



Teaching ECDIS at the U.S. Merchant Marine Academy

By Christian Hempstead
Master Mariner, Associate Professor

Digital Ship USA
10/08/09

Q: What is safe navigation?

A: Getting somewhere in 1 piece

- Planning a voyage
- Dock to dock without incident
- Track-keeping to the next waypoint
- Adaptation to changing conditions
- Ongoing validation of sensors
- Applying all aids effectively
- Keen visual lookout all around
- Backups at the ready

Teaching and learning ECDIS means that . . .

. . . the trainee is able to
show safe navigation
using ECDIS.

That's it.

As applied to ECDIS, this means:

While underway, alarms must sound, charts must load, routes must be made & monitored, shoals and other vessels must appear, day should end, visibility should change, ETAs should be found, courses should be steered, chart layers should be selected, . . . on top of everything else.

Why is this a crucial measure of success in ECDIS training?

- ECDIS is a centralizing tool...it is lifeless outside the context of visual navigation
- ECDIS underway is the only sensible way

Unsafe navigation using ECDIS is **unacceptable** because:

- The poor use of ECDIS may have interfered with navigation that was otherwise safe
- Faulty navigation was not improved enough with ECDIS

What I've learned about learning ECDIS

- Practice requires a variety of contexts
- Do not expect self-prioritizing of skills
- Solo watchkeeping is where the learning takes place
- Group exercises (interactive ownships) produce a social transfer of knowledge & skills

Satisfying results

- At first I expected that navigational experience was necessary to learn ECDIS
- Now I am using the ECDIS focus to provide navigational experience,
- And especially the development of good watchstanding habits

Concerns for ECDIS training

- Multiple brands of ECDIS provide more exposure at the risk of confusion, or
- Instead, learn one system very well
- Either way, success depends on the transfer of skill to an unfamiliar system
- Qualifying a trainer requires considerable effort & time underway

Structure of ECDIS training at USMMA

- Meets future STCW requirements
- Outline (50 hour course)
 - Elements of ECDIS
 - Watchstanding with ECDIS
 - ECDIS Route Planning
 - ECDIS targets, charts & systems
 - ECDIS outlook & responsibility
- Lecture & practice 50%
- Solo ECDIS navigation & testing 50%

24-workstation integrated navigation classroom (ECDIS in coaching environment)



Checklist

- Checklist of 90 tasks in priority of watchstanding importance:
 - Basic tasks
 - Overall presentation of display
 - Intermediate tasks
 - Navigator's tasks
- Checklist is guidance for coaching, and basis for trainee's learning how to learn the next ECDIS to be encountered

16-workstation Integrated Navigation Lab (ECDIS navigation in solo environment)



Exercise

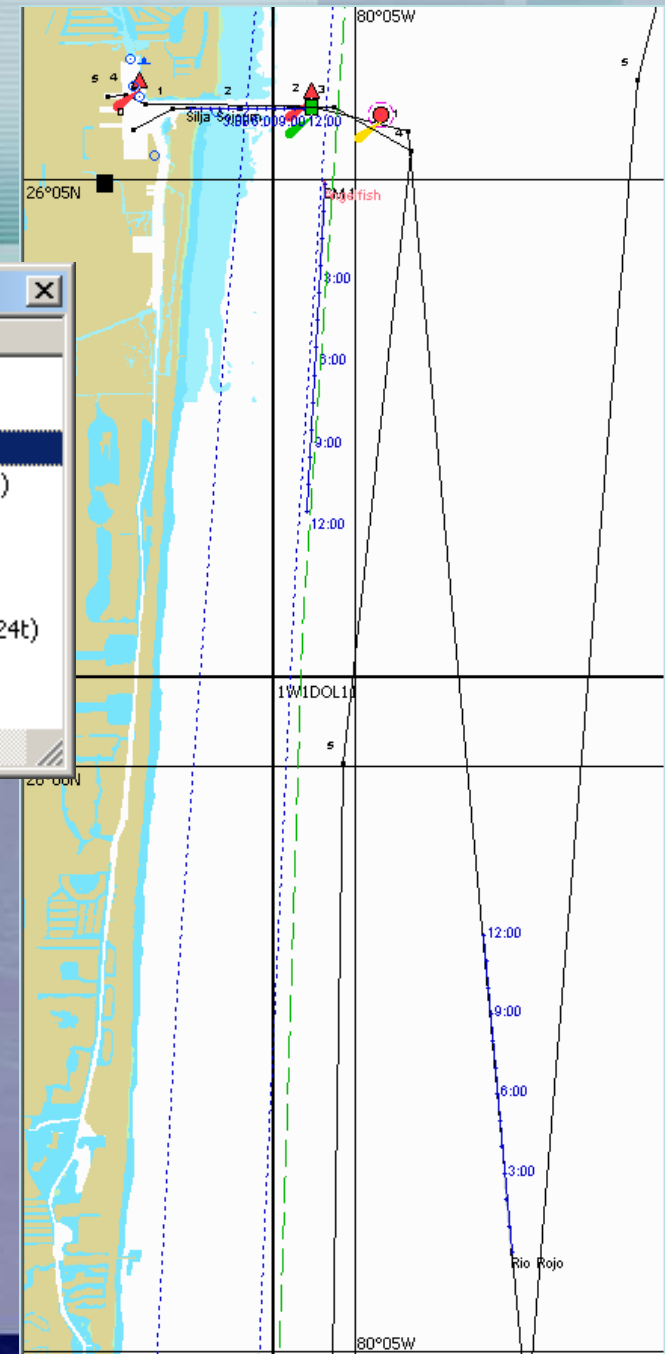
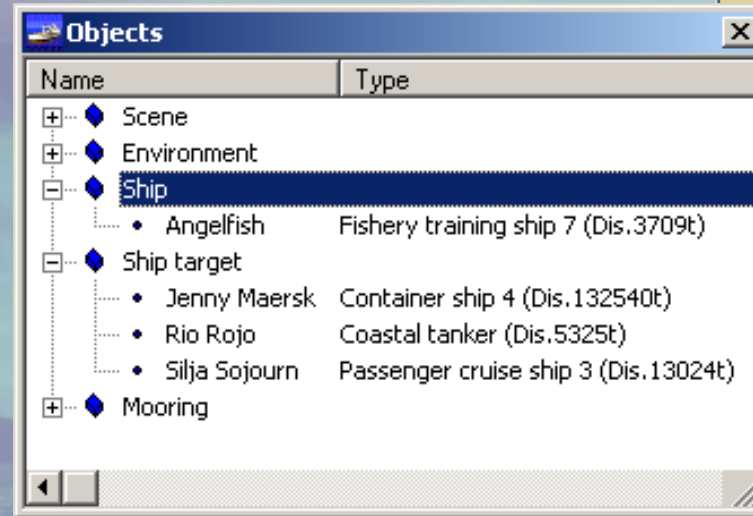
Piloting in open waters for 1 ownship (assign 12 times simultaneously)

