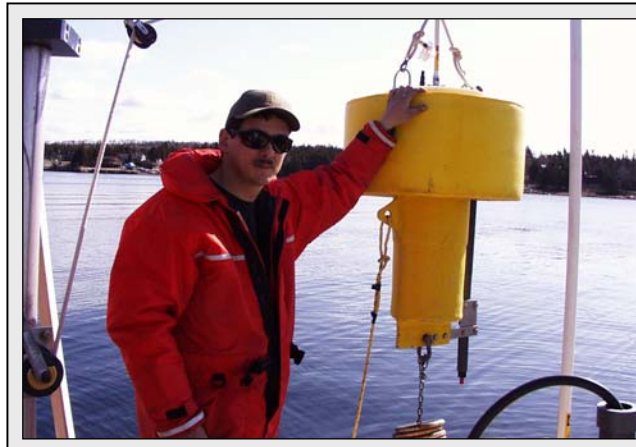


A Division of AMIRIX Systems Inc.

VRAP Radio Acoustic Positioning System

Real-time detailed positioning and tracking system

VEMCO's VRAP system measures real-time, detailed position information from underwater acoustic transmitters using a series of three buoys and a two-way radio link to a base station. Depending on environmental conditions, the VRAP system is typically able to furnish position information with a resolution in the range of 1 to 2 meters within the buoy triangle. Scientists use the VRAP system to investigate a wide range of animal species from lobsters to sharks. Applications include ecological impact studies, bioenergetics, spawning aggregate interactions, predator versus prey interactions and site residency studies. VRAP is particularly useful in studying the impact of various environmental conditions such as changing tides, sea state, temperature and storms on the movements of aquatic organisms.



A VRAP buoy is lowered into the ocean using a small winch. Three buoys and a two-way radio link to a base station are used to triangulate detailed position information on acoustic transmitters.

Receivers on the buoys collect transmitter data from an animal that is being tracked. This information is then dispatched by radio to a base station and a position is calculated and displayed in real-time. This movement information is also stored to disk for later play back. Depending on transmitter type, temperature and depth data can also be collected. VRAP can currently track up to 12 "continuous" type transmitters on different frequencies.

VRAP also operates with VEMCO coded tags and can detect coded tags operating on 12 frequencies between 50 kHz and 84 kHz. If other receivers are being used with the VRAP system, such as VR2 receivers, then the coded tags should be purchased on a frequency that will be detected by all receiver types involved (VR2 receivers are only available on 69 kHz, 51 kHz, or 81 kHz). More than 65000 coded pingers and 250 coded sensor transmitters can be detected on each channel (frequency) of the VRAP system.

Operation

Buoys are easily deployed from a small boat and have side and bottom mooring lugs. Weighing 43 kilograms in water, each buoy contains a hydrophone, ultrasonic receiver, two-way radio link, a microprocessor controller, and re-chargeable battery. The base station includes a two-way radio, timing circuitry and a PC serial data link. Gain control is automatic. The buoys are normally re-charged by removing the buoy from the water and using an AC charger. Battery life depends on buoy listening time and radio usage and is typically in the range of seven days.

Contact us

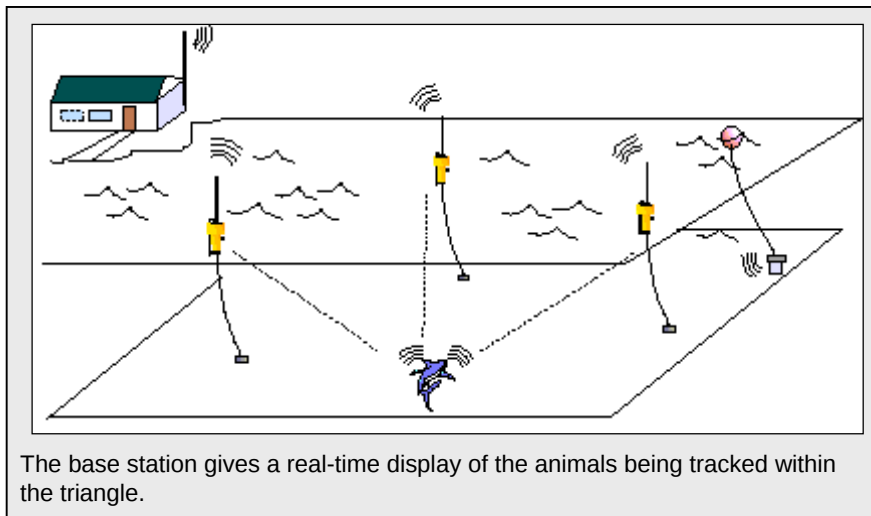
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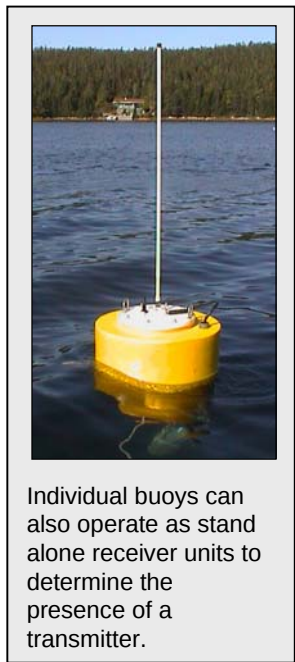
Specifications may change without notice.

