Code of Good Practice

The design and use of Portable Pilot Units

2nd Edition

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Approved by the Executive

Code of Good Practice – The Design and use of Portable Pilot Units

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Recommended reference documents

IMPA - GUIDELINES ON THE DESIGN AND USE OF PORTABLE PILOT UNITS, 2016 - http://www.impahq.org/admin/resources/guidelines.pdf

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1. Introduction

The purpose of the AMPI guidelines for Portable Pilot Units is to provide a framework based on the factors of existing technologies, available equipment and extant practices. Consequently, the practitioners should review these guidelines at regular intervals to reflect updates to these factors. In order to develop guidelines for a PPU standard, consideration needs to be given to what is being used by pilots at the moment.

Since the PPU Code of Good Practice was first published in 2012 there have been a number of technological changes. The presence of ECDIS as part of the Bridge equipment means that the PPU needs to be more than just a chart plotter to add value on the bridge of today. The pilot needs to be proficient in the use of the PPU and should have positioning independent of the ship of an accuracy at least as good as if not better than the ECDIS.

For a thorough shared mental model to exist between the bridge team a common Passage Plan must be on both the ships ECDIS and the pilots PPU, with visual piloting backed up by the PPU and ECDIS. Below is an overview of the two AMPI recommended systems for piloting.

Very High Accuracy Independent Heading Berthing Systems are available with independent heading to the nearest 0.01 degree and speed with an accuracy of 0.05 of a knot. Rate of turn can now be measured to fractions of a degree per minute. All this in turn can create an accurate ship predictor which most importantly allows a pilot to tell at a glance exactly what the ship is doing right now as well as where it will be in a few minutes time. These units are normally larger in physical size and weight and used for specialised tasks where the very high precision is assessed as necessary.

High Accuracy Dependent Heading General Piloting Systems do not utilise independent heading however technology advances have produced very accurate Rate Gyro's which can refine the heading output of the ship's gyro and also generate accurate predictors; however they may lack the very high precision required for some berthing requirements. These systems have high accuracy independent position sensor/s.

As the lines between the different categories of equipment become blurred, it is important to differentiate systems based on the level of accuracy of both their sensors and charting information, as well as their software usability.

The identification of categories has been based in three main categories

- Very High accuracy independent heading berthing systems - Class A
- High accuracy dependent heading general piloting systems - Class B
- Ship dependent navigation systems - Class C
- Specialised PPU systems* - Class D

*Specialised systems for tasks such as ship to ship (STS) cargo transfers are now available which utilise antenna on more than one vessel which communicate with each other and resolve the relative motion and approach speeds. Such systems are highly specialised and don't need to be specifically mentioned in this document, but can be referred to as Class D.

IMPORTANT NOTE.

1. Any system which relies totally on ship's AIS data and does not augment or provide *any* independent input, cannot be considered a portable piloting unit for the purposes of this Code.
2. There are considerable common or overlapping objectives between all above classes.
3. This code gives detailed requirements for each class, with some aspects being mandatory (must), recommended (should) and suggested (may) components.
4. As the wider pilotage fraternity continues to adopt electronic positioning and chart technology, care must be taken to meet industry standards while embracing new PPU technology.

2. PPU Classes

PPU Class A – High Accuracy Independent Heading Berthing Systems

These high accuracy PPU's can be used for channel, docking and berthing operations where defined maximum fender landing speeds are specified.

Hardware

Mandatory requirements

1. Independent Positioning
    a. Very high positioning accuracy, <1.2m uncorrected GNSS.
    b. Multi constellation GNSS receiver utilising at least two GNSS constellations.
    c. Differential corrections providing 0.3m or better position accuracy using either terrestrial (RTK) or space based (SBAS, Atlas etc) corrections services. These should be received directly by the PPU antenna.
    d. Performance integrity monitoring and notifications of any reduction in accuracies of the correction service. Notification of the accuracy level in use should be clearly displayed and obvious to the user.

