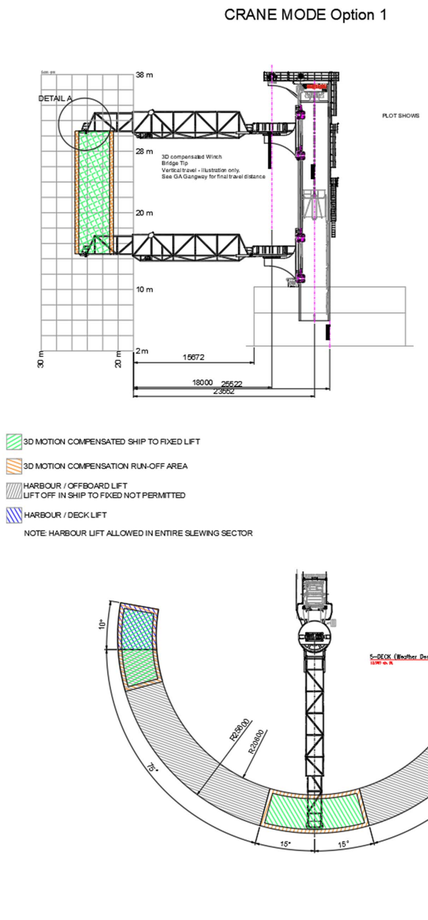
- Four Linkage arms
- Four cylinders, - 2 in pair
- Motion within an irregular shape of approx 5x3,4m
- Active Heave Compensated Winch
- Anti-Collision

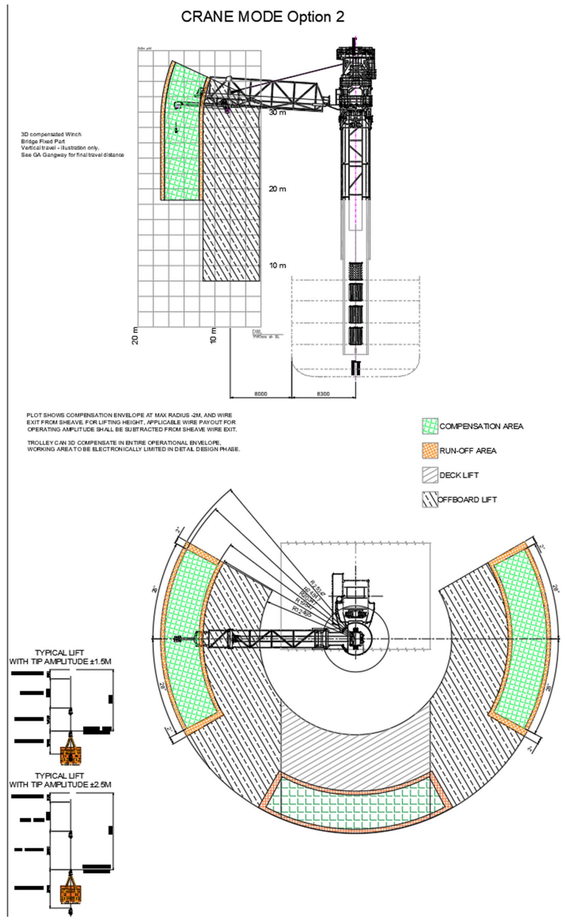


MACGREGOR
Designed to perform with the sea

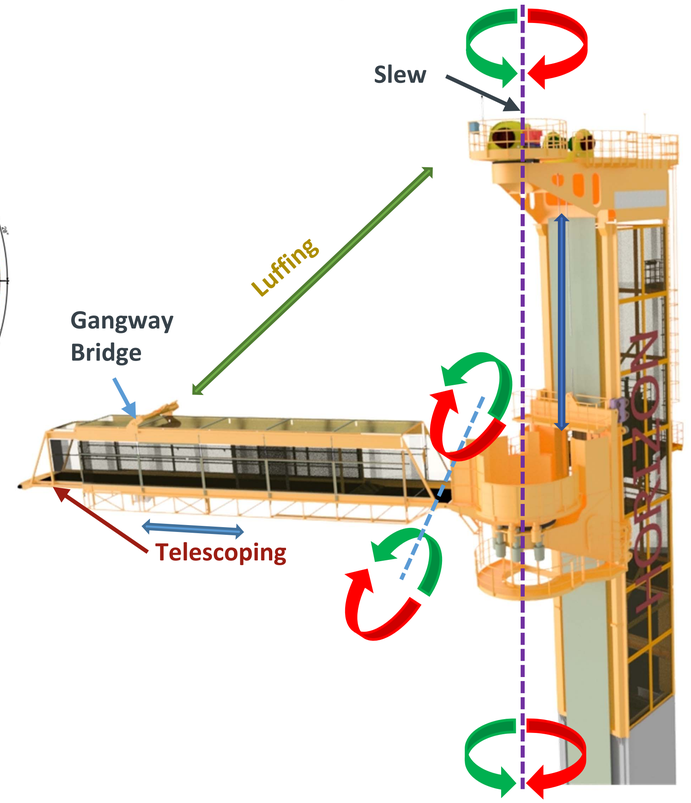
Crane Free lifting solutions - What are the advantages

3D Compensated lift - Gangway





- Active Heave Compensated Winch
- Part of Bridge
- 2 solutions
- Integrated



MACGREGOR
Designed to perform with the sea

Discussion points

- Which direction to go, Hydraulical or fully Electrical system for?
  - Pros and cons..

- Will crane fitted on the Gangway eliminate the need of a additional crane?
  - Is this always pratical during operations?

- What would be the preferable way to operate a 3D compensated lift.

MACGREGOR
Designed to perform with the sea

MACGREGOR

Designed to perform with the sea