# MARITIME TECHNICAL WORKING GROUP

## CASE STUDY: OCEAN INFINITY – ARMADA FLEET

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# DOCUMENT CONTROLS

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# OCEAN INFINITY

Founded in 2017, Ocean Infinity, headquartered in Austin, Texas, and Southampton, United Kingdom, uses autonomous and remotely operated marine robotics for ocean and seabed data collection, serving energy, telecommunications, government, defense, and research sectors.

## Ocean Infinity Autonomous Vessel Technology

Ocean Infinity operates the Armada fleet, a series of unmanned and minimal crewed vessels supported by a global network of remote control centers and an integrated portfolio of robotic subsea systems. The fleet includes vessels ranging in size from the 8-meter Armada A8 to the 86-meter Armada A86.

Armada vessels feature dynamic positioning, modular sensor suites (e.g., multibeam echo sounders, side-scan sonar, sub-bottom profilers), and remote control capabilities for survey, geotechnical, and maintenance tasks. Remote command and control functionality allows these vessels to conduct operations including surveying, geotechnical sampling, and maintenance support while reducing offshore personnel exposure and environmental footprint relative to conventional crewed vessels.

The Armada fleet operations include autonomous underwater vehicles, remotely operated vehicles, and modular geotechnical sampling systems.

### ARMADA A8

The Armada A8 (Figure 1) is Ocean Infinity's 8-meter unmanned surface vessel designed for a variety of coastal and shallow-water offshore tasks. Designed for operations in nearshore conditions, the A8 is suited for flexible deployment and rapid mobilization.

The A8 has an endurance of up to seven days at typical survey speeds of three to four knots.

Typical applications include:

- Coastal and shallow water hydrographic surveys
- Environmental monitoring and sample collection
- Seabed inspection near offshore infrastructure
- Port and harbor activity monitoring

The A8 is capable of operating as part of a larger multi-vessel campaign or as a standalone platform in constrained or remote environments.


Figure 1 Armada A8 unmanned surface vessel

### ARMADA A21

The Armada A21 (Figure 2) is Ocean Infinity's 21-meter unmanned surface vessel designed for offshore geophysical surveys and light subsea inspection. It includes an adaptable pop-top wheelhouse for crewed use if activities such as short harbor voyages or repositioning maneuvers are needed.

The Armada A21 is powered by twin 78 kilowatt-hour lithium-ion battery systems, with endurance ranging from 10 to 35 days depending on mission profile.

Typical applications include:

- Offshore wind farm site surveys
- Cable route and unexploded ordnance investigations
- Coastal infrastructure inspections
- Environmental baseline studies


Figure 2 Armada A21 unmanned surface vessel

### ARMADA A36

The Armada A36 (Figure 3) is Ocean Infinity's 36-meter optionally crewed surface vessel developed for offshore geophysical surveys, subsea inspections, and remote operations. The A36 is designed for use in moderate sea states, generally in waves up to about 2.5 meters high.

The A36 supports the integration of remotely operated vehicles, hosting an automated launch and recovery system onboard. Endurance is up to 35 days depending on tasking.

Typical applications include:

- Offshore wind farm site characterization
- Pipeline and cable inspections
- Subsea asset monitoring
- Environmental and habitat mapping
- Unexploded ordnance surveys


Figure 3 Armada A36 OUSV

### ARMADA A78

The Armada A78 (Figure 4) is Ocean Infinity's 78-meter vessel designed for offshore survey, geotechnical sampling, and inspection, maintenance, and repair operations with capabilities for extended endurance (21 -35 days).

The A78 can be crewed with up to 16 personnel when required. A modular deck layout and moonpool based launch and recovery system enable remote deployment of autonomous underwater vehicles, remotely operated vehicles, seabed drills, and cone penetration test tools.

Typical applications include:

- Deepwater geophysical and geotechnical site investigations
- Subsea infrastructure inspections
- Environmental and habitat surveys
- Unexploded ordnance detection and clearance


Figure 4 Armada A78 Lean-crewed Robotic Vessel

### ARMADA A86

The Armada A86 (Figure 5) is Ocean Infinity's 86-meter multi-role vessel designed to expand the capabilities introduced by the Armada A78. The A86 supports autonomous, remote, and limited-crew operations.

The vessel features hybrid propulsion, a modular deck layout, and a moonpool-fitted launch and recovery system for autonomous underwater vehicles, remotely operated vehicles, seabed drills, and cone penetration test tools.

