Training and its Assessment on Mariner's Techniques Utilizing Ship-handling Simulator

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• seamen's training, safety evaluation of ship maneuvering
• ship maneuverability.

Education:
• Tokyo University of Mercantile Marine
• Osaka University
• Hiroshima University
Outline of Presentation

1. Human Factor on Ship Handling
   • Necessary Condition of Safe Navigation

2. Method of MET (Maritime Education and Training) based on Necessary Condition of Safe Navigation
   • Definition of Maritime Techniques
   • Method of Rational MET
   • Assessment of Mariner’s Competency
   • Combination of Different Training Methods
Grade of License

<table>
<thead>
<tr>
<th>Grade of License</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Master</td>
</tr>
<tr>
<td>2 Chief Mate</td>
</tr>
<tr>
<td>3 2\textsuperscript{nd} Mate</td>
</tr>
</tbody>
</table>

IMO: the International Maritime Organization is the United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine pollution by ships.
The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (or STCW), 1978 sets qualification standards for masters, officers and watch personnel on seagoing merchant ships.
Chapter 1
Human Factor on Ship Handling

• Necessary Condition of Safe Navigation from viewpoint of the relation between necessity level of mariner’s competency necessity condition of navigational environment

• Accident Occurrences and its Condition
The probability of the degree of ship-handling difficulty

- Maneuvering characteristics of own vessel
- Water area for navigation
- Weather and sea state
- Traffic condition (kinds of traffic vessels and the density)
- Rule of road
The probability of the degree of human competency

- Mariner’s license rank
- Experiences
- Fatigues (relating to the elapsed time of standing watch)
- Tension (relating to the time of watch)
## The awareness level of the brain

<table>
<thead>
<tr>
<th>Phase</th>
<th>Awareness</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>unconscious, sleep</td>
</tr>
<tr>
<td>I</td>
<td>careless, drunken</td>
</tr>
<tr>
<td>II</td>
<td>normal, relax</td>
</tr>
<tr>
<td>III</td>
<td>normal, active</td>
</tr>
<tr>
<td>IV</td>
<td>panic</td>
</tr>
</tbody>
</table>
The probability of the degree of human competency

- Mariner’s license rank
- Experiences
- Fatigues (relating to the elapsed time of standing watch)
- Tension (relating to the time of watch)
The navigational safety defined by both condition of human competency and required competency by navigational environment
The fluctuation of safety degree relating to the probability of human competency and required competency

Required competency caused by navigational environment
Summary of Chapter 1

- The safety degree of navigation can be discussed based on the relation between the mariner’s competency and the necessary competency required by navigational environment.
Chapter 2
Method of MET based on Necessary Condition of Safe Navigation

1. Definition of Maritime Techniques
2. Method of Rational MET
3. Assessment of Mariner’s Competency
4. Combination of Different Training Methods
Method of MET based on Necessary Condition of Safe Navigation

1. Decision of Training Techniques
2. Development of Training Syllabus
3. Necessary Function of Simulator
4. Briefing Methods
5. Training Period
(1) Decision of Training Techniques

Following issues should be discussed
- Necessary techniques for safe navigation
  Elemental Techniques Development
  STCW and mariner’s expertise
- Function of simulator
- Time capacity of training
Definition of Maritime Techniques
Competence: Positioning

- Knowledge, Understanding and Proficiency: Position determination in all condition

- Criteria for evaluating competency: The primary method chosen for fixing the ship’s position is the most appropriate to the prevailing circumstances and condition. The obtained fix is within accepted accuracy level and the accuracy of resulting fix is properly assessed.
**STCW Requirement & Training Situation**

(StCW)
- Maneuvering Condition(1) competence -A, competence -B,
- Maneuvering Condition(2) competence -A, competence -C, •
- Maneuvering Condition(3) competence -A, competence -D, •
- Maneuvering Condition(N) competence -F, competence -G, •

(Training)
- Maneuvering Condition(I) competence -A, competence -B
- Maneuvering Condition(II) competence -B, competence -E
- Maneuvering Condition(III) competence -A, competence -C
- Maneuvering Condition(IV) competence -C, competence -D

