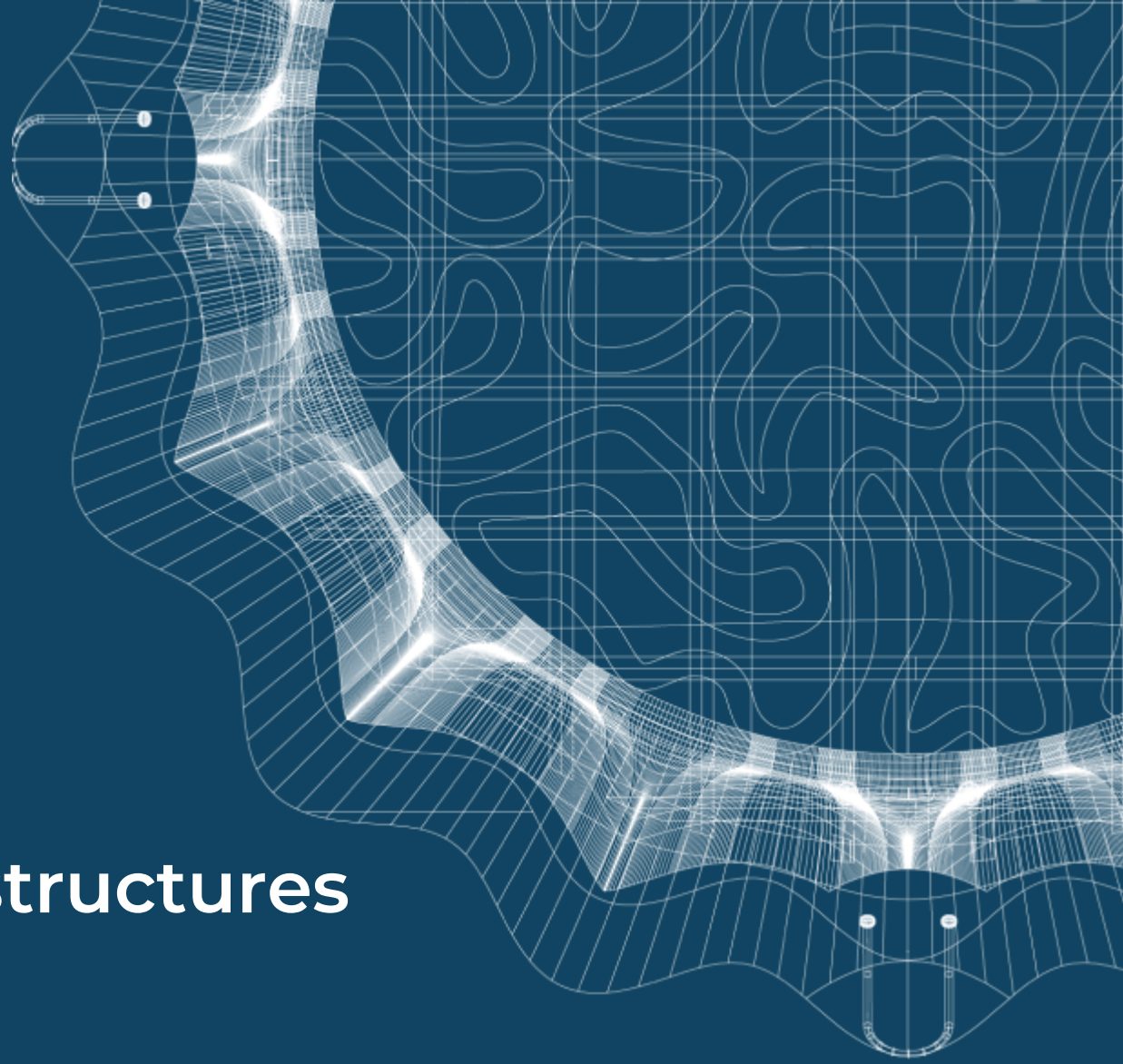


Additive Construction of Floating Offshore Wind Substructures

Mason Bell, Anchor Lead

10/8/2024

Introduction to Sperra

sperra

A vertically integrated technology, design, and construction firm for renewable energy infrastructure.

Our Vision:

To build clean energy that is abundant and sustainable for nature and communities.