The A86 can, if required, accommodate up to 16 crew members. Operational endurance ranges from 21 to 35 days depending on configuration and mission type.

Key applications include:

- Offshore geophysical and geotechnical surveys
- Subsea inspection and maintenance
- Environmental and habitat mapping
- Unexploded ordnance surveys
- Support for offshore energy, defense, and telecommunications operations

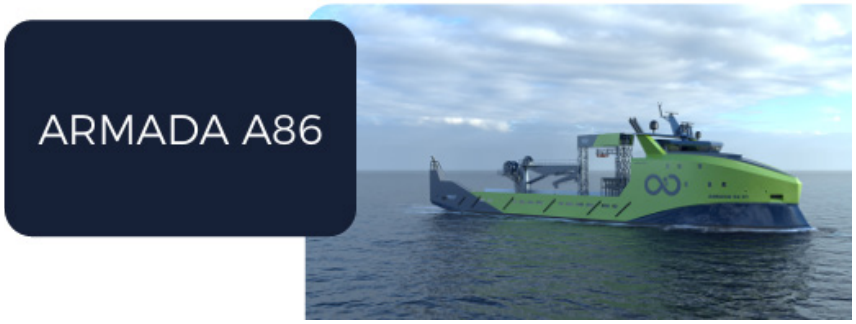


Figure 5 Armada A86 Lean-Crewed Robotic Vessel

# Vessel Deployments

Ocean Infinity's Armada fleet is designed to support a range of autonomous and remotely operated offshore activities. The following summarizes the deployment status of each vessel class as of May 2025, based on publicly available information. While the Armada A78 has documented field operations, details for the Armada A8, A21, A36, and A86 remain limited due to commercial confidentiality or ongoing development.

### ARMADA A8 DEPLOYMENT STATUS

Although the Armada A8 has been operational since 2017 or 2018, specific deployment records are limited, likely due to use in small-scale or confidential client projects. A confirmed deployment occurred during Project Seagrass in the Solent, United Kingdom in 2021. During this project, Ocean Infinity's *SeaWorker 8,* an Armada A8-class vessel, conducted remote operated bathymetric and side-scan sonar surveys covering approximately 10 square kilometers and supported marine habitat restoration efforts. It marked the first known fully remote seagrass survey in the region.

### ARMADA A21 DEPLOYMENT STATUS

As of May 2025, the Armada A21 class is reported to be under construction at Grovfjord Mekaniske Verksted in Norway, with initial deliveries expected in 2022. No confirmed public records verify active field operations.

Publicly available information suggests that the Armada A21 may have supported operations under Ocean Infinity's joint venture with Gregg Drilling, which focuses on geophysical and geotechnical surveys for offshore wind. Ocean Infinity stated that this venture will mobilize seabed drilling equipment onto vessels between 21 and 78 meters in length.

### ARMADA A36 DEPLOYMENT STATUS

As of May 2025, the Armada A36 is under construction in Norway. Public records confirm five vessels were ordered, with initial deliveries anticipated in 2022. Some units are reported to be approaching commissioning or early operational phases; however, no commercial deployments have been publicly verified.

The Armada A36 has been used in a research and development context as part of the "Drone Swarm for Unmanned Inspection of Wind Turbines" project in the United Kingdom from 2022 to 2025. Funded by Innovate UK, the project involved launching autonomous aerial drones from a 36-meter Armada vessel, using 5G and satellite connectivity for remote operation and data transfer, serving as a mobile base for autonomous aerial systems.

### ARMADA A78 DEPLOYMENT STATUS

As of May 2025, documented deployments for the Armada A78 include:

*Southern Indian Ocean – MH370 Search*

In late 2024 and early 2025, three A78 vessels resumed seabed mapping in the search for Malaysia Airlines Flight MH370. These vessels conduct deepwater surveys using autonomous underwater vehicles under remote supervision with real-time data streaming for quality control.

*Clarion-Clipperton Zone (Pacific Ocean)*

In early 2025, an Armada A78 performed environmental baseline studies and bathymetric mapping in the Pacific Ocean's Clarion-Clipperton Zone. The vessel also supported the United States Navy by recovering a Global Autonomous Reconnaissance Craft in San Diego Bay.

*North Sea & Norwegian Sea – Subsea Pipeline & Infrastructure Survey*

An Armada A78 conducted pipeline and interconnector route surveys in the North Sea, including seabed imaging, unexploded ordnance detection, and shallow geotechnical investigations.