STCW Required Training Condition

Training Center

Training Capacity
1. What techniques the instructor should train.
2. How to train the techniques.
3. How to assess the trainee's competency
STCW

Maneuvering Condition (1) = skill(A, B, C, ⋯, ⋯)
Maneuvering Condition (2) = skill(A, ⋯, C, D, ⋯)
Maneuvering Condition (3) = skill(A, B, ⋯, D, ⋯)

⋮

Maneuvering Condition (N) = skill(⋯, ⋯, ⋯, F, G,)

M. Condition (1)  M. Condition (2)  M. Condition (3)

skill A  skill B  skill C  skill D

⋮

⋮

⋮

⋮

Necessary Technique 1

⋮

⋮

Necessary Technique 9

|||

9 Elemental Techniques
9 Elemental Techniques Development

1. **Planning**
   The technique to gather information concerning the navigational environment conditions and to make an operational plan and a navigational plan.

2. **Rule of Road**
   The technique to navigate according to the International Regulations for Preventing Collision at Sea etc.

3. **Positioning**
   The technique to find the position of own ship by selecting and recognizing proper objects by visual observation, radar etc. To understand her position and motion.

4. **Lookout**
   The technique to identify and recognize moving targets and fixed targets and to gather information of the direction, distance and speed and to estimate the future situation of the targets.

5. **Maneuvering**
   The technique to control her course, speed and ship’s position by steering rudder and controlling main engine etc.

6. **Communication**
   The technique to exchange information among member in bridge and inside and/or outside of the ship.

7. **Instrument Manipulation**
   The technique to properly utilize instruments for lookout positioning, maneuvering, etc.

8. **Emergency**
   The technique to cope with malfunction of the main engine and the steering system, etc. and to execute the rescue activity properly.

8. **Management**
   The technique to make good use of member’s competency and to raise the bridge team’s performance and manage the necessary techniques.
(Advanced Training System)

Maneuvering Condition (Ⅰ) = skill(E.T(1), E.T(2), E.T(3), E.T(4))
Maneuvering Condition (Ⅱ) = skill(E.T(5), E.T(6), E.T(7))
Maneuvering Condition (Ⅲ) = skill(E.T(8), E.T(9), E.T(2), E.T(3))
Maneuvering Condition (Ⅳ) = skill(E.T(1), E.T(2), E.T(3), E.T(6))
Summary of Chapter 2-1

1. 9 elemental techniques are defined as necessary techniques for achieving safe navigation
Method of MET based on Necessary Condition of Safe Navigation

1. Decision of Training Techniques
2. Necessary Function of Simulator
3. Development of Training Syllabus
4. Briefing Methods
5. Training Period
The meaning of training

Condition

Mariner's behavior

<Training>

Mariner's behavior

Mariner having sufficient competency

Mariner not having sufficient competency

Wide variation

Distribution of behavior

0 0
Condition x0 X

Y

Y

y0 x0

Mariner's behavior

Wide variation

Distribution of behavior

0 0
Condition x0 X

Y

Y

y0 x0

Mariner's behavior

Wide variation

Distribution of behavior

0 0
Condition x0 X

Y

Y

y0 x0

Mariner's behavior
The meaning of training reappearance in simulator

Condition shown by insufficient reappearance

Mariner’s behavior

Mariner having sufficient competency

The training items should be decided based on simulator function. The relation is very important when we decide the training skill.
Method of MET based on Necessary Condition of Safe Navigation

1. Decision of Training Techniques
2. Necessary Function of Simulator
3. Development of Training Syllabus
4. Briefing Methods
5. Training Period
(3) Development of Training Syllabus

1. Development of Handling Guideline
2. Development of Training Scenarios
3. Development of Assessment System
Development of Training Syllabus

1. Development of Handling Guideline
   - to define the necessary action
   - to explain concretely
   - to explain clearly

