Maritime Head-Up Display:
Preliminary Evaluations

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A Critical Problem

- Too much ‘head down’ time with standard displays should make mariners uncomfortable
- Looking out the window essential for proper lookout
- Radar, ARPA, ECDIS had to prove their worth to the old salts
- HUD may be the solution to problem

Maritime HUD Evaluations

Goal: Collect performance data and define Maritime HUD:

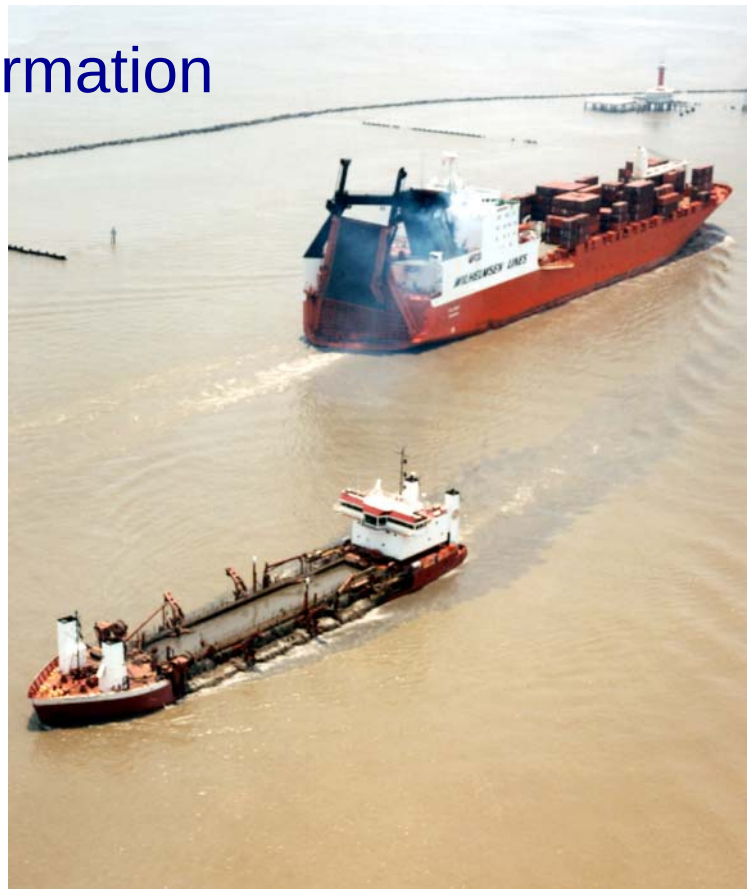
- CONOPS
- Essential information, applications, concerns
- Variations by vessel, crew, and task

Maritime HUD Hypotheses

- Potentially Useful Features
  - Conformal: Planned route, safe boundaries, upcoming alterations, navaids, obstacles and other dangers (Augmented Reality)
  - Non-Conformal: Speed, heading, performance parameters, etc.
- Potential Advantages:
  - Less time to integrate information
  - Less scanning, accommodation, head movement, & head down time

Key Results

- HUD very useful in confined waters
- Comments
  - Augmented with additional information
    - Stationary long-term objects
    - Highlighting channels and TSS
  - Concerns
    - Pilot acceptance
    - Clutter and distraction



Key Results

- HUD useful in restricted visibility
- Comments
  - Allow for quick understanding of situation
  - Can make the invisible visible
  - Confident maneuvering
  - Keeps eyes out the window
  - Would require properly integrated collision avoidance information

