



e-Navigation....

Making e-Navigators out of Traditional Navigators

...or

Making (e-)Captains out of e-Navigators?

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Outline:

- Introduction
- New People, New Tools, New Processes
- Command ...Training for Decision-making
- e-Navigation ...Help or Hindrance?
- Conclusion



We mariners operate to a **very ancient and sacred principle of navigation** – it is called, quite simply, cross-check. It is not redundancy, where you revert to a secondary system only after the primary fails. No, **we verify the data integrity of the primary system against the secondary as a matter of routine navigational practice**

Captain S. Krishnamuthi, NI Seaways Sep 2007

3.2 Research indicates that around 60 per cent of collisions and groundings are caused by direct human error. Despite advances in bridge resource management training, it seems that **the majority of watchkeeping officers make critical decisions for navigation and collision avoidance in isolation**, due to a general reduction in manning.

3.3 In human reliability analysis terms, the presence of someone checking the decision-making process improves reliability by a factor of 10. ...

“IMO Adopts e-Navigation”, NI Seaways Feb 2009

However, one drawback of e-Navigation is that it **requires a new level of sophistication** and equipment on the part of the system users. This in turn requires new levels of user training and certification. Systems and procedures cannot be imposed overnight, they will **have to transition gradually**.

M. Sollosi, NI Seaways Mar 2012



E-Navigators....

and...
Traditional
Navigators!



The end-state of transformation: (?)

The Captain of a destroyer in World War II was a think box into which radar, radio and sight reports were fed, and out of which were triggered response orders (reactions) some of which were considered decisions and some wild guesses...

Roger Hill, *Destroyer Captain*

From “civvies” to naval officers...

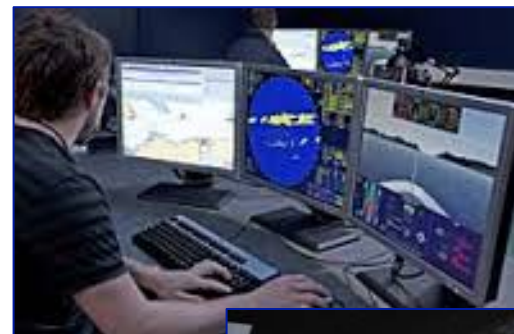
Over view of MARS Training
(Maritime Surface/Sub-surface Officers)

Following post-secondary education, 200 training days (+/-) over ~1 year:

MARS II: SIM- 2 days	Seatime: 1 week D/N, conning & fixing
MARS III: SIM- 2 weeks	Seatime: 2 weeks D/N, core BWK skills
SIM- 2 weeks	Seatime: 2 weeks D, OOW MNVRES
MARS IV: SIM- 1 week	Seatime: 2 weeks D/N, pilotage
SIM- 2 weeks	Seatime: 3 weeks D/N, OOW charge
Board: ½ hour oral	

Naval Officers Professional Qualification (NOPQ):

- 18 mo onboard operational ship, Harbour W/K, Bridge W/K Seatime 100-200 days
- Certificate of Competency Board: 1.5-2 hour oral

