Support systems for pilotage, past and future.

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Abstract

Pilots and navigators have through history used everything available to support them in the execution of their task. From the simple sounding means (for instance a stick or a line with a heavy object tied to it) to the advanced electronic support systems that are available today. This means that apart from the more traditional side of his set of tasks the influence of modern technology is felt. In general it concerns such diverse and complex subjects that it requires the pilot to remain up to date with regard to the most modern techniques. In a sense this also concurs with the change form a provider of (local) knowledge to that of a manager of a high risk operation. More information flows can reach the pilot on the place where he executes his profession. With marginal scope the pilot has to translate such information to the situation in which he finds himself in order to give a balanced advice. Knowledge of the surroundings, variable circumstances in his specific area but also language and culture play a crucial role. This paper touches on the history of pilot support systems and examines the developments of pilot support systems in the present day operating environment and addresses the implications. These range from the historic basic needs for pilot information to the present and future possibilities, supporting the pilot to make the most precise assessment at each operational stage to continually execute a safe journey in and out of port.

1. Introduction

"The boats are on their several stations in all weather blow high blow low; and the pilot's life is an arduous one, and extremely dangerous at times. One of the many dangers to which they are subject is boarding vessels in a heavy sea with the punt (a flat bottomed shallow boat). When there is a very heavy sea on, one in which a punt could not live. They board the ship with the big boat, which is done in this manner: The pilot-boat approaches the ship on the lee side within a yard or two, or as near as she dare; a line is then passed form the deck of the ship through a block on the lower yardarm, and made fast to the pilot's body, who, watching the opportunity, either jumps or is swung aboard"

The above is part of an article in the October 3rd 1857 issue of the supplement of "The illustrated London News". It describes the transfer of pilots in the port of Liverpool. Almost more than 150 years have passed since the article was published. In essence the "line made fast to the pilots body" may be interpreted as a pilot support system in the true sense of the word during embarkation and disembarkation. In another sense pilots and navigators have through history used everything available to support them in the execution of their task. Pilots have performed these task for thousands of years. Presumably the first persons acting as pilot were captains of local vessels or local fishermen. As expert in navigation in addition to their local knowledge of coasts and rivers. Most pilots from this period are unknown to us. One of the first indications is contained in information from as long ago as approximately 1.500 B.C. According to an inscription on a sarcophagus a pilot would have guided the fleet of Admiral Quoi at least eleven times on the Nile river. To enhance their local knowledge such pilots probably made use of support systems in the form of simple sounding devices (presumably a long stick or a heavy object made fast to a line). Over the years one finds that it is not only the specific local knowledge but also the accumulated knowledge during a voyage that earned a person the position of pilot on board a seagoing vessel. Thus when in 325 B.C Alexander the Great returned from his forays in the Indus area his fleet made use of a local pilot to enter the Arabian Gulf. A Greek by the name of Timosthenes was employed by Ptolemy I (323-284 B.C.) to write sailing instructions for his new fleet. Such sailing instructions might be regarded as "support system" in the sense that it supported others to act as pilots for the fleet. An expedition of Ptolemy VIII in 120 B.C. to research the route from Egypt to India was thus guided by local Arab pilots. Much later pilots formed part of the crew as experts in navigation and drew their expertise from the accumulated knowledge of other seafarers if available. One should underline if available. Such knowledge was in general of very high value and more than often heavily guarded. The navigators support system in those days consisted of well guarded charts and book works that contained detailed information about the coasts and stretches of water to be encountered during the sailing of the vessel. Sometimes capital punishment was the ultimate price that a pilot paid for selling information to other parties interested.

