Issues with ECDIS

CHIRP received a report from a pilot detailing concerns over the use of ECDIS.

"With ECDIS becoming mandatory, I have serious concerns that there will be significant issues with safety of navigation. During a recent pilotage, a positional discrepancy was noted between the ECDIS, the position identified by radar and that by visual observations."

Prior to departure, the accuracy of the ECDIS position had been confirmed. The vessel was outbound, and the information was being reported in "real time" directly from the ECDIS, (i.e. not historical from a position marked upon a chart and then reported). The OOW reported a position, which was 0.5 - 0.7 of a cable astern of the vessel's actual position.

Pilots in this port can use a PPU, (Portable Piloting Unit), to compare the error between the vessel's actual position and that being displayed on ECDIS which in this case, had no radar overlay. It was determined that the ECDIS display gave more range to a target ahead than that observed by radar.

As pilot, my biggest concern was to prove the error to all the officers including the Master. It went a bit like, "Captain what is the relative bearing to 'A' Beacon?" He gave his answer and I followed up with, "No Captain it is abeam on the port side – Please look out of the window." It was at this point he realised that there was an issue. In my opinion, the Captain believed that the ECDIS could not be wrong…

The Master was requested to investigate the fault and to advise the pilotage authority at the next port of call (in the same country), as to whether the error had been rectified. The Master did not advise the next port, but information was forwarded with the following advice:

1. *With the vessel stationary, no apparent error was observed.*
2. *The faster the ship went, the larger the error.*
3. *It was determined that the error originated from the main GPS receiver.*

The pilot at the second port confirmed items 1 and 2 above, and determined the error to be approximately 200 metres at 12 knots, which would take 32 seconds to transit. If a turn had been delayed by 32 seconds at the first port, the result would have put the vessel aground! I therefore question the value of ECDIS in its current form:

- *It is too easy for a watchkeeper to operate it on the wrong scale.*
- *It is too easy to acknowledge alarms without checking to see what they are.*
- *Any bridge equipment which takes its input from another source, (GPS, speed log, etc.) requires frequent verification that the data input is correct. (It might be true to suggest that this has not been fully embraced by the maritime sector, and this is not solely limited to ECDIS).*

Associated ECDIS problems include, but are not limited to:

- *A lack of standardisation of ECDIS displays and the method of presenting the information.*
- *Far too many non-essential alarms.*
- *Differing requirements for training regarding on board familiarisation and type specific training.*

CHIRP Comment

ECDIS may be regarded as a significant safety tool, providing real-time position awareness to the bridge team using the inputs of log, gyro and GNSS. However, like all computer systems, the effectiveness of its output is directly related to the quality of the inputs.

CHIRP sought advice from INTERTANKO who have been preparing ECDIS Guidelines. Their advice is that the concept of ECDIS positioning is considerably different from traditional navigation. Historically, position fixing was based upon a time interval which in turn was governed by the simple fact that the vessel must not stand into danger in the interval between positions. ECDIS however, gives you a "real time" position, **but** only if the information inputs are correct. Therefore, they need to be verified at regular intervals.

INTERTANKO advise that the verification process should consist of all of the components of an ECDIS unit as follows:

- Hardware – i.e. the actual ECDIS unit itself.
- Software – i.e. the operating system, and ECDIS presentation software.
- Data – i.e. log, gyro, radar / ENCs overlays, their corrections and GNSS signal.

On this basis, the recommendation is that ECDIS is verified once every watch when deep sea or in open waters. This is reduced to at least hourly when in coastal waters or port approaches, and during anchoring and berthing operations.

Looking elsewhere we note the MAIB has recently investigated several grounding incidents in which the ECDIS configuration and utilisation was a contributory factor. In their report 22/2017 on the grounding of the *MUROS*, they state;

"*There is increasing evidence to suggest that first generation ECDIS systems were designed primarily to comply with the performance standards required by the IMO, as these systems became a mandatory requirement on ships, with insufficient attention being given to the needs of the end user. As a consequence, ECDIS systems are often not intuitive to use and lack the functionality needed to accommodate accurate passage planning in confined waters. This situation has led to seafarers using ECDIS in ways which are at variance with the instructions and guidance provided by the manufacturers and/or expected by regulators".*

"In collaboration with the Danish Maritime Accident Investigation Board, the MAIB is now conducting a safety study, "designed to more fully understand why operators are not using ECDIS as envisaged by regulators and the system manufacturers. The overarching objective is to provide comprehensive data that can be used to improve the functionality of future ECDIS systems by encouraging the greater use of operator experience and human centred design principles".

CHIRP is aware of ECDIS problems due to display screens being too small, resulting in too much information on a cluttered screen and alarm fatigue. In some cases navigators are missing the ease of use of a paper chart. Don't be lulled into a false sense of security regarding the accuracy of the electronic charts. Like all computer systems, the effectiveness of its output is directly related to the quality of the inputs. The ECDIS image is not infallible; in some cases, there are ECDIS charts which have been drawn by hand, using a computer pen tracing information off paper charts.

While accident investigators may cite human error as the underlying cause of ECDIS-assisted groundings, ***CHIRP*** believes there are typically three distinct areas where the root cause of the accident may lie:

1. *Pre-programmed grounding*: Failure to fully appraise the route and other navigation information before creating a passage plan, or planning a voyage without paying close attention to the potential risks due to depth of water and other hazards. This will only serve to ground the vessel where planned!

2. *Absence of cross-check procedures*: It is essential the ENC's are correctly interpreted and interrogated during the voyage, while regularly monitoring the vessel's position and potential dangers. The use of radar overlay is a simple and effective means of checking the validity of the ship's position.

3. *Error management and reversionary procedures*: If a position error is suspected, then reversionary procedures should be used to 'drive' the ECDIS manually - exactly as one would fix using Dead Reckoning and Estimated Position techniques on a paper chart.

CHIRP also believes that associated with the above, there is a case for the designers of ECDIS to consider human factors. It should not be possible in the voyage planning stage to create a voyage unless a draft, an under keel clearance, and a safety contour has been entered. Additionally a zero entry should automatically not be accepted and require an entry to be made.

There are textbooks describing ECDIS in detail, the use of best practice and training. It is not for CHIRP to replace these guidelines, but for those readers seeking guidance, the following points should be considered:

ECDIS Planning Checks

- Chart display / Symbology settings.
- Safety Contour setting, safety depth (ship's draft + squat).
- Shallow contour setting, (the next contour shallower than the safety contour).
- Deep Contour (normally twice the vessel's draft and indicates area where squat may be experienced).
- Underwater obstruction/Isolated dangers - (these change depending on the safety contour).
- Appropriate Cross-track distances.
- Turn settings.
- Chart accuracy (CATZOC).
- Tidal streams / currents.
- Notes / Critical points.
- Parallel Index lines.
- Navigational warnings.
- T&P Notices to Mariners.
- Contingency plans.
- Visual and electronic route check.
- Voyage plan must be approved by the Master.
- Loaded / plotted on a backup system.

ECDIS OOW Checks

Alarms:
Audible alarm working.
Safety alarms enabled.

Safety Contour:
Draught + Safety – Height of Tide.
Defaults to next deepest contour.
DO NOT CROSS without very careful checking.

Guard-zone / Plan Ahead:
Size / shape appropriate to the speed and location.

Display:
Chart display / symbology settings.
Display at correct scale for chart (SCAMIN – Scale minimum.)

Other:
Route and associated voyage planning notes are loaded into the system.
Backup systems are ready for immediate use.

Last but not least - LOOK OUT OF THE BRIDGE WINDOW!!