

# ORBITAL

## MARINE POWER

Engagement Opportunities for Steel fabricators

# Who we are.

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European Marine  
Energy Centre

Headquarters:  
Kirkwall, Orkney

Edinburgh office

Privately held Scottish company with 33 employees who have accumulated over 100 engineering years focused on optimising the world's most advanced tidal turbine technology.

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Company  
rebrands,  
2018

Company  
starts build of  
first 2MW O2.  
2019-2020

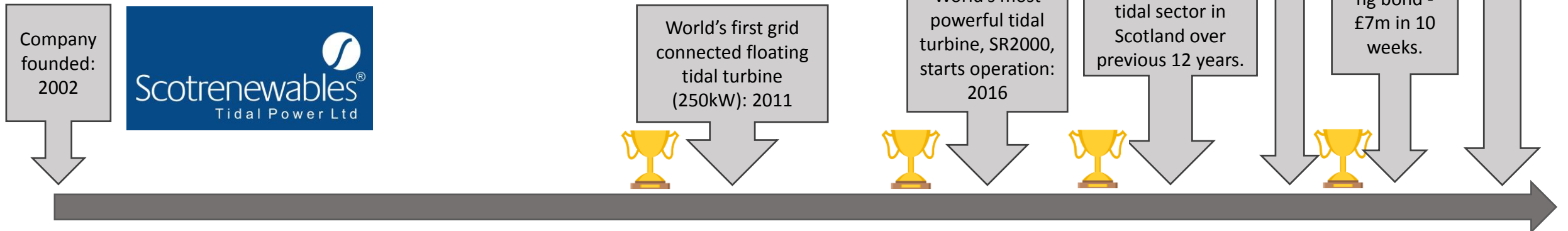
SR2000 exports  
more power  
(3GWh+) in 12  
months than  
entire wave &  
tidal sector in  
Scotland over  
previous 12 years.

Company  
raises UK's  
largest ever  
crowdfundi  
ng bond -  
£7m in 10  
weeks.

