CISMaRT

CANADIAN NETWORK FOR INNOVATIVE SHIPBUILDING, MARINE RESEARCH AND TRAINING | RÉSEAU CANADIEN POUR L'INNOVATION DANS LA CONSTRUCTION NAVALE, LA RECHERCHE MARINE ET LA FORMATION

Progress Report 3 on Development of CISMaRT

Workshop on Marine Education and Training – Findings and Recommendations

December 2017

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The Workshop on Marine Education and Training was financially sponsored by NSERC, ACOA and Memorial University.

Members of the workshop organizing committee are Dr. Wei Qiu (Chair), Prof. Jon Mikkelsen (Co-Chair), Dr. Neil Pegg, Brian McShane, Dan McGreer, Leonard Pecore and Dr. Roger Basu.

The preliminary report was prepared by Dr. Roger Basu who serves as a consultant of Memorial University and assists the development of the CISMaRT National Network.

Supported by

Highlights

- The report describes recent activity towards implementing the National Network CISMaRT (**C**anadian **I**nnovative **S**hipbuilding, **Ma**rine **R**esearch and **T**raining). The report summarizes the findings from the one-day workshop held at the Sheraton Ottawa Hotel in Ottawa on July 11, 2017.
- The Ottawa Workshop was the third workshop and built upon the outcomes from the first and second workshops held at the University of British Columbia (UBC) in Vancouver on July 6, 2016, and Memorial University (MUN) in St. John's on September 26, 2016. Many of the participants at the Ottawa Workshop also attended the UBC and the MUN Workshops.
- The focus of the Ottawa Workshop was marine technology-related education and training in Canada. The primary objective of the Workshop was to understand the current state of marine-related education and training, identify perceived weaknesses, and propose approaches and methods to improve the current state of marine-related education and training.
- The morning session of the Workshop was devoted to a few presentations including a brief summary of the outcome from the previous two workshops, and various perspectives on marine-related education and training in Canada and internationally.
- The presentations in the morning provided input for the two breakout sessions conducted in the afternoon, one on education and the other on training. Seven breakout teams considered a series of questions and general sessions were held after each of the breakout sessions where observations and recommendations were made by each breakout team.
- The information gathered was useful in understanding the stakeholder priorities in education and training, and will be used to formulate plans for CISMaRT to facilitate or lead efforts to improve the current state of marine-related education and training in Canada.
- A post-Workshop meeting was held by the Interim Board to formalize the input from the Workshop and the initial tasks for the next steps.

1 Introduction

The development of the National Network for Canadian Innovative Shipbuilding, Marine Research and Training (CISMaRT) was accomplished through three full-day workshops seeking the input of stakeholders in a systematic way. The first workshop was held at the University of British Columbia (UBC) in Vancouver on July 6, 2016 and the results were summarized in the first Progress Report[1]. A follow-on workshop building on the accomplishments of the first workshop was held at Memorial University of Newfoundland (MUN) in St. John's on September 26, 2016 and the findings were summarized in the second Progress Report[2].

The subject of this report is the outcomes of the third Workshop held in Ottawa on July 11, 2017. This Workshop was particularly focused on Education and Training. In the present context, ***education*** and ***training*** mean:

- Education – formal education received by naval architects, engineers, and technologists leading to degrees, diplomas and certificates.
- Training – other education received by naval architects, engineers and technologists. Typically this would include short courses, mid-career training etc.

[1] Progress Report - Development of the National Network for Innovative Shipbuilding, Marine Research and Training – iSMART, September 8, 2016.
[2] Progress Report 2 - Development of the Canadian Network for Innovative Shipbuilding, Marine Research and Training - CISMaRT, January 2017.

2 Overview of the Ottawa Workshop

The agenda for the Ottawa Workshop on Marine Education and Training is presented in Appendix A.

The overall objectives of the one-day workshop were to:

- To identify the key challenges and needs for the education and training of highly qualified personnel in engineering and technology areas related to Canada's marine sector.
- To develop strategies and innovative solutions to address the challenges and needs in marine education and training.