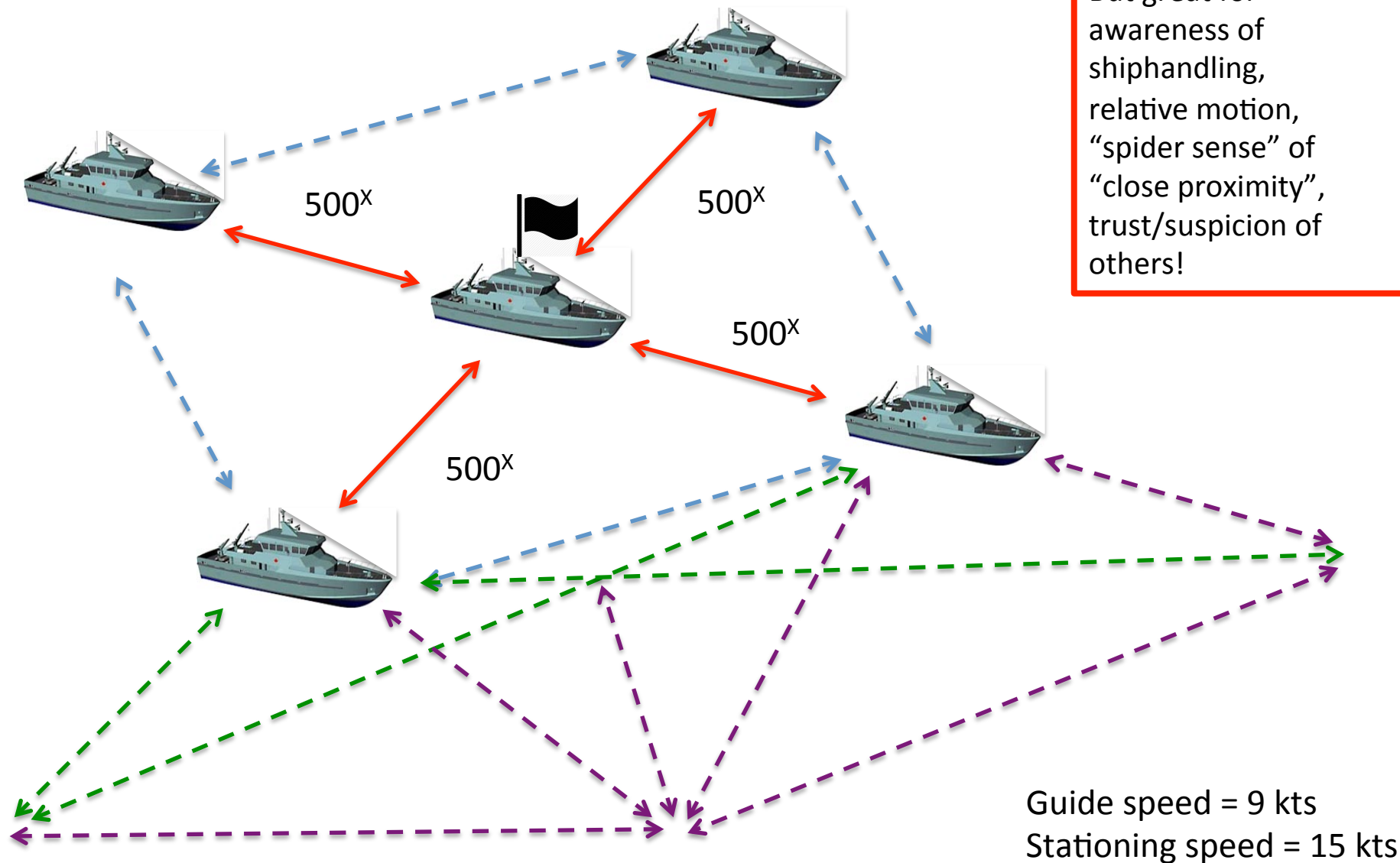




OOW Manoeuvres ...(sp!)

Diminishing tactical utility...

But great for awareness of shiphandling, relative motion, "spider sense" of "close proximity", trust/suspicion of others!



Transformation Continued...

From tactics to operations...

From technical competence to corporate management...

From instructors to mentors...

From direct orders to command intent...

From immediate objectives to strategic vision...

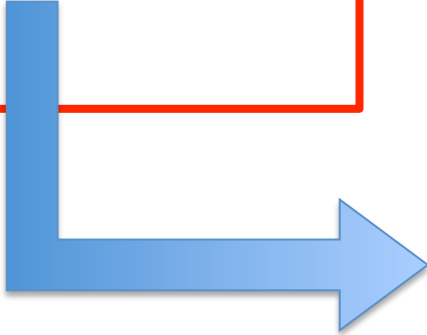
From Officer of the Watch to Command

... constant, progressive change

Command Development Course (10 wk)

- Theory ...ship-handling, seamanship, leadership, decision-making, risk assessment
- “Whiteboard” problems
- Worksheets
- Case Studies
- Exams
- Simulator problems and practice (3 weeks)
- Mock “Command Boards” (table-top and Sim)
- ORCA (2 weeks) ...qualify to command

Causes of accidents:

- Material failure
 - Extreme conditions
 - Human error
 1. Lack of anticipation
 2. Lack of skill
 3. Poor decision
 - a. Timing
 - b. Achievability
 - c. Sufficiency
- 

Causes of Poor Decisions

- Lack of relevant experience
- Lack of information
 1. Don't have it (old and continuing problem)
 2. Can't distil it (new(?), modern problem)
- "De minimus" error ... (denial!)
- Losing sight of the Aim
- Too many/poor ordering of priorities
- Deciding before it is necessary
- Intolerance for uncertainty
- Too much/Too little use of the team to gather inputs
- Locking on a point of view
- Un-realistic expectations
- *Entering Rabbit holes...*

Ref: RCN Command Development
Course Notes

Safe Navigation =

decision-making under forced change circumstances ...

