Navigation in Narrow Waters and the impact of 3D display on Safety

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Outline

- **Mental rotations**
- **Similarities and Differences of 3D on land and sea**
- **Egocentric and exocentric**
- **3D display of sea bed**
- **North up versus ship's head up**
- **Synthetic Sea lanes**
- **Comparison of performance**

Mental rotations

- **Take time**
- **Degree of difficulty increases as rotation gets larger**
- **We get worse with age**
- **But experience helps**
- **Men are slightly better than women but not much**

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Similarities

- **Flat screen**
  - **Therefore 3D is represented by:**
    - **Foreshortening**
    - **And sometimes overlaid grid lines**
    - **Colour**
    - **Shading**
- **3D is a deliberate trick of perception**
- **Movement of beholder important to achieve effect**

Differences

- **The sea surface is featureless**
- **Horizontal distances at sea are much greater.**
- **Land maps, and particularly town maps, have much greater density of detail.**
- **In car navigation systems are not used to maintain track.**

Egocentric and Exocentric

- Egocentric.
  - The view we see through our own eyes
  - Sometimes called:
    - "The forward field of view".
- Exocentric.
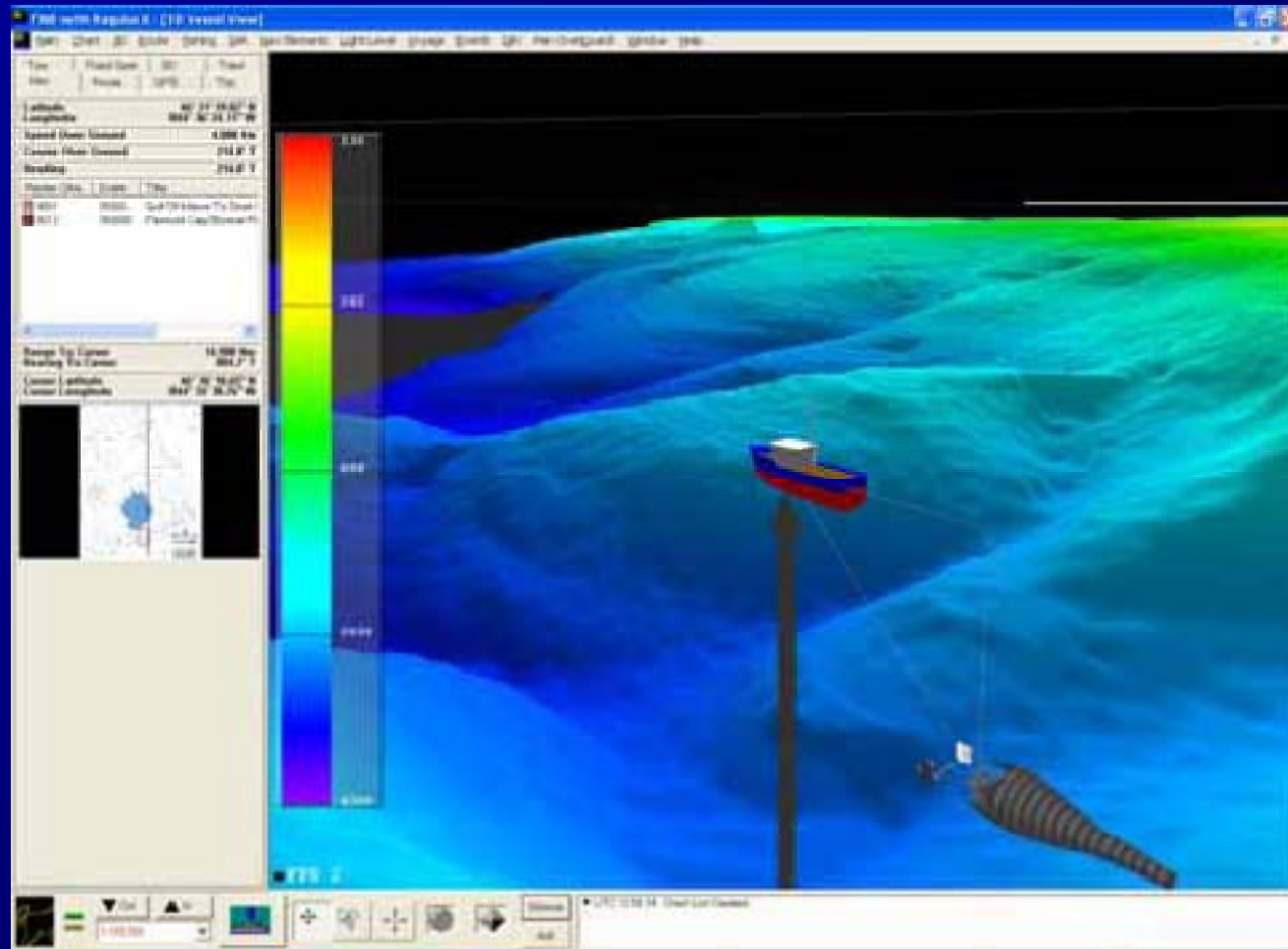 - An external view.
  - The bird's eye perspective of traditional charts.