*East of Taiwan – Ryukyu Trench Deep-Sea Survey*

An Armada A78 conducted deep sea surveys near the Ryukyu Trench in the Pacific Ocean, including geological assessments and subsea cable corridor planning.

*European Waters – Offshore Wind & Energy Support*

Multiple A78 vessels were used in the North Sea, Baltic Sea, and Atlantic Shelf to support offshore wind farm investigations, environmental surveys, and infrastructure inspections. Specific project names are not publicly available.

## ARMADA A86 DEPLOYMENT STATUS

As of May 2025, no confirmed public records note operational deployments of the A86. The vessel is expected to perform missions similar to those of the Armada A78 once fully operational.

## OTHER OCEAN INFINITY PROJECT DEPLOYMENTS (UNSPECIFIED VESSELS)

Several offshore projects conducted by Ocean Infinity have not identified specific vessels in public records; however, these deployments are summarized below.

*Ossian Floating Wind Farm (Scotland, 2023–2024)*

Ocean Infinity conducted seabed-based geotechnical investigations for the Ossian Floating Offshore Wind Farm, located 84 kilometers southeast of Aberdeen. The project area spans 858 square kilometers with average depths of 72 meters. Ocean Infinity performed 90 cone penetration tests, 45 seismic cone penetration tests, and collected 20 Vibracore samples.

*Morro Bay Floating Wind Survey (United States West Coast, 2024)*

Ocean Infinity conducted geophysical surveys for Equinor Wind US LLC offshore of the California coast. The operation involved simultaneous deployment of multiple deepwater autonomous underwater vehicles across depths from 974 to 1,317 meters. The data supported Equinor's Site Assessment Plan and Construction and Operations Plan. While the vessel used was not disclosed, the depth and scale suggest potential use of an Armada A78-class vessel.

*Baltica 2 Offshore Wind Farm Survey (Polish Baltic Sea, 2024)*

In 2024, Ocean Infinity completed a survey campaign for Ørsted and PGE Baltica at the Baltica 2 project site. A multibeam echo sounder and ultra-high-resolution seismic system were used to map 540 kilometers of sub-seabed features. The use of a limited-crew Armada vessel was reported, potentially an Armada A78 given the project profile.

*Stabroek Block Offshore Guyana – ExxonMobil Survey (2024)*

Ocean Infinity conducted a geophysical and geotechnical survey for ExxonMobil in the Stabroek Block, covering 3,100 square kilometers in water depths from 70 to 2,150 meters. Multiple autonomous underwater vehicles were deployed simultaneously for high-resolution data acquisition. The vessel was not identified, but the operational scale and water depth indicate potential use of an Armada A78-class platform.

# Ocean Infinity's Autonomous Vessel Solutions

### CREW SAFETY & FATIGUE

Traditional offshore survey operations require personnel to work long shifts in remote, challenging environments. These conditions can increase fatigue, slow decision making, and elevate safety risks. By supervising Armada vessels from onshore control centers, Ocean Infinity enables offshore teams to focus on tasks such as data interpretation, system maintenance, and mission planning, while reducing their exposure to hazardous conditions.

Ocean Infinity's Armada fleet is designed for continuous, remotely supervised operations, reducing reliance on offshore personnel and improving data acquisition rates. By acting as a force multiplier (multiple vessels deployed supporting crewed vessels), unmanned surface vessels have been shown to double survey coverage and reduce time on site. For example, during the Ossian Floating Offshore Wind Farm campaign, Ocean Infinity remotely deployed the Infinity Cone Penetration Test 250 system for seabed sampling without sending personnel offshore.

Key features contributing to improved safety and reduced fatigue include:

- Automated launch and recovery systems on larger vessels (such as those with moonpool launch and recovery systems on the Armada A78 and A86)
- Simultaneous deployment of autonomous underwater vehicles and remotely operated vehicles
- Real-time data streaming to remote control centers, allowing quality control and mission adjustments without crew rotations

This approach limits offshore exposure to crew, reduces vessel days at sea, and helps maintain schedule certainty.

### HIGH OPERATIONAL COSTS

Offshore vessel operations are typically influenced by crew, fuel, and idle time. The Armada fleet addresses these through a combination of remote operation, modularity, and hybrid propulsion.

Examples include:

- Reduced personnel costs by optimizing crew complements (often fewer than 16), which allows for smaller accommodation modules, lower material and resource requirements, and streamlined onboard logistics.
- Lower fuel consumption than comparable vessels through efficient hull design and hybrid systems, with some vessels reporting fuel savings of up to 90 percent compared to conventional platforms
- Improved platform versatility by using modular payload bays and standardized power and data interfaces, enabling rapid swap out of equipment (for example, replacing a geotechnical CPT skid with a multibeam echosounder and sub-bottom profiler) within a single shift, eliminating extended downtime and reducing mobilization costs.

