FURUNO

Vision of onboard use of S-100 based products

Hannu Peiponen

IHO HSSC-13 Stakeholders session
Virtual meeting
May 2020

Vision of onboard use, Topics

- From printed material to electronic material
- Current way: Multiple electronic systems
- Future: Integrated system
- Key features of integrated system
- Need of information from shore authorities
- Conclusions

From printed material to electronic material

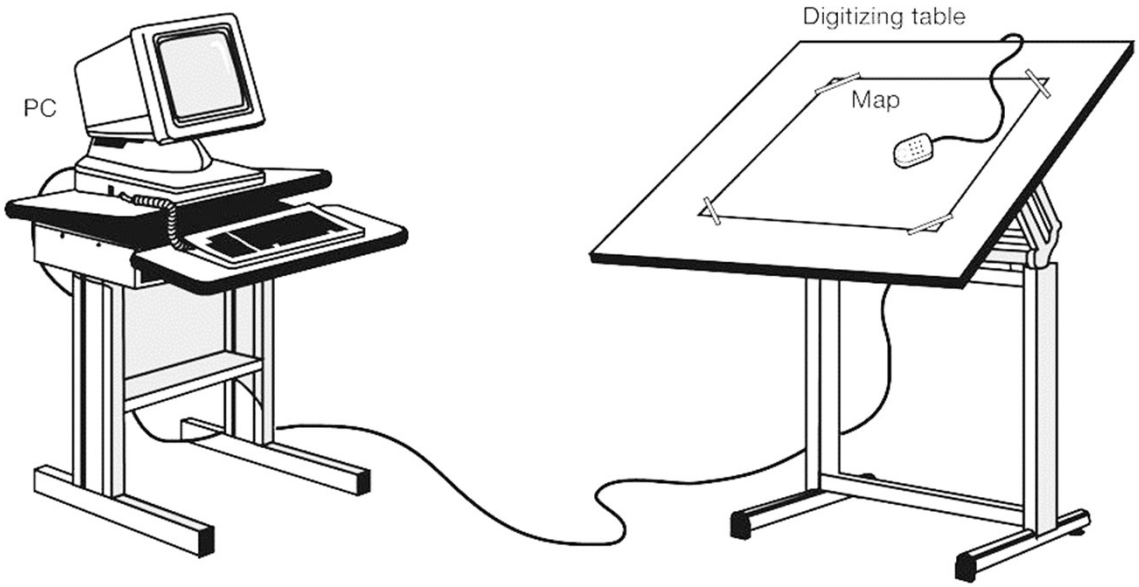
Evolution so far

- Paper chart and dividers
  - Paper chart and dividers were used onboard to obtain numerical values of latitude and longitude for typing into computerized applications
  - Typical instruments for viewing the result were radar display (graphics) and separate text-based computer display

From printed material to electronic material

Evolution so far

- Chart size digitizing tables
  - Computer assisted method to do same as with dividers and manual input of numerical values
  - Base was official paper chart
  - Digitizing onboard by the end user



- **Origin of still existing functionality**
  - **Route plans** = geometry
  - **Mariner notes:**
    - **User charts** = additional points, lines and areas of interest and significance. Duplicated traditional drawings by pencil on paper charts
    - **Voyage plan annotations**, **Pilot points**, **Actions points**, etc. = instruction for sailing, planned speeds, events to contact shore services, etc.

From printed material to electronic material

Evolution so far

- Digital raster charts
  - Cursor location on digital raster chart replaced digitizer on paper chart
  - Facilitated use of chart as visible digital background for actual sailing (= Route Monitoring)
  - Initially private facsimile copies of official paper charts
  - Evolved as official IMO recognized product published by government authorized authority
    - ECDIS: RCDS mode of operation

From printed material to electronic material

Evolution so far

- Vectorized digital charts
  - Added possibility of "Pick report", "Cursor query", "Info request", etc. to see details and additional information
  - Added possibility to tailor what is visible – viewing group selectors
  - Initially private vectorization of official paper charts
  - Evolved as official IMO recognized product published by government authorized authority
    - ECDIS: S-57 ENC charts
  - Still limited to features of traditional paper charts
    - Digital content limited to features available in the traditional paper charts
    - Limited steps of depth contours – limitation originates from publishing policy, not from technical ability