2. Independent Heading
    a. Very high heading accuracy (order of magnitude 0.01 degree)
    b. Current technology advances utilise two main systems for resolving heading;
        i. Long Baseline
        ii. Carrier Wave Phase Shift

Suggested requirements

1. Internal Rate Gyro
    a. A Rate Gyro or similar product may be used to assist with RoT calculations and heading integrity monitoring.
2. Roll sensor
    a. Using either accelerometers or high precision vertical positioning measurements, detecting the vessel's roll. This allows the ship's movement to be accommodated by the predictor in swell conditions.
3. AIS Data
    a. If AIS data is used for acquiring target information it should be received via own PPU receiver, however due to range requirements in some ports, the ship's AIS data feed (Pilot Plug) could be a better solution.
4. Battery Life
    a. Minimum run time on batteries alone should not be less than 10 hours, however port specific requirements may necessitate longer run times or interchangeable batteries.
5. Weight
    a. Gross weight should not exceed 8kg (not including display).

6. Redundancy of GNSS corrections
    a. If the primary corrections method becomes inoperable, the unit should be able to provide a high position accuracy via a different method. This could be received directly by the PPU antenna or via 4G/5G network. Regardless, the correction method in use must be displayed and obvious to the user.

Software

Mandatory requirements

1. Software Design
    i. Designed for precision pilotage and berthing.
    ii. Standard feature having a docking/berthing display.
    iii. Indicate ship's speed along longitudinal & athwartships axis (bow and stern) in docking mode.
    iv. Display a customisable ship predictor based on independent heading, CoG, RoT, SoG, drift and optionally a roll sensor.
2. Alarms
    i. Display an unambiguous visual and audible warnings when position and/or heading accuracy falls below a set threshold or there is any other threat to the integrity of the displayed data.
    ii. The software must have robust performance monitoring and error display, and be configurable by the user.
3. Charts
    i. Must be capable of displaying official electronic charts (ENCs).
4. Routes
    i. The software must be capable of displaying full route information equivalent to that of an ECDIS, including waypoints, turn radius and cross track margins.
5. Tides
    i. The software must be capable of making allowances for tide height. This can be manual, automatic (based on predictions) or in the best case, live data.
    ii. It must be obvious whether the displayed depth contours exclude tide height (as in ECDIS) or include it.
    iii. The software should be capable of displaying safe navigable water based on ship's draught, UKC allowance and height of tide.
6. Playback feature
    i. Must have the ability to playback past recordings.

Suggested requirements

1. Meeting Points
    i. Ability to display meeting points on same route by ships on reciprocal courses, taking account of multiple legs (using AIS data).
2. Docking lines
    i. Ability to select Docking Lines with distance to ship, displayed in Docking Mode.
3. Recording
    i. Software to automatically record on start up.
4. Voice and video
    i. Software may be capable of recording voice and optionally video.
5. Bathymetric Charts
    i. Ability to display Bathymetric Electronic Charts (BENCs).

PPU Class B - High Accuracy Dependant Heading General Piloting Systems

These high accuracy PPU's can used for channel and berthing operations however the heading feed is dependent on the vessel's gyro compass received either via the Pilot Plug or wirelessly through AIS transmission. Whilst this Class of unit may be used during berthing operations, this system may not be suitable for ensuring critical fender landing speeds are achieved.

Note. *Some Class B PPU's may have the ability to switch to Class A with additional Hardware and software upgrades.*

Hardware

Mandatory requirements

1. Independent Positioning
    a. High positioning accuracy, <2.5m uncorrected GNSS.
    b. Multi constellation GNSS receiver utilising at least two GNSS constellations.
    c. Performance integrity monitoring and notifications of any reduction in accuracy of positioning signal. Notification of the accuracy level in use should be clearly displayed and obvious to the user.
2. Refined Heading
    a. An internal rate gyro, or similar technology to refine the ship's gyro heading to fractions of a degree to assist with independent RoT calculations.

Suggested requirements

1. Differential Corrections
    i. Differential corrections providing 0.7 m or better position accuracy using either terrestrial (RTK) or space based (SBAS, Atlas etc) corrections services received directly by the PPU antenna or via 4/5G
    ii. Performance integrity monitoring and notifications of any reduction in accuracy of the correction service. Notification of the accuracy level in use should be clearly displayed and obvious to the user.
2. Redundancy of differential corrections
    i. If the primary corrections method becomes inoperable, the unit may be able to provide high position accuracy through a secondary corrections method.
3. AIS Data
    i. If AIS data is used for acquiring target information it should be received via own PPU receiver, however due to range requirements in some ports the ships AIS data feed (Pilot Plug) could be better utilised.
4. Battery Life
    i. Minimum run time on batteries alone should be not less than 9 hours, however port specific requirements may necessitate longer run times or interchangeable batteries.
5. Weight
    i. Gross weight should not exceed 3kg.