2. Development of Training Scenarios

3. Development of Assessment System
# Handling Guideline

## Maneuvering and Management

<table>
<thead>
<tr>
<th>E/Technique</th>
<th>Guidelines to Maneuver</th>
<th>Rank</th>
</tr>
</thead>
</table>
| Maneuvering | • Turning rate for altering course less than 5deg/min except in case of avoiding dangerous situation.  
• Deviation from charted course line less than 0.3mile.  
• To control ship based on understanding maneuvering ability and circumstances. | Master  
C/O  
2/O |
| Management  | • To reduce ship speed as planned (see an example of speed-reducing plan).  
• Ship speed at pilot station less than 6k fts and to keep ship posture.  
• To anchor inside 1/2L circle centering around planned anchorage. | Master  
C/O  
2/O |
| Management  | • To understand the navigational plan and shared duties before the training start.  
• To keep communication with other bridge members, ships and VTS etc.  
• To confirm whether the ship course and rudder angle is in order. | Master  
C/O  
2/O |
| Management  | • To put each crew in charge of the task from viewpoint of each ability.  
• To reply to the reports suitably and direct each crew to show their ability. | Master |
(2) Development of Training Syllabus

1. Development of Handling Guideline
2. Development of Training Scenarios
   - Scenario Length
   - Training Techniques in Scenario
   - Arrangement of Training Techniques in Scenario
   - Consideration of assessment
3. Development of Assessment System
Development of Training Scenarios

- Scenario length
  - The length means the training time. In case of training for student, proper length of one training is 45min to 1hour. Because initial stage of professional training, it is important for student to carry out necessary behavior for specific situation. Training longer than 1hour make them fatigue. Proper time to keep their tension is mentioned above.

- Training techniques
  - We have to decide the training techniques before making training scenarios. It is no good to contain too many training techniques in one training scenario. It is important for student to execute each necessary technique exactly. If they have to execute many techniques in short period, their behavior will be confused and insufficient. The objectives of training for students are to enhance them to realize their knowledge in real situation.
Development of Training Scenarios

-The distribution of each event

- When we assume that one training scenario is 45min., the tasks in one scenario are 5 to 7 are proper number. In this case, each task requires to carry out some techniques. Tasks mean the handling situation that are positioning, avoiding collision, altering course and so on.

-Consideration for assessment

- The objectives of training are to bring up trainee's competency. Therefore, instructor has to recognize the improvement of their competency. The action to recognize them is assessment on trainee's behavior. So when we design the training scenarios, we have to consider how to assess their competency. It is necessary consideration them to assess the competency easily the we make scenarios.
(2) Development of Training Syllabus

1. Development of Handling Guideline
2. Development of Training Scenarios
3. Development of Assessment System

The characteristics of the assessment system are shown:
1) The items of assessment are clarified.
2) The standards of ship-handling technique are concretely.
3) The assessing items are designated along the process of scenario
# The List of Assessment Sheet

<table>
<thead>
<tr>
<th>Task</th>
<th>Elemental Technique</th>
<th>Points of Assessment</th>
<th>+1</th>
<th>0</th>
<th>−1</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collision avoidance</td>
<td>Lookout  Understanding other ships action and checking the risk of collision</td>
<td>Ship #7 dist&gt;5' 5'~3' 3'&gt;dist</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ship #8 dist&gt;5' 5'~3' 3'&gt;dist</td>
<td></td>
<td></td>
<td></td>
<td>+1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ship #6 dist&gt;5' 5'~3' 3'&gt;dist</td>
<td></td>
<td></td>
<td></td>
<td>−1</td>
</tr>
<tr>
<td>Rule of Road</td>
<td>Understanding the navigation between plural ships</td>
<td>Ship #7&amp;8 Attained - Missed</td>
<td></td>
<td></td>
<td></td>
<td>+1</td>
</tr>
<tr>
<td>Maneuvering</td>
<td>Maneuvering based on the guideline</td>
<td>Ship #7 Attained - Missed</td>
<td></td>
<td></td>
<td></td>
<td>−1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ship #8 Attained - Missed</td>
<td></td>
<td></td>
<td></td>
<td>+1</td>
</tr>
<tr>
<td>Pilot station</td>
<td>Maneuvering/ Planning  Deference between ETA and arrival time</td>
<td>5min&gt; 5~10 &gt;10min</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Ship speed at pilot station</td>
<td>6k'/ts&gt; - &gt;6k'/ts</td>
<td></td>
<td></td>
<td></td>
<td>+1</td>
</tr>
<tr>
<td>Management</td>
<td>Keeping appropriate motion</td>
<td>Attained Lack Missed</td>
<td></td>
<td></td>
<td></td>
<td>−1</td>
</tr>
<tr>
<td></td>
<td>Understanding the navigation plan and shared duties at the Briefing</td>
<td>Attained Lack Missed</td>
<td></td>
<td></td>
<td></td>
<td>−1</td>
</tr>
<tr>
<td></td>
<td>Directing contents of duties and supervising them</td>
<td>Attained Lack Missed</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Management</td>
<td>Keeping communication and cooperate with members in bridge</td>
<td>Attained Lack Missed</td>
<td></td>
<td></td>
<td></td>
<td>+1</td>
</tr>
</tbody>
</table>
Summary of Assessment