Benefits of each

- **Egocentric better for route execution**
  - **Not so many mental rotations needed**
  - **Complex moving problems**
  - **Stressed environments**
- **Exocentric better for passage planning**
  - **Tends to be canonical**
  - **Better at big picture**
  - **Better for Position reporting**

3D Display of Seabed

Experiment

- **4 techniques:**
  - **Paper Chart**
  - **Electronic North up**
  - **Electronic Ship's Head up**
  - **3D**
- **Spread of navigational experience**
- **Ages 15-64**
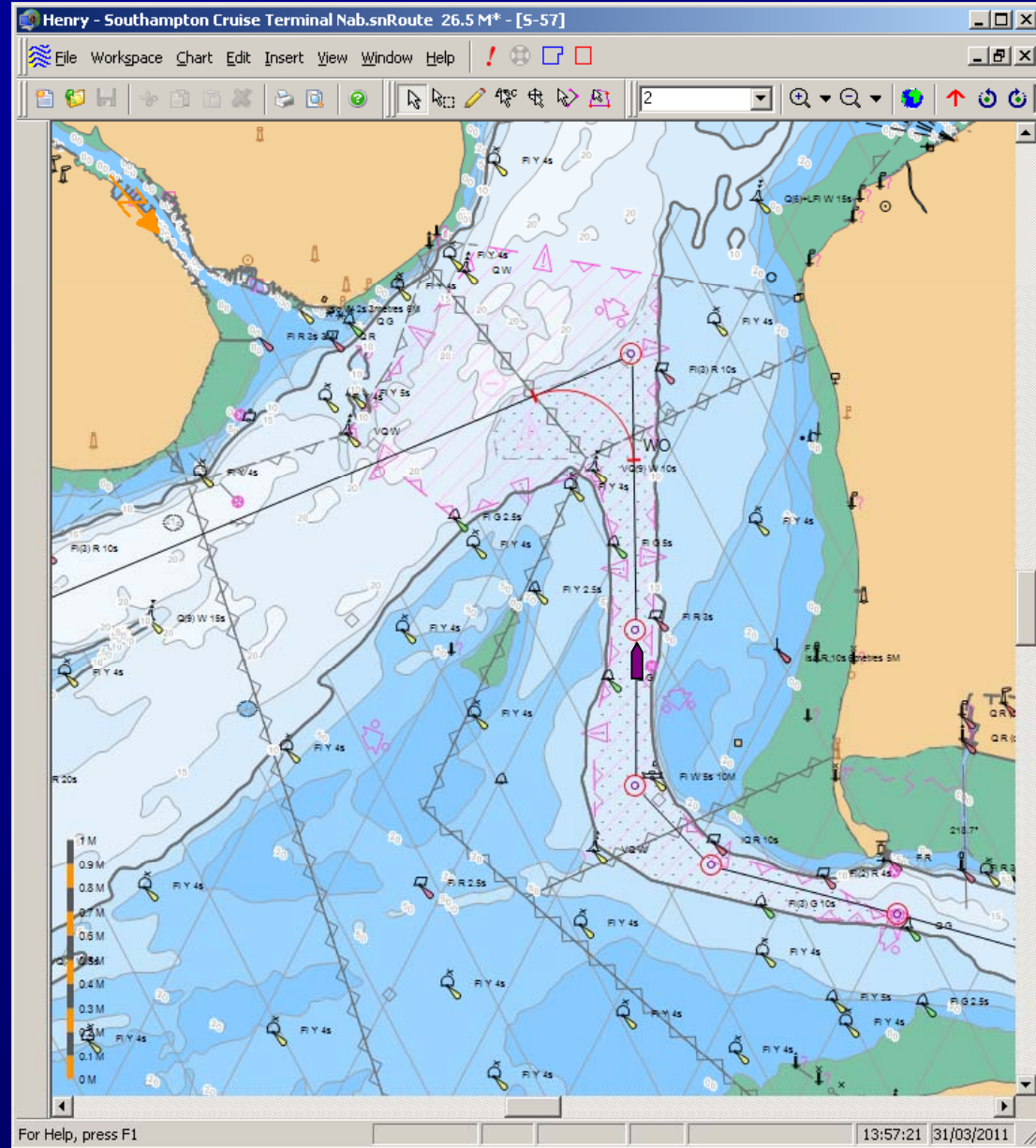- **Roughly balanced male female**

