GUIDELINES ON THE DESIGN AND USE OF PORTABLE PILOT UNITS

INTERNATIONAL MARITIME PILOTS' ASSOCIATION

WITH TECHNICAL INPUT FROM
Comité International Radio-Maritime (CIRM)

CIRM

FOREWORD

With the increasing use of maritime Portable Pilot Units (PPUs), the International Maritime Pilots Association (IMPA) have modified their guidelines on the design and use of PPUs to ensure:

a) That Pilots or Pilot Associations are aware at the time of acquiring PPUs that the device fulfils the basic requirements of the pilots employed in that district;
b) That manufacturers and suppliers of such devices are aware of standards normally used for ships equipment and relevant to the needs of Pilots; and
c) That the basic functionality of such devices is user-friendly for pilots and easy to explain to others.

Pilot associations should independently assess their need for PPUs in the practice of piloting in their district. These needs include the scope of information and graphics to be provided by the PPU. The particular configuration should take into consideration these needs and complement the service provided by the pilot. These guidelines are not intended to be used as a detailed specification for a standard PPU as it is clear that the arrangements for Pilotage are different in different Ports and Harbours and that in some instances Pilots may need special PPU features due to the navigational constraints in that area.

PPU manufacturers and suppliers may consult these guidelines to better understand the factors that influence purchasing decisions by pilot organizations.

1 Scope

These guidelines cover Portable Pilot Units (PPUs) carried aboard ships by Pilots. Used together with the bridge's other mandatory shipborne radiocommunications and navigational equipment, a PPU is a pilot's tool that assists the local pilot in the safe navigation of the piloted vessel. It does this by incorporating a range of navigation sensors with an electronic chart and display. The sensors are typically GNSS (with or without augmentations), AIS Interfaces, and Heading - Rate of Turn Generators. Other information can include tidal and depth information when this information is provided locally and any other information that is specific for a particular port. Typically PPUs can be set up quickly on the Bridge with simple deployment of the navigation antennas and interfaces. Most connect using wireless technology to a personal computer (PC) / laptop or tablet positioned where the Pilot normally navigates. Connection may also be made to the ship's AIS to allow display of other ships and navigational aids that have AIS capability.

2 Definitions

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

ARPA
Automatic Radar Plotting Aid

Bluetooth
A wireless communications technology that shares the same frequency as WiFi. It is generally more flexible than WiFi but provides lesser throughput of data at generally shorter distances.

Charting Programs Software used to display Own Ship and Target Vessel positions on a nautical chart. The 3 most common types of Charting Programs are: Raster Navigational Chart, Electronic Navigational Chart (Vector), and Custom or Proprietary Vector Display.

DGNSS
Differential GNSS uses a surveyed position and compares it with the GNSS position. The difference indicates the GNSS error (i.e., differential correction), which is then broadcast to capable receivers.

ENC Electronic Navigational Charts

GBAS
Ground Based Augmentation System is a terrestrial-based differential correction system.

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

PC/Tablet
The most common user interface used for PPUs.

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

PPU
Portable Pilot Unit can be generally described as a portable, computer-based system that pilots bring aboard a vessel to use as a decision-support tool for navigating in confined waters.

RADAR
Radio Detection and Ranging
RNC
Raster Navigational Charts (full colour digital images of paper charts that are compatible with most marine navigation software)
SBAS
Satellite Based Augmentation System is a satellite based differential correction system. Examples include the U.S. Wide Area Augmentation System (WAAS) and the European Geostationary Navigation Overlay System (EGNOS).
WiFi
A wireless communications technology that enables equipped devices to exchange data. For the purposes of this paper, WiFi refers to the 2.4 GHz 802.11b/g/n standard.

3 General requirements and configurations

Because Pilotage is a local matter, what works well for one port may be impractical or cumbersome for a geographically different area. There is no single PPU or other solution that can meet the needs of all pilotage areas. In some cases, the use of a PPU may not be appropriate. It is crucial to note, however, that, when used, the PPU is a navigation and decision-support tool for the pilot alone. Whilst members of the piloted ship's bridge team may view the PPU display, the PPU should not be considered as a source of information for transmission to the piloted ship, other ships, or shore. It is not designed for that purpose.

Because PPUs are tailored to a particular pilotage area, there are a number of configurations that may be utilised. The following are the most common configurations employed by pilots:

- [D]GNSS/Charting Program: This basic configuration provides a representation of Own Ship position on a chart display of varying detail. Position accuracy may be enhanced by the use of differential corrections. Differential GNSS may be accomplished with GBAS or SBAS. Differentially corrected positioning devices are recommended as the minimum standard for carry aboard devices.
- [D]GNSS/Charting Program/Self-contained AIS: A proprietary transponder system added to the basic GNSS/Charting configuration provides positions of other AIS-equipped vessels in addition to Own Ship position. Another variation utilizes an internet based server operating as a Virtual Private Network (VPN).
- [D]GNSS/Charting Program/AIS Input via Pilot Plug: Other vessel positions are added to the display of Own Ship Position on a chart. Target vessel location and data is received from the Own Ship's AIS through a connection to the Pilot Plug. Own Ship Gyro Heading may also be obtained through the Pilot Plug.
- Charting Program/AIS Input via Pilot Plug: The display of Own Ship Position on the chart is dependent on the ship's GNSS and AIS equipment.