World's most  
powerful tidal  
turbine, SR2000,  
starts operation:  
2016

World's first grid  
connected floating  
tidal turbine  
(250kW): 2011

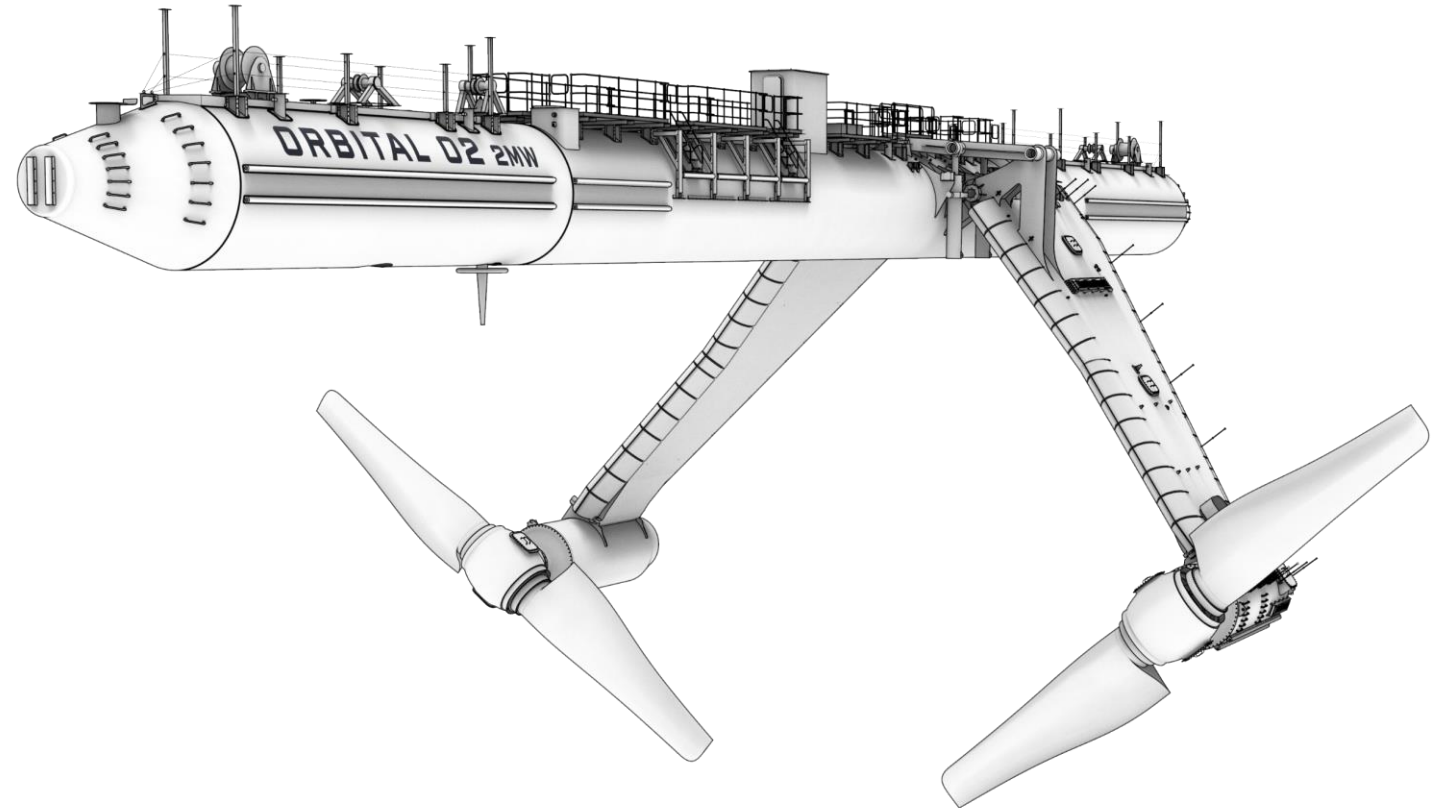
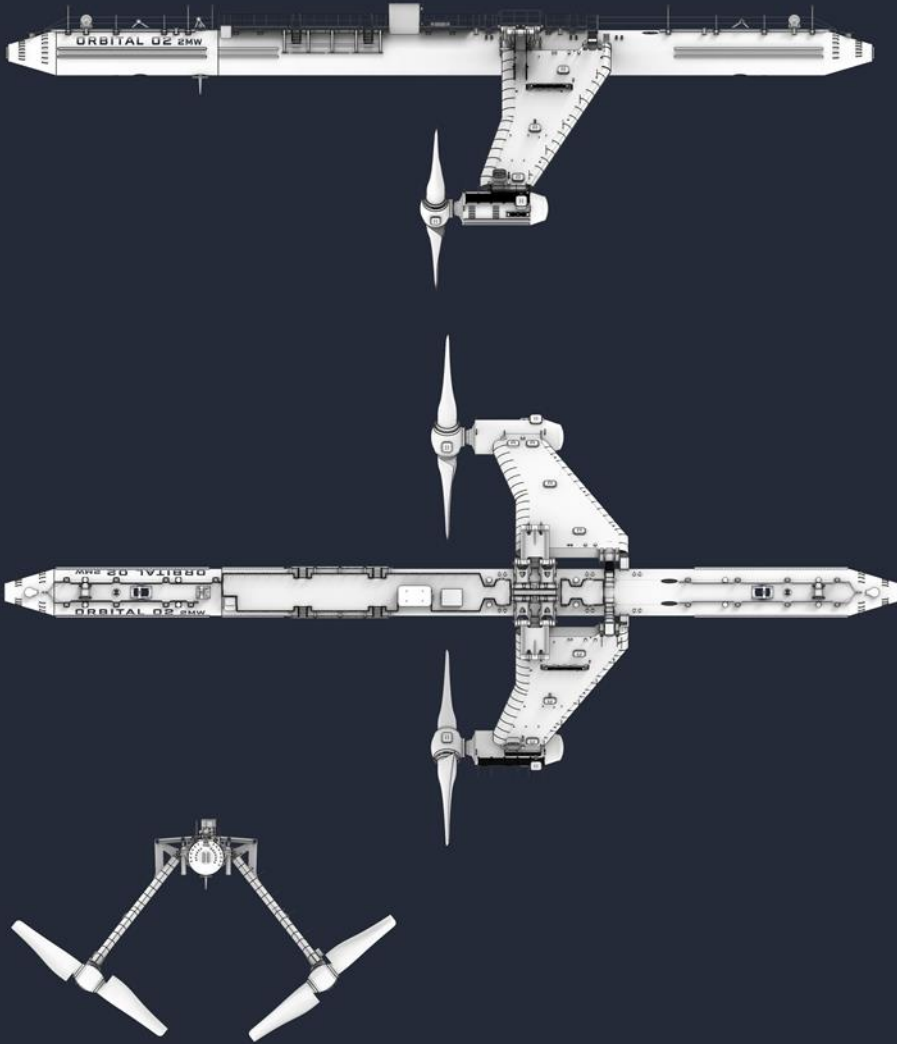
Company  
founded:  
2002



# What does Orbital Marine want to achieve.

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Unlock clean, predictable power for millions of people, homes and businesses around the world through the commercialisation of our proprietary technology and engineering know-how.



# Breakthrough Industry Project: SR1-2000

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- ✓ World's most powerful operating tidal turbine – 2MW.
- ✓ 2 x 1MW nacelles with 16m rotor diameters.
- ✓ Stall regulated control.
- ✓ 500T turbine mass.