Task groups:

- Safe navigation through skills integration

Outcomes:

- Navigate with ECDIS
- Monitor SOG & COG
- Apply standing orders:
 - > 1 nm off land,
- Stay in counter current
- 1-person watch
- Visual lookout



Exercise

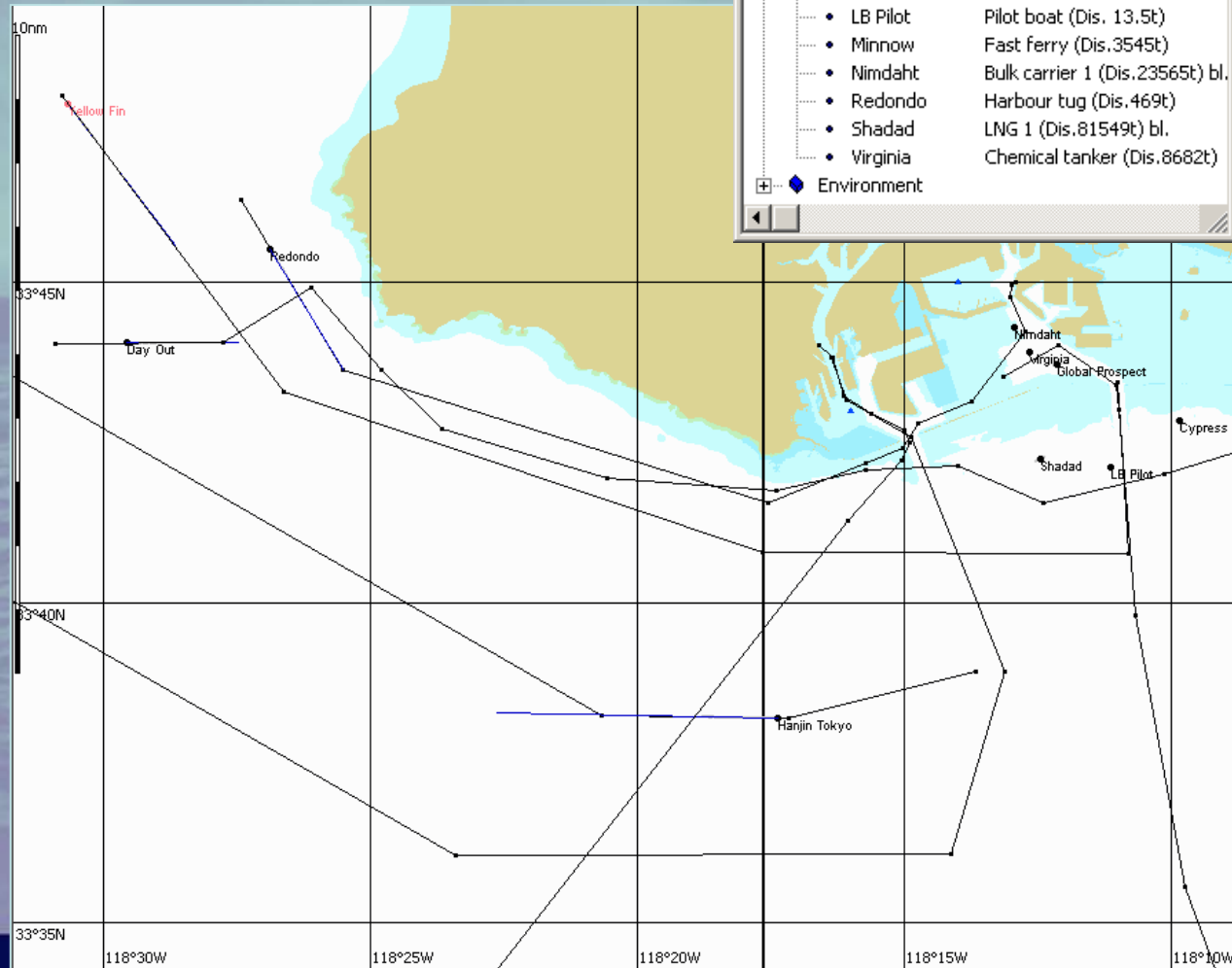
Piloting in open waters for 1 ownship (assign 12 times simultaneously)

Task groups:

- Safe navigation through skills integration
- Adjust heading to maintain track

Outcomes:

- Navigate with ECDIS
- 1-person watch
- Cooperative navigation
- Visual lookout
- Limited maneuvering