Software

Mandatory requirements

1. Software Design
    i. Designed for precision pilotage and berthing.
    ii. Display a customisable ship predictor based on independent heading, CoG, RoT, SoG and drift.
2. Alarms
    i. Display an unambiguous visual and audible warnings when position and/or heading accuracy falls below a set threshold or there is any other threat to the integrity of the displayed data.
    ii. The software must have robust performance monitoring and error display, and be configurable by the user.
3. Charts
    i. Must be capable of displaying official electronic charts (ENCs).
4. Routes
    i. The software must be capable of displaying full route information equivalent to that of an ECDIS, including waypoints, turn radius and cross track margins.
5. Tides
    i. The software must be capable of making allowances for tide height. This can be manual, automatic (based on predictions) or in the best case, live data.
    ii. It must be obvious whether the displayed depth contours exclude tide height (as in ECDIS) or include it.
    iii. The software should be capable of displaying safe navigable water based on ship's draught, UKC allowance and height of tide.
6. Playback feature
    i. Must have the ability to playback past recordings.

Suggested requirements

1. Docking Mode
    i. Standard feature having a docking/berthing display
    ii. Indicate ship's speed along longitudinal & athwartships axis (bow and stern) in docking mode.
2. Meeting Points
    i. Ability to display meeting points on same route by ships on reciprocal courses, taking account of multiple legs (using AIS data).
3. Docking lines
    i. Ability to select Docking Lines with distance to ship, displayed in Docking Mode.
4. Recording
    i. Software to automatically record on start up.
5. Voice and video
    i. Software may be capable of recording voice and optionally video.
6. Bathymetric Charts
    i. Ability to display Bathymetric Electronic Charts (BENCs).

PPU Class C: Ship dependent navigation systems

These systems only augment and refine the ship's gyro feed to give independent rate of turn. Position, speed and heading are derived from the ship via the transmitted AIS signal or the pilot plug and display on professional PPU software.

They are only suitable for general navigation pilotage and should not be relied on for narrow channel or berthing operations.

CAUTION - this technology is NOT recommended by AMPI for port pilotage, pilotage in confined waters or in situations where high accuracy position information has been assessed as required.

Hardware

Mandatory requirements

1. Refined Heading
    b. An internal rate gyro, or similar technology to refine the ship's gyro heading to a tenth of a degree to produce independent RoT calculations with an accuracy in the region of 0.5 degrees/min.
2. Auto Tx Pin Detection
    a. The unit must be able to detect and correct faulty AIS plug wiring.

Suggested requirements

1. Wireless Transmission To Pilot Display
    i. Utilising either Bluetooth or WiFi to transmit the position, heading, AIS and RoT data to the pilot's laptop/tablet.
    ii. Performance integrity monitoring and notifications of any interruption to the AIS signal.
2. Battery Life
    i. Minimum run time on batteries alone should be not less than 15 hours.
3. Weight
    i. Gross weight should not exceed 0.5kg.

Software

Mandatory requirements

1. Software Design
    i. Designed for professional piloting use.
    ii. Display a customisable ship predictor based on independent heading, CoG, RoT, SoG, drift and optionally a roll sensor
    iii. Have the ability to correct erroneous AIS antenna offsets.
2. Alarms
    i. Display an unambiguous visual and audible warnings when position and/or heading accuracy falls below a set threshold or there is any other threat to the integrity of the displayed data.

ii. The software must have robust performance monitoring and error display, and be configurable by the user.

3. Charts
    i. Must be capable of displaying official electronic charts (ENCs).
4. Routes
    i. The software should be capable of displaying full route information equivalent to that of an ECDIS, including waypoints, turn radius and cross track margins.
5. Tides
    i. The software must be capable of making allowances for tide height. This can be manual, automatic (based on predictions) or in the best case, live data.
    ii. It must be obvious whether the displayed depth contours exclude tide height (as in ECDIS) or include it.
    iii. The software should be capable of displaying safe navigable water based on ship's draught, UKC allowance and height of tide.
6. Playback feature
    i. Should have the ability to playback past recordings.