Receivers



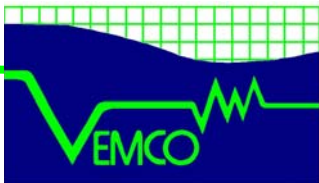
When the VRAP system is initialized, the base station sends a radio command to each of the three buoys to determine “buoy-to-buoy” distances. Positioning is performed in sequence and each transmitter can be monitored from five to 60 seconds. Ten seconds of monitoring is a typical range. Following initialization, each transmitter is positioned based on arrival time of the acoustic ping to each buoy.

All valid transmitter detections are recorded. In order for a triangulated position to be calculated, all three buoys must register a signal from a transmitter.



- VRAP has been used with other VEMCO equipment such as the VR100 field receiver to track an animal that travels outside the buoy area.
- Smaller monitoring receivers, such as the VR2, can be positioned outside the buoy area to identify the direction taken when the marine animal left the study area.
- If standard acoustic pingers are used for tracking, VRAP software will calculate the x and y position of the transmitter. If 3D data is required, the z coordinate can be determined in one of two ways: use of a depth transmitter, or if the animal being studied travels at a reasonably constant depth, its depth can be manually entered in the system [this will be an estimate only].
- The user can add “reference” pingers set at fixed points near the sea floor within the buoy triangle. This allows for evaluation of buoy movements during tidal movements or rough sea states.

VRAP Specifications	
Floatation	Yellow polyethylene foam, spiral wound & heat-sealed in a floatation collar.
Hull material	FRP Fiberglass
Dimensions	60 cm diameter x 100 cm height
Reserve buoyancy	60 kg
Antenna height	132 cm
Buoy weight	43 kg
Radio Link (North America)	Motorola RNET 9600S Standard UHF frequency; 458.53850 MHz. Other frequencies available: 450 - 470 MHz. Modulation: FM 9600 Baud. Bandwidth: 5 kHz. Power: 2 watts



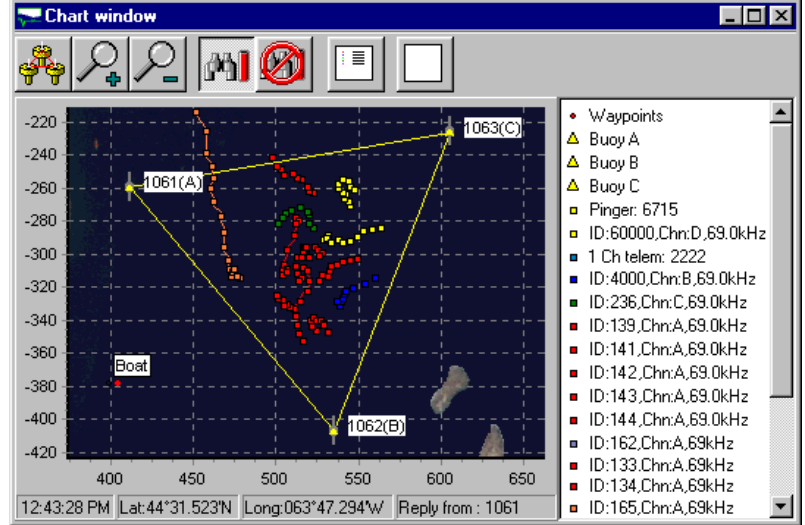
VRAP Software V5.0

VRAP software gives users the ability to process the true latitude and longitude position of tags. Users with latitude & longitude data on a scaled bitmap can determine a true world position for the tagged animal based on buoy position.

Software Features

VEMCO's VRAP V5.0 software was developed to give users detailed position information on tagged animals within the buoy triangle. Features and capabilities of the software include:

- The ability to concatenate separate studies. For example, if it is necessary to move the buoys mid-study or temporarily suspend data acquisition, the software can connect and re-play separate segments as a continuous study.
- Disables or enables tags at any point during a study. If, for example, two fish out of eight in a study are exhibiting behaviour that is of more interest, some tags can be "turned off" in order to permit more frequent updates from other tags.
- Calibrates buoys using a true speed of sound for that specific operating environment.
- Allows time referenced notes to be manually added during a study. For example, for data analysis, it may be helpful to note that a noisy vessel entered the study area, or the wind direction changed.
- The ability to specify the period of time the system tracks an individual tag and the frequency of the data upload. For example, a researcher may have three tags in the water. You may want tag number 1 tracked for five minutes at a time, and tags 2 and 3 tracked for one minute each. The data upload period can also be specified for each tag. For instance, position updates from tag number 1 can be sent to the base station every ten seconds whereas the other two can be uploaded every 30 seconds.
- Tracks two-channel telemetry tags (V16TP).
- Adds location "way points" to a study. Users can add "reference points" on a screen.
- Provides a buoy status window with information on signal strength, battery voltage, receiver gain, time of last communication and tag status.



Other VRAP features:

- The system automatically calibrates itself to quickly determine buoy-to-buoy separation distance upon startup or periodically by a user-programmed command. Necessity of re-calibration is highly dependent on environmental conditions. For example, during a very calm day, the self-calibration command may only need to be issued every few hours, whereas in heavy sea states, it may need to be issued every 30 minutes.
- Powerful 34 kHz calibration transmitters are built into the hydrophone.
- The VRAP system can receive any of VEMCO's continuous or coded transmitters operating between 50 kHz to 84 kHz.
- By using special software (VR20RAD), buoys can be used individually to determine the presence or absence of a particular transmitter (triangulated position is not available) or depth or temperature data.

For more information on the specific applications of VRAP technology, please contact VEMCO.