

## Role and Place of Modelling and Simulation in Wargaming

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### ***ABSTRACT***

*In spite of the fact that MS technologies are very well spread and accessible to the community, its role in the analytical domain is underestimated and not well anchored. Wargaming as an important part of almost any military analytical study at strategic/operational level has different requirements on M&S in comparison to the well-known training domain. The article deals with a role place and constraints of MS in support of wargaming. The proposed capability planning process in the Czech MoD is a use case where the role of MS is specified. The main focus is put on the architecture of a proposed solution when the manual and computer assisted wargaming is employed.*

## **1 INTRODUCTION**

Modelling and Simulation (M&S) technologies and approaches are well known and spread over the Nations and NATO as well. It has broad applicability in the military domain. The NATO M&S Master Plan can be taken as an example of the classification of M&S use for military purposes [1]. There are five application areas:

- Support to Operations
- Capability Development
- Mission Rehearsal
- Training and Education
- Procurement

In spite of the existence of the document, there is a lack of understanding of M&S potential; mainly in the analytical domain. One explanation of such situation might be not clear border between M&S discipline and operational research discipline. Therefore it is obvious that it requires increase of awareness, promote interoperability standardization and further develop the professional M&S Corps within NATO [2] with precise definition of the intersection of these two disciplines.

Any analytical study regardless the military application areas require tools to be used and to increase the rigour of the final results and recommendation of the study. One of the tools that is applicable through all levels of military decision making is wargaming. It is important to clarify the role and place in the form of constraints of M&S in wargaming and vice versa as well.

## **2 WARGAMING**

**Wargaming dates back to era of Kriegsspiel. It was the very first systematic approach to**

**train a commander staff in decision making process in the Prussian army in 1830. It was originally played as a game strictly controlled by explicitly defined rules. However it proved to be contra productive. The players abused the rules to win the game and there was no authority – umpire who decides on the results of the particular CoA. Therefore the open version of the Kriegsspiel was launched and rules were more flexible and adjudication of CoA was done by a senior rank with sufficient authority.**

The Perla definition of wargaming says [3]:

**“A warfare model or simulation, using rules, data, and procedures, not involving actual military forces, and in which the flow of events is affected by, and in turn affects, decisions made during the course of those events by players representing the opposing sides.”**

**The definition shows that wargaming is explained using terms like the model and simulation. However to better specify the role of M&S in wargaming is important to have detailed view on the individual construct of wargaming and to specify the limitation of M&S use to support it.**

## **2.1 Wargaming elements**

Wargaming from the system point of view might be seen being composed of the following key constructs:

- Scenario is the scene opener for the Players. It is exhaustive description of the scene.
- Order of Battle (ORBAT) contains capability of own forces and its characteristics.
- Objectives of wargaming is critical point for the successful design of the game.
- Maps and Charts create the interface between Scenario and Players.
- Clock is the driver of the flow of the game. It should reflect needs of Objectives and Players.
- Rules & Data create boundaries for Players’ moves and decision making process. It is enforced during the game by Umpire.
- Players create dynamicity of a wargame. They manage their planning and decision making process.
- Analysts read the results of the game and supports Umpire in his decision.
- Facilitator supports the execution of the game to better achieve the objectives of the WG.
- Umpire makes decision over the executed Course of Action of Players.

## **2.2 Wargaming process**

Wargaming might be explained as a process composed of the following main phases – micro processes:

- Precondition set up is the phase where the personnel involved in the game is trained for the all phases of the game.
- Design is the phase where the Designers based on the objective design the game and all constructs.
- Development is the phase where the Developers implement constructs following the design phase.
- Validation is the phase where the developed game is validated against the objective of the game.

- Execution is the phase where Players are stimulated to make a decision that drives the flow of the game. Execution phase is usually run in cycles and composed of the steps describes on the Figure 1-1.

