# Setting the Stage: The Importance of Common Datums as Related to Navigation

Julia Powell
Chief, Navigation Services Division

Current and Future State of ECDIS

- **S-57 Based ECDIS**
  - Single product system
  - All data is contained within the S-57 Electronic Navigational Chart
- **S-100 Based ECDIS**
  - Multiple product system
  - Can be used with little/no integration
  - Layers can also integrate with each other
- **S-100 framework**
  - specifications for how different data products integrate with each other.
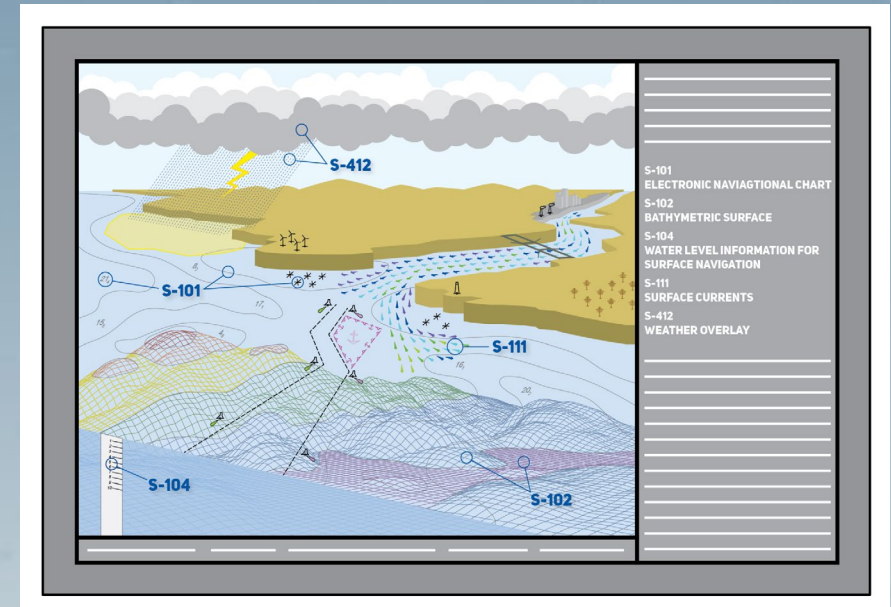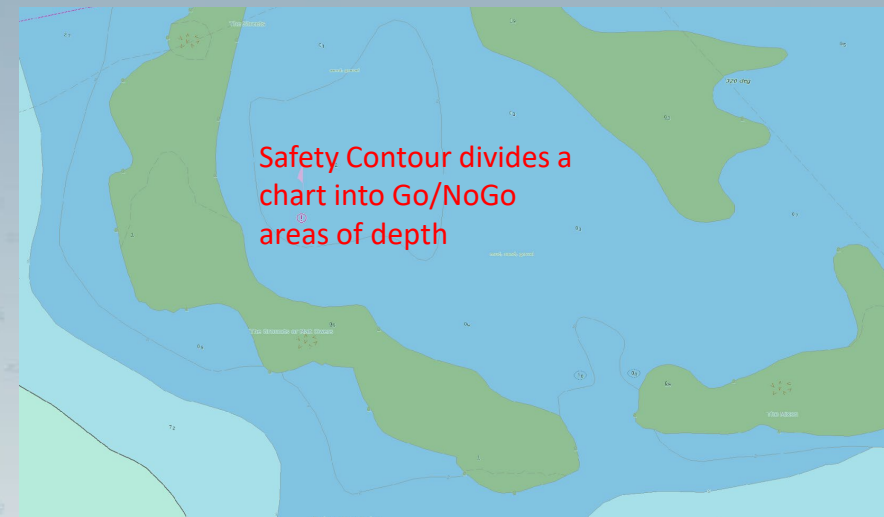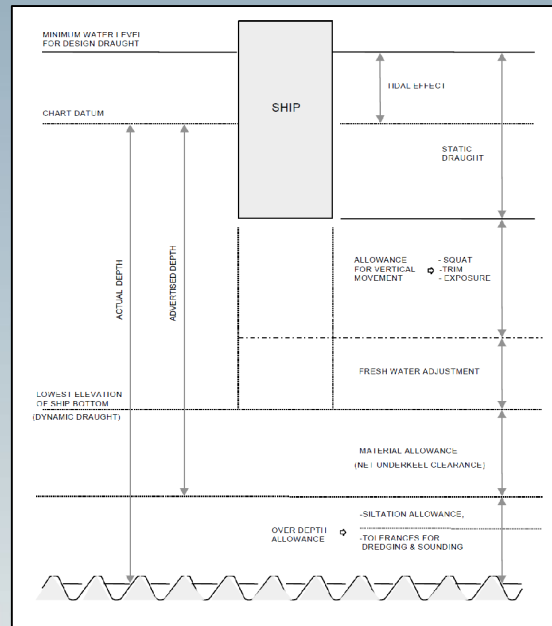