As with the UBC and MUN workshops, the participants were invited to be broadly representatives of the Canadian marine community and were drawn, in approximately equal numbers, from industry, academia and government.

The day was divided in two: the first half was devoted to several presentations and the second part focused on two brainstorming sessions. For most of the morning, speakers gave presentations on education and training subjects ranging from the general to the more specific. These presentations provided useful background and input for the afternoon breakout sessions.

The remainder of the day was taken up by two brainstorming sessions. The first session focused on key elements on education and the second on training pertaining to Canada's marine industry. These breakout sessions were designed to identify challenges, suggest strategies and possible solutions to address the challenges. This will be valuable for CISMaRT to develop a plan improving Canada's marine education and training.

2.1 Workshop Participants

The participants are listed in Appendix B. A significant proportion of the participants also attended both the UBC and MUN workshops. Note that about 35 people attended the UBC workshop, 45 attended the MUN workshop, and 55 attended the Ottawa workshop.

For the brainstorming teams participants were divided into seven teams each with 6-8 members. The breakout session teams are listed in Appendix C.

3 Key Findings From Ottawa Workshop

This section summarizes the key findings of the Ottawa Workshop. The findings are reported according to the recommendations, suggestions and thoughts expressed by the workshop participants. The morning session included a number of presentations by representatives of industry, government and academia. The key points made in these presentations are summarized below in Section 3.1. The presentations provided valuable background information for the afternoon discussions.

The afternoon was devoted to two breakout sessions and each session was followed by a general discussion in which each team presented their findings and recommendations. The approach for systematically eliciting the opinions of the participants was to pose a series of questions to the participants of the breakout sessions. These questions, presented in forms together with possible answers, are reproduced in Appendix D. Participants were encouraged to add their own questions and answers. The key points made by each breakout group and those that emerged in the general discussion are summarized below in Sections 3.1 and 3.2. No attempt has been made to be comprehensive. Nevertheless, the report summarizes both areas where a general consensus emerged but also areas in which there were divergent opinions.

3.1 Summary of Morning Session Presentations

Broadly there were three categories of presentation in the morning session:

- General – presentations designed to "set the scene". These presentations outlined the current status of marine-related education and training in Canada as well as current and future challenges.
- Industry and Government – presentations dealing with more specific aspects of education and training in the Canadian context. This included aspects of education and training in Canada that are considered satisfactory, the current and future needs for the marine-related workforce, and current and anticipated challenges.
- Funding Opportunities – an overview of government funding programs that are available for initiatives such as CISMaRT in general, and more specifically for advancing the education of Highly Qualified Personnel (HQP).

An summary of the presentations are given below.

3.1.1 General Presentations

The first presentation of the day provided an brief overview of CISMaRT and summarized the progress made so far. Current and future activities to be undertaken towards the goal of CISMaRT were summarized.

This was followed by an overview of education and training of marine-related high quality personnel in Canada and the associated current challenges. Possible strategies for addressing the challenges were also presented. The next presentation provided an overview of the marine colleges and some key statistics gathered by Canadian Association of Marine Training Institutes.

A broad overview of the international marine education and training sector was then provided. This included a discussion of the distinction between engineering and science, current perceptions of the quality of engineering education, current issues and future actions needed to address identified shortcomings.

3.1.2 Presentations on Industry and Government Perspectives

Industry and government perspectives were presented by a senior representative from VARD Marine and two senior representatives from two key government agencies – the Royal Canadian Navy (RCN) and the Canadian Coast Guard (CCG). In terms of government agencies, these two are the biggest employers of marine-related high quality personnel.

The industry presentation focused on the strengths and weaknesses of current naval architectural and marine engineering education in Canada and also summarized some of the challenges related to research funding, government policies and industry fragmentation. Among the strengths identified in graduates of Canadian universities and colleges are that they generally receive a good grounding in many relevant disciplines, and also gain real world experience through co-op programs.

The presentation from RCN outlined key initiatives ranging from major capital projects to maintenance activities, all of which require a skilled technical workforce. A number of technological areas, some routine and others more cutting edge were identified as important to RCN, both now and in the future. In some areas, Canada is considered strong and in other areas improvement is required. The challenges identified include the design of platforms for a 30-40 year life, dealing the rapid rate of technology improvement and its incorporation in the business of RCN, and also the key role of automation.