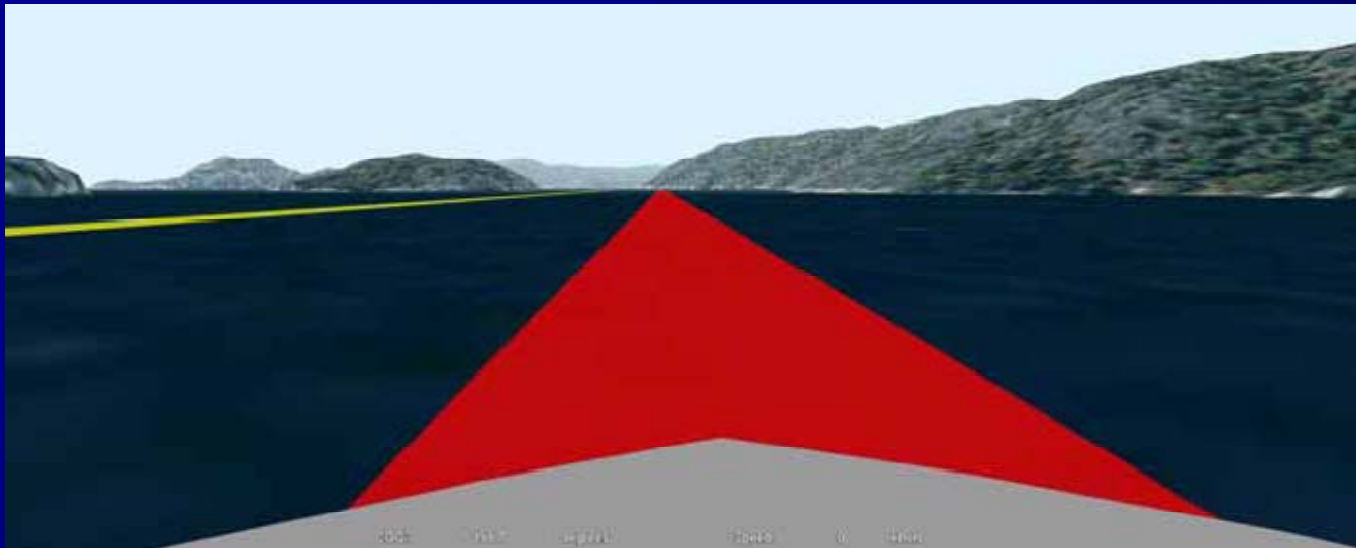# Paper Chart 1

Paper Chart 2

