The new generation of portable pilot aids

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Introduction

Around the world we are seeing dramatic increases in demands on shipping. Ships are getting bigger, and although new ports are being built to cope with them, many existing ports have little scope to expand. This means:

- Tighter manoeuvring margins;
- Increased stress and demand on the bridge-team;
- Increased stress on pilots; and
- Greater scope for error.

Although historically pilots have relied almost exclusively on their own knowledge, experience and intuition, advances in technology are now available to assist them. Adoption of technology is generally very slow, often because ports have difficulty seeing the benefits that technology can bring. The benefits can vary from port to port, but one example is of a port in Australia which, in one use of their equipment, saved its purchase price several times over – simply by being able to sail a ship which would otherwise have blocked berth until the next tide.

This article will explain some of the technological options, and show the level to which each can assist pilots and ports in improving safety and profitability.

Simple (position only) systems

The simplest electronic aid is one that uses a single GPS receiver. The system typically comprises a PDA or laptop and a single antenna, either integrated into the display (typically a PDA), or separate from it with a cable or wireless connection to a laptop display. The latter allows operation inside the wheelhouse and enables more sophisticated software to be used. Navicom Dynamics' 'FairwayPilot' system is an example of this type of system using a wireless data link to a laptop display.

Simple systems are inexpensive and very portable – and may be all that is required in relatively straight and wide channels. For example they show the position of the vessel (or normally its bridge wing, where the antenna is sited) in relation to its surroundings, which can help prevent confusion as to which buoy the ship is passing.

As ships move into more restricted waters, these systems become less effective. The size of the ship in relation to the navigable water becomes significant, and it is critical that the ship's outline is accurately displayed on the chart. While this can be achieved in some software by entering the ship's dimensions, together with the offsets of the GPS antenna, the displayed picture is only meaningful if heading is accurate. Simple systems can only assume that ship's head is the same as the course over ground (COG); while this is a valid assumption when the ship is moving in a straight line with no wind or tidal stream, heading will be gravely in error once the ship starts to turn. At slow speeds, and particularly when using tugs or moving astern, ship's head and COG may be up to 180° apart.

Advanced (position and heading) systems

For precise navigation in confined waters it is vital to know heading, as this allows every part of the ship to be shown in its correct position on the chart. There are two main ways of obtaining heading and ROT for use on a portable system: AIS, and Portable Pilot Units with their own heading sensors.

Figure 1. Vessel turning in confined space.

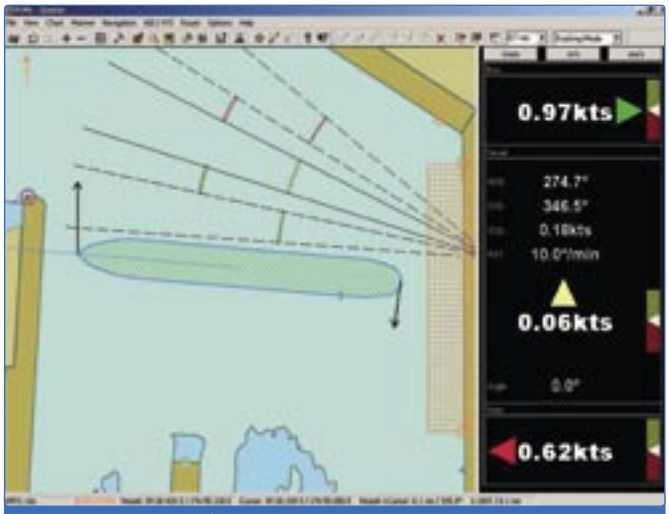

Figure 2. Plan position of vessel.

Automatic Information Systems (AIS)

In 2004, the IMO made it a mandatory requirement for vessels to have AIS fitted. AIS was primarily developed to provide reliable information about other ships in the vicinity for collision avoidance purposes, but many people have advocated using it as a low-cost solution for supplying 'own-ship' navigation information via the Pilot Plug.

Unfortunately, reality falls short of theory, largely because of poor quality source data for the AIS (including gyro errors, lack of ROT data, and imprecise GPS positions), and inadequate physical installation of the systems aboard many ships. Problems with the 'mandatory' pilot plug include vessels which are not fitted, difficulty in locating it, and inability to get a data stream due to incorrect wiring. All too often, even when a connection is successful, the high quality data required for close-in pilotage work is simply not available. Distractions while finding and making the connection, combined with unreliable data, do not contribute greatly to vessel safety in pilotage waters.