The next presentation from CCG provided an overview of the activities of the CCG, many of which involve marine-related highly qualified personnel. The activities include marine navigation, icebreaking, marine communications and traffic services, search and rescue, environmental response and maritime security. Extensive employment of technical personnel is anticipated now and in the near future. Concerns were expressed in regard to the competition for technical personnel that will be generated by major programs such as NSS. Some details were provided on the types of technical personnel needed. These range from the trades to professional staff. Other issues raised were readiness for staff to deal with newer technologies. In meeting these challenges, value was seen in partnering with industry, academia and other government departments.

Two lunchtime presentations were made by representatives from Natural Sciences and Engineering Research Council of Canada (NSERC). The first presentation provided an overview of NSERC focusing on the various programs. These programs fund scientific and technological research and also provide opportunities for hiring students to perform research in industrial settings. The second presentation provided an overview of NSERC's Collaborative Research and Training Experience (CREATE) Program. CREATE is designed to encourage collaborative approaches in undertaking scientific and technological research, and is also designed to facilitate the transition of new researchers into the Canadian workforce.

3.2 Findings From Breakout Session on Education

The questions considered in this breakout session are in the following categories:

- General
- Curriculum
- Practical Experience
- Casting the Net Wider

A summary of the response of the groups is given below. Additional comments made during the general sessions are also included.

3.2.1 General

The participants were mostly satisfied with the overall state of naval architectural and marine engineering education in Canada. The supply of naval architects and engineers was also considered to be generally satisfactory. The only area of concern expressed by several participants was the weakness in marine engineering education. One of the associated weaknesses was the lack of engineers with qualifications/experience in marine electrical and electronics engineering. This observation also applies to the dearth of senior technologists in this general technical area.

A recommendation was made that academia should engage with industry more to understand workforce needs better. It was also suggested that the oil and gas sector is better at attracting talent, mainly because of higher salaries, and related to this retention can sometimes be a problem. Shipyards are big employers and it was observed that they are not well represented in CISMaRT.

3.2.2 Curriculum

The primary demand in the coming decades for naval architects and engineers in Canada's marine sector will arise from the National Shipbuilding Strategy. In this regard it would be useful to understand better the needs of shipyards and those of other employers in this sector. It was noted that employers need to express their requirements better and similarly academia should be more proactive in understanding and responding to the needs of the

industry. A significant source of uncertainty was the Canadian Surface Combatant element of the NSS while other programs are proceeding more or less as planned. Among the strategies mentioned for dealing with any mismatch of supply and demand for personnel was to maximize flexibility of the workforce by cross-training engineers.

The participants were asked to consider how important it was for programs to address newer technologies as part of the curriculum. While these subjects were considered important, concern was expressed about being too specialized. This could lead to a lack of flexibility in employing engineers in certain sectors of the marine industry. It was noted that overly specialized engineers are vulnerable to variations in the market and furthermore they tend to lack flexibility in terms of what they can work on. Other observations made include the importance of including practical aspects of engineering in the curriculums. Again the shortage of engineers with expertise in marine applications of electrical/electronic engineering was highlighted as a concern.

In the UBC workshop, seven technologies were identified as important to ships and offshore installations:

- Green ship technologies
- Marine simulation
- Advanced shipbuilding technologies
- Ship design issues concerned with systems design and modelling
- Arctic technology
- Marine and cyber security
- Automation and control

A question was posed to the participants in this workshop about how these technologies should be integrated into educational programs of naval architects and marine engineers. There was very little support for including these subjects in current undergraduate programs. A number of other methods were proposed, including:

- Graduate courses
- Short courses/professional development courses – using professionals experts in the technology areas
- Capstone projects

It was suggested that over-specialization should be avoided.

There was strong support for courses in a number of "soft" skills. In this regard the following three subjects were frequently mentioned - technical writing, communications and project management. Other courses were also suggested, including problem solving, business and entrepreneurial skills, and social media skills.

