

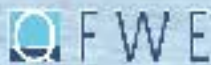
Floating Wind Solutions

Serial Fabrication to Facilitate Commercial Scale

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Quest Offshore

The logo for Floating Wind Solutions (FWS), featuring a stylized blue and white graphic of a wind turbine nacelle and tower, with the letters "FWS" in a bold, blue, sans-serif font.

FWS

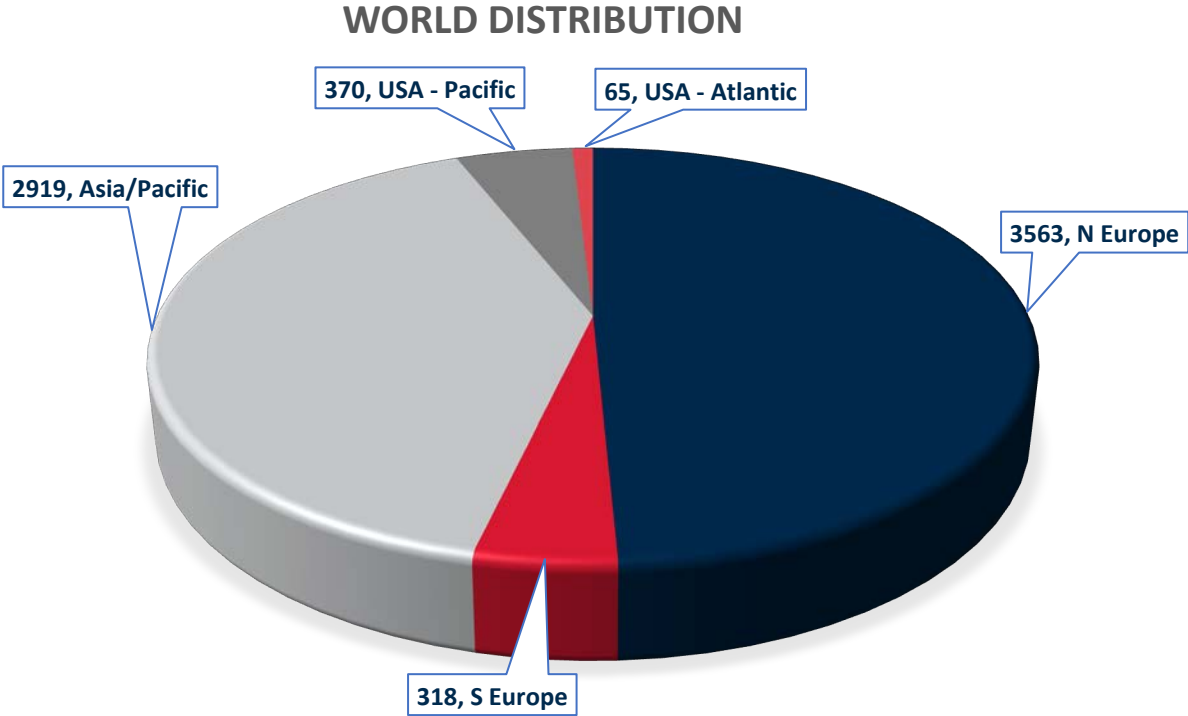
The Marriott Marquis, Houston 1-3 March 2022

