



# Littoral Crawlers:

## Knowing land and sea

**C-2i amphibious crawlers operate on land and on the seafloor across the continental shelf collecting the data that you need. Operate safely, free of weather and sea state constraints, and in all surface traffic environments.**

The Sea Otter and Sea Ox can be **deployed ashore or at sea** and operate in depths up to 300m.

Vehicles can be fitted with a variety of environmental, oceanographic, hydrographic, benthic and industry specific sensors. Installations have included: sidescan, CTD, magnetometers, acoustic releases, vibracores, penetrometers, video and photographic imagery - standalone guest sensors can easily be attached in the field or workshop integrated.

The vehicle **low profile and high stability** allows them to penetrate the surf zone with up to 6 ft wave height and collect data independent of sea state and weather providing more days on task.

Low domestic power draw provides static endurance of 100 days for continuous observations.

Three single operator modes are available: **autonomous, tethered or RF link buoy.**



**Sea Otter**

Lighter two person portable vehicle for non-heavy weather, small boat deployment and smaller payloads.

**Sea Ox**

Tool-free in-field assembly for two person portability and design allows heavier weather and larger payloads.

Standard systems come complete with a vehicle, tough book, Gameboy controller, Xbee radio link, C-2i Diagnostics and Mission Planner software, GPS, AHRS and single axis FOG.

### Sled

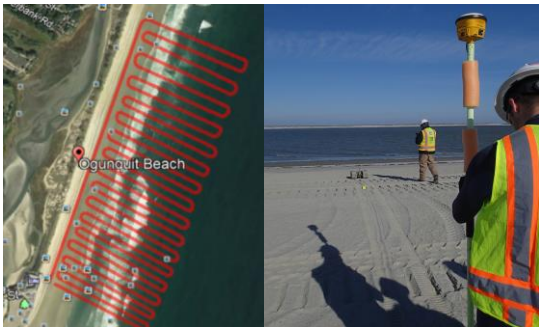
25 x 69 inch non-metallic sled towable by the Sea Otter and Sea Ox. Sled provides additional space for independent payloads, AUV delivery systems or additional power sources. The low sled EM signature makes it suitable for magnetometer and other sensitive sensors.



# Surveying on the Seafloor: Safely and when you choose

The C-2i Sea Otter and Sea Ox are amphibious systems capable of being deployed from sea or shore to collect bathymetric, seafloor, water column, video and environmental data with their integrated, or guest sensor packages.

Single or dual GNSS receivers provide precise positioning and heading when dry, which can be augmented by RTK. Positional data is blended with the INS to provide precise navigation when the vehicle is submerged; whether operating in autonomous or tethered modes.



Most **water column errors are removed** by operating on the seafloor. Depth determination is from a high precision inclinometer and a pressure sensor allowing you to survey on the ellipsoid or reduce soundings to a local datum. Additional multibeam and sidescan payloads to meet feature detection requirements have small SV uncertainties due to operating in the same depth layer and an integrated SV sensor.

The inclinometer allows you to remove large wave motion from the dataset, and generate a continuous dataset across the wet dry divide. The system has negligible altitude or speed over ground uncertainty through the use of a sink gauge, being on the seafloor and measuring distance over ground with track movement.

The most suitable **applications** are:

- cable surveys,
- beach surveys,
- dredge monitoring,
- coastal management, and
- survey checks.

High sea state and weather tolerance means fewer survey days lost, and operations can be conducted **day or night** reducing costly scheduling constraints.

The Sea Otter is two person portable, and the Sea Ox is designed to be two person portable using in-field tool free assembly. Operating both vehicles takes one person.

Low domestic power draw allows for long-term station keeping of 100 days for tidal or current observations, the sink gauge will negate any scouring. Program your system to **collect tidal data** using the pressure sensor and then run the survey mission before you recover it.

Standard range is 10 miles submerged and 24 miles dry, and a 1.5 knot speed provides high sounding density.





# Own the Littoral: Merge the Land and Sea Domain

The C-2i Sea Otter and Sea Ox are amphibious systems deployable from sea or shore independent of weather, to collect information necessary for amphibious operations and littoral warfare.

