

Offshore Autonomous Underwater Vehicle Market - Global Industry Size, Share, Trends, Opportunity, and Forecast, Segmented By Vehicle Class (Work-Class Vehicle, Observatory-Class Vehicle), By End-User (Oil and Gas, Defense, Research, and Others), By Activity (Drilling and Development, Construction, Inspection, Repair & Maintenance, Decommissioning, and Others), By Region & Competition, 2019-2029F

Market Report | 2024-11-30 | 180 pages | TechSci Research

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## **Report description:**

Global Offshore Autonomous Underwater Vehicle Market was valued at USD 2.44 Billion in 2023 and is anticipated to project robust growth in the forecast period with a CAGR of 6.32% through 2029. The Global Offshore Autonomous Underwater Vehicle (AUV) Market is experiencing significant growth driven by advancements in technology and the increasing demand for deep-water exploration. AUVs, which are programmable, self-propelled underwater robots, are crucial for a variety of applications including oceanography, environmental monitoring, and underwater archaeology. The growing need for efficient and accurate data collection in deep and harsh underwater environments is pushing the adoption of AUVs across the globe. These vehicles provide critical data for the oil and gas industry, military and defense applications, and scientific research, contributing to their rising market demand. One of the primary growth drivers is the increasing investment in offshore oil and gas exploration. With many onshore reserves being depleted, the focus has shifted to untapped underwater reserves. AUVs play a pivotal role in subsea exploration and pipeline inspection, offering cost-effective and reliable solutions. Additionally, the rise in marine research activities to study ocean currents, underwater topography, and marine life is bolstering the AUV market. Technological advancements, such as enhanced battery life, improved sensors, and better navigation systems, are also making AUVs more efficient and attractive for a wider range of applications.

Several trends are shaping the Global Offshore AUV Market. The integration of artificial intelligence (AI) and machine learning (ML) with AUVs is a significant trend, enhancing the autonomous capabilities of these vehicles. AI and ML enable AUVs to perform complex tasks, such as pattern recognition and decision-making, without human intervention. Another notable trend is the

development of hybrid AUVs that combine the features of autonomous and remotely operated vehicles, providing greater flexibility and operational efficiency. The miniaturization of sensors and other electronic components is also facilitating the production of smaller, more cost-effective AUVs, opening up new market opportunities. Opportunities abound in various sectors. The defense sector is increasingly adopting AUVs for mine countermeasures, surveillance, and reconnaissance missions. The growing focus on environmental conservation and the need to monitor and protect marine ecosystems present significant opportunities for AUV deployment. Furthermore, the commercial sector, particularly underwater infrastructure inspection and maintenance, is seeing substantial growth potential.

Despite the promising growth prospects, the Global Offshore AUV Market faces several challenges. High initial costs and maintenance expenses of AUVs can deter smaller organizations from adopting these technologies. Ensuring the reliability and accuracy of data collected by AUVs in diverse and challenging underwater environments is another critical challenge. The complexity of underwater navigation and the risk of vehicle loss due to harsh conditions or technical failures also pose significant concerns. The development of robust communication systems for AUVs operating in deep waters remains a technological hurdle. Addressing these challenges requires continuous innovation and collaboration among industry stakeholders, researchers, and policymakers. By overcoming these obstacles, the AUV market can achieve sustained growth and contribute significantly to various sectors, from energy to environmental conservation.

# Key Market Drivers

## Increasing Demand for Offshore Oil and Gas Exploration

One of the primary drivers of the Global Offshore AUV Market is the growing demand for offshore oil and gas exploration. As conventional hydrocarbon reserves on land become scarcer, the offshore sector has gained prominence. Offshore exploration and production (E&P) activities require extensive surveys of the seabed, pipelines, and infrastructure, which is where AUVs come into play.

AUVs are equipped with advanced sensors and imaging systems that can map the seafloor, inspect subsea infrastructure, and gather valuable data about underwater geological formations. These capabilities are crucial for oil and gas companies in identifying potential reserves, planning drilling operations, and maintaining offshore infrastructure. AUVs offer a cost-effective and efficient solution for collecting accurate data in challenging offshore environments, reducing the risks associated with traditional human-operated missions.

Moreover, with the growing interest in deep-sea and ultra-deepwater drilling, the demand for AUVs has risen exponentially. AUVs can reach extreme depths, operate for extended periods, and provide real-time data, making them indispensable for the oil and gas industry.

#### Advancements in Autonomous Technology

The continuous advancements in autonomous technology represent another major driver of the Global Offshore AUV Market. AUVs are becoming more sophisticated and capable, thanks to innovations in navigation, communication, artificial intelligence, and sensor technologies. These advancements enable AUVs to operate autonomously and make critical decisions without human intervention.

Navigation and localization systems have greatly improved, allowing AUVs to precisely map their surroundings and follow predefined paths with high accuracy. Additionally, communication technologies have evolved, enabling AUVs to transmit data in real-time, making them more responsive and adaptable during missions.

Artificial intelligence plays a pivotal role in enabling AUVs to process large datasets, identify objects of interest, and adjust their operations accordingly. Machine learning algorithms can enhance the AUV's ability to recognize underwater features, detect anomalies, and respond to unexpected events, such as the detection of uncharted obstacles or marine life.

Sensor technologies have also witnessed significant progress, with AUVs now equipped with advanced sonar systems, cameras, and environmental sensors. These sensors facilitate tasks such as seafloor mapping, hydrographic surveys, marine life monitoring, and pollution detection. As AUV technology continues to advance, it will become even more instrumental in a wide range of offshore applications. For instance, in September 2023, BAE Systems partnered with Cellula Robotics, a Canadian marine technology and offshore engineering group, to accelerate the development and demonstration of a new Extra Large Autonomous Underwater Vehicle (XLAUV) testbed. The collaboration is gearing up for trials scheduled in 2024. Environmental Monitoring and Conservation Efforts

Environmental Monitoring and Conservation Efforts

The growing concern for environmental conservation and the need to monitor and protect delicate marine ecosystems have emerged as a significant driver for the Offshore AUV Market. AUVs are employed for environmental monitoring and scientific research in offshore areas to assess the health of marine ecosystems and investigate the impact of human activities on the oceans.