About ABS

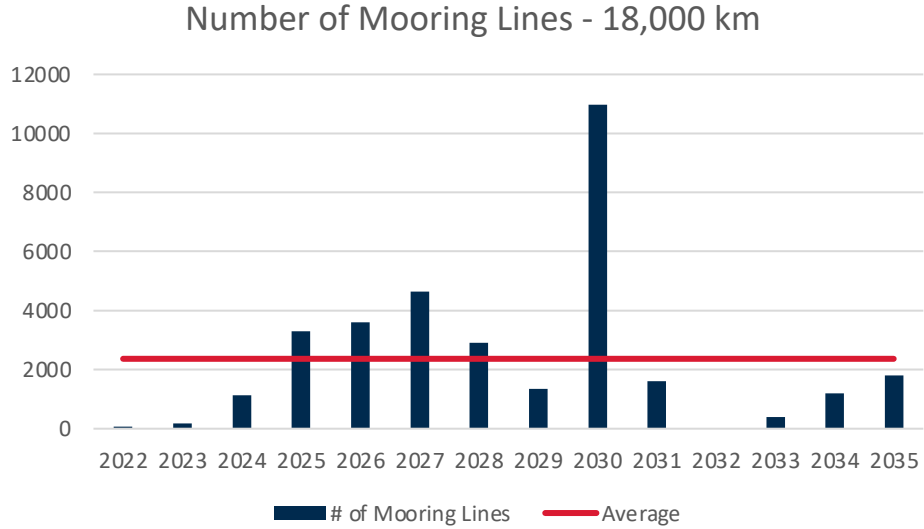
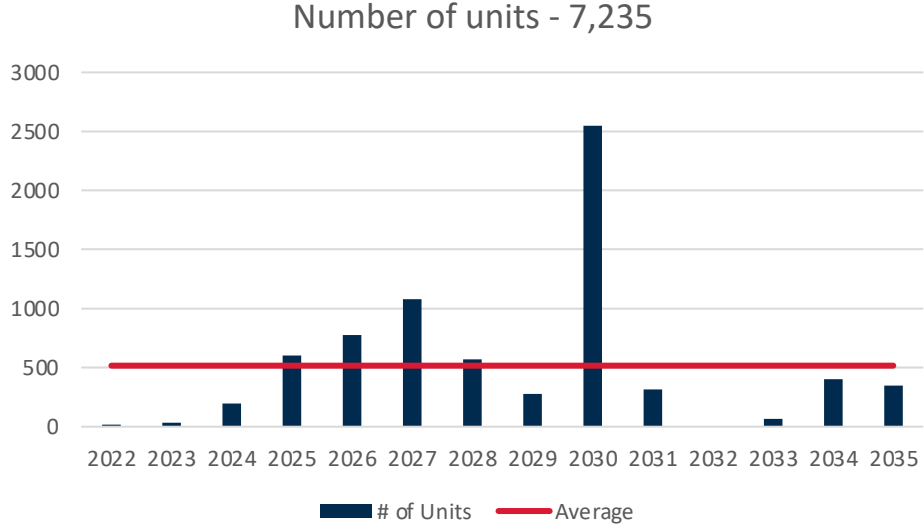
The mission of the American Bureau of Shipping (ABS) is to serve the public interest as well as the needs of our members and clients by promoting the security of life and property and preserving the natural environment

- Founded in 1862 by 9 U.S. marine insurance companies
- ‘Not-For-Profit’ Marine Classification Society
- No owners/shareholders, ABS Board of Directors are appointed from its Members
- ABS Members are the owners, operators, designers and builders of ships, offshore units and associated equipment
- ABS as a class society represents industry and helps:
 - Design
 - Construction
 - Operational maintenance
- Headquarters – Houston, Texas
- Employees: 4,000 globally, 1,300 U.S.
- 200 offices in 70 countries

Why talk about serial production from an industry perspective



Based on Quest Database 2 February 2022



Why talk about serial production from a class perspective

- The hull and mooring of a floating wind turbine is similar in construction to known oil and gas platforms BUT:
 - Instead of manufacturing one unique unit at a time, FOWT will require multiple identical units to be fabricated in parallel
 - Installation will be an ongoing process over a long period of time
 - Inspections will be an ongoing process, not a once-a-year event
 - Quality, consistency and record keeping will be key
- It is important that we do not start from scratch but build on past experiences