The peculiarity of the proposed Assess system are as follows;

1. The assessing items are concrete and correspond to the elemental techniques
2. The assessment are objectively and quantitatively.
3. The trainee’s competency can be described as numerical value.
4. The changes of trainee’s competency are also described as the change of scores.
Method of MET based on Necessary Condition of Safe Navigation

1. Decision of Training Techniques
2. Necessary Function of Simulator
3. Development of Training Syllabus
4. Briefing Methods
5. Training Period
   1) Learning Process
   2) Passing mark
   3) Combination of Different Training Methods
Learning Process of Onboard Training and Simulator Training

**ONBOARD TRAINING**

- **Training Process (month)**
- **Competency level (%)**
- **Estimation**
- **Obs.Value**

**SIMULATOR TRAINING**

- **Training Process (times)**
- **Competency level (%)**
- **Estimation**
- **Obs.Value**
The characteristics of learning process for ship handling techniques are described as following

\[ A(n) = 1 - (1 - a(n)) \exp\left(- \frac{x}{T(n)}\right) \]  

(1)

where

- \( A \): the competency level of the technique,
- \( n \): variable indicating the kind of technique to be trained,
- \( a \): initial competency at the beginning of training,
- \( T \): time constant indicating the speed of learning process,
- \( x \): proceeding time for learning
Learning Process of Simulator Training -Cadet-

Scenario 4 (TOTAL)

Competency level (%) vs. Training Process (times)

- Cadet: A
- Cadet: B
- Ave.
Summary of Learning Process

1. The assessing items are clarified and based on the training objectives in guideline.

2. By the results of assessing the competency accurately, trainee’s competency can be shown in quantitatively.

3. The characteristics of learning process can be estimated by proposed formula.
2) Passing mark

- We cannot find the quantitative passing mark in STCW code.
- We have to decide them by ourselves.
Learning process of each technique

Scenario 1–10A

- Planning
- Positioning
- Maneuvering
- Positioning/Plan.
- Planning/Man.
- Management
- TOTAL

Competency level (%) vs. Training Process (times)
## Example of essential competency level for each scenario

<table>
<thead>
<tr>
<th>Scenario 10 (class 1)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Techniques</td>
<td>Competency level (%)</td>
<td>Planning</td>
<td>99.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Positioning</td>
<td>83.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maneuvering</td>
<td>62.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Positioning &amp; Planning</td>
<td>83.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Planning &amp; maneuvering</td>
<td>98.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Positioning &amp; maneuvering</td>
<td>99.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Positioning, Planning &amp; maneuvering</td>
<td>77.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Management</td>
<td>99.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>88.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 5 (class 2)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Techniques</td>
<td>Competency level (%)</td>
<td>Communication</td>
<td>99.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maneuvering</td>
<td>85.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maneuvering &amp; Communication</td>
<td>66.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rule of Road</td>
<td>99.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rule of Road &amp; Communication</td>
<td>98.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>90.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 4 (class 3)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Techniques</td>
<td>Competency level (%)</td>
<td>Watch keeping</td>
<td>99.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rule of Road</td>
<td>97.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maneuvering</td>
<td>98.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Watch keeping &amp; Maneuvering</td>
<td>98.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Communication</td>
<td>99.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Positioning</td>
<td>99.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Planning</td>
<td>98.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>98.8</td>
</tr>
</tbody>
</table>
The Estimation of necessary training times corresponding to required competency