3.2.3 Practical Experience

There was general support for work terms as practiced by Memorial and Waterloo. There was also support for the idea of internships. Among the suggestions to improve on the work

term scheme were extending the length of each individual work term while others felt the current typical 4-month term was about right. A suggestion for an 8-month work-term did not receive support. Some concern was expressed that it was perhaps too expensive for SMEs to support work terms; support from government programs might be possible. Planning to allow early application for security clearance was suggested for work on naval contracts.

Some participants supported the concept of shipyard visits, which allows students to be familiar with practical aspects of shipbuilding. In addition to shipyard visits, it was suggested that visits to ships in ports and harbours also have value. There was one suggestion that shipyard visits should be a requirement for shipyards under the value proposition arrangements, and perhaps incentives could also work. A suggestion was made that foreign shipyards could also be targets for internships.

3.2.4 Casting The Net Wider

This session concerned initiatives that could potentially diversify the intake into marine-related educational programs. The broad objectives include increasing the number of women, increasing diversity in the field, and developing an interest in the marine field in K-12 students. There are existing programs[3] designed to encourage greater diversity and could be broadened to include other cohorts and applied/adapted to more institutions. Another suggestion is to involve organizations, such as Women in Science and Engineering (WISE).

The issue of raising awareness in secondary schools of the engineering disciplines relevant to the marine industry was discussed. Several ideas were floated, including contacting guidance counsellors using volunteers from the industry, encouraging marine-oriented projects using volunteers, and promoting engineering in general and marine-related fields in particular. Apparently, SNAME has been encouraging members to interact with high schools. Other suggestions included using social media, offering online courses, and approaching parents although it wasn't clear how this could be accomplished.

Among some thoughts, it was suggested that the "fun" element of engineering should be emphasized and illustrated through familiar and very diverse items such as snowboards and cosmetics. "Theatre lighting" was mentioned as a diverse subjects that might be used as a means for promoting naval architecture and engineering as a career choice. It was mentioned that there is a perception that engineering is "boring" and that needs to be

[3] Examples include the Nova Scotia Community College program "Pathways to Shipbuilding" program which is designed to is designed to create pathways and support for Indigenous Canadians to enter the shipbuilding industry.

countered.

3.3 Findings From Breakout Session on Training

The general headings under which the subject of Training was considered are:

- Training Support to Industry/Government
- Collaborations
- Commercial Aspects
- Role Of New Teaching/Training Technologies

3.3.1 Training Support to Industry/Government

On the topic of short courses there were diverse opinions. Some organizations rely on internal training while others use external short courses. With respect to the latter, the main complaint was the lack of depth and the high cost of external short courses. Customized short courses tailored to the specific needs of the audience was suggested by one group although it was recognized that these would be expensive. Also suggested were very short focused courses. Cost was a common concern, especially for smaller companies. In this regard, one recommendation was that CISMaRT could play a coordinating role in identifying training needs of smaller companies and perhaps facilitating the setting up of courses.

While there was general support for the concept of "conversion" courses where engineers educated in non-marine disciplines can be trained in marine-related skills. Many companies undertake the "conversion" using informal methods internal to the company. Apparently, RCN does use such courses. A key desirable feature is that such courses need to be short and focused.

Several related issues were raised:

- One group observed that there are barriers for technologists to become certified engineers and courses designed for this purpose may have some value.
- A general theme was the lack of electrical/electronic engineers with marine-related skills. "Conversion" courses to "marinize" traditional electrical/electronic engineers were considered by some to be of value.
- A concern was expressed in regard to professional licensure issues.

Some considered that there was a role for CISMaRT to facilitate conversion courses in general. There was strong support for the idea that CISMaRT should undertake a survey of short courses currently available and identify gaps.

3.3.2 Collaborations

Two common themes emerged in answer to the questions concerning academic institutions performing more industry-oriented research. The suggested form of industry naval architects and engineers spending "sabbaticals" in academia was generally not supported;

there was much more support for the reverse. Cost was raised as a concern by some of the groups. Greater interaction between academia and industry was suggested as a way to encourage more industry-relevant research; the example of the ABS/Memorial Harsh Environment Technology Centre was mentioned as a good example. Among other points made are:

- The US Small Business Innovation Research (SBIR) Program was suggested as a model for what could be tried in Canada.
- Intellectual Property (IP) was raised as a concern.
- University advisory board could be used to promote more industry-oriented research.
- Less emphasis on publishing papers and more focus on useful products and on commercialization was encouraged.