Leadership

Automated Construction – Renewable Energy – Commercialization

Jason Cotrell

Chief Executive Officer & Founder

MS, Mechanical Engineering, MBA

Gabriel Falzone

Chief Operating Officer

PhD, Materials Science

Vahid Azad

Chief Structural Engineer

PhD, PE, Civil Engineering

Taylor Marchment

Lead R&D Engineer

PhD, 3DCP Civil Engineering

NREL Transforming ENERGY

CARBONBUILT ULTRA-LOW CARBON CONCRETE

XPRIZE CARBON | nrg | cosia

wsp

moffatt & nichol

SWINBURNE UNIVERSITY OF TECHNOLOGY

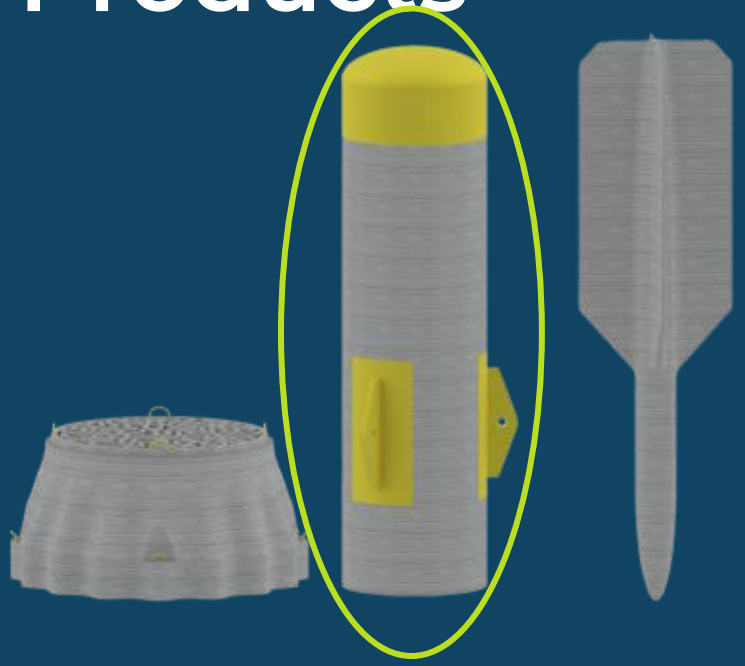
Markets

Offshore Solar

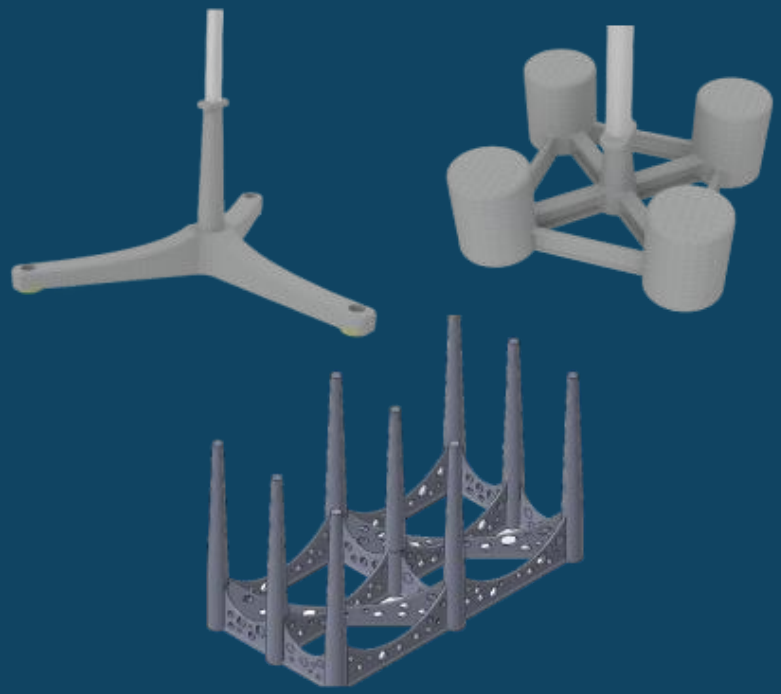
Wave Energy

Offshore Wind

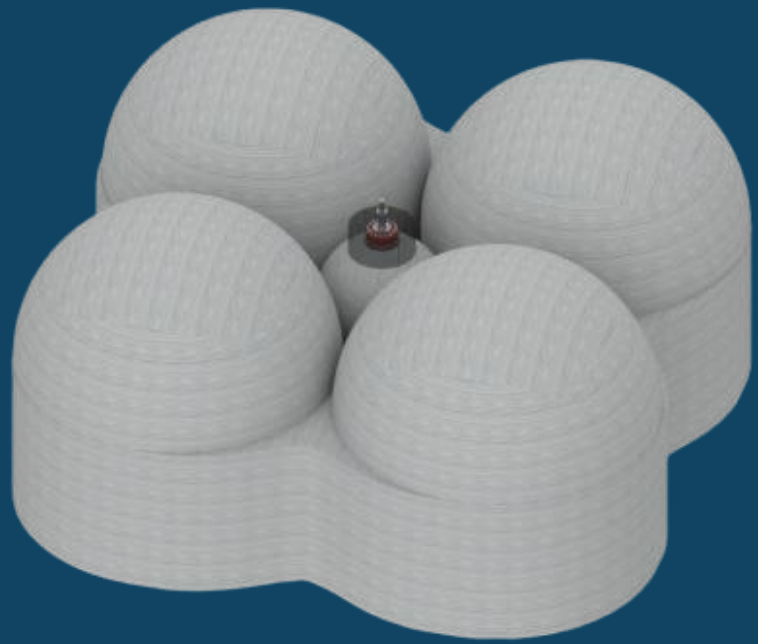
Products



Anchors



Foundations and Docks



Subsea Energy Storage

