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DESIGNING A MODEL BASED ON EXISTING SIMULATORS THIS TIME INUSE BY THE ROMANIAN NAVY TO ENSURE EFFECTIVE INTERVENTIONS IN LIMITING THE EFFECTS OF MILITARY ACTIVITIES ON THE ENVIRONMENT UNDER ROUTINE AND WAR CONDITIONS

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Abstract: *In the documents underlying the National Security Strategy of Romania, military missions and actions that the Romanian Navy can perform, and in the studies and forecasts on regional security in the Black Sea region, there is a simultaneous increase in strategic importance of the Black Sea region while emphasizing ecological risks, paying attention tothe protection of the marine environment and restoration of multiple functionality by exploiting the potential of Danube - Black Sea macro-ecosystem.*

Of the three types of simulation available at present in thescientific literature,virtual simulation(simulation where real people operate simulated systems), may be taken as the basis for choosing a modelbased on existing simulators used by the Romanian Navy to date, to ensure effective interventions to limit the effects of military activities on the environment under routine and warconditions.

Based on the stages of development in establishing the model for simulating military action with the generation of pollution and intervention situations, theoptimal configuration chosen fitted with ICT tools (simulators, software)enhaces the general development model which currently is as follows:Proteus tactical simulator with software supplied and installed by the manufacturer to generate situations at the tactical-operative level; Simulator for dangerous goods –usage of space-time simulation software for marine pollution incidents GNOME; the development and presentation of hydro-meteorological forecastsintegrated system SIMIN of the MaritimeHydrographic Department; the Integrated ship management simulator TRANSAS 5000 with the oil pollutionprediction software Adios-2.

1. INTRODUCTION

In order to develop a model for a process of simulating a major pollution generated in different situations (training or actual conflict) in the NW area of the Black Sea with partial use of forces and equipment owned by the Romanian Navy, we can choose two of the three levels of training required by simulation, respectively level one -individual and collective training, based on simulators and virtual simulation, in which each member of the intervention team is put in a position to engage and intervene according to the tactical situation created, and level two- tactical training by simulating forces participating in military actions, generating situations and participate in the removal of major pollution effects on coastal marine ecosystems.[1]

NATO classifies simulations in to three categories:

a) *real simulation*: a simulation where real people operating real systems;

b) *virtual simulation*: a simulation where real people operating simulated systems. Virtual simulations play a central role by exercising motor and control skills, decision-making skills and communication skills;

c) *constructive simulation*: simulations in which simulated people operate simulated systems. Real people provide inputs for these simulations, but are not involved in setting the output of the simulation process;

Note that elements composing the model are belonging to an open system architecture, which is always in dynamic by means of data entry and of the situations created.

To simulate for routine conditions, it is necessary to determine which could be the potential components of military units with the most pronounced degree of pollution and the types of potential pollutants that may be incurred. This is determined by a qualitative impact matrix. Of the three types of simulation (time evolution of the model chosen) above, was chosen virtual simulation (simulation where real people operate simulated systems) to simulate conflict situations taking into account the real possibilities in terms of equipping the simulators of the Romanian Navy to date (Proteus simulator and Transas simulator 5000), to generate a situation of pollution.

Figure 1 presents the steps necessary in developing the model.[2]

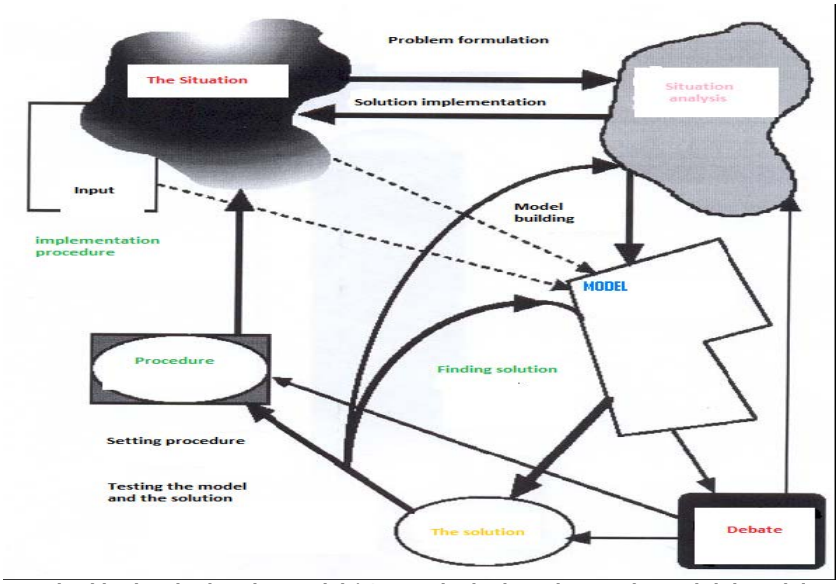

Figure 1. The steps required in developing the model (*Strategia de dezvoltare a domeniului modelare-simulare în Armata României*, Bucureşti 2003)

