



GNSS GUIDED  
**VIRTUAL  
ANCHORING**

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# GNSS GUIDED VIRTUAL ANCHORING

Have you ever wondered how a GNSS Compass might make your life as a boat captain a little bit easier?



As a boat captain, your job can sometimes be stressful and tedious. On a typical day, you may be responsible for guiding your vessel from a small marina blockaded with piers and docks at each turn. Whether departing for a long fishing trip, a leisurely trip up the coast or embarking on a multi-day cruise, the needs of any trip can be demanding. When you arrive at your destination, you may find a tight waterway and small berths in your pathway. Add some harsh weather conditions, and these factors can test your limits and patience.

Fortunately, over the past decade, advances in GNSS technology have pioneered new applications such as Virtual Anchoring and Assisted Docking designed to help you navigate challenges and harsh weather conditions so you can stay safe and stress-free in any situation you may encounter while out at sea. The GNSS Compass is the secret that guides these new applications.

Virtual Anchoring and Assisted Docking technologies are steadily becoming more popular in marine vessels. These technological advances include the integration of different visual and motion sensors to monitor and adjust the boat's position in multiple ways. The integration and collaboration between these sensors create a more advanced boat called a "Smart Boat".

For those not familiar with Virtual Anchoring, Assisted Docking, Sensor Fusion, or Smart Boats, here is a breakdown for you.



### What is Virtual Anchoring?

Virtual Anchoring holds a boat's set position on the water using the boat's engines and/or propulsion system. Rather than physically anchoring a boat in position using a traditional steel anchor lowered into the water, a virtually anchored boat position is established by the GNSS positioning and heading compass. The compass uses measurements to guide the boat's engines and propellers to make small adjustments to move the boat side-to-side or forward-and-back, to keep the boat in a single location and account for any drift due to increased wind or currents.

### How does Virtual Anchoring Work?

When setting a virtual anchor point, the user will enable the virtual anchor system, which can be done with a physical switch or with a program in the multifunctional display. By enabling Virtual Anchoring, the GNSS compass, using the best possible measurements from all the visible constellations (GPS, GLONASS, BeiDou, Galileo, and QZSS) takes a snapshot of the exact position (latitude and longitude) of the boat. Using this position as the control, the GNSS compass continuously takes measurements and calculates the exact position and heading of the boat in comparison to the controlled position recorded when the virtual anchor was enabled. The position data is then fed into an engine controller that adjusts the propellers, moving them either forward or backward to keep the boat within a 3-to-4-meter tolerance of the virtual anchored position.

### What are the benefits of virtual anchoring versus a physical anchor?

Like a physical anchor, the virtual anchor can keep a boat within the desired region. The advantage of the virtual anchor is that a seafloor is not required to keep the boat in a specific location. With a traditional anchor, the anchor is required to hit and dig into the floor. This requires knowing the exact depth of the floor and the necessary length of the anchor chain to meet the depth of the floor.



When sport fishing, this can cause a reduction in available areas for spot fishing. Conversely, the virtual anchor provides a more oceanfriendly solution. When the traditional anchor hits the floor, it could cause damage to reefs, cabling, or other fragile items on the floor. Virtual anchoring completely removes this danger.

### What is Assisted Docking?

Assisted Docking is a system that receives input from the GNSS positioning and heading compass, cameras, IMUs, and lidar measurements. The Assisted Docking system guides the boat's engines and propellers and makes small adjustments to move the boat in a straight line to maintain a constant position and heading as the boat maneuvers into the desired docking location.





### How does Assisted Docking Work?

Assisted Docking works by taking the GNSS compass derived position. Using measurements from GPS, GLONASS, BeiDou, Galileo, and QZSS satellites. These measurements are then processed to show the exact position and heading of the boat. This position and heading data is sent to an engine controller which makes slight adjustments to keep the boat in the desired position. While the boat is being held in a stable position, the measurements from the GNSS compass are being compared to the Lidar measurements (locating the dock, pier, or other inanimate objects located near the boat) and determining the distance to each of these items.

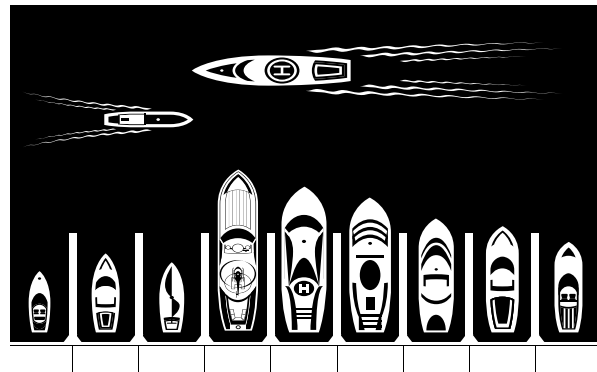
Additionally, cameras are used to ensure no other obstacles are present that the lidar sensor has not identified. If all sensors report a clear path, the engines will proceed to move in the direction of the dock. The GNSS compass continuously acts as the basis for the docking solution marking the clear path with a new position and holding the boat



steady and with the correct orientation. As the boat moves closer to the dock, the Lidar, camera, and GNSS sensors continuously provide measurements and feedback. This continues until the boat comes to a stop and is tied off.