### SURVEY EFFICIENCY

Ocean Infinity's vessels operate continuously and are equipped with modular sensor systems, reducing changeover time between scopes. Real time communications support data validation during acquisition, further reducing project timelines.

Efficiency enablers include:

- Dynamic payload control systems for rapid switching of survey equipment (e.g., multibeam echo sounders and sub-bottom profilers)
- Automated launch and recovery systems that reduce deployment time and improve equipment safety
- Simultaneous multi-asset operations, especially on the Armada A78 and A86, where autonomous underwater vehicles and remotely operated vehicles are deployed in parallel
- Real-time data streaming to remote control centers

### DISTANCE FROM SHORE

Ocean Infinity's Armada vessels are configured for extended range operations in remote and deepwater environments. Their endurance (typically 21 to 35 days) and global communication capabilities support missions far from shore without requiring frequent crew transfers.

Operational capabilities include:

- Range and endurance: Armada A21 vessels can cover over 5,500 kilometers, Armada A36 over 10,000 kilometers, and Armada A78 and A86 vessels can remain at sea for up to 35 days

- Reliable connectivity: Satellite and wireless links support command and data relay over long distances, as demonstrated in the Dr-SUIT project where an Armada A36 maintained stable communications across a 10,000-kilometer operating area
- Remote control center integration: Facilities in Southampton (United Kingdom), Austin (Texas), and Australia provide global coverage for mission control and data oversight

# Autonomous Fleet Development

### NAVIGATIONAL SAFETY

Ocean Infinity applies safety protocols based on sensor integration, remote oversight, and regulatory compliance with the International Regulations for Preventing Collisions at Sea, the International Maritime Organization adopted navigation rules governing vessel conduct to prevent collisions. Vessels are equipped with specific sensor systems for navigational safety, including sonar, multibeam echo sounders, Automatic Identification Systems, and optical and infrared cameras.

### INFRASTRUCTURE REQUIREMENTS

The Armada fleet requires minimal dependence on traditional port infrastructure.

Key elements include:

- Remote operation by design: Armada vessels do not require onboard bridge control
- Globally integrated remote control centers: Facilities in the United Kingdom, United States, and planned sites in Asia manage mission control, vehicle deployment, and payload operations across locations
- Digital payload integration: Ocean Infinity's in-house systems connect vessel navigation, subsea deployment, and data collection, eliminating the need for separate support vessels

### TRAINING APPROACH AND SKILL DEVELOPMENT

Ocean Infinity's operational model emphasizes digital systems, remote mission management, and integrated team roles. The company employs cross disciplinary teams comprising marine engineers, roboticists, data analysts, geotechnical specialists and other experienced offshore roles.

Training methods include:

- Simulation based onboarding: Operators are trained in virtual environments and through digital twins of vessels and operations, enabling rapid scaling without vessel access
- Workflows: Teams are trained to manage the full survey chain remotely, including geophysical sensors, autonomous underwater vehicles, remotely operated vehicles, and seabed sampling tools.

# Application of Ocean Infinity's USVs to Offshore Wind Operations

Ocean Infinity's Armada fleet is designed to support a range of offshore wind development activities. These include early site investigation, foundation and cable installation support, and long-term inspection and maintenance. The fleet addresses operational challenges associated with deeper water deployments, expanded lease areas, compressed construction schedules, and evolving decarbonization targets.

### SEABED SURVEYS, SITE INVESTIGATION & CABLE ROUTING

Armada vessels are equipped with multibeam echo sounders, side-scan sonar, sub-bottom profilers, and autonomous underwater vehicles, enabling high-resolution mapping of seabed and sub seafloor conditions for turbine siting, foundation design, and export cable routing. Armada vessels are able to launch autonomous underwater vehicles, conduct remote geotechnical testing, and are used for unexploded ordinance detection.

### ASSET INSPECTION & MAINTENANCE

After offshore wind infrastructure is installed, Armada vessels support regular condition monitoring using a combination of hull-mounted sensors and deployable subsea systems, including foundation inspections from remote operated or autonomous underwater vehicles, sonar imaging of fixed and floating wind turbine foundations, and cable integrity monitoring.