2. RESULTS

For current activities related to military bases, the matrix developed is presented in Table 1.
The results by components and types of pollutants are presented in Fig. 2 and Fig. 3.

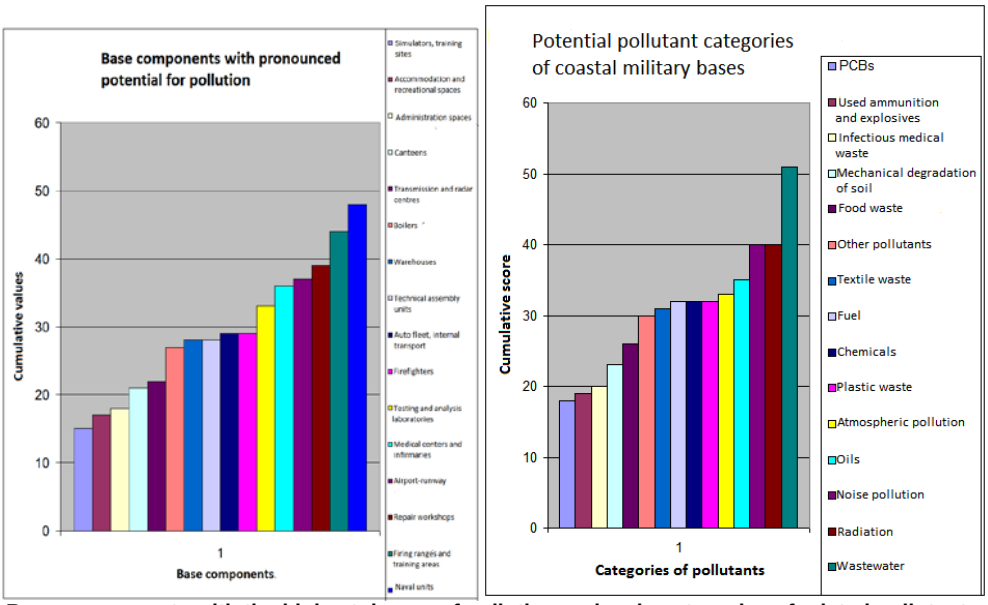

Figure 2. Base components with the highest degree of pollution and main categories of related pollutants according to cumulative qualitative scores.

Using the analysis results, we conclude that simulating high current activities of pollution in a military base on marine ecosystems is required during peacetime on military ships [3].

The same principle will apply to simulate situations of conflict, taking the example of a convoy of ships (3 anti-submarine corvettes, a frigate - F-111, two military tankers - as Fig.3) who engaged in combat with the enemy (Figure 4), will eventually generate a situation of pollution by oil (Fig. 6) materialized on the simulator "Navi-Trainer Professional 5000", following the destruction of an oil tanker (Fig.5), a situation that can be adapted for current activities - explosion due to gas accumulation (hypothesis).

Table 1: Matrix of correlations between the components of the bases, toxic substances and waste estimated quantity and quality and environmental implications

Toxic substance – residual material and the impact factor –potential pollutant / BASE COMPONENTS	Ammunition and explosives used	Fuel (kerosene. Diesel, gasoline)	Oils	PCBs	Chemicals	Atmospheric pollutants(emissions)	Noise pollutions	Mechanical degradation of the soil	Plastic wastes	Infectious medical wastes	Food waste	Textile waste	Waste water	Radiation	Other pollutants	TOTAL
Airports: Runway	2-3	3	3	3	2	4	5	2	1	1	1	1	3	3	2	**37.00**
Administration spaces: offices, conference rooms, etc	-	1	1	-	1	-	1	-	2-3	-	2	2	3	2	2	**18.00**
Repair workshops	2	4	4	2	3	2	3	2	2-3	1	1	3	4	2	3	**39.00**
Canteens	-	1	1	-	1	2	1	1	2	-	4	1	4	1	2	**21.00**
Transmission and radar centers	-	-	2	-	2	1	2	1	1	1	1	2	2	5	2	**22.00**
Boilers	-	3	3		2	4	3	2	1	1	1	1	2	2	2	**27.00**
Medical centers: infirmaries , operating rooms, laboratories, medical warehouses.	-	1	1		3	2	2	1	4	5	3	3	4	4	3	**36.00**