Exercise

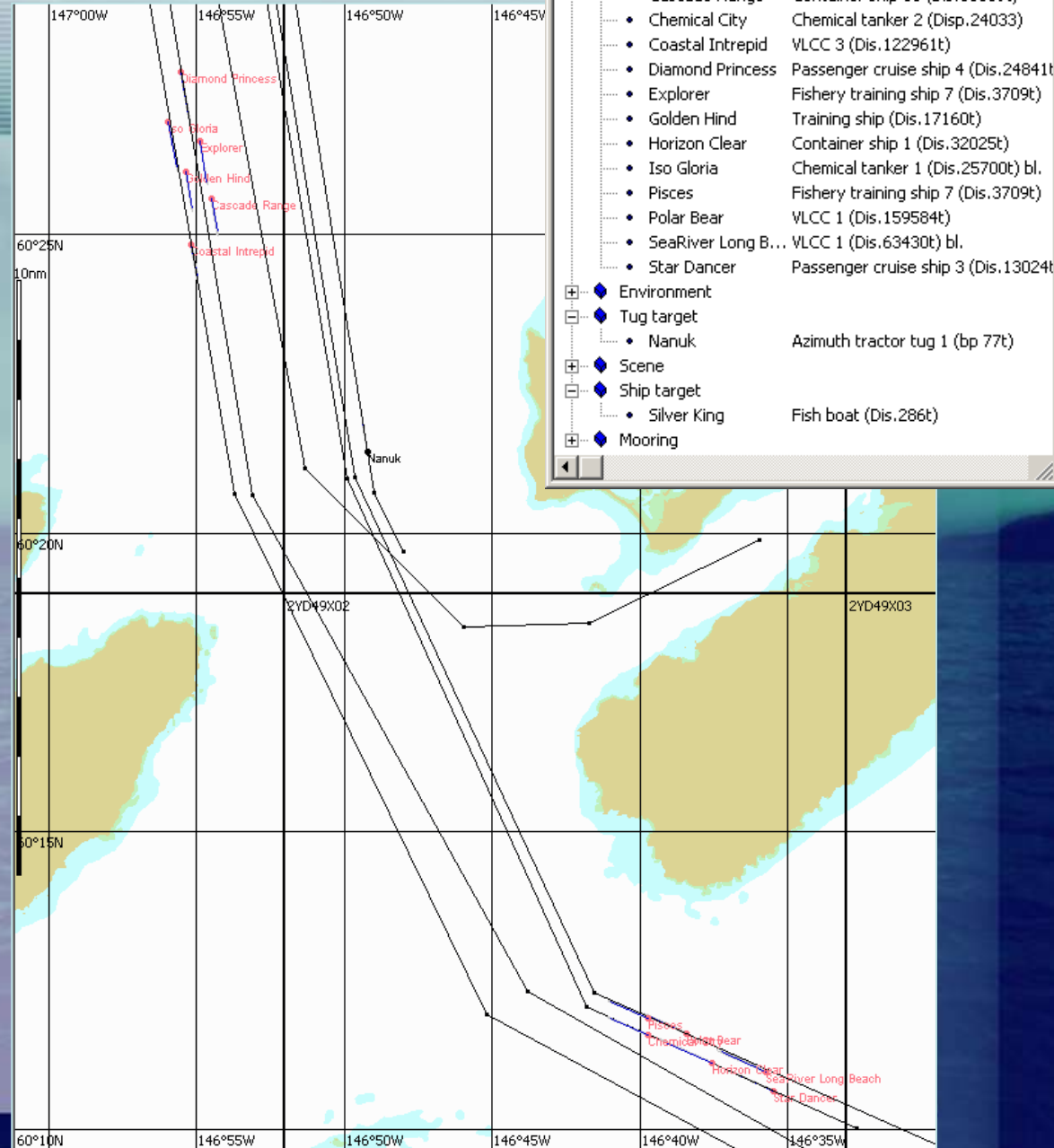
**Piloting in open waters
for 12 ownships (assign
in one group exercise)**

Task groups:

- Safe navigation through skills integration
- Adjust heading to maintain track

Outcomes:

- Navigate with ECDIS
- 1-person watch
- Cooperative navigation
- Visual lookout
- Maneuvering



Exercise

Piloting in open waters for 13 ownships (assign in one group exercise)

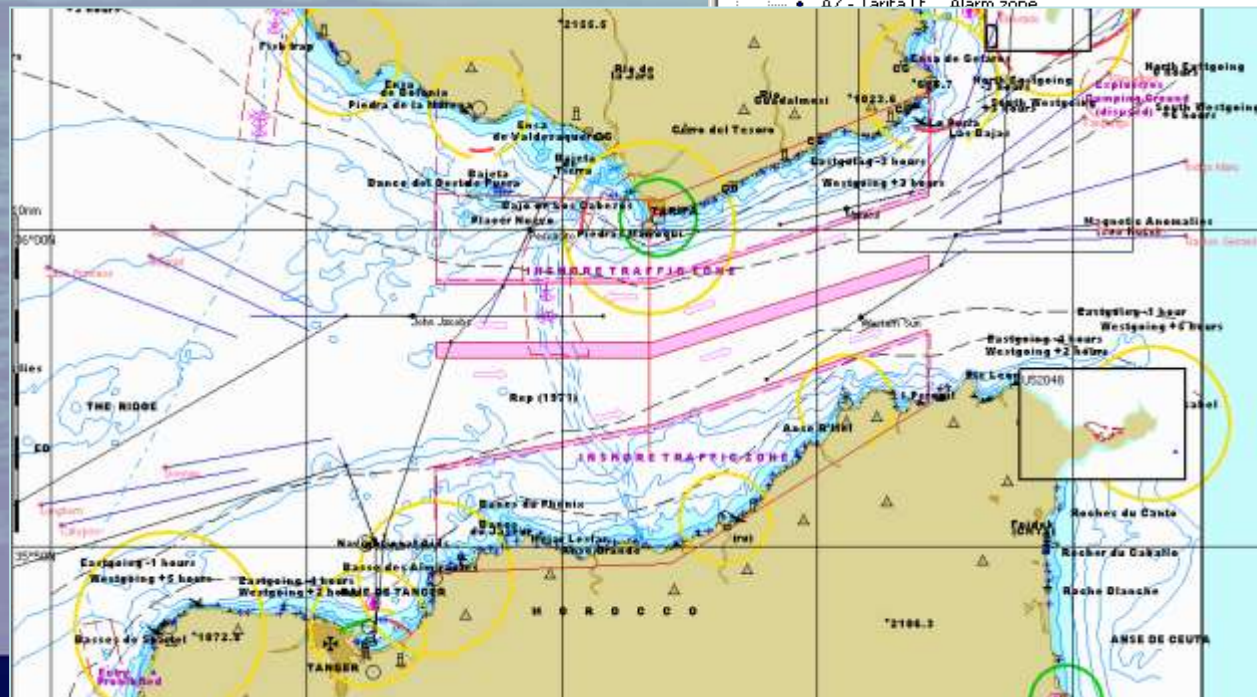
Task groups:

- Safe navigation through skills integration
- Create and apply route
- Adjust heading to maintain track
- TSS, alarm zones

Outcomes:

- Navigate with ECDIS
- 1-person watch
- Cooperative navigation
- Visual lookout
- Maneuvering

Name	Type
Environment	
Scene	
Ship	
• Astrid	LNG 1 (Dis.81549t) bl.
• Belgrad	Passenger car ferry (Dis.11046t)
• Calypso	Ro-Ro Passenger Ferry (Dis.7100t)
• Donnau	Car carrier 2 (Dis.19587t) bl.
• Eldorado	LNG 1 (Dis.81549t) bl.
• Fandango	Passenger car ferry (Dis.11046t)
• Gaston Gerra..	Ro-Ro Passenger Ferry (Dis.7100t)
• Hanjin Highw...	Car carrier 2 (Dis.19587t) bl.
• Indigo Maru	Container ship 9 (Dis.188280t)
• Jade Princess	Passenger cruise ship 4 (Dis.24841t)
• Kilimanjaro	Passenger cruise ship 4 (Dis.24841t)
• Longhorn	Container ship 9 (Dis.188280t)
• Thunder Knoll	Oil tanker 3 (Dis.67850t)
Ship target	
• John Jacobs	Container ship 1 (Dis.32025t)
• Marazul	Fisher (Dis.1676t)
• Pescadito	Fisher (Dis.1676t)
• Spartan Glory	IMT 992 (Dis.5334.2t)
• Western Sun	Bulk carrier 1 (Dis.23565t) bl.
TEAS	
• A7 - Tarifa Lt	Alarm zone



Exercises

Piloting in open waters for 12 ownships (assign in one group exercise)

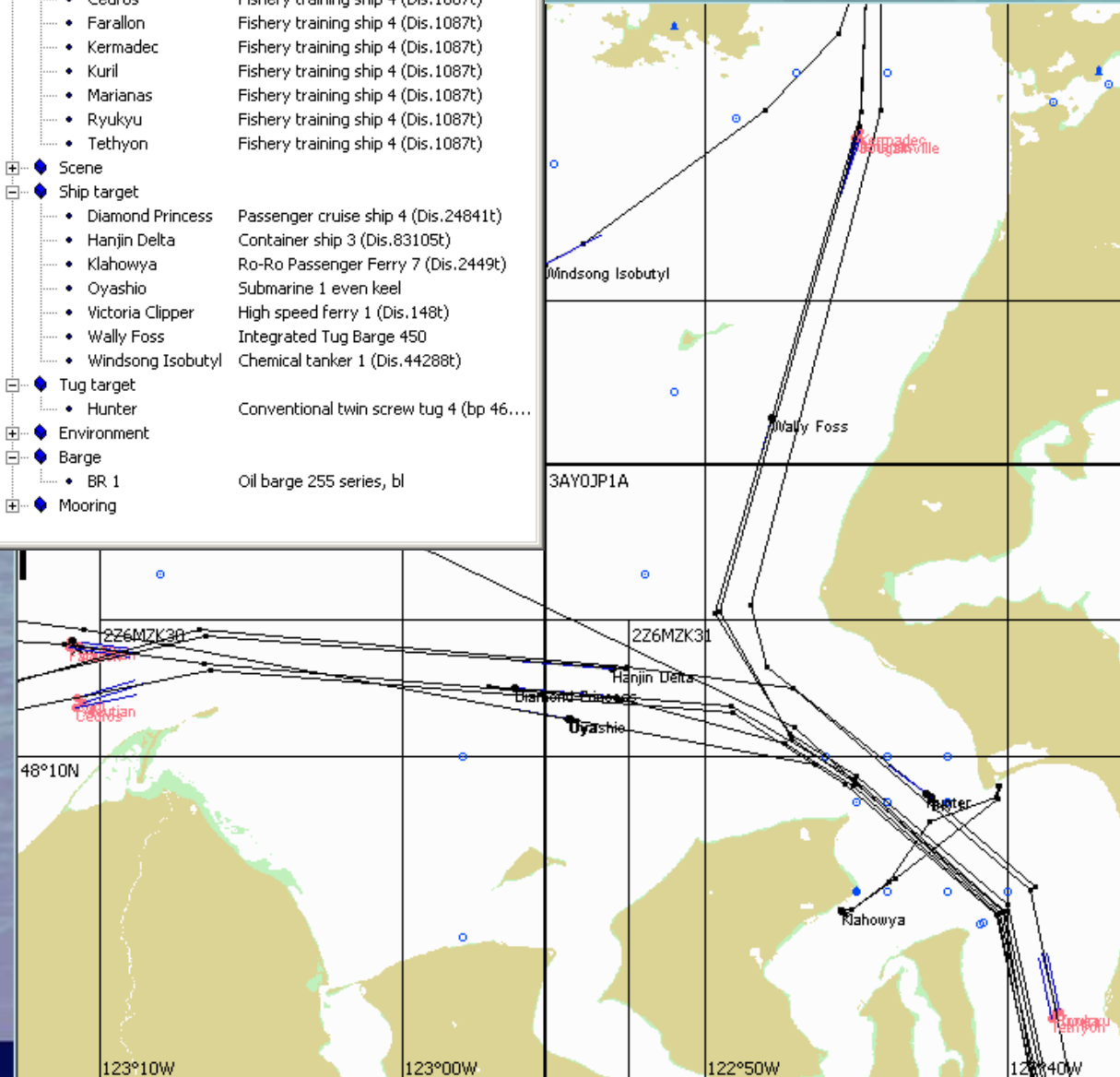
Task groups:

- Safe navigation through skills integration
- Adapt instruments to conditions
- Adapt track keeping to workload

Outcomes:

- Navigate with ECDIS
- 1-person watch
- Cooperative navigation
- Visual lookout
- Maneuvering

Name	Type
Ship	
• Aleutian	Fishery training ship 4 (Dis.1087t)
• Atacama	Fishery training ship 4 (Dis.1087t)
• Bougainville	Fishery training ship 4 (Dis.1087t)
• Cayman	Fishery training ship 4 (Dis.1087t)
• Cedros	Fishery training ship 4 (Dis.1087t)
• Farallon	Fishery training ship 4 (Dis.1087t)
• Kermadec	Fishery training ship 4 (Dis.1087t)
• Kuril	Fishery training ship 4 (Dis.1087t)
• Marianas	Fishery training ship 4 (Dis.1087t)
• Ryukyu	Fishery training ship 4 (Dis.1087t)
• Tethyon	Fishery training ship 4 (Dis.1087t)
Scene	
Ship target	
• Diamond Princess	Passenger cruise ship 4 (Dis.24841t)
• Hanjin Delta	Container ship 3 (Dis.83105t)
• Klahowya	Ro-Ro Passenger Ferry 7 (Dis.2449t)
• Oyashio	Submarine 1 even keel
• Victoria Clipper	High speed ferry 1 (Dis.148t)
• Wally Foss	Integrated Tug Barge 450
• Windsong Isobutyl	Chemical tanker 1 (Dis.44288t)
Tug target	
• Hunter	Conventional twin screw tug 4 (bp 46....)
Environment	
Barge	
• BR 1	Oil barge 255 series, bl
Mooring	



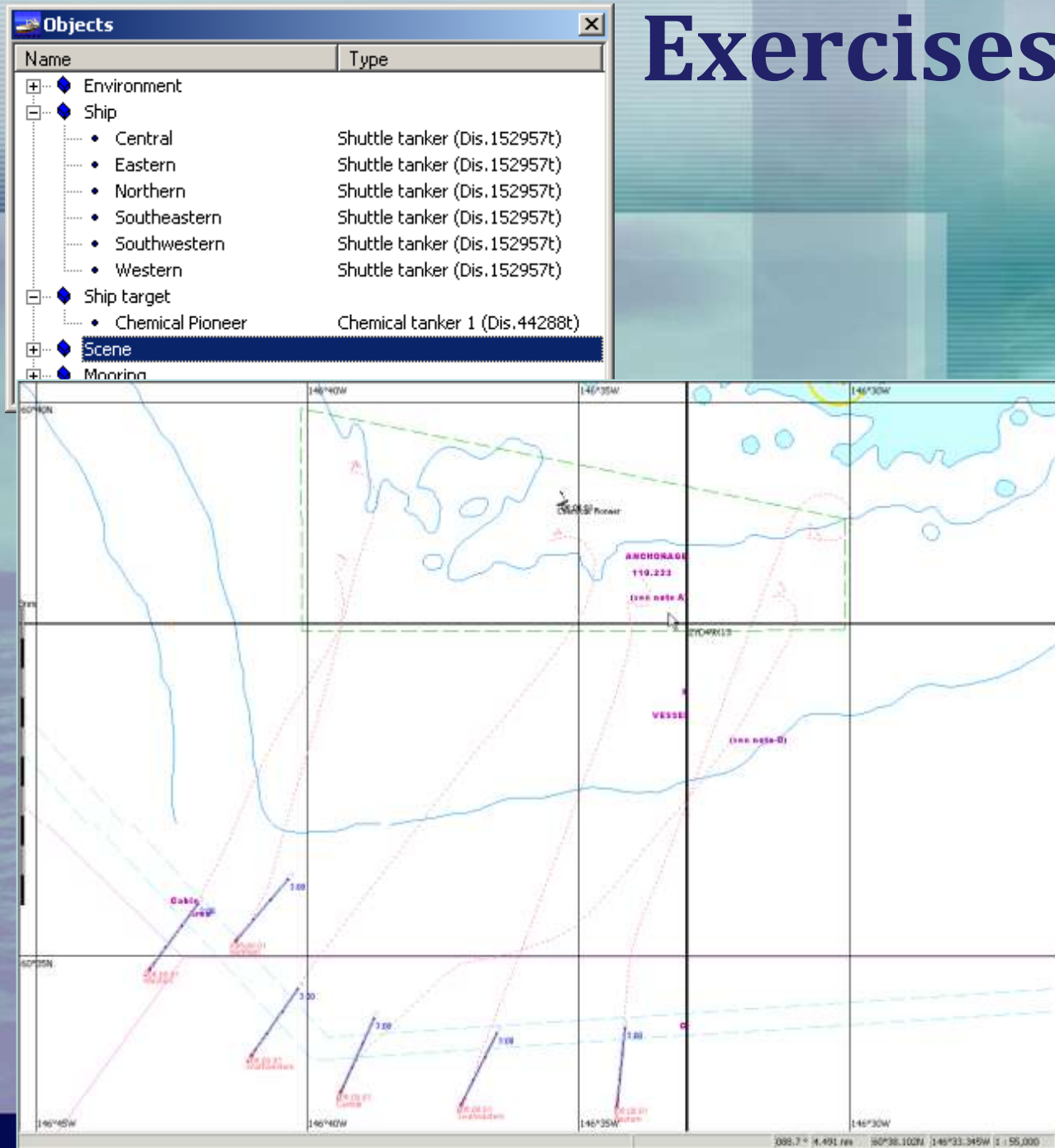
Piloting in semi-confined waters for 6 ownships (assign 2x)

Task groups:

- Safe navigation through skills integration
- Create & apply route
- Adjust heading to maintain track
- Create & apply user layer for anchoring

Outcomes:

- Navigate with ECDIS
- 1-person watch
- Cooperative navigation
- Visual lookout
- Maneuvering