### What are the advantages of Assisted Docking?

Assisted Docking removes the potential of human error from the calculations. If a person were to overcorrect or make an adjustment that would cause the boat to hit the dock, it could cause thousands of dollars' worth of damage to the boat and the dock. A system that calculates current, wind, and overall movement, creates the best possible docking scenario and keeps expensive equipment and boats intact without damage. Whether you are docking in an open dock or a tight marina, you will have the same performance and accuracy while safely guiding your boat into the slip. Another important factor for Assisted Docking and Virtual Anchoring is sensor fusion.



### What is Sensor Fusion?

Sensor fusion is the ability to use multiple sensor technologies together to maneuver a vessel. These sensors include motion sensors, cameras, Lidar, GNSS position, and heading compass. The sensor's combined data understands where the boat is, in comparison to its surroundings, and makes decisions on how to move the vessel. These sensors

work synergistically to perform multiple tasks on a vessel. These tasks include guiding a boat into a dock or keeping the boat in the desired location without physically anchoring the boat to the floor or the body of water.



The sensors provide precise measurements to ensure the automated applications work flawlessly. The foundation of these sensors is the GNSS technology. When on the water, many things are at stake including the safety of life. The GNSS technology provides precise position and heading measurements to ensure the boat is always on the desired course and when virtually anchored, stays in one position, while the other sensors work to identify the environment around the boat, such as docks, other boats, piers, or other marine equipment.

### Understanding the “Smart Boat”

The concept of a “Smart Boat” starts with a standard boat and integrates valuable advanced technology to enhance the boat’s performance in open water. These enhancements are typically in the form of integrated sensors or displays. Assisted Docking and Virtual Anchoring are two key technologies that identify a Smart Boat. Within these two technologies, the GNSS performance is of the highest importance, always delivering precise and quality performance.



### What Environmental Forces are at Play?

Boats, unlike land vehicles, can make lateral movements without changing the current heading or vehicle orientation. For example, your boat could be facing north, and drifting east with the current. The boat maintains the same orientation, but the position of the boat has drifted offline. A boat can move multiple meters offline within only a few seconds. Based on these dynamics, the thrust management system must perform hundreds if not thousands of calculations to keep the vessel on the right course. GNSS compass technology typically uses or provides 20-50 Hz data (50 Hz = 50 positions/per second) to calculate these drastic shifts in the currents and provides the necessary data for the engines and propellers to adjust in real-time and keep the vessel in the desired location. This GNSS application is useful when attempting an automated assisted docking maneuver, or in the open water seeking to stay in a virtually anchored position.

With all the calculations and adjustments made in real-time, you want to ensure you have the highest quality equipment working for you. When it comes to GNSS technology, Hemisphere GNSS is synonymous with quality and affordability and has been for over the past two decades. Hemisphere GNSS manufactures and delivers the most precise and reliable GNSS compasses in the marine market.



The new GNSS Compass from Hemisphere GNSS is the Vector V200 GNSS Compass. The V200 offers an incredible combination of simple installation, small form factor, and amazing performance. The compass measures only 35 cm in length and mounts easily to a flat surface or pole.

The stability and maintenance-free design of the Vector V200 provide simple integration into autopilots, chart plotters, and AIS systems.

#### Key Features:

- L1 GPS, GLONASS, Galileo, BeiDou, QZSS
- 50 cm RMS worldwide positioning accuracy with Atlas corrections
- 0.75 degree heading accuracy in an amazingly small form factor
- Excellent in-band and out-of-band interference rejection
- Integrated gyro and tilt sensors help deliver fast start-up times and provide heading updates during temporary loss of satellites
- Provides heading, positioning, velocity, course over ground, heave, roll, and pitch

Crowded waterways, small berths into marinas, and constant environmental forces on your boat call for precise accuracy and performance. Using the top quality GNSS compass to drive your equipment is imperative. Make sure the equipment installed on your boat is the highest quality and most affordable solution. Hemisphere GNSS offers the most reliable and precise GNSS equipment in the world. Be confident your boat is powered by the leader in GNSS systems.

To learn more about the V200 along with all the Hemisphere technology log on to the HGNSS website at [www.hgnss.com](http://www.hgnss.com). Reach out to your local Hemisphere GNSS Dealer today!



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