Warehouses: ammunition, fuel, lubricants, food, equipment, etc.	2	3	3	2	1	1	1	4	2	1	1	2	2	1	2	**28.00**
Testing and analysis laboratories	3	3	3	3	3	2	2	1	1	1	1	2	3	3	2	**33.00**
Auto fleet, internal transport	-	3	3	1	1	3	3	2	1	1	1	2	4	1	3	**29.00**
Firefighters	-	2	2	1	4	2	3	2	1	1	1	2	4	1	3	**29.00**
Fireing ranges and training areas	5	3	3	3	3	3	5	4	2	1	2	2	2	3	3	**44.00**
Simulators, training sites	-	-	1	-	1	-	2	-	2	1	-	1	2	3	2	**15.00**
Technical assembly units: Military technique, ammunition, etc.	2	1	1	1	2	2	3	-	3	1	-	3	3	3	3	**28.00**
Naval units (navy ships)	2	4	4	2	2	4	3	1	3	3	4	3	5	5	3	**48.00**
Accommodation and recreational spaces	-	-	-	-	1	1	1	-	2	1	3	1	4	1	2	**17.00**
TOTAL	19	32	35	18	32	33	40	23	32	20	26	31	51	40	39	

The potential impact of pollutant category

1. insignificant impact
2. little impact
3. medium impact
4. strong impact
5. very strong impact

Following the analysis matrix scores were calculated, for potential cumulative impact of pollutants from military bases categories (Fig. 2), on which basis the most prominent components of potential pollution rank (Fig. 2).

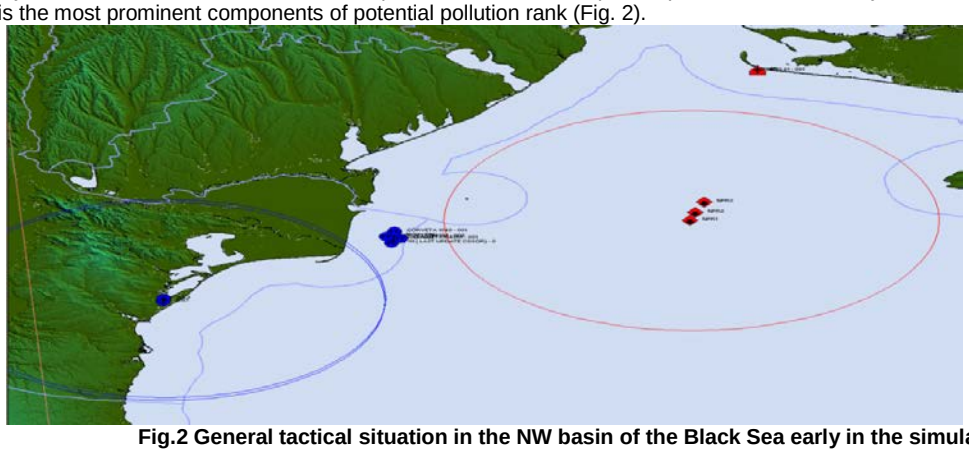

Fig.2 General tactical situation in the NW basin of the Black Sea early in the simulation

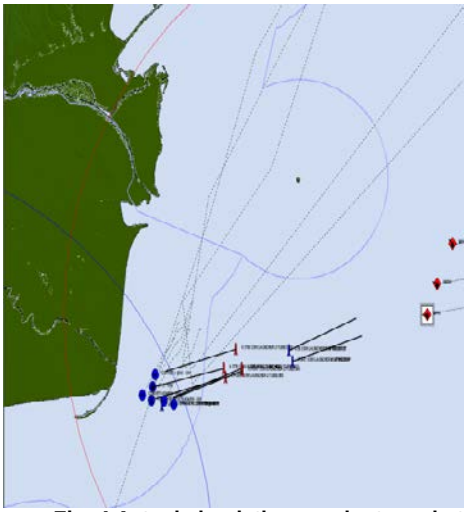

Fig. 4 Actual simulation conduct combat actions

Fig 5. Generating a situation of oil pollution from carrying out military actions

