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**Project Acronym: MPCS**

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# **MPCS Validation Report**

**Deliverable 4.3**

Version 1.0

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## Acronyms and Abbreviations

DCPM - Directorate for Combating Pollution of the Sea

DGAM - Directorate-General of the Maritime Authority

POLREP - Pollution Reporting System

UCPM - Union Civil Protection Mechanism.



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## History of Changes

Table 1 - History of changes

Version	Publication date	Changes
1.0	30.1.2024	Initial version.



## Contractual aspects

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## 1 Introduction

This document is the Overall MPCS validation for the Marine Pollution Control Simulator (MPCS).

The MPCS should be multilingual (Portuguese, Spanish, and English), software-based, and accessed simultaneously by different users at different geographical locations. It should be an environment for teaching, training, and performance evaluation of individual and team Marine Pollution Response actions.

Teaching should consist of a set of e-learning courses on Marine Pollution Response, Simulator operation, and Simulator management.

The performance evaluation should allow qualitative and quantitative assessment of the users' performance in training.

The training (simulation) will run in a multi-user environment, where each user will assume the role of a real professional belonging to the existing real means consisting of bodies, facilities, people, and equipment. The simulation will run in a given geography, based on a map's platform, and use real weather conditions recorded from the relatively recent past to simulate spill movement. Users can, and should, interact with each other, interact with the equipment, and interact with the spill to achieve the exercise's goal. A mathematical model of the spill and its interaction with the elements and combat actions will simulate reality as necessary and sufficient for the MPCS objectives.

The MPCS should provide two types of Exercises: the *Exercise for teaching* and the *Exercise for training*. The former is intended for schools and professionals in training. The second is intended for professionals to maintain high readiness.

Users should be able to run the Exercise via their smartphone, tablet, or computer.

In the case of the *Exercise for training*, the users' login will determine which person they are in the Exercise. Each available profile will correspond to one of the elements of the existing means, as well as the bodies, facilities, and equipment. The responsibility of keeping this data updated will be up to the MPCS Manager and the adhering entities.







In the case of the *Exercise for teaching*, after logging in, the user can choose, among the available virtual persons, which person is in the Exercise. The bodies, facilities, people, and equipment can be fictitious and be created and configured for each Exercise by the MPCS Manager.

Users, when assuming an identity, will inherit the properties that the database has defined for that identity, which will differ from person to person (for example: qualifications, roles, contacts, Hxh cost, ...).

All users, in the role of a given virtual person, will be able to change their geographic location, will be able to rest and eat to recover virtual health (a property that varies with working hours, resting, eating, and random injury), and will be able to interact virtually with other people and equipment.

Any interaction between the different virtual entities should be determined by some of their current properties.

The available interactions should allow the simulation of the necessary and fundamental procedures in pollution response, such as the use of equipment (booms, skimmers, pumps, shovels, hoses, blankets, ...), communication between people, movement of people and equipment, refueling, maintenance, etc.

The drift of the spill, the hypothetical effect on the shore, and the effect of equipment on its drift, as well as its quantity, should be based on a realistic mathematical model and actual geography, meteorology, and hydrodynamics, as well as actual material specifications.

The purpose of this Test Specification is to evaluate the accomplishment of the MPCS project requirements, the usability of the MPCS and the satisfaction from the user's point of view. It is intended to be a test of the operation and management features.





## 2 Objectives

The goals of this validation process will be aligned with the objectives of the MPCS Project, with the Simulator Operational Requirements, deliverable 2.1, and with the Simulator Functional Requirements, deliverable 2.2. This validation will focus on the overall major functionalities and operability of the simulator ensuring the software works as intended and satisfies the end user's functional needs.

For these objectives it was created a script, for demonstration and test purposes, of a Tagus estuary scenario with a spill near the Naval Base, with several professionals, and materials, fighting the pollution.

In this validation, it is assumed that the tests of the code units have been carried out during the development as well as the integration tests of these same code units.

## 3 Scope

This validation specification will cover the major functions of the MPCS as:

1. Teaching
2. Training (simulator):
  - a. Management (MPCS configuration, exercises creation, database management)
  - b. User access and roles
  - c. Begin, continue and end of the exercise
3. Performance evaluation.