Current way: Multiple electronic systems

Role of **Voyage plan**

- Both rules and safe navigation require creation of a voyage plan
- Chart – being paper or digital – has never alone being sufficient source for a voyage plan
- Additional material for voyage plans is available from **Nautical Publications** and **weather reports**
  - Sailing directions
  - Lists of lights
  - Radio signals
  - Tidal tables
  - Weather forecasts
  - Etc.
- Traditional format has been printed books, voice broadcast and facsimile broadcast

Current way: Multiple electronic systems

Electronic versions of **Nautical publications**

- Typical has been digital book in **PDF-format**
  - Industry de facto method
  - Viewable in all platforms without extra efforts
- Some has been available as **e-books**
  - Require specialized viewer application, for example
    - Admiralty e-Nautical Publications
    - Admiralty TotalTide
- Common for current systems
  - The workflow from information sources to voyage plan is 'traditional' although sources are digital instead of paper
  - **Human operator**:
    - Study digital material
    - Make notes by pencil on paper or print pages from the digital material or try to remember details
    - Add study results as Mariner notes, etc. into **ECDIS**

Future: Integrated system

More assistance for human operator

- There is a need to automate at least some parts of the process to create voyage plans
- All information available in an integrated system facilitates possibility to annotate significant information from Nautical Publications, Weather forecasts, etc. related to the Route Planning
- **To annotate**
  - Human operator instructs the ECDIS to visualize the annotated features when the related Route Plan is in use
  - No need to read from own paper and pencil notes or from own printouts information which is then entered manually into the ECDIS
  - No cluttering of display by non-significant features
  - "*The needle from the haystack*" is already picked and ready to use

Future: Integrated system

More assistance for human operator

- Dynamic information available for tidal and water level in an integrated system facilitates possibility to adjust water level conditions to actual or forecasted situation
- **To adjust**
  - Human operator instructs the ECDIS to adjust charted features to be adjusted related to the planned schedule Route Plan in use
  - No need to make external notes, plans, instructions

Future: Integrated system

More assistance for human operator

- Dynamic information available for weather, availability of locks, etc. in an integrated system facilitates possibility to benefit from actual or forecasted environmental conditions

- **To benefit**
  - Human operator instructs the ECDIS to use additional S-10X layers to be related to the Route Plan or Monitored Route in use
  - Easy to see how to benefit from surface current, wind, opening times of locks, etc.
  - Possible to amend route plan (geometry, speed plan, etc.) and to see immediate result
  - Possible to amend monitored route (geometry, speed plan, actual speed, etc.) and to see immediate result

Key features of integrated system

Navigators onboard still need basic Route planning and monitoring functionality

- **Route plans**
  - Geometry
  - Corridor of safe water
- **Mariner notes**
  - "User charts", "Nav lines", etc.
    - Additional points, lines and areas of interest and significance
    - For items not available to annotate from S-10X layers
    - Replace traditional drawings by pencil on paper charts
  - "Voyage plan annotations", "Pilot points", "Actions points", etc.
    - Instructions for sailing
    - Instructions for performing position fixing based on LOPs
    - Planned speeds
    - Events to contact shore services
    - Events to report to shore actors
    - etc.

