

Integrated USBL Acoustic Tracking and Communication Systems

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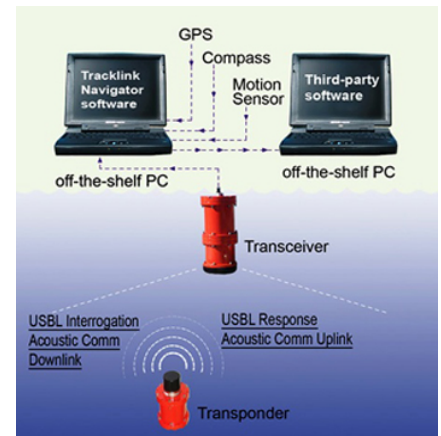
Introduction



The TrackLink systems are the world's best selling USBL acoustic tracking systems with fully integrated high speed acoustic communication capability. Capitalizing on its benchmark **Broadband Acoustic Spread Spectrum (BASS)** technologies, LinkQuest provides the end users with solutions for underwater tracking and communication at sharply reduced cost and increased robustness. An extensive line of models are available to suit the users' specification and budget constraint.

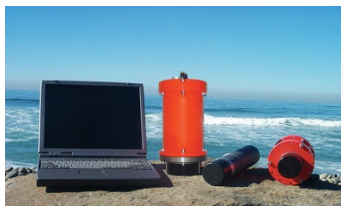
Since their introduction early 2002, the TrackLink acoustic tracking systems have quickly become the best selling USBL tracking systems in the world. The TrackLink 1500 systems, sold to more than 12 countries in less than a year, have become the world's primary choice for tracking underwater vehicles and objects in water depth of less than 1000 meters.

- Extensive use of modern digital signal processing techniques and state-of-the art DSP processors sharply reduced cost for end users.
- **Broadband Acoustic Spread Spectrum (BASS)** technologies.
- Strong rejection to multipaths and ship noise.
- Fully integrated with LinkQuest's most advanced high speed acoustic modems. The USBL transponder and acoustic modem share the same electronics and transducer. It significantly reduces the total size, weight and power consumption and eliminates acoustic interface.
- Advanced power-efficient DSP technology for the USBL intelligent transponders. Field operation time is increased by many folds.
- PC Windows tracking software to display range, bearing, depth, GPS position and other information from the sensors such as an altimeter. Interface directly to the transceiver. No need for a heavy proprietary deck unit.
- Industry's Smallest and lightest transceivers allow easier and cheaper installation from a ship.



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TrackLink Models



TrackLink 1500 Series

Range: up to 1000 meters

Accuracy: up to 0.25 degree



TrackLink 5000 Series

Range: up to 5000 meters

Accuracy: up to 0.15 degree



TrackLink 10000 Series

Range: up to 11000 meters

Accuracy: up to 0.25 degree

** A complete system includes a ship-mounted hydrophone array or transceiver, a subsea transponder or responder, the TrackLink Navigator PC software, one 70 foot cable, a transit case and an operation manual.*

TrackLink Navigator Windows Software

The TrackLink Navigator Windows software integrates the TrackLink transceiver with ship's GPS/DGPS, compass and motion sensor using serial communication. The software displays the positions of the ship and the targets in various plots and textual displays. The TrackLink Navigator software also sends target position data to a selected serial port for input to third party software such as **Hypack**, **Winfrog** and **HYDROpro**. It optionally interfaces to other computers for acoustic communication data.

The TrackLink Navigator software runs on any off-the-shelf PC. No cumbersome "Deck Unit" is needed to operate the system. The software is simple to use and highly robust. A few clicks from the mouse will start your tracking session smoothly.



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TrackLink 1500 Series

TrackLink 1500LC

This system is a low cost yet highly robust system. It tracks up to 16 targets at a range of up to 1000 meters with ship noise. The TrackLink 1500LC System sells at 40% lower price with improved accuracy (3 °) when compared against competing products. This system brings the convenience of an USBL system to a large number of users who typically do not have the budget for an expensive USBL tracking system.

TrackLink 1500MA

This system is a cost-effective, medium accuracy tracking system. The accuracy of the system is 1 degree. It tracks up to 16 targets at a range of up to 1000 meters with ship noise. The TrackLink 1500MA System provides a highly robust solution to cost conscious users who require improved positioning accuracy.