## 4 Validation Plan

The Validation Plan has been implemented as follows:

1. EVM presented the MPCS e-Learning modules
2. Coimbra University demonstrated the simulator (training and performance evaluation) following the script with a team of 4 users assuming different operational roles and one MPCS manager
3. DGAM observed and interacted with the Coimbra University coordinator and with the Qualiseg team
4. At the end of the exercise, a debriefing has been developed to exchange ideas and suggestions
5. MPCS End User Validation.



## 5 Validation actions and results

### 5.1 MPCS e-Learning modules

The MPCS e-Learning modules were presented as follows:

1. The hosting is at MoodleCloud.com and users can log in with a personal password (Figure 1):

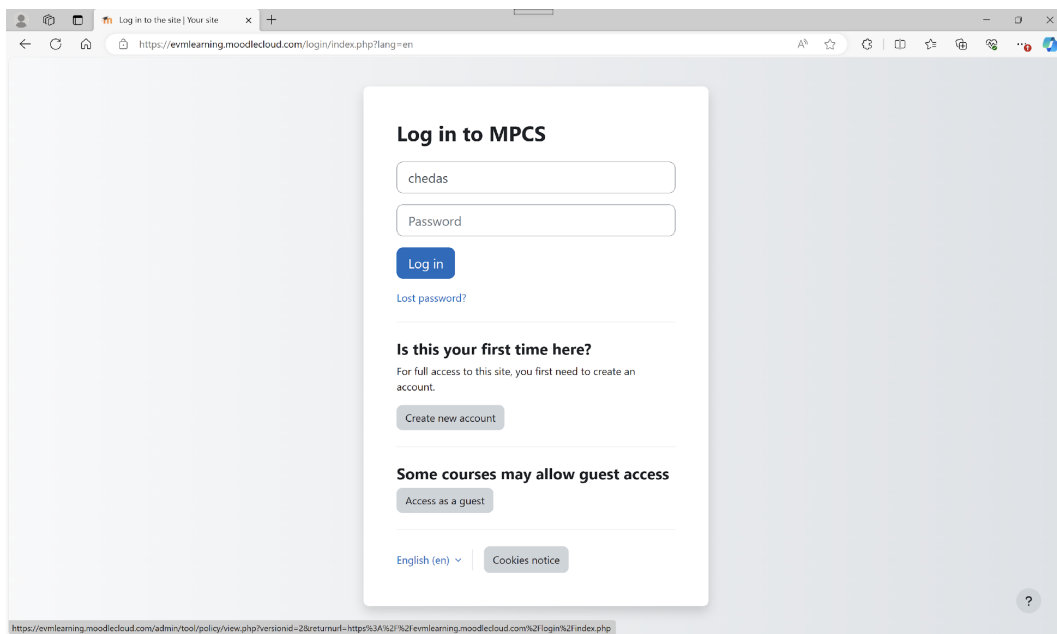


Figure 1: MPCS e-Learning log in



2. The user accesses the courses, until now in Portuguese and Spanish (Figure 2):

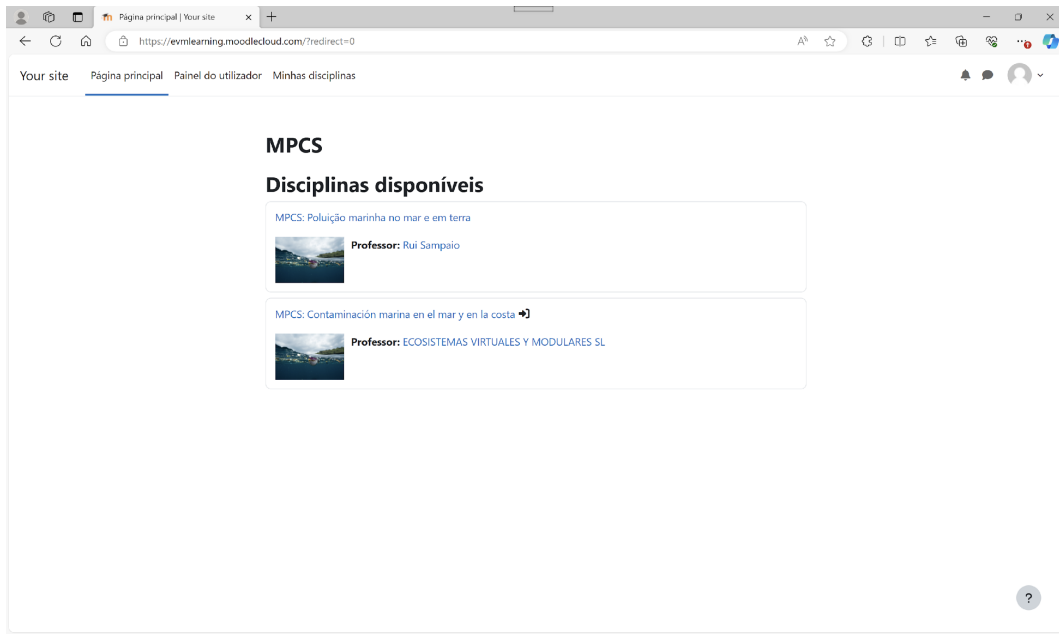


Figure 2: MPCs e-Learning user area





3. The user accesses the course that has four modules, *booms*, *skimmers*, *country legislation* and *country oil spill response* (Figure 3):

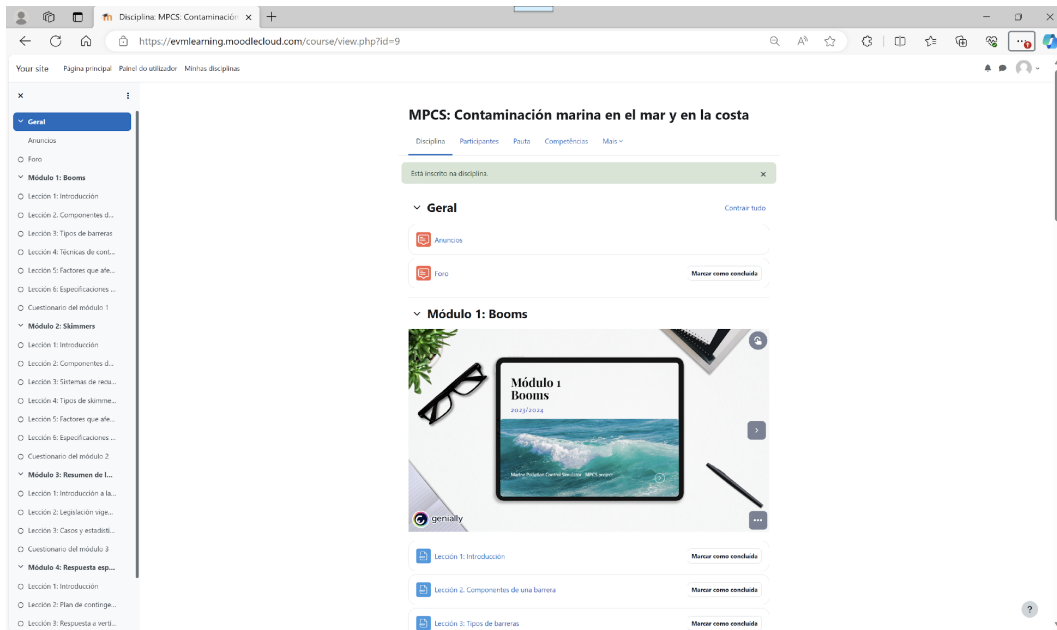


Figure 3: MPCs e-Learning course (four modules)