2. Peilloot

The name of a support system consisting of a line with a piece of lead probably also forms the root of the name pilot. In the 1600's one finds in The Netherlands that the word Lootsman and Piloot/Peilloot are introduced. Dutch sources have it that this word is derived from the ancient Dutch word "Peilloot". Translated "Peilen" is the verb that describes taking a sounding and "Loot" describes a piece of lead. Ergo a piece of lead on a rope used as a sounding device.
Today, pilots in The Netherlands are addressed as "Loods" (probably derived from the last part of the word "Peilloot"). Gradually pilots are also seen to evolve from practical (local) navigational experts into chart makers and chart publishers. The nature of such support systems remained essentially more or less similar over several centuries. Major changes occur when the printing press is introduced because by then charts and tide tables can be printed in larger quantities for use in the pilot station or on the ship. The Dutch Pilots' organisation has in its possession a tide table printed in 1750 for the entrance of the Maas and the Goeree. These were the important entrances to the ports of Rotterdam and Dordrecht before the New Waterway was constructed.
In spite of the changes in the Dutch coastline and waterway system some of the information is still current.

3. Changes

More influential changes occur with the advent of electricity on board ships in the 19th century. This opens the possibility for the use of electronic navigation aids on board. An indication of how relatively fast things go in this respect is when I look back on the first ship with which I went to sea as a cadet. It had been built in 1954 and was equipped with a "state of the art" Marconi radio direction finder, about the size of today's refrigerator, a very bulky radar set and a Decca Mark V receiver. Decca, Loran and Omega and other electronic navigation systems techniques were refined thereby becoming an important element in navigation. Decca was additionally tailored for use in the Port of Rotterdam area in the entrance to Europoort for deep draught vessels. The devise that was developed with this in mind was called the Brown Box. Brown Box because it mechanically combined the signals received from the Green and the Red slave (Green and Red forming Brown) of the Decca chain. These two Decca slaves were put in such a position that the Red lines lay over one leg of the approach channel, with Green almost perpendicular to it (to give maximum position indication) and on the last stretch they combined so that an ideal grid lay over the last stretch into Europoort. Essential for precision navigation in the deep draught approach to the port. This year such ships will exceed 400 metres in length for the first time and have a draft of approximately 21.5 metres.

4. Further developments

The Netherlands pilot organisation developed an electronic manual in which all information relevant to pilots working in a certain area was stored. Such equipment already contained tide information, specific port and berth information etcetera. Also a successor was developed for the Decca Brown Box resulting in the Channel Navigator (working on GPS information). This proved however still a bulky set that was difficult to handle. Since the late 90's also navigational decision support systems in the shape and form of lap top devices have been surfacing. This development has taken place amongst others in Australia, Sweden, the USA and Europe. One of the developments in Europe based amongst others on experiences in the USA has been the development of the Innovative Portable Pilot Apparatus (IPPA). This was the result of a project of the European Union in which the European Maritime Pilots' Association was one of the partners.

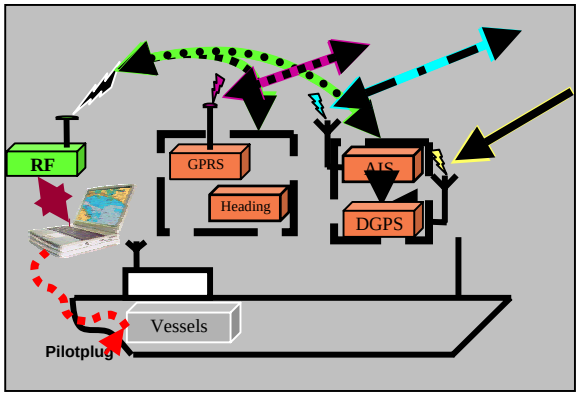

Fig. 1 IPPA total concept

IPPA sought to develop and validate an advanced prototype portable pilot support equipment that can receive data from a shore based Vessel Traffic Services (VTS) centre, such as track and environmental data, and thus, together with its stored data and other vessel's AIS, display a comprehensive traffic image.