PM: Passing Mark

<table>
<thead>
<tr>
<th>Training Process (times)</th>
<th>Competency Rank (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maneuvering &amp; Planning</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>2.2 times</td>
</tr>
<tr>
<td>9</td>
<td>18.0 times</td>
</tr>
<tr>
<td>13</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

P.M 87.5
P.M 83.8
Combination of Different Training Methods
The relation between the training periods onboard and training periods in simulator

Simulator Training

Training on Board

\[ k: \text{conversion ratio of the training periods in simulator to one onboard} \]

\[ k = \frac{t_{all}}{\tau_{all}} \]

The training periods in simulator that correspond to the period onboard can be estimated by following formula;

\[ t_{sim} = k \times \tau_{ship} \]
## Conversion Ratio for each License Rank

<table>
<thead>
<tr>
<th>Rank of License</th>
<th>Required Onboard Training</th>
<th>Required Simulator Training</th>
<th>Conversion Ratio ($1/k$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd Mate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chief Mate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Master</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The conversion ratio between the training on board and training in simulator using training system proposed by TUMSAT.

If different training system are used, the conversion ratio will be changed.
Conclusion

(1) We have to clarify the necessary techniques for achievement of safe navigation. The concept of elemental technique development is necessary concept for confirmation of them.

(2) The development of training system using simulator is explained including the development of guideline for ship handling, the method of design on training scenarios, the development of assessment sheet.

(3) The abstract of the way on decision of passing marks and the estimation of necessary training periods are explained.
References

1. Hiroaki KOBAYASHI: Simulator Training and Assessment Utilizing Ship Handling, 1998, INSLC 10
9 Elemental Techniques

1. Planning
2. Rule of Road
3. Positioning
4. Lookout
5. Maneuvering
6. Communication
7. Instrument Manipulations
8. Emergency Treatments
9. Management
## Planning

<table>
<thead>
<tr>
<th>Definition</th>
<th>The technique to gather information concerning the navigational environment conditions and to make an operational plan and a navigational plan</th>
</tr>
</thead>
</table>
| Main Functions | (1) To understand the item of necessary information  
(2) To understand the way to use  
(3) To apply the information on the plan  
(4) Change in the plan (The relation between the current condition and the original plan) |
| Relating Factor | (1) Rule and Regulation  
(2) Useful Information (Recommendation)  
(3) Basic Information (Weather and sea, Geographic and water area, Navigation Information)  
(4) Navigational area (Ocean Navigation, Coastal Navigation, Harbor Navigation, Other area, River)  
(5) Navigation Objectives (Anchoring, Berthing Jetty) |
## Rule of Road

<table>
<thead>
<tr>
<th>Definition</th>
<th>The technique to navigate according to the International Regulations for Preventing Collision at Sea etc</th>
</tr>
</thead>
</table>
| Main Functions | (1) To understand the rule  
(2) To apply the rule |
| Relating Factor | (1) Kinds of rule  
(2) Other Traffic vessels  
(3) The condition where the rule apply (Sea area, Weather) |
# Positioning

<table>
<thead>
<tr>
<th>Definition</th>
<th>The technique to find the position of own ship by selecting and recognizing proper objects by visual observation, radar etc. To understand her position and motion</th>
</tr>
</thead>
</table>
| Main Functions | (1) Choice of the methods to get the information for making positioning (Choice of instruments, Choice of objects for making positioning)  
(2) Estimation of position (Accuracy, Frequency)  
(3) Recognition of her motion (Moving direction, Moving velocity, Rate of turn) |
| Relating Factor | (1) Navigation Instrument (Radar, GPS, Echo sounder)  
(2) Condition of Navigational Environment  
(3) Visibility  
(4) Disturbance |
## Lookout

