EMPA presentation April 2015

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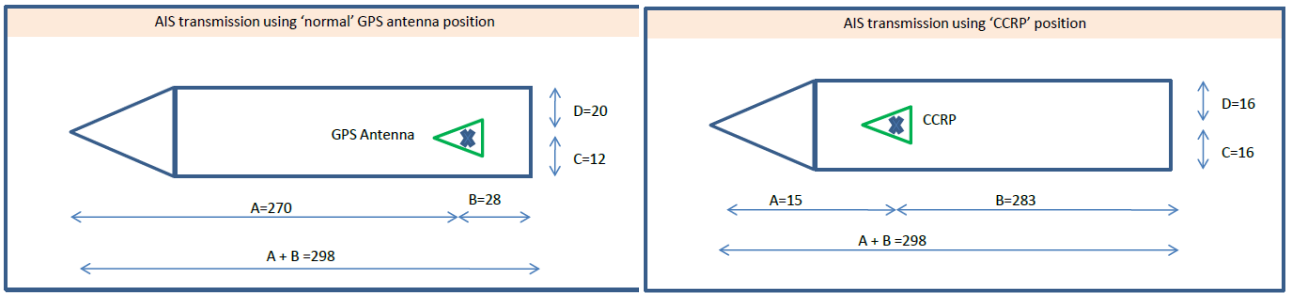
Your first quick response might be '*no, I look out of the window. Oh, in fog I use the radar*'

But wasn't that the same reaction as with the introduction of the first radar, many years ago? The use of radar needs proper training, but it's impossible today to imagine ships without it.

Besides radar we all saw the introduction of Electronic Chart Systems on board of the ships we are piloting. Do you ever use it? And for what purpose, while navigating or even manoeuvring?

Eye opener should have been the Cosco Busan. The well-known case with a master and pilot struggling with the information of the ships ECDIS while sailing in fog. In all the distraction they forgot to use basic radar.

But new technical developments and integrated bridges have side effects on the use of basic radar. Video processors take time to build up a smooth picture; the radar screen is not necessary placed under the antenna. Large vessels have radar antenna's on bow and one the stern of the vessel. That Radar information is transferred to a reference point:



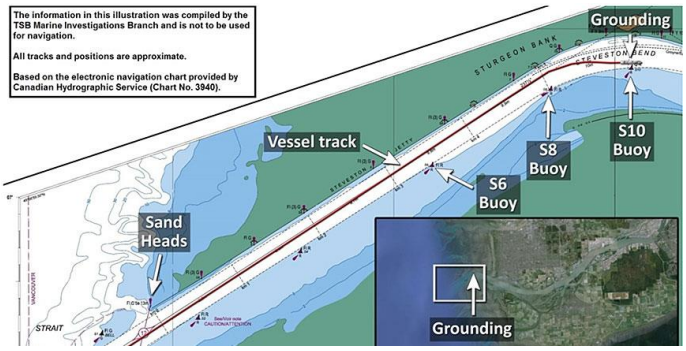
The reference point is the calculation-point (CCRP: Consistent Common Reference Point) for the projection of the own vessel on ECDIS and Radar screens. Some large ships transfer the information from the bow-radar to the reference point, which is the bridge, maybe 280 meter behind the bow. What do you see…? When do you notice…? Would anybody on the bridge tell you…? If al settings are correct, the vessel is presented/visualised correctly, but the bearing and distances are coming from the bow… Manoeuvring stern first to the berth?

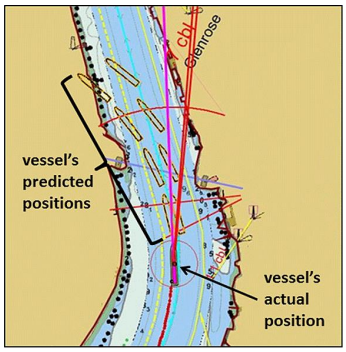
Over reliance of unknown sources of information on board. Even on an integrated bridge with a class approved ECDIS, it is not clear to the user what the reliability or accuracy is of the information. Individual settings of the applied instruments are usually hided for crewmembers and pilots.

Then the AIS pilot plug was introduced on board of the ships. However the pilot plug on board is not more than a relay station for doubtful data and not under control of the pilot.

One example with consequences is the grounding of the container vessel Cap Blanche in a bend of the Frazier River in Canada in January 2014. The vessel was under the conduct of a pilot and was sailing in reduced visibility due to fog. The report of the safety board of Canada is available on internet.

I will not discuss the whole of the report, but highlight the use of the PPU.





According to the report, the pilot set up his PPU and connected his RoT generator to the AIS pilot plug in order to monitor the vessel's progress. The pilot's PPU had a predictor to display the vessel's next 6 predicted positions at intervals of 30 seconds.

In the absence of visual cues due to reduced visibility, the pilot relied primarily on the projected vessel positions displayed on the PPU to monitor the vessel's RoT, and did not notice that, at one point, the RoT had reached twice the average value through the bend, causing the vessel to deviate from its intended route and into the south side of the channel. The PPU was obtaining information from the vessel's AIS pilot plug, which was subject to GPS smoothing. As a result, the predicted vessel positions displayed on the PPU were not accurately reflecting the vessel's future positions, but the pilot was unaware of this.