# Construction Philosophy

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**Manufacturing process analogous to ship building.**

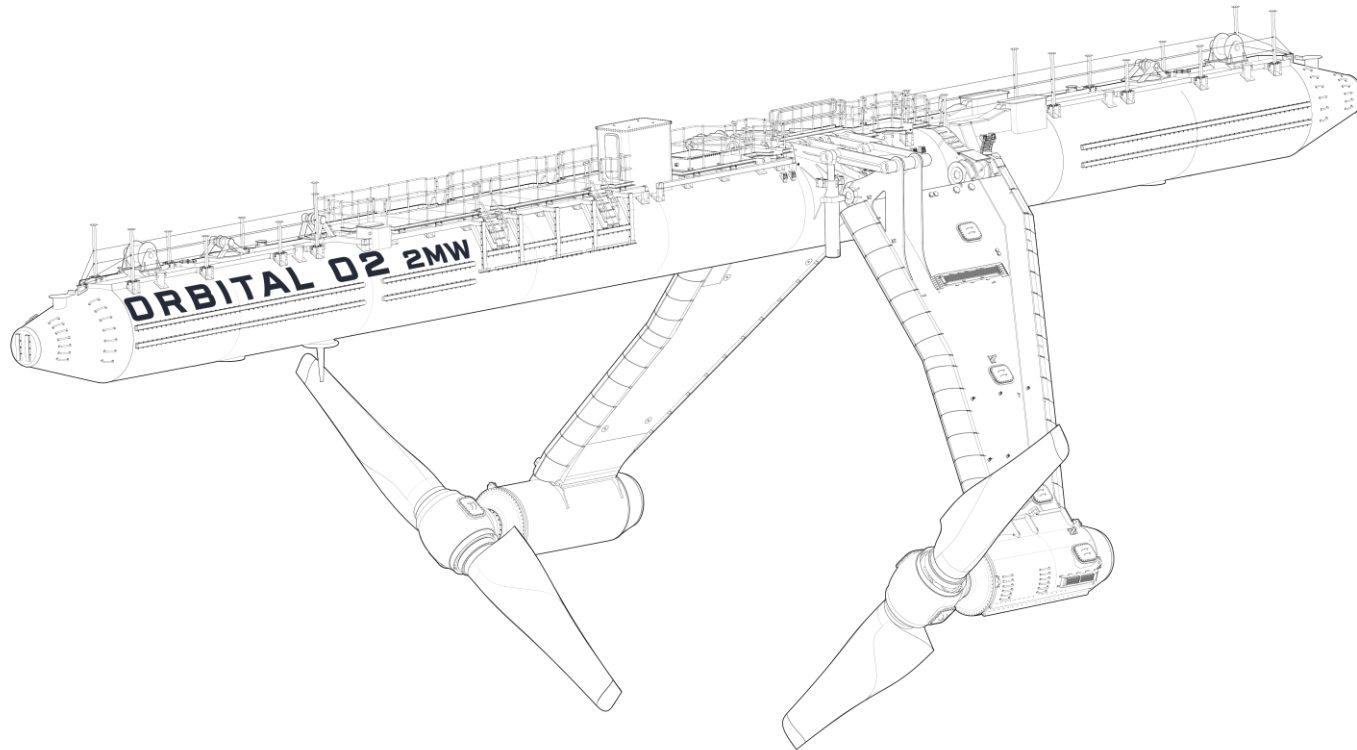
**No dependency on high cost specialist construction vessels.**

