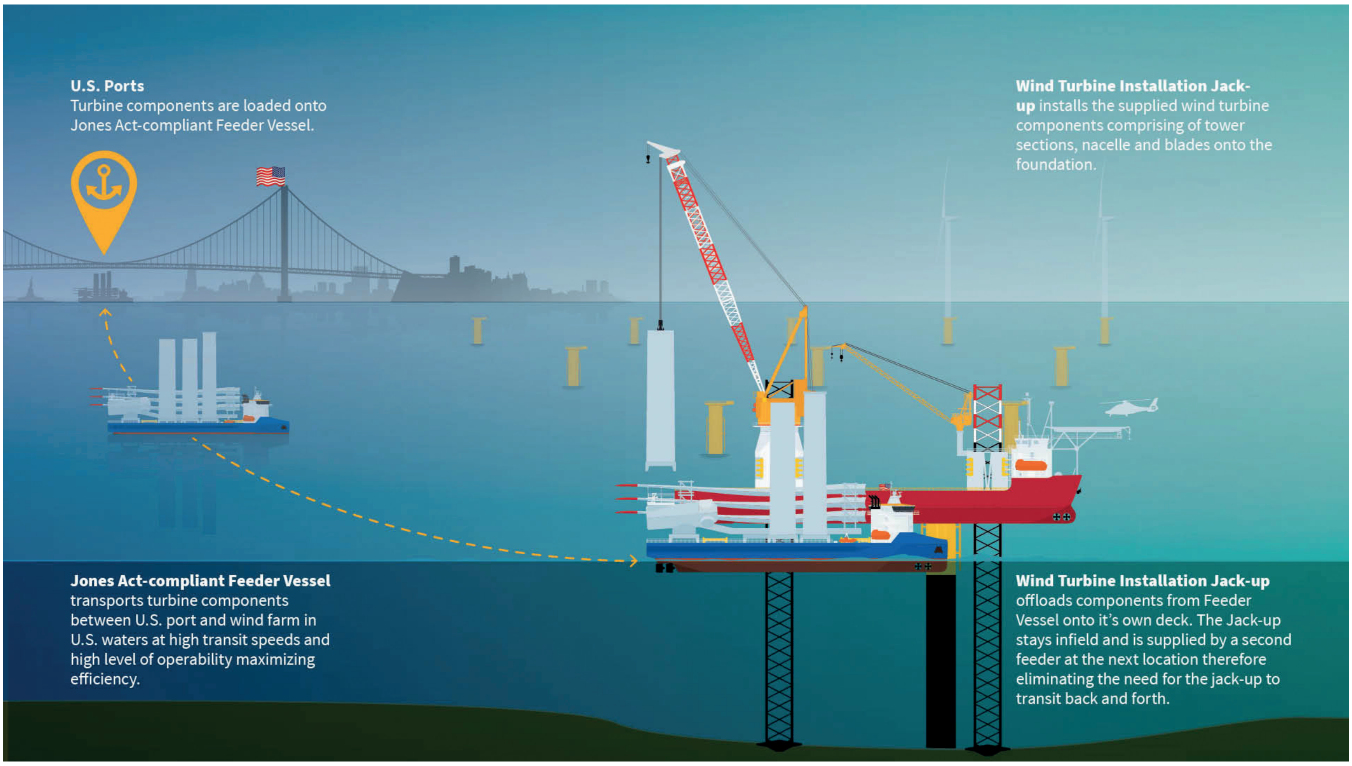
Game-changing feeder solution integrates proven technology to support alternate T&I model

The first wind turbines were often installed using existing jack-ups, originally built for civil construction or oil and gas service markets. Then the industry invested in a fleet of purpose-built wind turbine installation vessels (WTIV) jack-ups. Now, current trends and developments in the offshore wind industry are shaping the installation fleet of the future. An increasing volume of wind turbine installations and turbine weights, as well as the heavier and taller cranes require owners to modify existing jack-ups and invest in new, larger WTIV jack-ups. At the same time, turbine installations are moving to deeper waters farther offshore, requiring jack-ups adapted for these conditions. Additionally, the offshore wind market has expanded into new territories, including Japan, Taiwan and the United States. US offshore wind faces particular challenges due to the Jones Act and a lack of suitable ports on the East Coast. Accordingly, the use of traditional self-transiting installation jack-ups is being challenged by alternative concepts, such as the new Steady Top Feeder Vessel from GustoMSC.



