



<b>Implementation Group</b>	
Doc.:	ESDC/2026/115
Date:	18/02/2026
Origin:	ESDC Secretariat

Country <b>IT</b>	Institution <b>INA</b>	Common Module <b>Naval Sensors</b>	<b>ECTS 2.0</b>
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<b>Service(s): Navy</b>	<b>Minimum Qualification of Instructors:</b>
<b>Language: English</b>	
<b>SQF MILOF:</b>	<ul style="list-style-type: none"> <li>• PhD degree in Communications Engineering.</li> <li>• English: Common European Framework of Reference for Languages (CEFR) Level B2 or NATO STANAG Level 2+.</li> <li>• <b>Competence area</b> – Military technician.</li> <li>• <b>Learning area</b> – Employment of weapon/ operating platform/ systems.</li> <li>• <b>Organisational level</b> – Single Arm/Branch.</li> </ul>

<b>Prerequisites for participants:</b>	<b>Contents of the Module:</b>
<ul style="list-style-type: none"> <li>• English: Common European Framework of Reference for Languages (CEFR) Level B1 or NATO STANAG Level 2.</li> <li>• Elements of real, complex and vector calculus, electromagnetics and wave physics, and basic circuit theory.</li> </ul>	<ul style="list-style-type: none"> <li>• Technical specifications and design of relevant naval sensors.</li> <li>• Effective exploitation of the relevant naval sensors with due consideration of safety measures.</li> </ul>

<b>Learning outcomes</b>	Know- ledge	<ul style="list-style-type: none"> <li>• Perform review of the characteristics and possibilities of the naval sensors (Navigational radar, Early Warning radar, CW radar, Multi-static radar, Over the Horizon radar, Phased Array radar, EW systems, Electro-optical systems).</li> <li>• Formulate the basics of naval sensors management (military radar systems for detecting, tracking and locking on targets, EW systems, Electro-optical systems) as parts of integrated combat information systems in the sustainment realm of operations.</li> </ul>
	Skills	<ul style="list-style-type: none"> <li>• Recognise the constructive type of equipment and integrated system by various specific criteria.</li> <li>• Deal with integrated combat information systems using the data provided by naval sensors.</li> </ul>
	Respon- sibility & Autonomy	<ul style="list-style-type: none"> <li>• Make correct tactical decisions exploiting information from different systems.</li> <li>• Manage on-board naval sensors in different warfare and scenarios.</li> </ul>

<b>Verification of learning outcomes:</b>
<ul style="list-style-type: none"> <li>• <b>Observation:</b> <ul style="list-style-type: none"> <li>○ Class time is primarily assigned to lecturing. Educational materials such as slides or videos may be used in order to illustrate some of the basic points in the lecture in order to encourage discussions and debates about focus points.</li> <li>○ Methods of teaching/lecturing are: lecturing, heuristic conversation, explanation, discussions/debates, case study, and simulation of situations.</li> </ul> </li> <li>• <b>Tests:</b> final exam (written test).</li> <li>• <b>Evaluation:</b> The final exam will consist in examination based on a multiple-choice test and applications of the taught subject.</li> </ul>

## Module details:

Main Topic	Recommended WH for the residential phase	Details
Pulsed radars	4	<ul style="list-style-type: none"> <li>Principles and performances.</li> <li>2D, 3D, OTH, Phased Array radar overview.</li> <li>E.M. propagation effects.</li> <li>Block diagram.</li> <li>Clutter.</li> </ul>
CW radars	1	<ul style="list-style-type: none"> <li>Principles and performances.</li> <li>Block diagram.</li> <li>FM-CW radar.</li> </ul>
Secondary radars	2	<ul style="list-style-type: none"> <li>SIF modes.</li> <li>S mode.</li> </ul>
Fire control radars	1	<ul style="list-style-type: none"> <li>Target acquisition.</li> <li>Angular tracking techniques.</li> <li>Range tracking technique.</li> </ul>
Electronic warfare (EW)	1	<ul style="list-style-type: none"> <li>Terminology and principles of operation.</li> <li>Doctrine overview and outlooks.</li> </ul>
Passive EW	3	<ul style="list-style-type: none"> <li>Operational parameters.</li> <li>Interceptors and different types of receivers.</li> <li>Goniometric techniques.</li> </ul>
Active EW	2	<ul style="list-style-type: none"> <li>Operational parameters.</li> <li>Jamming techniques.</li> <li>Deception techniques.</li> <li>Chaffs and decoys.</li> </ul>
Electro-optical Systems	3	<ul style="list-style-type: none"> <li>Principles and performances.</li> <li>Main operational applications.</li> </ul>
Sound propagation in water	4	<ul style="list-style-type: none"> <li>Principles and performances.</li> <li>Behaviour at different frequencies.</li> </ul>
Underwater sensors	3	<ul style="list-style-type: none"> <li>Active/passive transducers.</li> <li>Main operational applications.</li> </ul>
<b>Total WH (contact hours)</b>	<b>24</b>	
<b>Additional hours (WH) to increase and assess the learning outcomes (during residential phase):</b>		
Self-studies	25	<ul style="list-style-type: none"> <li>The guidelines on Naval sensors.</li> <li>NATO ATPs rules and regulations.</li> <li>Popa S. (coord.), Naval Sensors, INS module, Romanian Naval Academy Publishing House, 2025.</li> </ul>
Test/evaluation / assessment	1	<ul style="list-style-type: none"> <li>Final Assessment</li> </ul>
<b>Total WH</b>	<b>50</b>	The detailed amount of hours for the respective main topic is up to the course director according to national law or the home institution's rules.



## List of Abbreviations:

B1, B2, C1 .....	CEFR Levels
BIP .....	Blended Intensive Programme
CEFR .....	Common European Framework of Reference for Languages
CIC .....	Combat Information Centre
ECTS .....	European Credit Transfer and Accumulation System
ESDC .....	European Security and Defence College
Fm-CW .....	Frequency Modulated – Continuous Wave
IG .....	Implementation Group
IT .....	Italy
MTI/MTD .....	Moving Target Indicator/Detector
NATO .....	North Atlantic Treaty Organization
OTH .....	Over The Horizon
RCS .....	Radar Cross Section
RF .....	Radio Frequency
SIF .....	Selective Identification Feature
STANAG .....	Standardisation Agreement
STC .....	Sensitivity Time Control
TWT .....	Travelling Wave Tube
WH .....	Working Hour (60 minutes)