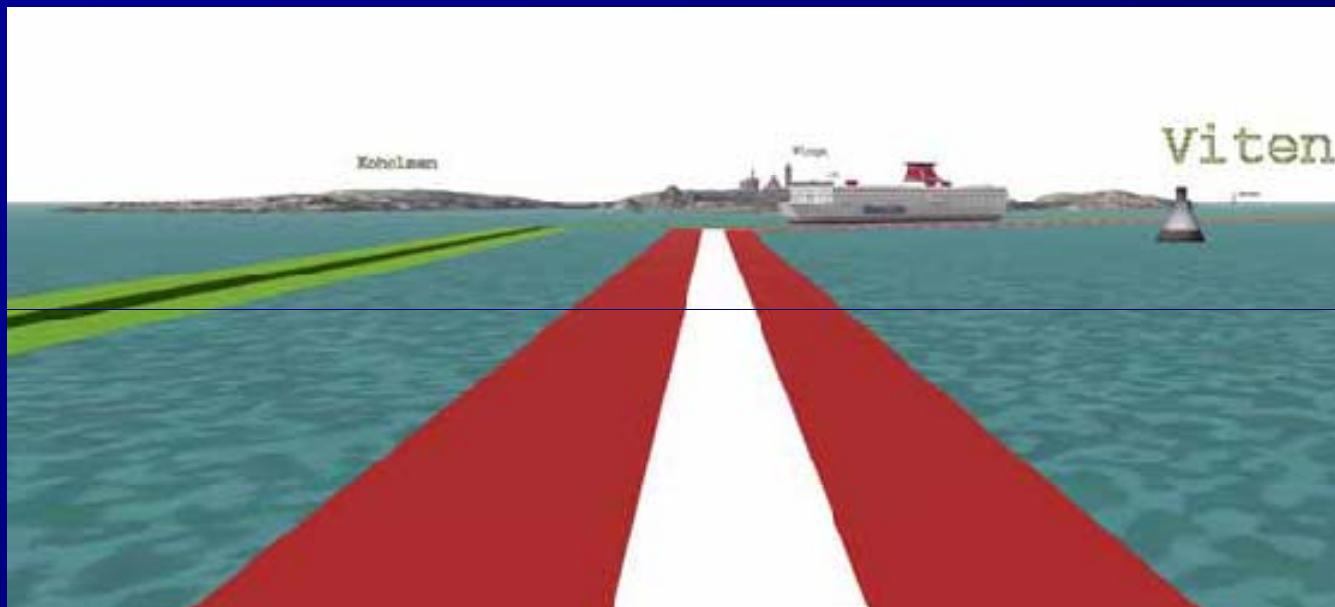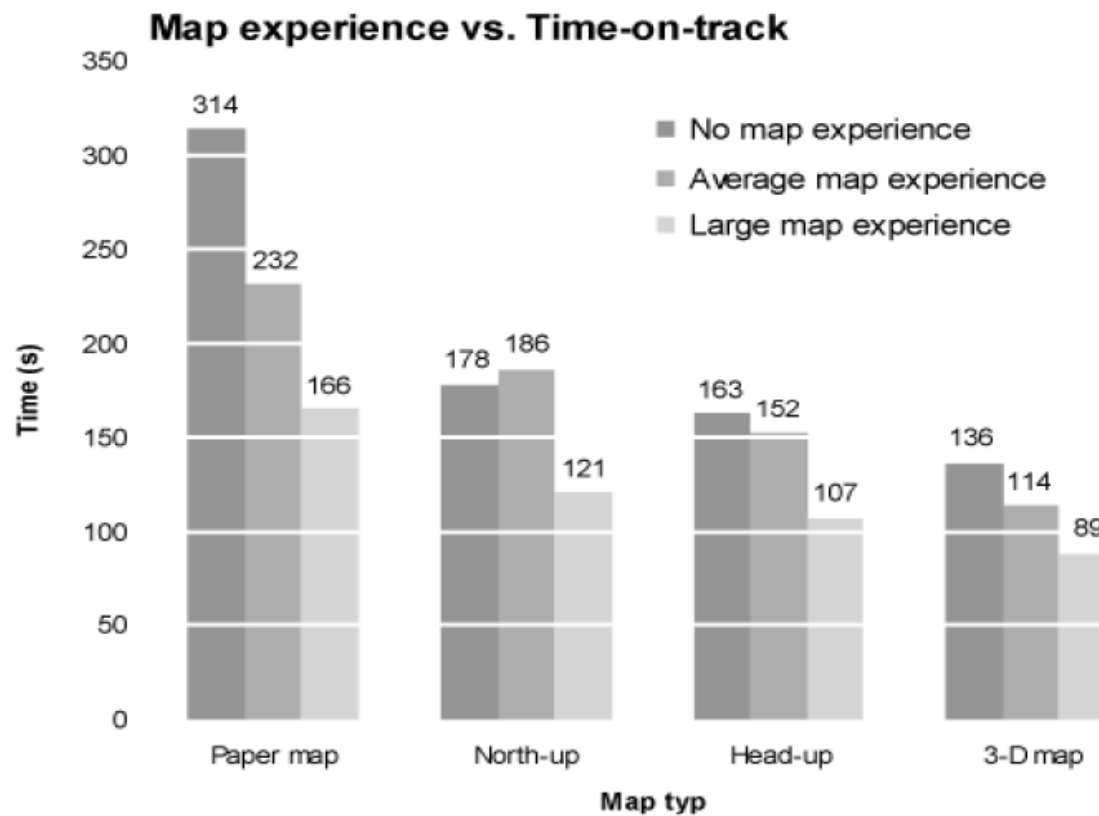