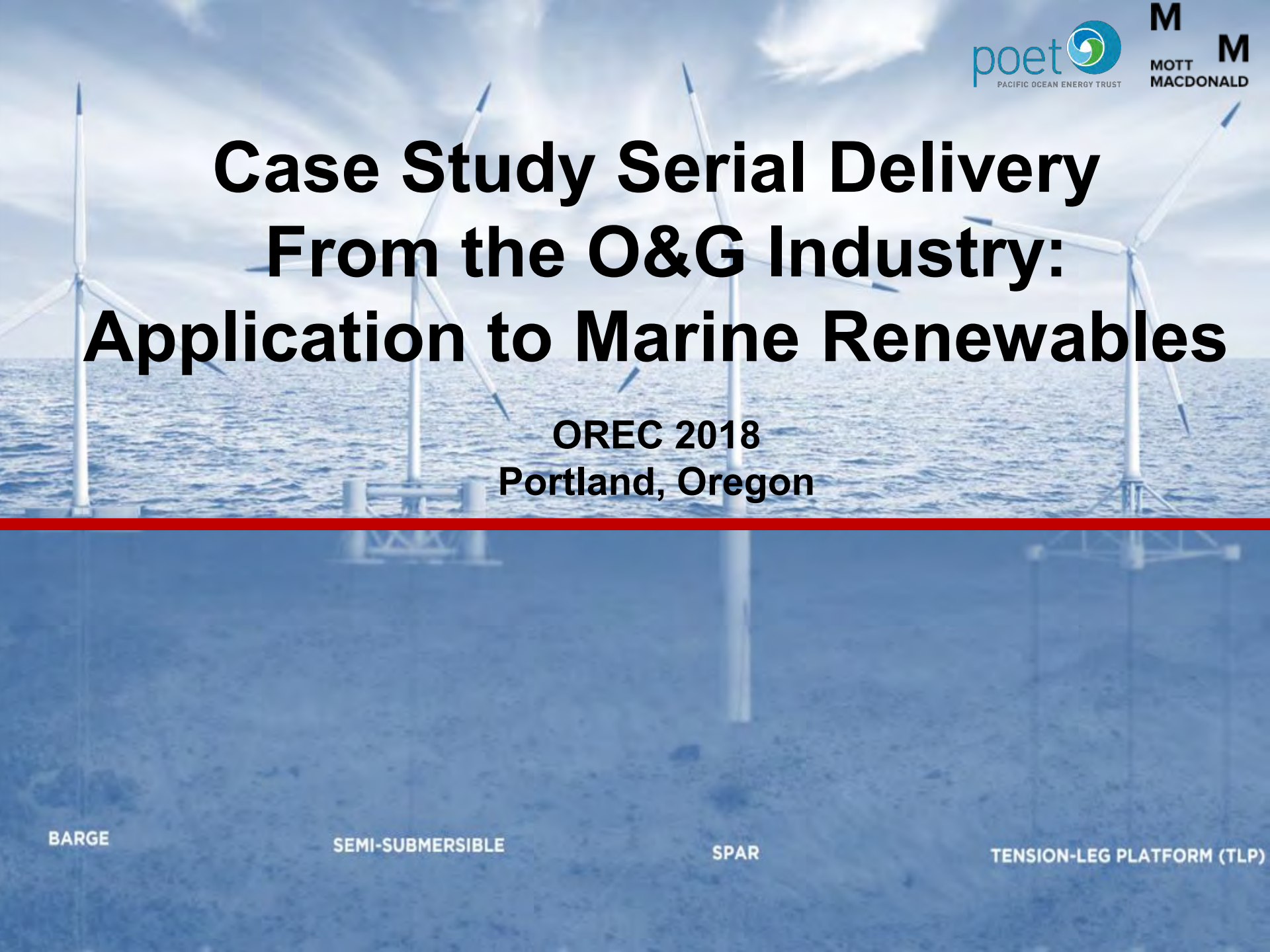
Case Study Serial Delivery From the O&G Industry: Application to Marine Renewables

