O&M Subgroup

Inaugural webinar

18th May 2021

Offshore technicians, source – Iberdrola

Webinar Programme

10.00am – Introduction - Jeya Calder and Paul O'Brien, HIE

Introduction to Subgroup co-chairs

10.05am - **Halliburton, Graham McArthur**

10.15am - **MISTRAS, Paul Cairns**

10.25am – Fraserburgh Harbour - Update on O&M base – **Jill Smith**, **Fraserburgh Harbour Commissioners** and **Paul Mewse, Head of O&M for Moray East, Ocean Winds**

10.45am – Open session to get feedback from members on future subgroup activities and themes

11.00am – End of webinar

Image courtesy of MHI Vestas

Subgroup Membership

- Currently 120 members out of 581 members of the main cluster
- New members of the cluster are invited to join the subgroups so this O&M Subgroup will continue to grow organically

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O&M Market - Costs

- Estimated costs for Operations, Maintenance and Service for a 1GW windfarm is around £75m per annum
- Operations is approximately £25m per annum
  - includes health and safety, control and operation of the asset including wind turbines and balance of plant, remote site monitoring, environmental monitoring, electricity sales, administration, marine operations supervision, operation of vessels and quayside infrastructure along with back-office tasks.
- Maintenance and Service is around £50m per annum
  - includes planned and unplanned maintenance and service in response to faults, either proactive or reactive.

Image courtesy of MHI Vestas

Image courtesy of Maersk Supply Service

O&M Market - Scale

- Current UK market has 10GW of offshore wind operational i.e. the Operations, Maintenance and Service market is worth approximately £750m per annum
- By 2030 the UK target is to have 40GW of offshore wind capacity
- The Operations, Maintenance and Service market in 2030 will be worth around £3bn/annum

INDUSTRIAL STRATEGY CLUSTER

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O&M Market - Future

Image courtesy of Maersk Supply Service

- By 2050 the aim will be to have 100GW of offshore wind capacity in UK waters
- This will mean an Operations, Maintenance and Service market of £7.5bn per annum
- In the decade leading up to 2050 the offshore wind industry will be building out 3GW per annum and the total for both CAPEX and OPEX will be around £10-11bn per annum

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Graham McArthur

HALLIBURTON

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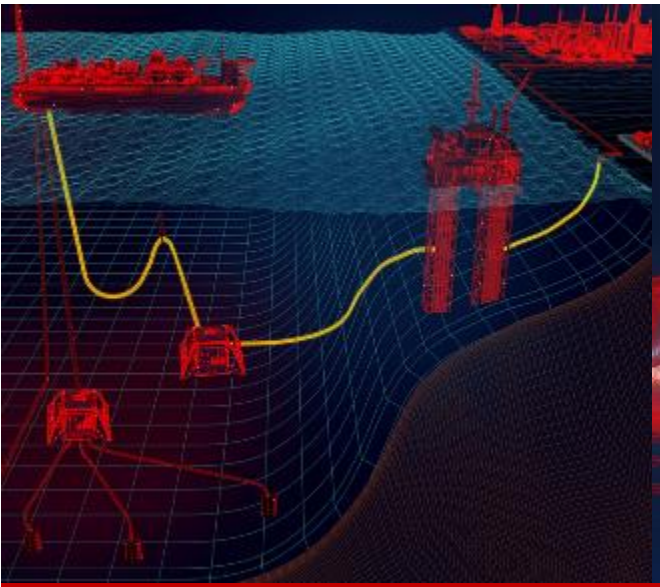
Value Proposition

Engineered technical solutions from pre-com to de-com to maximize efficiency and integrity of our customers' assets.