How do we do it

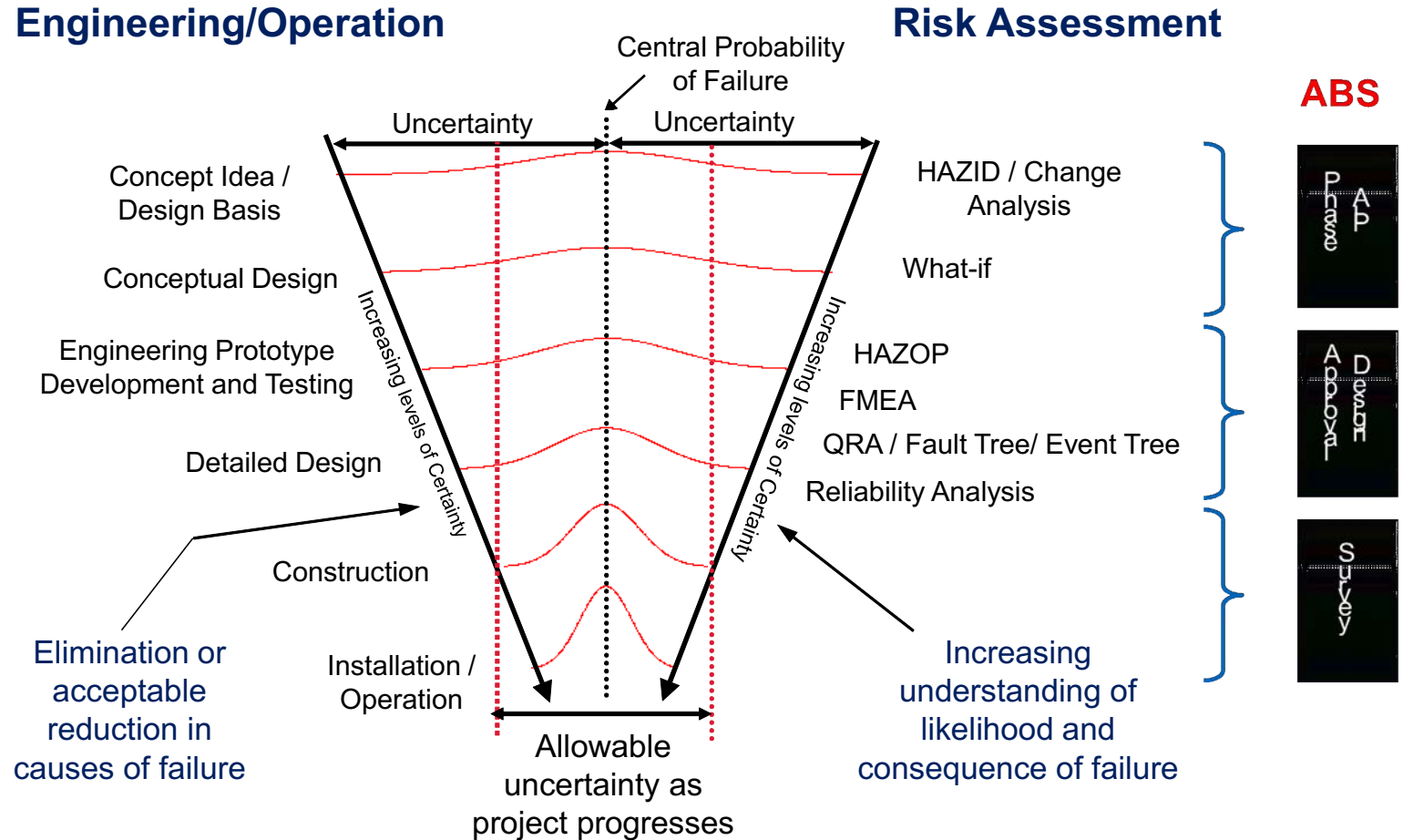
- Develop standards with industry participation (Rules and Guides)
- Design review and approval
- Surveys during construction
- Surveys during installation
- Periodic surveys to maintain Class