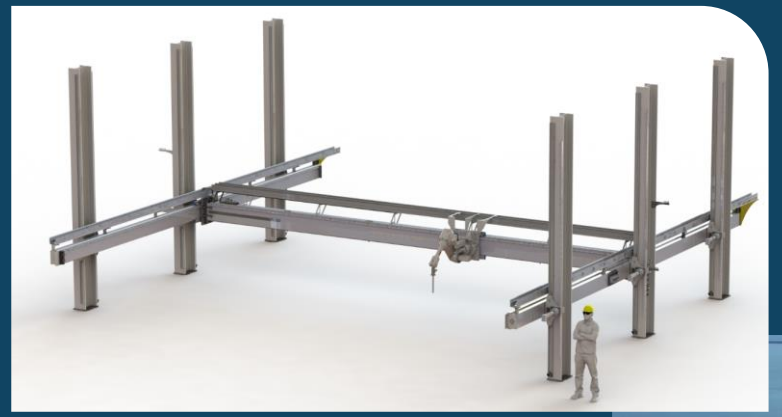
3D Concrete Printing

- Form-free process enables lean manufacturing with a small footprint
- Increases manufacturing efficiency
- Reduces physical burden
- Digital design: customization, complex geometries, structural optimization
- Sustainable locally sourced materials

U.S. Printing Facilities

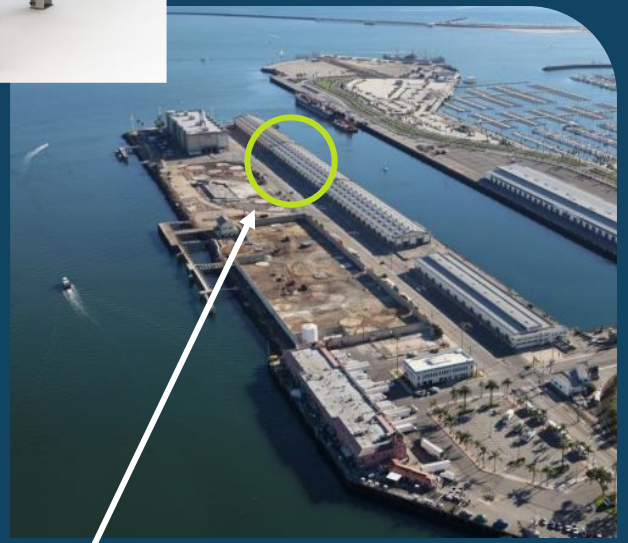
New York

- 24-m tall gantry printer with batch plant and ready-mix printing capability



Los Angeles

- Portside printing facility with gantry and robot arm printers



Port Manufacturing Opportunity

There is a 350 GW pipeline of U.S. offshore energy construction projects worth $1.5 trillion,

but...

port, vessel, and supply chain availability are limiting deployment.