Datums and Navigation
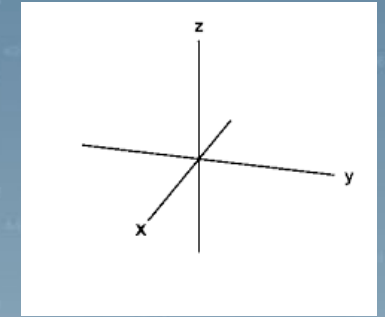
- Navigation answers the question "Is it safe to go from A to B"
  - **Horizontally** (which route and waypoints?) [x and y]
  - **Vertically** (will I have sufficient UKC or vertical clearance?) [z_t]
- Currently, the chart provides a static (in time) snapshot of <u>some</u> of this information
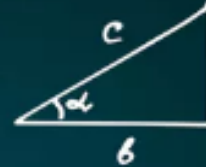- The Mariner must use the chart along with other information to figure this out
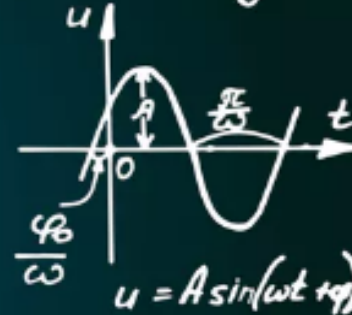
Is it safe? [Z]

