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## X3D / Xj3D Usage for Bathymetric Rendering in Battlespace Management

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## Workshop Goals

- **NUWC DIVNPT X3D Usage**
  - Antisubmarine warfare battlespace visualization
  - Includes air, surface, subsurface assets
  - Visualization of weapon placement
- **Discuss current state**
  - Current bathymetric content
  - Tristrips and Elevation Grids
- **Discuss planned upgrades/enhancements**
  - Transition to Geo-Elevation Grids
  - Constraints

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## Web3D Usage for Distributed Battlespace Management

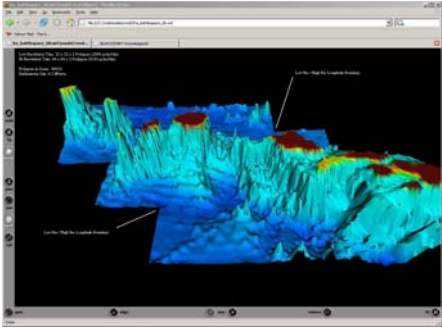
In late 2004 Naval Undersea Warfare Center investigated the feasibility and level of effort required to develop a lightweight 3D replay capability using X3D technology.

The investigation focused on 3 factors:

- data retrieval from a consolidated database of fleet exercises and events
- integration of bottom bathymetry anywhere on the planet
- performance

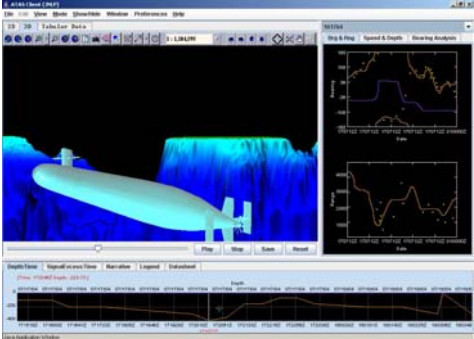
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## Screenshots



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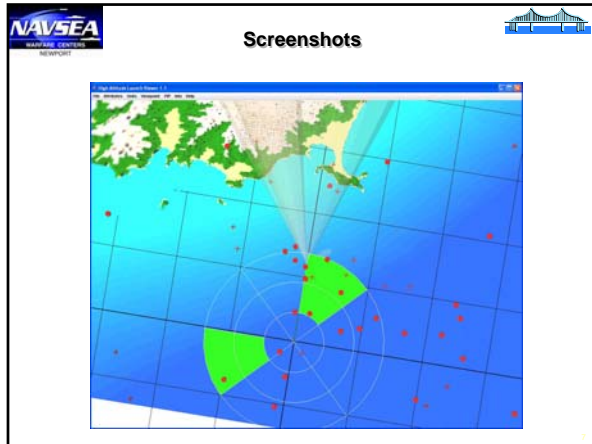
## Screenshots



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## Screenshots





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### Bathymetry – Grid Derivation

**DNC** based bathymetry grids are generated using NUWC/NRL based Inverse Distance Weighted (IDW) algorithm.

$$z_p = \frac{\sum_{i=1}^n \left( \frac{z_i}{d_i} \right)}{\sum_{i=1}^n \left( \frac{1}{d_i} \right)}$$

IDW is tunable based on number of surrounding data points used to generate vertices and grid density. Creates homogenous output.

**DBDBv** based bathymetry is generated by accessing proprietary API. X3D files are assembled after raw dump.

The diagram shows a central point labeled  $P(x,y)$  on a grid. Four surrounding data points are shown with their respective distances  $d_1, d_2, d_3, d_4$  from the central point. The distances are represented by colored lines radiating from the center to each data point.

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- ### Standardization and Conventions
- **Level of Detail**
    - Do we page in differing X3D bathymetric models with varying grid densities?
    - Textures
  - **X3D data structures**
    - Does it make sense to have separate elevation/geo-elevation grid libraries?
  - **Meta data**
  - **Approved gridding methods?**