## Exploit the Environment

Rapid Environmental Assessment, Beach Lane Surveys, Anchorage Surveys, Minefield Surveys, Sound Propagation, Surf Observations

## Protect the Task Force

Mine Detection and Clearance, Swimmer Detection, Hull Inspections, Wharf Inspections, Chokepoint Transit Clearance

## Sustain Operations

Intelligence Collection, Prepositioned Supply Dumps from OTH, SAR, Static and Mobile Training Target, Diver Toolbox, Comms Relay



One operator across land and sea. The Sea Otter is two person portable, and the Sea Ox is designed to be two person portable using in-field tool free assembly.



The **scalable** and high capacity payloads provide cross-environment monitoring, survey and sampling (including trafficability) capabilities that are underpinned by a blended GNSS and INS navigation solution to allow the vehicle to be operated with confidence in either autonomous or tethered modes.

GNSS and a high precision inclinometer are used together to provide a **seamless gradient** dataset from back of beach across the littoral to remove ambiguity.

Low domestic power draw allows for long-term station keeping of 100 days for intelligence collection, environmental observations, or pre-positioning supplies.

Standard range is 10 miles submerged and 24 miles dry, with a 1.5 knot speed.

Sidescan, magnetometers and other imaging technologies are integrated on customer request, an optional sled, and guest ports also allow for **independent sensors** to be carried.





# Environmental Monitoring: Compliance and Exploitation



The C-2i Sea Otter and Sea Ox are amphibious systems deployable from land or water craft that can be integrated with sensor packages to sample and analyze environmental media.

The **low ground pressure** and large area ground contact means the system can operate in a wide range of environments from the surf zone, dunes, rivers, tailing ponds, marshes and mudflats; independent of weather.

A blended GNSS and INS navigation solution allows the vehicle to be programmed to **collect samples** at specified locations, or to accurately record the location of collected samples in either autonomous or tethered modes.

Low domestic power draw allows long-term station-keeping of 100 days providing a stable platform for continuous environmental monitoring. The low profile of the vehicle with automatic recovery features increases equipment safety from external interference.

Typical sensor integrations have included: ADCP, CTD, water level meters, penetrometers, vibracores, magnetometers, video, water sample collection systems, optical turbidity sensors, and dissolved oxygen probes.

Beyond integrated sensor options the open cargo bay design, coupled with an additional sled option, provides **payload flexibility** and the easy mounting of additional independent sensors.

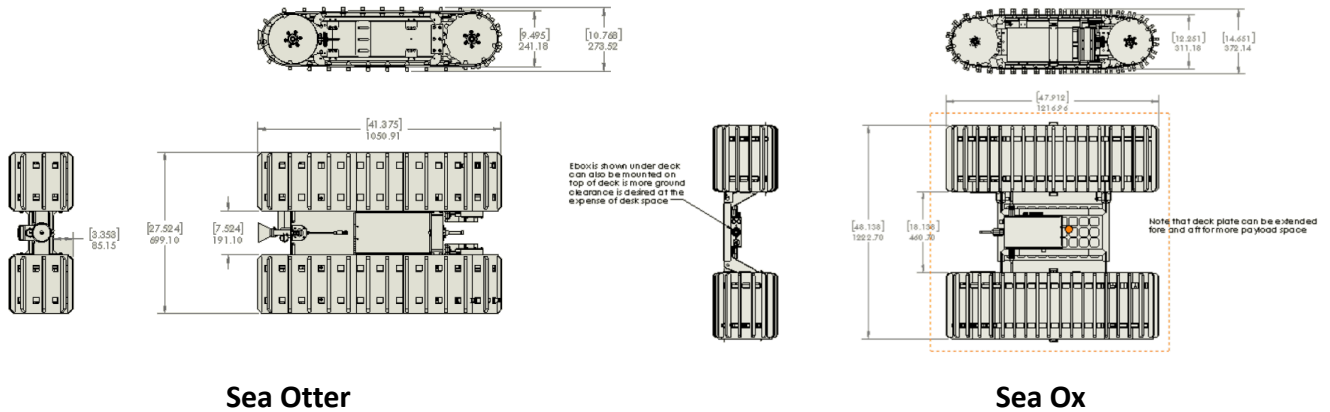
Standard range is 10 miles submerged and 24 miles dry, with a 1.5 knot speed.

The systems' two person portability, one person operation and payload accessibility allows rapid deployment in emergency situations on all surface types, cold environments and high energy areas.