**Simplified, standard offshore operations involving moorings and cable installation.**



# O2 2MW floating tidal turbine.

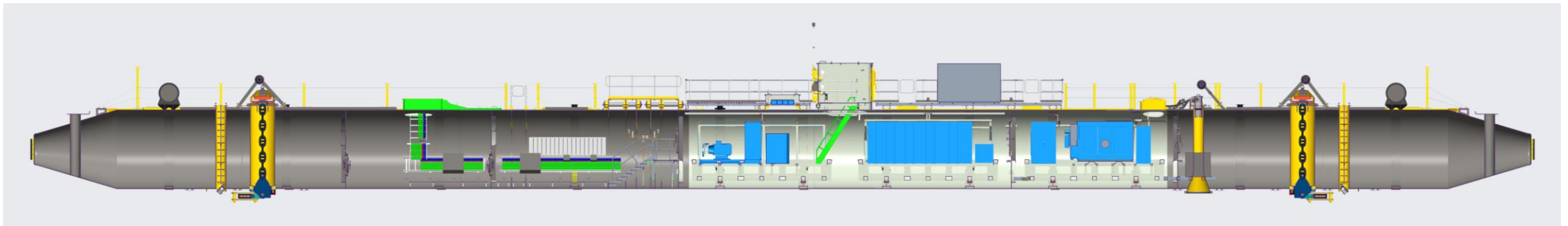
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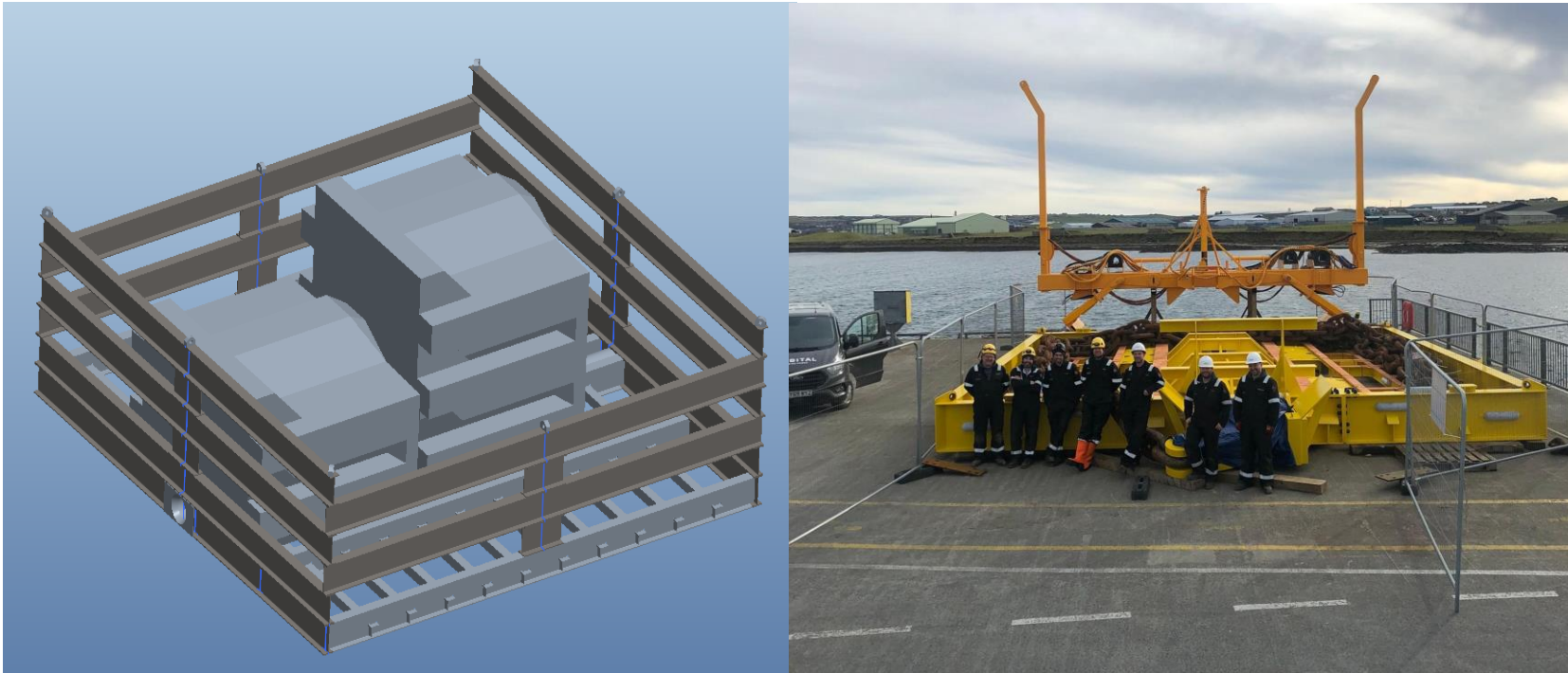
**MOST POWERFUL  
TIDAL TURBINE IN  
THE WORLD.**

**LARGEST EVER  
SWEPT AREA ON A  
TIDAL TURBINE.**

- 74m main tube structure @ 3.8m diameter.
- Two retractable leg structures.
- Hydraulic driven actuation system.
- Modularised equipment skids housed in main tube.
- Two 1MW nacelle in-line drive trains.
- Twin rotor pitching hubs.
- 10m composite rotors.
- Chain catenary mooring system forward and aft.
- Self-installing pull-in mooring connectors.
- Dynamic export cable with dry-mate deck connector.



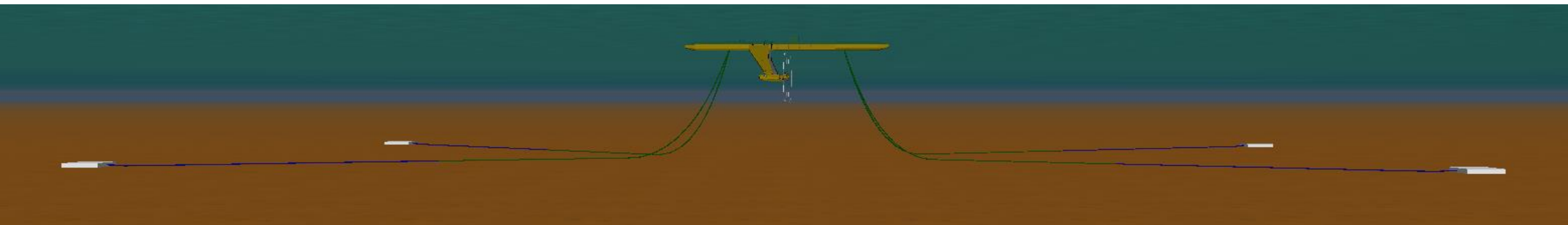
# O2 2MW floating tidal turbine.



## **MOST POWERFUL TIDAL TURBINE IN THE WORLD.**

### **ANCHORS**

- Gravity anchor steel frames
- Can use locally available ballast – concrete or steel
- Floating design ensures anchor fabrication decoupled from generating system





## O2 – Facilitating Supply Chain Engagement through design

- Superstructure – Easily road transportable – final assembly and fabrication facilities can be decoupled.
- Fabrication facilities can be inland or coastal
- O2 sea transport draught reduced to 3m though retractable leg design. Increases flexibility around choice of final assembly facility
- Standard steel fabrication, steel grades and welding techniques.
- Design to avoid complex welding operations
- Fabrication scope can be executed by both large and SME fabricators





# Local build contract examples– O2.



EMEC  
THE EUROPEAN MARINE ENERGY CENTRE LTD



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GRAY  
FABRICATION



LIBERTY



FAUN  
TRACKWAY



AC MARINE & COMPOSITES LTD

Location: Orkney Islands.  
Contractor: European Marine Energy Centre.  
Activity: Operation of installation site.

