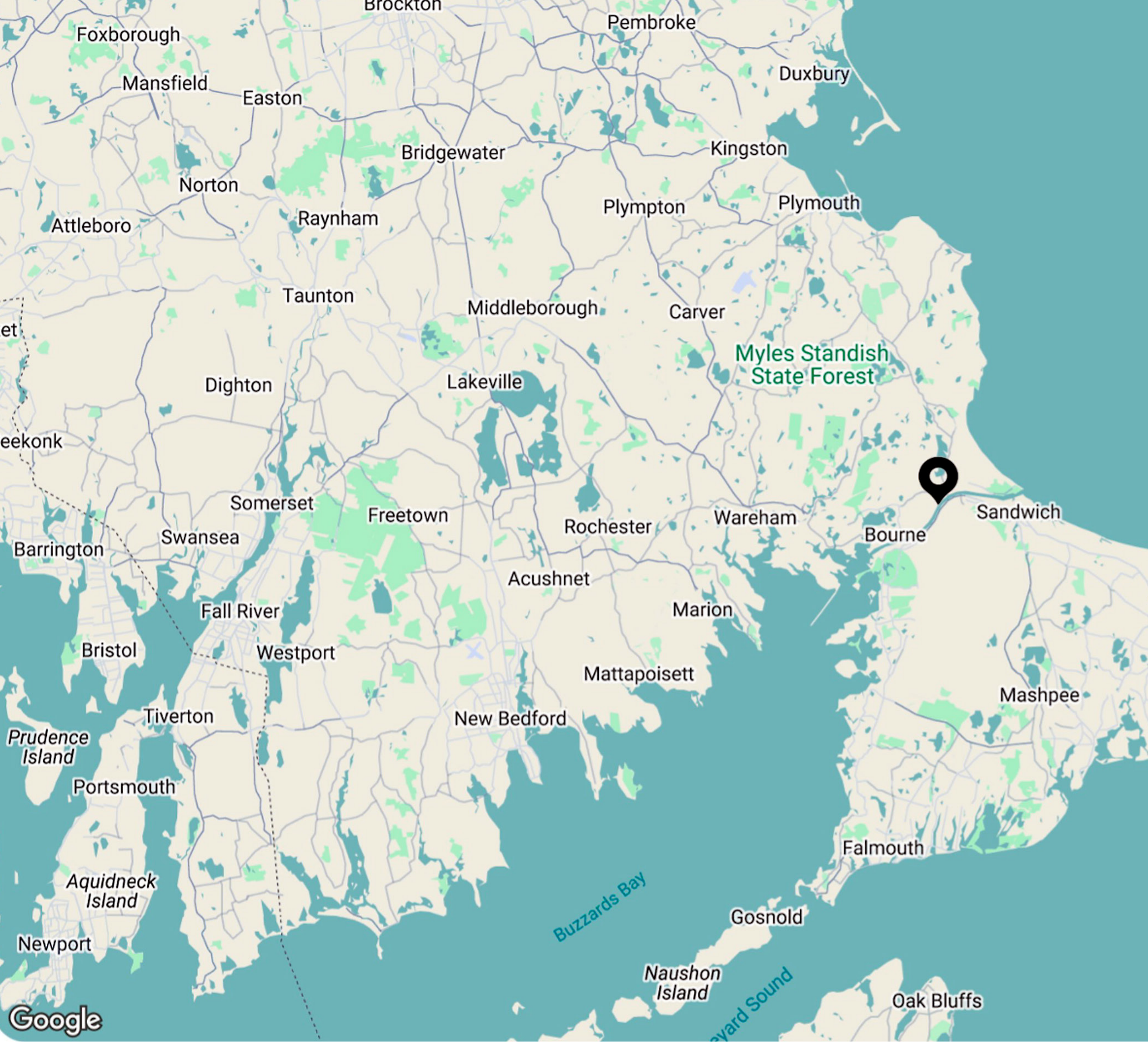
FROM LAB TO SEA

Bridging the Deployment Gap for Ocean Startups through Shared Test Infrastructure

by Kim Gavin, John Miller

The ocean is the least observed domain on Earth. Satellites transformed how we see the Earth – sound is the next medium to map and understand the ocean. BLUEiQ is building a persistent, scalable acoustic sensing network delivering continuous data-driven maritime awareness and creating a new layer of ocean intelligence through sound.

