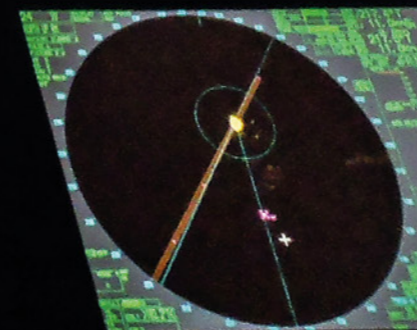




MODERN SHIPS RELY HEAVILY ON GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) SERVICES, SUCH AS THE **GLOBAL POSITIONING SYSTEM (GPS)**, TO ENSURE SAFE NAVIGATION. **GNSS POSITIONING, NAVIGATION, AND TIMING (PNT) DATA INPUTS** ARE ALSO INTEGRATED WITH OTHER NAVIGATIONAL AND COMMUNICATION SYSTEMS ON BOARD.

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NAVIGATIONAL RISKS AT SEA:

THE GROWING THREAT OF GNSS JAMMING AND SPOOFING

However, incidents of GNSS jamming and spoofing are increasing, which can disrupt all equipment reliant on GPS PNT data. According to the US Coast Guard 'Navigation Center' (NAVCEN), recent reports show marine GPS signal disruptions in regions such as the eastern Mediterranean, Black Sea, Red Sea, coastal waters of China, and the Persian Gulf—many of which are near areas of geopolitical conflict.



WHAT IS JAMMING?

Jamming is the intentional Radio Frequency Interference (RFI) with GNSS signals. It occurs when interference disrupts the signals at GNSS frequencies, preventing the GNSS receiver from detecting and processing the authentic signal. This happens because the strength of the jamming device exceeds that of the weaker GNSS signals received.

WHAT IS SPOOFING?

Spoofing involves transmitting a fake GNSS signal to deceive receivers, causing them to compute incorrect PNT data. This should not be confused with Automatic Identification System (AIS) spoofing, where altered or fabricated AIS data is transmitted to deceive AIS tracking systems regarding a ship's identity, position, and other information.

HOW TO DETECT GNSS JAMMING OR SPOOFING

- A position loss alarm on the GPS receiver or other navigation and communication systems that depend on PNT data
- Unexpected deviations in the vessel's track displayed on the Electronic Chart Display and Information System (ECDIS) when compared to RADAR
- Sudden jumps in the vessel's position or unexpected increases in speed on ECDIS, even when the GPS receiver's horizontal dilution of precision (HDOP) is below 2
- Inconsistencies between RADAR overlay and the ECDIS when the vessel is near land
- Discrepancies in the plotted ship's position when cross-referencing GNSS data with RADAR or visual verification at regular intervals
- Differences between the echosounder depth and the expected depth according to contour lines when passing a depth contour.

SAFETY IMPLICATIONS OF GNSS DISRUPTIONS

- In open sea navigation, where GNSS positioning is the only available method, ships will need to rely on dead reckoning (DR) positions or celestial navigation techniques
- A sudden GNSS loss will trigger alarms on all navigational and communication systems relying on GNSS PNT data, which can be distracting for the bridge team, especially in high traffic areas or confined waters
- AIS positions of other vessels may become inaccurate, and your own ship's AIS position could mislead nearby vessels
- If crew members are not properly trained to handle such situations, the safety of the ship's navigation could be seriously compromised.

ACTIONS TO TAKE ONCE GNSS OUTAGE/ DISRUPTION IS DETECTED

- Change the ECDIS position (both primary and secondary) and speed input to DR position and log speed
- Identify RADAR-conspicuous objects in the passage plan
- Begin manually plotting the vessel's position using visual or RADAR means if near land
- Use tools such as RADAR parallel indexing and RADAR overlay on ECDIS to monitor the vessel's position near land
- Confirm that the RADAR speed input is log speed, if not already set
- Other ships in the vicinity may also be affected by GNSS disruption; navigate cautiously and rely less on AIS information from other vessels
- Turn off AIS overlay on ECDIS if anomalies are observed in the AIS information of target vessels
- Advise the master of the situation. An extra deck officer may be required on the bridge for assistance
- Give wide room to any encountered traffic
- Consider arriving during daylight hours when approaching a port or area known for GPS disruptions
- Report any marine GPS signal disruptions to NAVCEN at <https://www.navcen.uscg.gov/report-a-problem>
- Alternatively, any GPS disruption can be reported to NATO at <https://shipping.nato.int/nsc/page10303037>

THE CLUB RECOMMENDS THAT SHIPOWNERS AND OPERATORS DEVELOP A RESPONSE PLAN FOR GNSS DISRUPTION AS PART OF THEIR SAFETY MANAGEMENT SYSTEM. CREW RESPONSIBLE FOR SAFE NAVIGATION SHOULD BE TRAINED TO RECOGNISE GNSS DISRUPTIONS AND IDENTIFY THE SYSTEMS AND EQUIPMENT AFFECTED ON BOARD. GNSS FAILURE DRILLS SHOULD BE CONDUCTED TO FAMILIARISE THE CREW WITH THE STEPS REQUIRED, INCLUDING CHANGING EQUIPMENT SETTINGS DURING SUCH DISRUPTIONS.