PORTABLE PILOT UNITS

OPERATIONAL NOTES AND RECOMMENDATIONS
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1 INTRODUCTION

The introduction of modern lightweight Portable Pilot Units (PPU) for use during pilotage has proved to be another major advance for pilotage operations worldwide. The use of these units not only provides an additional level of information available to the Pilot but also has the potential to improve safety, efficiency and enhance operational parameters.

2 DEFINITIONS

AIS Automatic Identification System is a VHF-based time division multiple Access (TDMA) radio system used by vessels and Vessel Traffic Services and other shore based facilities primarily for identifying and locating vessels. It also provides a means for vessels to electronically exchange data. GPS, without correction, is typically used to supply AIS positions.

ENC Electronic navigation chart.

EGNOS The European Geostationary Navigation Overlay Service (EGNOS) is a satellite based augmentation system (SBAS) developed by the European Space Agency, the European Commission and EUROCONTROL. It supplements the GPS, GLONASS and Galileo systems by reporting on the reliability and accuracy of the positioning data.

DGPS Differential GPS is a system based on the enhancement of GPS signals by use of a network of ground-based reference stations. Improved accuracy is achieved by comparing the surveyed position of the reference station with the GPS position. This results in a differential correction being broadcast to capable receivers.

GNSS Global Navigation Satellite System refers to any of the global positioning satellite systems such as GPS, GLONASS, Galileo, Beidou, and others in development.

SBAS Satellite Based Augmentation System is a satellite based differential correction system.

PC / Tablet The most common user interface used for a PPU.

Pilot Plug International Maritime Organisation-specified data port installed in a vessel that provides a pilot with access to data received and transmitted from the vessel's AIS.

RTK Real Time Kinematics is a differential GNSS technique that provides high positioning performance (up to centimetre-level accuracy) in the vicinity of a base station. A RTK base station covers a service area spreading about 10 or 20 kilometres.

WAAS A wide area augmentation system (WAAS)-based differential global positioning system (DGPS) antenna augments the global positioning system (GPS) with an additional signal containing a correction to the position computed by the GPS, thereby providing greater accuracy.

3 EQUIPMENT TYPES

A typical PPU is comprised of units or pods transferring data to a PC or tablet loaded with appropriate chart display software and ENC's.
There are a number of manufacturers producing different types of PPU, however the units/pods they produce largely operate within the following three arrangements.

3.1 AIS only via Pilot Plug

The PPU relies entirely on position data transmitted via the Pilot Plug. The Pilot Plug is merely a relay station for data collected from sensors on board the vessel. The Pilot is therefore unaware of the origin and accuracy of this information. In some cases the source of some of this information may also be unknown to the Master. Therefore it can be seen that the Pilot, and in many cases the Master, are unsure of the position quality and accuracy of data via the Pilot Plug.

Other possible errors can occur as a result of an incorrect setup of the AIS system at installation. This can be incorrect wiring (most PPU providers solve this by use of auto polarity conversion) or faulty settings for the location of the ships aerial, which results in an incorrect representation of the own vessel on an electronic chart.

As the origin of data is unknown the pilot cannot assume that the position received via the AIS pilot plug is linked to the vessels integrated GNSS receiver (DGPS or uncorrected GPS); it could just as easily be derived from the simple GPS in the AIS receiver. Other unknowns could be the quality of the signal or rate of turn output and whether GPS smoothing is being applied; all of which can seriously affect the displayed predicted track.

Therefore a PPU based on AIS data only can be useful to aid situational awareness, planning of a passage, to see if a ship on the berth is on the move or for the calculation of meeting points. In view of the factors mentioned above a PPU should not be used for navigation or manoeuvring when data is sourced entirely from the pilot plug.

3.2 Pilot Plug/AIS Data with independent position receiver

This is typically an external unit that provides an independent position source whilst working with selected data from the ships AIS transmission. AIS data can be received wirelessly from a tandem unit connected to the pilot plug or by receiving the ships own VHF AIS transmission. As the position source is known and the signal quality can usually be monitored on the chosen display device, confidence in position accuracy is significantly enhanced. These units are usually of a similar size and weight to that of the 'pilot plug unit'.