This method relies on the ship's AIS equipment and is subject to

1. **position latency**
2. **offset errors**
3. **issues with GPS hardware quality and accuracy.**
4. **Utilising a devices inbuilt GPS.**

There is substantial evidence that relying on AIS for position is not good practice and this code emphasises this fact. Recent trials have shown AIS position latency on some ships as being far too great for accurate navigation.

Consider the comments below before using AIS for position data:

- Using a ship's AIS for positioning data defeats the purpose of a PPU providing independent and accurate information.
- AIS was not originally designed as a source of position information for pilots.
- Using AIS alone for ship's positioning information is inherently risky and therefore discouraged.
- AIS should only be used for target information and own ship's heading.
- Evidence exists that AIS positioning data can often be wrong.
- AIS offsets are often incorrect.
- AIS offsets follow a unique protocol and not the ECDIS protocol. This may explain the number of ships with inaccurate offsets.
- Using a position circle rather than the ship's shape does not eliminate any AIS offset errors. For example, if the AIS GPS antenna has an incorrect GPS offset the position circle will offset accordingly on the pilots PPU display.
- AIS GPS Positions may not be precise due to poor equipment quality and antenna siting.
- AIS GPS Positions may not be differentially corrected.

- AIS GPS Positions may not be in WGS84 datum.
- Heading is only provided to the nearest degree at best.
- ROT is frequently lacking or inaccurate.
- GPS receivers connected to AIS incorporate a significant amount of filtering which may result in positions lagging behind the ship's actual position. This major error in position is often in the fore and aft line (and therefore may go unnoticed), and the ship will appear to be tracking down the middle of the channel and on the leads in spite of lagging considerably. At over 10 knots, errors of up to a ship length are common – the faster the speed the greater the lag error.

It is recommended that AIS data should not be relied on for positioning and that all PPUs use independent GPS or DGPS position input.

See Appendix 1 for a table summary

3. PPU EQUIPMENT SPECIFICATION

Overview

Having separated the High Accuracy Independent Heading and High Accuracy Dependent Heading PPU systems from the low accuracy Navigation Systems and identified the risks in relying solely on the AIS for position, the next step is to look at the equipment itself.

The main components are

- Display Device
  - Laptop/tablet
- Device Software
  - Takes the raw NMEA data and converts it into a user interface display
  - The display software is also usually responsible for collating the necessary data for displaying a predictor
- Position Sensors
  - One or more GNSS receivers ideally utilising a minimum of two or more satellite constellations
- Independent Heading
  - Sensors utilising Long Baseline or Carrier Wave Phase Shift methods for resolving independent heading. This may be augmented by an internal rate gyro
  - Long Baseline methods require a reasonable separation of antenna to achieve accurate heading, in the region of 20m
  - Phase Shift methods use the doppler shift of the carrier wave frequency coupled with a known and exact distance between the antenna. An approximate minimum distance of 1.5m is required for accurate heading calculation. It is also dependant on a good number of satellites in view, the more the better.

  Processor/Controller/Other Sensors.
  - The processing unit may be housed separately or incorporated into the receiving antenna. This element processes the sensor inputs, handles communication between the components and outputs the data to the laptop wirelessly. It also takes in information from any other sensors like AIS, IMU, RTK or other corrections methods and applies them to the picture.
- A Rate Gyro or Rate of Turn Generator
  - Used in non-independent systems to refine the vessels gyro output.
  - Used in independent heading systems as a comparator.
  - Can take the place of processor/controller transmitting data to the device

Software User Display

PPU technology is under constant development and the encouragement of continued innovation is very important. PPU technology and software development needs to remain adaptable to the needs of differing pilotage requirements.

In order to promote ongoing development, the standards need to be kept flexible and the purpose of this document is to set only the minimum requirements and encourage continuous innovation to keep pace with technological developments.

It is critical that all systems provide alarms to let the pilot know immediately when something is wrong before it is too late. Position signal degradation or loss is the main issue. It should be noted that PPU software exists that will go into DR mode for up to a minute or more without any warning that the primary signal has been lost.