These vehicles can collect data on water quality, temperature, salinity, and marine life distribution, aiding researchers and organizations in understanding and preserving the marine environment. AUVs are particularly valuable in conducting surveys in ecologically sensitive regions where traditional manned operations may pose risks.

Additionally, AUVs are vital tools for responding to and mitigating environmental disasters, such as oil spills. Their ability to operate autonomously in hazardous conditions and collect critical data for emergency response and environmental remediation efforts makes them indispensable in safeguarding marine ecosystems.

As environmental regulations and awareness continue to grow, the demand for AUVs in environmental monitoring and conservation is expected to rise, further driving market growth. For instance, in July 2023, the Deutsche Bucht Offshore Wind Farm in the German North Sea successfully tested autonomous surface and subsea platforms for their operations and maintenance tasks. Commissioned by Northland Power, the wind farm's owner, the project aimed to assess the performance and refine the operational workflows of Subsea Europe Services' Autonomous Surveyor uncrewed surface vessel (USV) for multibeam surveys, and the A.IKANBILIS hovering autonomous underwater vehicle (HAUV) for subsea inspections, such as scour and marine growth surveys. These technologies were deployed from a service operations vessel (SOV) already in use for O&M at the wind farm. Subsea Infrastructure Inspection and Maintenance

The inspection and maintenance of subsea infrastructure, such as pipelines, cables, and offshore platforms, is a crucial driver of the Global Offshore AUV Market. AUVs are uniquely suited for these tasks due to their ability to navigate complex underwater structures, capture high-resolution images, and conduct comprehensive surveys.

Routine inspections of subsea infrastructure are essential to ensuring the integrity and safety of offshore operations. AUVs equipped with advanced imaging systems and sensors can identify corrosion, cracks, or other defects in pipelines and platforms. This early detection allows for timely maintenance and prevents costly downtime or environmental disasters.

AUVs also play a significant role in underwater infrastructure installation, as they can survey the seabed and assess the suitability of a location for subsea developments. Moreover, they can monitor the installation process and ensure that it is carried out correctly and safely.

The efficiency and precision of AUVs in subsea infrastructure inspection and maintenance are driving their adoption across various industries, including energy, telecommunications, and marine construction.

Defense and Security Applications

The defense and security sector is another major driver of the Global Offshore AUV Market. AUVs are integral to various defense applications, including mine countermeasures, anti-submarine warfare, intelligence, surveillance, reconnaissance (ISR), and underwater surveys.

AUVs are capable of detecting and neutralizing underwater mines, which pose a significant threat to naval and commercial vessels. Their autonomous operation allows them to search and clear minefields efficiently and safely. Furthermore, AUVs are used for anti-submarine warfare, providing underwater surveillance and tracking capabilities, making them essential for naval operations.

In the field of ISR, AUVs can conduct covert missions to gather intelligence and monitor underwater activities. They are also valuable for offshore security and border control, as they can patrol and safeguard maritime boundaries.

These defense and security applications drive the development and adoption of AUVs with enhanced stealth, endurance, and advanced sensor capabilities, as well as the ability to operate in challenging underwater environments.

Key Market Challenges

High Initial Investment and Operational Costs

One of the primary challenges facing the Global Offshore AUV Market is the high initial investment and operational costs associated with these advanced underwater vehicles. AUVs are sophisticated machines equipped with state-of-the-art sensors, navigation systems, communication technology, and advanced materials, making their upfront purchase cost substantial. The investment extends to the training and education required to operate and maintain AUVs, which can be a significant financial

## burden for organizations.

Moreover, operational costs include expenses related to mission planning, deployment, maintenance, and data analysis. While AUVs provide significant benefits in terms of efficiency and data collection, their high operational costs can be a deterrent for some potential users, particularly smaller organizations or research institutions with limited budgets. Efforts are being made to reduce these costs through technological advancements, streamlined maintenance processes, and the development of more cost-effective AUV models. However, cost remains a substantial challenge for the widespread adoption of AUVs in the offshore sector.

# Limited Endurance and Payload Capacity

AUVs typically have limited endurance, which is another challenge that affects their application in the offshore industry. Endurance refers to the amount of time an AUV can operate autonomously underwater before it needs to be retrieved and recharged. The relatively short endurance of many AUVs can limit their effectiveness in long-duration missions, such as deep-sea exploration, extended surveillance, or lengthy data collection tasks.

Furthermore, AUVs often have limited payload capacity, meaning they can only carry a specific amount of equipment, sensors, and instruments. This constraint can be a challenge, especially when multiple sensors or a variety of tools are required for complex missions. Operators must carefully plan and prioritize the payload, which can result in compromises regarding the data collected or the overall mission objectives.

These limitations are partially due to the size and power constraints of AUVs, as well as the need to maintain their mobility and efficiency. Addressing endurance and payload capacity challenges is an ongoing area of research and development in the AUV industry.

# Data Management and Analysis Complexity

The complexity of data management and analysis is a significant challenge in the Global Offshore AUV Market. AUVs are equipped with advanced sensors that generate vast amounts of data during their missions. These data sets can include high-resolution images, sonar scans, environmental data, and more, all of which require meticulous processing, analysis, and interpretation. Managing and analyzing the data collected by AUVs can be resource-intensive and time-consuming. It necessitates the use of specialized software, algorithms, and skilled personnel who can extract valuable insights from the data. This complexity poses challenges for organizations in terms of data storage, transmission, and interpretation.