The result is that in its current state of development, although AIS is very useful for providing information on other ships in the vicinity – particularly if it is displayed on the radar or ENC – the pilot is unlikely to be able to rely on the navigation data provided from the

Figure 3. A PPU in its carrying case.

AIS plug for safe, accurate own-ship pilotage. The Nautical Institute has a forum on AIS which provides some interesting insights into these sorts of problems – see http://www.nautinst.org/ais.

Portable Pilot Units (PPUs)

In order for a pilot to feel confident, he must know that the information provided for both position and heading is accurate and reliable. This can be achieved using a PPU carried aboard, set up and operated by the pilot.

Navicom Dynamics' HarbourPilot is an example of such a system. It provides the reliable accuracy needed to conduct safe and efficient pilotage, even in poor visibility conditions. The system takes less than one minute to set up, is easy to use and has been specifically designed for pilotage.

When combined with the pilot's experience, knowledge and intuition, the use of a high quality position and heading system, such as HarbourPilot, leads to precision piloting. HarbourPilot allows the pilot to plan, execute, and subsequently analyse his pilotage, and the result is an informed pilot who is fully aware of his situation at all times, including in restricted visibility.

Experienced pilots who have used sophisticated PPUs like HarbourPilot report that the overall accuracy of their piloting has improved dramatically. This is especially true when using the curved-path predictor function while negotiating long bends, as the pilot can adjust his ROT to adhere very closely to the planned track. During very tight (500 m radius), tug-assisted, 90° turns with a 300 m ship, HarbourPilot has been able to show – after turning through only 10° – that the achieved ROT is sufficient to complete the turn safely, enabling the pilot to ease the turn immediately. Without such assistance, pilots invariably generate a high rate of turn initially and maintain it until it is absolutely obvious to the eye that the turn will not be too wide; in the process they clip the apex of the bend and turn inside the optimum track. Pilots using HarbourPilot have acknowledged that this tendency can largely be eradicated.

Contrary to what one might expect, working with a PPU does not create dependency, but rather improves the quality of pilots' work, even when they are not using it. Captain Ted Lysons of Port Hedland, Western Australia: "I can do a better job using only your equipment, and not looking out of the window, than I can do by eye. This is after eight weeks of using HarbourPilot and twenty eight years of traditional piloting. By using the predictor and rate of turn, the ship can be kept precisely on the designated track around bends in a narrow channel. It is further evident to me that I appear to learn from using the equipment. By using it and also looking out of the window, I believe I have increased the data base on which my mental assessments are made. My pilotage skills without the equipment are thereby (also) improved."