# Sea Otter and Ox: Technical Specifications



**Sea Otter**

**Sea Ox**

Dimensions: 33 x 20 x 10 inches Standard Open Deck Space: 24 x 6 inches	Standard Dimension: 48 x 52 x 14 inches Heavy Duty Dimension: 60 x 60 x 16 inches Standard Open Deck Space: 33 x 14 inches Heavy Duty Open Deck Space: 42 x 16 inches Ground Clearance: 7.5 inches
Weight (with batteries): 125 lbs	Weight (with batteries): 250 lbs
Duration Dry / Wet: 22 / 10 miles	Duration Dry / Wet: 24 / 10 miles
Deck Capacity: 350 lbs	Deck Capacity: 850 lbs (max component 75 lbs) Drawbar Pull: 800 lbs
Ground Pressure – Dry / Wet: 0.15 / 0.08 psi	Ground Pressure – 10' Track Dry / Wet: 0.39 / 0.20 psi – 15' Track Dry / Wet: 0.26 / 0.13 psi
Battery: Li-ion 54V, 48.1V nominal 80Ahr with 2 packs on inside of track Recharge: 4 hrs per battery at max rate Power Available: 5V (500mA), 12V (3A), 24V (3A), 48V	Battery: Li-ion 54V, 48.1V nominal 80Ahr with 2 packs on inside of track Recharge: 4 hrs per battery at max rate Power Available: 5V (500mA), 12V (3A), 24V (3A), 48V
I/O: RS232 (2), RS485(1), non-isolated analog input (2), non-isolated analog output (2), isolated digital input (2), isolated digital output (2), Ethernet (4)	I/O: RS232 (2), RS485(1), non-isolated analog input (2), non-isolated analog output (2), isolated digital input (2), isolated digital output (2), Ethernet (4)
Connectors: SUBCON or Heyco	Connectors: SUBCON or Heyco
Positioning: GNSS Receiver (Dual Rx and RTK options) Heading: Single or Three Axes KVH Fiber Optic Gyro AHRS: Sparton M2	Positioning: GNSS Receiver (Dual Rx and RTK options) Heading: Single or Three Axes KVH Fiber Optic Gyro AHRS: Sparton M2
Precision Inclinometer: 0.05°, 2 axis Pressure Gauge: 10 Hz, 0.4 inches	Precision Inclinometer: 0.05°, 2 axis Pressure Gauge: 10 Hz, 0.4 inches
Internal Sensors: Temp, Overvoltage, Wet/Dry, Battery Monitoring	Internal Sensors: Temp, Overvoltage, Wet/Dry, Battery Monitoring
Sink Gauge: +/- 0.05 inches with 3.75 inch range (opt)	Sink Gauge: +/- 0.05 inches with 3.75 inch range (opt)
External Comms: Ethernet tether, 2.4 GHz XBee RF Additional Comms: RTK, MIMO RF link buoy (option)	External Comms: Ethernet tether, 2.4 GHz XBee RF Additional Comms: RTK, MIMO RF link buoy (option)



# Comprehensive Littoral Services



C-2i provides data collection services that support surveys and environmental monitoring using the Sea Otter and Sea Ox amphibious systems. Areas of application include:

**Cable surveys, beach surveys, dredge monitoring, coastal management, wharf surveys, hull inspections and survey checks.**

Bathymetric, benthic, water column, magnetic, video and environmental data can be collected with integrated sensors, and client provided guest sensor packages can be added onboard or on a towed sled.

Dual GNSS receivers provide precise positioning, which can be augmented by RTK. GNSS positional data is blended with the INS to provide precise navigation when the vehicle is submerged.

Basic depth measurements are from a high precision inclinometer and a pressure sensor, while 2D and 3D multibeam and sidescan payloads meet feature detection requirements, or provide high resolution imagery.

The Sea Otter and Sea Ox high sea state and weather tolerances, coupled with our ability to operate by day and night mean that costly scheduling constraints are limited, providing the client with timely and cost effective data.

C-2i equipment is self-contained and can be transported by air, sea, road and rail allowing us to deploy rapidly to all parts of the country at short notice to meet high need requests.

Client sensors which require integration can be managed with sufficient lead-time, and independent client sensors can quickly be attached in-field. This includes connecting to client RTK and subsea position systems.

C-2i Field Engineers and Operators can operate the equipment independently or in conjunction with a client representative or operator.

Contact us or visit our website to find out the latest additions to our available payloads which include: pressure sensors, sidescan sonar, CTD, video, ADCP, penetrometers, vibracores, optical turbidity sensors, magnetometers, acoustic transponders, and dissolved oxygen probes.