Furthermore, real-time data analysis can be critical for some applications, such as environmental monitoring or defense-related missions. Ensuring that AUVs can provide immediate feedback and actionable data while operating autonomously is a demanding task.

Efforts are ongoing to develop more efficient data processing and analysis methods, as well as to create user-friendly interfaces that allow operators to interact with AUVs and access their data in a more intuitive manner. The goal is to simplify data management and analysis and make AUV technology more accessible.

Technological and Regulatory Challenges

Technological and regulatory challenges are another set of obstacles facing the Global Offshore AUV Market. As technology rapidly advances, it is essential for AUVs to keep pace with the latest developments to remain relevant and effective. This requires ongoing research and development efforts to improve navigation, communication, sensors, and artificial intelligence capabilities. Moreover, regulatory frameworks governing the use of AUVs in offshore environments can be complex and vary from one region to another. Navigating these regulations and ensuring compliance can be a challenge for organizations that operate in multiple geographic locations.

Additionally, security and safety considerations play a significant role, particularly when AUVs are used in defense and security applications. Ensuring that AUVs are secure from cyber threats and protecting their data from unauthorized access are paramount concerns that require continuous vigilance and adaptation.

Technological and regulatory challenges call for a coordinated effort between industry stakeholders, governments, and research institutions to establish clear guidelines and standards that can support the safe and effective use of AUVs in offshore environments.

# Environmental and Geographical Complexity

The diverse and often harsh environments in which AUVs operate present a significant challenge. AUVs are utilized in a wide

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range of settings, from shallow coastal waters to extreme deep-sea conditions, and each environment comes with its unique challenges. For example, in the deep-sea environment, extreme pressures and temperatures can affect AUV performance and durability. Additionally, navigating the vast and largely uncharted ocean depths is inherently complex, requiring sophisticated technology to ensure the safe operation of AUVs.

Coastal waters present their own challenges, with factors such as varying water currents, weather conditions, and the presence of marine life adding to the complexity. Navigating and operating in these environments can be particularly demanding, especially when avoiding collisions with obstacles or marine organisms. Furthermore, AUVs are used in polar regions to conduct research on ice-covered oceans, where the extreme cold and challenging ice conditions place additional strain on the vehicles. Adapting AUV technology to these diverse environments while maintaining their autonomy and functionality is a continuous challenge. It requires specialized design, robust engineering, and extensive testing to ensure that AUVs can effectively perform in such demanding conditions.

#### Key Market Trends

#### Increasing Utilization in Scientific Research and Exploration

One of the prominent trends in the Global Offshore AUV Market is the expanding utilization of AUVs in scientific research and exploration. AUVs have become indispensable tools for marine scientists, oceanographers, and researchers in various fields. These vehicles are used to explore and study the world's oceans, providing invaluable insights into marine ecosystems, underwater geology, and biodiversity. AUVs are capable of conducting detailed surveys of the seafloor, mapping the ocean bed, and collecting samples of water, sediment, and marine organisms. They are also instrumental in exploring extreme environments, such as deep-sea hydrothermal vents and polar regions, where they can withstand the challenging conditions and gather critical data. Furthermore, AUVs are contributing to the study of climate change by monitoring ocean parameters, such as temperature, salinity, and carbon dioxide levels. This trend is expected to grow as researchers continue to unlock the mysteries of the oceans and address global challenges related to climate change, resource management, and conservation.

Expanding Applications in Offshore Energy Industries

The offshore energy sector, including oil and gas, renewable energy, and underwater infrastructure, is experiencing a significant trend towards the increased utilization of AUVs. These vehicles play a crucial role in surveying, inspecting, and maintaining offshore assets, contributing to the efficiency and safety of energy production and infrastructure projects. For the oil and gas industry, AUVs are used in subsea pipeline inspections, wellhead monitoring, and offshore platform assessments. They can detect corrosion, damage, and other anomalies in underwater infrastructure, helping operators identify maintenance needs and prevent costly downtime.

In the renewable energy sector, AUVs are used to survey the seabed for offshore wind farms and tidal energy projects. They help identify suitable locations for renewable energy installations, assess environmental impact, and monitor the structural integrity of underwater turbines and cables. AUVs are also employed in the maintenance and inspection of underwater cables and telecommunications infrastructure, ensuring the reliability and efficiency of global communication networks. As the offshore energy sector continues to expand and diversify, the role of AUVs in supporting exploration, production, and maintenance operations is expected to grow, further fueling market demand.

Advancements in Data Collection and Sensor Technologies

A significant trend driving the Global Offshore AUV Market is the continuous advancements in data collection and sensor technologies. AUVs are equipped with an array of sensors, including sonar systems, cameras, environmental sensors, and more, which enable them to capture a wide range of data in high resolution. Recent developments in sensor technologies have significantly enhanced the capabilities of AUVs. For example, advanced sonar systems allow for detailed mapping of the seafloor and precise detection of underwater objects and geological formations. High-resolution cameras enable AUVs to capture clear images and videos of marine life and underwater structures.

Environmental sensors provide real-time data on water quality, temperature, salinity, and other parameters, aiding researchers and operators in monitoring the health of marine ecosystems and ensuring compliance with environmental regulations. As AUVs continue to be equipped with more powerful and specialized sensors, their applications expand into new domains, such as marine archaeology, pollution detection, and marine biology research. This trend is driving the development of innovative sensor technologies and the integration of artificial intelligence to improve data processing and analysis capabilities.