BLUEIQ



The Deployment Gap

The greatest challenge facing ocean startups is not invention – it is deployment. For ocean technology companies, transitioning from laboratory validation to real-world operations remains one of the most difficult phases of commercialization. Marine environments are inherently unforgiving: corrosion, biofouling, strong currents, vessel traffic, and limited access all complicate testing and iteration. Unlike terrestrial systems, ocean technologies cannot be fully validated indoors. Laboratory simulations approximate reality but cannot replicate the variability of dynamic marine environments. In-water testing is not optional – it is essential to demonstrate performance, reliability, and operational viability.

Yet access to these environments is constrained. Permitting complexity, vessel logistics, insurance requirements, and high operational costs create significant barriers. For early-stage companies, a single deployment can require months of planning and substantial capital. The result is a persistent deployment gap – where promising technologies stall between proof-of-concept and operational readiness. This gap is not unique to any one region; it reflects a global bottleneck in ocean innovation.

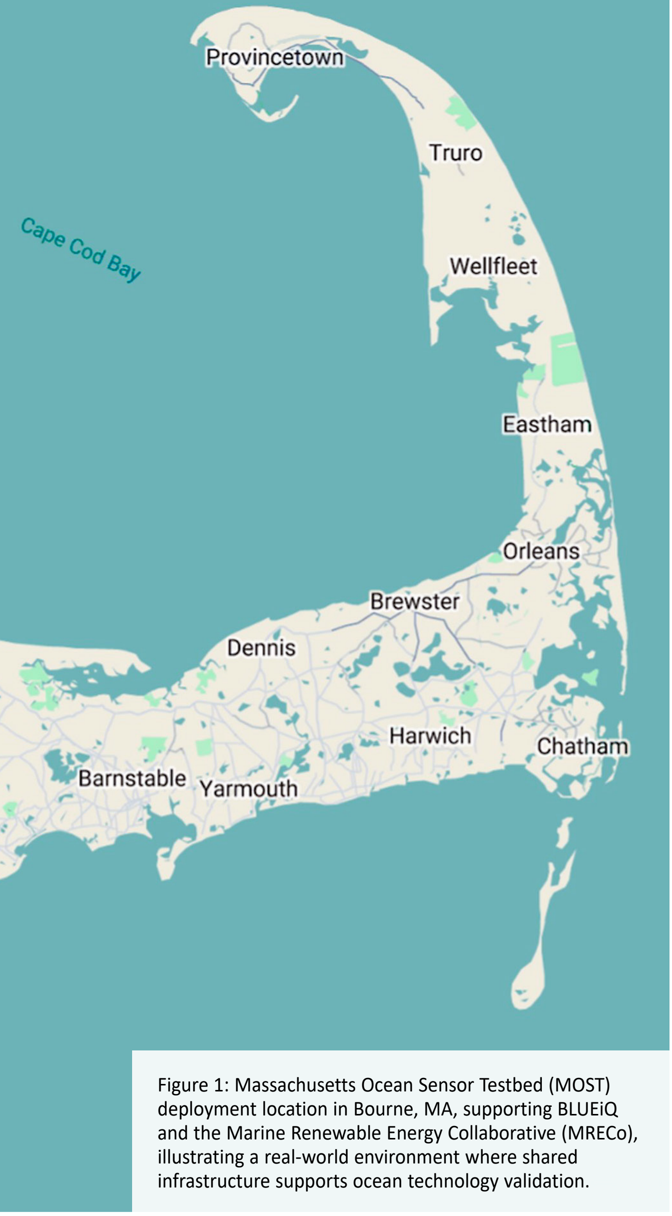


Figure 1: Massachusetts Ocean Sensor Testbed (MOST) deployment location in Bourne, MA, supporting BLUEiQ and the Marine Renewable Energy Collaborative (MRECo), illustrating a real-world environment where shared infrastructure supports ocean technology validation.