Fig. 6 Simulation of post-conflict situation by extracting it from Proteus simulator and marking the oil spill and its subsequent evolution of the simulator "Navi-Trainer Professional 5000"

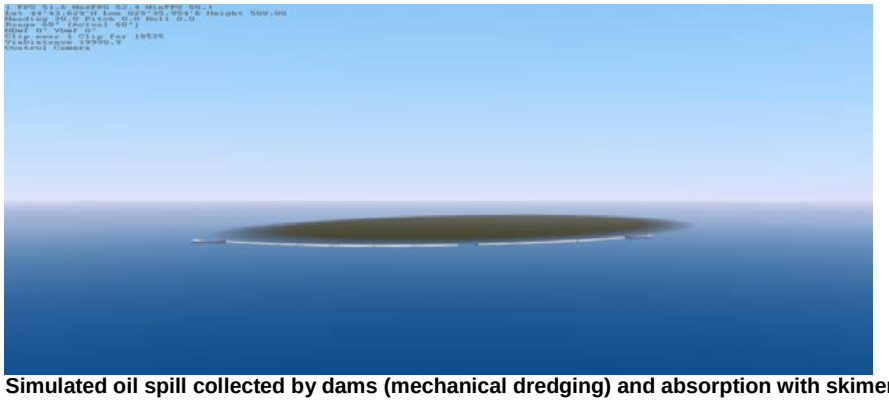

Fig 7. Simulated oil spill collected by dams (mechanical dredging) and absorption with skimerelor

4 CONCLUSIONS

The novelty of the model used for military action affecting the marine environment resulting from the choice of its configuration (multiple simulators and software that initially worked independently without being connected) and its use in specific situations of the Romanian Navy whose purpose is to provide at least theoretical possibility of estimating quantities of pollutants such as liquid (whole range of hydrocarbons), as opposed to the dry environment that is spilled is a liquid medium (marine environment), so that the use of modelling and simulation programs aimed strictly this medium. It should be noted from the beginning that at this time there is no such a model of "cascading" in the Romanian Navy (military action, generating pollution situation, receiving hydro-meteorological information for the district , dispersion modelling, pollutant dispersion intervention to limit based on the prediction for oil pollution) [3].

Following the "cascade" algorithm operations (working method) will be:

1) Using Proteus simulator for composing a tactical scenario, in which a group of ships that will be consisted of two fuel transport ships will perform a march from Constanța to Sulina in order to ensure supply of fuel (diesel) for military units located in the area. Protection is provided for the convoy by three corvettes (model 1048M) and a frigate - F111. In March, at the beam of Sfântul Gheorghe, the convoy is attacked by naval aviation and a ship carrying a group of enemy missiles. The "calculated" result of the fight is presented by simulation in the "results and discussion analysis" chapter;

2) Generation of pollution situations: Will be based on the simulation result of the fight and will include a significant amount of hydrocarbons in water suddenly discharged from one / several ships hit. The amount and type of hydrocarbons

will be estimated based on the displacement of the vessels, type of hydrocarbon being known. Discharge date is taken from tactical scenario, as the discharge was left to the operator will;

3) Accessing the Navy SIMIN hydro-meteorological system, (we can't screen capture using the software) to select information about the district in which the discharge occurred. Mentioned that previously, the SIMIN system was accessed for the introduction of hydro-meteorological data requirements necessary for the operation of various weapon systems on board ships (sonar stations, torpedoes, rockets, etc.);

4) Hydro-meteorological data entry in GNOME software, to simulate spatial-temporal dispersion of the oil sheet to know every move, its location parameters and the time when ships for collection, or use of dispersants/ burning (whichever best choice) will reach it.

5) Enter data as required by ADIOS2 program to determine the optimal variant chosen for intervention, given the effectiveness of each method (burning, collection of skimmer or dispersion with chemicals). Variant chosen, will be presented in the results and analysis.

6) Use for determining the optimal number of vessels and types of intervention required (taking into account the amount remaining after evaporation, emulsion (sea level), etc.), the transfer position (geographical coordinates), size (thickness), the estimated quantity of oil spill in GNOME programs and ADIOS2 the simulator "Navi-Trainer Professional 5000" using graphical interfaces.

7) Simulated actual intervention in the district, with viewing means of intervention in simulated conditions close to reality (simulation of burning area under Annexes of the results, the simulation of oil spill collected by dams, etc.) and training of crews and personnel to manage such situations.

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