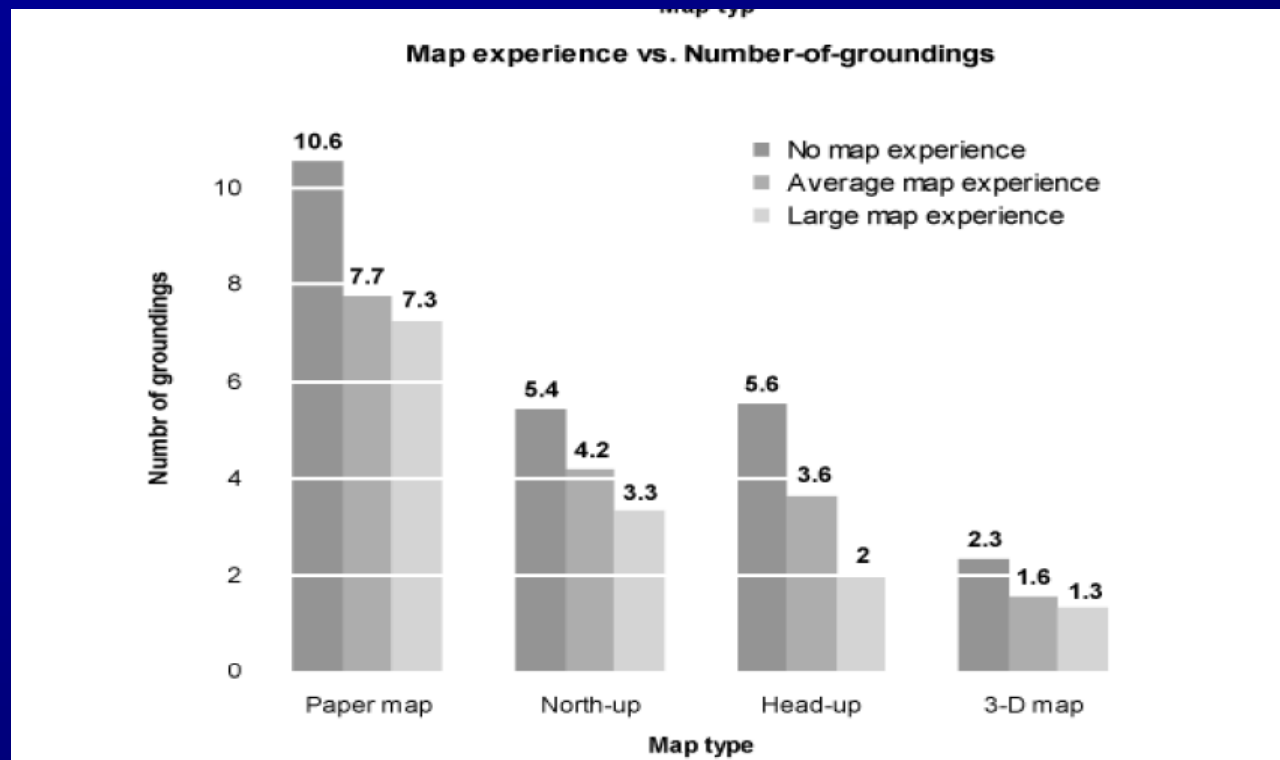# Electronic North up
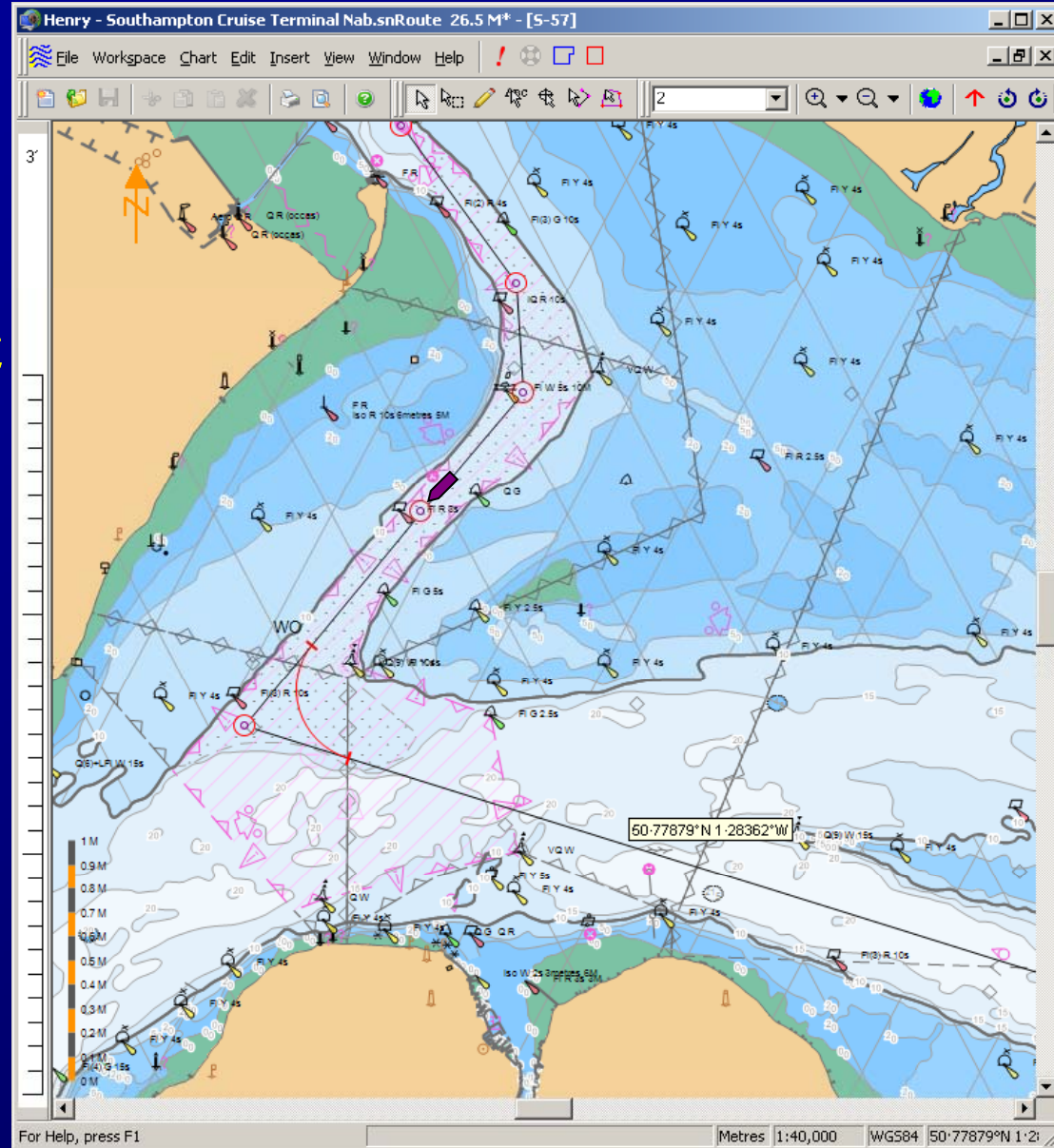