


Application form for research projects in FY2014 (Form for Optional Theme 4)

Theme (to be related to the objectives and goals of IAMU, Basic Agreement Article II and III)	
Theme 4: Human Element Keys: Simulator Training, Common/Individual Skill, Team Work & Mental Workload Goal: To develop a method of simulator-based training using physiological index. To read a characteristics of a navigator's common/individual skills. To evaluate a team work and their mental workload for ship handling.	
Research title (a concise sub-title is available if needed)	
Evaluation of Bridge Teammates' Mental Workload for simulator-based training Using Physiological Indices	
Research coordinator	
Name and position: Tadatsugi Okazaki, Professor Specializations: Navigation, Control Engineering, Human Factor Member University: Tokyo University of Marine Science and Technology Post Address: 2-1-6, Etchujima, Koto-ku, Tokyo, 135-8533 JAPAN Phone, Fax and e-mail: (Phone): +81 -3 -5245 -7377 (Fax) : +81 -3 -5245 -7377 (E-mail) : okazaki@kaiyodai.ac.jp	
The representative of the IAMU member institution (President/Rector/Dean)	
Name in print IWASAKA Naoto, Ph.D. Phone, Fax and e-mail: (Phone) : +81 -3 -5245 -7301 (Fax) : +81 -3 -5245 -7301 (E-mail) : iwasaka@kaiyodai.ac.jp	Signature 
Date and place	28th April 2014 in Tokyo.

<p>Theme (to be related to the objectives and goals of IAMU, Basic Agreement II and III)</p>
<p>Theme 4: Human Element</p>
<p>Possible key concepts to be structured and explored within the theme (Similar format shown in the guideline)</p>
<p>Simulator Training, Common/Individual Skill, Team Work & Mental Workload</p>
<p>Desirable goals (Similar format shown in the guideline)</p>
<p>To develop a method of simulator-based training using physiological index. To read a characteristics of a navigator's common/individual skills. To evaluate a team work and their mental workload for ship handling.</p>
<p>Research title (a concise sub-title is available if needed)</p>
<p>Evaluation of Bridge Teammates' Mental Workload for simulator-based training Using Physiological Indices</p>
<p>Research objectives (describe the relationship with the desirable goals in about 300 words)</p>
<p>Physiological indices, heart rate variability (R-R interval), salivary amylase/nitric acid, and facial (nasal) temperature, are sufficient to evaluate the mental workload of a ship bridge teammate: a captain, a duty officer, a helmsman and a pilot. The safe navigation keeps with bridge team work, and it is not only a duty officer. From this point, we need to evaluate bridge teammates together for understanding their mental workload. The evaluation of bridge teammates had been tried using heart rate variability with the collaboration of KOBE and Maine Maritime Academy in 2004. However, it is not using facial temperature and saliva yet. Each physiological index has unique characteristics, so if we use multi physiological indices we could improve the accuracy of evaluating their mental workload. In this project, we attempt to evaluate the bridge teammates' mental workload using facial temperature, heart rate variability and saliva together, and we read their characteristics of mental workload for the ship handling.</p> <p>Also, we use a performance assessment for evaluating simulator-based training results. Time series of their performance indices and time series of their mental workload are compared to evaluate their skill in this research. This research is one of proposes to evaluate the bridge teamwork using the mental workload, and we will be able to get a common and individual skill from the related to their change of mental workloads. Moreover, if we can read the mental performance as a decision-making for the ship handling, it is a new measure of simulator training, and a trainee can show as the training results. The students get understanding well of the reviews.</p>

Description of work (possibly broken down into tasks, and role of partners in about 500 words)

This project consists of 3 Steps to achieve the goal: Evaluation of Bridge Teammates' Mental Workload for simulator-based training Using Physiological Indices (Heart rate variability, Facial temperature, Saliva). The project group is 3 Universities: KOBE, CMA, TOKYO. For this research, each university has special knowledge as follows,

- KOBE: Method for evaluating seafarers' mental workload using heart rate variability, saliva, facial temperature,
- CMA: Method of the simulator-based training evaluation depends on a performance assessment,
- TOKYO: Method for evaluating seafarers' performance index and system for measuring facial temperature using thermograph.

[3 steps to Goal]

Step 1: To make a Scenario- 2 per group (bridge team: Navigator and Helmsman)

Step 2: To measure 3 indices of mental workload and performance indices (simulator-based experiment) - all groups

Step 3: To evaluate bridge teammates' mental workload - all groups

[Measurement of 3 Indices]

1) Heart rate variability- we measure heart rate variability (R-R interval) with a tolerance of one millisecond. In the majority of R-R intervals, the accuracy is one millisecond as well, and 95 per cents confidence interval is better than plus/minus 3 milliseconds. The heart rate monitor consists of a chest belt (sensor) and a wrist watch (data memory).