TrackLink 1500HA

This system is a high accuracy USBL tracking system. The accuracy of the system is 0.25 degree. It tracks up to 16 targets at a range of up to 1000 meters with ship noise. The TrackLink 1500HA system is priced significantly below comparable systems.

TrackLink 1500I

This system is an inverted USBL tracking system. The depth rating of the 1500I transceiver is increased to 1000 feet (300 meters). The accuracy of the system is 2 degrees. It tracks up to 8 targets at a range of up to 1000 meters with vehicle noise. The TrackLink 1500I system is designed for applications where the entire system needs to be submerged in deep water.



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TrackLink 1500 Series

TrackLink 1500 Series System Specifications

Positioning Accuracy	1500LC	3.0° (better than 5% of slant range)	
	1500MA	1.0° (better than 2% of slant range)	
	1500HA	0.25° (better than 0.5% of slant range)	
	*1500I	2.0° (better than 4% of slant range)	
Slant Range Accuracy		0.20 meter	
Working Range With Ship Noise		up to 1000 meters	
Operating Beamwidth		120 to 150°	*(90 to 120°)
Targets Tracked		up to 16	*(up to 8)
Operating Frequency		31.0 to 43.2 kHz	
Transponder Maximum Depth		up to 1500 m	
Transceiver Maximum Depth		up to 20 m	*(300meters)
Transceiver Dimension		24(1500I : 45.7) cm x 12.6 cm (diameter)	
Transceiver Weight out of water		3.5 kg	*(5.9kg)
Transceiver Weight in water		1.2 kg	*(1.9kg)
Transmit Mode Power Consumption		10 Watts	*(18 Watts)
Receiver Mode Power Consumption		1.6 Watt	*(12 Watts)
Operating Temperature		-2 to 45 °C	
Storage Temperature		-5 to 75 °C	
RS-232 Configuration		9600 baud, 1 start bit, 1 stop bit, no parity bit, and no flow control	
Optional High Speed Acoustic Modem Data Rate		up to 19200 baud	

*TrackLink 1500I



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Intelligent, Power Efficient Transponders Field Operation Time Is Significantly Increased With Power Efficient Transponders



A wide range of transponders are available for the TrackLink acoustic tracking systems. All the transponders use state of the art DSP to manage the power usage efficiently. The **Broadband Acoustic Spread Spectrum** technology used by the TrackLink system further decreases the power consumption. The DSP is programmed to stay in the standby mode most of time and wakes up to intercept acoustic signal periodically. After the transponder is awakened by the surface TrackLink transceiver, it will be transitioned to the active mode and ready to respond to surface transceiver interrogation. The transponder will go to the standby mode after a prolonged period with no signal reception.

Each transponder has 8 configurable addresses stored in the flash memory and the user can conveniently use the RS232 interface to configure the addresses and other parameters. TN1510 is a high power omni-directional transponder. It uses addresses from 1 to 8. It has comprehensive integrated acoustic communication functions. TN1505 is a high power compact omni-directional transponder. It uses addresses from 9 to 16.

Model A (e.g. TN1510A) is a compact transponder with no batteries. Model B for TN1510 transponder is equipped with alkaline C cells for medium term field use. Model B for TN1505 transponder uses alkaline AA battery cells. Model C's internal alkaline batteries for TN1510 transponder are designed to last for years in the field. Model C for TN1505 transponder uses Lithium AA battery cells. All transponders operate at frequency band from 31.0 to 43.2 KHz.

All transponder/responders have a high power option which increases the transmit power by 6 dB. This option can be useful for long-range high noise environments. The letter "H" following the model number, e.g. TN1510BH, indicates the transponder has the high power option.

All models also have a remote transducer option. With this option, the transducer is connected to the electronics housing by a cable. The letter "R" following the model number, e.g. TN1505BR, indicates the transponder has the remote transducer option. All transponders can be configured to act as a responder. All internally powered transponders can also be powered externally. If the external power is cut off, the transponder will automatically switch to use the internal battery.