One point was made that universities may not possess expertise in relevant new technologies. In some cases it is industry that has the expertise rather than academia. However, in the case of newer technologies companies may be reluctant to participate because of the desire to protect their Intellectual Property. A point was made that in cases where expertise in a particular technology is absent in Canada, it might be available elsewhere and advantage should be taken of this source.

Several approaches were suggested as a means for introducing new technologies in the training setting:

- University short-courses with industry participation.
- Involvement of more than one school, each with their own expertise, could be combined to address new technologies.
- One recommendation made was that CISMaRT should undertake a survey of members to better understand the needs of industry with respect to training for new technologies.

Unfortunately there are no or very few courses in Canada focusing on specialist topics such as combat systems and shock and electromagnetic interference (EMI). This may be a circumstance where collaboration with organizations in other countries might make sense. Funding is considered a challenge in some cases. An observation was that with the NSS we are in the process of "rebuilding" the ship design and building industry. It may be necessary to reach out to international partners in an effort to develop expertise in Canada. Some universities in Canada already have collaborated with international universities. It was suggested that we should collaborate with international universities which may have expertise in technologies absent in Canada. An example noted by one the groups was The Transatlantic Ocean System Science and Technology (TOSST). This is a model that could be considered by CISMaRT.

3.3.3 Commercial Aspects

There was no clear consensus among the participants on short courses and hence a diverse

set of comments and observations were made:

- All short courses should be preceded by a market survey to establish the level of demand.
- Courses offered by universities and colleges should aim to be break-even, or even turn a profit.
- One group noted that a model already exists for providing short courses in a university setting – The Gardiner Centre[4] at Memorial.

3.3.4 Role Of New Teaching/Training Technologies

Diverse opinions were expressed on how new technologies should be applied to teaching and training in Canada, including:

- It was recommended that we should be guided by what international players do in terms of using newer teaching/training technologies and adapt them for our purposes.
- A concern was expressed that Canadian academia need to keep up to date with the relevant technology for providing remote teaching/training.
- One shortcoming identified in using internet for training is the difficulty in providing the practical/hands-on component of a course.

[4] Gardiner Centre develops and delivers current and relevant professional development programs that advance the business and leadership knowledge and/or skills of organizations and existing or aspiring supervisors, managers, executives and entrepreneurs

4 Summary

Some of key findings are highlighted below and some recommendations and suggestions may be considered as potential action items for CISMaRT:

- There is a lack of engineers with qualifications/experience in marine electrical and electronics engineering. Plans need to be developed to address this gap.
- There was strong support for courses in a number of "soft" skills, including technical writing, communications and project management.
- Shipyard and ship visits are considered as an important part of education and training, which allows students to be familiar with practical aspects of shipbuilding.
- The work-term model practiced by Memoria and Waterloo is strongly supported by industry.
- Collaboration is needed with international universities which may have expertise in technologies absent in Canada.
- CISMaRT should undertake a survey of short courses currently available nationally and internationally and identify gaps.
- CISMaRT could play a coordinating role in identifying training needs of industry, especially smaller companies.