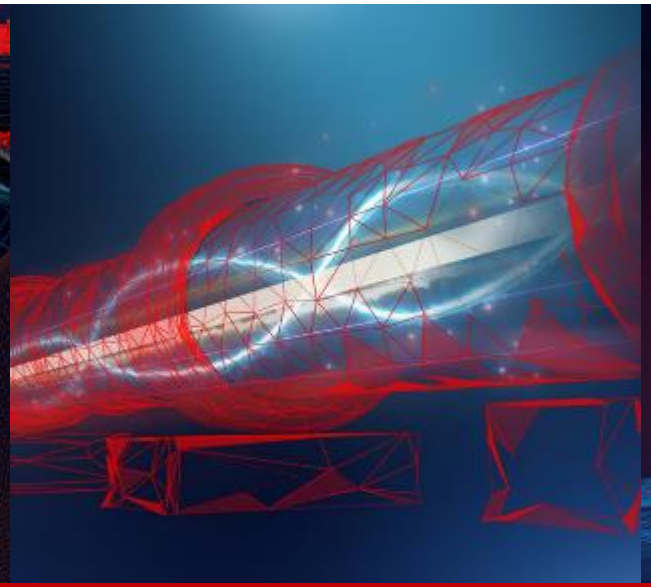
INTEGRITY

EFFICIENCY

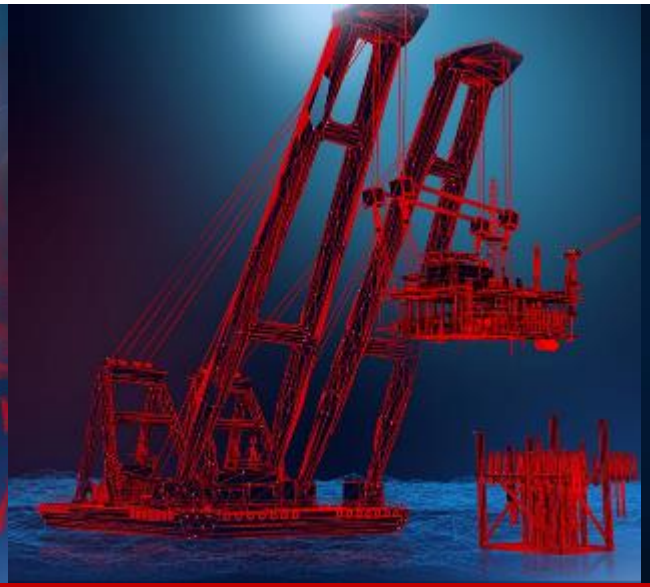
VALUE



PRECOMMISSIONING



MAINTENANCE



DECOMMISSIONING

RENEWABLES

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Offshore Wind

HALLIBURTON

Key Technologies Portfolio

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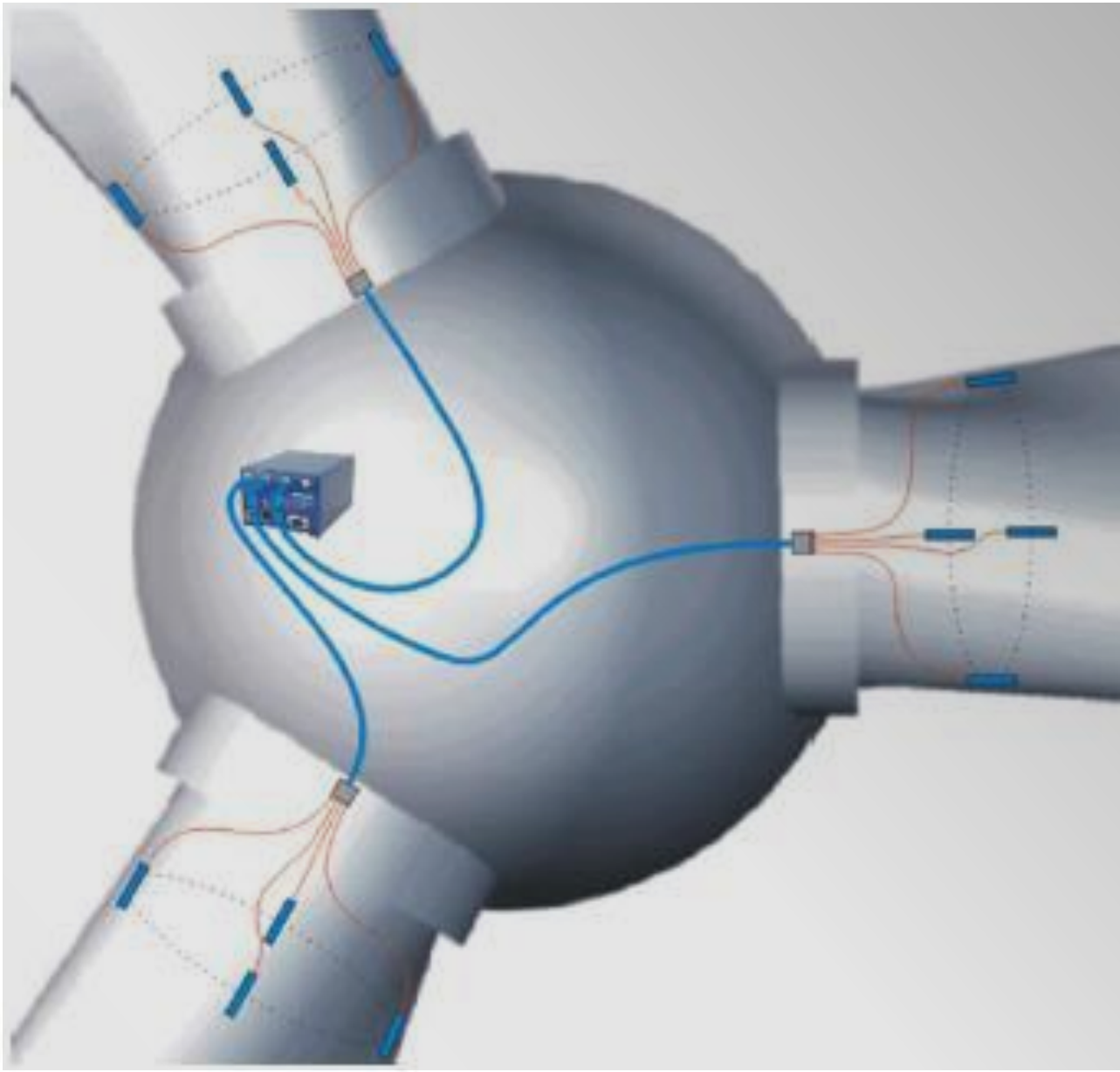
Smart Blade Fibre Optic Technology

Optical Blade Loads Monitoring and Control System for Wind Turbines

- Independent Blade Pitch Control
- Blade Condition Monitoring
- Blade residual fatigue life assessment
- Ice detection