<table>
<thead>
<tr>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition</strong></td>
</tr>
<tr>
<td><strong>Main Functions</strong></td>
</tr>
<tr>
<td>(1) Recognition of Present Situation [Kinds of Target, Motion of Target (Position, Heading, Speed)]</td>
</tr>
<tr>
<td>(2) Estimation of Future Situation [Motion (Position, Heading, Speed), Change of Motion (Position, Heading, Speed), Interaction (CPA, TCPA, Passing distance on her H/S line)]</td>
</tr>
<tr>
<td><strong>Relating Factor</strong></td>
</tr>
<tr>
<td>(1) Navigation Instruments (Radar, Radar/ARPA, AIS, VTIS)</td>
</tr>
<tr>
<td>(2) Visibility</td>
</tr>
<tr>
<td>(3) Density of Maritime Traffic</td>
</tr>
<tr>
<td>(4) Traffic condition (Traffic rule)</td>
</tr>
</tbody>
</table>
## Maneuvering

<table>
<thead>
<tr>
<th><strong>Contents</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition</strong></td>
</tr>
</tbody>
</table>
| **Main Functions** | (1) Measurement of Motion  
(2) Decision of Steering Devices (Rudder, Engine, side thruster, Tug boat, Anchor, Mooring line)  
(3) Decision of steering quantity (Single operation, Plural Operation) |
| **Relating Factor** | (1) Maneuvering condition (Course Keeping, Position control, Speed control, Berthing)  
(2) Control devices (Rudder, Engine, side thruster, Tug boat, Anchor, Mooring line)  
(3) External disturbance (Wind, Current, depth of water, Ship interaction) |
## Communication

<table>
<thead>
<tr>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition</strong></td>
</tr>
</tbody>
</table>
| **Main Functions** | (1) Communication ways  
(2) Timing of communication  
(3) Language |
| **Relating Factor** | (1) Communication Target (Report to VTS, Information exchange between vessels, Information exchange in bridge and in vessel)  
(2) Communication Situation (Emergency, Regularly) |
## Instrument Manipulations

<table>
<thead>
<tr>
<th>Definition</th>
<th>The technique to properly utilize instruments for lookout positioning, maneuvering, etc.</th>
</tr>
</thead>
</table>
| Main Functions | (1) To have knowledge to utilize the instruments  
(2) To understand the characteristics of the information  
(3) To understand the way to use the information |
| Relating Factor | (1) Kinds of Instruments  
(2) Using objectives of information |
# Emergency Treatments

<table>
<thead>
<tr>
<th>Definition</th>
<th>The technique to cope with malfunction of the main engine and the steering system, etc. and to execute the rescue activity properly</th>
</tr>
</thead>
</table>
| Main Functions | (1) Recognition of the part of trouble  
(2) To understand the way to repair the trouble  
(3) To understand the necessary relating task |
| Relating Factor | (1) Kinds of troubles (Hull, Cargo, Main Eng., Steering Mechanism, Navigational Equipments, Cargo Handling System, etc.)  
(2) Traffic surrounding  
(3) Weather condition |
# Management

## Contents

<table>
<thead>
<tr>
<th>Definition</th>
<th>The technique to make good use of member’s competency and to raise the bridge team’s performance and manage the necessary techniques</th>
</tr>
</thead>
</table>
| Main Functions | (1) To understand the kinds of management (Bridge Team Management, Information management)  
(2) To understand the way of management  
(3) To execute management  
(4) To evaluate the function  
(5) To evaluate the competency |
| Relating Factor | (1) Target of management |
9 Elemental Techniques

- Planning
- Lookout
- Positioning
- Communication
- Maneuvering
- Management
- Emergency Treatment
- Instrument Manipulation
- Rule of Road
The Scenario for chief mate intending to promote master rank

- Current <256> 0.5k't
- Wind <076> 5.0m/s
- Own Ship Co. <076>
- Speed: 12k’t
# The List of Assessment Sheet