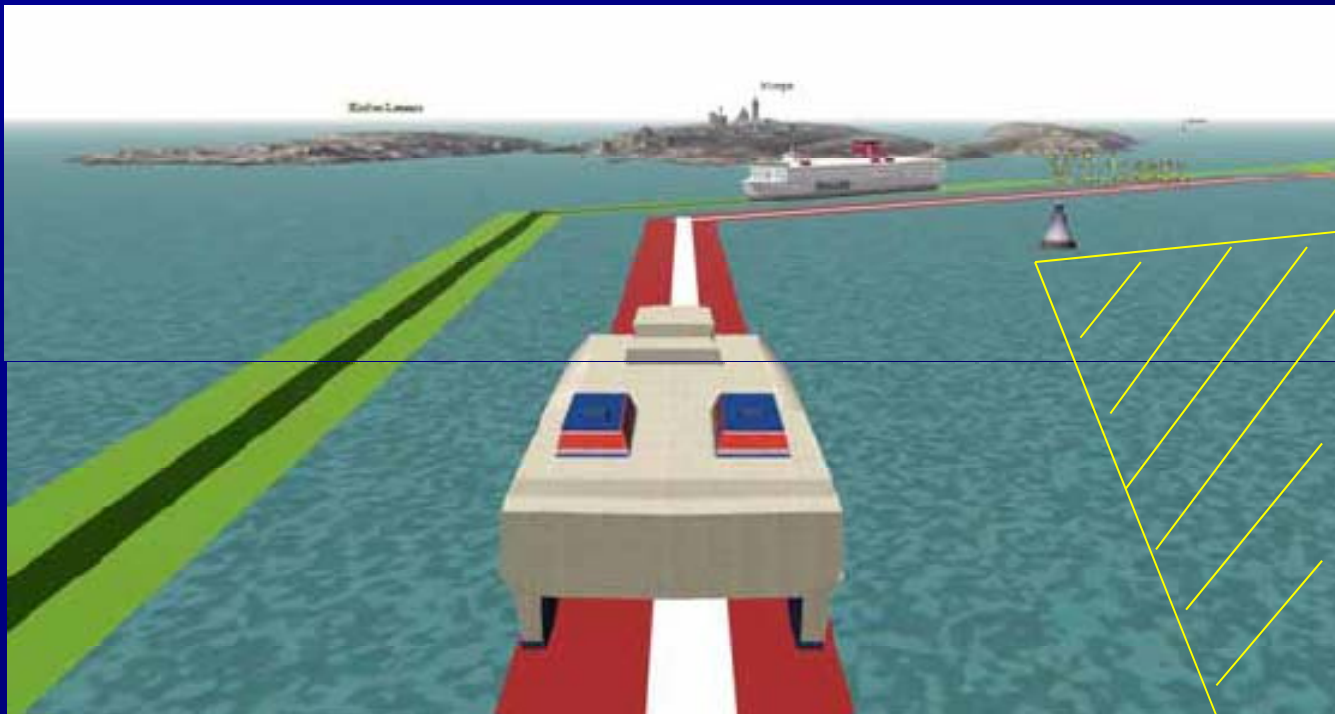
Electronic Chart Ship's Head Up

3D

Ego-centric sea lane

Results 1

Results 2

Modified egocentric 3D view

Discussion