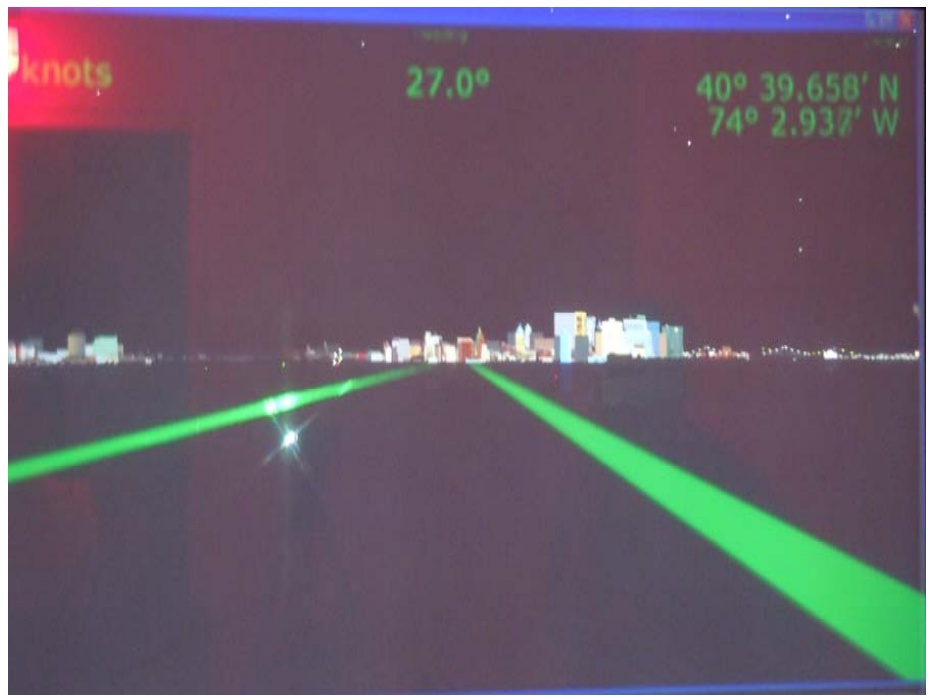
Key Results

- Reduced Head-Down Time (HDT) compared to ECDIS
- Comments
  - Overall, reduced HDT was seen as one of the primary benefits of HUD

Key Results

HUD Primary Benefits:

- Increased Situational Awareness (SA)
  - Results in reduced Stress
- Connects trackline to reality outside of window
- Potential to turn electronic navigation back into visual navigation



Key Results

HUD Supports:

- Staying on track, course to steer & speed required vs. CMG & SOA
- Range and bearing assessments (to WPs)
- High-speed vessels and confined bridges
  - Rapidly changing information

Key Results

HUD Primary Concerns:

- Obscuring outside information (targets, buoys) & distraction
- Potential for clutter and information overload
- Encouragement of poor Bridge Resource Management
- Another system to cross-check
- Training issues
- On-ship proof of concept
- Cost

Conclusions

- HUD demonstrated significant value-added
- Focus future R & D on confined waters, reduced visibility, & high-speed vessel applications
- Compare different bridge equipment configurations
- Conduct performance comparisons with video-based AR and 3D navigation displays

Conclusions

- Validate standard information requirements across additional situations
- Validate benefits to providing task-specific information
- Explore advantages of utilizing ECDIS data stream directly
- Test concerns and solutions
  - Include hard to see targets and objects, test variety of danger locations, test scenarios with missing or bad data

CMA as a HUD Test Bed

- E-Nav Course lab sessions are dedicated to testing HUD and other emerging technologies
- International Association of Maritime Universities allocated funding for another e-Nav Course
- Student Course Ratings Very Positive
  - Felt course gave them a view of the next generation maritime world they would be operating in
  - Felt they were shaping the future of the navigation technology with HUD research
  - Participating in cutting edge research made them proud to be attending CMA

Future Directions: Golden Bear

Future Directions: Manufacturer Partner

- Groundwork has been laid
  - CONOPS produced and tested
  - Results suggest value of HUD
- Need partner to provide prototype for onboard testing and real-world production
- Manufacturer partner needs to have:
  - Familiarity with marine nav equipment
  - Familiarity with HUD applications
  - Familiarity with emerging technologies

Any Questions?

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