According to the report the Pacific Pilotage Authority (PPA) has provided each pilot with a PPU, a ROT generator and a WAAS-based DGPS antenna. The WAAS-system provides an additional signal containing a correction to the GPS position and thereby providing greater accuracy. In this occurrence, the pilot did not have his antenna with him, having encountered some technical problems with it in the past. The PPA does have spare equipment, and pilots can switch out equipment when it is defective.

So what about the PPU of the pilot. And why did the pilot prefer the use of his predictor instead of using conventional radar? Maybe the picture on his PPU just looked fine as usual and no alarms were raised. The pilots had a 5-day training course that oriented them on the operation of the equipment and functions of the software. The course did not include details about GPS smoothing intervals.

Today any laptop or tablet a pilot carries around is called a PPU. A laptop with software that presents information on an electronic chart. But the heart of a PPU is not the laptop, but the source where the software gets the information from to calculate the position, COG, SOG, ROT and maybe even a prediction of the ships motion.

Indirectly the Canadian reports' advice is against the use of the ships GPS on a PPU. The explanation on the smoothing is just one example why ships instruments cannot at all times be relied upon.

You would assume that the position via the AIS pilot plug is based on the vessels Differential GPS and not derived from the simple GPS in de AIS receiver. The latter only included for the correct time schedule of transmitting and receiving AIS signals.

Other common issues with AIS as source for PPU is faulty settings for the location of the ships GPS antenna. As a result the presentation of the own vessel is not correct in the electronic chart.

This is an Example picture of an auto-carrier: of all locations on board, the antenna is not placed outside the bow. As a result, in front of the bridge: in reality 4 to 5 meters to port, on the AIS-based PPU virtually 12 meter to starboard. But what in reduced visibility?

The Canadian report is not stating where the predictor gets the heading from. The PPU provided has only one GPS antenna and although WAAS correction is being applied, the system is not able to provide independent heading. Two antennas are needed instead. For a reliable prediction, an accurate heading, position, CoG, SoG and RoT are very important.

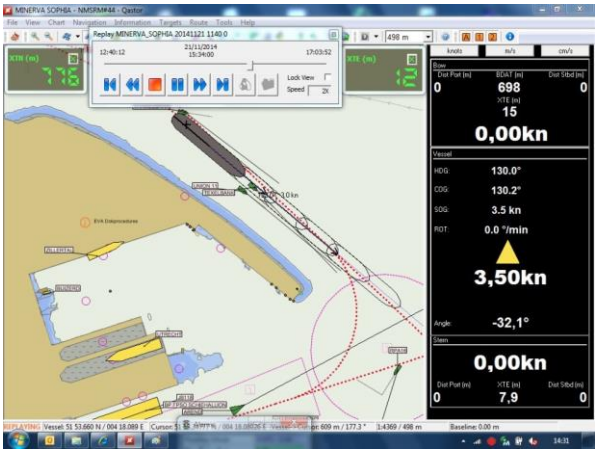
Before using prediction based on AIS as source, it is important to realize that not every AIS unit is transmitting ROT all the time. Only when a course alteration of more than 10 degrees per minute occurs the AIS is transmitting the value as a random indication. A prediction based on this information shows a straight course at first with all predicted vessel shapes straight ahead, then a jump to port or starboard because of the sudden ROT value. It should be prohibited to make use of this functionality. And this is actually done by the Australian government, it is not allowed to use the pilot plug for navigation in the Australian waters.

In the past we spoke of VHF and ARPA assisted collisions, today we could add AIS guided groundings.

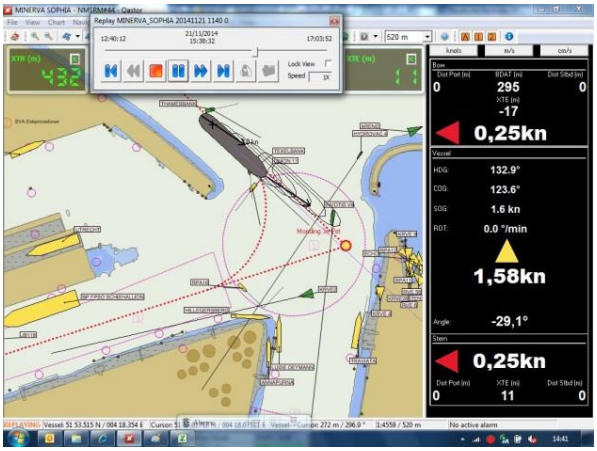
So the title question should have been: Can we trust the ships instruments?

The issue at stake is the source of information for the PPU. Do we connect the PPU simply to AIS or provide ourselves with an independent system.