## Enhanced Autonomy and Communication Systems

The trend toward enhanced autonomy and communication systems is playing a pivotal role in the growth of the Global Offshore AUV Market. AUVs are becoming increasingly autonomous, capable of executing missions with minimal human intervention. They can navigate complex underwater environments, avoid obstacles, and make decisions based on real-time data. Navigation systems have evolved to provide AUVs with precise positioning and obstacle avoidance capabilities. These advancements allow AUVs to operate safely in challenging and dynamic environments, such as near offshore platforms, coral reefs, or shipwrecks. Communication systems have also improved, enabling AUVs to transmit data in real-time to operators or remote monitoring centers. This feature is crucial for offshore applications that require immediate feedback and decision-making, such as search and rescue missions or environmental monitoring during oil spills. Enhanced autonomy and communication systems are opening up opportunities for remote and unmanned operations, reducing the need for extensive human presence in offshore missions. This trend is contributing to greater efficiency and safety across various applications.

Growing Interest in Deep-Sea Exploration

The growing interest in deep-sea exploration is a transformative trend in the Global Offshore AUV Market. AUVs are increasingly used to probe the mysteries of the deep ocean, including the world's deepest trenches, underwater volcanoes, and uncharted ecosystems. The technology allows for the collection of data and samples from extreme depths that were previously inaccessible to humans. Deep-sea exploration missions conducted by AUVs aim to uncover valuable insights into biodiversity, geology, and the potential for underwater resources. Researchers are particularly interested in understanding the unique organisms and ecosystems that thrive in extreme conditions, which may have applications in biotechnology and pharmaceuticals. Deep-sea mining is a burgeoning industry, with AUVs playing a crucial role in prospecting for valuable minerals and metals on the ocean floor. These vehicles can locate and assess potential mining sites, contributing to the sustainable extraction of resources from the seabed. The trend of deep-sea exploration is aligned with global efforts to preserve these fragile ecosystems and promote responsible resource management in the deep ocean.

# Segmental Insights

## Vehicle Class Analysis

The Global Offshore Autonomous Underwater Vehicle (AUV) Market is segmented primarily by vehicle class into Work-Class Vehicles and Observatory-Class Vehicles, each serving distinct purposes in underwater operations. Work-Class Vehicles are designed for robust, heavy-duty tasks such as subsea construction, pipeline inspection, and maintenance activities in offshore oil and gas fields. These vehicles are equipped with advanced manipulator arms and tools capable of handling complex tasks under high-pressure and harsh underwater conditions. Their primary function is to support deep-water exploration and industrial operations, ensuring efficiency and safety in challenging marine environments.

On the other hand, Observatory-Class Vehicles are geared towards scientific research and environmental monitoring. These AUVs are equipped with sophisticated sensors and instruments for gathering data on oceanographic parameters, marine biology, and climate-related studies. Observatory-Class Vehicles play a crucial role in studying underwater ecosystems, mapping ocean floors, and conducting long-term monitoring of environmental changes. They are essential tools for researchers and institutions involved in marine science, offering detailed insights into underwater phenomena that are vital for understanding climate change impacts and biodiversity conservation.

The distinction between Work-Class and Observatory-Class Vehicles lies not only in their intended applications but also in their technological specifications. Work-Class Vehicles prioritize payload capacity, endurance, and maneuverability to perform precise and demanding tasks required in offshore industries. In contrast, Observatory-Class Vehicles emphasize sensor accuracy, data collection capabilities, and endurance for extended missions without human intervention. Both classes of AUVs leverage advancements in autonomous navigation, sensor technology, and data processing to enhance their operational capabilities and expand their applications across various sectors beyond traditional roles.

The demand for Work-Class Vehicles is driven by the ongoing expansion of offshore oil and gas activities and the need for reliable subsea infrastructure inspection and maintenance. Conversely, Observatory-Class Vehicles benefit from increasing investments in marine research, environmental monitoring initiatives, and underwater resource management. As technological innovations continue to improve the capabilities and cost-effectiveness of AUVs, both vehicle classes are expected to play integral roles in shaping the future of offshore operations and scientific exploration beneath the world's oceans.

## **Regional Insights**

The Global Offshore Autonomous Underwater Vehicle (AUV) Market exhibits regional segmentation across North America, Europe & CIS, Asia-Pacific, South America, and the Middle East & Africa, each region presenting unique dynamics and opportunities for AUV deployment and development.

North America stands out as a key market due to its strong presence in offshore oil and gas exploration and production activities. AUVs in this region are extensively used for pipeline inspection, seabed mapping, and environmental monitoring in deep-water fields off the coasts of the United States and Canada. The region's advanced technological infrastructure and substantial investments in marine research contribute to the robust demand for AUVs, particularly in scientific expeditions and defense applications.

In Europe & CIS, AUV adoption is driven by stringent environmental regulations and the region's emphasis on sustainable energy solutions. Offshore wind farms in the North Sea and Baltic Sea utilize AUVs for turbine maintenance, seabed surveys, and ecological assessments. Additionally, European countries leverage AUVs for naval operations, underwater archaeology, and research projects focusing on climate change impacts in the Arctic and subsea exploration in the Mediterranean.

Asia-Pacific emerges as a burgeoning market for AUVs, propelled by rapid industrialization, maritime security concerns, and growing investments in offshore energy projects. Countries like China, Japan, and Australia are at the forefront of deploying AUVs for deep-sea mining exploration, marine resource management, and underwater infrastructure inspection. The region's expansive coastline and strategic geopolitical interests drive the demand for AUVs in naval defense operations, marine surveillance, and environmental monitoring initiatives.

South America showcases increasing AUV utilization primarily in offshore oil exploration and marine research expeditions along the Atlantic and Pacific coasts. Brazil, in particular, utilizes AUVs for subsea inspections and geological surveys in its deep-water oil fields, while Chile and Argentina focus on marine biodiversity studies and coastal surveillance using autonomous underwater technologies.

The Middle East & Africa region exhibits growing interest in AUV applications, driven by offshore oil and gas developments in the Persian Gulf and Red Sea. AUVs are employed for pipeline integrity assessments, underwater maintenance, and environmental monitoring in these regions. Additionally, Africa utilizes AUVs for marine conservation efforts, offshore mining exploration, and enhancing maritime security along its expansive coastlines.