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TrackLink 1500 Series

TN1505

- Transmit Power: 25 Watts
- Beamwidth: omni-directional
- Depth Rating: 500 m

1505A:

- Dimension: 25 cm x 6.4 cm (d)
- Weight in water: 0.6 kg
- Weight out of water: 1.4 kg
- Input Voltage: 12 to 24 v

1505B:

- Dimension: 30 cm x 6.4 cm (d)
- Battery Storage Time: 3 years
- Battery Operation Time: 1 year
- Active Responding time: 8 x 10 hours
- Weight in water: 0.86 kg
- Weight out of water: 1.77 kg
- Input Voltage: 18 to 24 v

1505BR:

- Electronic Housing Dimension:
 - 24 cm x 6.4 cm (d)
- Weight in water: 0.65 kg
- Weight out of water: 1.45 kg

1505C:

- Dimension: 30 cm x 6.4 cm (d)
- Battery Storage Time: 3 years
- Battery Operation Time: 2 years
- Active Responding time: 8 x 30 hours
- Weight in water: 0.86 kg
- Weight out of water: 1.77 kg
- Input Voltage: 18 to 24 v

Options:

- High Power

TN1510

- Transmit Power: 32 Watts
- Beamwidth: omni-directional
- Depth Rating: 1500 m

1510A:

- Dimension: 23 cm x 12.6 cm (d)
- Weight in water: 1.4 kg
- Weight out of water: 3.2 kg
- Input Voltage: 12 to 24 v

1510B:

- Dimension: 41.3 cm x 12.6 cm (d)
- Battery Storage Time: 3 years
- Battery Operation Time: 10 months
- Active Responding time: 8 x 25 hours
- Weight in water: 2.0 kg
- Weight out of water: 5.2 kg
- Input Voltage: 22 to 24 v

1510C:

- Dimension: 46 cm x 12.6 cm (d)
- Battery Storage Time: 3 years
- Battery Operation Time: 20 months
- Active Responding time: 8 x 50 hours
- Weight in water: 2.8 kg
- Weight out of water: 6.8 kg
- Input Voltage: 19 to 24 v

Options:

- Integrated Acoustic Modem
- High Power



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TrackLink 5000 Series

TrackLink 5000LC

This system is a low cost yet highly robust system. It tracks up to 8 targets at a range of up to 5000 meters with ship noise. The cost of the TrackLink 5000LC system is a small fraction of the cost of competing USBL tracking systems capable of reaching 5000 meters of range. This system brings the convenience of a long-range USBL system to users who typically do not have the budget for a very expensive long-range USBL tracking system.

TrackLink 5000MA

This system is a very cost-effective, medium accuracy long-range USBL tracking system. The accuracy of the system is 1 degree. It tracks up to 8 targets at a range of up to 5000 meters with ship noise. The TrackLink 5000MA System provides a highly robust solution to cost conscious users who require improved positioning accuracy.

TrackLink 5000HA

This system is a high accuracy long-range USBL tracking system. The accuracy of the system is 0.15 degree. It tracks up to 8 targets at a range of up to 5000 meters with ship noise. The TrackLink 5000HA system is priced significantly below comparable systems. This modern spread spectrum USBL tracking system can typically save the user \$40,000 to \$60,000 while providing equally good or better accuracy than any other long range USBL tracking systems in the market.



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TrackLink 5000 Series

TrackLink 5000 Series System Specifications

Positioning Accuracy	TrackLink 5000LC	3.0° (better than 5% of slant range)
	TrackLink 5000MA	1° (better than 2% of slant range)
	TrackLink 5000HA	0.15° (better than 0.3% of slant range)
Slant Range Accuracy		0.3 meter
Targets Tracked		up to 8
Operating Frequency		14.2 to 19.8 kHz without acoustic modem option
		12.75 to 21.25 kHz with acoustic modem option
Operating Beamwidth		120 °s
Operating Temperature		-5 to 45 °C
Storage Temperature		-255 to 75 °C
RS-232 Configuration		9600 baud, 1 start bit, 1 stop bit, no parity bit, and no flow control
Working Range With Ship Noise		up to 5000 m with TN5015 transponder
		up to 4000 m with TN5010 transponder
Optional High Speed Acoustic Modem Data Rate		up to 4800 baud
Transceiver Maximum Depth		up to 20 m
Transponder Maximum Depth		up to 7000 m
Transmit Mode Power Consumption		40 Watts
Receiver Mode Power Consumption		2 Watt
Transceiver Hydrophon Array Dimension		26 cm x 12.6 to 16 cm (diameter)
Acoustic Transmitter Dimension		28 cm x 14 cm (diameter)
Transceiver Weight in water		2.3 kg
Acoustic Transmitter Weight in water		3.6 kg
Transceiver Weight out of water		5.2 kg