The Scale of the Opportunity – and the Stakes

The Blue Economy represents a rapidly expanding and increasingly strategic segment of the global marketplace. Growth is driven by offshore energy, maritime transportation, fisheries, defence, climate monitoring, and coastal resilience. Regions like Massachusetts in the United States play an influential role within this ecosystem, supported by established maritime infrastructure, research institutions, and a growing technology startup base.

Across this landscape, sensing technologies are a foundational enabler but only when they can be deployed at scale. Reliable, scalable sensing is essential to offshore energy development, maritime domain awareness, and climate monitoring and ecosystem management. Each of these applications depends on continuous, in-situ data collected under real-world ocean conditions. Without deployable sensing systems, operators lack the visibility required to manage assets, ensure safety, and respond to environmental change.

This growing demand underscores a clear reality: the future of the Blue Economy depends not just on innovation but on deployable, scalable systems operating in real-world conditions. Yet the ability to deploy these systems remains constrained – leaving a gap between innovation and impact (as illustrated by the BLUEiQ-Marine Renewable Energy Collaborative (MRECo) deployment partnership in Massachusetts (Figure 1). This is the deployment gap introduced earlier: the disconnect between promising technologies and their ability to function reliably in real-world environments. Until this gap is addressed, innovation alone will not translate into impact.

Why Low-Cost Sensing – and Acoustics – Matter

Sensing is central to ocean operations, but not all modalities perform equally in marine environments. Among sensing approaches, acoustics offers distinct advantages. Sound propagates efficiently in water, travels long distances, and remains effective in conditions where optical and radio-frequency systems degrade. This makes it particularly valuable in dynamic coastal environments where visibility is limited and conditions are constantly changing.

Resilient ocean sensing increasingly depends on multi-modal systems, where acoustics provides an independent, passive layer of awareness. It enables detection and characterization without emitting signals or requiring cooperation from observed objects

– an important characteristic for both environmental monitoring and security applications.

Historically, however, acoustic systems have been constrained by cost, complexity, and power requirements. Traditional approaches relied on large, centralized systems and post-processed data, limiting scalability. Recent advances in low-power electronics and edge processing are shifting this model. Sensing systems can now operate in smaller, distributed configurations – enabling more persistent and economically viable monitoring. In this context, acoustics is not a standalone solution, but a critical component of a broader sensing ecosystem. Crucially, these advances only matter if systems can be deployed and sustained in real-world environments – bringing the focus back to the challenge of operational deployment.

The Role of Shared Test Infrastructure

Addressing the deployment challenge requires more than improved technology – it requires access to environments where systems can be deployed, tested, and iterated under real-world conditions.

Shared test infrastructure provides a practical solution to this gap. Facilities such as the Massachusetts Ocean Sensor Testbed (MOST), operated by MRECo, offer startups access to permitted, instrumented ocean environments where technologies can be evaluated under operational conditions (Figure 2).

These environments provide more than physical access. They enable:

- Reduced regulatory friction through programmatic permitting
- Lower deployment costs by removing redundant logistics
- Repeatable testing environments for iterative development
- Access to operational partners and support services

This model shifts the focus from isolated testing to structured deployment. Rather than designing one-off pilots, startups can engage in continuous learning cycles that accelerate validation and reduce risk. In effect, shared test infrastructure serves as a critical intermediary between laboratory validation and full-scale deployment – translating technical feasibility into operational capability. Importantly, this approach is not limited to sensing – it represents a scalable model for accelerating deployment across the broader ocean technology ecosystem.

A Model for Shared Ocean Test Infrastructure

MOST provides a working example of how shared test infrastructure can address the deployment gap. At its core is the Bourne Tidal Test Stand (BTTS), located in the Cape Cod Canal. The site combines strong tidal currents, vessel traffic, operational constraints, and proximity to shore-based power and communications – creating a highly representative environment for real-world testing (Figure 2).

