Maine Floating Offshore Wind Terminal

Launch Barge Development and Estimate

PREPARED FOR:					
MOFFATT & NICHOL					
AUTHOR:	CLB		4/29/2024		
REVIEWER:					
DOC:	40-00640-100-02	**REV:**	0	**DATE:**	April 29, 2024

In June of 2023 a study of various methods for launching large floating structures from the proposed Searsport pier was conducted (Ref Doc 40-00640-100-01). Out of this study, the concept of using two large deck barges, joined together and outfitted to be submerged, was determined to be a viable concept.

Since then, the design hull size and weight have been adjusted, and the design elevation of the pier has been finalized. No further engineering has been completed on the launch barge concept.

Pier Criteria:

- Pier Elevation: +15ft NAD
- MLLW: - 5.84ft
- Total Design Dock Freeboard at MLLW: 20.84

Floating Foundation Design Criteria:

- 20,000mt
- Footprint 333ft x 300ft
- Allowable overhang: TBD

Submersible Launch Barge Criteria:

- The primary mission to be designed to launch the floating foundation from the intended Pier Face
    - Ballast System capable of keeping the barge deck even with the pier face during loadout operations. Primary power TBD.
    - Joining or connecting structure for the barges to be able to function as a single ridged unit. The system is to be designed to be field installed.
    - Buoyancy towers design to allow the barges to be submerged for float-off operations
- Two independent hulls capable of functioning as independent deck barges
- Steel Hull – Designed to ABS Barge Rules

Submersible Launch Barge Development Path:

To further develop the launch barge concept a feasibility study to determine the principal dimensions and arrangements for (2) launch barges which can be combined to carry a 20,000 MT offshore wind floating platform with the capability to submerge and launch the platform at sea. Additionally, the depth of the barges must be able to accommodate loading the platform at a marine bulkhead located at 20.84' above mean lower low water.

The total engineering effort can be planned into distinct phases which progressively increase in the level of technical design detail. Each project phase will conclude with the achievement of specific project milestones as described below. However, some overlap between phases towards meeting the program schedule. The breakdown of work into these Design Sequences have proven successful on recent new builds for barges.

DESIGN SEQUENCE
The overall project design/consulting would be completed as follows:

• Phase 1a: Feasibility Study (determine barge major characteristics and regulatory requirements)
• Phase 1b: Preliminary Design (for construction budgetary pricing)
• Phase 2: Contract Design (for full classification design review and fixed-price shipyard bidding)
• Phase 3: Production Design (3D modeling of structure and piping systems for construction); if required.
• Phase 4: Contract and Construction Technical Support

Phase 1a: Feasibility Study

This phase develops the initial barge layout principal dimensions and establishes the primary barge design characteristics. We will then develop the barge's midship scantlings per ABS Rules for Building and Classing Steel Barges, review hull-girder longitudinal strength and still water bending moment based on that midbody structure and create a weight estimate.

By the end of this phase, the following deliverables will be developed and provided:
o Structural Midship Section Drawing
o Preliminary Steel Weight Estimate and Stability Assessment
o Outline Specification demonstrating the design philosophy, mission & system requirements and regulatory notations sought.

Phase 1a Estimate:
• ***Estimated Fee Range: $42,500 to $49,000 (Time and Materials)***
• Schedule: 3 - 4 weeks
• Phase Milestone(s): Barge design concept package for customer review

Phase 1b: Preliminary Design
Phase 1b Preliminary design tasks and deliverables to support obtaining shipyard budgetary pricing:
o Concept General Arrangement Drawing
o Concept Machinery Arrangement/Equipment List
o Ballast System Diagram

Phase 1b Estimate:
• ***Estimated Fee Range: $39,000 to $43,700 (Time and Materials)***
• Phase Milestone(s): Barge design details to support Shipyard budgetary pricing.
Note the optional tasks can be accomplished nearly concurrently with the other feasibility study tasks so we estimate adding 1 week to the Phase 1a schedule for completion of both the Phase 1a and 1b tasks and deliverables.