Safety Contour divides a chart into Go/NoGo areas of depth

Is it safe? [X,Y]

Datums and Navigation
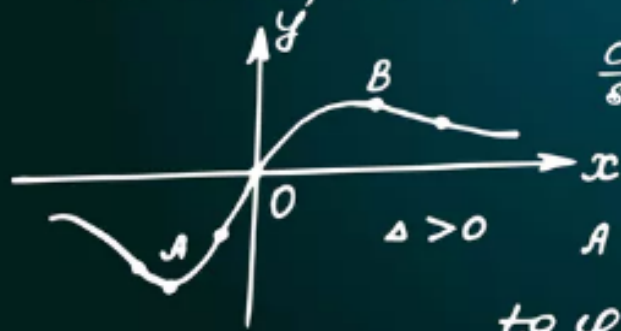
Water Level Changes with Time

- Multiple Vertical Datums exist in charts
  - capture the extremes of temporal variation of water level

- Allows minimum safe UKC and Vertical Clearance to be shown.
  - Charted Depth shows a simplified minimum depth.
  - Charted Vertical Clearance shows the minimum space above the water of a feature.

- The two datums aren't always MLLW/MHW
  - But they are normally a low water (depth) and a high water (clearance)

Charted Clearance (A)

A =

Tidal Clearance (D)

D =

Total Clearance (A + D)

E =

Air Draft of Vessel (F)

F =

Will it fit under the bridge?   Negative answer   Positive answer

E - F =
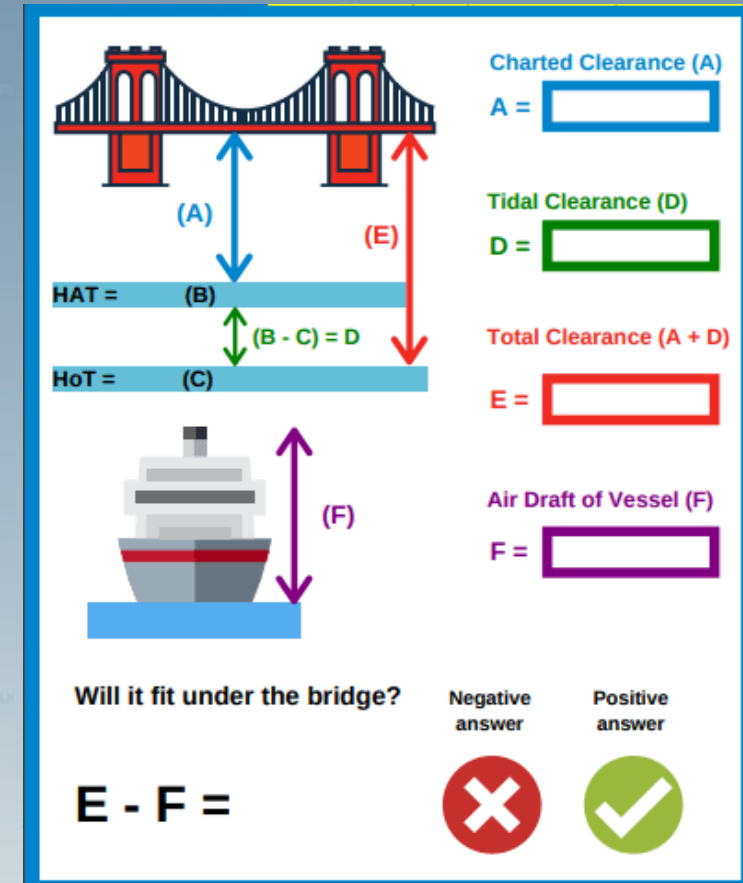
Future of Navigation with S-100

S-100 allows data producers to reduce the amount of manual work necessary to understand whether planned navigation is safe with respect to depth
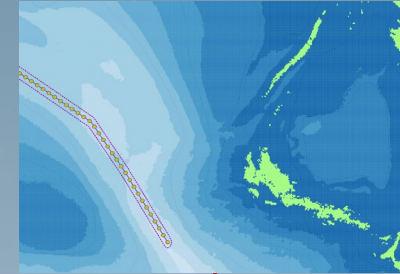
Charts + Dense bathymetry + Water Level gives the fundamental "depth" against which UKC and Vertical Clearance is measured