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Intelligent, Power Efficient Transponders **Field Operation Time Is Significantly** **Increased With Power Efficient Transponders**

A wide range of transponders are available for the TrackLink acoustic tracking systems. All the transponders use state of the art DSP to manage the power usage efficiently. The **Broadband Acoustic Spread Spectrum** technology used by the TrackLink system further decreases the power consumption. The DSP is programmed to stay in the standby mode most of time and wakes up to intercept acoustic signal periodically. After the transponder is awoken by the surface TrackLink transceiver, it will be transitioned to the active mode and ready to respond to surface transceiver interrogation. The transponder will go to the standby mode after a prolonged period with no signal reception

Each transponder has 8 configurable addresses stored in the flash memory and the user can conveniently use the RS232 interface to configure the addresses and other parameters.

TN5010 is a high power directional transponder. TN5015 is a high power narrowbeam directional transponder. Model A (e.g. TN5010A) is a compact transponder with no batteries. Model C's internal alkaline batteries are designed to last for years in the field. All transponders operate at frequency band from 14.2 to 19.8 kHz.

Each transponder can be configured to work in the transponder mode or the responder mode. For model C, if the external power supply is at 26 volts, the external power will be used instead of the internal batteries. In case the external power is cut off, the transponder will automatically switch over to use the internal batteries. If the transponder works at the responder mode while the external power is cut off, it will automatically switch to the transponder mode using internal batteries.



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TrackLink 5000 Series

Acoustic communication capability is available as an option for all TN5010 and TN5015 models.

TN5010

- Transmit Power: 100 Watts
- Beamwidth: 60 °
- Depth Rating: 4000 m
- Typical Range: 4000 m

5010A:

- Dimension: 29 cm x 15.2 cm (d)
- Weight in water: 4.6 kg
- Weight out of water: 8.2 kg
- Input Voltage: 18 to 28 v

5010C:

- Dimension: 71 cm x 15.2 cm (d)
- Battery Storage Time: 5 years
- Battery Operation Time: 3 years
- Active Responding time: 8 x 100 hours
- Weight in water: 10.2 kg
- Weight out of water: 19.4 kg
- Input Voltage: 26 to 28 v

TN5015

- Transmit Power: 1000 Watts
- Beamwidth: 30 °
- Depth Rating: 4000 or 7000 m
- Typical Range: 5000 m

5015A:

- Dimension: 39 cm x 15.5 cm (d)
- Weight in water: 9.6 kg
- Weight out of water: 16.2 kg
- Input Voltage: 18 to 28 v

5015C:

- Dimension: 82 cm x 15.5 cm (d)
- Battery Storage Time: 5 years
- Battery Operation Time: 3 years
- Active Responding time: 130 hours
- Weight in water: 16.2 kg
- Weight out of water: 28.4 kg
- Input Voltage: 26 to 28 v



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TrackLink 10000 Series

TrackLink 10000LC

This system is a low cost yet highly robust system. This system brings the convenience of an USBL system to the users who typically do not have the budget for an expensive ultra-deepwater USBL tracking system.

TrackLink 10000MA

This system is a cost-effective, medium accuracy tracking system. The accuracy of the system is 1°. The TrackLink 10000MA System provides a highly robust solution to cost-conscious users who require improved positioning accuracy.

TrackLink 10000HA

This system is a high accuracy ultra long-range USBL tracking system. The accuracy of the system is 0.25°.

Positioning Accuracy:

TrackLink 10000HA: 0.25°

TrackLink 10000MA: 1.0°

TrackLink 10000LC: 3.0°

Operating Frequency:

8.4 kHz to 11.7 kHz without acoustic modem option

7.5 kHz to 12.5 kHz with acoustic modem option

RS-232 Configuration: 9600 baud, 1 start bit, 1 stop bit, no parity bit, and no flow control

transceiver:

Maximum Depth: 20 meters

Transmit mode power consumption: 100 Watts

Receive mode power consumption: 1.8 Watts

Hydrophone Array Dimension: 25.2 cm x 12.6 to 27 cm (d)

Acoustic Transmitter Dimension: 32.2 cm x 12.6 cm (d)