Phase 2: Contract Design

Phase 2 would build on phase 1a&b design to fully develop a package that would result in a packed to get firm pricing from the shipyard and go through the ABS review process. A detailed scope of this phase would be developed as part of phase 1 but is estimated to take between 6-10 months with a rough order of magnitude ***and with a cost of $2.5 million.***

Phase 3: Production Design
Phase 3 takes the contract-based design and develops it into production-ready work packages that the yard will use to sequence its build process and provide guidance on how the shipyard works on each piece of steel, piping, and machinery that will be used to make up the vessel and the platform. This work scope is often part of the contract with the shipyard and overlaps with the vessel's construction. While third parties can be utilized to develop this production engineering, the sequencing and construction methodology are highly dependent on the selected shipyard.

Phase 4: Construction Management
Phase 4 assumes that a shipyard has been selected and the vessel will move from an engineering phase to a construction phase. During this, there will need to owners representation in the shipyard to manage the build process. This allows for the shipyard to get questions answered and make decisions on building details. Furthermore, it allows the building process to be monitored to ensure the build schedule is tracked with the plan and the quality of the work is in line with the shipyard contract.

Schedule

Phase 1a: Feasibility Study – 3-4 Weeks
Phase 1b: Preliminary Design -1 Week if concurrent with Phase 1a
Phase 2: Contract Design – 6-12 months
Phase 3: Production Design – 3-6 months prior to cutting steel
Shipyard construction – 18 to 28 months
Delivery and Final Assembly – 1-2 months

Rough Order of Magnitude Costs

With the purpose-built barge platform structure being only conceptual at this stage, a parametric cost-estimating approach can be used to determine preliminary estimates. With the majority of construction materials being steel, structural weight is the most accessible metric to compare against similar completed projects or scale from recent construction estimates.

In order to arrive at the hull, tower, and interconnection structural weights, existing barge designs were used as a guide. Scaling these designs and utilizing the as-built weights based on the principal dimensions of this concept provides a very rough estimate of the potential weight of this structure. This does not consider a particular arrangement or preliminary structural calculation.

Many shipyards within the US are capable, and some specialize in building barge and barge-like structures. Recent barge designs of have been quoted and contracted. This study did not include enough detail to get independent estimates from these yards for this particular design. In order to arrive at a rough order of magnitude price for the concept, several similar barge quotes have been used to arrive at range of average construction cost based on dollars per pound of steel being fabricated. These ranged from $3.32/lb to $5.52/lb. Using $4.40/lb. average we have arrived at the below range of potential costs.

Steel Estimated Based on new	3.32	$/lb - Lowest New Build Barge Estimate
construction barge estimates	5.59	$/lb - Highest New Build Barge Estimate
with average dollars per	4.4	$/lb - Average Used for ROM Estimate
weight for fabrication	9698	$/mt

	Wt Per Engr Est. (mt)	Low Estimate	ROM per Engr Est	High Estimate
Phase 1a 1b Engineering		$ 81,500	$ 87,100	$ 92,700
Phase 2-3 Engineering		$ 2,300,000	$ 2,500,000	$ 3,000,000
2 New Built Barge Structures	12,704	$ 92,960,000	$ 123,200,000	$ 159,076,588
2 New Built Tower Structures	2,062	$ 15,088,123	$ 19,996,308	$ 25,819,354
Connecting system.	508	$ 3,718,400	$ 4,928,000	$ 6,363,064
Ballasting system		$ 15,000,000	$ 20,000,000	$ 45,000,000
Construction Management		$ 500,000	$ 1,000,000	$ 1,500,000
ROM Delivery (Assuming GOM Yard)		$ 800,000	$ 1,200,000	$ 1,600,000
ROM Total		$ 130,448,023	$ 172,911,408	$ 242,451,705

Typically, a parametric cost estimating approach is employed when limited to no design details are known. The resulting cost estimation accuracy is generally considered no better than 25%. With the assumption in this estimate scaling from known smaller barges to larger structures, these cost estimates do not account for the added logistics complexities associated as well as develop and testing of the barge connection details.