- ✕ U.S. will miss its 2030 offshore wind targets by 50%
- ✕ 80% of foundations will be imported through 2030
- ✕ First floating wind foundations will cost 50% more

3D Concrete Printed Anchors

Concrete Torpedo Anchors

Operating Principal: Torpedo anchors rely on their momentum from being dropped off a ship to embed themselves deep in the ocean floor.

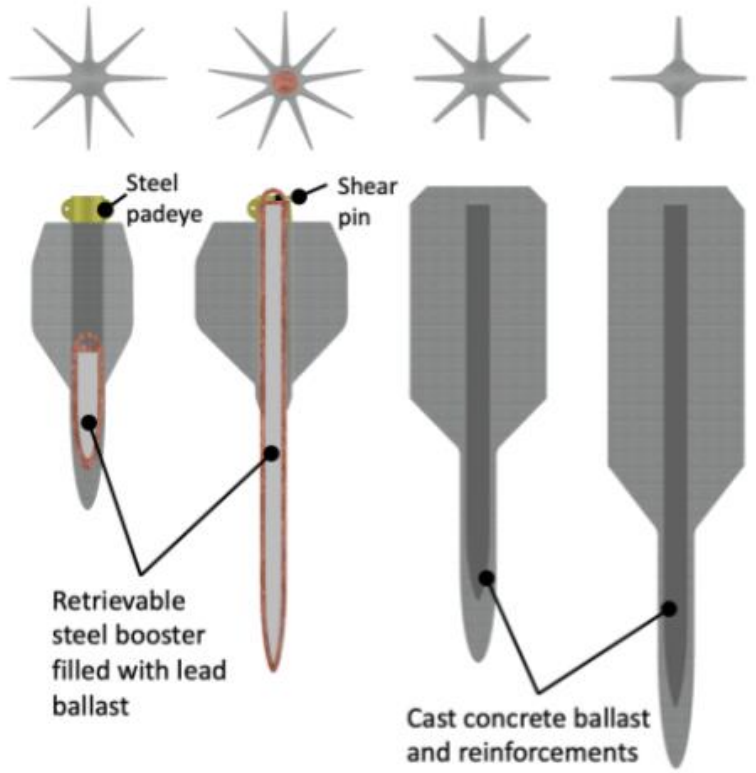
Over 2,000 steel torpedo anchors have already been installed off the coast of Brazil by Petrobras for Oil & Gas.

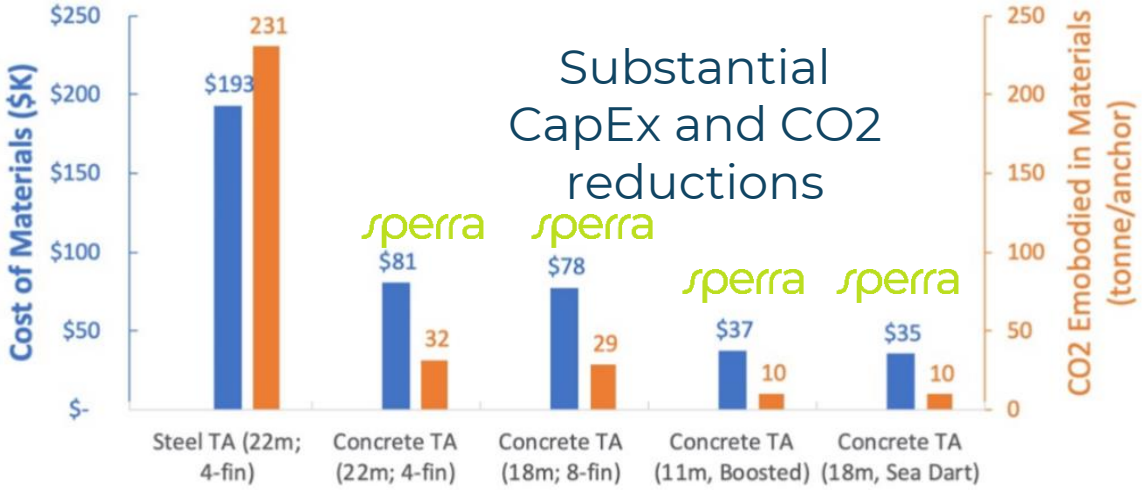
INNOVATIONS

- Uses locally sourced concrete and local labor
- Retrievable steel booster
- Hydrodynamic features to increase freefall speed
- Structural optimization/efficient use of materials