Steps in the decision-making process

- Recognize the need for action (acknowledge problem)
- Develop options
- Test against constraints (time, speed, distance, capability, contingency)
- Assess sufficiency (ie: does it solve the problem?)
- Assess urgency
- Decide
- Implement
- Review
- Adjust

Command
Development:
How to
increase the
net cycle
time?

In a study of AEGIS class cruiser commanders, Kaempf et al. found that 95% of situation assessment decisions were made by a recognition-based process.

Only 5% of decisions indicated an analytic strategy

- quoted in DRDC Toronto TR 2005-164

Decision-assist approaches:

- More info
.... How much really required?
- Synthesize experience
.... Manufacture disaster in the SIM?
- Automation
..... TEWA: managing the system?
- External direction
..... Remote entity really “omniscient”?
- Better presentation
.... What is the key info that leads to an “intuitive” (immediate, correct) decision?



**“It ain't what you don't know
that gets you into trouble.
It's what you know for sure
that just ain't so.”**

Mark Twain

Hdg: (HDG1) **189.9°T**
CMG: **189.9°T**
SMG: **4.8 kt**

Lat: **48° 37.410' N**
Lon: **123° 22.580' W**
(CR) **Anchor berth**
SLog: (SPD1) **4.8 kt**
Depth: (DEP1) **191.4 m**
Wind: (1) **10 kt at 276°T**
Drift: **0.0 kt**
Set: (ORD) **000.0°T**
RoT: **000.0°/min**

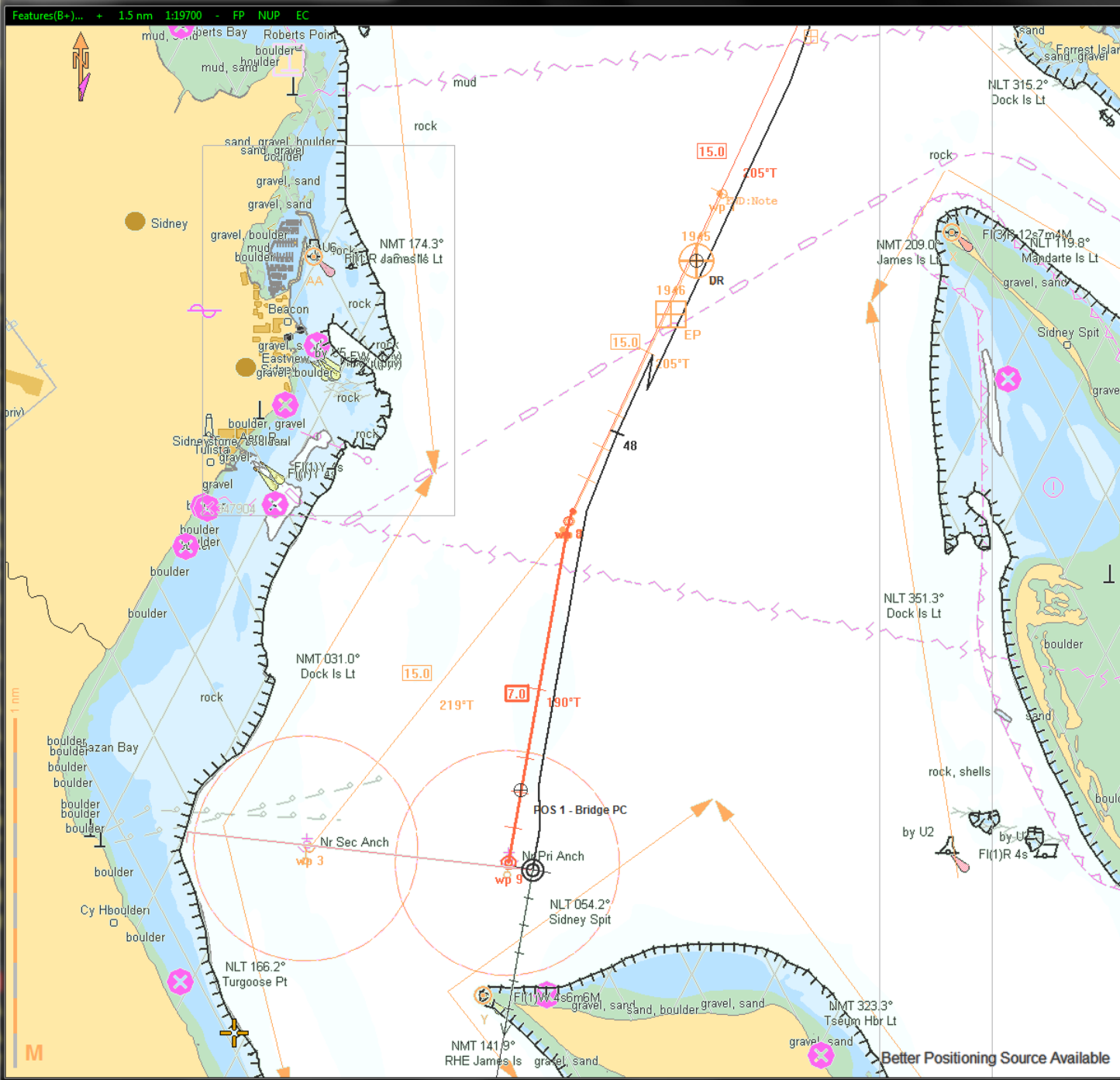
EBL:
Brg: **N/A**
Rng: **N/A**
Lat: **N/A**
Lon: **N/A**