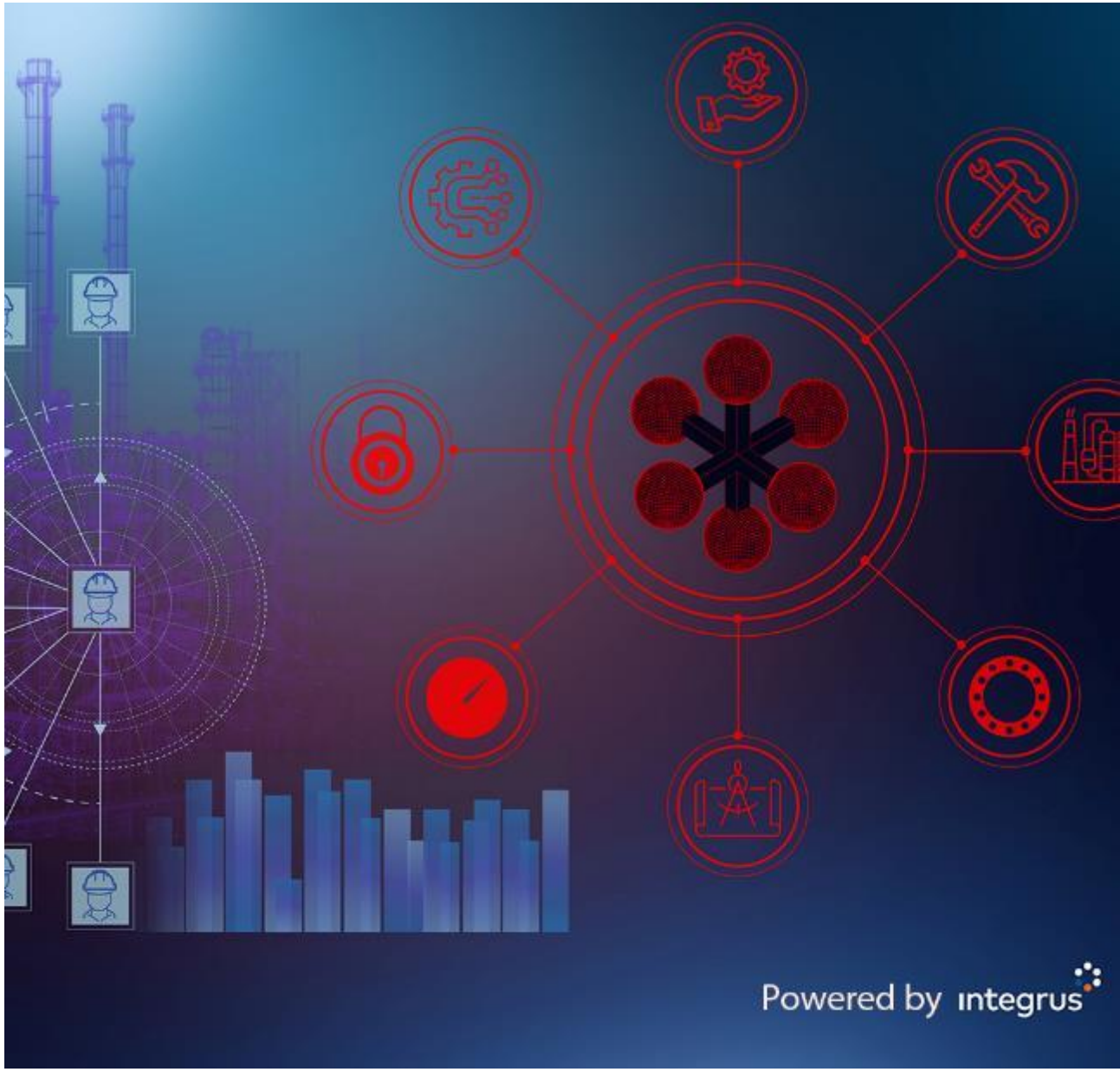


HALLIBURTON

Integrity Management

Your digital safety net

Real time digital integrity management to ensure safe life of asset whilst lowering total cost of ownership



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Paul Cairns

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DeepWind O&M Subgroup webinar

PAUL CAIRNS

BUSINESS DEVELOPMENT MANAGER

MISTRAS Group

MISTRAS' asset protection solutions support clients with cutting-edge, technology-driven mitigation of risks.

VISION

Be the **integrated-solution partner** to solve civilization's unmet asset protection needs

MISSION

We will deliver value by developing, integrating, and executing asset protection solutions that **maximize uptime and safety**

Founded in **1978**

NYSE: **MG**; IPO in 2009

Global HQ in Princeton, NJ - USA

Over 106 Locations Worldwide

Over **5,000** Employees

WHO WE HELP

Backed by decades of experience, our subject matter experts (SMEs) understand the unique problems that our customers face every day, and recommend solutions tailored to particular equipment and facilities.

Certain industries operate in some parts of the world more than others. With locations all over the globe, we have the ability to operate wherever our customers are.