Location: Kirkwall, Orkney.  
Contractor: Orbital Marine Power.  
Activity: Electrical systems assembly.

Location: Coupar, Fife.  
Contractor: Gray Fabrication.  
Activity: Heavy steel fabrication.

Location: Motherwell.  
Contractor: Liberty Steel Dalzell.  
Activity: Main plate steel supplier.

Location: Llangefni, North Wales.  
Contractor: Faun Trackway.  
Activity: Anchor manufacturer.

Location: Gosport, Southampton.  
Contractor: AC Marine Composites.  
Activity: Blades



Location: Island of Eday.  
Contractor: Orbital Marine Power.  
Activity: Onshore grid connections.

Location: Fall of Warness.  
Contractor: Leask Marine.  
Activity: Mooring and cable installation.

Location: Dundee.  
Contractor: TEXO Group.  
Activity: Main turbine manufacture.

Location: Edinburgh.  
Contractor: Orbital Marine Power.  
Activity: Engineering & project management.

Location: Scunthorpe.  
Contractor: Bonds Heavy Castings.  
Activity: Load bearing heavy castings.

Location: Sheffield.  
Contractor: Shepcote Engineering.  
Activity: Hydraulic cylinder supply.



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LEASK  
MARINE



TEXO  
GROUP



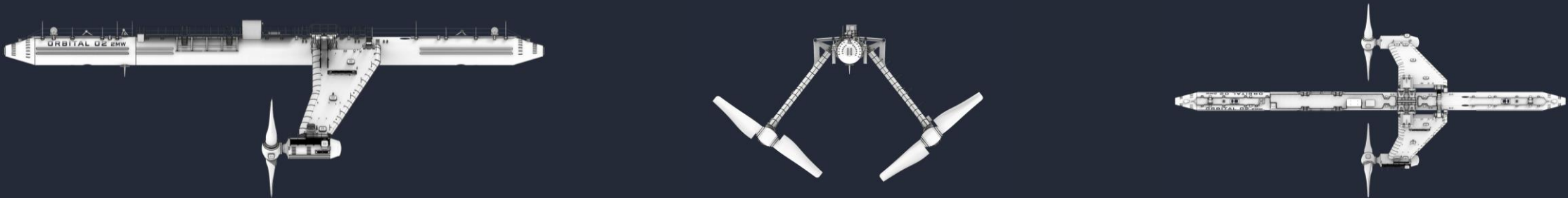
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Bonds