Exercises

Exercise

**Piloting in open waters
for 6 ownships (assign
in one group exercise)**

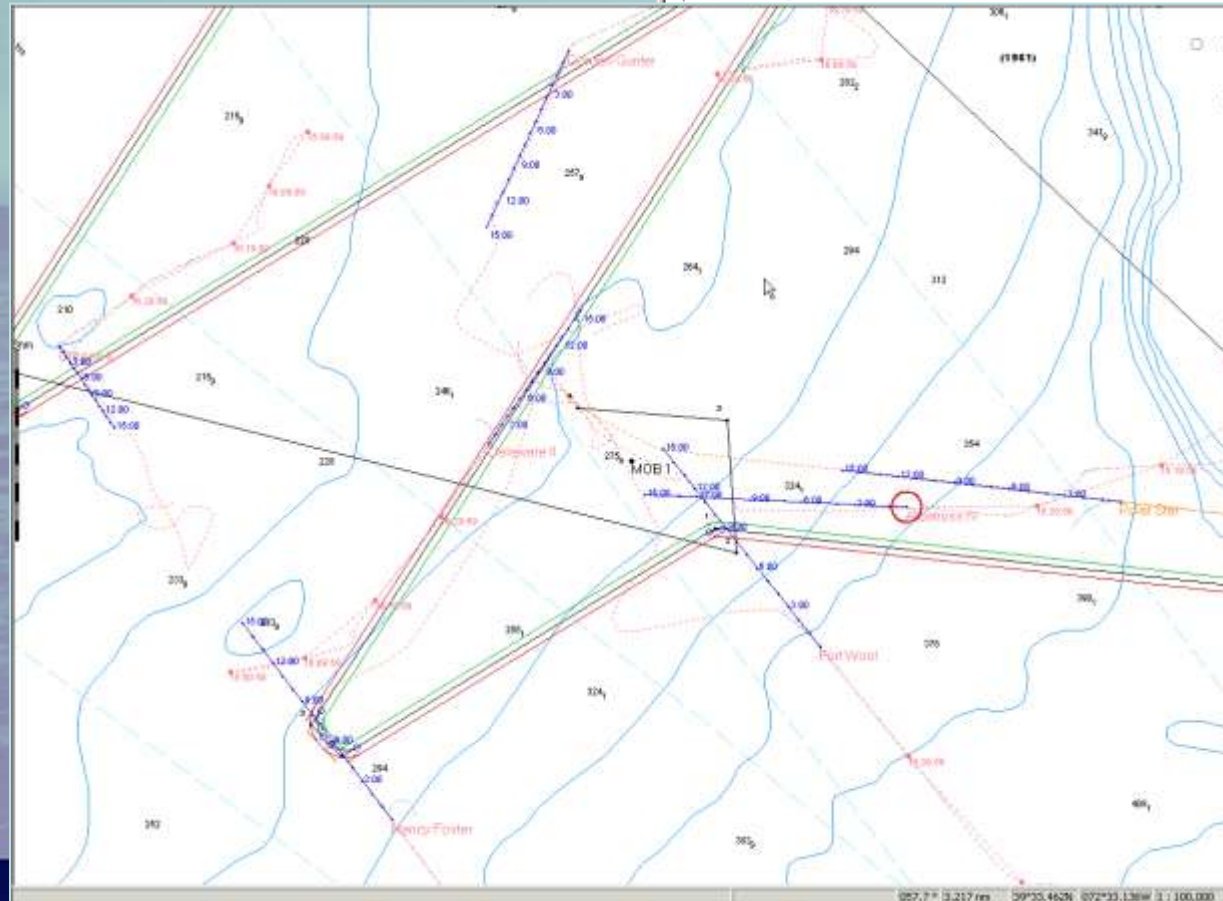
Task groups:

- Safe navigation through skills integration
- Adapt ECDIS route to SAR
- Find MOB

Outcomes:

- 'Email' ECDIS route
- 2-person watch
- Cooperative navigation
- Team & communications
- Visual lookout
- Maneuvering

Name	Type
Environment	
Scene	
• Buoy	Scene buoy
• Polar Star route	Route
• RT 1	Route
• RT 2	Route
Ship target	
• Davisville	OSV 1 (Dis.5334t)
Ship	
• Albatross IV	Fishery training ship 4 (Dis.1087t)
• Delaware II	Fishery training ship 4 (Dis.1087t)
• Fort Wool	Multirole support ship (Dis.2250t)
• Gordon Gunter	Research ship (Dis.2630t)
• Nancy Foster	Fishery training ship 4 (Dis.1087t)
• Oregon II	Fishery training ship 4 (Dis.1087t)
• Polar Star	Stern trawler (Dis.2210t)
Mooring	



Exercises

Piloting in open waters for 13 ownships (assign in one group exercise)

Task groups:

- Safe navigation through skills integration
- Adapt instruments to conditions
- Adapt track-keeping to workload

Outcomes:

- Navigate with ECDIS
- 1-person watch
- Cooperative navigation
- Team & communications
- Visual lookout
- Maneuvering

Name	Type
◆ Scene	
◆ Environment	
◆ Ship	
• Albatross IV	Fishery training ship 4 (Dis.1087t)
• Bartlett	OSV 3 (Dis.5291t)
• Billy Mumford	Multirole support ship (Dis.2250t)
• Gordon Gunter	Research ship (Dis.2630t)
• Iso Octyl	Chemical tanker (Dis.8682t)
• Nancy Foster	Fishery training ship 4 (Dis.1087t)
• Nantucket	Ro-Ro Ferry 2 (Dis.25598t)
• North Star	FSV 1 (Dis.812.7t)
• Oregon II	Fishery training ship 4 (Dis.1087t)
• Red Rover	Fish boat (Dis.286t)
• Ronald H. Brown	Fishery training ship 1 (Dis.3300t)
• Silas	Ro-Ro Passenger Ferry 2 (Dis.560t)
• Willard	Fisher (Dis.1676t)
◆ Ship target	
• Alexis	Fish boat (Dis.286t)
• Bessie Jane	Stern trawler (Dis.2210t)
• Billy Mumford	Multirole support ship (Dis.2250t)



