Simulation, Stakes and Perspectives

The Simulation and Operational Research Division ("DSRO") received within the Forces Employment Doctrine Center ("CDEF") the mission to be "the Army expert in matters of simulation". This mission is demanding for many reasons:

- simulation keeps taking an increasing part in all the activities contributing to the operational efficiency,
- the computer technology is permanently evolving and regularly pushing back the systems limits,
- the range of the Army units missions is broadening in a more complex general environment,
- the actors around simulation are more and more numerous and demanding.

After clarifying the perimeter of that simulation, these four topics will be studied and the stakes and perspectives highlighted.

BY COLONEL FRÉDÉRIC **MORINIÈRE,** FORCES EMPLOYMENT DOCTRINE CENTER SIMULATION AND OPERATIONAL RESEARCH DIVISION DIRECTOR

Simulation: What is it about?

Simulation is **before all a method and a tool, among others,** to help solve a fundamental problem: to get prepared for war in peace time! Indeed lessons learned clearly show the necessity and the added value of units hardened and trained to face stress and fear in combat. This imperative for results must take into account our limited means and a necessary progressiveness while trying to reach at the end the best possible realism. At all times the armed forces had to invent processes to bypass these difficulties. But the latter are far more important today. "Real size" exercises remain rare or even incomplete for different reasons: cost, security, forces economy and civilian population tolerance. In this context what is simulation providing?

Simulating weapon systems (with a technological main characteristic) has been well known for a long time and permits to learn the know-how necessary **to implement them.** Studied and developed in the framework of armament programs it is indispensable for the education of the crews, the gunners and the pilots. It is the expertise domain of the Army Technical Development Branch ("STAT"). The latter is also in charge of the simulation (sometimes called living) implemented at the Force on Force Training Center ("CENTAC") in Mailly; The added value provided to the realism of the training is no longer to be demonstrated. Between the technical simulation and the simulation there is another form of simulation aiming at facilitating the learning of the **employment** of the weapon systems and the training to forces commanding. It is the domain of the commander and the staffs. It is no longer only a matter of simulating the weapon systems but rather their effects and the different interactions between the actors and the terrain. This simulation in networks is called *constructive*. The "DSRO" is in charge of bringing both a technical and operational expertise to this type of simulation. To be an expert does not mean to be the only one to know or to work, on the contrary. This function relies on numerous complementary works conducted in partnership with forces, staffs, and Army schools but also with the "DGA" (French Defense procurement agency) and the Armed forces joint staff in the framework of studies and exploratory works concerning the Land forces domain. This article will therefore essentially deal with **constructive simulation**[1].

ADC Fabrice CHESNEAU/SIRPA TERRE

Simulation keeps taking an increasing part in all the activities contributing to the operational efficiency.

These last fifteen years have seen numerous devices arrive relying on digital simulation. The **JANUS**

simulation, provided by the Americans, has been upgraded in the early 90s within the "DSRO" (at that time called "CROSAT") then has been successively set up in five Army schools (Infantry, Armor, Artillery, Engineer, Staff), then in 3 countries (Morocco, Tunisia, Lebanon).
The Armor branch later developed the ROMULUS system which also keeps upgrading for the benefit of other branches. As and when the computer technology changed the Army developed **a competence and a know-how today appreciated.** The decrease of the maneuvering troops strength in the schools, the costs and the increasing constraints for the implementation of equipment led to a more important recourse to substitution and simulation means. Besides the teaching contributions of simulation thanks to their capability to record during action and to replay facilitate **the education of the officers** and **the training of the staffs.**
The exercises conducted that way also permit to prepare the exercises with organic assets or in simulation with force on force combat equipments and to improve their return.

This last 15 years growth will continue. Beside the constraints (security, nuisance, costs) that will probably increase, **the battle space digitization** will also result in evolutions in the way we train. Indeed the CIS assets only produce their total effect if they are all interconnected from the bottom to the top. Beyond that technical constraint they will also cause **an evolution in the reasoning methods and the tactical procedures.** That transformation causes a need for the appropriation of these tools. Each training will imply a representation of the non represented CIS segments. This synthetic and virtual environment around the player echelon can only be produced by constructive simulation. The latter will thus remain a privileged means for the operational preparation.

The computer technology is permanently evolving and regularly pushing back the systems limits.
The **power of computer science** in term of speed and memory is **permanently increasing.** This brings new employment possibilities that the human imagination faculties discover each year. Who would have said four years ago that the games in the shops would be exploited today for serious matters? In the same way **programming robots** so that they have a behavior in keeping with the doctrine and plausible in comparison with reality looked like a risky bet but today it's a winner. Representing terrain in 3 dimensions is costly today but might be very affordable tomorrow and naturally integrated in all the systems. We need to avoid letting ourselves be lured by the sirens of the all technological but we need to be watchful and to seize every thing that brings **a high added value to our requirements** with an acceptable cost. This is the role of the **technological watch indispensable** for any company that wants to remain competitive.

The range of the missions of the Army units is broadening in a more complex general environment.
It is obvious to note that the environment and the missions of the Army have considerably evolved between the 70s and today. Training and educating officers and NCOs have become more demanding. **We must keep preparing ourselves to fight a traditional enemy while taking into account all the aspects of the new types of conflicts.** Trying now to model the urban area or the population, just to take these two examples, is a difficult challenge for simulation. Besides how can we represent the media effects or all the peace keeping missions?
Modelling always implies some kind of simplification. Our limited means command to remain reasonable. But simulation must also be on the same wavelength as the reality of the missions. This double demand must guide all the actors implementing it.