OREC 2018
Portland, Oregon



Mott MacDonald

Full-service multi-discipline engineering

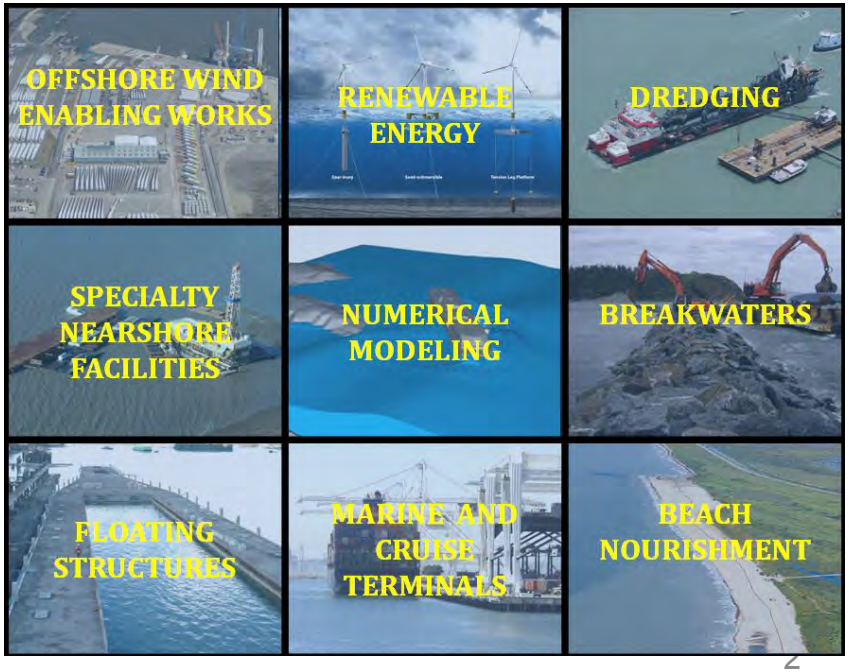
- 16,000+ Staff
- 150 Countries

OFFSHORE WIND, MARINE RENEWABLES

PORTS, COASTAL, NAVIGATION

Offshore Wind – Global Engineering & Advisory services over 20+ years

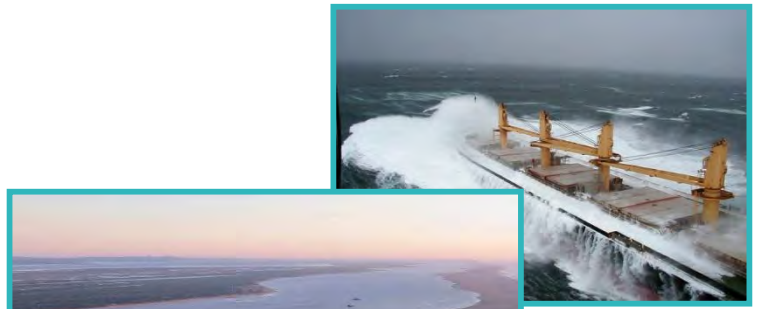
Worldwide experience and strong technical skills in coastal, marine, ports, and waterfront engineering

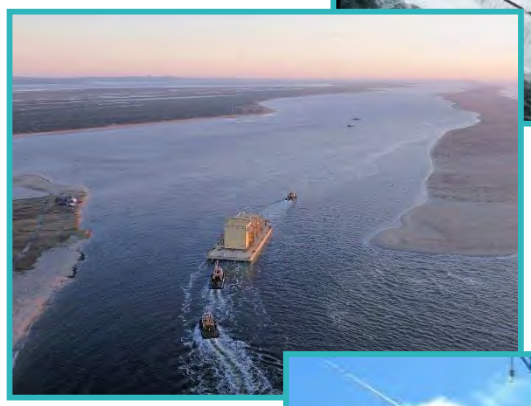


Serial Delivery

- BOEM (2016-011):
  - Requirements & Capabilities of Offshore Floating Wind and MHK Ports
- O&G - Sealift
  - Project feasibility/planning
  - Risk of downtime/delivery schedule is assessed

