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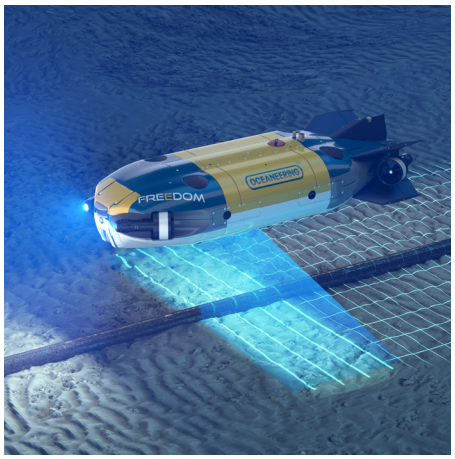
Freedom™ Autonomous Underwater Vehicle

Advanced AUV system for high speed, close proximity inspections

The Freedom™ AUV leverages advanced autonomy to provide customers with a more efficient, cost-effective, and environmentally friendly method of completing operations. Freedom completes pipeline inspections faster than a traditional work class remotely operated vehicle (ROV) and does so in a single pass, reducing costly infill work often required when using a traditional AUV.

Freedom's ability to operate in close proximity to pipelines and umbilicals enables the vehicle's innovative and advanced autonomous software to trigger inspection behaviors when it detects points of interest, providing full coverage of the pipeline length at higher data resolution than a traditional AUV can provide.



FEATURES

Fast, low altitude, single pass inspection with obstacle avoidance

Automated flight control to optimize data collection using advanced tracking algorithms

Sophisticated detection behaviors optimize data gathering for burial, crossing, and free span occurrences

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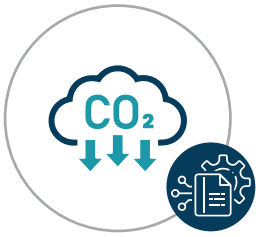
Our extensive experience with ROVs, autonomy, and subsea robotics has helped to develop Freedom into the industry's most thoroughly tested, demonstrated, and robust platform for autonomous and residency-based robotic solutions. Freedom is an amalgamation of building blocks that provide flexibility and functionality for our customers while serving as the cornerstone for next generation subsea robotic developments.

Faster speed. Better coverage.

Outperforms traditional AUVs and ROVs

Reduces CO_2 emissions



Gathers high-quality data in fewer runs

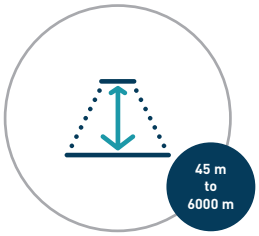
Increases safety

Over-the-side deployment reduces risk

Autonomous anomaly detection

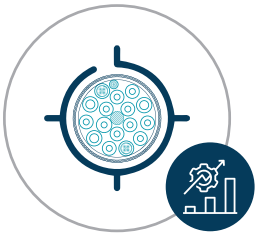
Close proximity inspection (3-5m)

Working depth range



45 m to 6000 m

Umbilical tracking



Increases efficiency and capability

Through Oceaneering's complete control to amend and update Freedom's payload, the AUV is uniquely flexible and can be optimized to meet diverse work scopes and requirements, including:

- High speed, close proximity autonomous inspection of pipelines and umbilicals in a single pass
- Autonomous free span, burial, and crossing inspections
- Touch-free (proximity) cathodic protection (CP) measurements
- Hydrocarbon leak detection
- General visual and instrumented inspection of subsea structures (orbital)
- Bathymetric mapping using a multibeam echosounder (MBES)
- Configurability for use in a resident deployment mode to support field of the future applications where pipeline and leak detection surveillance is required

Dimensions	
Weight in Air	4,950 lb / 2245 kg
Crane Hook Weight with L&R Basket	9,200 lb / 4200 kg
Payload	300 lb / 136 kg
L x W x H	14.8 ft x 3.9 ft x 2.6 ft / 4.5 m x 1.2 m x .8 m
Depth Rating	19,500 ft / 6000 m
Thrusters	4x vectored horizontal and 4x vertical

Performance	
Survey Speed	0-3 kts | 0-1.5 m/s
Survey Range (Benign Conditions)	75 mi / 120 km
Station Keep	87 h @ 0.5 kts
Charge Time (0 to 80%)	4 h
Max Fwd Speed	6 kts | 3 m/s
Max Lat Speed	3 kts | 1.5 m/s
Max Vert Speed	2 kts | 1 m/s

Navigation Systems	
Lights	4x 23,000 LM OII Halo LED
Fwd Looking Sonar	2x NORBIT WBMS-FLS; 1 vertical and 1 horizontal
Fwd Camera	Imenco Goblin Shark Wide Angle HD
Acoustics	Sonardyne Ranger 2 USBL
INS/IMU/DVL	Sonardyne SPRINT-Nav 500
Acoustic Modem	Sonardyne AvTrak 6
GPS and Iridium	MetOcean Novatech IBCN MMI-513
Radio Locator	MetOcean Telematics MMB-533
Strobe	MetOcean Telematics MMF-523

Payload Sensors	
Laser Imaging	Voyis ULS 500 PRO
Stills Camera and Flash	Voyis Observer Stills and NOVA LED
Multibeam	Teledyne Seabat T20-S
Hydrophone	OceanSonics icListen HF Smart SB60-ETH
Altimeters	2x Valeport VA500
CTDs	2x Valeport MIDAS Bathy Pack SV
Turbidity	Sea-bird ECO NTU
Timing	PTP grandmaster clock with GPS sync (less than 6 ppb free-run drift)

Deck Equipment (L x W x H)	
Launch and Recovery Basket	15.8 x 7.9 x 6.9 ft / 4.8 x 2.4 x 2.1 m
Control Van	19.7 x 8.2 x 8.5 ft / 6 x 2.5 x 2.6 m
Workshop/Spares Van	19.7 x 8.2 x 8.5 ft / 6 x 2.5 x 2.6 m

Mission Options
Force Technology FiGS® Field Gradient CP
Franatech Subsea Hydrocarbon Leak Detection

Note: Specifications are provided as indications of performance which have been measured or calculated with respect to specific environmental conditions.

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