

## Education and training program for research and development experts in marine and maritime industries

The National Research Council of Italy, Institute of Marine Engineering, has organized as part of the [Project TRIM – Technology and Industrial Research for Marine Mobility](#), funded at national level by the Italian Ministry of University and Research, the “*Education and training program for research and development experts in marine and maritime industries*”.

The program addresses three alternative objectives and aims at training experts in green shipping in the areas of:

- lightweight structures and new materials;
- design techniques development for efficiency improvement;
- development of new propulsion systems, emission control and noise and vibration management.

The program – starting 1st of December 2020 and lasting 13 months – includes:

- 480 hours of education activities on disciplinary topics provided by university teachers, researchers, and/or experts in the sector;
- 180 hours of education activities on research project management provided by university teachers, researchers, and/or experts in the sector;
- 540 hours of training internships at companies/organizations of the sector involved in the project.

Thirty attendees are selected (the procedure is currently running) based on qualifications and interview, following the details of the call announcement (ID: [INM-001-2020-RM-Prot 0064218](#), Gazzetta Ufficiale n. 81, on 16/10/2020, deadline: 16/11/2020). The twenty-one (21) top ranked will be awarded a € 16,200.00 scholarship (gross of taxes and of the charges borne by the CNR), the other nine (9) will be auditors of the program.

Within this context, the opportunity is offered – under sponsorship of BlueMed CSA – to attend (according to the program illustrated in the following):

- a. 480 hours of education activities on disciplinary topics, i.e., the entire path on: PC1 “lightweight structures and new materials”; or PC2 “design techniques development for efficiency improvement”; or PC3 “development of new propulsion systems, emission control and noise and vibration management”;
- b. one or more group of lessons pertaining a single objective: PC1 “lightweight structures and new materials”; or PC2 “design techniques development for efficiency improvement”; or PC3 “development of new propulsion systems, emission control and noise and vibration management”;
- c. group of lessons pertaining two or three diverse PCs (applicants should be aware of the possibility that lectures included in different PCs might be held simultaneously).

Courses will be given online in the period December 1, 2020 – June 2021 and their scheduling (daily attendance 4 to 6 hours) will be published monthly on the [TRIM project website](#).

Candidates applying for this opportunity should send an email – by 27th of November – to the address: [trim\\_meets.bluedmed@inm.cnr.it](mailto:trim_meets.bluedmed@inm.cnr.it), with a unique file (PDF format) attached, including:

- a brief CV indicating their qualification and experience;
- a motivation letter;
- the chosen attending option (i.e, PC1, PC2, or PC3, and in case of PC2 or PC3 the list of group of lessons selected).

A maximum of 15 attendees from all BlueMed countries will be selected by a joint TRIM-BlueMed expert group.

Attendance certificates will be issued upon completing attendance of the entire group of lessons.



## TRIM meets BlueMeD: Education program for research experts in marine and maritime industries

<b>Program Course 1: Education program for Research Expert in the area of lightweight structures and new materials</b>	
<b>Unit 1: Naval structures</b>	<b>Total hours: 70</b>
UF1-E1: Types of naval structures and their classification. Fundamental nomenclature of naval structures. National and international regulatory framework. Mechanical characterization of the main hull materials [16 hours]	
UF1-E2: Elements of naval design in modern shipyard practices [16 hours]	
UF1-E3: Overview of Construction Technique for typical shipbuilding applications [16 hours]	
UF1-E4: Ship statics [16 hours]	
UF1-E5: Experiences in shipyards, production sites and/or laboratories supporting the shipbuilding industry [6 hours]	
<b>Unit 2: Numerical simulation techniques in ship design</b>	<b>Total hours: 55</b>
UF2-E1: Structural models adopted in shipbuilding [19 hours]	
UF2-E2: Numerical models in design [10 hours]	
UF2-E3: Numerical simulation (FEM) for strength analysis of composite structures [8 hours]	
UF2-E4: Numerical simulation (FEM) for strength analysis of structural connections and joints [6 hours]	
UF2-E5: Numerical simulation (FEM) for strength analysis of mechanical and fitting-out components [6 hours]	
UF2-E6: Simulation of the dynamic behaviour of structural and fitting-out components [6 hours]	
<b>Unit 3: Virtual prototyping for naval structures</b>	<b>Total hours: 170</b>
UF3-E1: Computer aided industrial design [45 hours]	
UF3-E2: 2D Sketch [40 hours]	
UF3-E3: 3D Sketch [40 hours]	
UF3-E4: Integrated CAD+FEM approaches in design and shipbuilding [20 hours]	
UF3-E5: Design techniques for weight reduction [25 hours]	
<b>Unit 4: Composite materials</b>	<b>Total hours: 130</b>
UF4-E1: Classification and standards for composite materials [15 hours]	
UF4-E2: Design and material testing [50 hours]	
UF4-E3: Fire resistance [30 hours]	
UF4-E4: Production processes used in the naval and nautical field [35 hours]	
<b>Unit 5: Integration of the fitting-out into the construction. Acoustic comfort</b>	<b>Total hours: 55</b>
UF5-E1: Hull and fitting-out materials: weight reduction by adopting innovative materials [8 hours]	
UF5-E2: Vibration of N-DOF systems [8 hours]	
UF5-E3: Components and fitting-out materials of the hull [8 hours]	
UF5-E4: Elements of psychoacoustics [6 hours]	
UF5-E5: Advanced methods to design and integrate hull fitting-out into shipbuilding by reducing weight [25 hours]	