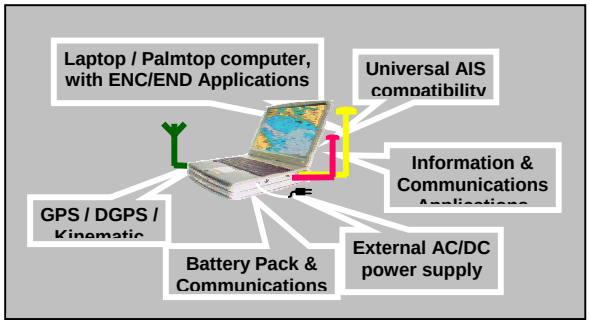

Fig 2. IPPA components layout

The equipment was intended to meet the user's needs, be stand alone (apart from a capability to accept power if available) and function autonomously. It was envisaged that with a variety of communications interfaces, production equipment would also be capable of transmitting back to a VTS centre data required for traffic and port management. The effect was expected to be an improvement in navigational safety, a reduction in voice radio communications and provision of a beneficial impact on the efficiency of traffic flow. Interoperability with AIS was seen as a key requirement. Implementation showed however at the time that it was not at all easy to implement such technologies. Tests were conducted in various countries in Europe after which it was concluded that it was in principle possible to fulfil the other goals that were set by the IPPA project.

5. Navigator Marginale Schepen.

In several countries pilots have taken this development a step further, amongst others in The Netherlands. The pilot organisation developed the "Navigator Marginale Schepen" (NMS). The Scheldt Area organisation "took the biscuit" and succeeded in introducing the SNMS (Schelde Navigator Marginale Schepen) in 2004. It is specifically designed as a support system for pilots on large vessels. One should however be aware that such lap top pilot support systems do not form a "pilot in a box". The pilot with his knowledge and skills is supported by information supplied from the NMS.

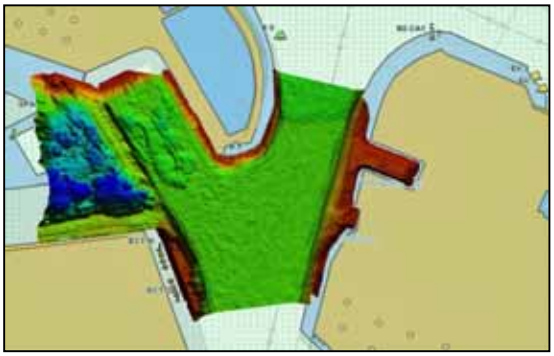

Fig 3. On line bottom profile

If for instance an on-line bottom profile or on line tidal information is available, this will allow the pilot with his specific skills and knowledge to decide to sail at a different (tailor made) time instead of sailing within the limitations of

predicted information. Some of the ships equipment also acts as support instrumentation for the pilot. Amongst these are radar, VHF, ARPA, ECDIS etc. It seems that technological developments in the maritime field are proceeding at an ever increasing pace. As indicated maritime pilots are assisting world-wide in the development and use of advanced electronic systems in ports and waterways, such as NMS, AIS, ECDIS, "Silent VTS" and other innovations. The International Maritime Pilots' Association acknowledges these developments and urges administrations to recognise and support the role of maritime pilots in leading the efforts to utilise such (emerging) maritime technologies in order to further advance the safety of navigation, safety of life, and the protection of property and the environment.

6. Vulnerability of GNSS (GPS/GLONASS/GALILEO) systems

Quite some developments in the provision of satellite navigation systems and the SOLAS requirement for all ships to carry means of receiving transmissions from suitable radio navigation systems throughout their intended voyage have taken place. Modern equipment relies however heavily on GNSS information. the John A. Volpe Vulnerability Assessment of Transportation Infrastructure relying on the GPS (Aug 2001) in the United States showed beyond the shadow of a doubt how vulnerable these GNSS systems really are. There is an increased awareness of the potential for natural, accidental and deliberate interference (and jamming) of satellite navigation systems. Some devices used in jamming the system can be very small and extremely effective. A jamming device the size of a dice can disturb the signal over an area of several hundreds of metres.

Fig. 4 Annoying toy or serious threat, jamming device.