OIL & GAS

AEROSPACE & DEFENSE

INFRASTRUCTURE

POWER

MANUFACTURING

HOW WE HELP

FIELD INSPECTIONS

Individual spot inspections all the way up to evergreen inspection program management and execution

ACCESS

Trained and industry-certified technicians safely access assets in at-height, confined, subsea, and hazardous locations

MAINTENANCE SERVICES

Complementary light mechanical services to clean and repair assets after damages are discovered in inspections

DATA SERVICES

Solutions to manage, analyze, and digitally transform enterprise, site, and asset integrity data

ENGINEERING CONSULTING

Engineering and mechanical integrity consultation services to optimize facility design and operations

EQUIPMENT

Innovative, leading-edge inspection equipment enables our customers to track their assets' conditions

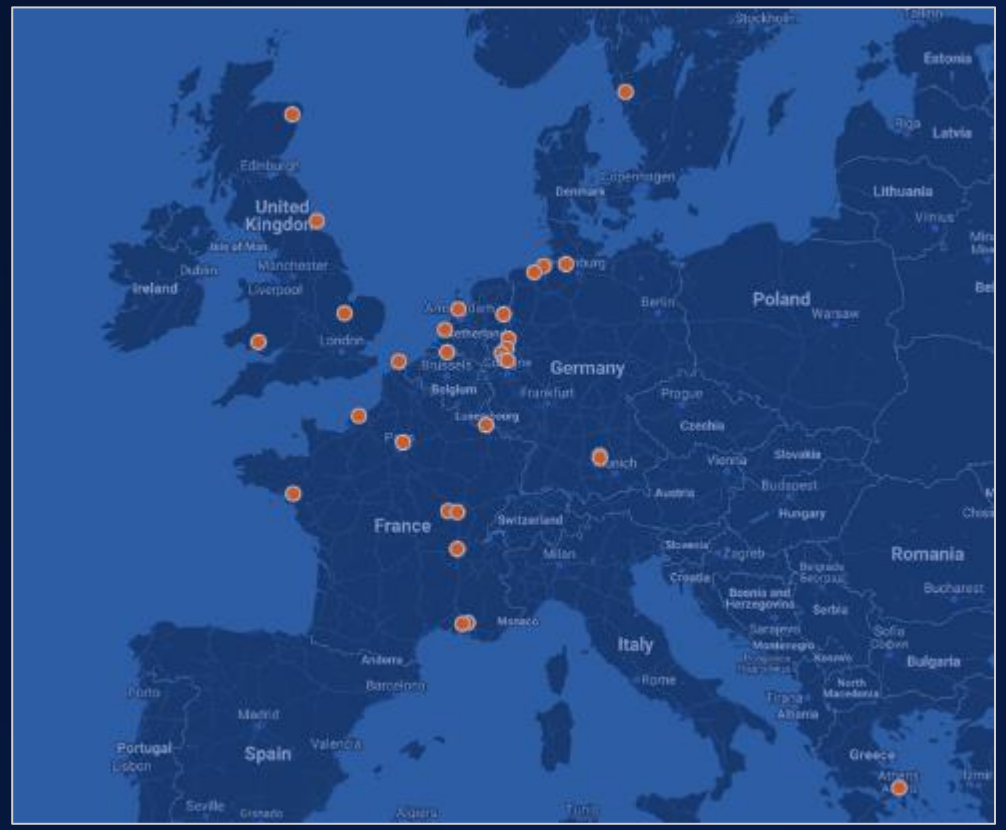
LAB QA/QC SERVICES

In-house testing and quality assurance solutions for newly-fabricated components and materials

SPECIAL EMPHASIS

Proceduralized programs that use our asset protection expertise to target hazardous and costly damages