Speed Over Ground vs Ship Speed (2D)

It is imperative when Class A/B software is in docking mode that the SHIP'S SPEED is displayed in two dimensions, longitudinally (ahead and astern) and athwartships (port and starboard) is displayed. Furthermore, the speed athwartships of the bow and stern of the vessel should be differentiated. SHIP'S SPEED should be displayed both numerically and graphically (vector line).

This is opposed to the default SPEED OVER GROUND (SOG) vector that indicates the speed of the travel of either the GPS antenna, MCCRP – or with some pilotage software the speed of the centre of the vessel – irrespective of ship's heading and rate of turn. SOG when manoeuvring can be misleading, and this code hopes to highlight the absolute need for Ship Speed – actual vessel motion that is essential when ship handling in close quarters. It should be noted that not all PPU software is capable of providing this critical information.

It is important that pilots know the difference.

Motion Prediction

PPU software for class A and B must provide a visual presentation to user, of the vessel's predicted future position. This prediction, to be of any use, must be based on a number of pieces of data including but not limited to: COG, SOG, RoT, longitudinal speed, drift and roll.

Safety Alerts

In addition to the software requirements the following safety related criteria should apply to all PPUs:

- **Software must display an unambiguous visual and audible warning when position accuracy falls below a set threshold**
- **Software that goes into DR mode, even for short periods, must immediately alert the pilot**
- **Software must be configurable so that a pre-selected default display, scale, route and layout will appear every time on start up with the minimum input from the pilot**
- **Software that is set up to allow user selectable layouts must have a default setting. This default setting should be the Standard Mode to revert to known setting parameters**
- **Integrity monitoring of positioning data, from whatever source, is essential**
- **Ability to record voice with PPU data is a great benefit for training, debriefing and conducting checks**
- **PPU data should be protected and archived**

These basic recommendations should provide a safe platform and reduce known risks without becoming overly prescriptive and stifling innovation.

PPU Display Unit

Pilots will choose displays that suit their particular application, from the ultra-light or rugged laptops and tablets to hand-held devices. Standardisation is desirable within a group.

- Minimum run time on batteries alone not less than 4 hours.
- Each pilot may have their own dedicated display unit or at least have familiar default settings if the software does not provide individual user profiles for pilots to log into.
- PPU display units should be dedicated to that purpose alone.
- Ability to dim the night screen to a point where it does not interfere with the night vision of personnel on the bridge.
- Display units used outside a protected environment for berthing assistance must be viewable in bright sunlight.
- Display units used outside a protected environment for berthing assistance should be weatherproof.

Reliability

PPUs from reputable suppliers are designed to be reliable and robust.

In some cases, pilots have unwittingly ended up with equipment that is poorly designed or unsuitable. The combination of GNSS, WiFi, UHF, DGPS, AIS and RTK signals squeezed into a small case can create signal "noise" problems that can result in erratic and unreliable service. Interference has been also known to occur from port communication radio links in poorly designed equipment.

Pilots faced with unreliable equipment will soon lose confidence, and therefore interest. It is imperative that extensive trials are done before acceptance.

- Logbooks should be kept of PPU use and faults noted.
- Maintenance should be planned and documented.
- Unreliable equipment should be repaired or replaced promptly.
- A designated person should be responsible for scheduled maintenance.

Accuracy

High Accuracy Independent Heading PPU's provide a powerful addition to the eye during precision berthing operations where landing speed must be carefully monitored.

The availability of SBAS, RTK and other shore-based position correction systems have given a major boost to precision piloting, and the high accuracy and compact unit size for positioning that is now available in Class B PPU's makes this a very popular lightweight option with positioning accuracy comparable with Class A PPU's.

The Positioning/Heading Sensor

The most significant issue with carrier wave phase measurements (the basis of heading calculations) is multipath. To avoid both multipath and other interference, good siting of antennas is important and a clear view of the sky essential.

Transmission between the positioning/heading sensor, processing unit and display unit is currently either Bluetooth or WiFi. There are advantages and disadvantages to both of these wireless technologies. WiFi is reported to be subject to more interference but has the advantage of longer range while Bluetooth is reported to be more stable but has less range. Bluetooth draws less power than Wi-Fi.