The set up time is usually fractionally longer than that of the AIS only unit noted above.

This type of system utilizes static data and certain dynamic information from the Pilot Plug but crucially delivers a position based on a known independent source; typically satellite based augmentation system eg; EGNOS, WAAS etc. In this case the user is required to enter the position of the receiver relative to its location on the vessel (antenna offset). This resolves the issues surrounding position accuracy and data origin, which in turn allows the PPU to be considered as a navigation and manoeuvring aid.

3.3 Self Contained Unit

These are completely stand-alone systems, often equipped with an AIS receiver, that can provide high positional accuracy, particularly when configured to operate with an RTK system. It should be noted that there is usually little or no difference in setup time than the previous system noted in 2.2.

Whilst these units can be used on any vessel, evidence indicates that they are more suited for the movement of larger vessels, barges and marine structures.

They are usually larger and heavier than the above and are normally provided with their own carry aboard case / backpack. Whilst the additional size and weight is not restrictive there may need to be additional considerations when transferring to/from a vessel.

4 PRACTICAL CONSIDERATIONS

It can be seen that there are a number of options available to a Pilot and it is the navigational requirements or vessel types of each Port or District that will largely dictate the type of equipment and software that is most appropriate. Such considerations may include;

- Fairway and Channel constraints
- Berthing and Docking Requirements
- Proximity of Navigational hazards
- Traffic density
- Prevailing weather
- Specific Cargo Operations
    - Ship to Ship
    - Single buoy moorings

Further considerations need to be taken into account for the type of software and platform from which to launch that software.

- Ruggedised Laptop
- IPad/tablet
- Type of system to be employed
    - Standalone for each individual Pilot
    - Fully integrated Port system
    - Hybrid of the above
- Availability of Port specific ENC's
- Need / desire for shared information between Pilots
    - Ship database
    - Generic port information
    - Pilot specific information / notes

The most important element is to ensure that appropriate software and hardware is chosen at an early stage to make sure that confidence in the system is not compromised.

Further information and reference to technical specifications, bridge standards, ruggedness, intrinsic safety etc. can be found in the IMPA document 'Guidelines on the design and use of Portable Pilot Units'

5 OPERATIONAL CONSIDERATIONS

The ability of PPU software to deliver specific information to the Pilot that is not available from any standard Bridge equipment, and in a position best suited to con the operation, is well known.

However it is important to remember that, just like any electronic equipment on the Bridge, the user needs considerable practice and familiarisation before relying on the

information delivered by a PPU; particularly in marginal conditions and when being used as a manoeuvring aid.

Prior to deploying a PPU the pilot should ensure that the software is the latest version and that all charts and corrections are currently up to date. This not only refers to charts and corrections issued electronically by the chart agent, but also to any notations that the user may have manually inserted on the display; software permitting. These notations may include port specific information, temporary restricted areas or notices to pilots.

5.1 Training

Like all equipment available for use by a Pilot and Bridge Team it is important that a level of competence is achieved in the understanding of the capabilities of the supplied technology before it is used in practice. In accordance with recommendations laid down in IMO Resolution A.960 (Recommendations on training and certification and operational procedures for Maritime Pilots other than Deep-Sea Pilots) training in the use of the available hardware and software should be considered essential for continuous professional development and initial licence requirements.

Pilots should ensure they have received appropriate training in the use of the chosen hardware and software prior to including a PPU in the act of pilotage.

As pilots generally work independently it is recognized that obtaining regular ‘real-time’ familiarisation can be difficult without compromising the operation, as with all screen-based technology it is easy to become distracted from the current operation. However, two pilot operations and reference to recordings can provide a useful opportunity to gain additional familiarisation with the equipment. Additionally many nautical college simulators are now fitted with a pilot plug to facilitate pilot training in this area.