30 European Sites



EUROPEAN LOCATIONS

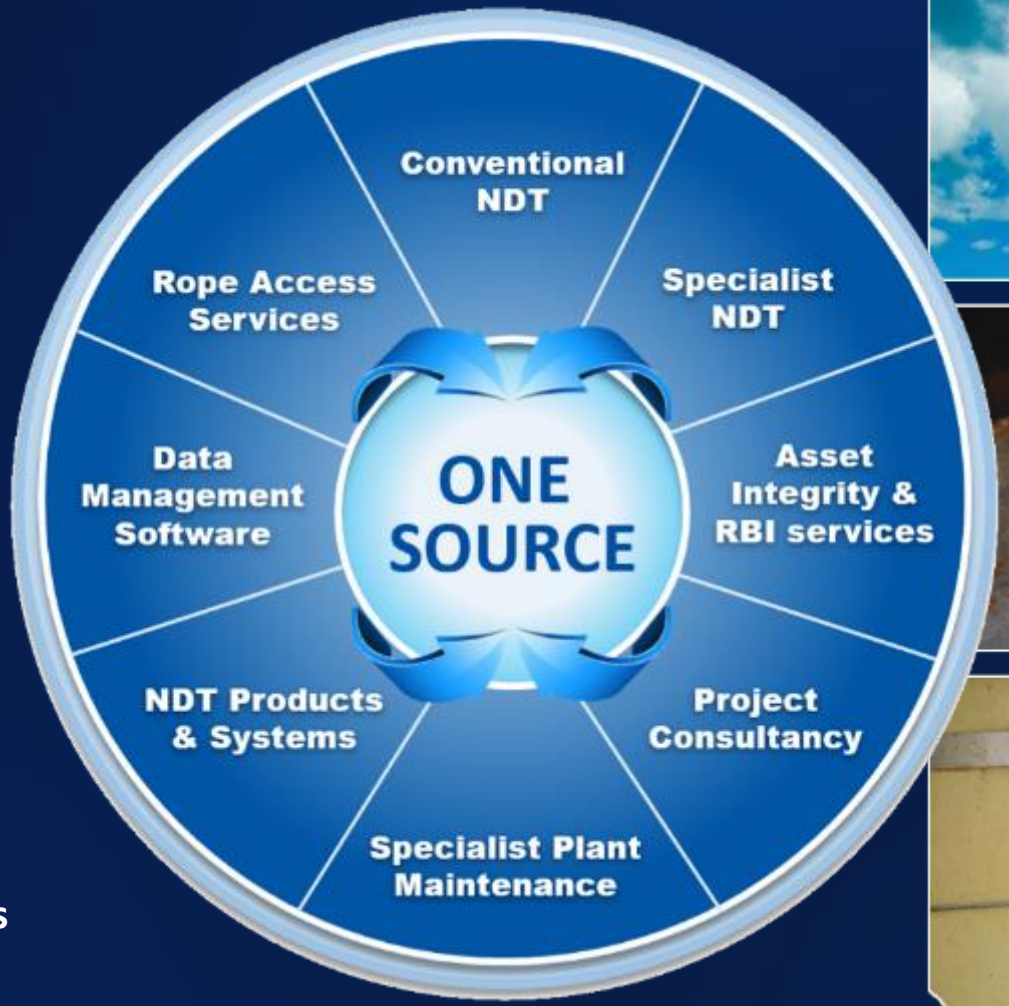
Aberdeen - UK
Bridgend - UK
Cambridge - UK
Hartlepool – UK
Augsburg - Germany
Cologne - Germany
Düsseldorf - Germany
Essen - Germany
Friedberg - Germany
Gelsenkirchen - Germany
Leverkusen - Germany
Nordenham - Germany
Stade - Germany
Varel – Germany
Auberville la Campagne - France
Dunkerque - France
Feyzin – France
Le Creusot - France
Martigues - France
Rosselange - France
Saint-Remy - France
Sucy-en-Brie - France
Trignac - France
Vitrolles – France
Amsterdam - Netherlands
Hengolo - Netherlands
Spijkenisse – Netherlands
Antwerp – Belgium
Athens – Greece
Gothenburg – Sweden

WIND TURBINE SERVICES

Evaluating the structural integrity of assets within the Oil & Gas, Wind Energy and Infrastructure Sectors

Our services and solutions provide customers the ability to comply with government safety requirements, meet environmental regulations, enhance risk management operational decisions and extend the useful life of their assets.

- **Specialist Advanced NDT**
- **Inspection for Hidden Defects**
- **Mechanical, Repair and Access Solutions**
- **Asset Integrity Management Services**



WIND TURBINE MONITORING SOLUTIONS

Evaluating the structural integrity of assets within the Oil & Gas, Wind Energy and Infrastructure Sectors

Our services and solutions provide customers the ability to comply with government safety requirements, meet environmental regulations, enhance risk management operational decisions and extend the useful life of their assets.

- **Condition Monitoring Systems (CMS)**
- **Structural Health Monitoring (SHM)**
- **Blade Monitoring Systems (BMS)**
- **Acoustic Emission Monitoring (AEM)**
- **GAP Monitoring System**

MISTRAS

PAUL CAIRNS

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Jill Smith

Fraserburgh Harbour Commissioners

Paul Mewse

OW OCEAN WINDS

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North of Scotland Offshore Wind Cluster

Fraserburgh Harbour

Deepwind Presentation
18th May 2021

Fraserburgh Harbour Commissioners

Fraserburgh Harbour Commissioners – who are we?

- Fraserburgh Harbour is a trust port
  - *A trust port is an independent statutory body governed by its own local legislation and run by independent boards. Unlike private company ports, they have no shareholders so all the surpluses from port operations are put back into the port. (Transport Scotland Website, 2021)*

- Fraserburgh Harbour Commissioners (the board)
  - The board consists of 11 unpaid members, and 1 salaried employee.
  - The Convenor (Non-Exec Chair) Commissioners are appointed for 3 year terms.

- Key Management Positions
  - Harbour Master
  - Harbour Superintendent
  - HSEQ Lead / Clerk to the Board
  - Treasurer

- Workforce
  - 34 full and part time employees providing 24 hr service.

History of Fraserburgh Harbour

- 1542 Alexander Fraser, 7th of Philorth, received from King James V a charter of the whole fishings opposite his lands and he constructed a convenient harbour. As a result, he received a royal charter erecting Faithlie into a Burgh of Baron
- 1818 The construction of the South Pier was started and the first direct local Harbour Authority, as constituted by Act of Parliament, met for the first time - the first Fraserburgh Harbour Commissioners.
- 1850 Construction begun of a new North Breakwater, called, ever since the Crimean war, the Balaclava Pier.
- 1879 First election of Harbour Commissioners with Lord Saltoun's Factor as Chair of the Harbour Board until 1892.
- 1894 – 1896 Balaclava Harbour deepened.
- By 1931 Slipway at Faithlie basin had been built.
- 1959 Fish market build on Walker Quay at Faithlie Basin.
- 1989 Original fish market replaced with a new one.
- 1992 New dry dock built.
- 1997 Inner Balaclava deepened.
- 2000 Six berth shiplift constructed.
- 2011 Commencement of deepening of North Harbour.
- 2018 Fraserburgh is selected as preferred port for Moray East offshore wind project
- 2019 Masterplan exercise undertaken by Commissioners

Offshore wind journey

- Although historically a fishing port, the Commissioners offshore wind journey starting in 2011, when it was agreed that due to available capacity within the port there was an opportunity to look at diversifying.