2) Saliva- we measure Saliva Amylase Activity (SAA) and NO⁻. The monitor consists of a measurement part and a marker/a metal spoon. The subject puts the marker under their tongue for 30 seconds, the tester inserts it in the measurement part, and SAA value extracted by the measurement part for 30 seconds. The tester needs 1 minute for a measured value.

3) Facial temperature- we measure facial temperature at intervals of 1 second by thermography.

Deliverables (brief description in about 200 words)

This project contributes the evaluation of bridge teammates' mental workload. The currently method of the simulator-based training evaluation depends on a performance assessment, and it is only the subjective value for physical performance. The assessment for both of physical and mental performance is best for evaluating the training. We challenge the evaluation of bridge teammates' mental workload.

We plan to present this research result to Int. Conf. (IEEE SMC2014 and 2015 etc.), Journal, and Annual meeting of IAMU 2015 after the report. If Program committee of IAMU Conference allows, we hope to organize Special Session on our project.

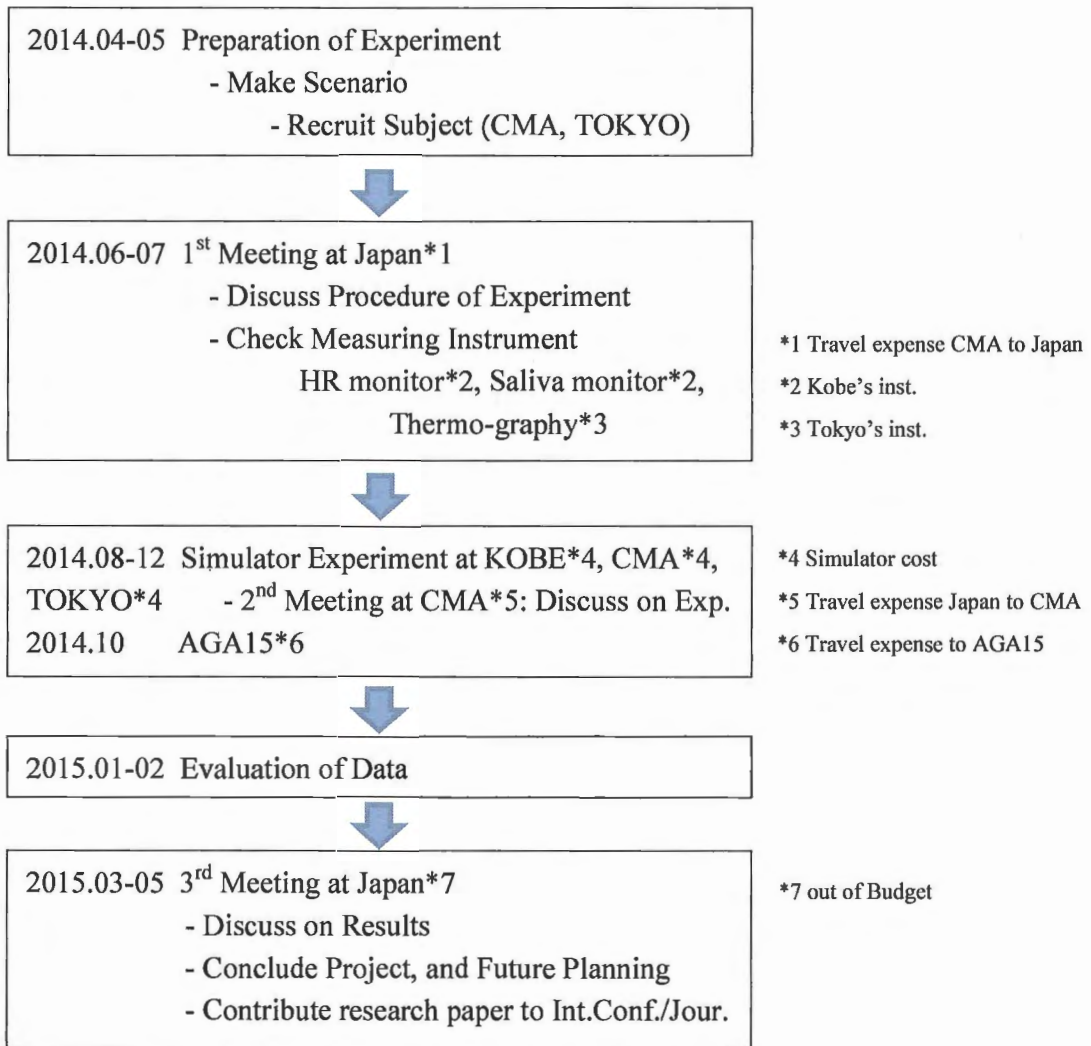
INTERNATIONAL ASSOCIATION OF MARITIME UNIVERSITIES

Research partners
<p>Name and position: Victor J. Schisler, Captain/Director of Professional Simulation</p> <p>Specializations: Training</p> <p>Affiliation: California Maritime Academy</p> <p>Responsible task(s): Simulator experiment</p> <p>Phone, Fax and e-mail: (Phone): 714 -292 -6467 (Fax): N/A (E-mail): VSchisler@csum.edu</p>
<p>Name and position: Koji Murai, Associate Professor</p> <p>Specializations: Navigation, Human Factor (<i>Kansei</i>)</p> <p>Affiliation: Kobe University</p> <p>Responsible task(s): Simulator experiment</p> <p>Phone, Fax and e-mail: (Phone): +81-78-431-6242 (Fax): +81-78-431-6242 (E-mail): murai@maritime.kobe-u.ac.jp</p>
<p>Name and position:</p> <p>Specializations:</p> <p>Affiliation:</p> <p>Responsible task(s):</p> <p>Phone, Fax and e-mail: (Phone): (Fax): (E-mail):</p>
<p>Name and position:</p> <p>Specializations:</p> <p>Affiliation:</p> <p>Responsible task(s):</p> <p>Phone, Fax and e-mail: (Phone): (Fax): (E-mail):</p>