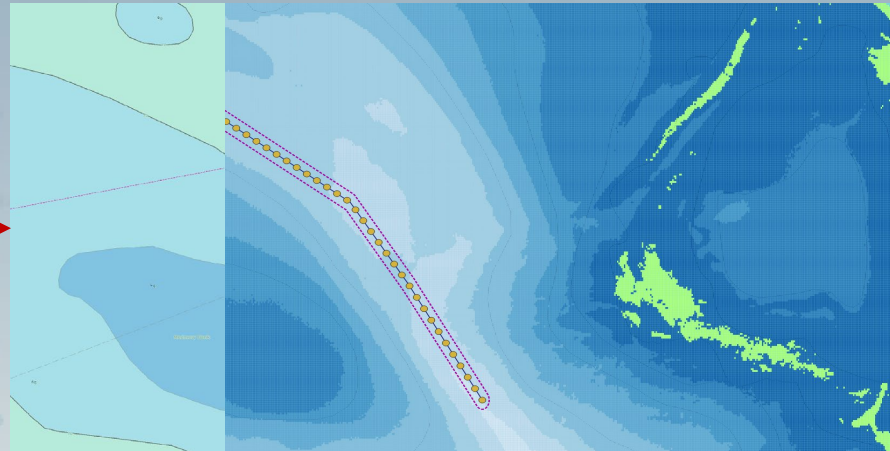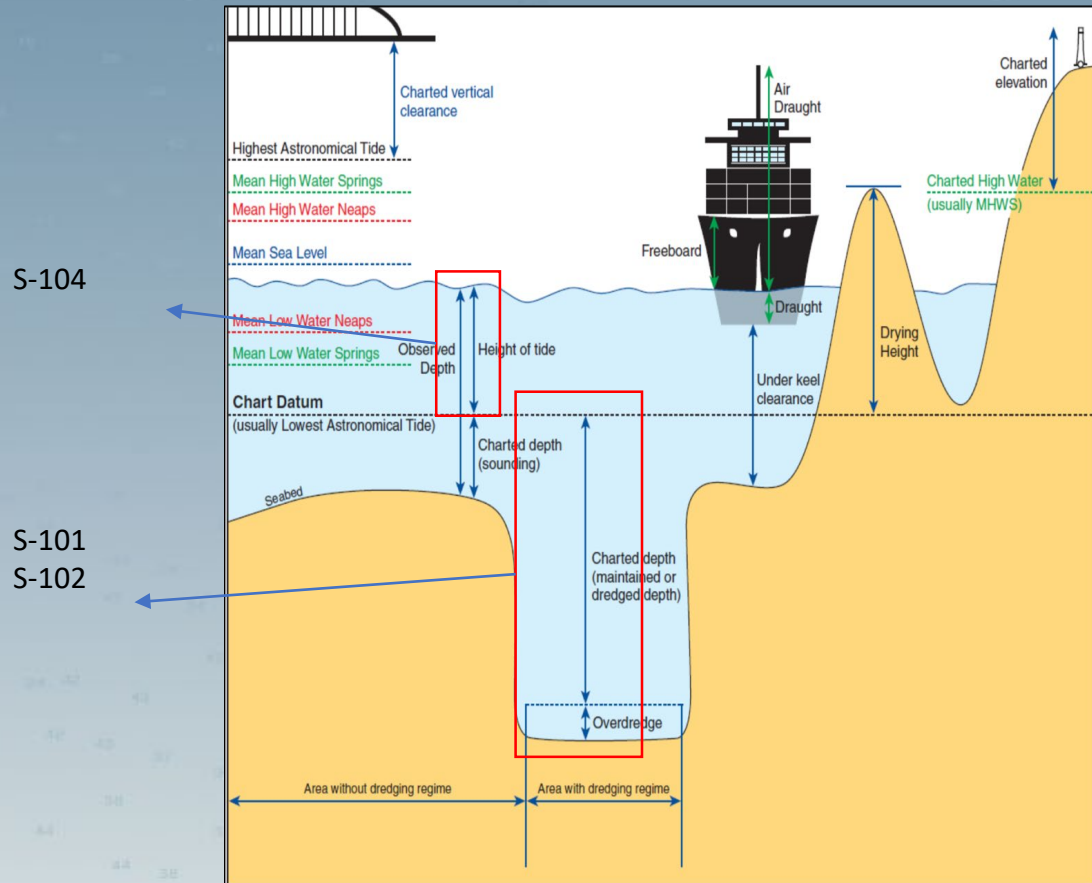The Chart provides an extremely simplified picture of bathymetry with only certain safety contours available to the end user

Future of Navigation with S-100

- S-101 ENCs + S-102 Bathymetry + S-104 Water Levels
  - Provides the fundamental "depth" against which UKC and Vertical Clearance is measured
- Integrating S-101, S-102, and S-104 is a complex process
  - Adjusted Depth = (Charted Depth OR depth from S-102) + (S-104 Water Level) [at a particular time "t"]
- This ONLY works if:
  - S-102 depth values can be substituted for the underlying S-101 depth data
  - S-104 Water Levels can be added to (S-102 or S-101) depths
- This ONLY works if:
  - The vertical datums of the products are **the SAME**