BENEFITS

- Reduced CAPEX and emissions by using concrete instead of steel
- Expedited installation speed compared to other anchors
- Partial material recovery and reuse (booster)
- Quayside 3DCP = reduced transport costs





Substantial CapEx and CO2 reductions

CALIFORNIA ENERGY COMMISSION

Concrete Suction Anchors

Operating Principal: Suction anchors are installed into the ocean floor using pile driving or by vibratory installation. When lifted the hollow bottom generates a pressure differential providing additional anchoring capacity.

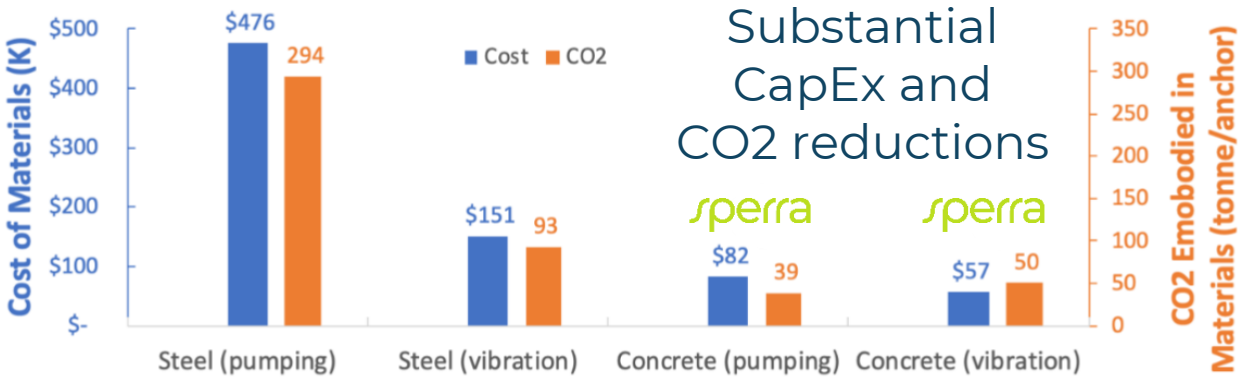
Using concrete for suction anchors provides an offshore wind anchoring solution that is both economically and environmentally superior to conventional steel suction anchors.

INNOVATIONS

- Uses locally sourced concrete and local labor
- Combines 3DCP, reinforcement, and sprayed concrete to make a composite structure
- Structural optimization/efficient use of materials