Originally developed for tidal energy research, the platform has evolved into a versatile facility supporting a broad range of ocean technologies. Its fixed infrastructure enables repeatable deployments and long-duration testing – capabilities that are difficult and costly for startups to replicate independently. This consistency supports iterative development and more rigorous validation under operational conditions – allowing technologies to be evaluated not just for performance but for persistence.

More broadly, MOST demonstrates a scalable model for ocean innovation: shared, permitted, and operationally supported infrastructure that reduces barriers to deployment and accelerates the transition from prototype to fielded capability. This model is replicable in other regions and offers a practical pathway to accelerate ocean technology development at scale.

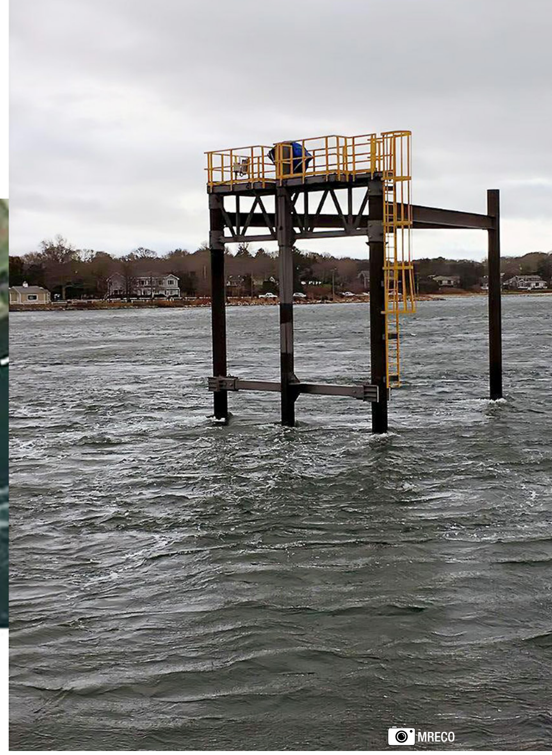


Figure 2: The Massachusetts Ocean Sensor Testbed (MOST) is a project managed by the Marine Renewable Energy Collaborative (MRECo) on the Cape Cod Canal that provides a secure platform for long-term, cost-effective testing of ocean sensors, including the Bourne Tidal Test Site (BTTS; right).

Infrastructure Challenges and Resilience

The development of shared test infrastructure is not without challenges. Efforts to expand power and broadband connectivity at BTTS – supported by state and regional funding – illustrate the complexity of evolving ocean test facilities. Planned upgrades to enable grid-connected, high-bandwidth operations have faced delays due to regulatory, funding, and coordination constraints. These challenges highlight a critical reality: in ocean innovation, infrastructure – not technology – sets the pace. Without alignment among regulators, infrastructure providers, and funding agencies, even well-developed technologies remain constrained by access to deployment environments. This underscores the importance of sustained investment – not only in innovation, but in the systems that enable innovation to be tested, validated, and ultimately deployed at scale.

A Startup Perspective: From Concept to Deployment

The experience of early-stage companies illustrates both the challenge and the opportunity. Many ocean startups achieve technical feasibility in controlled environments but struggle to demonstrate sustained performance in real-world conditions. Short-duration pilots provide limited insight, often falling short of what customers and regulators require. Access to shared test infrastructure changes this dynamic.

Through facilities such as MOST, startups can move from episodic testing to continuous, programmatic deployment. Systems can be evaluated over extended periods, across varying environmental conditions, and refined using real-world data through in-situ deployments (Figure 3). This shift enables a deeper understanding of performance – and accelerates the transition from prototype to operational capability. This transition – from controlled validation to sustained, real-world deployment – is often the defining step between promising technology and operational capability.

The experience of BLUEiQ, an early-stage ocean technology company, reflects this transition in practice. Through access to shared test infrastructure, the company was able to deploy sensing systems over extended durations, evaluate performance under dynamic conditions, and iteratively refine system performance using field-collected data.