Worldwide problem = International Standards

- Port of London
  - London has many bridges with a large tidal range and low clearance
    - Vessels are forced to calculate safe clearance, as the minimum clearance (above MHWS) may not be enough.
  - Port of London publishes clearance heights above charted depth in order to make the process simpler
  - If Charts contain vertical clearance on the same datum as water level then such clearances can be automatically calculated

8_7m

LAT

15_8m

7_1m correction CD->LAT does not appear on chart

CD

LONDON BRIDGE

Proceeding Downstream

Arch No.2   Arch No.3

MHWS   8.7   15.8   CD   MHWS   6.7   13.6   CD

North   South

| Working Arches | 2 & 3 | Distance above London Bridge | 0.0nm | Height in Main Navigable Arch | 15.8m above CD | Distance above Gravesend | 23.13nm |
| | | | | | 8.7m above MHWS | Special Signal Light | Yes |
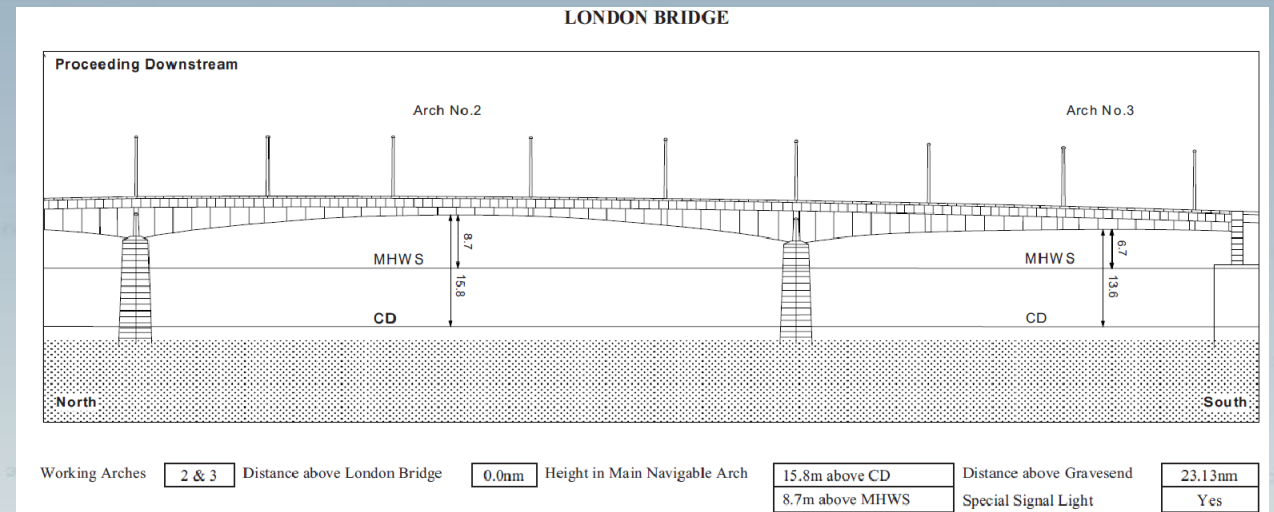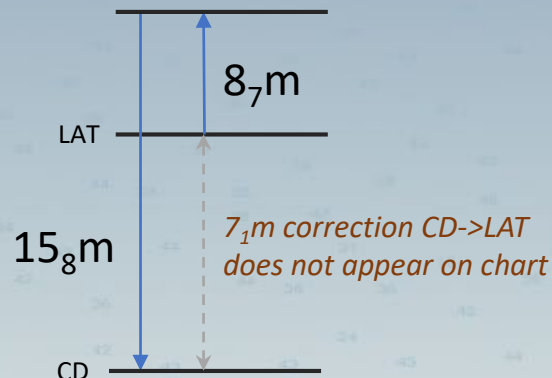
S-100 Framework

- As we move towards producing interoperable products:

  - The S-100 Framework has incorporated water level adjustments to bathymetry for use in navigation systems
    - Datums must be the same across the product stack
    - This has to be done by the producer of the product

  - Navigation systems are not equipped to perform complex datum transformations
    - They would have to store all the possible corrections
    - They don't want to assume the liability