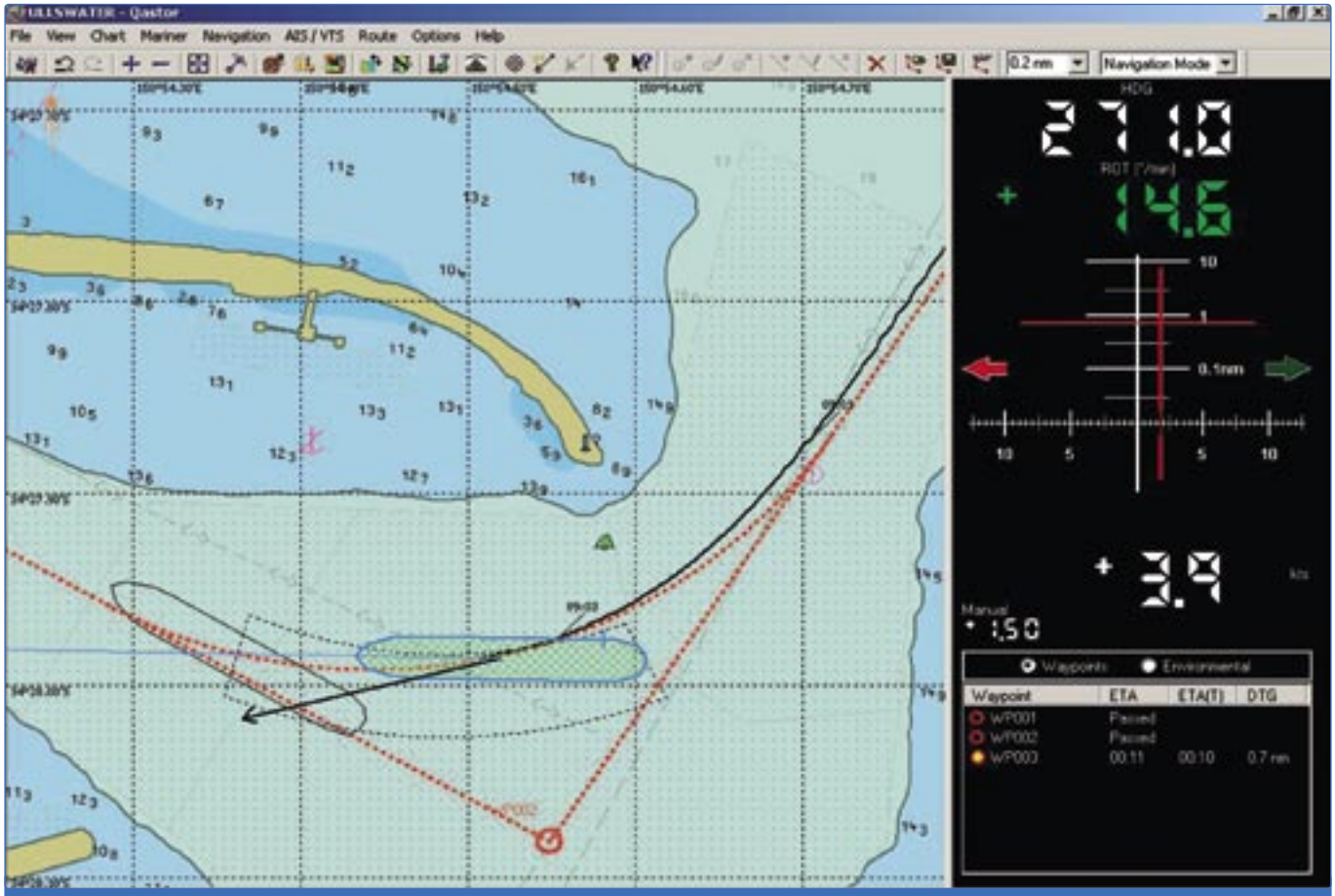

Figure 4. A tight tug-assisted turn – with predictor.