<table>
<thead>
<tr>
<th>No</th>
<th>Task</th>
<th>Elemental Technique</th>
<th>Contents of Assessment</th>
<th>Points</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>On recognition of the movement for plural ships (the distance when trainee recognized)</td>
<td></td>
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<tr>
<td>1</td>
<td>Lookout</td>
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<td>On recognition of the movement for plural ships (the distance when trainee recognized)</td>
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<tr>
<td>2</td>
<td>Recognizing for avoiding collision</td>
<td>Rule of road (1)</td>
<td>On recognition of relations for plural ships based on the traffic rule</td>
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<tr>
<td>3</td>
<td>Rule of road (2)</td>
<td></td>
<td>On recognition target ships (based on the traffic rule (interview))</td>
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### Points and Score

<table>
<thead>
<tr>
<th>Points</th>
<th>Score</th>
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<tr>
<td>1</td>
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<tr>
<td>0</td>
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<tr>
<td>-1</td>
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<table>
<thead>
<tr>
<th>1st</th>
<th>5th</th>
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<tbody>
<tr>
<td>100%</td>
<td>100%</td>
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</tbody>
</table>

**Score Details**

- **Ship 8**:
  - dist > 5'
  - 5' - 3'
  - 3' > dist
  - Points: 1
  - Score: 1

- **Ship 9**:
  - dist > 5'
  - 5' - 3'
  - 3' > dist
  - Points: 1
  - Score: 1

- **Ship 10**:
  - dist > 5'
  - 5' - 3'
  - 3' > dist
  - Points: 1
  - Score: 1

- **Ship 11**:
  - dist > 5'
  - 5' - 3'
  - 3' > dist
  - Points: 1
  - Score: 1

- **Ship 12**:
  - dist > 5'
  - 5' - 3'
  - 3' > dist
  - Points: 1
  - Score: 1

- **Ship 13**:
  - dist > 5'
  - 5' - 3'
  - 3' > dist
  - Points: 1
  - Score: 1

**Lookout**

- **Ship 8**: attained - missed
  - Points: 1
  - Score: 1

- **Ship 9**: attained - missed
  - Points: 1
  - Score: 1

- **Ship 10**: attained - missed
  - Points: 1
  - Score: 1

- **Ship 11**: attained - missed
  - Points: 1
  - Score: 1

- **Ship 12**: attained - missed
  - Points: 1
  - Score: 1

- **Ship 13**: attained - missed
  - Points: 1
  - Score: 1

**Rule of road (2)**

- **Ship 8**: attained - missed
  - Points: 1
  - Score: 1

- **Ship 9**: attained - missed
  - Points: 1
  - Score: 1

- **Ship 10**: attained - missed
  - Points: 1
  - Score: 1

- **Ship 11**: attained - missed
  - Points: 1
  - Score: 1

- **Ship 12**: attained - missed
  - Points: 1
  - Score: 1

- **Ship 13**: attained - missed
  - Points: 1
  - Score: 1

**Rules**

1. Rule of road (1)
2. Rule of road (2)
<table>
<thead>
<tr>
<th>No</th>
<th>Task</th>
<th>Elemental Technique</th>
<th>Contents of Assessment</th>
<th>Points</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Maneuvering for avoiding plural ships based on the guideline (DCPA)</td>
<td>Maneuvering (1)</td>
<td>On manoeuvring for avoiding plural ships based on the guideline (DCPA)</td>
<td>Ship 8: dist&gt;5’ 5’-3’ 3’&gt;dist 1 1</td>
<td>100% 67%</td>
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<tr>
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<td>Ship 9: dist&gt;5’ 5’-3’ 3’&gt;dist 1 0</td>
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<td></td>
<td>Ship 10: dist&gt;5’ 5’-3’ 3’&gt;dist 1 1</td>
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<tr>
<td>5</td>
<td>Maneuvering for avoiding on traffic vessel</td>
<td>Management (1)</td>
<td>On maneuvering for avoiding target ship based on the traffic rule (interview and replay)</td>
<td>attained - missed 1 1</td>
<td>100% 100%</td>
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<tr>
<td>6</td>
<td>Maneuvering (2)</td>
<td>On decision of the timing for avoiding target ship (distance when trainee practiced)</td>
<td>dist&gt;3’ 3’-1’ 1’&gt;dist 1 1</td>
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<tr>
<td></td>
<td></td>
<td>On decision of maneuvering for avoiding target ship (interview and replay)</td>
<td>attained - missed 1 1</td>
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</tbody>
</table>