The actors around simulation are more and more numerous and demanding.
Our society leads us to always demand more. Who now would accept a black and white screen yet enough for many applications? The increasing employment of simulation and the appearance of computer science in most of the domain of operation of our society cause all the actors to have **always stronger demands considered as natural.** Terrain representing is always too poor for the engineer. The infantryman wants to see the last 50 meters. The Army aviation wants to practice terrain contour flight. Without continuing that listing this increasing demand is understandable. Fortunately the costs limits impose us some wisdom and compel us to identify the needs and prioritise them. Drift risks are thus limited. Nevertheless the importance of the appropriation of the new tools by the users which is an indispensable condition for their optimum return must not be neglected. It is therefore a demand that we must take into account.

Simulation stakes and perspectives

In front of the various demands and of the aforementioned constraints, we must ask ourselves how to manage the **future developments.** We have seen the expansion in the operational preparation activities. At the dawn of the battle space digitization, it is easy to imagine the essential role that it will play to enable the forces to get familiar with and then to tame these digital tools. But for all that is simulation arrived at its maturity? Probably not and the three following tracks need to be looked into for the broad margins of progress they might provide:
- mastering these tools,
- assistance to the operational decision,
- combat realism.

Mastering the tools
All the constructive simulations include a certain number of common modules (exercise creation, terrain creation, after action analysis, etc.). However as of today none has been reused except for the simulations created by the same "Maître d'oeuvre" (MOE)[2] . When the "MOE" is external these modules are bought for each tool and therefore several times. When it is internal each center operates independently. So there are profits that are perhaps not exploited. Let us try a comparison with the management computer science. After they have known scattered developments, management computer systems are now built in a more and more rational way. The applications are separated in layers or modules (data

bases, networks, man-machine interface, common services, job layer). These different "bricks" are well identified and their liaisons are standardized. Most of them can then be reusable from one system to another. On the contrary, the so called "job" layer is often specific to an enterprise. It is the most important, the one that must be mastered in priority. In simulation the "job" layer is the one that models the interactions between the different entities, i.e. the combat. This representation varies depending on the simulation objectives. The other "bricks" (terrain creation, system data base, etc) might constitute the modules common to the different simulations. This would facilitate also **the increasing need for interconnection of the simulations** that request more standardization.

It is probably excessive to use the term urbanization of the simulation systems but the increasing pressure on the resources and the obvious need for interconnections impose **that the future developments be oriented around a common base, a kind of overall operation "simulation"** similar to the "OE SIC TERRE" (Army CIS coordination program). This operation would probably permit a better mastering of our systems.

Assistance to decision making
Regarding this application sector we are just in the **early stages** and **beginnings.** The "APLET" demonstrator, realized during a "PEA" (upstream study planning), and the first robots met in SCIPIO are examples that show us that computer technology is going to be more and more capable to respond to the needs for decision making assistance as soon as we are able to express them. We will have to remain modest and progressive. Indeed these tools will have to **demonstrate their relevance to win the confidence of the users.** Two examples of tools might be created. The first would be able to develop a scenario in an accelerated way depending on certain parameters. It would permit to compare different courses of action opposed to varying hypotheses and record their consequences in a relevant way. Once integrated into or added to the CIS equipments, this tool would facilitate the future maneuver preparation and perhaps would permit to anticipate unfavorable scenarios.
A second type of tool would constitute a virtual sand box around which the leader would more easily think and give his orders. This implies to be able to have the necessary environmental data. Satellites and other intelligence sensors would enrich this modelling as and when possible. In the domain of decision making assistance simulation will only be a proposing force. It must therefore convince. These two examples are probably not exhaustive but they **constitute tracks that we must keep exploring.**


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Combat realism
Generally there is **a margin between theory and reality,** consequently between the simulation and the effective operation that will take place in the field. This is all the more true as the operations may very rapidly evolve in gravity and intensity whereas they are today characterized by their duration. The actors are multiple and numerous, the notion of friend or foe is more subtle than black and white. The effects obtained in the field are sometimes transported and amplified by the medias in another environment which then modifies their meaning.
If the operational preparation and the operational readiness before projection will never permit to study all the possible cases, they must nevertheless do their best to make people aware of this complexity by as realistic exercises as possible. Here also the last technological realizations demonstrate that modelling more and more numerous and versatile actors and situations is possible. The current operations in an obvious international and legal context require more and more subtle and realistic tools.
This necessary realism must however **aim at the strict necessity.** The goal is not to produce an epic movie.
We simply need to represent **what is necessary to respond to the demands, the training objectives and the exercises.** These are the goals that must guide simulation.

1 The simulation tools are traditionally separated into three categories :
- Live, when the question is to implement equipments and men as in the Force on Force Training Center.
- Virtual, when the player is immersed behind screens representing the world in 3D.
- Constructive, when using systems in networks substituting themselves to the player's subordinates or higher echelons (JANUS, ROMULUS, SCIPIO for example).
2 Project manager.

As conclusion

Simulation plays an increasing role for the efficiency of our forces. Its permanent evolution is made necessary by numerous demands explained in the first part.
Three main axes - mastering of the tools, decision making assistance and realism - seem to be going to play a major role in this evolution. They will constitute the "DSRO" main axes of effort in the near future. However we need to be pragmatic: it is a permanently evolving domain in which it is important **to keep a careful watch while keeping in mind the expected objective.**