The connections and setting up of the positioning/heading sensor must be able to be done easily in the dark and should not take more than a minute or two. The sensor may be transported in a case or a backpack. Waterproofing and impact resistance should be considered, and, in this respect, a case offers the best protection, although it may increase weight slightly.

Window shades have been noted to potentially degrade the signal from sensors to the PPU.

The Pilot Plug Connector

When connecting to the pilot plug for the purposes of obtaining ships heading, the use of a wireless connection is recommended. Benefits include protection from an electrical spike damaging the PPU display unit should the pilot plug be wired incorrectly. The wireless connection has the major advantage of allowing unfettered movement on the bridge so that the PPU can be located in the most convenient conning position.

- The pilot plug connector should have the ability to indicate the pilot plug is operational and, when necessary, correct any wiring anomalies.
- Battery life should not be less than 12 hours.

It is recommended that AIS data not be relied on for positioning and that it always be augmented by an independent GNSS position input.

Weight

One of the reasons High Accuracy PPU equipment has been big and heavy was because of the need to provide differential corrections to the raw GPS feed. This required a receiver and that was often quite large and heavy.

The availability of SBAS has meant that the receiver is now tiny and lightweight. This is a game changer for PPU consumers as it now makes some of the less expensive equipment very accurate in positioning.

Where PPU Equipment is heavy and time consuming to set up pilots may become reluctant to carry and make use of the equipment. Excessive weight may also lead to health and safety concerns while transferring equipment between the pilot launch and the piloted vessel.

Equipment weight is primarily a problem for Class A PPU, however there are High Precision Berthing Systems available that weigh in at less than 2kg (without laptop).

In the Class B equipment category well established PPU suppliers have both sensors weighing less than 1kg and a high level of accuracy with the addition of SBAS and/or RTK.

Set-To-Work

Set-up time for a High Accuracy System should be less than three minutes in the hands of a well-trained pilot. The laptop computer should be capable of being prepared with ship details in advance and left in standby mode until needed.

Portability

The PPU bag or case should be fitted with snap hooks to allow securing to the pilot boat and quickly attaching to the heaving line during transfers. The carry case or bag should be waterproof and float and have retro-reflective tape applied to each side. Bags have the advantage of being lighter than cases and less likely to cause injury to those on the launch as well as the ship's crew having to heave the equipment up the ship's side. For this reason, bags are favoured for transfers to and from launches.

Compass Safe Distance

PPU equipment should be labelled with 'Compass Safe Distance' for those rare occasions when the heading and positioning sensors used with Class A equipment are deployed on the monkey island and placed within 5m of the magnetic compass.

- PPU manufacturers should be required to provide compass safe distance information.

Intrinsic Safety

On tankers, the bridge and bridge wings are designated safe areas. As long as the PPU does not transmit at power in excess of 1 watt there should not be an issue with intrinsic safety.

- PPU manufacturers should be required to provide transmission power output details to comply with equipment use in the safe area of a tanker.

4. CHARTING (see Appendix 2 for Definitions)

Charting used should provide the highest level of accuracy available. There are a range of different chart options, however for pilotage purposes the official Australian Hydrographic Services (AHS) Electronic Navigation Charts (ENC) should be used unless a more suitable alternative exists.

Suitable Charts.

- Where Official S63 ENCs exist and are sufficiently detailed, these are the preferred charts.
- Just because charts are "Official", do not assume they will be absolutely accurate until thoroughly checked – particularly in confined water. Zones of Confidence (ZOC) should be known and their associated uncertainties taken into account during planning and piloting. For completeness have a hydrographic surveyor check accuracy.
- Official S63 ENCs sometimes do not have sufficient detail for port pilotage. The accuracy of individual ENCs is indicated by their Nav Purpose number.

A. Nav Purpose 6 denotes Berthing levels of detail.

B. Nav Purpose 5 is Harbours and Approaches.

C. Nav Purpose 3&4 is for Coastal Navigation.

- The third character in the ENC chart title is the Nav Purpose indicator. AU5******.*** tells us this is a Nav Purpose 5 (Harbours and approaches) chart.
- Nav Purpose 5 ENC charts exist for pilotage purposes and are available from the Australian Hydrographic Services. At the time of writing, there are commercially available special Nav Purpose 6 Berthing ENCs in Australia for some ports.
- Ideally the Pilot PPU and the ships ECDIS will be using the same highly detailed ENC.
- The lack of commonality should not be allowed to preclude the use of higher quality information when it is available to the Pilot.
- Official Pilotage ENCs with at least 1m density contours, 50m spaced soundings, 4000 compilation scale and no dredged areas with maintained depths should be aimed for use with PPU class A & B.

