Geollect Position Validation Report

AIS, or Automatic Identification Systems, provide valuable insight into maritime vessel activity by using a transponder to ping a ship's location - resulting in a log of past and present data that can be used for various applications. AIS was initially created as a collision avoidance measure for ships at sea, but they now also help track things like global shipping trends and individual vessel activity. Overall, it's a reliable system when used correctly. The problem is that AIS data is prone to user manipulation - typically by turning off an AIS transponder or using complex spoofing patterns to report false positions. Consequently, AIS monitoring must also employ additional verification methods like satellite image analysis and open-source information.

Another way we can verify AIS tracking data is by using a position validation service. Position validation services observe a vessel's radar emissions caused by the doppler effect - which is essentially the change in the frequency of sound, light, or other waves in relation to a source or point of observation. When paired against AIS data, these radar emissions (doppler data) can reliably confirm or refute whether a vessel was in its recorded AIS position during transit.

Geollect, the UK's leader in geospatial intelligence technologies, helps public and private entities build robust maritime awareness with position validation services and doppler data. In fact, Geollect was among the first to validate the feasibility of using doppler data alongside AIS tracking data for vessel investigations - ultimately providing invaluable insight into everything from sanctions evasion to human trafficking.

The following report outlines how Geollect identified a strong use case for doppler data to address some of the shortcomings of AIS - using real-world data from two AIS spoofing events.

The Situation: The Symphony 3

The Simphony 3 photo credit: Marinetraffic.com

The Symphony 3 (IMO 9288083) is a Panama-flagged oil tanker owned and operated by Shining Gem Limited. Over the last year, the Symphony 3 has recorded several suspicious transits, which Geollect determined to almost certainly be AIS manipulation events. Geollect concluded this by using doppler data, satellite imagery, and open-source information to identify the vessel in Venezuelan waters on two occasions - far from West Africa, where the AIS tracks were recorded.

The Symphony 3 spent most of June-July 20222 transiting from Singapore to West Africa. On July 13th, the vessel changed course to a northwest heading when passing the southernmost part of the Continent, and the AIS tracks that followed led Geollect to determine that the ship almost certainly began manipulating its AIS position from that point onward.

After the 13th of July, the vessel recorded an average speed between just 5 and 7 knots. During previous transit, however, the Symphony 3 recorded speeds as fast as 11 knots, so the low rate of movement during the time in question was particularly suspicious. Further, there was minimal speed variation after July 13th, whereas the ship recorded a range of speeds before that time that were consistent with a standard open water transit.