4. The user can answer a quiz with random questions, from a database to self-evaluation (Figure 4):

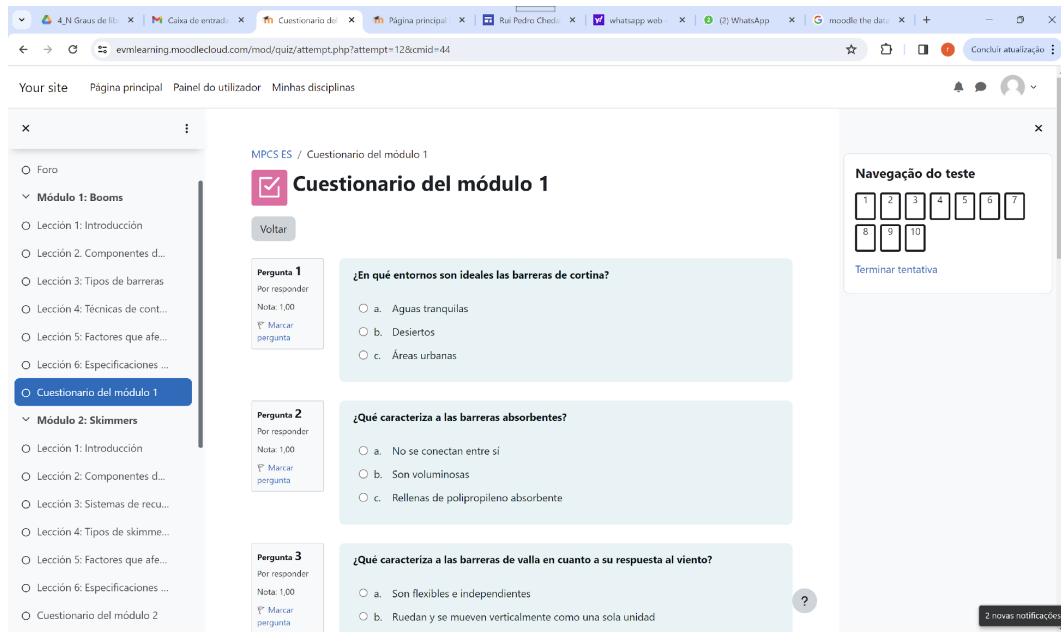


Figure 4: MPCES e-Learning quiz



## 5.2 MPCS Simulator

The MPCS simulator validation by the end-user, has been developed having Coimbra University providing a demonstration to the end-user DGAM, by the complete execution of a typical pollution control exercise using the MPCS simulator.

The main objective of the exercise was to contain an oil spill and prevent it from contaminating the areas around the naval base and the sensitive areas of the estuary to the south. In addition to containment, removal must be attempted. To do this, the participants should check the conditions on site, issue a POLREP, call in the necessary teams, deploy human and material resources to combat the pollution, coordinate the exercise and ensure the safety and health of those involved.

The users invited to this exercise assumed the role (professional) of Harbor Captain (HCap), Responsible for directing and coordinating maritime pollution response (RC) and two Elements of the First Intervention Team (IT01 and IT02).

Each professional was assigned a fake email and a smartphone number to simulate the contacts' addresses during the simulation.

The exercise started and the users followed the script previously created to guarantee a pedagogical demonstration of the simulator (in fact the simulator lets the users do what they want).

In the end, it presented the information that the simulator saved during the exercise and how that can be useful for the performance evaluation of the users.

A resume of the script was as follows:

1. HCap says he received notice of an incident and sent IT02 to confirm it near Naval Base Lisboa. (IT01 and RC wait for messages/orders).
2. IT02 - Takes the boat off the installation and moves close to the spot. After seeing the characteristics of the incident, send a message to the HCap confirming the incident





- and informing the type of spill and area affected. Then returns to the shore and waits for the next actions.
3. HCap receives the message and sends the same message to RC.
  4. RC - Goes to the computer (inside the facility), and sends an email with POLREP (a pdf) to HCap and IT01. After this, he also sends IT01 to go and draw the sensitive areas on a map of the surrounding areas.
  5. RC Informs (via the Speak action) that a certain boom and a certain skimmer are needed. Orders IT01 and IT02 to remove the boom and the skimmer from the warehouse and to drive the truck (SCANIA).
  6. IT01 and IT02- Load a skimmer and a boom onto a truck and call people if necessary.
  7. RC checks that the truck is low on fuel and goes back to the warehouse to fetch diesel oil. Also, inform them that it's a long day and they may need to bring food/drink.
  8. RC checks the health of IT01, IT02 and of the material. If they are low in health RC must order them to rest.
  9. RC, IT01 and IT02, after everything has been loaded onto the truck, get in and move closer to the coast (near where the boat is). The driver of the truck must be IT01 because is the only one with a truck driving license.
  10. RC sends IT01 and IT02 to unload the boom and the skimmer from the truck to the boat.
  11. RC informs HCap that they are ready to go to the spill spot.
  12. IT02 pilots the boat.
  13. RC, after arriving at the spot, orders IT01 e IT02 to place the boom and the skimmer.
  14. IT01 and IT02, after spending time placing the boom, place the skimmer.
  15. RC, after some time, informs the HCap that the oil was collected.
  16. RC orders IT02 to pilot the boat to remove the boom and the skimmer from the water
  17. RC orders returning to base after all the equipment is onboard
  18. RC, at the base, informs HCap that the operation was successful.

Note: all actions have a predefined time of duration. This time can be altered by the MPCS manager to improve the realism of the simulation.



