



► JAMMING AND SPOOFING: RESPONDING TO GNSS AND AIS INTERFERENCE

Safe navigation of vessels today primarily relies upon Global Navigation Satellite Systems (GNSS) and Automatic Identification Systems (AIS) for real-time positioning and situational awareness. However, both systems operate using radio frequencies – which makes them susceptible to interference.

With ever-increasing political instability across the globe, the frequency and volume of deliberate and targeted disturbance, primarily via jamming and spoofing, is becoming increasingly common – posing significant risk to the safety of shipping.

Below is a short guide, jointly prepared by the [United Kingdom Hydrographic Office \(UKHO\)](#) and The Shipowners' Club, exploring the difference between jamming and spoofing, with practical steps crews can take to prepare for and respond to these threats.

JAMMING VS SPOOFING: WHAT'S THE DIFFERENCE?

Deliberate interference with GNSS and AIS navigational systems typically falls into two categories: jamming or spoofing.

- **Jamming:** Using a device to deliberately interfere with radio signals, blocking the system's ability to receive accurate data.
- **Spoofing:** Sending fake radio signals to deceive a navigational system into showing false positions or data.

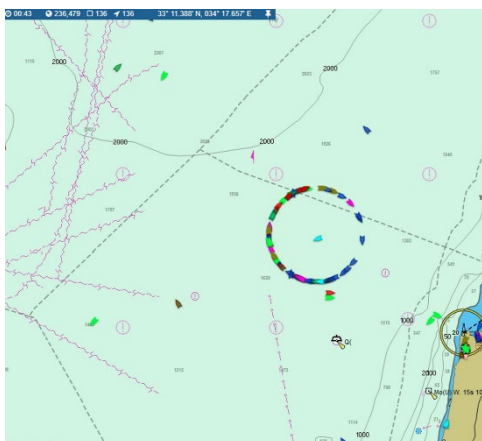


Image 1: AIS spoofing of vessels at sea



Image 2: AIS spoofing of vessels on land

Image 1 shows vessel AIS positions being spoofed to appear to circle an offshore platform, in image 2 the vessel's AIS positions are being spoofed to appear on land at an airport.

L-band signals from GNSS satellites operate within the 1-2 GHz range of the radio spectrum and are considered low frequency compared to other satellite communication bands. Therefore, even a weak interference source can cause the receiver to fail or even produce inaccurate or misleading information – both of which pose a risk to safety.

AIS primarily operates on two VHF channels: 161.975 MHz (AIS 1, channel 87B) and 162.025 MHz (AIS 2, channel 88B). These frequencies are used for transmitting and receiving vessel information, which aids in collision avoidance and situational awareness at sea.

Jamming

While a complete loss of GNSS signal or AIS is usually easy to detect, minor distortions caused by jamming can be much harder to recognise and can sometimes resemble the effects of spoofing. Jamming is particularly concerning as it can be carried out without the need for specific expertise or expensive equipment. Historically jamming devices have had limited range and capability. However, advances in technology – coupled with the increased use of drones – has evolved their ability and reach. Jamming systems can now be mobile with the capability to disrupt signals over very wide-ranging areas.

Spoofing

In contrast, spoofing has traditionally been a much more complex procedure and is often harder to detect. Spoofing can take many forms, but it primarily involves trying to deceive systems into thinking a vessel is located at a particular position – when in fact it is in an entirely different location. Spoofed signals can manipulate the system to report that the vessel is in a location determined by the attacker, or that it is in the correct location but at the wrong time. This technique has also been known to be used by vessels whose interests are to intentionally confuse its actual whereabouts when operating in the vicinity of sanctioned locations.

HOW TO DETECT JAMMING AND SPOOFING

During the appraisal and planning stage of a voyage, navigators should assess the likelihood of interference based on their route's proximity to known areas of disturbance¹. Identifying high-risk areas in advance will give crews early warning that they could be susceptible to some form of interference during their voyage.

There are several practical techniques² crews can use to detect interference during the voyage:

- **Position verification:** Regularly check positions at appropriate intervals by taking manual fixes on known objects, such as buoyage or conspicuous land features.
- **ECDIS and RADAR overlay:** Use ECDIS and RADAR overlay to identify jamming and spoofing, noting any discrepancies such as when land is visible on the RADAR.
- **Dead reckoning vs GNSS:** Observe any significant difference between Dead Reckoning position (the position calculated using the gyro course steered and distance measured by speed log) and the GNSS fix.
- **Depth verification:** When navigating in suitable depth areas, compare the depth information shown on the ENC against observed depths on the echo sounder to identify any significant discrepancies.

PREPARING A RESPONSE PLAN

As jamming and spoofing attacks become more frequent, it is essential for ship operators and their crews to have a well-defined response plan and to regularly practice drills to prepare for an emergency. Response plans should include the following:

¹ For live information on GNSS interference:

<https://gpsjam.org/>

<https://www.flightradar24.com/data/gps-jamming>

² Further guidance on the mentioned navigational techniques can be found in the Navigation Booklet Series

<https://www.shipownersclub.com/latest-updates/news/navigation-booklet-series/>)

- **Select a secondary position sensor:** If the primary GNSS is compromised, manually switch to a secondary position sensor. If available, reliable and functioning, use another GNSS input as a backup.
- **Use Dead Reckoning (DR) or Estimated Position (EP):** If the secondary sensor cannot provide a reliable position and no other means are available to input position fixing, the navigator should switch to DR or EP mode. For vessels not fitted with ECDIS, approximate the position on paper charts using dead reckoning.
- **Understand DR mode:** For vessels fitted with ECDIS, ensure crews understand how to switch the ECDIS to DR mode and are familiar with the information displayed during this mode.
- **Manual position plotting:** If the vessel is close to shore, begin manually plotting the ship's position on ECDIS. If possible, seek greater sea room to ensure safety.
- **Exercise caution with AIS:** Be aware that other vessels' GNSS positions are likely to be compromised by spoofing or jamming, as well as your own, so use AIS with extreme caution.
- **Parallel indexing for coastal navigation:** Use the parallel indexing method during coastal navigation to keep safe distances and determine turning waypoints.
- **Stopping the vessel:** In extreme circumstances where the vessel cannot reliably determine its position relative to navigational hazards, it may be necessary to stop the vessel for safety.
- **Cease operations:** For vessels that rely upon GNSS for accurate position keeping, using Dynamic Positioning (DP) Systems, operations should be ceased and the vessel brought to a safe position if there is a suspicion of a lack of reliability of electronic position inputs.

SUMMARY

- ✓ Know the difference between jamming and spoofing
- ✓ Know how to detect GNSS and AIS interference
- ✓ Identify high-risk areas during the planning stage
- ✓ Be familiar with alternative position fixing methods
- ✓ Have a response plan and practice drills regularly