BENEFITS

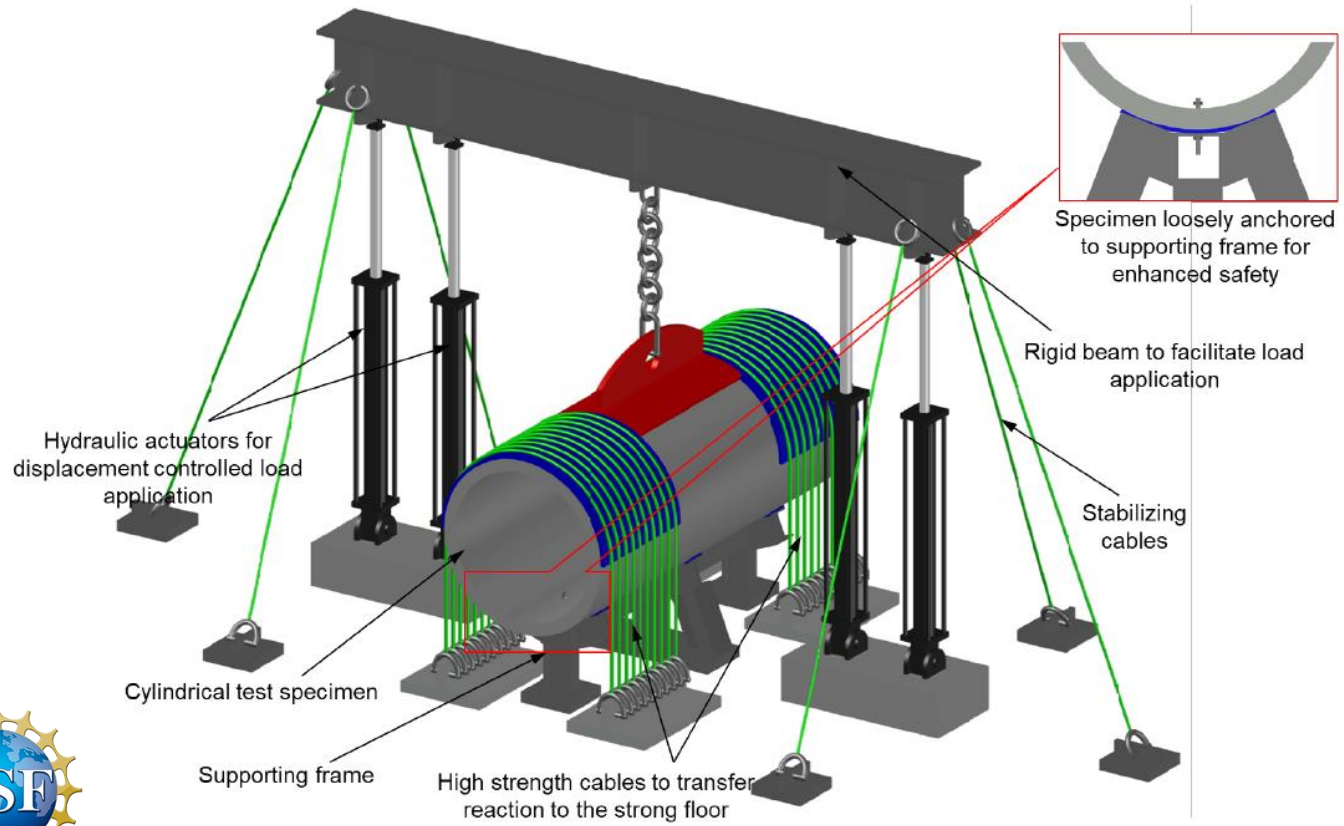
- Reduced CAPEX and emissions by using concrete
- Faster installation times