SHEPCOTE  
engineering

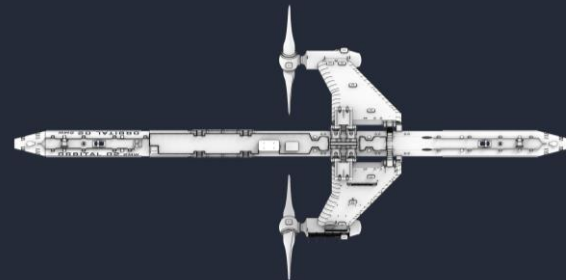
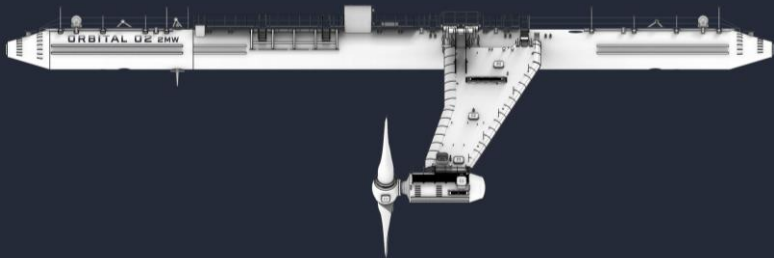
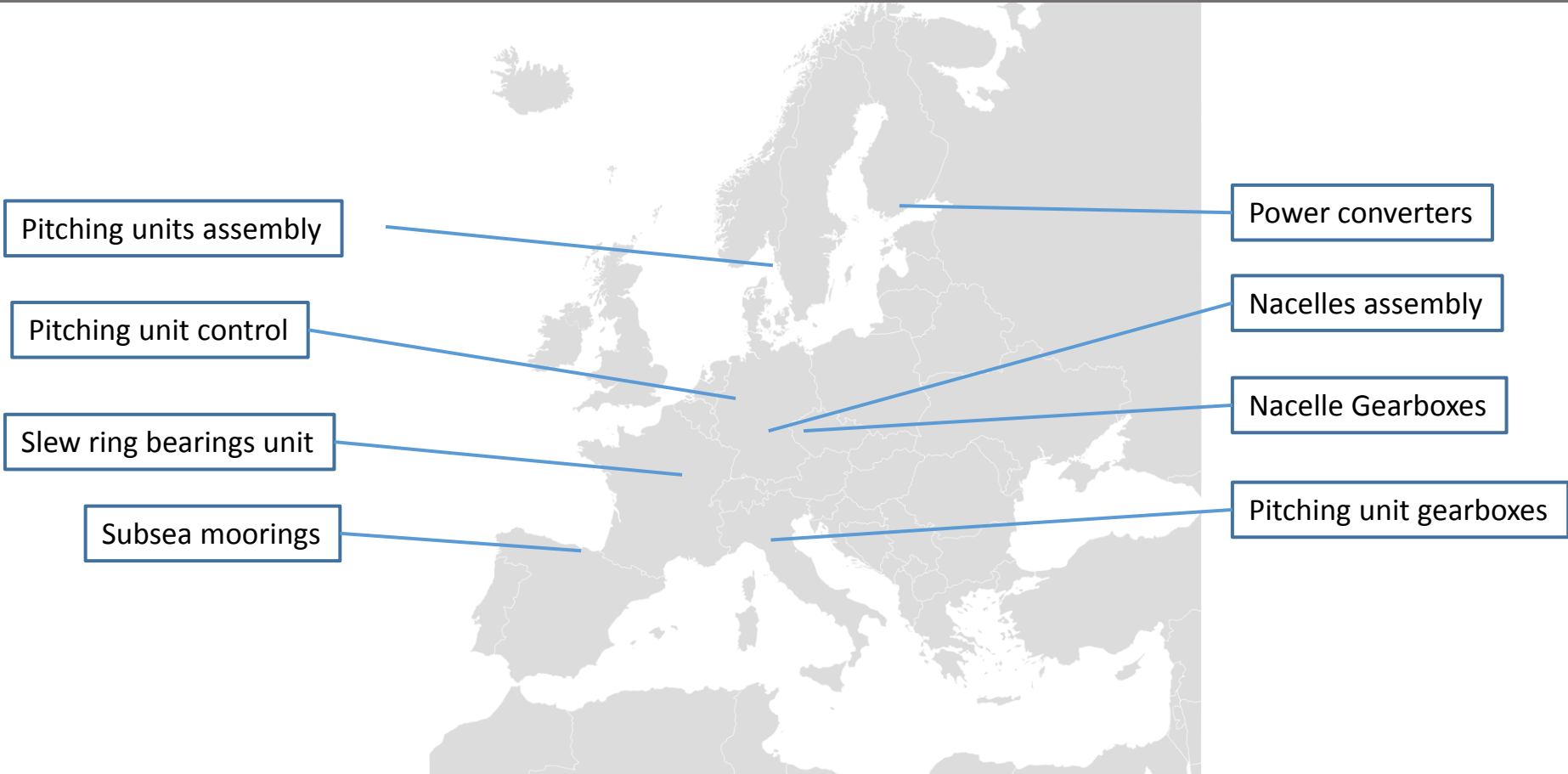


# Local build – steel fabrication opportunities

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# EU contract examples – O2.





# Powertrain – steel fabrication opportunities



Gearboxes completed testing and awaiting painting at Wikov in Czech republic



Gearbox testing

*Courtesy of SKF*



# Powertrain – steel fabrication opportunities



Mainshaft Unit Assembly



Nacelle cylinder segments

*Courtesy of SKF*

# Large Volume Production Study - Overview

- Economies of scale represent a clear cost reduction pathway for Orbital's Technology.
- This opportunity is presented through the production and deployment of multiple O2 Turbines as part of tidal energy arrays.
- Reduction in cost through:
  - Bulk order discount,
  - Learning by doing,
  - Optimisation and enhanced understanding of manufacturing processes/procedures,
  - Investment in tooling and facility development,
  - Standardisation of common components.
- Scope for a dedicated large volume production study is being defined and will:
  - Focus on the O2 Technology,
  - Consider individual sub-systems (e.g. hull, blades, moorings, powertrain),
  - Evaluate small and large scale array sizes and specific Project sites,
  - Consider the UK and EU supply chain and facilities,
- The study will incorporate value manufacturing and marine operations expertise.