5.2 SETTING UP

Modern equipment and software usually requires little time to intialise. Whilst most hardware usually relies on the simple pressing of a button to the software can require considerable user engagement. Depending on the software and the purpose for which the PPU is to be used, there may be a requirement for additional user input such as new ship details or allowance for gyro error.

5.2.1 On departure

Clearly a ship alongside provides a stable platform and therefore good opportunity to verify position, heading and reference points on the display unit.

Allowing additional time prior to departure will allow for good satellite acquisition and/or data reception from the pilot plug (noting the AIS reporting intervals at varying dynamic conditions).

5.2.2 On arrival

Assuming the pilot boarding area is located as per A960 recommendation;

"3.3 The pilot boarding point should also be situated at a place allowing for sufficient time and sea room to meet the requirements of the master-pilot information exchange"

there should be ample time to permit the setting up of the hardware and software during the Master / Pilot exchange (MPX). Modern equipment and software requires very little dedicated time to initialise.

The traditional use of transits, beam bearings and bridge equipment comparisons are the easiest ways to verify position and data output. Unless a good position reference can be obtained and verified it is prudent to use the PPU with caution until such information can be confirmed.

5.3 Antenna position

When only using information from the pilot plug the antenna offsets received are usually those that were preset at installation. In the early days of AIS this data was regularly inaccurate and was treated with caution until independent verification was obtained. Thankfully this problem has significantly reduced over time but occasionally ships still present with inaccurate offsets. This of course can significantly affect the presentation of the ships image and projected track on the chart display.

When using a unit that provides an independent position source, the following factors should be taken into account when selecting an appropriate location for the device;

- Proximity of radiating antennas
- Intervening obstructions
- Potential for multipath errors
    - Reflected signals from deck
    - Reflected signals from adjacent bulkheads etc.
- Knowledge of the available satellites
- Knowledge of SBAS satellite location
    - Effects on position accuracy at different stages of the passage / maneouvre
    - Will a swing of the vessel block signals from an SBAS satellite low on the horizon

6 WORKING WITH THE BRIDGE TEAM

The capability of modern software and wireless technology allows a Pilot to access a considerable amount of information from a single point and at a location on the Bridge of his/her choosing. It can be seen that, in certain circumstances, unless good resource management principles are observed there is the potential for the Pilot to become isolated from the Bridge Team.

It is therefore incumbent on the Pilot to ensure that he includes the use of the PPU in the Master/Pilot exchange; making sure the Master and Bridge Team is advised of the following;

- The position reference being used
    - Pilot Plug
    - Independent SBAS
- That the Pilot has confirmed, or will be confirming that the data on his unit compares with that of the ships equipment before using the PPU
- That regular comparisons will be made with ships equipment and visual references to confirm continued confidence in the system
- That the Master will be notified immediately of any discrepancies or irregularities in data output
- That the Pilot intends to use the Software as;
    - An information and basic decision making tool only
    - A navigation and manoeuvring aid in conjunction with other equipment, as appropriate

In addition to the above the software can be used to supplement the MPX showing, for example;

- Intended route
- Intended manouevre from previous recordings (software permitting)
- Additional information not readily available to Master
    - Data from up to date Port specific ENC's
    - Local / temporary hazards
- Current shipping movements

SUMMARY

These operational notes and recommendations are produced solely to assist pilots in the everyday use of PPU's.

A correctly configured PPU is an invaluable source of information to the Pilot but the information displayed should be regularly referenced with other navigation aids, both visual and electronic.

REFERENCES

i. Grounding of the container vessel *CAP BLANCHE*, Transportation Safety Board of Canada Marine Investigation Report M14P0014.

ii. 'Guidelines on the design and use of Portable Pilot Units', International Maritime Pilots' Association

iii. Portable Pilot Units: A Best Practises Summary. American Pilots' Association

iv. IMO A960 (Recommendations on training and certification and operational procedures for Maritime Pilots other than Deep-Sea Pilots)

v. An introduction to GNSS, GPS, GLONAAS, Galileo and other Global Navigation Satellite Systems, NovAtel Inc.