The regional segmentation of the Global Offshore AUV Market reflects diverse applications and technological advancements tailored to meet specific regional demands, from industrial operations and scientific research to defense and environmental monitoring initiatives across the world's oceans.

**Key Market Players** ☐ DeepOcean Group Holding AS **DOF** Group ☐ Helix Energy Solutions, Inc. **BOURBON** Maritime Fugro N.V. □□Subsea 7 S.A. Saipem S.p.A. Oceaneering International, Inc. ☐☐Teledyne Technologies Incorporated □□TechnipFMC plc Report Scope: In this report, the Global Offshore Autonomous Underwater Vehicle Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below: Offshore Autonomous Underwater Vehicle Market, By Vehicle Class: o Work-Class Vehicle

o Observatory-Class Vehicle

□Offshore Autonomous Underwater Vehicle Market, By End-User:

- o Oil and Gas
- o Defense
- o Research
- o Others
- □Offshore Autonomous Underwater Vehicle Market, By Activity:
- o Drilling and Development
- o Construction
- o Inspection
- o Repair & Maintenance
- o Decommissioning
- o Others
- □Offshore Autonomous Underwater Vehicle Market, By Region:
- o Asia-Pacific
- 🛛 China
- 🛛 India
- 🛛 Japan
- 🛛 Indonesia
- Thailand
- South Korea
- 🛛 Australia
- o Europe & CIS
- Germany
- Spain
- France
- 🛛 Russia
- 🛛 Italy
- United Kingdom
- Belgium
- o North America
- United States
- 🛛 Canada
- Mexico
- o South America
- 🛛 Brazil
- ] Argentina
- 🛛 Colombia
- o Middle East & Africa
- South Africa
- Turkey
- 🛛 Saudi Arabia
- 🛛 UAE
- Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Global Offshore Autonomous Underwater Vehicle Market.

Available Customizations:

Global Offshore Autonomous Underwater Vehicle Market report with the given market data, TechSci Research offers

customizations according to a company's specific needs. The following customization options are available for the report: Company Information

Detailed analysis and profiling of additional market players (up to five).

# **Table of Contents:**

- 1. Introduction
- 1.1. Product Overview
- 1.2. Key Highlights of the Report
- 1.3. Market Coverage
- 1.4. Market Segments Covered
- 1.5. Research Tenure Considered
- 2. Research Methodology
- 2.1. Objective of the Study
- 2.2. Baseline Methodology
- 2.3. Key Industry Partners
- 2.4. Major Association and Secondary Sources
- 2.5. Forecasting Methodology
- 2.6. Data Triangulation & Validation
- 2.7. Assumptions and Limitations
- 3. Executive Summary
- 3.1. Market Overview
- 3.2. Market Forecast
- 3.3. Key Regions
- 3.4. Key Segments
- 4. Impact of COVID-19 on Global Offshore Autonomous Underwater Vehicle Market
- 5. Global Offshore Autonomous Underwater Vehicle Market Outlook
- 5.1. Market Size & Forecast
- 5.1.1. By Value
- 5.2. Market Share & Forecast
- 5.2.1. By Vehicle Class Market Share Analysis (Work-Class Vehicle, Observatory-Class Vehicle)
- 5.2.2. By End-User Market Share Analysis (Oil and Gas, Defense, Research, and Others)
- 5.2.3. By Activity Market Share Analysis (Drilling and Development, Construction, Inspection, Repair & Maintenance,
- Decommissioning, and Others)
- 5.2.4. By Regional Market Share Analysis
  - 5.2.4.1. Asia-Pacific Market Share Analysis
  - 5.2.4.2. Europe & CIS Market Share Analysis
  - 5.2.4.3. North America Market Share Analysis
  - 5.2.4.4. South America Market Share Analysis
- 5.2.4.5. Middle East & Africa Market Share Analysis
- 5.2.5. By Company Market Share Analysis (Top 5 Companies, Others By Value, 2023)
- 5.3. Global Offshore Autonomous Underwater Vehicle Market Mapping & Opportunity Assessment
- 5.3.1. By Vehicle Class Market Mapping & Opportunity Assessment
- 5.3.2. By End-User Market Mapping & Opportunity Assessment
- 5.3.3. By Activity Market Mapping & Opportunity Assessment
- 5.3.4. By Regional Market Mapping & Opportunity Assessment
- 6. Asia-Pacific Offshore Autonomous Underwater Vehicle Market Outlook
- 6.1. Market Size & Forecast