Appendix A Agenda of Ottawa Workshop

Workshop on Marine Education and Training July 11, 2017 Sheraton Ottawa Hotel, Ottawa Agenda		
8:00-8:40	Registration/Breakfast Meeting • Welcome • Overview of CISMaRT and Updates • Objectives and Scope of the Workshop	Wei Qiu
8:40-9:00	Overview of Status and Challenges of Marine-Related Education and Training in Canada	Roger Basu
9:00-9:20	Overview of Technologist Training in the Marine Sector	Catherine Dutton
9:20-9:45	Engineering for the Ocean – Education, Training and Learning (International Experience)	Peter Noble
9:45-10:10	Marine Technology Education and Training Needs – RCN Perspective	Commodore Simon Page
10:10-10:30	Networking Break	
10:30-10:55	Marine Technology Education and Training Needs – Engineering Company Perspective (Vard Marine)	Andrew Kendrick
10:55-11:20	Marine Technology Education and Training Needs – CCG Perspective	Sam Ryan
11:20-11:30	Group Photo in the Foyer	
11:30-12:10	Working Lunch at Salon E (2nd Floor)	
12:10-12:40	NSERC Programs Supporting Collaborations	Jen Bailey and Jeffery Nerenberg
12:40-12:50	Guidelines for the Breakout Session – I: **Education**	Roger Basu
12:50-1:50	Identification of **Education** Gaps and Possible Strategies to Address Shortcomings	Tools Required: Flip Charts - *Working session (breakout group brainstorming)* - *Breakout groups (7 groups)*
1:50-2:35	Identification of **Education** Gaps and Possible Strategies to Address Shortcomings • Presentation of findings & discussions • Consolidate input from groups • Summarize overall findings	Group Facilitator: Roger Basu - *Presentation by each breakout group* - *Large group facilitated discussion*
2:35-2:55	Networking Break	
2:55-3:00	Guidelines for the Breakout Session – II: **Training**	Roger Basu
3:00-4:00	• Identification of **Training** Gaps and Possible Strategies to Address Shortcomings	Tools Required: Flip Charts - *Working session (breakout group brainstorming)* - *Breakout groups (7 groups)*
4:00-4:45	Identification of **Training** Gaps and Possible Strategies to Address Shortcomings • Presentation of findings & discussions • Consolidate input from groups • Summarize overall findings	Group Facilitator: Roger Basu - *Presentation by each breakout group* - *Large group facilitated discussion*
4:45-5:00	Concluding Remarks	Wei Qiu

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Appendix C Breakout Sessions Teams

Team 1		**Team 2**	
Andrew	Kendrick - Team Leader	Jon	Mikkelsen - Team Leader
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Patrick	Denis	Sue	Molloy
Catherine	Dutton	Mike	Kelloway
Bruce	Quinton	Jason	Mills
Neil	Pegg	Sherry	Scully

Team 3		**Team 4**	
Peter	Noble - Team Leader	Joe	Rousseau - Team Leader
Natacha	Bestari	Noah	Calkins
Matthew	Crawley	S. (Bodo)	Gospodnetic
Andrew	Gerber	Maybelline	Lee
Simon	Page	Brian	McShane
Laurie	Therrien	Nico	Pau
Craig	Tulk	Farid	Taheri

Team 5		**Team 6**	
Glenn	Walters - Team Leader	Leonard	Pecore - Team Leader
Anne	Barker	Pierre-Charles	Drapeau
Phil	Hart	Randall	McGregor
David	Molyneux	Mohsen	Mohammadi
Alexander	Li	Jeffery	Nerenberg
Brian	Staples	Michel	Plamondon
Eleonora	Miccolis	Michelle	Traore

Team 7	
Fraser	Winsor - Team Leader
Jen	Bailey
Allan	Dale
Michael	Fitzpatrick
Bill	Jackson
Jasmin	Jelovica
Mike	Howley
Ravi	Kumar

Appendix D Breakout Session Questionnaire

Breakout Session I - Education

The broad objectives of this session are to:

1. Review marine education in Canada and identify current challenges
2. Identify possible strategies for addressing perceived shortcomings

Three categories of questions:

A. General
B. Curriculum
C. Practical experience
D. Casting the net wider

A General

1. *Are you generally satisfied with the current state of marine education (university level) in Canada?*
   Express your answer on a scale of 1 to 5 where 1 = very dissatisfied and 5 = very satisfied

   _____

2. *Are sufficient numbers of naval architects, engineers, and technologists graduating in Canada?*
   Express your answer on a scale of 1 to 5 where 1 = not nearly enough, 3 = just about right, and 5 = too many

   _____

3. *Are the technical manpower needs of your organization generally satisfied by the naval architecture and marine engineering programs being offered by universities and colleges in Canada today?*
   Express your answer on a scale of 1 to 5 where 1 = Not at all, and 5 = Very much so