Ocean Conditions	Quayside Fabrication and Assembly
Towing of assembled units	Navigation Constraints





Odoptu Stage II: US/Korea to Piltun Bay

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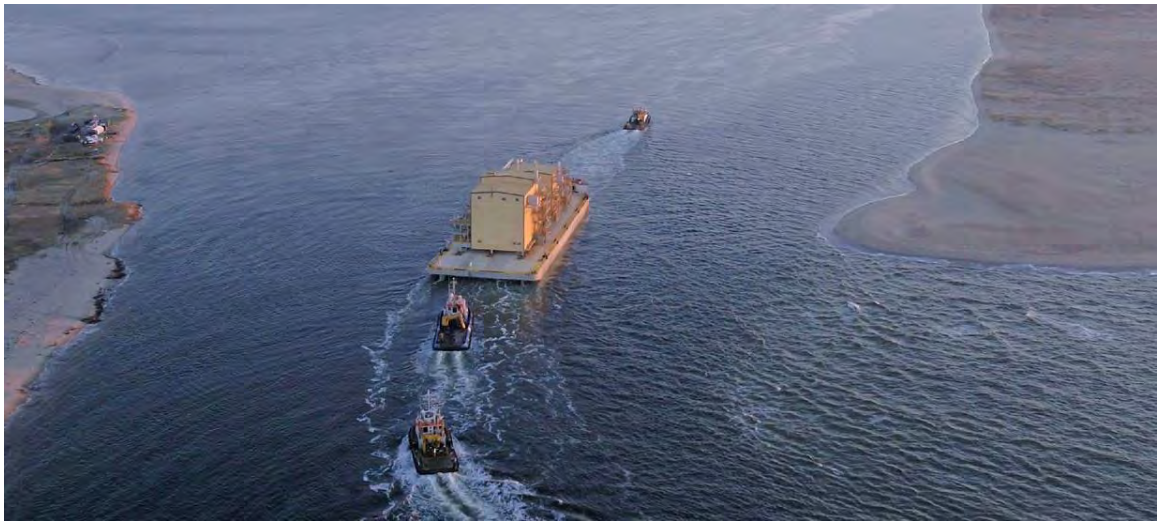
Modules – 2600 Tons



Entrance Conditions

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WAVES, WIND, TIDAL CURRENTS, SHOALS, SEDIMENT MIGRATION, FOG

Key Challenges

- No dredging permitted
- High energy wave regime
- Highly dynamic sediment transport
- Regulatory (Russian)
- Many other (not presented)