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| 6.1.1. By Value  |  |  |  |
|--|--|--|--|
| 6.2. Market Share & Forecast   |  |  |  |
| 6.2.1. By Vehicle Class Market Share Analysis                          |  |  |  |
| 5.2.2. By End-User Market Share Analysis                               |  |  |  |
| 6.2.3. By Activity Market Share Analysis                               |  |  |  |
| 6.2.4. By Country Market Share Analysis                                |  |  |  |
| 6.2.4.1. China Market Share Analysis                                   |  |  |  |
| 6.2.4.2. India Market Share Analysis                                   |  |  |  |
| 6.2.4.3. Japan Market Share Analysis                                   |  |  |  |
| 6.2.4.4. Indonesia Market Share Analysis                               |  |  |  |
| 6.2.4.5. Thailand Market Share Analysis                                |  |  |  |
| 6.2.4.6. South Korea Market Share Analysis                             |  |  |  |
| 6.2.4.7. Australia Market Share Analysis                               |  |  |  |
| 6.2.4.8. Rest of Asia-Pacific Market Share Analysis                    |  |  |  |
| 6.3. Asia-Pacific: Country Analysis                                    |  |  |  |
| 6.3.1. China Offshore Autonomous Underwater Vehicle Market Outlook     |  |  |  |
| 6.3.1.1. Market Size & Forecast  |  |  |  |
| 6.3.1.1.1. By Value  |  |  |  |
| 6.3.1.2. Market Share & Forecast                                       |  |  |  |
| 6.3.1.2.1. By Vehicle Class Market Share Analysis                      |  |  |  |
| 6.3.1.2.2. By End-User Market Share Analysis                           |  |  |  |
| 6.3.1.2.3. By Activity Market Share Analysis                           |  |  |  |
| 6.3.2. India Offshore Autonomous Underwater Vehicle Market Outlook     |  |  |  |
| 6.3.2.1. Market Size & Forecast  |  |  |  |
| 6.3.2.1.1. By Value  |  |  |  |
| 6.3.2.2. Market Share & Forecast                                       |  |  |  |
| 6.3.2.2.1. By Vehicle Class Market Share Analysis                      |  |  |  |
| 6.3.2.2.2. By End-User Market Share Analysis                           |  |  |  |
| 6.3.2.2.3. By Activity Market Share Analysis                           |  |  |  |
| 6.3.3. Japan Offshore Autonomous Underwater Vehicle Market Outlook     |  |  |  |
| 6.3.3.1. Market Size & Forecast  |  |  |  |
| 6.3.3.1.1. By Value  |  |  |  |
| 6.3.3.2. Market Share & Forecast                                       |  |  |  |
| 6.3.3.2.1. By Vehicle Class Market Share Analysis                      |  |  |  |
| 6.3.3.2.2. By End-User Market Share Analysis                           |  |  |  |
| 6.3.3.2.3. By Activity Market Share Analysis                           |  |  |  |
| 6.3.4. Indonesia Offshore Autonomous Underwater Vehicle Market Outlook |  |  |  |
| 6.3.4.1. Market Size & Forecast  |  |  |  |
| 6.3.4.1.1. By Value  |  |  |  |
| 6.3.4.2. Market Share & Forecast                                       |  |  |  |
| 6.3.4.2.1. By Vehicle Class Market Share Analysis                      |  |  |  |
| 6.3.4.2.2. By End-User Market Share Analysis                           |  |  |  |
| 6.3.4.2.3. By Activity Market Share Analysis                           |  |  |  |
| 6.3.5. Thailand Offshore Autonomous Underwater Vehicle Market Outlook  |  |  |  |
| 6.3.5.1. Market Size & Forecast  |  |  |  |
| 6.3.5.1.1. By Value  |  |  |  |
| 6.3.5.2. Market Share & Forecast                                       |  |  |  |

- 6.3.5.2.1. By Vehicle Class Market Share Analysis
- 6.3.5.2.2. By End-User Market Share Analysis
- 6.3.5.2.3. By Activity Market Share Analysis
- 6.3.6. South Korea Offshore Autonomous Underwater Vehicle Market Outlook
- 6.3.6.1. Market Size & Forecast
- 6.3.6.1.1. By Value
- 6.3.6.2. Market Share & Forecast
- 6.3.6.2.1. By Vehicle Class Market Share Analysis
- 6.3.6.2.2. By End-User Market Share Analysis
- 6.3.6.2.3. By Activity Market Share Analysis
- 6.3.7. Australia Offshore Autonomous Underwater Vehicle Market Outlook
- 6.3.7.1. Market Size & Forecast
- 6.3.7.1.1. By Value
- 6.3.7.2. Market Share & Forecast
- 6.3.7.2.1. By Vehicle Class Market Share Analysis
- 6.3.7.2.2. By End-User Market Share Analysis
- 6.3.7.2.3. By Activity Market Share Analysis
- 7. Europe & CIS Offshore Autonomous Underwater Vehicle Market Outlook
- 7.1. Market Size & Forecast
- 7.1.1. By Value
- 7.2. Market Share & Forecast
- 7.2.1. By Vehicle Class Market Share Analysis
- 7.2.2. By End-User Market Share Analysis
- 7.2.3. By Activity Market Share Analysis
- 7.2.4. By Country Market Share Analysis
- 7.2.4.1. Germany Market Share Analysis
- 7.2.4.2. Spain Market Share Analysis
- 7.2.4.3. France Market Share Analysis
- 7.2.4.4. Russia Market Share Analysis
- 7.2.4.5. Italy Market Share Analysis
- 7.2.4.6. United Kingdom Market Share Analysis
- 7.2.4.7. Belgium Market Share Analysis
- 7.2.4.8. Rest of Europe & CIS Market Share Analysis
- 7.3. Europe & CIS: Country Analysis
- 7.3.1. Germany Offshore Autonomous Underwater Vehicle Market Outlook
- 7.3.1.1. Market Size & Forecast
- 7.3.1.1.1. By Value
- 7.3.1.2. Market Share & Forecast
- 7.3.1.2.1. By Vehicle Class Market Share Analysis
- 7.3.1.2.2. By End-User Market Share Analysis
- 7.3.1.2.3. By Activity Market Share Analysis
- 7.3.2. Spain Offshore Autonomous Underwater Vehicle Market Outlook
- 7.3.2.1. Market Size & Forecast
- 7.3.2.1.1. By Value
- 7.3.2.2. Market Share & Forecast
- 7.3.2.2.1. By Vehicle Class Market Share Analysis
- 7.3.2.2.2. By End-User Market Share Analysis