In Summary

- **Always use the most accurate charts possible.**
- **Keep charts up to date.**
- **Nominate a responsible person to monitor chart developments and manage updates.**
- **Use Official Charts whenever possible.**

5. TRAINING

Without proper initial training and ongoing refresher training the true benefits of PPU equipment might go unrealised. Incidents where PPUs have been available but not utilised indicate that there is disconnect between some pilots and the enhanced situational awareness a PPU can provide.

The common maritime industry practice of supplying a mariner with a piece of equipment and an instruction manual with no formal training on the equipment, cannot be regarded as a proper or safe procedure for a PPU. In spite of the absence of a specific regulatory requirement that a pilot be trained in the use of a particular piece of equipment, the inability to competently use an available resource, particularly one brought aboard by the pilot, has the potential to constitute negligence.

Clearly pilots should be trained prior to their first use of a PPU. The manufacturer, a third-party trainer or an instructor pilot should deliver this initial training. After initial training, ongoing currency should be maintained by using the PPU in challenging conditions in a bridge simulator. Such advanced training would be "in context" and would include abnormal scenarios where either the PPU or shipboard sensor accuracy degrades. On completion, the pilot should be familiar with the equipment, competent in its use, and able to cope with abnormal situations.

Pilots should receive supplemental instruction any time their hardware or software configuration has an appreciable change. Formal training on the PPU equipment should be implemented with regular checks and skill updates.

Training should address the following:

- Pilot services need to comply with PPU training as required by the industry regulator.
- In the absence of specific regulatory training requirements, the pilot services need to provide evidence of formal training and periodic checks of PPU competency.
- Prior to using a new PPU the pilot should receive initial equipment specific training.
- After a familiarisation period the Pilot should be able to demonstrate the required level of competency. At this stage the Pilot can be given advanced training and further competency checks.
- After receiving the advanced equipment specific training and on the water, competency checks the next phase of training should involve simulation to help develop these new skills. This training should include blind pilotage exercises as well as abnormal sensor accuracy degradation, in a simulated environment.
- Pilots should be given PPU refresher training and checks annually.
- Pilots should undergo blind Pilotage and sensor accuracy degradation exercises every two years.
- Whenever possible PPU instructor pilots should be appointed from within the pilot group. These PPU instructor pilots should initially receive extensive equipment specific training following which they will be equipped to provide ongoing PPU training to their group.

6. STANDARDISATION

It is essential that all systems in a given pilotage area are as uniform as possible, contain and display the same waypoints, routes, and aids to navigation. In more extended pilotage areas, several routes may be appropriate. Changes are inevitable as skills and equipment are developed and more experience is gained. It is important that standard operating procedures are updated to reflect changes once new practices have been agreed upon and formally adopted.

Standardisation of equipment, training and procedures will produce the most consistent outcomes.

7. LIABILITY CONSIDERATIONS FOR PILOTS

Pilot services around the world have considered the issue of liability and the use of PPUs. The best protection against liability is to do the best possible job you can while piloting. Pilots should do whatever they can, and use whatever resources are available, to prevent an incident.

If an incident does occur, the law favours those who can show that they did their best rather than those who tried to avoid liability. It could be argued that there may be a case to answer should a PPU have been provided but not used if it may have prevented an incident.

Consider the following recommendations:

1. Receive formal training before using any PPU.
2. Learn as much as possible about your particular portable units.
3. If the unit is taken aboard set it up and use it competently.
4. Continue to exercise good piloting practice.
5. Carry spare batteries and other ancillary equipment that may be needed.
6. Makes sure the system is working properly with routine checks.
7. Establish a system of periodic maintenance checks. Keep a log of usage and any faults.
8. Consider placing ownership of maintenance with a separate, limited liability entity.
9. Do not use PPU equipment that is not sanctioned by the service provider and/or authorised by the regulator.
10. Undertake all available training including blind pilotage exercises.