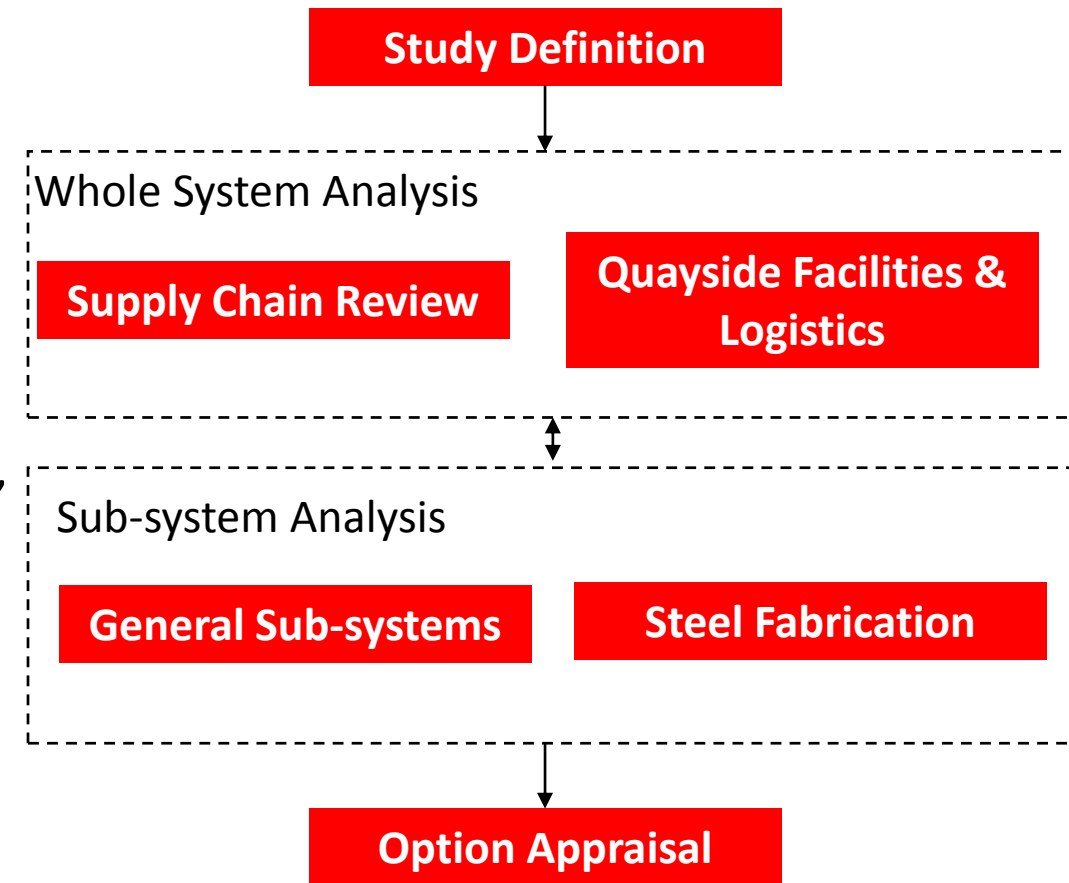


# Large Volume Production Study – Approach (1)

- **Study Definition:**
  - O2 Technology characteristics,
  - Project site(s) and array size(s),
  - Establish timeline/hit rate assumptions,
  - Establish political/funding assumptions.
- **Supply Chain Review:**
  - Engage with existing supply chain and facilities and complete capability review,
  - Evaluate strategies for production (whole system/modular, fabrication decoupled from assembly),
  - Identify potential for project specific facilities/supply chain,
  - Propose contract strategies for individual sub-systems.

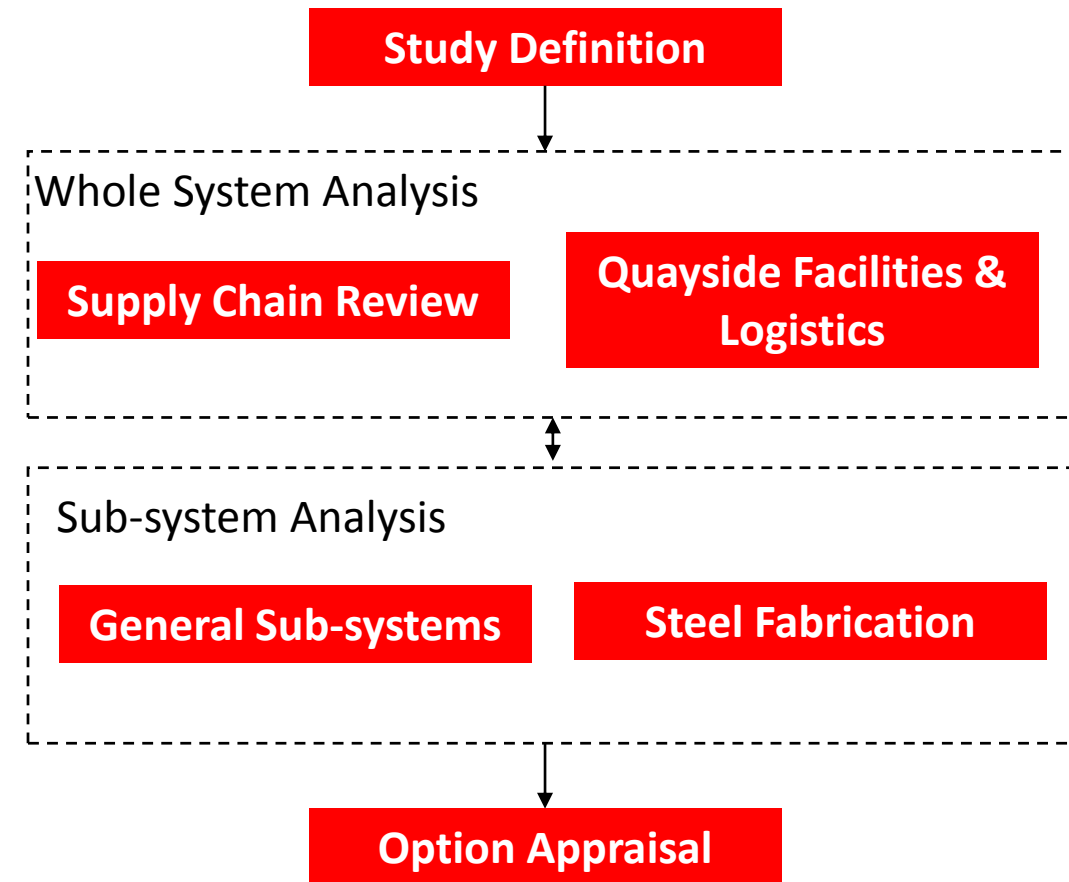
## Quayside Facilities & Logistics:

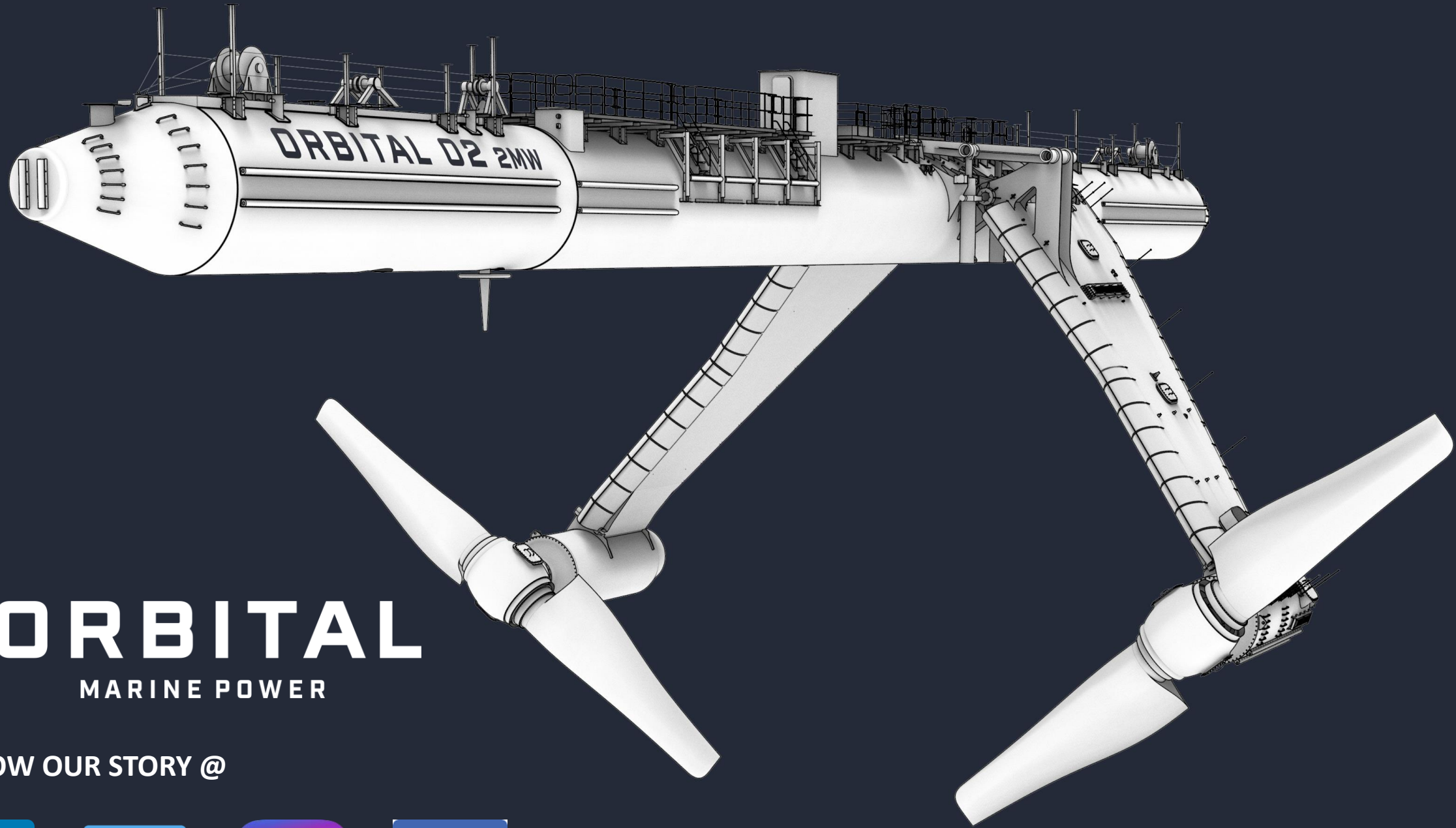
- Support Supply Chain Review,
- Review existing quayside infrastructure and constraints (logistics, load-out),
- Road & water access constraints.



# Large Volume Production Study – Approach (2)

- General sub-system analysis:
  - Suppliers to prepare CAPEX estimates for delivery of specific sub-systems (e.g. blades, electrical & mechanical).
- Steel Fabrication:
  - Supply engagement consider large and SME fabricators,
  - Adopt 'Issued for Construction' design,
  - Understand how the design will be fabricated and assembled given facilities/equipment,
  - Develop CAPEX estimates.
- Option Appraisal:
  - Techno-economic assessment to determine cost benefits,
  - Review conclusions against other project sites.





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