Addressing new challenges with an alternative model

The use of self-transiting WTIV jack-ups has been the predominant transport and installation (T&I) model for offshore wind turbine installation to date. The WTIV jack-up loads multiple turbines in port using its own onboard crane, which it then sails to the offshore wind farm. Next, the jack-up positions itself next to a turbine foundation and elevates on its legs to provide a stable installation platform. It installs the turbine components from its own deck on the turbine foundation, then jacks down, refloats and sails to the next foundation location. When the jack-up is empty, it returns to port for reloading and repeats the cycle.

An alternative to this traditional T&I model uses feeder vessels to transit components from port to site and use a separate installation vessel for the lifting operations. The feeder vessel is loaded with turbine components in port using an onshore crane or SPMTs and then sails to the offshore wind farm. The feeder vessel positions itself next to an installation WTIV jack-up that is already on site, which lifts turbine components from the feeder vessel's deck and installs the components on the turbine foundation. Finally, the feeder vessel sails back to port for reloading to repeat the cycle, and the WTIV jack-up moves to the next location.

Typically, two feeder vessels would be used to support an installation jack-up, but one feeder vessel may be sufficient when the resulting waiting time is not a factor or three feeder vessels may be required for projects that are located far from port.

Initial concept

In 2018, GustoMSC developed an initial Steady Top Feeder Barge concept to meet requirements for US projects awarded at the time and planned for the following years.

This first iteration was based on existing and available equipment, namely the BM-T700 motion compensation platform from Barge Master B.V., and existing 300 ft US barges and modular thruster systems.

By using existing equipment, the concept could be put together in a relatively short time frame with minimal investment allowing the concept to be applied on a per-project basis without the long-term investment required for a new-build vessel. And the motion compensated DP barge allowed for relatively high workability and reduced risk of feedering operation compared to other floating feeder operations.

The concept was worked out in detail and reported in an operational procedure report for review by marine warranty surveyor LOC and various industry stakeholders. LOC provided its 'approval in principle' for the concept in 2019.

This effort led to an understanding of the DP and achievable motion compensation performance and the resulting level of workability. It also led to an understanding of the challenges in handling, hook-on and release of turbine components, as well as the development of ancillary solutions for these aspects.

Issues for the initial concept

A higher than expected cost and required investment horizon when using this initial approach, based on existing equipment quickly became apparent however.

Though BM-T700 motion compensation platforms and modular thruster systems are existing and proven products, they are not widely available for commercial lease. As a result, the cost for the solution on a per-project basis is high and a longer-term investment horizon is required.

Furthermore, the emergence of larger, next-generation offshore wind turbines led to the realization that the Steady Top Feeder Barge concept would not scale to these next generation turbines. Larger motion compensation platforms would be required to handle the larger components.

Based on the combination of these two findings, GustoMSC developed a more integrated and well-tuned solution as an efficient, capable and future-proof solution for the offshore wind industry: the Steady Top Feeder Vessel (STFV).

The fully integrated Steady Top Feeder Vessel (STFV)

The STFV is a fully integrated solution based on proven technology, specially designed to load WTG components in port and transport them to the field.

The STFV features the BM-T1500G integrated motion compensation platform capable of compensating motions for components up to 1,250 tons in offshore environments. This makes the platform suitable for next-generation offshore wind turbines comprising nacelles, towers (in sections) and blades (in a rack).

The BM-T1500G motion compensation platform is a joint development in partnership with Barge Master B.V. It's based on the existing and proven BM-T700 motion compensation platform, which has two units in operation today, with the main differences being the increased capacity, stroke and velocity of the platform to reach the required performance, as well as the integration of the platform with the vessel. Where the BM-T700 system is designed for modular transport and installation on a subject vessel deck, the BM-T1500G platform is designed to be integrated in the hull of the STFV and in a retracted position flush with the skidding deck.

