



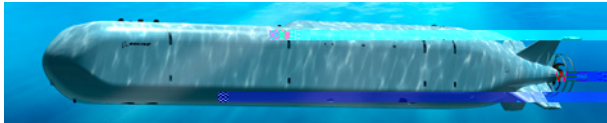
# ECHO VOYAGER

## Extra Large Unmanned Undersea Vehicle

### Current Environment

Unmanned Undersea Vehicles (UUVs), due to their limited endurance, require host platforms for launch and recovery. That reliance results in significant size restrictions limiting on-board power availability, precluding incorporation of redundancy for long-term operations, and reducing payload capacity. At the same time, new sensor and system payloads are rapidly being introduced that could expand the UUV mission set. Viable, cost-effective UUVs providing endurance capabilities and meeting modular payload requirements for varied missions are needed to support the demonstration and refinement of capabilities in open ocean environments.

Boeing's Echo Voyager, a multi-market, pier-launched, modular, long-range Extra Large Unmanned Undersea Vehicle (XLUUV) shifts that paradigm.



### The Boeing Solution

Echo Voyager is a game-changing platform, capable of performing as a multi-mission system and playing a pivotal role in future force structure. The vehicle's advanced autonomy allows it to operate for months at a time without physical human contact and in congested waters. Echo Voyager is complete with a generous internal and external payload volume and available energy capacity. Echo Voyager is the next generation of UUVs.

Host Ship Independent	Very Long Endurance/Range
• Swims from port	• 6,500 nm range (1 fuel module)
• Fully autonomous	• Months of operation

### Navigation System

The vehicle provides remarkable navigational accuracy. The primary navigation system features a proven Kalman Filtered Inertial Navigation Unit (INU) aided by a set of Doppler Velocity Logs (DVLs), and depth sensors, and can use sea floor long baseline (LBL) transponders to augment the navigation solution. GPS is available operating on or near the surface.

Key navigation performance characteristics:

- Altitude Stability: 0.8 ft / 0.25 m ‡
  - Depth Stability: 1.0 ft / 0.3 m ‡
  - LBL aided position accuracy: 7.7 ft / 2.3 m ‡
  - Unaided position accuracy: 0.15% distance traveled ‡
- ‡: RMS values

### Communications

The vehicle uses encrypted Inmarsat IV, Iridium, Wi-Fi, and/or freewave enabled communications for operational command, control, system status, and mission re-planning during near-surface operations, and acoustic communications for command, control, and status messages during submerged operations.

### Buoyancy Control and Trim

The vehicle features an active buoyancy control system with the following features:

- Autonomous buoyancy control capability
- Forward and aft trim control
- Sea floor mooring capability

### Obstacle Avoidance

The vehicle features an active obstacle avoidance capability. The capability is enabled by a Forward-Looking Sonar (FLS) and proven autonomous obstacle avoidance algorithms.

### Terrain Following

The vehicle's FLS system along with a DVL enable terrain following mission capability operations near the sea floor.

### Modular Payload Capacity

The vehicle's internal payload support capability includes:

- Size: Up to 34 ft in length
- Volume: Up to ~ 2,000 cu ft internal volume (14 ft length provides ~ 900 cu ft internal volume)
- Capacity: 8 ton dry weight, 18 KW battery power

The vehicle can also accommodate external payloads.



### XLUUV Summary

A fully autonomous vehicle featuring:

- Weight in Air: 50 tons (45,360 kg)
- Envelope (no payload): 51 ft x 8.5 ft x 8.5 ft (15.5 m x 2.6 m x 2.6 m)
- Envelope (with a 34 ft payload section): 85 ft (25.9 m)
- Maximum Depth: 11,000 ft (3,000 m)
- Maximum Speed: 8.0 kts (14.8 km/hr)
- Minimum Speed: 2.5 kts (4.63 km/hr)
- Optimal Speed: 2.5 - 3 kts (4.6 – 5.6 km/hr)
- Range between recharges: ~150 nm (~280 km) at nominal speed

### Sonar Payload

Echo Voyager can utilize various types of sonar payload including a Raytheon PROSAS PS60-6000 Synthetic Aperture Sonar to enhance its ocean-bottom mapping capability.

- Swath: 6,234 ft (1,900 m)
- Resolution: 0.3 ft (10cm)
- Altitude: 328 ft (100 m)

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