Figure 3: BLUEiQ field deployment of distributed acoustic sensing systems in real-world ocean environments, illustrating sustained, in-situ operation under dynamic conditions.

More broadly, this case reinforces a central insight: bridging the deployment gap depends as much on access to infrastructure and partnerships as it does on technology.

Designing for Deployment: Lessons from the Field

Field deployments reveal an important principle: ocean technologies must be designed for deployment from the outset – not adapted later. Several design principles emerge:

- **Persistence over episodic sensing:** Continuous, long-duration deployments provide the temporal context needed to distinguish patterns from anomalies – particularly in dynamic environments.
- **Edge processing over centralized models:** Processing data at the sensor reduces bandwidth requirements and supports near real-time awareness in constrained environments.
- **Distributed systems over single assets:** Deploying multiple, lower-cost nodes enables broader coverage and resilience compared to reliance on a small number of high-value systems.

Together, these principles reflect a broader shift toward systems designed not only to perform but to persist under real-world conditions.

Shared test environments play a critical role in validating these approaches. Long-duration deployments, environmental variability, and operational constraints expose performance characteristics that cannot be replicated in laboratory settings – providing essential feedback for system refinement. In practice, these principles define the difference between systems that function in controlled settings and those that operate reliably in the ocean.

Commercialization Impact

Shared test infrastructure reshapes commercialization timelines for ocean startups. Startups with access to these environments reach pilot-stage validation faster, enabling earlier engagement with customers, regulators, and investors. Access to repeatable, permitted

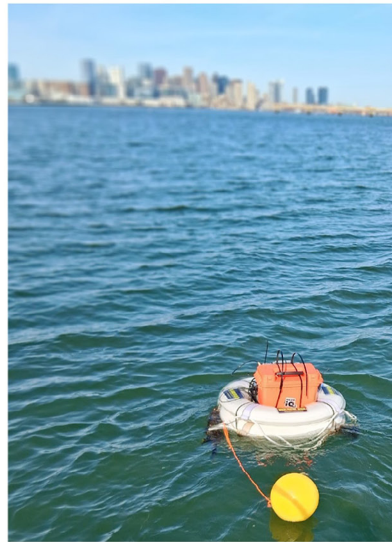



Figure 4: Field deployments illustrating design for deployment – persistent operation, distributed sensing, and edge processing in real-world ocean environments.

deployments accelerates progression from proof-of-concept to pilot-scale demonstration – providing more credible validation under operational conditions, as demonstrated through distributed field deployments (Figure 4).

For the broader ecosystem, these facilities strengthen regional innovation by retaining talent, building institutional knowledge, and enabling collaboration across sectors including energy, defence, and environmental monitoring. Ultimately, shared infrastructure translates early-stage innovation into deployable systems – closing the gap between technical feasibility and operational reality.

Why Partnerships and Pilots Matter

Technical innovation alone is rarely sufficient to achieve commercialization. The gap between a working prototype and an operational system is bridged through access – to infrastructure, to partners, and to real-world environments where technologies can be tested credibly. Access – not invention – is often the limiting factor in ocean startup success. Partnerships with test infrastructure providers, public agencies, and ecosystem organizations reduce the burden on startups to navigate permitting, logistics, and operations independently – allowing resources to be focused on learning and system improvement.

Funded pilot programs are particularly impactful, as they share the cost and risk of early deployment while enabling the collection of operational data required for adoption, as evidenced by integrated deployments and partner systems (Figure 5). In practice, the availability of funded pilots often determines whether technologies can progress beyond demonstration into sustained deployment. These pilots also change behaviour. Rather than minimizing exposure, startups can engage in iterative learning – testing, failing, and improving in controlled but realistic conditions. In ocean environments, where variability is inherent, this learning model is essential.

More broadly, partnerships and funded pilots accelerate commercialization by shifting success from isolated demonstrations to sustained progress toward deployment. In practice, this collaborative model is essential to scaling innovation in environments where cost, complexity, and uncertainty are high.