Route: **ADL Deep Cove to**
wp 8 to wp 9
WP Brg: **286.2°T**
XTD: **N/A**
Crs/CTM: **190.0/190.0°T**
DTG: **N/A**
TTG: **N/A**
Dest ETA: **N/A**
Next Crs: **N/A**

Cursor: **5.0-10.0 m**
Brg: **241.5°T**
Rng: **1976 yd**
Lat: **48° 36.946' N**
Lon: **123° 23.869' W**
TTG: **00:12:11**

Sensor: **CR (S+D)**
HDOP: **N/A**
Sats: **N/A**
Anti-Gr: **OFF**

(UNDERSCALE) (2012 Sep 24) CA570567 - Approaches to/Approches à Sidney



Better Positioning Source Available

The e-Problem:

- **Improved data rates...**
 - Playing catch up in human ability to assimilate
 - Decision clouded by too much data
 - Decision delayed by examination of all data
- **Highly precise data ...**
 - Decreasing skepticism of reliability
 - Less reliance on intuition, seaman's eye, gut instinct
 - Precision not the key to solution...
- **Data highly manageable...**
 - Multitude of menus to know, "navigate"
 - Variety of proprietary systems
- **Instantaneous position info...**
 - Tendency to drive "intuitively" rather than plan
- **Improved methods, veracity of training...**
 - Diminishing sea-time, "real" experience
 - No-consequence training ...lack of fear
 - Un-improved pass rates in qualifying for command



The e-Problem:



1960's ... "radar-assisted collisions"
2010's ... "e-Nav assisted collisions"?



Intent of e-Navigation

Generally: improve (safe) berth-berth navigation, through:

- Increase availability/integrity of data
 - One-stop shop
 - Improve/automate data push/pull
- Reduce admin burden
 - Improve ship-shore communications
- Provide decision support
 - Improve presentation of data
 - Improve bridge ergonomics
 - Increased direction from shore?

e-Navigation “Solutions”

S1 bridge design

S2 automated reporting

S3 reliability, resilience and integrity of information

S4 presentation of available information

S5 Information management

S6 information for Search and Rescue

S7 information for shore-based users

S8 shore-based systems and services

S9 communication of VTS service portfolio

Redlined priorities as result of 2013 work of the IMO Correspondence Group on e-Navigation