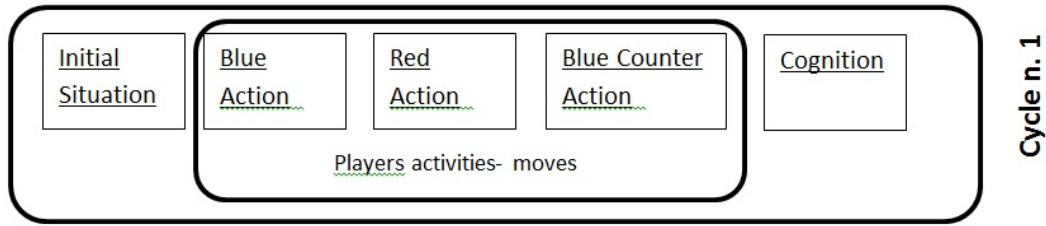


Figure 1-1: Wargaming execution phase.

- Analysis is the phase where the Analysers analyse and interpret the results collected during the execution phase of the game.

### 3 M&S CONSTRAINTS, DRAWBACKS & IMPLICATIONS IN WARGAMING

The Table 1-1 shows the identified constraints and implication of and for M&S in wargaming in the perspective of its elements. The constraints are mentioned regardless the form of wargaming (e.g. Manual Wargame, Computer Assisted Wargame, Computes Assisted Wargame with Human in the Loop). The identified constrains are results of the Case Study explained in details in the chapter 4.

Table 1-1: M&S constraints in wargaming elements.

Element	M&S constraints/implications
Scenario	<p>Missing common language at the strategic level for a scenario description</p> <p>No best practice or automation of translation from the strategic level down to the operational level and from operational down to the tactical level</p> <p>No automation of the scenario generation at any level in real time; expensive</p> <p>MSDL doesn't contains features that would connect it with the higher levels; too tactical</p> <p>No defined interface between DataBase (DB)'s like JANE'S to assure the realism for training purposes</p>
ORBAT	No defined interface between DB's like JANE'S for validation purposes
Objectives	<p>If WG used for experimentation then no automation of design of Measure of Effectiveness (MoE), Measure of Performance (MoP) and Key Performance Indicator (KPI) in relation to the scenario</p> <p>No DB or predefined set of MoE, MoP, KPI to be used in a simulation</p> <p>If WG used for experimentation then no standardized way to express MoE, MoP and KPI in a simulation</p>
Maps and Charts	<p>No automation of real world maps generation based on the selected territory</p> <p>No automation of faked maps generation if territory is not important (MoE, MoP and KPI, a simulation and scenario should be inputs of such automation)</p>

Clock	Current simulators are complicated and discrete in character and not fast enough to be used in WG to support critical time decision
Rules & Data	No native way in explanation of the rules and data implemented in a simulation based on the level of the simulation use
Players	If WG used for experimentation there is no automation of human behaviour at all decision levels; validation is critical  No best practice of verification of Players – no way to be sure that they are ready for a game  No best practice to reduce Players bias
Analysts	If WG used for experimentation there is no automation of human behaviour that would replicate the role of Analyst  No best practice to reduce Analyst bias
Umpire	No automation of umpire decision into the rules of a simulation- learning phase of a simulation used for experimentation purposes  No best practice to reduce Umpire bias

**4 USE CASE: CAPABILITY PLANNING PROCESS IN THE CZECH MOD & WARGAMING**

The Czech MoD hasn't formalized process of capability planning. The current research activity should reveal potential and limitation of modelling and simulation and wargaming principles in the capability planning process. Wargaming approach used in the capability planning process is based on two forms. The first one is Manual Wargaming (MWG) and the second one is Computer Assisted Wargaming with the Human in the Loop (CAWHiL). MWG is a table top game with no computer assistance in any phases of a wargame. CAWHiL is a wargame where the simulation is used to support the decision of Umpire, Control Team and Analyst in any phase of a wargame. There are other forms of Computer Assisted Wargame, however it is beyond the scope of the paper.

Figure 1-2 shows the architecture of the capability planning in the Czech MoD.