Figure 1: AIS History of the Symphony 3 for July 2022

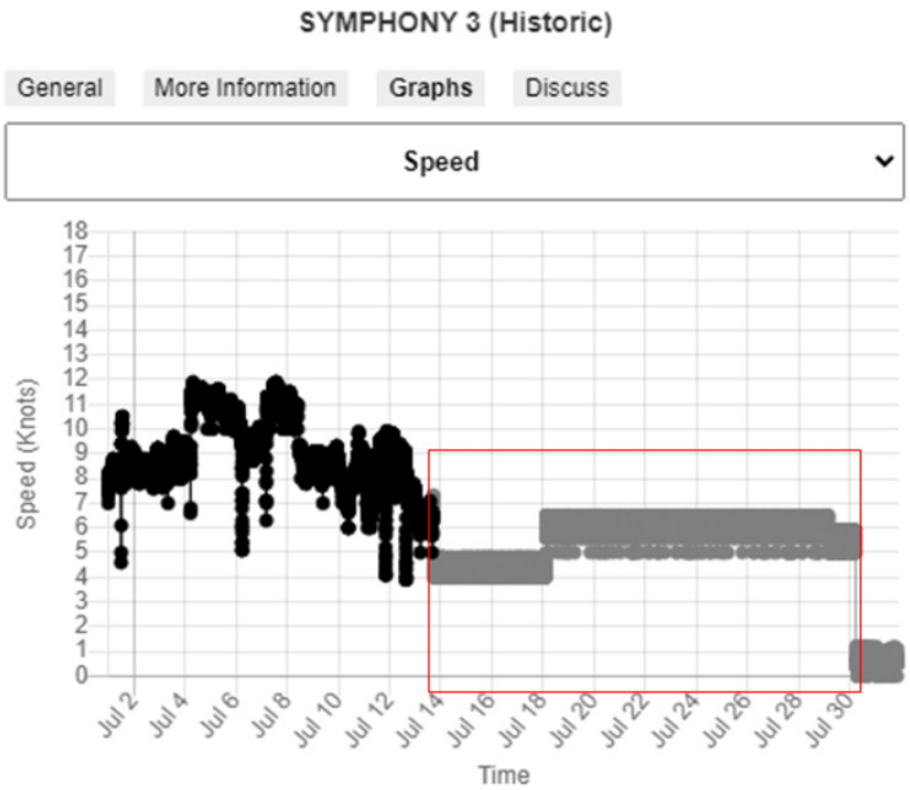

Figure 2: Speed Record of the Symphony 3 for July 20222

The rest of the AIS tracks for July-August show the Symphony 3 just west of Angola, conducting transits in a "back and forth" pattern at low speeds. However, Geollect used doppler data for AIS validation, which showed the ship's true position in transit toward Venezuelan waters. On August 4th, Geollect identified several radar positions of the Symphony 3 close to the Port Jose Oil Terminal in Venezuela. After reviewing satellite imagery of the port at that time, Geollect identified a vessel to almost certainly be the Symphony 3 alongside port at the terminal. This capture was made on August 7th, just three days after the last received doppler transmissions - so it is likely that the ship was at anchor near the port before moving to the terminal to load oil.

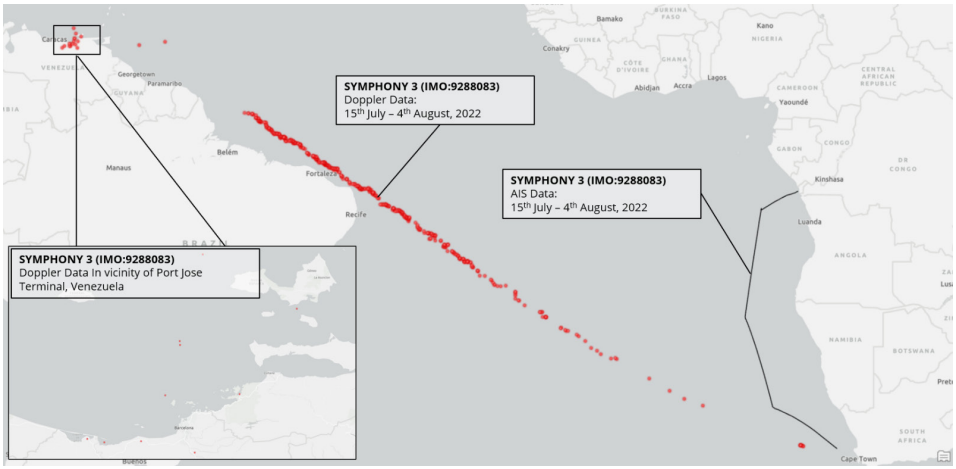

Figure 3: AIS Positions (Black Line) and Doppler Data (Red Dots) of the Symphony 3 from July 15th to August 4th, 2022

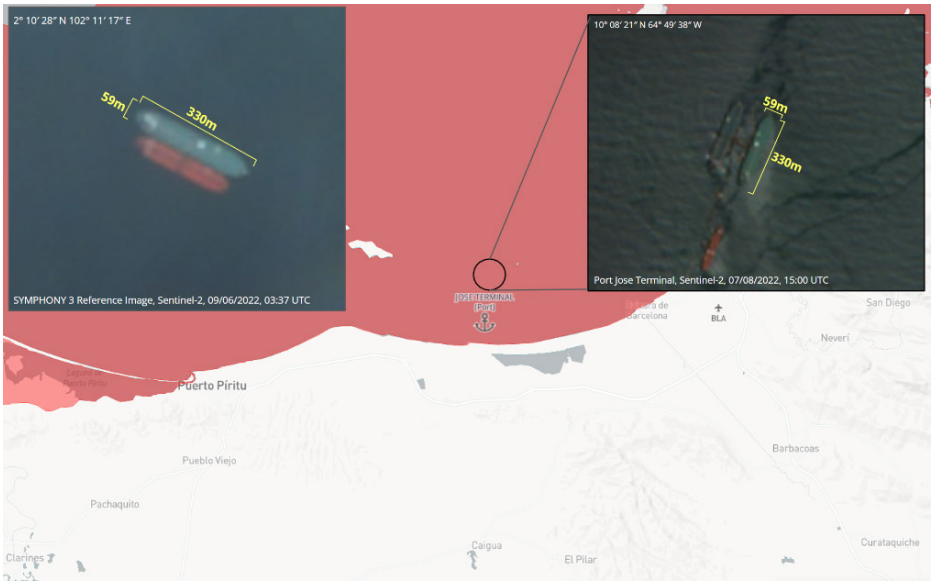

Figure 4: Satellite Imagery of Port Jose Terminal (Right) and a Reference Image of the Symphony 3 (Left)