- In the early stages representatives of the port attended a number of meet the buyer events arranged by HIE and SE and All Energy Conferences for networking and to understand the industry a little better.

Learning journey

The Harbour Superintendent visited Workington to see the Robin Rigg Offshore wind farm

Fraserburgh Harbour Commissioners

In 2012 the Commissioners accessed specialist consultant support through Scottish Enterprise Offshore Wind Expert Support scheme to assist in market research. This support and interaction was extremely advantageous. Subsequently dialogue was opened up with developers.

Strategic partnerships and collaborative working

- In 2013 a working group was set up with strategic partners including the local Council and North East Scotland College with the support of Scottish Enterprise.
- This collaborative working was due to the acknowledgement that anchoring a developer within the port would be economically beneficial to the local community and the potential of long term employment opportunities.
- This working group had a further learning journey in early 2013 to Great Yarmouth and Lowestoft

NORTH EAST SCOTLAND COLLEGE

Scottish Enterprise

Aberdeenshire COUNCIL

Fraserburgh Harbour Commissioners

Memorandum of Understanding

BIG DAY: At the harbour, from left, are Dan Finch, of Moray Offshore Renewables Ltd, Belinda Miller, of Aberdeenshire Council, Eilidh Whiteford MP, harbour convener Peter Bruce and Duncan Abernethy, from North East Scotland College

- April 2014 Memorandum of Understanding signed with Moray Offshore Renewables Ltd.
- The agreement formalised the commitment of both parties to work together and investigate developing operations and maintenance facilities for the proposed windfarm
- Allowed the Commissioners time to properly consider the facilities, services and skills available, both currently and planned, which could be utilised.

Fraserburgh Harbour Commissioners

Contract for Difference

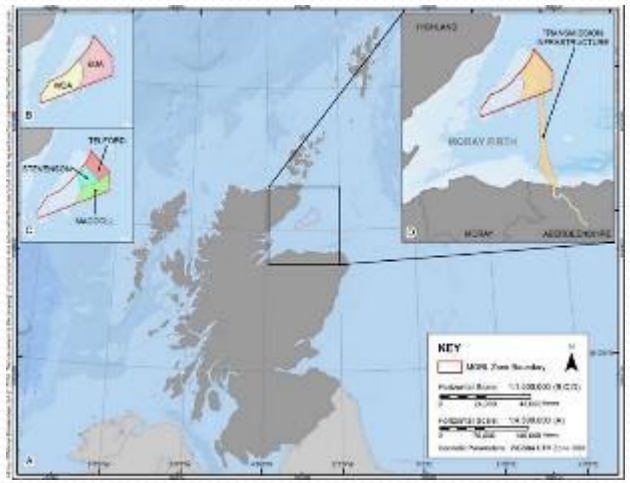
- Moray East narrowly missed out in the February 2015 CfD bidding process
- Dialogue continued with developer and strategic partners
- In September 2017 Moray East were awarded a CfD
- FHC joined Deepwind Cluster in May 2019

Operation & Maintenance Port Selection

- In June 2018 the Commissioners were delighted that Fraserburgh Harbour was selected as the preferred operation and maintenance port for Moray Offshore Windfarm East

Fraserburgh Harbour Commissioners

Moray East Offshore Windfarm



Site Area	296km²
Water Depth	37m-57m
Capacity	950MW
Turbines	100 MHI Vestas V164-9.5MW Turbines
Turbine Foundations	Three-legged jacket foundations with pre-installed piles
Grid Connection	- Onshore substation at New Deer, Aberdeenshire - 34.5km long onshore export cable route - 58km long offshore export cable route - Three offshore substation platforms connected through interlink cables
OFTO assets construction update	Commissioning expected in phases between May 2021 and Sep 2021
Scheduled Commercial Operations Date	Q2 2022

Fraserburgh Harbour Commissioners

Moray East Offshore Windfarm

Offshore Substation Platform Foundation:

- 3 OSP Foundation
- 3 Clusters
- Height: 80 meters
- Weight: 1200 tons
- Pin Piles:
  - 9 Pin Piles
  - Length max: 58 m
  - Weight max (1 pile): 180 tons

Wind Turbine Jacket Foundation:

- 100 WTG Foundations
- 4 Clusters
- Height: 80 meters
- Weight 1000 tons

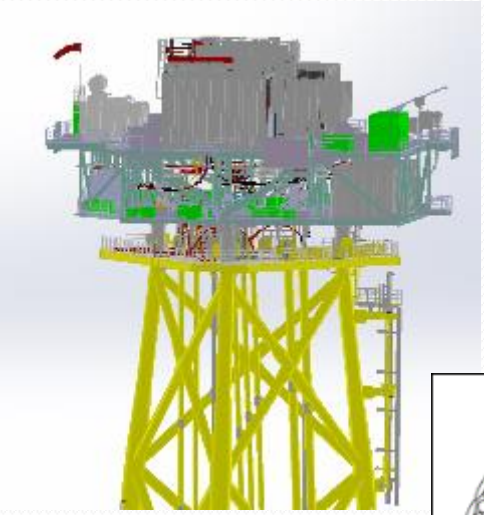
Pin Piles:

- Length average: 40 m
- Weight Average (1 pile): 120 tons

Model: MHI Vestas V164-9.5MW

- No. Of Turbines: 100
- No. Of Blades: 300
- Rated Power: 9.5MW
- Nacelle weight 375t
- Blade weight 35t
- Tower weight 291t
- Blade Diameter: 164 m
- Approx. Tip Height: 187 m
- Tip Speed: 90 m/s
- Swept Area: 21,242 m^2

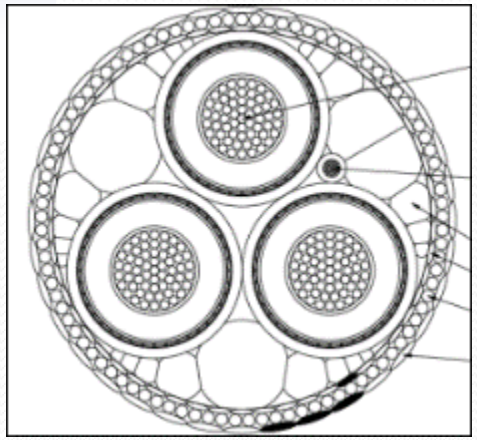
Moray East Offshore Windfarm



Key Details:

- 3 OSP's
- Each Topside weighs 1200 tonnes
- With a Jacket the total weight will be over 2400 tonnes

- Once installed will sit 30m above the water
- Each OSP has 3 decks
- Deck size is 30m x 27m



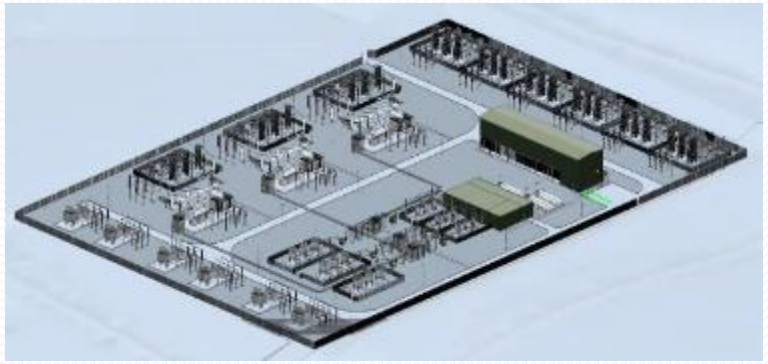
- 170 km subsea inter-array cables (66 kV)
- 2x OSP interconnecting cables 2 x 10km length (66kV)
- Total weight – 5,865 T
- Cables manufactured in Hartlepool UK
- 102 Cables in total – length ranges from 1.3 to 4.2 Km

- Export cables are 3 x 60 km in length
- Onshore cable 36km to New Deer Substation

Key details:

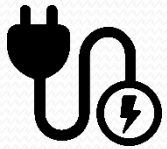
Onshore Substation:

- Onshore Substation area ~80,000 m² (279 x 189m) (11x football pitches!)
- 900 MW grid connection
- 3 Super Grid Transformers
- Control building that contains the Gas Insulated Switch gear [GIS]



Fraserburgh Harbour Commissioners

Moray East Offshore Windfarm

	Moray East will provide clean energy to at least 950,000 homes in the UK.
	Moray East will be able to provide approximately 40% of Scotland's electricity consumption.
	Moray East will save approximately 1.7 millions of tonnes of CO_2 emissions each year.
	Moray East is installing 100 one of the largest wind turbines existing in the market today.
	The total length of cable installed by Moray East will be approximately 500km nearly the distance between Edinburgh – London.
	The 950MW Moray East offshore windfarm will generate power at £57.50/MWhr – or 5.75p/kWhr.

Moray East O&M Base

- Site Size: Approx. 1880m2
- Onshore infrastructure : Two story building
- Storage & Unloading Area, Car
- Staff car parking for 30-40 vehicles
- Onshore facilities: Marine Co-ordination Centre
- Operational control room
- Maintenance Workshop & Stores
- Admin offices