8. LIABILITY CONSIDERATIONS FOR PILOT SERVICE PROVIDERS

If it can be demonstrated that the use of a PPU may have prevented an incident, and that the service provider has not supplied suitable equipment or training, there is potential for the service provider to be held accountable.

Clearly liability risks increase when a pilot is simply handed a PPU and dispatched to a ship without suitable training.

9. CONCLUSION

If using a PPU will, in a trained and competent pilot's own professional judgement, help to prevent an incident and will improve safety and the pilot's performance, the pilot should use it.

A properly trained and adequately equipped pilot using a PPU should have the advantage of better situational awareness and be better informed in difficult circumstances. The more precise the information the better the outcome is likely to be.

Used correctly, the PPU is a valuable addition to the existing navigation tools and bridge resources already available.

10. REFERENCES

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11. APPENDIX 1

PPU Class Summary Table

		Hardware								Software									
Class	**Type**	**Accuracy (Order of magnitude)**	**Integrity Monitoring**	**Independency from ship' s sensors**	**Heading accuracy (order of magnitude)**	**AIS Data**	**Battery Time**	**Weight**	**Purpose**	**Docking Mode**	**Dual axis Speed**	**Meeting Point Data**	**Position Prediction**	**Accuracy Warning**	**Auto Voyage Record**	**Auto Voice Record**	**Charting Level**	**Tidal Depth Adjustment**	**Safe Water Display**
A	High Accuracy Independent Heading	0.3-0.02m	✓	Fully independent Hdg & Position, SOG, COG, ROT	0.01deg	Internal or wireless plug	+4hrs	≤ 15kg	Very High Precision Pilotage & Berthing	✓	✓	✓	✓	Audible & Visual	✓	o	ENC S57	o	o
B	High Accuracy Dependent Heading	0.7-0.25m	✓	Independent with regard to Position, SOG, COG, ROT	Heading is ship dependent	Internal or wireless plug	+4hrs	≤ 6kg	Pilotage & non precision Berthing	-	-	✓	✓	Audible & Visual	✓	o	ENC S57	o	o
C	Low Accuracy Systems	Ship dependent	-	Ship dependent	Ship dependent	Direct or Wireless	-	-	General Navigation	No specific software requirement									
D	Specialised PPU systems	No specific guidelines for Class D Hardware – considered to be to the highest standard							Specialised STS Precision Berthing	No specific guidelines for Class D Software – considered to be to the highest standard									

12. APPENDIX 2

Charting definitions

Electronic Charts

ECDIS (Electronic Chart Display and Information System) – highly sophisticated navigation systems designed for ships. This equipment standard involves both hardware and software. Conforms to strict international standards.

ENC (Electronic Navigational Chart) – vector chart database published by a national hydrographic office for use in ECDIS. Meets international standards set by the IHO (International Hydrographic Organization) and IMO (International Maritime Organization).

S57 and S63

ENC data is arranged according to S57 format and specifications.

S57 – The IHO data format and specification which governs the content, creation and display of ENCs.

S63 – The IHO ENC data protection (encryption) scheme

Raster and ECS

RCDS (Raster Chart Display System) – a mode of operation for ECDIS which uses official raster charts (known as RNCs) in areas where ENCs have yet to be produced by Hydrographic Offices.

ECS (Electronic Chart Systems) – non-ECDIS chart navigational systems, some of which come close to ECDIS performance.

Bathymetric ENC's

These bENC's are becoming available when Hydrographic offices utilise bathymetric data to produce high density ENC's

The main features of these bENCs may include:

- 1:2500 compilation scale
- coverage based on the availability of high-density survey data
- depth contours at 1m interval, soundings with a 50m spacing, and essential Navaids

The ENC Story

An Official ENC, or Electronic Navigational Chart, is an official vector electronic chart produced in International Hydrographic Organization (IHO) S57 Edition 3.1 format and protected using the IHO S63 data protection scheme. It is authorised for use in International Maritime Organization (IMO) compliant Electronic Chart Display and Information Systems (ECDIS) and can also be used in compatible Electronic Chart Systems (ECS). Please note that "S57" is an IHO transfer format and is not an official ENC. Anyone can produce "S57" formatted data but only the official ENC complies with SOLAS requirements and carries the warranty of a National Hydrographic Office.