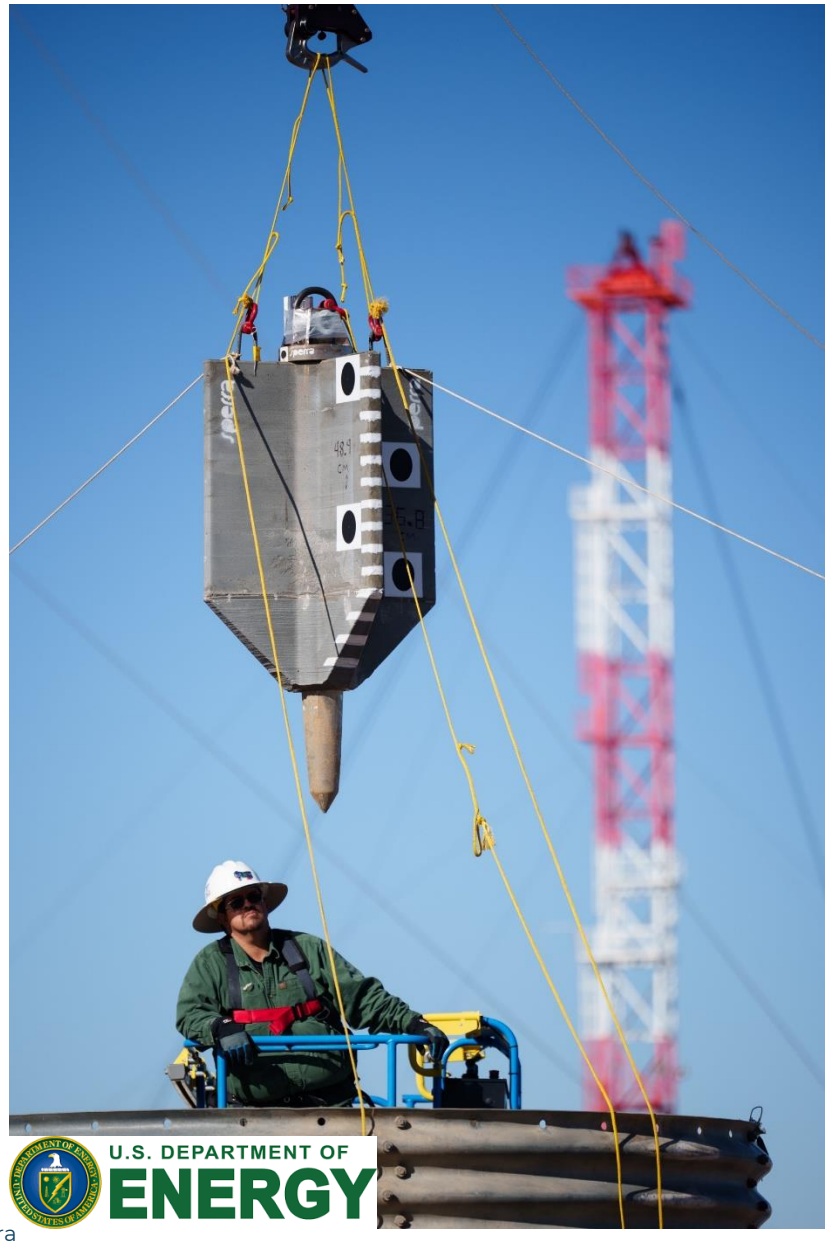


CALIFORNIA ENERGY COMMISSION

Anchor Prototype Testing

- Padeye Connection Pullout Tests
- Soil Embedment & Anchor Pullout Tests





Foundation Manufacturing using OmniDock™

California Needs Concrete Foundation Manufacturing

Manufacturing in California means concrete foundations. But current infrastructure cannot support them, and currently planned facilities are **7 to 11 years away**.

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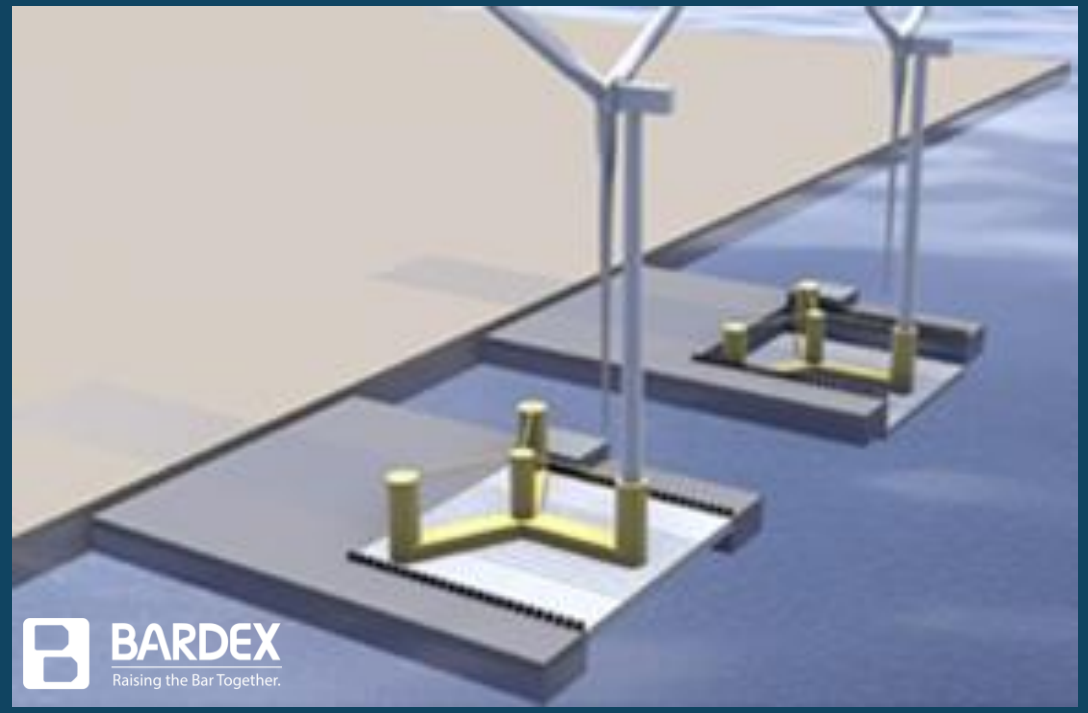