### 5.3 Questions addressed during and after the demonstration

Questions addressed by DGAM:

Loading and unloading capacity on equipment must have an operational limit because it constitutes an effective limitation. It would be desirable to include a combination of equipment for some operations, such as a trolley with a crane, or to use unloader to load equipment onto a trolley. In this case, it will be necessary to check whether a crane is already in use. The same applies to any other physical restriction.

Several vehicles can move at the same time, and therefore the simultaneous operation of equipment. However, the limitation of a simultaneous activity can be imposed on each piece of equipment (transport, crane, boat, etc.) with a defined number of people required, which would allow people to be aggregated and prevent them from trying to carry out multiple simultaneous activities such as loading or unloading two pieces of equipment at the same time.

The participants were asked about the scoring system. It was clarified that the system does not score itself as it does not have a system of scoring rules. It was specified that the system records and produces a report for human reading and evaluation of the exercise that facilitates analysis of the material conditions, timing, coordination and sequence of the actions performed.

The issue of differences in the performance of equipment depending on its state of repair or maintenance ("if it's dirty or clean" requiring different amounts of time) was raised.

The issue of fuel or energy in equipment other than vehicles was raised. The possibility of configuring consumables and a consumption rate was clarified.

Regarding user feedback, the feedback given on operating conditions (certifications, suits and other safety conditions) was considered interesting for teaching purposes. Regarding only downloading one device at a time, the possibility of a waiting list or showing a warning that an operation is already underway was raised.

The possibility of the MPCS manager interfering directly by adjusting aspects of the conditions during the simulation was identified as a way of rehearsing the reaction to accidents or imponderables. Examples were: the possibility of injecting a fault, of an activity affecting a person's health, the possibility of influencing the performance of equipment, etc. These options would be available in an exercise manager interface during the simulation exercise.



A question was asked about the possibility of simulating random accidents; this was answered with the current definition of a probability of failure per piece of equipment, which may partially meet this objective since the request would imply setting up a probability of accident associated with each activity, regardless of whether it involved equipment.

The possibility of simulating multiple blobs (e.g. three blobs and their dispersion) was questioned. In fact, MOHID simulates several pollutant units (blobs) that are dispersed and can collide with the pathways, but it only allows a global extraction rate to be configured (for the skimmers). When it was integrated into MPCS, the presentation of the simulation was simplified by presenting only the perimeter of the blob as a polygon, with extraction being independent of the exact location of the skimmer, only requiring the equipment to be close to the polygon (approximately up to 200m).

It was asked about the technical configuration needed for a performance with 20 participants, to which they replied that it should be possible with adequate resources. Only MOHID has minimal requirements due to the difficulty of running the previous simulations in time to make the data available for visualization and interaction.

It was considered essential to add the "radio" means of communication, even if only with a shared channel, and only being able to communicate to those who have a radio. This would be similar to what is already implemented with the telephone, but for radio, it would be broadcast to everyone who has it with them. The rest depends on the practice and discipline of radio communication that the participants must demonstrate.

The issue of exporting the report to a spreadsheet (opening the .CSV format in Excel) was raised, which may be feasible given that it is a table. Still, on the subject of producing the exercise report, it was pointed out that aspects should be highlighted to make it easier to identify essential steps and conditions met or not met in the exercise (e.g. with different colors) to make it easier to evaluate and give feedback to participants.

As far as users' operation is concerned, it was pointed out that participants would only need some training beforehand to understand what they have to do in the simulator. After getting used to the interface, they will be able to carry out all the activities. For example, it's not logical to go to the warehouse to collect equipment such as large boats, as they will already be in the port, but this could be a pre-configuration aspect. Some introductory training will be necessary.





## 6 Conclusions

The validation process's relevant conclusions are as follows:

- Regarding e-Learning modules
  - User access to the course and its four modules is working properly
  - random questions quiz is fully available to users
  
- Regarding the simulator
  - A typical real-like pollution control exercise has been fully executed in the simulator, **reaching the expected results**
  - the **simulator is readily available** to be used in different scenarios involving entities from local, regional, National and European/International levels
  - **improvement opportunities** have been identified constituting relevant inputs for a subsequent version 2.0 of the simulator.

After the debriefing session (post-exercise) the end-user (DGAM) overall conclusion, as expressed by the pollution control professionals present in the demonstration session, is that the **MPCS surpasses expectations and can be an important tool for teaching and to complement real training.**