New Paradigm of Seafarers Training in e-Navigation Age

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Prof. JANG, Eun-Kyu

Korea Institute of Maritime and Fisheries Technology (KIMFT)
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Even though...

- SOLAS Chapter V, Safety of Navigation
- Radar, ARPA, GPS, AIS, ECDIS... => Carriage requirements

Accident rates (Collision) have not reduced significant.

Why?

How about e-Navigation Age?
The important changes to ...

- New requirements relating to training in modern technology such as ECDIS.
- New requirements for awareness training and training in leadership and teamwork.
- Introduction of modern training methodology including distance learning and web-based learning.
Focused on…

• Training in modern technology

• Awareness, Leadership and Teamwork

• Modern training methodology including distance learning (e-Learning)

Human Element + Technology
◆ Human Error

Accident rates by Human Error

- Car Accident  95%
- Aircraft Accident  75%
- Ship Collision, Aground  65%
II. e-Navigation Strategy of IMO

“e-Navigation is the harmonised collection, integration, exchange, presentation and analysis of maritime information onboard and ashore by electronic means to enhance berth to berth navigation and related services, for safety and security at sea and protection of the marine environment”

- Electronic Navigation
- Enhanced Navigation
Swiss Cheese Model of Accident Causation
(After Reason)

Accident Analysis: Error Chains

- Organisational errors
- Operator errors
- "Trigger" event or failure
- Design Errors
- Unsafe Conditions

Incident Investigation
• **Types of Error**
  – Mistake
  – Slips
  – Lapse
  – Mode error

• **Violation**
Nuclear Plant
III. Situation Awareness and Decision Making

Navigation officer Training based on Situation Awareness

- 3 Researches
  * Professor Lee, Pusan National University (2010)

- Cognitive Task Analysis (CTA)
Research 1

- 2 Training methods for Navigation officers
  - Simulation Training
  - Onboard Training

- Cognitive Task Analysis (based on Situation Awareness)
Ship handling Simulation Training
Onboard Training
Training ship HANBADA (Korea Maritime University)
Length overall: 117.2m
Breadth: 17.80m,
Draft: 5.90m,
gross tonnage: 6,686,
Max Speed: 19.0 knots
Research 2

◆ Situation awareness ability assessment

- Beginners (Low level) 10 cadets
- Beginners (High level) 10 cadets
- Experts, 10 Navigation officers

“Professionalism” – Situation awareness ability
“Performance”
상황인식 1수준 능력의 측정
상황인식 3수준 능력의 측정

“BLACK OUT”
Research 3

◆ Effectiveness of Situation awareness Training

- Beginners, 18 cadets

“Increasing the Professionalism?”
“Increasing the Performance?”
“Experience and Time”
Situation Awareness Training for Navigation

• Situation 1
  - Introducing Situation 1 and Demonstration

• Situation 2
  - Exercise and Debriefing

• Situation 3
  - Exercise and Black out
IV. co-Navigation

Co...

- Cognitive Navigation

- Cooperative Navigation
New Navigation Environment
- dynamic environment for navigation
- increase of Cognitive Tasks (Radar, ECDIS…)

E-Navigation: communication with machine
- harmonized collection, integration, exchange and presentation of maritime information by electronic means

Co-Navigation: communication with person
- individual cognitive skills: SA and DM
- group cognitive skills: Team SA and Distributed DM
- social skills: interpersonal, team work, cooperative skills
Cognitive Tasks:

- Physical tasks are observable (overt); however, cognitive processes are not (covert)
- (to uncover) mental workload, knowledge, thought process, decision making strategies of VTS operators
- (to describe) the cognitive skills required for effective individual and team performance

Team Process Behaviors:

- Communication (Information Exchange)
- Coordination (Orchestrating the sequencing of actions)
- Leadership (Consensus Formation)
“e-Navigation is the harmonised collection, integration, exchange, presentation and analysis of maritime information onboard and ashore by electronic means to enhance berth to berth navigation and related services, for safety and security at sea and protection of the marine environment”

- Technology must be matched to the human cognition required

“Exchange” → “Sharing”
Cooperative Navigation

VTS (Vessel Traffic Service)

VTS Operators
Conclusion

Co-Navigation...

1. **Cognitive Navigation**
   - Design, Development *(Equipment, Training..)*
     Based on Human Elements
   - Cognition, Situation Awareness, Decision Making

2. **Cooperative Navigation**
   - Communicate with Ship to Ship, Ship to Shore
   - Vessel Traffic Service

3. **Team work, Leadership, Culture**
Thank you!