To further identify suspicious behavior, Geollect analyzed past transits of the Symphony 3. In March of 2022, the vessel idled at low speeds near West Africa. As with the transit in August, the ship's AIS tracks were erratic, with several jumps that suggest another spoofing event. Upon further open-source analysis, Geollect sourced a record of the Symphony 3 making a port call on March 24th at the Venezuelan port of Guanta.

SYMPHONY 3 - IMO n° **9288083**

Flag		(Panama)
Call Sign	3E3931	
MMSI	352986188	
Gross tonnage	156973	(during 2004)
DWT	299031	
Type of ship	Crude Oil Tanker	(during 2004)
Year of build	2004	
Status	In Service/Commission	(since 28/04/2004)

Last update of ship particulars 17/05/2022

Ship info | Inspections (12)

Port state control info

PSC Organisation	Vina Del Mar MoU
Authority	Venezuela
Port of inspection	Guanta
Type of inspection	Initial inspection
Date of report	24/03/2022
Detention	No
Number of deficiencies	0

Figure 5: Port Inspection of the Symphony 3 on March 24th, 2022

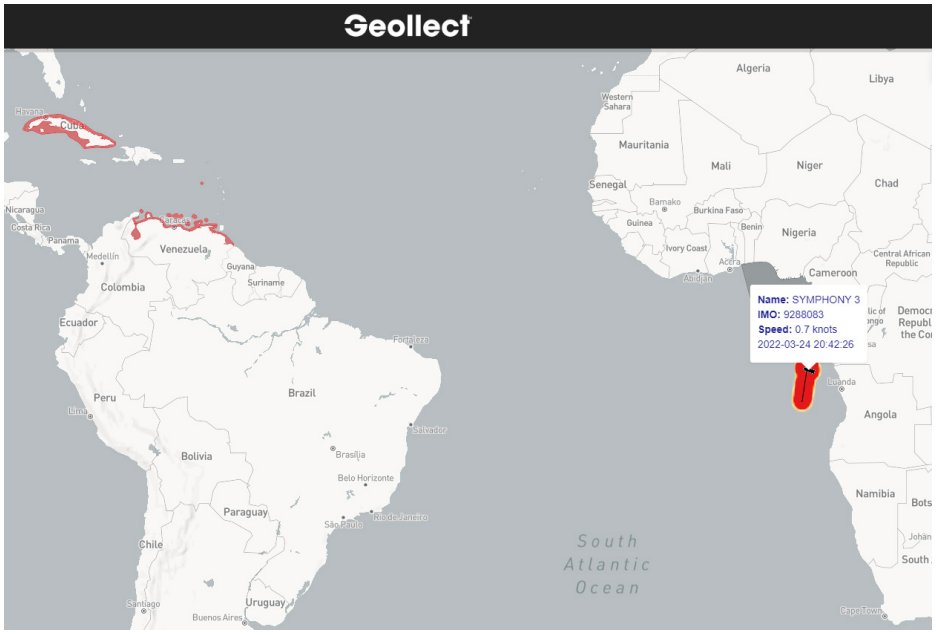

Figure 6: AIS History of the Symphony 3 for March 2022

On March 24th, 2022, AIS records placed the Symphony 3 near West Africa. However, since the ship had a clear history of visiting the port of Guanta at that time, the AIS position was almost certainly a case of spoofing. Geollect used SAR imagery of the recorded AIS position near West Africa to corroborate this claim, with imagery showing no vessel in the area at the time of the AIS log. In fact, the closest ship near that position was located over 40 kilometers away.