Key features of integrated system

- Possibility to annotate
  - Areas to be avoided based on instructions of master, shipowner, etc.
  - Traffic limitations, speed restrictions
  - Migrating whales
  - Places to call VTS, Pilot, Port Authorities, etc.
  - Method of communication, for example, band, frequency
  - Things to take care, for example avoid going too close because grounding due squat or bank effect
  - Things to take care, for example speed to avoid higher fuel consumption due squat effect
- Possibility to adjust
  - Charted depth areas for forecasted situation
  - Charted depth areas for actual situation
- Possibility to benefit
  - Surface currents to gain more speed or to minimize speed loss
  - Weather to gain favourable conditions or to minimize non-favourable conditions

Key features of integrated system

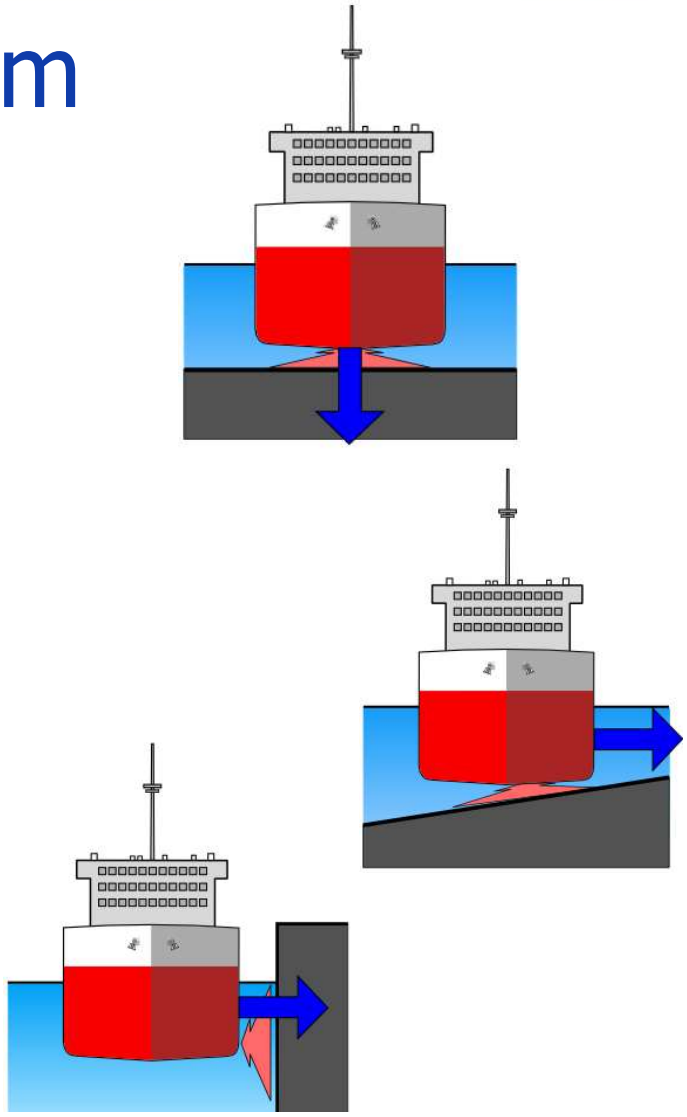
Management of date and time dependent functionality

- Reality is that this management cannot be left for the end user alone
- Need for strong computer assistance
  - Often the visible area is subject to multiple times of day
  - Warnings about using too old or otherwise not up-to-date information
  - Easy to understand which date/time event is used in different parts of displayed area
    - Use of the **time schedule of a Route plan** to apply dynamic content
      - User selectable time increment
    - Use of **forecasted own ship movement** to apply dynamic content (use case Route monitoring)
      - User selectable time increment

Key features of integrated system

Management of safe use

- Reality is that this cannot be left for the end user alone
- Need for strong computer assistance
  - Safety contour
  - Under Keel Clearance (UKC)
  - Squat effect
  - Bank effect
  - Dynamic content may have been changed since Route plan check
  - Content of features not selected for display may have changes since Route plan check



Key features of integrated system

One size does not fit all purposes

- The more covered area one can see, the better
  - Usability is higher when human operator can see larger area without scrolling
  - No need to memorize details not visible after scrolling the visible area
- Large displays do not fit as tilted or vertical display in front of bridge
  - For example, requirements for visibility out of bridge windows restrict height from floor
  - Knee or foot height displays are not optimal for usability – cursor, touch screen, viewing distance
- Large displays are suitable for horizontal mounting – like traditional chart tables
  - Back or front of bridge – many traditional front of bridge consoles has had a horizontal chart table on the left or right side of the central part of console