Feasibility Assessment

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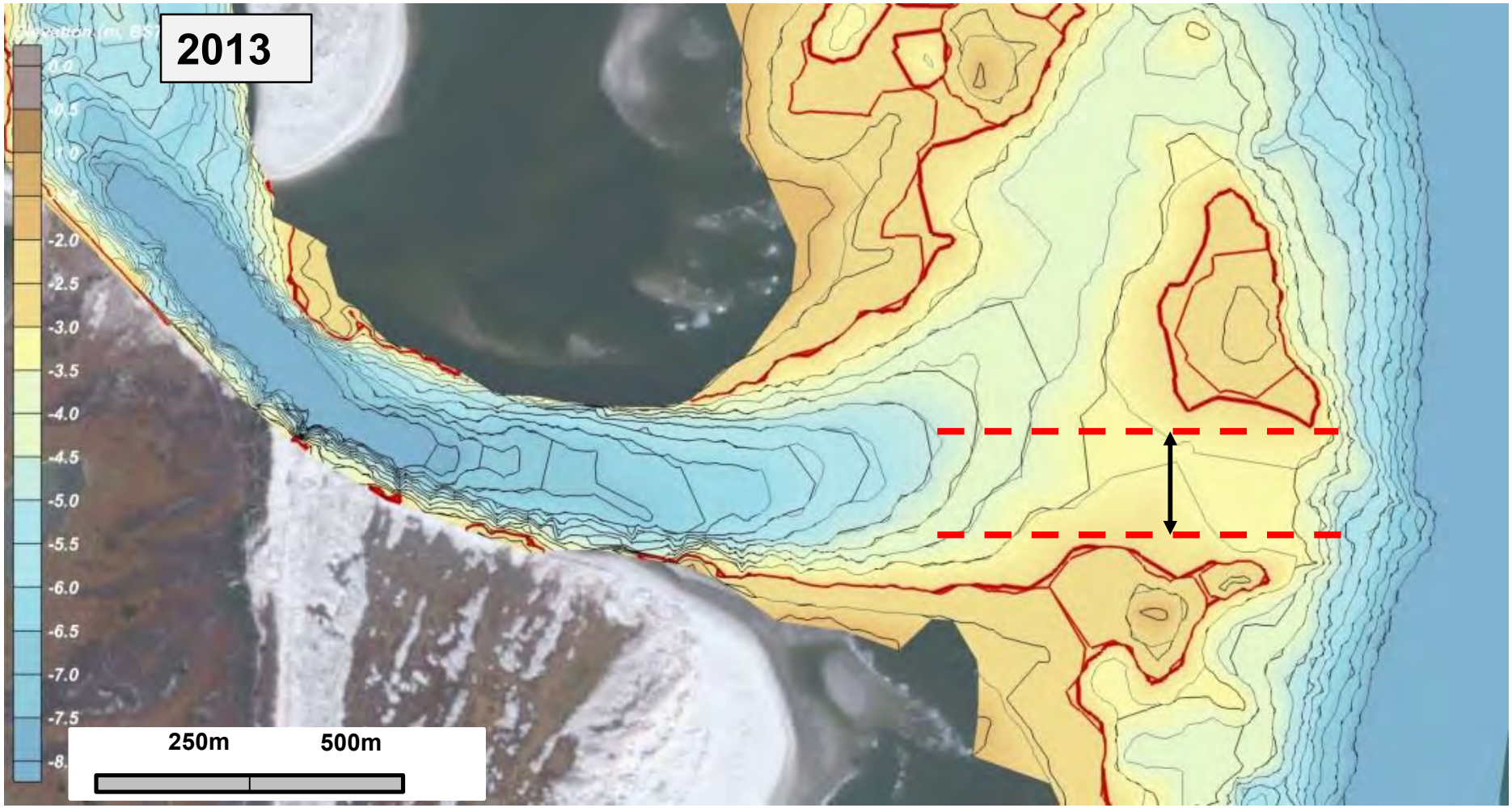
Under keel Clearance: <1meter



Question: Is safe navigation feasible considering channel geometry and dynamics?

Waterway Operability Question

Determine probability of all units delivered in one year (2016)

(4 years before delivery)

