Circular

Smooth Sailing

The GPS system and potential interference

Navigation is a key aspect of shipping, as it's essential for safe, smooth, and efficient sailing. Various equipment and systems are used to determine a vessel's position and surroundings. Since the vessel's navigation systems are so important, interference with them can have disastrous consequences. For this reason, it's imperative to understand how navigation systems work, and how they may be interfered with. In these times when cyber warfare is becoming standard practice, it is particularly important that shipowners are prudent when it comes to interference with the vessel's systems.

This circular mainly focuses on vessel's GPS system. It looks at how a GPS system works, the potential methods of interference, and the consequences for other systems on board. In addition, the circular discusses what shipowners can do to prevent interference with GPS systems.

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GPS: how does it work?

GPS stands for global positioning system, a type of global navigation satellite system (GNSS), and it's owned by the US government. Other GNSS systems exist, such as Russia's GLONASS, China's BeiDou Navigation Satellite System, and the European Union's Galileo. However, the GPS system is used by most vessels. This system works in any weather anywhere in the world, and is free of charge. GPS is operated, developed and maintained by the US Space Force.

Every GPS receiver is constantly visible to at least four satellites. Every GPS satellite transmits a signal that contains information about where the satellite is at a particular time. The receiver uses this information to calculate its distance from each of the four satellites.

Once the distances between the receiver and the satellites have been calculated, the GPS device can pinpoint its exact location on Earth, and display it in latitude and longitude.

Jamming and Spoofing

The GPS signal may be affected by natural causes, such as solar flares, which can temporarily disrupt the transmission of GPS signals. However, a GPS signal can also be jammed with malicious intent in order to create a false position.

A GPS jammer emits radio signals or a signal noise at the same frequency as the signal of the GPS device. This overrides or distorts the signals from the GPS satellite, and renders the GPS device unable to calculate its position. GPS signals are fairly weak, so jammers can cause problems even at low power levels, making them a relatively simple and cheap method of causing disruption.

Another way to interfere with a vessel's GPS system is spoofing. This is an intelligent form of interference which deceives the receiver about it's real location. During a spoofing attack, a nearby radio transmitter sends fake GPS signals to the target receiver.

Most navigation systems are designed to use the strongest GPS signal, so the fake signal overrides the weaker but legitimate satellite signal. Hackers use GPS spoofing to interfere with navigation systems without operators realising it. The fake GPS signals cause pilots, ship crew, and other operators to go off course without even being aware of it, so spoofing poses a real threat to vessel navigation.

Interference with GPS systems: the consequences

If a vessel's GPS system receives false signals or GPS signals are jammed, it increases the risk of accidents. For this reason, it's important that the crew checks the vessel's position regularly using other navigational equipment. If a false signal is suspected, the vessel's position should be calculated using the principle of dead reckoning. This means that the current position is calculated on the basis of the previous determined position together with estimates of speed, heading direction, and course over elapsed time. To do this, other navigational equipment such as a radar, sextant and a compass may be used.

In addition to problems with navigation, interference with the GPS system can affect other systems on board, such as the AIS system. AIS, which stands for automatic identification system, is generally used for navigation, fleet and cargo tracking, maritime security, search and rescue, and accident investigations.

The AIS collects the positioning data of the devices on the bridge, such as the GPS and gyro compass, and transmits it in combination with additional programmable AIS data, such as the vessel's MMSI number, name, call sign, destination and draught of the vessel. The data transmitted by the AIS is used by other vessels or shore-based vessel tracking services to identify vessels. These are then displayed on a digital chart or radar. The AIS collects multiple data points, such as position, course and speed, so it can calculate a closest point of approach. It follows that interference with the GPS system will affect the data sent by the AIS system, which may cause the vessel to be displayed in the wrong place on the radar, or even disappear.

Unfortunately, few measures are available to prevent interference with a vessel's navigation systems. It is recommended that the crew stays alert, especially in high-risk areas. If the crew decides to turn off the AIS, it's important to record the reason in the ship's log, because disabling the AIS may lead to contractual disputes and potential cover issues.

Moreover, if a suspicion of interference with the AIS or GPS system arises, it's always a good idea to document the false output of the device properly by taking a photo for evidential reasons.

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If you have any doubts or questions about the vessel's communication systems or dark activities, please do not hesitate to contact our **Loss Prevention Services** at LPS@msigspecialtymarine.com.

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