Need of information from shore authorities

Nautical charts

- Static content: S-101
  - Probable current once per week update cycle is enough
- Detailed bathymetry: 'bathymetric versions of S-101' and S-102
  - Some areas would benefit from daily update cycle
  - But in general, not necessary everywhere
- Dynamic content: Tidal and water level forecasts
  - Traditional tidal table-based information as forecast do not need higher update cycle than today
  - Weather based water level variations would require daily or even multiple times per day forecasts
- Real-time streaming: Actual water level values
  - Role of actual level is to confirm the forecast
    - Warning if actual level significantly different from forecast – cannot rely on forecast
  - Needs Internationally standardized communication method
    - Based on AIS ?
    - Based on future VDES ?
    - Or based on something else ?

Need of information from shore authorities

Nautical publications

- S-12x series
  - S-122, S-123, S-125, S-126, S-127, S-128, S-131

- Most are of static nature
  - Long time between update of content
  - Could be imported when the ship is within the range land-based mobile broadband networks

- Dynamic content also ?
  - S-122 Marine Protected Areas (MPA) could include dynamic more often updated content
    - For example, Migrating whales
  - Delivery method is an issue
    - For example, need to know migrating whales protection areas when still in open sea
      - Broadband satellite communication

Need of information from shore authorities

- **Maritime Safety Information** (MSI), IMO SOLAS IV
  - Navigational Warning
  - Meteorological warnings
  - Meteorological forecasts
  - Other urgent safety related messages broadcast to ships

- **Traditional delivery** – IMO recognized carriage requirements
  - NAVTEX, Short text message broadcast by MF radio
    - Limited coverage
  - Inmarsat, Short text message broadcast by satellites
  - Iridium, Short text message broadcast by satellites
  - BeiDou messages service, under approval by IMO, Short text message broadcast by satellites
  - Weather charts by Radiofax
  - Ice charts by Radiofax

Need of information from shore authorities

- Weather information
  - S-412: Weather and Wave Hazards => Meteorological warnings of MSI
  - S-413: Weather and Wave Conditions => Meteorological forecasts of MSI
  - S-414: Weather and Wave Observations
  - S-411: Ice information
- Navigational warnings
  - S-124: Navigational warnings
- S-10X based Maritime Safety Information (MSI)
  - Internet access => Delivery by broadband communication
    - In harbours and close to shore => Mobile phones
    - Open sea => Broadband satellite communication
  - Possible to use MSI for planning before arrival to the related area
  - Need to avoid duplicated between traditional and new delivery methods
    - For example, S-124 Navigational Warnings, which duplicates a part of NAVTEX, Inmarsat, etc.

Need of information from shore authorities

UKC management

- Managed by the crew
  - Basic use case for everybody
  - Based on tidal and water level forecasts from Nautical Publications
  - Benefit from real-time water level observations
    - Confirm the forecast

- Assisted by the pilot onboard
  - More challenging cases which require local knowledge
  - Bridge Resource Management (BRM)
    - Need to export and share the plan of the pilot to be available in the system of the ship

- Assisted by shore-based UKC management
  - Use case is to maximize cargo load
  - High risk of incident and small UKC tolerances require real-time observations, advanced processing and communication network, all including with availability and quality control
  - The S-129 use case facilitates situation sharing between ship, pilot and shore

Conclusions

- The basic needs are same as before the digitalization
- Integration is the way forward
- The Front of the bridge and the Back of the bridge exist
  - But it does not mean separation by available S-100 based products
  - The separation is by intended functionality and often include different screen size
- There is a limit how much processing is feasible onboard
  - The most challenging uses of waterways require huge amount of real-time data and expertise
  - These are often more feasible based on shore assistance
- Good things require that information is available for onboard use
  - Provision of the information and delivery methods is a challenge for shore authorities
- New functionality requires additional training
  - Without proper training users will surely misuse the available information
  - Training is required to avoid e-Navigation assisted incidents

Thank you for listening

- Questions ?