65
<table>
<thead>
<tr>
<th>No</th>
<th>Task</th>
<th>Elemental Technique</th>
<th>Contents of Assessment</th>
<th>Points</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Handling for heading to pilot station and accomplishment</td>
<td>Planning (1)</td>
<td>On planning of the course for heading to pilot station considering wind and current (interview and chart)</td>
<td>attained</td>
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<td>On planning of maneuvering for heading to pilot station considering wind and current (interview and chart)</td>
<td>lacked</td>
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<td></td>
<td>On maneuvering for picking up pilot at pilot station (interview and trajectory)</td>
<td>attained</td>
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<td></td>
<td>On maneuvering for entering port at pilot station (interview and trajectory)</td>
<td>lacked</td>
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<td>Maneuvering (4)</td>
<td>missed</td>
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<tr>
<td>8</td>
<td>Maneuvering for picking up pilot and entering port</td>
<td>Maneuvering (3)</td>
<td>On maneuvering for heading to pilot station considering a margin of error and accomplishment for reported ETA and designated ship’s speed at pilot station</td>
<td>diff&lt;5m ETA</td>
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<td>diff&gt;10 ETA</td>
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<td>below 6k’t at P.S</td>
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<td>6-7k’t at P.S</td>
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<td>over 7k’t at P.S</td>
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<tr>
<td>9</td>
<td>Planning</td>
<td>Planning (2)</td>
<td>On correction on the plan, maneuvering and procedure for heading to pilot station timely (interview and replay)</td>
<td>attained</td>
<td>0</td>
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<td>missed</td>
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<td>10</td>
<td>Maneuvering for picking up pilot and entering port</td>
<td>Maneuvering (4)</td>
<td>On maneuvering for picking up pilot at pilot station (interview and trajectory)</td>
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<td>On maneuvering for entering port at pilot station (interview and trajectory)</td>
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<td>Maneuvering Total(1)(2)</td>
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<td>Maneuvering Total(1)(2)</td>
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<td>Task</td>
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<td></td>
<td>Management in navigation</td>
<td>Management (2)</td>
<td><strong>On explanation of the plan and each task to all members</strong></td>
<td>attained</td>
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<td><strong>On command to all members timely</strong></td>
<td>attained</td>
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<td><strong>On confirmation of member’s performance</strong></td>
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<td><strong>On communication with all members</strong></td>
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<td><strong>On communication with target ship and VTS (interview and video)</strong></td>
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<td>Total</td>
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Total: 54% 93%
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<thead>
<tr>
<th>Required mariner’s function</th>
<th>Relating simulation function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recognition of target vessel</td>
<td>(1) Visual information&lt;br&gt;Visible range (field of view), Resolution, Color, Accuracy of image&lt;br&gt;(2) Instrumental information&lt;br&gt;Radar / ARPA, Communication system</td>
</tr>
<tr>
<td>Estimation of future situation</td>
<td>(1) Visual information&lt;br&gt;Same as above&lt;br&gt;(2) Instrumental information&lt;br&gt;Same as above&lt;br&gt;(3) Ship’s motion&lt;br&gt;Own ship, Target vessel</td>
</tr>
<tr>
<td>Handling for collision avoiding</td>
<td>(1) Visual information&lt;br&gt;Same as above&lt;br&gt;(2) Instrumental information&lt;br&gt;Same as above&lt;br&gt;(3) Ship’s motion&lt;br&gt;Own ship, Target vessel, Compass, Rate of turn&lt;br&gt;(4) Handling apparatus</td>
</tr>
<tr>
<td>Evaluation on executed action</td>
<td>(1) Visual information&lt;br&gt;Same as above&lt;br&gt;(2) Instrumental information&lt;br&gt;Same as above</td>
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</tbody>
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Relating simulator function’s for navigation in restricted condition (narrow waterway with disturbance)
Full Mission
Ship-handling Simulator
Briefing Room

Monitoring system 1

Monitoring system 2
Monitoring system 1
Monitoring system 2

Binoculars

Radar for Instructor

ECDIS for Instructor