### ENVIRONMENTAL MONITORING AND COMPLIANCE

Armada vessels support environmental monitoring activities required for permitting and operational compliance, with a smaller offshore footprint compared to traditional crewed vessels. These operations include passive acoustic monitoring for marine mammals' presence, turbidity and sediment monitoring, benthic habitat surveys, and underwater noise monitoring.

### FLOATING OFFSHORE WIND DEVELOPMENT

The Armada fleet is capable of extended endurance surveys, deepwater inspections using remotely operated and autonomous underwater vehicles (in depths up to 6,000 meters), and monitoring of dynamic assets such as mooring and anchor lines and export cables.

# Regulatory Agencies for Autonomous Vessels

The use of unmanned surface vessels is governed by a range of national and international regulations designed to ensure safety, environmental compliance, and operational integrity. Key entities involved in this oversight include the United States Coast Guard, International Maritime Organization, American Bureau of Shipping, and DNV (formerly known as Det Norske Veritas, a Norwegian-based international accreditation registrar). Additional regulatory constraints, such as the Jones Act, may also apply depending on vessel activities and locations.

### US COAST GUARD (USCG)

The United States Coast Guard oversees vessel safety, cybersecurity, and maritime law compliance within U.S. waters. For autonomous vessels, the Coast Guard is developing guidelines in collaboration with the American Bureau of Shipping, DNV, and other maritime societies.

In a 2025 interview, Coast Guard officials emphasized the importance of operator accountability, situational awareness, and early engagement with authorities when deploying unmanned systems, and noted that consistent oversight, real-time monitoring, and proactive risk management are essential to ensure safety for other mariners and the public. Agencies increasingly expect that autonomous operators maintain vigilance equivalent to onboard crews.

While no public information details Ocean Infinity's autonomous vessel operations in United States waters, their 2024 Morro Bay survey for Empire Wind suggests potential engagement with the Coast Guard for compliance. Managing Director of Armada Dan Hook notes the Coast Guard's supportive stance recognizing uncrewed vessels as a solution to offshore safety challenges including avoiding personnel exposure to severe weather and high sea states, eliminating the hazards of helicopter or vessel transfers, reducing fatigue related human errors on long watch cycles, and mitigating collision risks through advanced sensor-based navigation and automatic emergency stop functions.

### INTERNATIONAL MARITIME ORGANIZATION

The IMO is developing an international regulatory framework for Maritime Autonomous Surface Ships, expected to become mandatory by 2032. This includes standards for navigation, safety, emissions, and legal responsibility.

Ocean Infinity participates in these regulatory efforts through its involvement in the International Maritime Organization Maritime Safety Committee. Operations such as the MH370 search have followed these emerging guidelines for uncrewed navigation and oversight.

### AMERICAN BUREAU OF SHIPPING (ABS)

The American Bureau of Shipping develops technical standards for vessel design, construction, and remote operation systems and serves as a recognized organization for the United States Coast Guard and other flag states, supporting regulatory compliance and system verification.

### DNV CLASSIFICATION SOCIETY

DNV provides vessel classification, statutory surveys, and verification services focused on safety, environmental performance, and system reliability. The organization has experience with autonomous technology and low-emission systems.

Ocean Infinity's Armada vessels, constructed in Norway and flagged in the United Kingdom, operate under certification from DNV. In 2021, Armada 78-03 received the first Statement of Compliance for remote operations under DNV-CG-0264, validating the safety and cybersecurity of Ocean Infinity's remote control center architecture.

DNV's certification supports operations involving remote control center oversight and hybrid propulsion systems. Armada vessels are also equipped with DNV compliant ShipManager software for maintenance, procurement, and regulatory tracking.

### JONES ACT

The Jones Act requires vessels transporting goods or personnel between United States ports to be built, owned, and operated by United States citizens or permanent residents. It can affect mobilization and support operations for international unmanned surface vessels working in United States waters. Ocean Infinity's smaller uncrewed vessels, such as the Armada A8, A21, and A36, are constructed in Norway and do not meet the United States- built criteria. These vessels are primarily used for seabed mapping and offshore surveys and are not engaged in domestic cargo or passenger transport. As such, these vessels may fall outside the scope of Jones Act restrictions.

However, larger limited crew vessels such as the Armada A78 and A86, which are capable of carrying payloads and limited personnel, may be subject to further review depending on their intended use. Ocean Infinity is in discussions with United States shipyards to develop Jones Act compliant vessels that would allow broader participation in United States domestic operations. Additional clarification from the United States Coast Guard may be required to confirm the status of uncrewed survey operations under the Jones Act framework.