At site in dynamic positioning mode, a dedicated WTIV jack-up will lift-off WTG components safely from the motion compensation platform while maximizing workability in the offshore environment. Via the skidding system, components are transferred from their storage positions to the motion compensation platform one at a time for lift-off. Optimized main dimensions and hull design of the STFV offer a high transit speed, improved motion behavior for maximum workability, low air-draft and small beam for increased port access, and a low depth to allow for port loading using multi-wheelers (SPMTs).

Considerations for the T&I models

There are a number of real and perceived differences between the two T&I models, and some considerations must be made.

In particular, pivoting to the feeder model using the STFV in the US is a way to comply with the Jones Act. The Jones Act requires that vessels transporting merchandise, including offshore wind turbine components, from one point to another within the US need to be US-built, US-flagged, and manned and owned by US citizens. In the absence of Jones Act –compliant installation jack-ups, none of which currently exist, foreign WTIV jack-ups can be used when feedered by Jones Act–compliant vessels.

Other considerations include:

1. Floating vs jack-up feeders

   The feeders can either be jack-up feeders or floating feeders. Jack-up feeders have the advantage that the required lifts are fixed-to-fixed lifts without any significant influence of wave induced motions. For floating feeders, the motion behavior of the floating vessel in waves will limit the conditions in which these lifts can safely take place. In order to arrive at acceptable workability levels, some form of motion behavior is required.

2. Port access

   The ports accessible to feeder or installation jack-ups are limited by the large air drafts caused by their long legs. Floating feeder vessels with limited air drafts can sail under bridges and therefore access ports that would be inaccessible to self-transiting WTIV jack-ups.

3. Port infrastructure

   Self-transiting installation jack-ups typically use their main crane for port loading, but in order to do so, typically need to jack-up in port. In some ports, jacking may be an issue due to the soil properties or quayside bulkhead properties. Feeder vessels, on the other hand, would need to rely on a shore crane or SPMTs for loading. Each model operates under different constraints and therefore may be more or less suited for use in particular ports.

4. Utilization of WTIV jack-ups

   Using the feeder model, the WTIV jack-up is not required to transit from and back to the port, potentially allowing for a shorter project schedule and higher utilization of the jack-up. This is, however, only the case when the feeders efficiently feed components avoiding supply gaps and additional weather downtime.

5. Size of jack-up

   A jack-up's size and cost are typically dictated by the variable load capacity (payload), as well as by the crane capacity. A WTIV jack-up that is not required to transit with cargo can potentially be smaller and less expensive, provided that it has the crane capacity and lifting height to pick up and install the components.

'To expand quickly, the US offshore wind energy supply chain will have to team up with European players in order to kick-start and to meet the target timelines.'

6. Constructability

   Feeder vessels or jack-ups are smaller and simpler vessels to build than large WTIV jack-ups. As a result, they may be easier to contract at a yard. Also, construction times will be shorter.

7. Versatility and utilization of feeder assets

   A feeder vessel or jack-up may be used for other purposes than feedering, adding to the utilization and lifetime of the asset, and thereby potentially lowering the charter cost.

STFV supports US offshore ambitions

The new US administration has growing ambitions for offshore wind energy, setting targets to expand to 30 GW of offshore wind energy by 2030 and to have 110 GW in place by 2050.

The current focus in the US is on development of bottom fixed wind along the US East Coast. The Northeast has a very good wind resource in relatively shallow water conditions and is located close to population centers in need of renewable energy. States in the region also see offshore wind as a promising new industry from which they wish to reap economic benefits. This is an ideal combination that will fuel the development of the US offshore wind industry.

To expand quickly, the US offshore wind energy supply chain will have to team up with European players in order to kick-start and to meet the target timelines. Many recent developments and investments strongly rely on US–EU partnerships that build on European offshore wind experience and local American manufacturing. In these cases, the STFV provides an attractive alternative or complement to the traditional self-transiting installation jack-up concept.

Ultimately the choice between the different solutions will be determined by which model is more economically attractive. The cost of the feeders will increase the total cost of the spread. However, if additional costs can be offset by cost savings due to reduced project durations and a reduction in hired installation assets, port facilities, and more, it may be worth the additional cost. And specifically for the US, the additional premium for a Jones Act WTIV jack-up will potentially tip the scale in favor of feeders.

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