Floating Wind Solutions

Initial phases

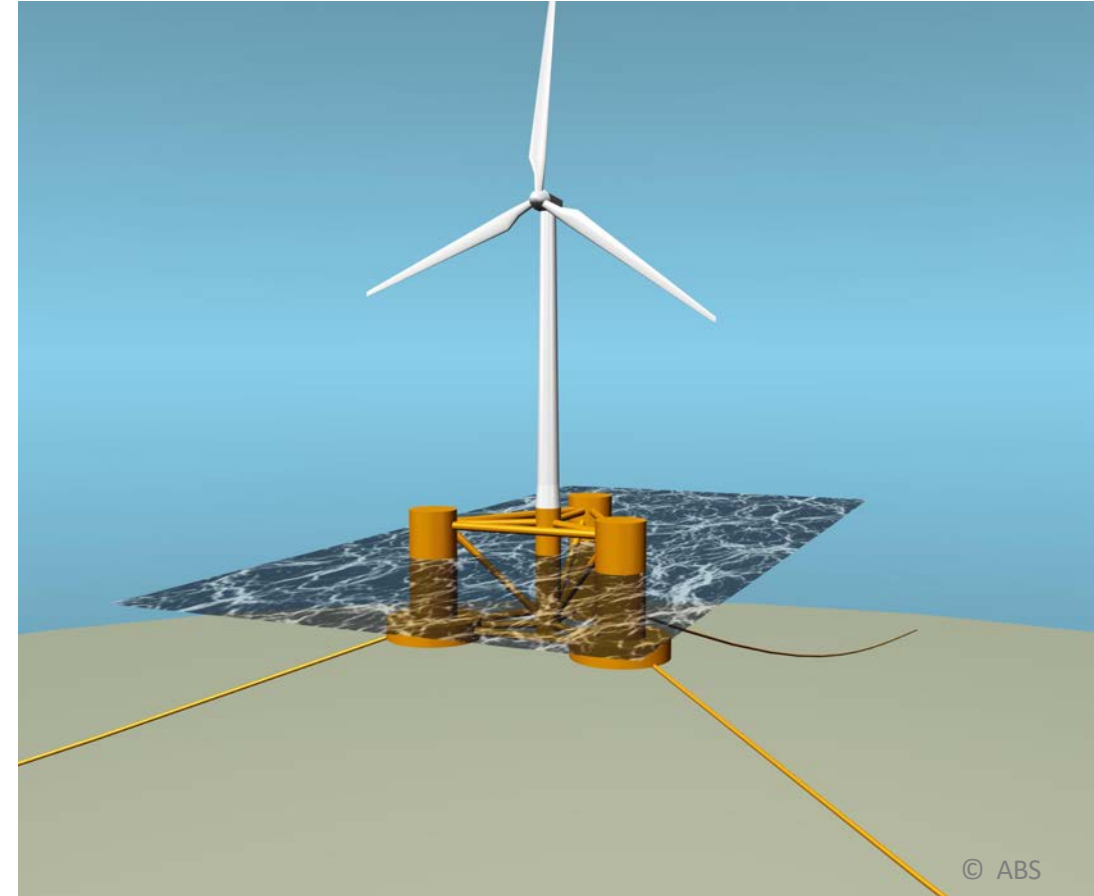
- **Preliminary Planning and Advice (PPA)**
- ABS personnel will discuss the design item in question and provide input as to the potential conformance with the design standards and other agreed requirements
- **Approval in Principle (AIP)**
- ABS will perform design review of significant design documents to verify the feasibility of the concept
- **New Technology Qualification (NTQ)**
- ABS will perform a systematic and consistent evaluation of new technologies as they mature from a concept through confirmation of operational integrity



Do not forget fabricability, operation and maintenance in the early phases

Design Phase

- It is important to be able to build on past experiences and not to have to start from scratch for each project
- The design for one development may be based on a previous design
- During the development of one project, there may be changes due to optimizations or fabrications issues.
- It is important to catch what is different in order to understand the unique aspects of each unit



Fabrication Phase

- It is not likely all units for one development will be fabricated at one yard
- Independent of the number of fabrication locations, the final product must be the same
- One independent third party overseeing the process with a consistent set of procedures will increase the chances to achieve identical units



Installation Phase

- For a field consisting of up to 100 units unexpected things will happen during installation
- The ABS surveyor will verify;
 - Installation follows approved procedures
 - All components have valid certificate
 - No damage occurred during transportation
 - Anchor point location
 - Mooring pre-tension
- Following procedures and recording any deviations is key



Operation

- Having multiple identical units subject to the same environment is different from class as we know it
- Survey scheme and Survey interval will be different
 - Risk-based inspections
- Inspection techniques will be different
 - Remote inspections
- Surveys dates will be aligned and scheduled to ensure power production is not impacted



Summary

Based on our experience of 80 MW of installed Floating Offshore Wind, ABS learned the following:

- Involving class will assist in all phases of the development to achieve consistency throughout the life of the units independent of number of manufacturing locations
- Recordkeeping over life of the development is key
- Class has the majority of the tools to support large scale serial production in place already



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Thank You

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