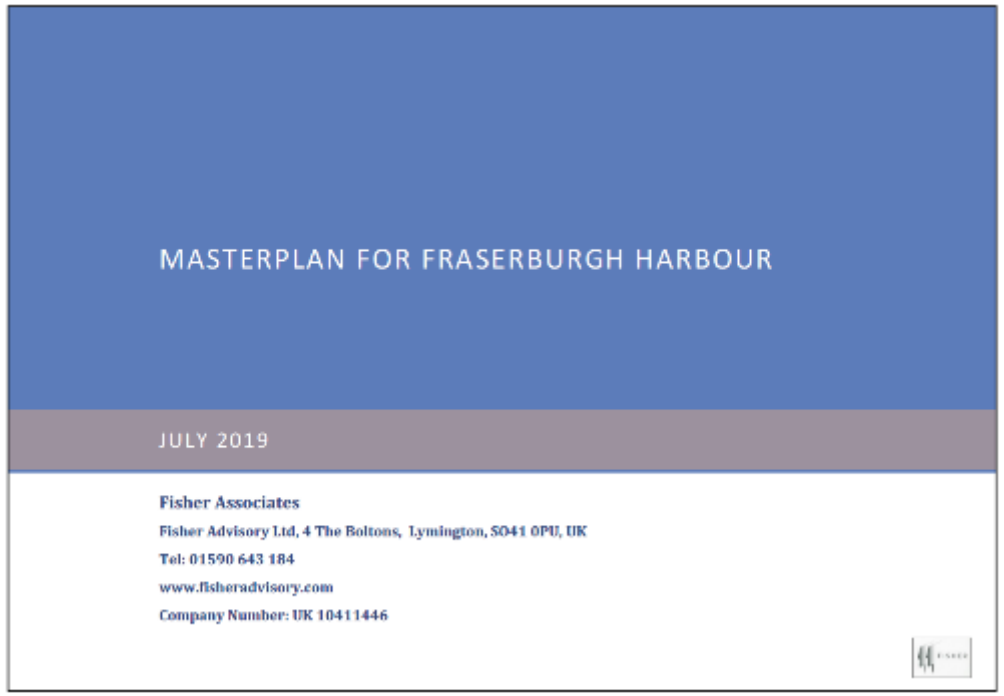
Fraserburgh Harbour Commissioners

Moray East O&M Base

- Berthing facility for windfarm SOV (Service Operation Vessel)
- Pontoon facility for CTV access (Summer months)
- 20 staff employed by Moray East Windfarm
- 60 staff by wind turbine OEM, Vestas
- Recruitment already underway

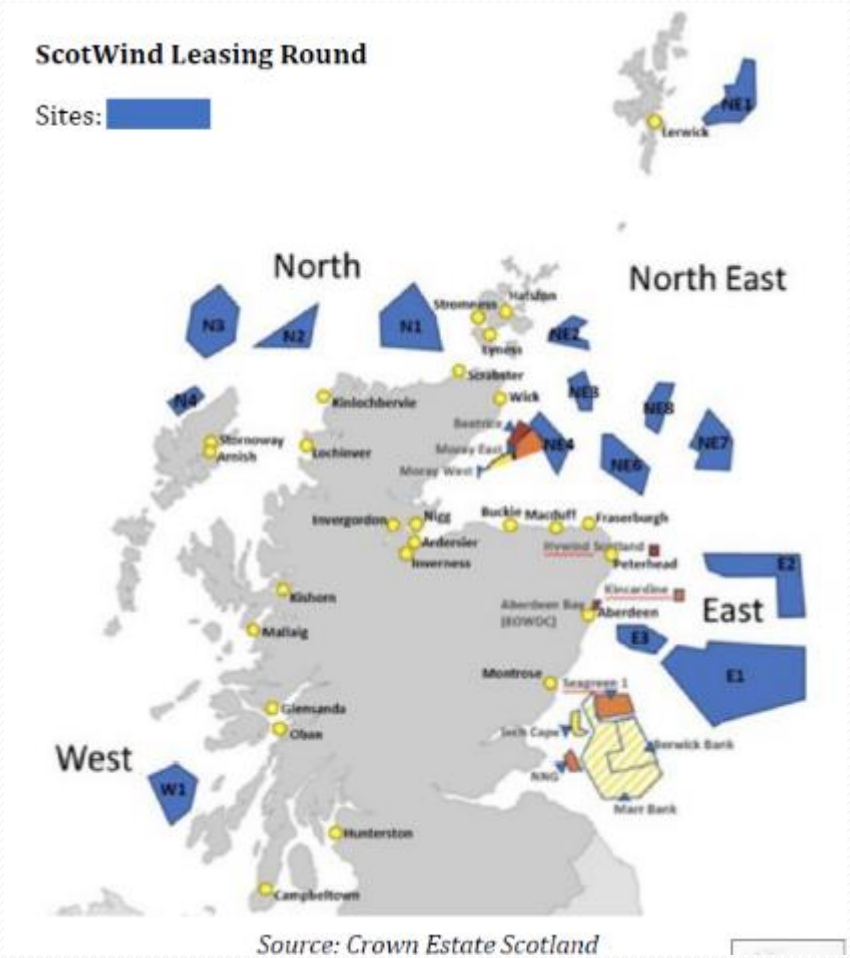
Fraserburgh Harbour Commissioners

Long term capabilities – the 2021 masterplan



- In 2019 the Commissioners undertook a Masterplan exercise for Fraserburgh Harbour.
- The plan was subsequently updated in Q1 2021 with respect to fisheries, offshore renewable energy opportunities and potential economic benefits.
- The Masterplan sets out a vision and strategic framework for the development of infrastructure at Fraserburgh Harbour over the next 20 years, supporting growth in existing markets as well as facilitating and attracting new business.

Interesting and exciting times for ORE. What role can Fraserburgh play?



Source: Crown Estate Scotland

Open Session

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