Bardex's OmniDock™ Solution

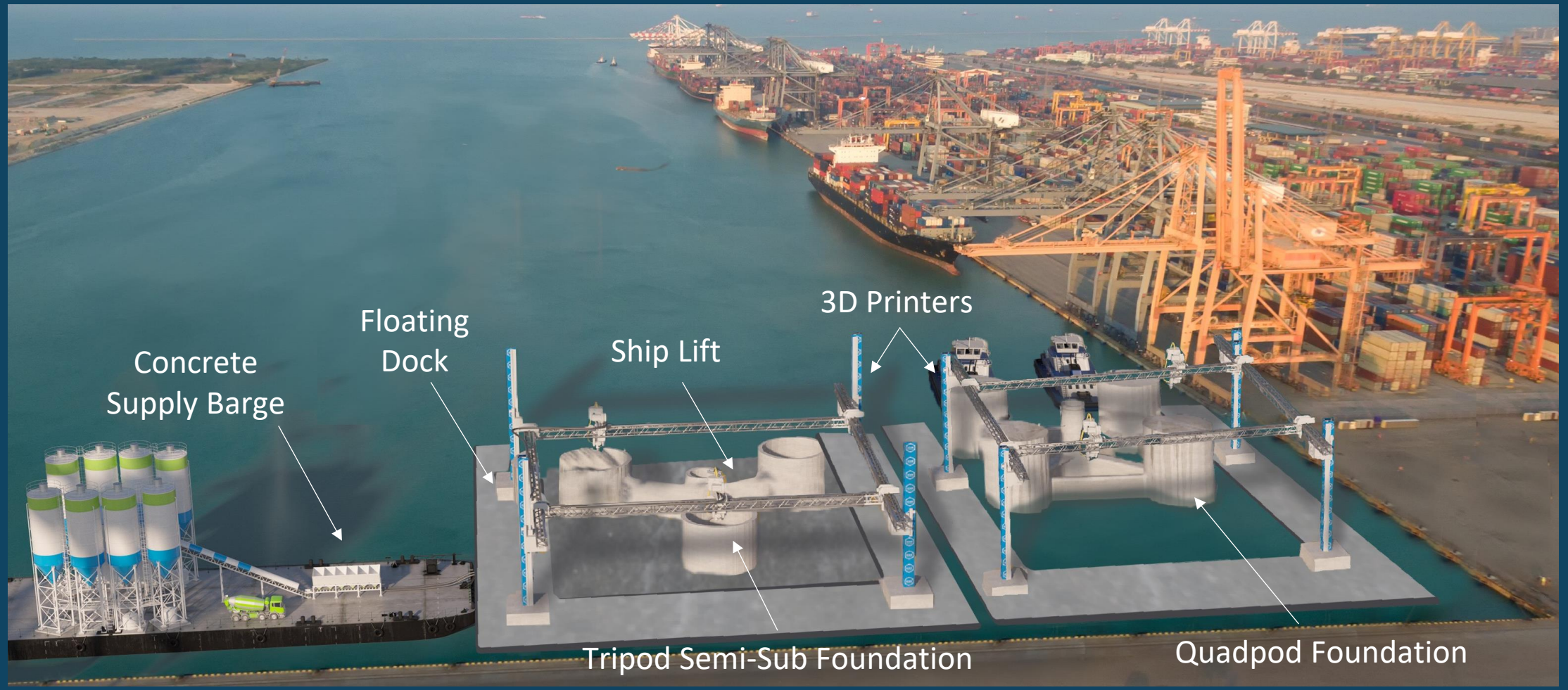
A concrete modular floating dock for domestic manufacture, assembly, launch, and retrieval of offshore foundation

Value Proposition

1. Manufacture floating offshore wind in California at least 5 years sooner
2. Increase foundation production 2x to 3x
3. Reduce cost of offshore wind foundations by ~50%
4. More local jobs and economic benefits

$3M OmniDock™ Proposal

- Design, 3D print, and deploy first subscale OmniDock in the Port of Los Angeles
- 3D Print a FOW foundation on OmniDock



We are seeking a concrete FOW foundation design to 3D print!

sperra

Thank you!

Mason Bell
mason.bell@sperra.com

1st 3D Printed OmniDock Prototype, October 2024