Full Bridge Simulation

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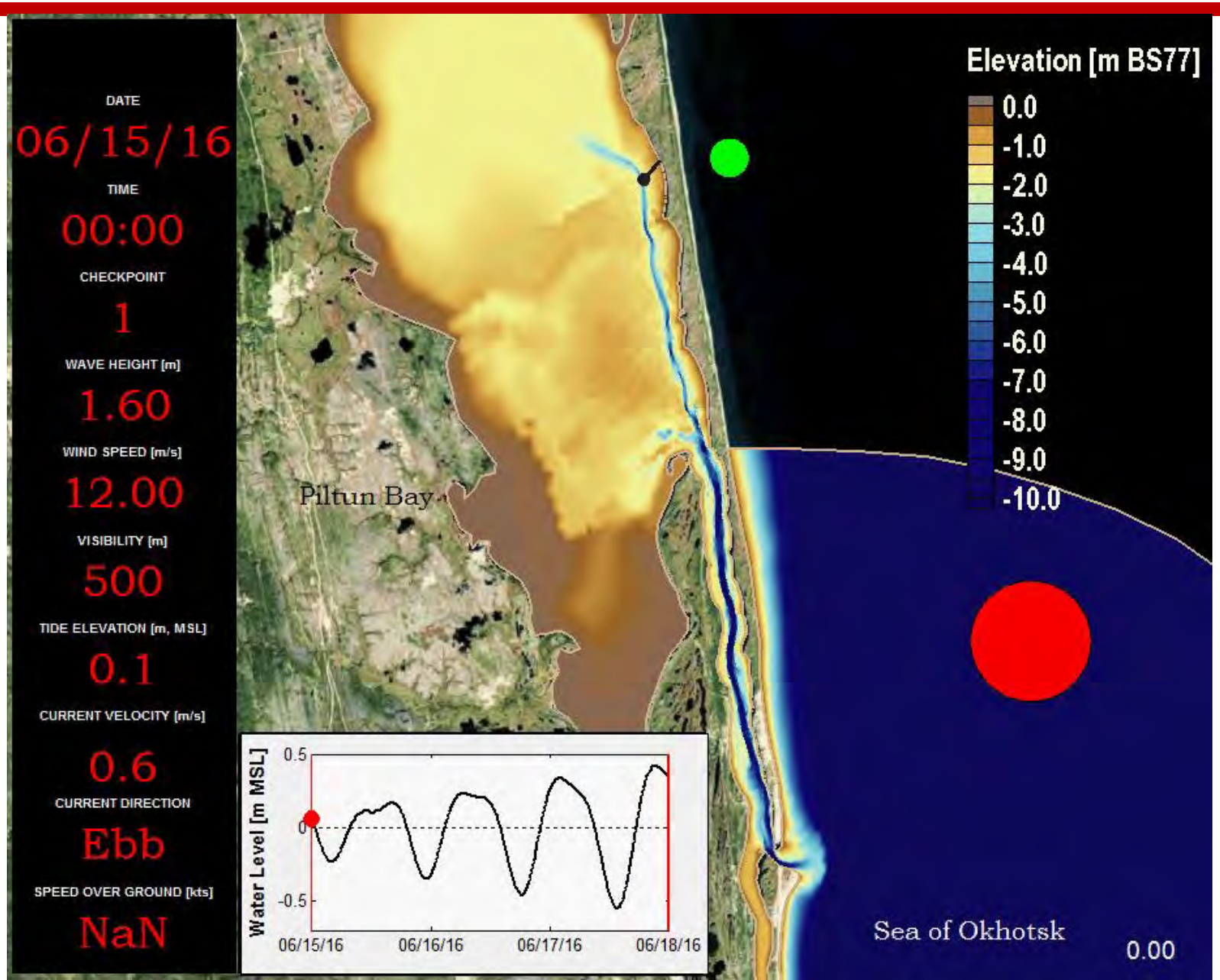
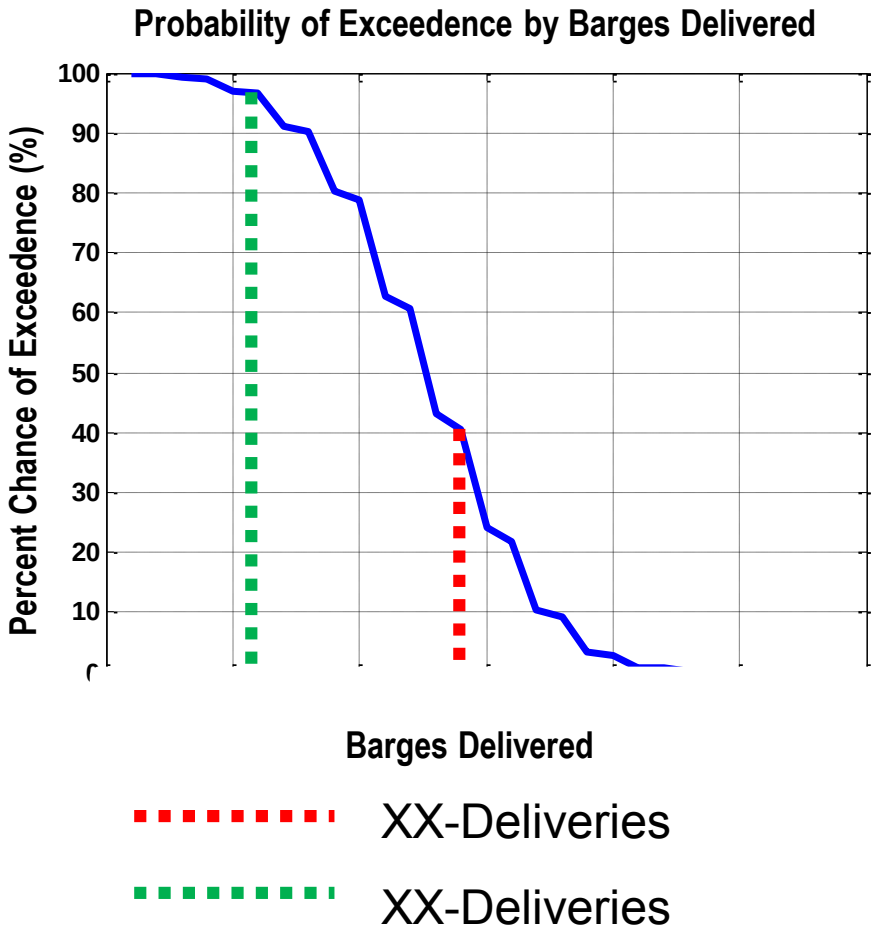
Note: Simulations conducted at Pacific Maritime Institute with inputs from advanced numerical wave and current modeling tools developed by MM. Common in industry for specialty marine operations.