<p>Name and position:</p> <p>Specializations:</p> <p>Affiliation:</p> <p>Responsible task(s):</p> <p>Phone, Fax and e-mail: (Phone): (Fax): (E-mail):</p>

Please extend this table if there are more than 5 partners to your project.

Research schedule (as per the attached Gantt Chart)

Research schedule chart:





Basis for calculation of Budget FY2014

(Unit:US\$)

Research Title	Evaluation of Bridge Teammates' Mental Workload for simulator-based training Using Physiological Indices		
Sub title (if any)			
Amount	Basis for calculation		Amount by Item
US\$23,200)	1) Air Travel Expenses		
	<i>JPN-CMA</i> 4prof., 2students	\$2,000 × 6 Ps × 1 Times	= \$12,000
	<i>CMA-JPN</i> 2prof., 2students	\$2,300 × 4 Ps × 1 Times	= \$9,200
	<i>AGA15</i> 1prof.	\$2,000 × 1 Ps × 1 Times	= \$2,000
US\$10,000)	2) Accommodation cost		
	<i>USA</i>	\$180 × 6 Ps × 5 Nights × 1 Times	= \$5,400
	<i>JPN</i>	\$200 × 4 Ps × 5 Nights × 1 Times	= \$4,000
	<i>AGA15</i>	\$200 × 1 Ps × 3 Nights × 1 Times	= \$600
US\$3,200)	3) Local Transportation cost etc.		
	<i>in USA</i>	\$50 × 6 Ps × 6 Days × 1 Times	= \$1,800
	<i>in JPN</i>	\$50 × 4 Ps × 6 Days × 1 Times	= \$1,200
	<i>AGA15</i>	\$50 × 1 Ps × 4 Days × 1 Times	= \$200
US\$3,000)	4) Personnel expenses: Salary cost for researcher, part-time employment etc (No more than 50% of Total Amount)		
	<i>CMA Subject</i>	\$100 × 15 Persons × 1 Months / Times	= \$1,500
	<i>CMA Prof.</i>	\$300 × 5 Persons × 1	= \$1,500
US\$20,600)	5) Research cost (Including costs for communication, Data, Meeting etc.)		
	<i>Simulator cost (CMA)</i>	\$7,000 × 1 Set × 1 Times	= \$7,000
	<i>Simulator cost (KOBE)</i>	\$12,000 × 1 Set × 1 Times	= \$12,000
	<i>Simulator cost (TOKYO)</i>	\$1,600 × 1 Set × 1 Times	= \$1,600
US\$0)	6) Miscellaneous (Consumables, Office supplies etc.)		
	<i>N/A</i>		
US\$60,000	Total Amount		

Note:

- 1 Consignment Contract :** The Contractor/Research Coordinator should achieve the tangible results within the contracted amount.
- 2 Payment condition :** A maximum 60% of the total budget amount will be paid upon receipt of the invoice from the contractor within thirty days following the completion of the contract. The remainder of the payment (40%) will be paid upon receipt of the invoice from the contractor on the premise that IAMU's IEB approves the results of the project.