Piloting in open waters for 13 ownships

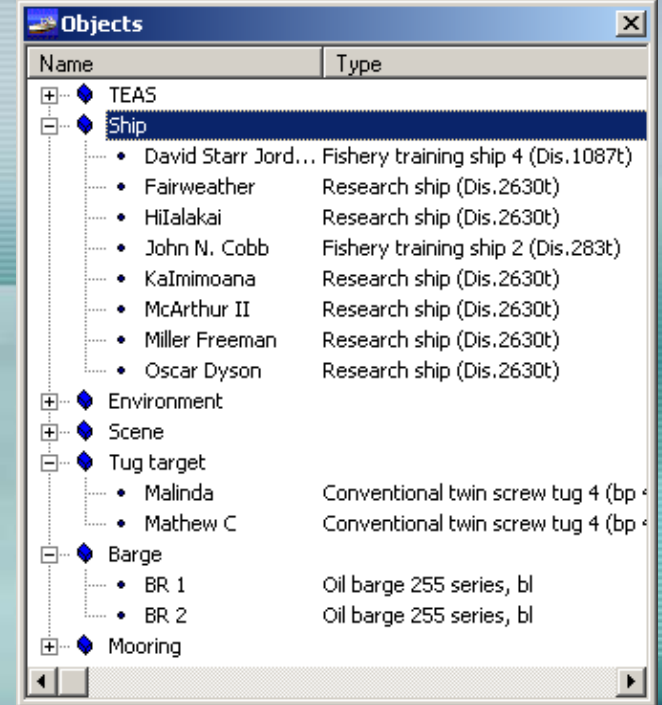
Exercises

Task groups:

- Safe navigation through skills integration
- Adapt instruments to conditions
- Create & apply route
- Adjust heading to maintain track

Outcomes:

- Navigate with ECDIS
- 1-person watch
- Cooperative navigation
- Visual lookout
- Maneuvering



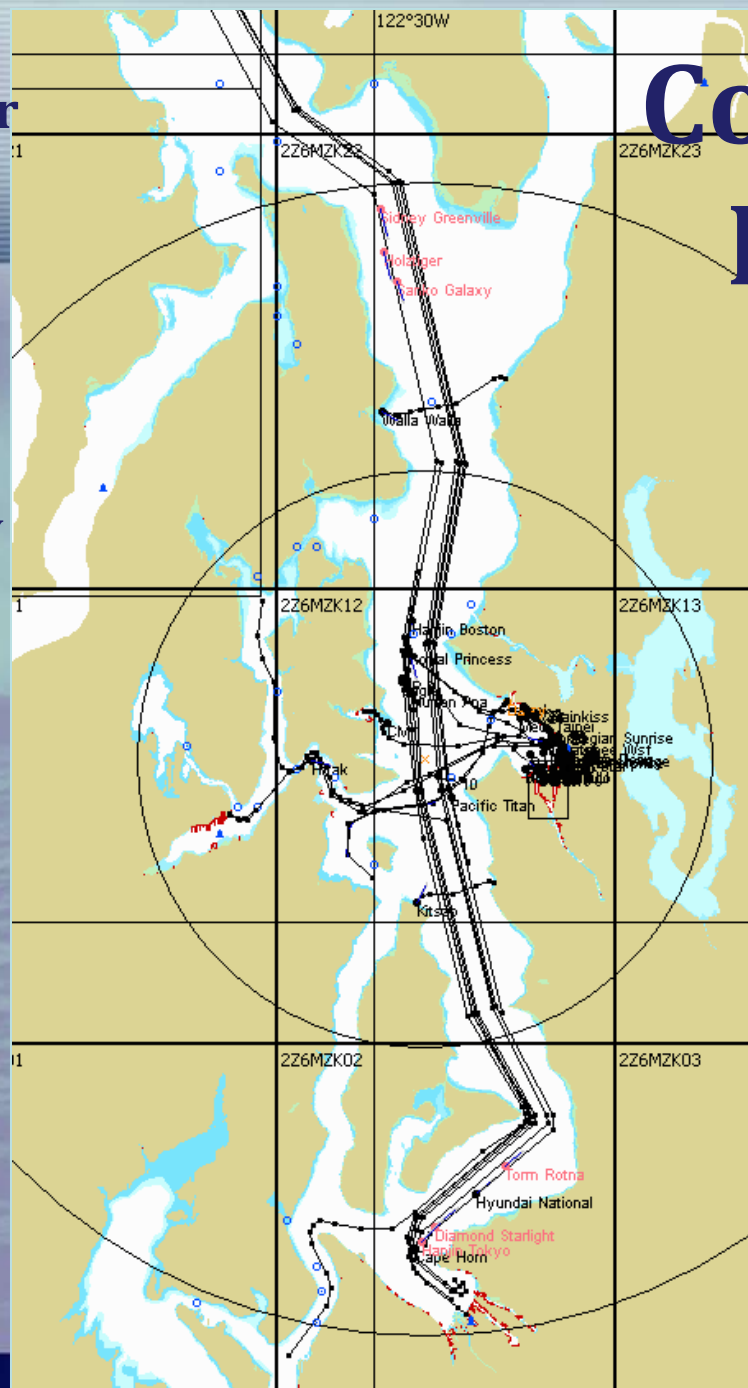
Piloting in open waters for 6 ownships together

Task groups:

- Use all ECDIS functions
- Safe navigation through skills integration
- Adapt & apply & modify route
- Adapt track keeping to workload
- TSS, alarm zones

Outcomes:

- Navigate with ECDIS
- 1-person watch
- Cooperative navigation
- Visual lookout
- Maneuvering