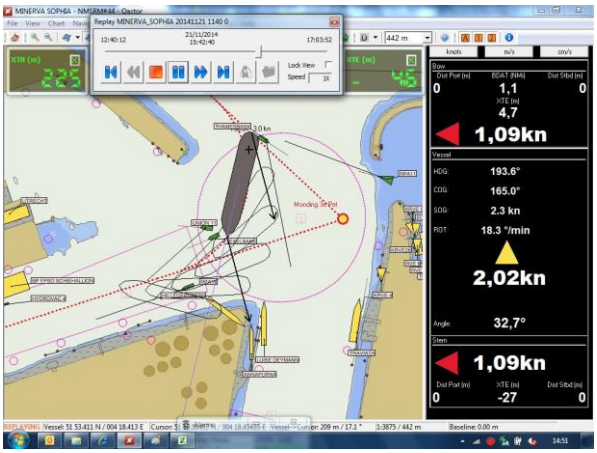
In the next example the difference is shown between an AIS based PPU (left) and a full independent PPU (right). During the voyage with the incoming Minerva Sophia, a tanker with a length of 244m, 44 meter wide and 13 m draft, recordings where made with both types of PPUs:



1. Both PPUs show the vessel approaching the Botlek: difference only the settings of the bathymetric chart.



2. Pilot is starting turn to starboard into the Botlek, difference in prediction



3. AIS predicts grounding in several minutes: what to do if this was all the info you had…? The independent PPU (right) indicates sufficient or even ROT being too fast!

AIS is intended as an identification system, definitely not for navigation. A PPU with docking facility should be independent of any ships instrument.

A PPU based on AIS, can be useful for situational awareness; planning of a voyage; to see if a ship on the berth is on the move; the calculation of meeting points. But again, not for navigation and not for anti-collision.

Considerations for implementation

- PPU tested
- Reliable and operating under ‘all circumstances’
- Setup simple and effective
- Comply with users’ needs
- Pilots must be trained

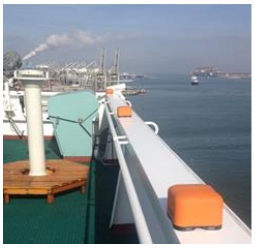


For a successful implementation of a full PPU amongst a pilot organisation it is important that the units are thoroughly tested, reliable and operating under ‘all circumstances’. Every ship is different and the setup must be done simple and effective. Loss of connection diminishes trust and most of all loss of connection must first be detected by the user. Therefore users of PPU must be properly trained and the PPU must comply with the users’ needs.

A surgeon is using a scalpel when doing high-precision surgery, and not a hobby knife.

Also for pilots a professional tool is available, the PPU. In Rotterdam, and several other European ports, pilots have over 10 years of experience and trust in the PPU. We wrote our own pilot criteria for a PPU:

Professional tool

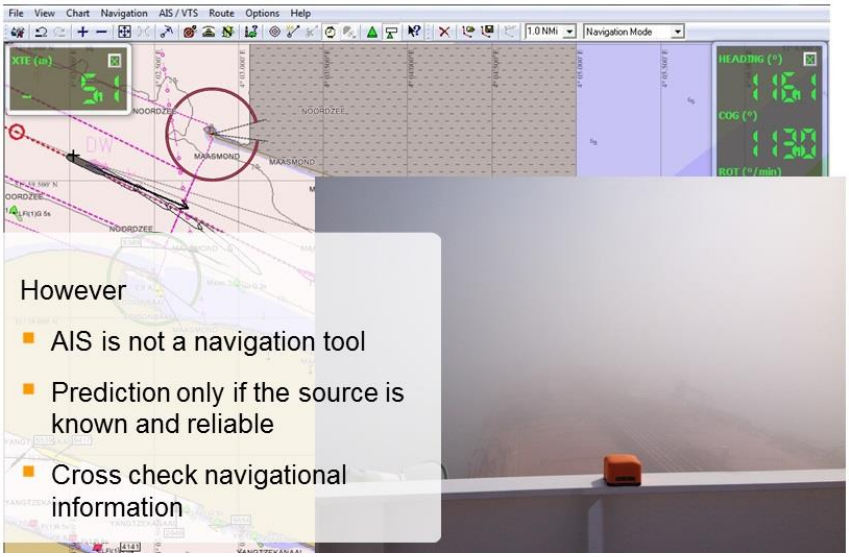


Pilot criteria for a trustworthy PPU:

- Fully independent of any ships instruments
- Using GPS and GLONASS satellites on both L1 and L2 frequencies
- EGNOS or RTK corrections
- Providing stable and accurate HDG, RoT, SoG, CoG, side speed on bow and stern without significant delay
- HDG backed up with RoT sensor and with Kalman filtering
- Presentation on ruggedized laptop with high-density ENC’s
- Additional info via UMTS data stream: VTS and Hydro-Meteo

Loodswezen

Yes, you can trust a PPU



In the case of the stranding of the Cap Blanch the pilot overestimated the significance of the PPU software without having assessed the proper source for the data provided. AIS is an Automatic Identification System, not a navigation tool.

Predictions, as found on board or integrated in a PPU, can only be used if the source is known and reliable.

Finally, the basic lesson to be learned is straight forward and a navigator should be cross checking navigational information across sources, even with a PPU.

Thank you for your attention