The priority of own-ship positioning display over AIS target display, or vice-versa, will greatly influence the hardware and software choices made within these general configurations. Similarly, the need for, and availability of, detailed hydrographic information or other area-specific information will drive the selection and configuration of many components. Charting programs, whether supplied by the system integrator or commercially obtained, should be tailored to the specific needs of the pilot group and area of operation.

Rate of Turn (ROT) display in a PPU can be derived from several sources, with varying degrees of accuracy depending on the method employed. Any Pilot association that chooses to display ROT in their PPUs should confirm that the accuracy they require is provided by the method that they select.

3.1 Electromagnetic compatibility

Because PPUs will be used by the Pilot on the bridge of a ship, it is important to ensure that they do not interfere in any way with the existing bridge navigation equipment. The typical PPU configurations noted above do not present electromagnetic interference problems. Nevertheless, PPUs should meet the following extract from SOLAS Chapter V, regulation 17, especially c) below.

a) *Administrations shall ensure that all electrical and electronic equipment on the bridge or in the vicinity of the bridge, on ships constructed on or after 1 July 2002, is tested for electromagnetic compatibility taking into account the recommendations developed by the Organization. (Res A.813(19))*
b) *Electrical and electronic equipment shall be so installed that electromagnetic interference does not affect the proper function of navigational systems and equipment.*
c) *Portable electrical and electronic equipment shall not be operated on the bridge if it may affect the proper function of navigational systems and equipment.*

Additionally IMO resolution A.694(17) paragraph 6.1 states

(A.694/6.1) All reasonable and practicable steps shall be taken to ensure electromagnetic compatibility between the equipment concerned and other radiocommunication and navigational equipment carried on board in compliance with the relevant requirements of chapters III, IV and V of the SOLAS Convention.

Tests for Electromagnetic compatibility are common in the electronics industry for all equipment even that which is used at home. The particular levels for tests suitable for ships equipment may be found in IEC 60945.
Annex C of IEC 60945 describes the sort of Electromagnetic environment found at sea and the types of tests appropriate.

3.2 Safe bridge design

SOLAS Chapter V regulation 15 concerns principles relating to bridge design, design and arrangement of navigational systems, and bridge procedures.

These regulations have been developed to:

a) facilitate the tasks to be performed by the bridge team and the pilot in making full appraisal of the situation and in navigating the ship safely under all operational conditions;
b) promote effective and safe bridge resource management;
c) enable the bridge team and the pilot to have convenient and continuous access to essential information which is presented in a clear and unambiguous manner, using standardized symbols and coding systems for controls and displays; and

d) minimize the risk of human error and detecting such error, if it occurs, through monitoring and alarm systems, in time for the bridge team and the pilot to take appropriate action.

Any PPU brought into the ships bridge environment should be consistent with these principles as they apply or are relevant to pilots.

3.3 Charts / Hydrographic displays

Although the display of hydrographic information on a PPU need not meet all the requirements of a SOLAS ECDIS, it may be advisable that the chart has the following attributes:

a) IHO symbology as defined in IHO publication S-52 or successor IHO standards:
b) Where available, IHO official chart data; and
c) Similar colour palettes available as used in ECDIS.

3.4 Compass safe distance

IMO resolution A.694(17) in paragraph 6.3 defines compass safe distance as follows:

Each unit of equipment normally to be installed in the vicinity of a standard or a steering magnetic compass shall be clearly marked with the minimum safe distance at which it may be mounted from such compasses.

IEC 60945 states that regarding minimum safe distance, *portable equipment shall always be marked.*

ISO 694 defines "vicinity," relative to the compass, as within 5 m separation.

3.5 Interfaces

3.5.1 AIS Pilot Plug

The Ship's AIS equipment is fitted with a "Pilot Plug" from which AIS data may be obtained. Specific data is available from the AIS Pilot Plug. The PPU may display AIS information that includes:

a) Dynamic data: Own Ship and Target Vessel positions (latitude and longitude), Course Over Ground (COG), Speed Over Ground (SOG), Heading, Rate of Turn (ROT), Navigational Status and time.

b) Static data: vessel name, Call Sign, IMO number, vessel type and dimensions

c) Voyage related data: actual draft, cargo type, destination and Estimated Time of Arrival (ETA)

3.5.2 Reliability of data from the AIS Pilot Plug

There has been some confusion on the wiring of such plugs, and in some cases the transmit and receive data lines have been reversed. Some PPU manufacturers have included the capability to identify incorrect wiring or even automatically correct wiring faults. Pilots should be aware of these and other potential problems and deficiencies with data obtained through the Pilot Plug. AIS information is subject to the vagaries of improper inputs, improperly maintained AIS data fields and poorly

maintained transponders. Information from the plug, if used, should be verified by the pilot with each use.