<b>Program Course 2: Education program for Research Expert in the area of design techniques development for efficiency improvement</b>	
<b>Unit 1: Hull resistance</b>	<b>Total hours: 120</b>
UF1-E1: Elements of numerical modeling for naval engineering [20 hours]	
UF1-E2: The role of Computational Fluid Dynamics (CFD) in naval design and optimization [20 hours]	
UF1-E3: Use of Super Computers for naval design and optimization, High Performance Computing (HPC) [20 hours]	
UF1-E4: Simulation-based optimization for efficient hull shapes [36 hours]	
UF1-E5: Methods of reducing frictional drag on the hull and experimental performance evaluation techniques [24 hours]	
<b>Unit 2: Marine propulsion: theoretical and methodological aspects</b>	<b>Total hours: 84</b>
UF2-E1: General aspects of marine propulsion [18 hours]	
UF2-E2: Computational and experimental methodologies for the design and analysis of naval propulsors [18 hours]	
UF2-E3: The problem of the environmental sustainability of ship propulsion [36 hours]	
UF2-E4: Applications of computational and experimental methodologies for the design and analysis of naval propulsors [12 hours]	
<b>Unit 3: On-board energy systems: analysis, monitoring and control</b>	<b>Total hours: 220</b>
UF3-E1: The energy system and energy uses [20 hours]	
UF3-E2: Energy efficiency and energy management models [20 hours]	
UF3-E3: Monitoring technologies and sensor networks [10 hours]	
UF3-E4: Data analysis for energy management [30 hours]	
UF3-E5: Methods and analysis tools for the efficiency of the propulsion and stationing phases [40 hours]	
UF3-E6: Methods and tools for the efficiency of on-board systems [40 hours]	
UF3-E7: Evaluation of operational efficiency: from structural monitoring to evaluation of navigation performance [30 hours]	
UF3-E8: Monitoring and conditioning of electrical power on board for energy efficiency purposes [30 hours]	
<b>Unit 4: Methods and technologies for advanced hull design</b>	<b>Total hours: 56</b>
UF4-E1: Design for X methodologies and multidisciplinary optimization in design [8 hours]	
UF4-E2: Topological optimization, Design for Additive Manufacturing and rapid prototyping [8 hours]	
UF4-E3: Rapid prototyping and reverse engineering, surface modeling [16 hours]	
UF4-E4: CAD/CAE/PDM systems: integrated management of project data to support the design [8 hours]	
UF4-E5: Expert systems: criteria, purpose and implementation [8 hours]	
UF4-E6: DOE / DACE from forecasting to experimentation to fine-tuning [8 hours]	



**Program Course 3: Education program for Research Expert in the area of development of new propulsion systems, emission control and noise and vibration management**

<b>Unit 1: Engines and energy systems</b>	<b>Total hours: 200</b>
UF1-E1: Ship propulsion machines [35 hours]	
UF1-E2: High pressure common-rail injection systems: injection strategies for combustion optimization [20 hours]	
UF1-E3: Use of natural gas in positive ignition engines and in dual-fuel technology with Diesel pilot injection [40 hours]	
UF1-E4: Optical diagnostics for the characterization of fuel sprays [20 hours]	
UF1-E5: Optical diagnostics of combustion [30 hours]	
UF1-E6: Power generation systems and auxiliary services on board ship [35 hours]	
UF1-E7: Numerical modeling for the simulation of complex energy systems [20 hours]	
<b>Unit 2: Techniques for the containment of polluting emissions</b>	<b>Total hours: 170</b>
UF2-E1: Standards and Methods for measuring gaseous and particulate polluting emissions from diesel engines [50 hours]	
UF2-E2: Optical diagnostics of pollutants [30 hours]	
UF2-E3: Formation of pollutants and their effects on health and the environment [40 hours]	
UF2-E4: Treatment processes of polluting effluents [50 hours]	
<b>Unit 3: Noise and vibration</b>	<b>Total hours: 110</b>
UF3-E1: Fundamentals of acoustics and vibration and measurement techniques for acoustic characterization [44 hours]	
UF3-E2: Review of vibration mechanics [20 hours]	
UF3-E3: Problems and applications in shipbuilding [26 hours]	
UF3-E4: Experimental methods for vibration measurement [20 hours]	