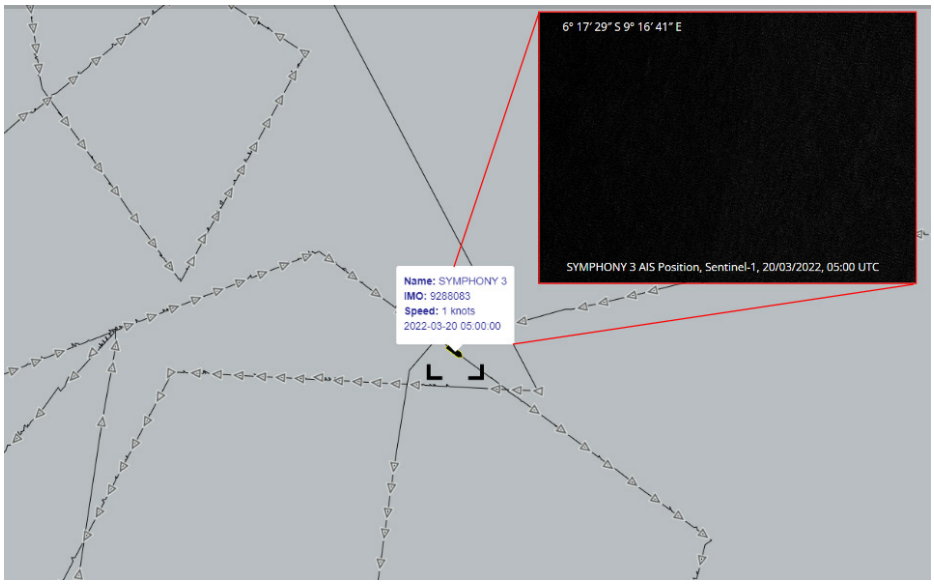

Figure 7: AIS History of the Symphony 3 for March 2022

Since it was determined that the Symphony 3's AIS tracks were almost certainly spoofed, Geollect conducted further analysis to try and uncover the ship's true position. Since the vessel was identified through satellite imagery in August in Venezuelan waters, Geollect focused on the same area for the moment in question in March. One image from March 20th displayed a ship assessed to almost certainly be the Symphony 3 at a Venezuelan anchorage. The vessel was in that position for nearly all of March - arriving on March 7th and departing at the end of the month. During that time, it is likely the Symphony 3 conducted a port call or loaded oil through a second vessel.

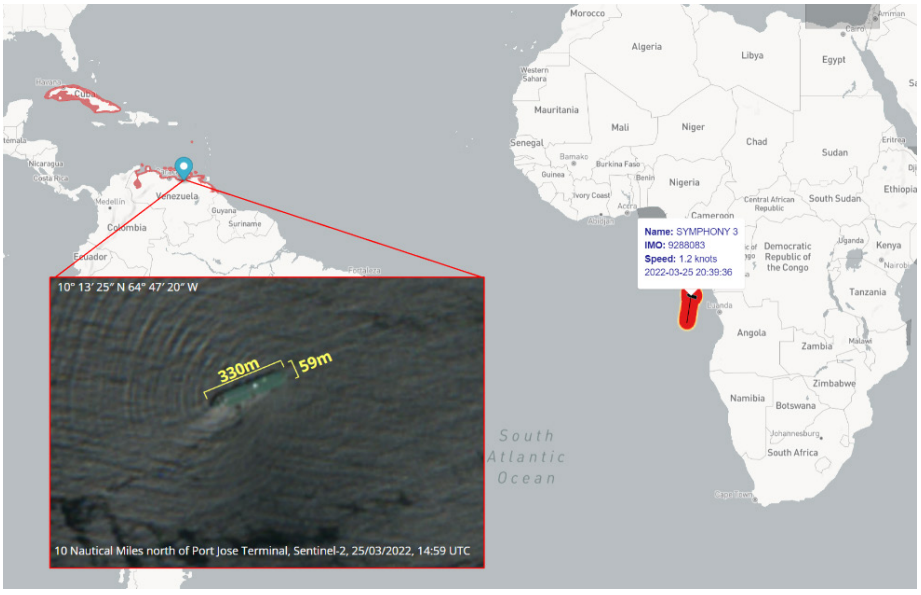

Figure 8: AIS History of the Symphony 3 for March 2022 Alongside Corresponding Satellite Imagery

Validating AIS Positioning with Doppler Data

This report was a direct approach to evaluating the feasibility of using doppler data to validate AIS records and investigate vessel operations. Geollect determined a strong use case for combining datasets to address the shortcoming of AIS, and position validation services like those from Geollect can help public and private entities gain valuable insight into maritime operations.