7.3.2.2.3. By Activity Market Share Analysis 7.3.3. France Offshore Autonomous Underwater Vehicle Market Outlook Market Size & Forecast 7.3.3.1. 7.3.3.1.1. By Value 7.3.3.2. Market Share & Forecast 7.3.3.2.1. By Vehicle Class Market Share Analysis 7.3.3.2.2. By End-User Market Share Analysis 7.3.3.2.3. By Activity Market Share Analysis 7.3.4. Russia Offshore Autonomous Underwater Vehicle Market Outlook 7.3.4.1. Market Size & Forecast 7.3.4.1.1. By Value 7.3.4.2. Market Share & Forecast 7.3.4.2.1. By Vehicle Class Market Share Analysis 7.3.4.2.2. By End-User Market Share Analysis 7.3.4.2.3. By Activity Market Share Analysis 7.3.5. Italy Offshore Autonomous Underwater Vehicle Market Outlook 7.3.5.1. Market Size & Forecast 7.3.5.1.1. By Value 7.3.5.2. Market Share & Forecast 7.3.5.2.1. By Vehicle Class Market Share Analysis 7.3.5.2.2. By End-User Market Share Analysis 7.3.5.2.3. By Activity Market Share Analysis 7.3.6. United Kingdom Offshore Autonomous Underwater Vehicle Market Outlook 7.3.6.1. Market Size & Forecast 7.3.6.1.1. By Value 7.3.6.2. Market Share & Forecast 7.3.6.2.1. By Vehicle Class Market Share Analysis By End-User Market Share Analysis 7.3.6.2.2. By Activity Market Share Analysis 7.3.6.2.3. 7.3.7. Belgium Offshore Autonomous Underwater Vehicle Market Outlook 7.3.7.1. Market Size & Forecast 7.3.7.1.1. By Value 7.3.7.2. Market Share & Forecast 7.3.7.2.1. By Vehicle Class Market Share Analysis 7.3.7.2.2. By End-User Market Share Analysis 7.3.7.2.3. By Activity Market Share Analysis 8. North America Offshore Autonomous Underwater Vehicle Market Outlook 8.1. Market Size & Forecast 8.1.1. By Value 8.2. Market Share & Forecast 8.2.1. By Vehicle Class Market Share Analysis 8.2.2. By End-User Market Share Analysis 8.2.3. By Activity Market Share Analysis 8.2.4. By Country Market Share Analysis 8.2.4.1. United States Market Share Analysis 8.2.4.2. Mexico Market Share Analysis 8.2.4.3. Canada Market Share Analysis

- 8.3. North America: Country Analysis
- 8.3.1. United States Offshore Autonomous Underwater Vehicle Market Outlook
- 8.3.1.1. Market Size & Forecast
- 8.3.1.1.1. By Value
- 8.3.1.2. Market Share & Forecast
- 8.3.1.2.1. By Vehicle Class Market Share Analysis
- 8.3.1.2.2. By End-User Market Share Analysis
- 8.3.1.2.3. By Activity Market Share Analysis
- 8.3.2. Mexico Offshore Autonomous Underwater Vehicle Market Outlook
- 8.3.2.1. Market Size & Forecast
- 8.3.2.1.1. By Value
- 8.3.2.2. Market Share & Forecast
- 8.3.2.2.1. By Vehicle Class Market Share Analysis
- 8.3.2.2.2. By End-User Market Share Analysis
- 8.3.2.2.3. By Activity Market Share Analysis
- 8.3.3. Canada Offshore Autonomous Underwater Vehicle Market Outlook
- 8.3.3.1. Market Size & Forecast
- 8.3.3.1.1. By Value
- 8.3.3.2. Market Share & Forecast
- 8.3.3.2.1. By Vehicle Class Market Share Analysis
- 8.3.3.2.2. By End-User Market Share Analysis
- 8.3.3.2.3. By Activity Market Share Analysis
- 9. South America Offshore Autonomous Underwater Vehicle Market Outlook
- 9.1. Market Size & Forecast
- 9.1.1. By Value
- 9.2. Market Share & Forecast
- 9.2.1. By Vehicle Class Market Share Analysis
- 9.2.2. By End-User Market Share Analysis
- 9.2.3. By Activity Market Share Analysis
- 9.2.4. By Country Market Share Analysis
- 9.2.4.1. Brazil Market Share Analysis
- 9.2.4.2. Argentina Market Share Analysis
- 9.2.4.3. Colombia Market Share Analysis
- 9.2.4.4. Rest of South America Market Share Analysis
- 9.3. South America: Country Analysis
- 9.3.1. Brazil Offshore Autonomous Underwater Vehicle Market Outlook
- 9.3.1.1. Market Size & Forecast
- 9.3.1.1.1. By Value
- 9.3.1.2. Market Share & Forecast
- 9.3.1.2.1. By Vehicle Class Market Share Analysis
- 9.3.1.2.2. By End-User Market Share Analysis
- 9.3.1.2.3. By Activity Market Share Analysis
- 9.3.2. Colombia Offshore Autonomous Underwater Vehicle Market Outlook
- 9.3.2.1. Market Size & Forecast
- 9.3.2.1.1. By Value
- 9.3.2.2. Market Share & Forecast
- 9.3.2.2.1. By Vehicle Class Market Share Analysis