3.6 Ruggedness

The maritime environment can be tough on equipment, especially during pilot transfer. It is recommended that PPUs be designed in accordance with the environmental requirements defined in IEC 60945 for similar portable equipment.

IEC 60945 defines 4 categories of equipment:

a) portable;
b) protected from the weather;
c) exposed to the weather; and
d) submerged or in continuous contact with sea water.

Although the PPU may have a waterproof container, any equipment used on the bridge wing should at least comply with the requirements defined by a) and c). Laptop computers will be used generally in a protected environment and should comply with a) and b).

4 Training

Pilots should be trained prior to their first use of a PPU, and they should receive supplemental instruction any time the hardware or software configuration has an appreciable change.

The amount and type of training required prior to using a PPU will vary depending on many factors. Some of the factors to be considered in determining the type and amount of training are:

- Type of positioning or navigation tool– GNSS / GBAS / SBAS
- Type of display device – PC / Tablet / Hand-held or portable GNSS
- User interface – Windows / MAC / Manufacturer's Proprietary System
- Type of display format – Text / Graphical / Charts (RNC, ENC) / Manufacturer's Custom System
- Connectivity method(s) of equipment – Wired / WiFi / Bluetooth
- Intended area or environment of use
- Other tools combined with the navigation system – AIS / Pilot Plug / Heading – Rate of Turn Generators / internet connectivity

Training should cover the theory behind the selected positioning device(s), an extensive hardware and software orientation, principles and use of Electronic Navigational Charts and AIS (when equipped), and integration of the equipment into the pilot's Bridge Resource Management practices. The training should also include discussion of the potential benefits and limitations associated with PPUs.

5 Maintenance of a PPU

Absent official guidance from a regulatory body, pilot organizations deploying a PPU should work with the supplier of their system to enact measures that ensure the systems their pilots use are maintained in good working order.

As a practical matter, a system for diagnosing and correcting any day-to-day problems with systems should be established. Likewise, a system for periodic maintenance checks and software or hardware updates should be established. It is recommended that maintenance be done either by the manufacturer/supplier or by qualified IT servicing providers.

If equipped with Wireless Broadband Internet Service, technicians can remotely access and service systems through a Virtual Private Network (VPN). VPN access for administrative or service purposes during actual piloting operations requires extreme caution and is not recommended when such action can be avoided.

A pilot group should maintain a supply of spare parts so that pilots can easily replace lost or damaged components such as carry bags, antenna cables, or power supply adapters. It may also be advisable for pilots to carry spare batteries, power cords, or other ancillary equipment as needed.

Up to date equipment assignment records, maintenance logs, and records of software and hardware updates should be kept.

6 Summary

These guidelines offer recommendations in the areas of design, development, configuration, deployment, operation and training to pilot groups that choose to employ PPUs. Maritime pilots are encouraged to consider these guidelines in light of their local conditions.

Annex

References

Within this document a number of references are made to International Standards which apply to equipment and facilities on ships that meet the requirements of the International Maritime Organization Safety of Life at Sea (SOLAS) regulations.

International Convention for the Safety of Life at Sea (SOLAS): 2014 as amended

IMO Assembly Resolution A.694(17): 1991, General requirements for shipborne radio equipment forming part of the global maritime distress and safety system and for electronic navigational aids

IMO Assembly Resolution A.813(19): 1995, General requirements for electromagnetic compatibility (EMC) for all electrical and electronic ship's equipment

IMO Assembly Resolution A.1021(26): 2009, Code on alerts and indicators Resolution A.1021(26) Adopted on 2 December 2009

IMO Safety of Navigation Circular 243 Rev. 1 Guidelines for the presentation of navigation-related symbols, terms and abbreviations (SN.1/Circ.243/Rev.1 dated 23 May 2014)

IEC 60945 Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results

IEC 61162 series Maritime navigation and radiocommunication equipment and systems – digital interfaces

OUR MISSION

IMPA represents the international community of pilots. We use the resources of our membership to promote effective safety outcomes in pilotage as an essential public service.

BELIEFS

1. The public interest is best served by a fully regulated and cohesive pilotage service free of commercial pressure.
2. There is no substitute for the presence of a qualified pilot on the bridge.
3. IMO is the prime authority in matters concerning safety of international shipping.
4. All states should adopt a responsible approach based on proven safety strategies in establishing their own regulations, standards and procedures with respect to pilotage.
5. Existing and emerging information technologies are capable of enhancing on-board decision making by the maritime pilot.

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