Competency Evaluation

Object	Type
◆ Barge	
◆ Environment	
◆ Mooring	
◆ Scene	
◆ Ship target	
• Cape Horn	Fisher (Dis.1676t)
• Da Ming Hu	VLCC 1 (Dis.159584t)
• Daisy	Yacht (Dis.286t)
• Hanjin Boston	Container ship 3 (Dis.83105t)
• Horizon Anchorage	Container ship 1 (Dis.32025t)
• Hyak	Ro-Ro Passenger Ferry 7 (Dis.2449t)
• Hyundai National	Container ship 1 (Dis.32025t)
• Kitsap	Ro-Ro Passenger Ferry 7 (Dis.2449t)
• Laurel	Yacht (Dis.286t)
• Medi Taipei	Bulk carrier 2 (Dis.76800t) bl.
• MOL Dynamic	Container ship 1 (Dis.32025t)
• MOL Enterprise	Container ship 1 (Dis.32025t)
• MW Rainkiss	Bulk carrier 1 (Dis.33089t)
• North Star	Container ship 2 (Dis.93130t)
• Norwegian Sunrise	Passenger cruise ship 2 (Dis.31085t)
• Nurten Ana	LO-RO ship (Dis.19512t)
• Pacific Titan	Integrated Tug Barge 450
• Royal Princess	Passenger cruise ship 1 (Dis.24841t)
• Santiago	Container ship 2 (Dis.41172t) bl.
• TG 10	Coastal tanker (Dis.5325t)
• TG 19	Container ship 2 (Dis.41172t) bl.
• TG 20	Bulk carrier 1 (Dis.23565t) bl.
• TG 21	Destroyer (Dis.4675t)
• Walla Walla	Ro-Ro Passenger Ferry 7 (Dis.2449t)
• Wenatchee Wsf	Ro-Ro Passenger Ferry 7 (Dis.2449t)
• Xin Dan Dong	LO-RO ship (Dis.19512t)
◆ Tug target	
• Barbara	Conventional twin screw tug 1 (bp 21t)
• Eagle	Conventional twin screw tug 1 (bp 21t)
◆ Ship	
• Diamond Starlight	Passenger cruise ship 1 (Dis.24841t)
• Hanjin Tokyo	Container ship 5 (Dis.86900t)
• Holztiger	Container ship 5 (Dis.86900t)
• Sanko Galaxy	Bulk carrier 4 (Dis.104510t)
• Sidney Greenville	Container ship 3 (Dis.83105t)
• Torm Rotna	Bulk carrier 3 (Dis.26343t) bl.

Solo competency evaluation

Score (24 pts required):

3=uses most/all, 2=uses some, 1=uses none

- Use navigation systems interfaced with ECDIS
- Verify settings of interfaced sensors
- Check that settings conform to procedures
- Monitor info on ECDIS for safe navigation
- Verify position by alternate means
- Adjust settings to suit conditions
- Use ECDIS-managed track control autopilot
- Maneuver using accepted navigation practice
- Manage contacts by AIS & radar interface*
- Assess environmental factors*

Instructor Station – remote non-interfering observation of ECDIS use and vessel events

The screenshot displays an ECDIS instructor station interface with the following components:

- Chart Windows:** Five windows at the top labeled ZBR-6-ECDIS, ZBR-8-ECDIS, ZBR-11-ECDIS, ZBR-13-ECDIS, and ZBR-15-ECDIS. The ZBR-15-ECDIS window is the largest and shows a detailed chart of a harbor area with a red circular area of interest.
- Data Panel (Right):** Displays vessel information for 'STORM BRINA' and other parameters.

Ship	07 - 10 - 09
08:00 W	07 : 54 : 15
Primary	47° 32.813 N
AIS-DGPS	122° 31.653 W
Sec:LRNC	▲ 243.9° -31 m
COG-p	042.2°
SOG-p	0.5 kt
HDG-t	192.0°
ROT	1°/min - start
2:6mzk12	Autoload: ON
1 : 25,000	Man. Corr.

ENC DATA AVAILABLE

Load chart	-
Load chart	-

Route data

Route	emerg anchor
To WP 2	
CSE	211.0°
XTE	9 m - port
BTW	212.8°
DTW	0.15 nm
ETA (Ship)	07-10-2009 08:11:40
TTC	17 m 26 s

CSE

Tasks List - Event - Help

Vectors: 6 min - Show

Depth in Feet: WGS-84
- Bottom Panel:** Contains various control buttons such as 'Delete chart', 'Show Objects', 'Show Attributes', 'Attachments', 'Download', 'Colour', 'Load chart', 'Unload', 'Focus on Chart', 'Merge', 'New Object', 'Edit Object', 'Shift Object', 'Show All Objects', 'Delete Object', 'Restore Object', 'Attachments', 'Attributes', 'Find object', and 'Main Dual'.
- Task List Table:**

WP	Course
1	271.5°
3	257.9°
4	247.2°
5	246.7°
>>>	XXXX

ECDIS simulation performance standards are being proposed

- Enable all of the operational capabilities of ECDIS
- Provide complete visual and communications scene
- Provide for application of backup methods

The training is accountable

- ECDIS is an integrating device, and its use must be mastered in solo watchstanding
- For the most part, students will learn what we teach them

My first 21 Axioms of ECDIS:

(in no particular order, and all discovered the hard way)

- No one setting suits all conditions
- The mouse will kill you
- When in doubt, right click
- If it's clickable, it will get clicked
- Structure your practice to master the basics
- Exercise the 7-second glance
- Stick to the single-point query
- Skilled use includes stepping back from the ECDIS
- Never under estimate the problem of partial use
- Make friends with every menu

more...

...continued

- Do as you would on a paper chart, and so much more
- Move the line, check the line
- Luckily, you cannot edit the route you're monitoring
- Check all source sensors and connected devices
- Treat the ECDIS as if it were steering the vessel
- Detect and resolve ambiguities
- The ECDIS display will have many readers
- Enable only the alarms you want to hear
- ECDIS is mostly about chart data
- Procure, install, select, initialize, and then load
- ECDIS use should enhance the safety of navigation

Thank you.

Questions?

Christian Hempstead
hempsteadc@usmma.edu

Digital Ship USA
10/08/09