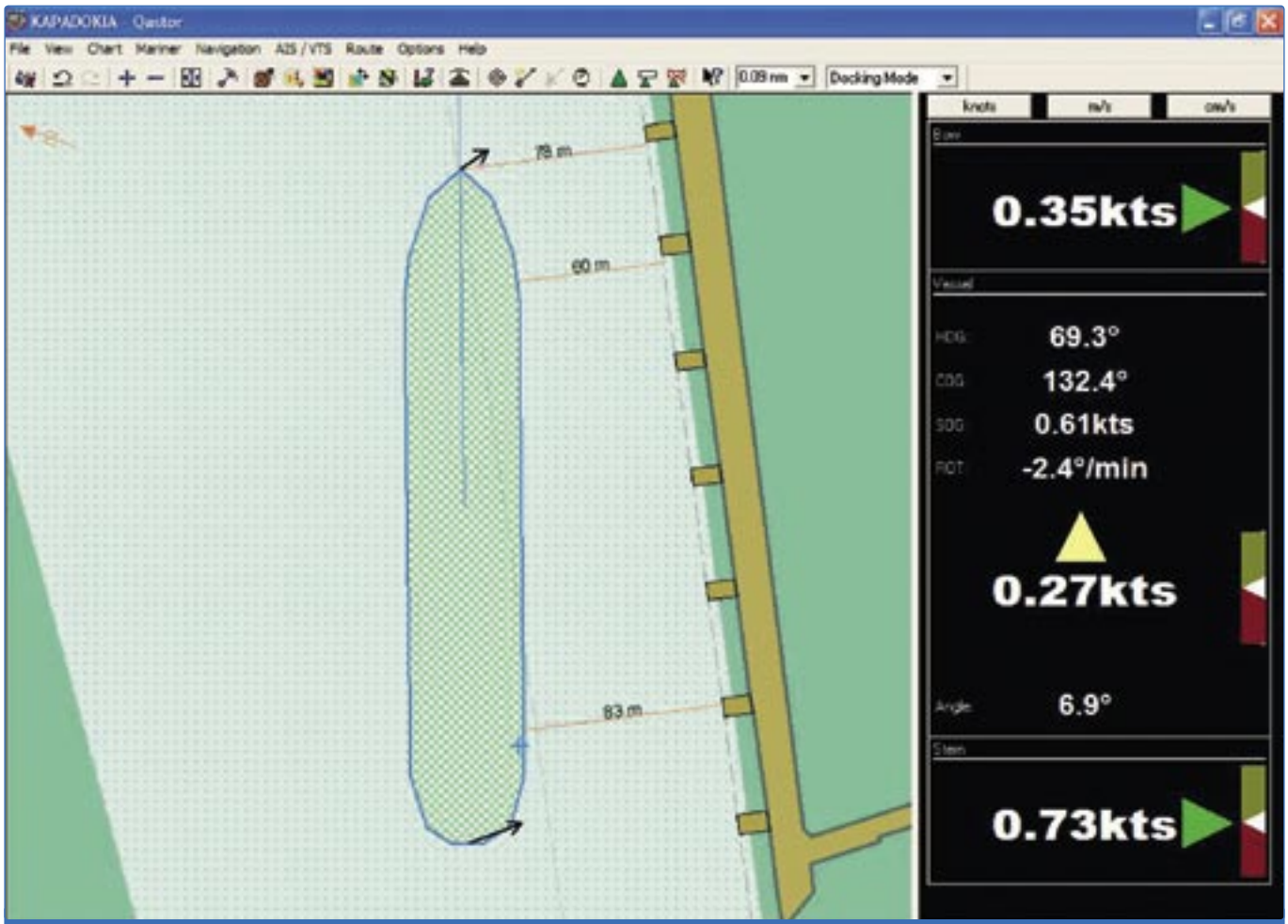

Figure 5. Berthing – showing distance off wharf and closing speeds.

Some advanced heading systems also give the pilot the ability to precisely monitor docking performance. HarbourPilot's heading solution is so stable that it is able to calculate the athwartship motion of the bow, over 200 m away from the sensor, down to 2 cm/sec. This meets the docking requirements of almost any port.

Training

For experienced pilots, the recording and playback capability of HarbourPilot provides an excellent tool for analysis and self-critique. It can also be used very effectively in training and debriefing new pilots, as many of them already have experience with the plan-view method of ship-handling from previous experiences using ship handling simulators.

The recording and playback facility can also be used during check pilotage, providing an indisputable record of what actually happened – thereby providing a powerful tool for analysis and fine tuning of technique.

Conclusion

Demands on the shipping industry will only increase, as will pressures on pilots and port services to meet these demands. Technologies are available to assist with today's pressure, but choosing the most suitable system can be a tedious task. The most important starting point is to assess needs and requirements, but acquiring a system that provides accurate and reliable information is vital. Return on investment can be very rapid – efficiencies come quickly – but there are also the hard-to-quantify benefits from avoided accidents.

Most pilots readily accept PPUs as a valuable aid to close-quarters ship-handling, and as a means of improving safety and efficiency, while also reducing their stress levels. PPU's such as HarbourPilot complement the pilot's skills by providing accurate information to support decisions. PPUs are invaluable as a means of fine-tuning the ability of pilots so they can consistently provide precision piloting – which ultimately means greater safety and efficiency in ports.

ABOUT THE AUTHOR

Paul Stanley was a Navigation Specialist in the Royal Navy and later the Royal New Zealand Navy. He had a particular interest in pilotage and ship-handling, which he both practised and taught to the highest levels. Working closely with pilots, he has been actively involved in developing portable aids for Marine Pilotage since the late 1990s.

ABOUT THE COMPANY

Navicom Dynamics specialises in the provision of precise position and heading for the Marine Industry. In addition to their HarbourPilot family of products (of which the latest is ShuttlePilot for use offshore with FPSOs and RTMs) they are also involved with automation of container handling systems.

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