Hydrophone Array Weight in water: 3.0 kg

Acoustic Transmitter Weight in water: 3.6 kg

Optional High Speed Acoustic Modem Data Rate:

up to 2,400 baud

Slant Range Accuracy: 0.40 meter

targets tracked: 8

Operating Beamwidth: 90 to 120°

Operating Temperature: -5 to 45 °C

Storage Temperature: -25 to 75 °C

Optional High Speed Acoustic Modem Data Rate: up to 2,400 baud

Working range with ship noise:

up to 11000 m with TN10015 transponders

up to 7000 m with TN100101 transponders

Transponder:

Transmit Mode Power: up to 500 Watts

Sleep Mode Power Consumption: 8 mwatts

Maximum depth: 7000 meters



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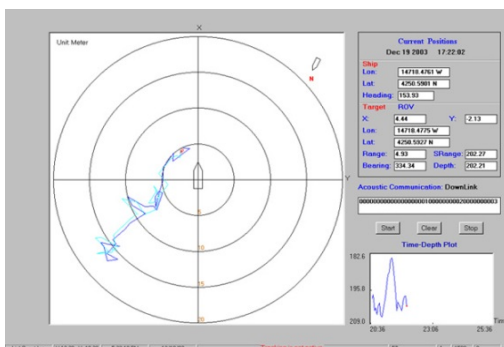
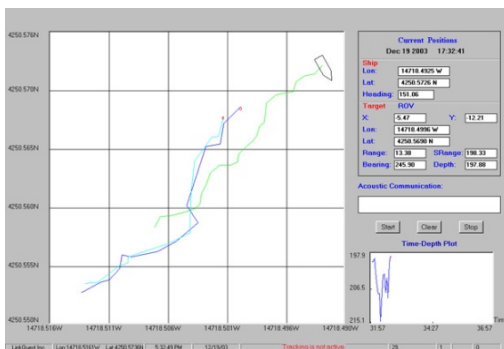
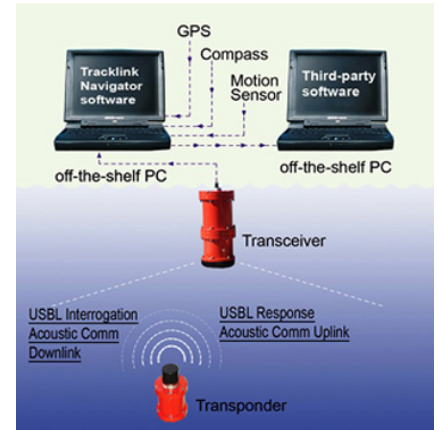
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Applications

- ROV Tracking and Navigation
- AUV Tracking and Communication
- Manned Submersible Tracking and Communication
- Survey Towfish Tracking
- Underwater Construction
- Diver Navigation and Tracking
- Moored Instrument Relocation



The TrackLink Navigator Windows software integrates the TrackLink USBL transceiver with the ship's GPS/DGPS, compass and motion sensor using serial communication. This software displays the positions of the ship and the targets in various plots and textual displays. It also interfaces to other computers for acoustic communication data and sends positioning data to other computers in a predefined format.

The TrackLink software works smoothly with third party software such as **HYPACK™**, **WinFrog™** and **HYDROpro™**

The TrackLink Navigator software runs on any off-the-shelf PC. No cumbersome "Deck Unit" is needed to operate the system. The software is simple to use and highly robust. A few clicks from the mouse will start your tracking session smoothly.



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1. ROV Tracking And Navigation

TrackLink systems have been used to track numerous ROVs including those from Deep Ocean Engineering, Hytec, Nova Ray, SeaBotix, Seaeye, Sub-Atlantic, VideoRay and Benthos all over the world. The **Broadband Acoustic Spread Spectrum** technology has set a new higher standard for robust and accurate ROV tracking and navigation. Extra telemetry option provides an easy way to add more data channels other than through the ROV umbilical. Highly reliable acoustic link can be used to command the ROV in case the umbilical is cut.

2. AUV/UUV Tracking And Communication

The acoustic tracking system and the high speed acoustic modem share the same electronics stack and the transducer. This approach eliminates the acoustic interference that typically exists between the acoustic tracking and communications systems. The size and weight of the overall system are also significantly reduced.

3. Underwater Construction

4. Diver Navigation And Tracking

Track multiple divers simultaneously. Each diver obtains his/her own GPS position with assistance of the acoustic link. Each diver can also send sensor information and images to the surface support vessel.

5. Survey Towfish Tracking

The small size of the TrackLink transponder reduces the drag. Highly robust telemetry option provides a reliable way to send information from extra sensors such as the Altimeter.



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