- 9.3.2.2.2. By End-User Market Share Analysis
- 9.3.2.2.3. By Activity Market Share Analysis
- 9.3.3. Argentina Offshore Autonomous Underwater Vehicle Market Outlook
- 9.3.3.1. Market Size & Forecast
- 9.3.3.1.1. By Value
- 9.3.3.2. Market Share & Forecast
- 9.3.3.2.1. By Vehicle Class Market Share Analysis
- 9.3.3.2.2. By End-User Market Share Analysis
- 9.3.3.2.3. By Activity Market Share Analysis
- 10. Middle East & Africa Offshore Autonomous Underwater Vehicle Market Outlook
- 10.1. Market Size & Forecast
- 10.1.1. By Value
- 10.2. Market Share & Forecast
- 10.2.1. By Vehicle Class Market Share Analysis
- 10.2.2. By End-User Market Share Analysis
- 10.2.3. By Activity Market Share Analysis
- 10.2.4. By Country Market Share Analysis
- 10.2.4.1. South Africa Market Share Analysis
- 10.2.4.2. Turkey Market Share Analysis
- 10.2.4.3. Saudi Arabia Market Share Analysis
- 10.2.4.4. UAE Market Share Analysis
- 10.2.4.5. Rest of Middle East & Africa Market Share Analysis
- 10.3. Middle East & Africa: Country Analysis
- 10.3.1. South Africa Offshore Autonomous Underwater Vehicle Market Outlook
- 10.3.1.1. Market Size & Forecast
- 10.3.1.1.1. By Value
- 10.3.1.2. Market Share & Forecast
- 10.3.1.2.1. By Vehicle Class Market Share Analysis
- 10.3.1.2.2. By End-User Market Share Analysis
- 10.3.1.2.3. By Activity Market Share Analysis
- 10.3.2. Turkey Offshore Autonomous Underwater Vehicle Market Outlook
- 10.3.2.1. Market Size & Forecast
- 10.3.2.1.1. By Value
- 10.3.2.2. Market Share & Forecast
- 10.3.2.2.1. By Vehicle Class Market Share Analysis
- 10.3.2.2.2. By End-User Market Share Analysis
- 10.3.2.2.3. By Activity Market Share Analysis
- 10.3.3. Saudi Arabia Offshore Autonomous Underwater Vehicle Market Outlook
- 10.3.3.1. Market Size & Forecast
- 10.3.3.1.1. By Value
- 10.3.3.2. Market Share & Forecast
- 10.3.3.2.1. By Vehicle Class Market Share Analysis
- 10.3.3.2.2. By End-User Market Share Analysis
- 10.3.3.2.3. By Activity Market Share Analysis
- 10.3.4. UAE Offshore Autonomous Underwater Vehicle Market Outlook
- 10.3.4.1. Market Size & Forecast
- 10.3.4.1.1. By Value

- 10.3.4.2. Market Share & Forecast
- 10.3.4.2.1. By Vehicle Class Market Share Analysis
- 10.3.4.2.2. By End-User Market Share Analysis
- 10.3.4.2.3. By Activity Market Share Analysis
- 11. SWOT Analysis
- 11.1. Strength
- 11.2. Weakness
- 11.3. Opportunities
- 11.4. Threats
- 12. Market Dynamics
- 12.1. Market Drivers
- 12.2. Market Challenges
- 13. Market Trends and Developments
- 14. Competitive Landscape
- 14.1. Company Profiles (Up to 10 Major Companies)
- 14.1.1 DeepOcean Group Holding AS
- 14.1.1.1. Company Details
- 14.1.1.2. Key Product Offered
- 14.1.1.3. Financials (As Per Availability)
- 14.1.1.4. Recent Developments
- 14.1.1.5. Key Management Personnel
- 14.1.2. DOF Group
- 14.1.2.1. Company Details
- 14.1.2.2. Key Product Offered
- 14.1.2.3. Financials (As Per Availability)
- 14.1.2.4. Recent Developments
- 14.1.2.5. Key Management Personnel
- 14.1.3. Helix Energy Solutions, Inc.
- 14.1.3.1. Company Details
- 14.1.3.2. Key Product Offered
- 14.1.3.3. Financials (As Per Availability)
- 14.1.3.4. Recent Developments
- 14.1.3.5. Key Management Personnel
- 14.1.4. BOURBON Maritime
- 14.1.4.1. Company Details
- 14.1.4.2. Key Product Offered
- 14.1.4.3. Financials (As Per Availability)
- 14.1.4.4. Recent Developments
- 14.1.4.5. Key Management Personnel
- 14.1.5. Fugro N.V.
- 14.1.5.1. Company Details
- 14.1.5.2. Key Product Offered
- 14.1.5.3. Financials (As Per Availability)
- 14.1.5.4. Recent Developments
- 14.1.5.5. Key Management Personnel
- 14.1.6. Subsea 7 S.A.
- 14.1.6.1. Company Details

- 14.1.6.2. Key Product Offered 14.1.6.3. Financials (As Per Availability) 14.1.6.4. **Recent Developments** 14.1.6.5. Key Management Personnel 14.1.7. Saipem S.p.A. 14.1.7.1. **Company Details** 14.1.7.2. Key Product Offered 14.1.7.3. Financials (As Per Availability) 14.1.7.4. **Recent Developments** 14.1.7.5. Key Management Personnel 14.1.8. Oceaneering International, Inc. 14.1.8.1. **Company Details** 14.1.8.2. Key Product Offered 14.1.8.3. Financials (As Per Availability) 14.1.8.4. **Recent Developments** 14.1.8.5. Key Management Personnel 14.1.9. Teledyne Technologies Incorporated 14.1.9.1. Company Details 14.1.9.2. Key Product Offered 14.1.9.3. Financials (As Per Availability) 14.1.9.4. **Recent Developments** 14.1.9.5. Key Management Personnel 14.1.10. TechnipFMC plc 14.1.10.1. Company Details 14.1.10.2. Key Product Offered 14.1.10.3. Financials (As Per Availability) 14.1.10.4. Recent Developments 14.1.10.5. Key Management Personnel 15. Strategic Recommendations 15.1. **Key Focus Areas** 15.1.1. Target Regions 15.1.2. Target Vehicle Class
- 15.1.3. Target Activity
- 16. About Us & Disclaimer



# Offshore Autonomous Underwater Vehicle Market - Global Industry Size, Share, Trends, Opportunity, and Forecast, Segmented By Vehicle Class (Work-Class Vehicle, Observatory-Class Vehicle), By End-User (Oil and Gas, Defense, Research, and Others), By Activity (Drilling and Development, Construction, Inspection, Repair & Maintenance, Decommissioning, and Others), By Region & Competition, 2019-2029F

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