Looking Ahead: Scaling Deployment

As ocean technologies evolve, the role of shared infrastructure will expand. Planned enhancements to facilities like MOST – including longer-duration deployments, higher-bandwidth connectivity, and integration with

Figure 5: Field deployments and partner integrations demonstrating how partnerships and funded pilots enable the transition from prototype to scalable, real-world ocean operations.

autonomous platforms – will enable more complex, data-rich operations. These capabilities move testing beyond individual components toward system-level validation, where multiple technologies operate together in realistic scenarios. For startups, this represents a shift from proving feasibility to demonstrating operational readiness at scale. More broadly, this progression reflects a shift from isolated innovation toward systems designed for sustained operation in real-world ocean environments.

Conclusion

The greatest barrier to ocean innovation is not invention – it is deployment. In ocean environments, infrastructure – not technology – sets the pace, determining whether promising ideas translate into operational capability. Shared test infrastructure offers a practical pathway to overcome this barrier by providing access to real-world environments, reducing cost and risk, and enabling iterative development. Together with partnerships and funded pilots, these models create a credible, accessible pathway for startups to move from concept to sustained deployment. As the Blue Economy continues to grow, expanding and replicating these approaches will be essential to unlocking innovation across sectors. For ocean startups, the path from lab to sea is defined not by technology readiness alone, but by access – to infrastructure, to partnerships, and to the real-world environments where innovation becomes impact.

DOI: https://doi.org/10.48336/BGVD-H021

Kim Gavin is the founder and CEO of BLUEiQ, a distributed ocean intelligence company transforming sound into real-time, actionable insight at the edge. She founded BLUEiQ to address a fundamental gap in ocean observation: while the ocean is inherently acoustic, scalable, distributed sensing solutions – low-cost, low-power, and capable of operating at real-world scale – have been limited. Since founding the company in 2023, she has led the transition of BLUEiQ's technology from concept to field-validated deployments through collaborations with government, academic, and industry partners. Her work focuses on advancing distributed sensing systems – spanning acoustic, satellite, and geospatial technologies – and integrating edge computing to enable real-time processing and decision-making in operational environments.

John Miller is the executive director of the Marine Renewable Energy Collaborative (MRECo), where he leads the development of shared ocean test infrastructure and partnerships supporting marine energy and ocean technology innovation. His work focuses on enabling access to real-world marine environments that support the transition of emerging technologies from concept to deployment. He brings extensive experience in marine energy, applied research, and technology commercialization, including leadership roles in ocean test sites, university research consortia, and regional innovation programs. Under his leadership, MRECo has expanded key ocean test capabilities, including the Bourne Tidal Test Site, providing pre-permitted infrastructure for technology validation. His work emphasizes collaboration across startups, industry, academia, and government to accelerate innovation in the Blue Economy.

BLUE iQ

About the Startup

Founded in 2023, BLUEiQ is an ocean intelligence company developing low-SWaP-C, AI-enabled acoustic sensing systems for persistent maritime domain awareness and marine ecosystem monitoring. Operating at the intersection of national security and ocean sustainability, the company delivers dual-use capabilities for defence, government, research, and commercial maritime applications.

Since inception, BLUEiQ has advanced its sensing systems from prototype to field-validated deployments through collaborations with the US Navy, NORAD/NORTHCOM, US Army, NOAA, and academic and industry partners. These efforts have supported both subsea and above-water sensing missions, including vessel detection, marine mammal monitoring, and counter-uncrewed system applications. BLUEiQ's work reflects a broader shift toward persistent, distributed ocean sensing systems and transforming sound into actionable intelligence.

Headquartered in Boston, Massachusetts, with operations in Gulfport, Mississippi, and Narragansett, Rhode Island, the company operates with a lean team supported by engineering partners and academic collaborators. Growth has been supported through government SBIR programs, Cooperative Research and Development Agreements, non-dilutive funding, awards, and accelerator programs.

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