Operability Visualization (x10,000)



Barges Required	% Chance of Successful Delivery
Confidential **XX**	**40%**
Confidential **XX**	**97%**

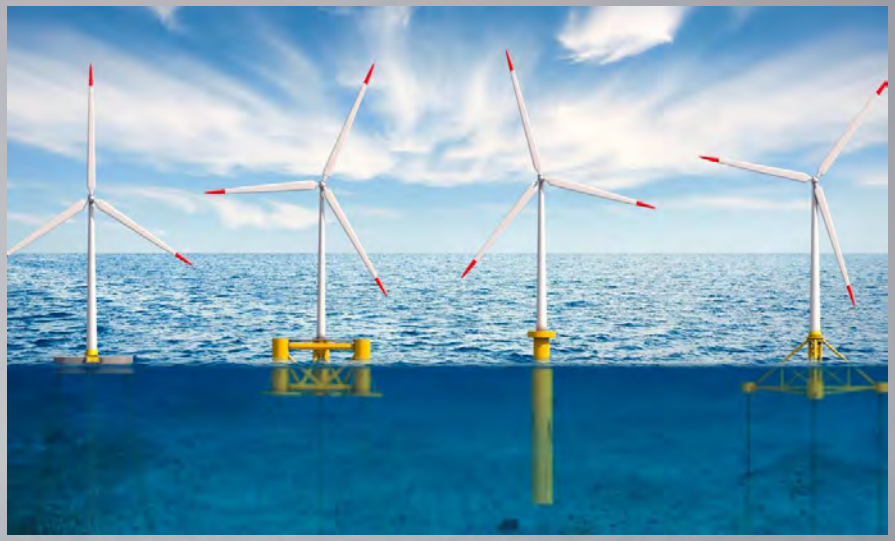


2 Delivery Seasons Selected (2016, 2017)

Summary

- Similarities:
  - Complex, high-value project
  - Tide-dependent navigation
  - High-energy natural system
  - New use of waterway with complex site conditions
- Lessons Learned:
  - Properly re-construct physical conditions
  - Development and use of the right engineering tools/models critical to success
  - Evaluate risk and communicate risk to owner, and make right decision about schedule

Questions?



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