   _____

4. *One of the objectives of the National Shipbuilding Strategy is to avoid the boom and bust cycle characteristic of past acquisition programs. What can be done to align Canadian universities and colleges plans to better meet the requirements of NSS for skilled personnel?*

Suggestions

B Curriculum

5. *Current university/college-level education in Canada focuses on traditional naval architectural/marine engineering subjects. Should other programs/subjects be offered, e.g. shipbuilding, marine systems, marine cybernetics etc.*

Suggestions

6. *A number of technologies were identified as important in an earlier Workshop. These are:*
   - *Green ship technologies*
   - *Marine simulation*
   - *Advanced shipbuilding technologies*
   - *Ship design issues concerned with systems design and modelling*
   - *Arctic technology*
   - *Marine and cyber security*
   - *Automation and control*

Should curriculums include any of these subjects? If yes, what are the most effective methods?

Suggestions

7. *What "soft" skills should be improved in typical graduates?*

Suggestions
Technical writing
Communications – presentations
Project management

C Practical Experience

8. *The Work Term concept has found universal support. Is it possible to a) improve it, and b) extend its use?*

Suggestions

9. *Practical Shipyard Experience is considered to be important for the education of naval architects and marine engineers. How can this be accomplished?*

Suggestions
Work terms in shipyards
Shipyard visits

D Casting the Net Wider

10. *There is interest in encouraging greater diversity in engineering. What initiatives can be taken to encourage greater participation by women in naval architecture and engineering?*

Suggestions

11. *What is the best way to make K-12 students aware of marine technology with the objective of encouraging students to pursue a career in this area?*

Suggestions

Breakout Session II - Training

The broad objectives of this session are to:

1. Review marine training in Canada directed at young and mid-career engineers
2. Identify possible strategies for addressing perceived shortcomings

Three categories of questions:

A. Training support to industry/government
B. Collaborations
C. Commercial
D. Role of new teaching/training technologies

A Training Support to Industry/Government

1. *Short Courses – Does your organization send its engineers on short courses? If so, are the courses generally considered worthwhile? If not, what are the main shortcomings? In what types of topics would you like to see short courses? What is the optimum length of course?*

Comments

2. *"Conversion" Courses - To meet engineering personnel needs, shipyards, engineering companies and government agencies in some cases hire engineers with no background in naval architecture or marine engineering (typically graduates in civil, mechanical and electrical engineering). Would there be any value in "conversion" courses to familiarize such graduates with naval architectural/marine engineering principles? If so, what type of course (length, online, delivery approach, etc.) would work best?*

Comments

B Collaborations

3. *Industry-oriented research - Can you think of arrangements in which industry can help universities and colleges undertake more relevant research and promote commercialization? An example is shown below. Are there other ideas?*

Comments
"Sabbaticals" in which naval architects and engineers from industry/government spend time in universities and colleges reviewing research, giving lectures, advising on commercialization etc.

4. *Courses for new technologies - It is well established practice for some academic institutions to "borrow" faculty from other institutions to fill "gaps". Can this concept be extended to offer courses in newer technologies? Some newer topics such as green shipping and marine cybersecurity rely on expertise/knowledge that may not all exist in a traditional naval architectural school. In such instances, a combined course (typically post-graduate) could be offered jointly by two institutions such that one provides the technology-specific expertise and the other the domain-specific expertise. Is there is any promise in such an approach?*

Comments

5. *International Collaboration – Is there any value in extended the concept outlined in Question 4 to collaboration with institutions in other countries?*

Comments

C Commercial Aspects of Training

6 *Short courses (~ few days), on-line courses (few days – several weeks) are offered in various topics. Many courses are offered on a commercial basis. Is this a model that can be adapted such as collaborative training with academic institutions and industries offering courses on a commercial basis?*

Comments

D Application of New Teaching/Training Technologies to Education/Training

7 Are newer methods for delivering education relevant to Canada?

Subject
MOOCs (Massive Open Online Courses)
Advanced distance learning centres
Webinars