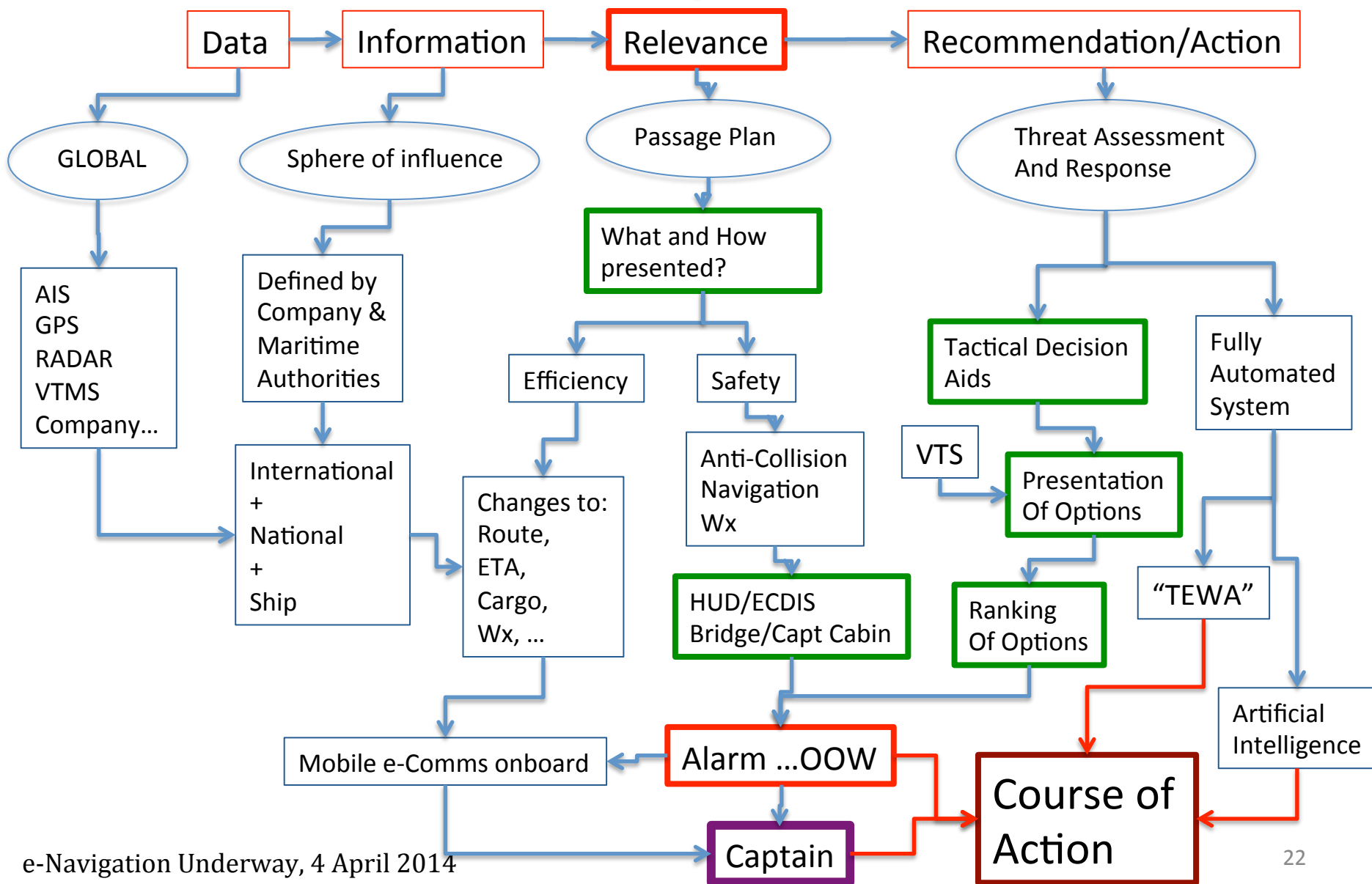
**What about improved training ... fit man to machine?
or machine to man?**

Challenge:

What non-traditional presentation of info (not data), being enabled by e-Navigation technology, would best serve to aid the awareness and decision-making process and thereby improve safe navigation at sea (the ultimate aim of e-Nav)?



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Questions?

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