It should be realised that satellite navigation information is not solely used for the determination of geographical positions but also as an essential input for timing devices of land based and maritime infrastructure (such as AIS).
There is a continued availability of electronic navigation systems (such as Loran-C/Eurofix) that can serve as an alternative source of input for the determination of position and time. Public funding will continue to form an important element for the continued existence of alternative systems. IMPA cautioned its Pilots in one of its resolutions as to the limitations of information derived from Satellite Navigation Systems. Such caution was also given by amongst others the Royal Institute of Navigation (RIN), the Netherlands Institute of Navigation (NIN), the Confederation of European Shipmasters Associations (CESMA) and others. It does seem, however, as if such conclusions have gone completely unnoticed by decision makers.

7. Back up systems

Whether noticed or unnoticed, the general issue is that there is (unfortunately) still a lack of proper back-up systems. The United States has meanwhile recognized that terrestrial systems may form a usable back up. After doing away with nearly all terrestrial systems in the world (Decca, Omega etc.) all that we seem to be left with for the moment is the Loran system. In Europe the participating countries have decided to end what is left of the system by ending the Northern European Loran System (NELS) agreement. It should, however, be realised that ending the agreement (for apparent economic reasons) means much more than just doing away with an (apparently) old and (seemingly) obsolete navigation system. With GNSS signals being extremely vulnerable to jamming and spoofing Loran may at this moment in time be the only terrestrial system left to fill the void. The United States has recognised this and has decided to invest approximately 140 million US dollars to revamp the system (under the name e-Loran). In Europe some countries have at the last moment decided not to switch of their Loran transmitters. Great Britain has installed and tested a LORAN transmitter in Rugby. Tests have been carried out in the Harwich area indicating that an accuracy below 10 metres is possible. While fully supporting the developments in GNSS systems such as Galileo the context remains however that there should at all times be a proper electronic back-up system.

8. Future

In the future presumably the pilot will see the number of tasks grow even further in the execution of his profession. Apart from the more traditional side of his set of tasks the influence of modern technology is felt. In general it concerns such diverse and complex subjects that it requires the pilot to remain up to date with regard to the most modern techniques. More information flows can reach the pilot on the place where he executes his profession. With marginal scope the pilot has to translate such information to the situation in which he finds himself in order to give a balanced advice. Knowledge of the surroundings, variable circumstances in the region but also language and culture in his region/port play a crucial role. The tendency to (over)legalise is felt in the shipping industry and its environment.
The pilot knows the rules of that environment, speaks the language as no other and is able to make the most precise assessment at each operational stage. In combination with a proper (legally embedded) independent position he will be able to continually execute a safe journey in and out of port.

9. Conclusion

We have followed the path from simple depth-sounding devices to the advanced electronic support systems that are available today. Developments like the NMS increase the support possibilities for pilots. At the same time there is concern for proper back up facilities and developments with regard to the terrestrial systems. Eventually however, whatever the level of technology, all equipment and people on board have to play in unison and work together harmoniously. For pilots the approval by IMO Assembly of Resolution A960 was an important milestone. This resolution contains recommendations on training and certification and on

operational procedures for maritime pilots (other than deep-sea pilots). Its coming into force was a prolonged process. Acceptance had long been considered necessary and IMO and its assembly is to be commended for its coming into being. The resolution states that “It is recognised that pilotage requires specialised knowledge and experience of a specific area and that States with many diverse waterways and ports have found it appropriate to administer pilotage on a regional or local basis”. It is to be expected that this resolution will form a solid basis to work on for many years to come. The number of pilots worldwide is not extremely large (there are worldwide approximately some 8000 pilots at work). Unchanged through history, whatever supporting equipment was available, it has remained a dangerous job. Even today embarkation and disembarkation is a hazardous undertaking. Every year several pilots lose their lives. It is in my view all the more a reason to seek common ground within the maritime industry (as ultimately happened with resolution A960) when discussing pilotage and when there is to build on it to reach an, in our view, common goal. That is quality pilotage for safer shipping.

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