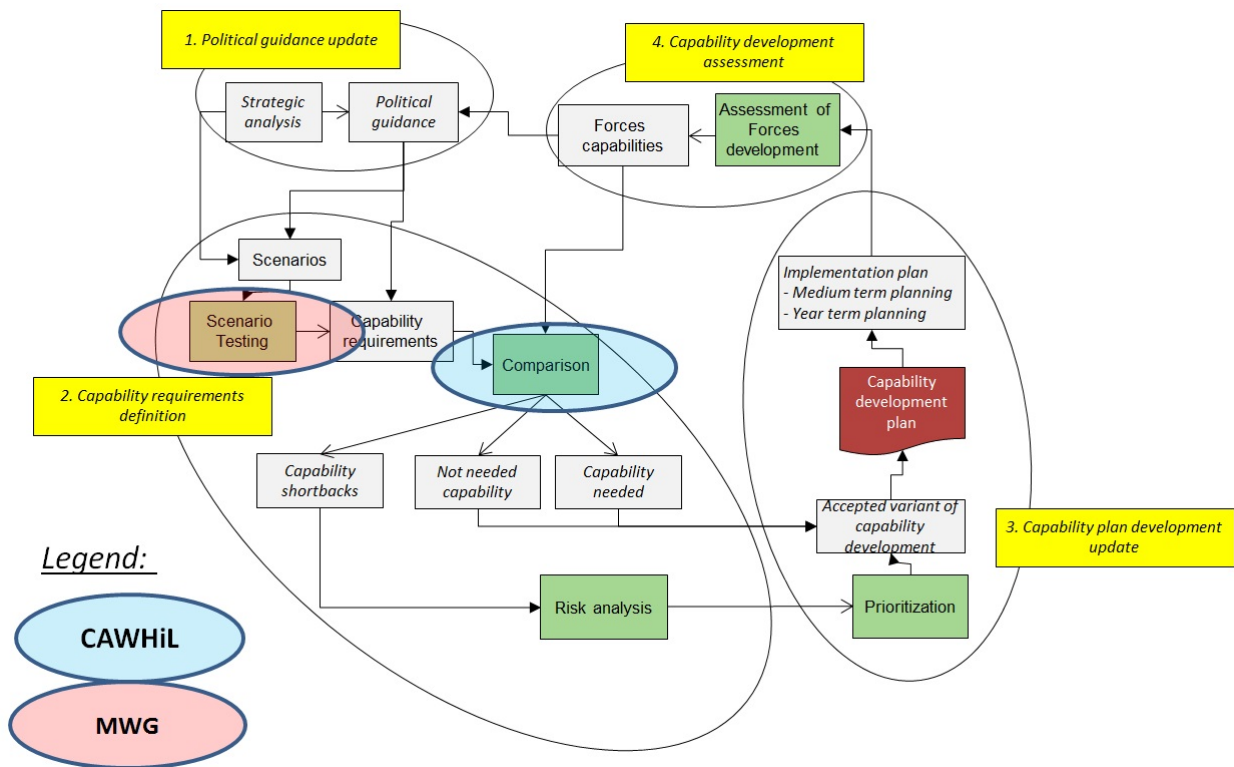


Figure 1-2: Czech MoD capability planning process.

The purple oval depicts the place where Manual Wargaming should be used. The blue one shows the place where Computer Assisted Wargaming with Human in the Loop should be used. Manual wargame is used when is necessary to identify the set of capabilities needed to fulfil the given political guidance in the perspective of the future scenarios. There is no time to run the wargame with support of simulation in any form. After the capability is defined for the group of scenarios, the CAWHiL should be run to support the comparison phase where current forces capabilities are confronted with capabilities requirements identified in the previous phase. The result of the CAWHil is set of capabilities shortbacks, needed and not needed capabilities derived from the current forces.

Figure 1-3 shows in details composition of WG into the capability process. From the generic scenarios the specific ones are produced. These are main sources for manual wargame to get the capability requirements without working with the current capabilities. The next step is to run experiment using the constructive simulation in the form of CAW with the Human in the Loop. Main inputs are executable scenario, Measure of Effectiveness and Performance and Key Performance Indicator used in the simulation. Last part of inputs is composed of current and planned capabilities expressed in the simulation in the form of Forces. Analysis of CAWHiL experiment results should support decision on delta between capabilities required and current and already planned capabilities.

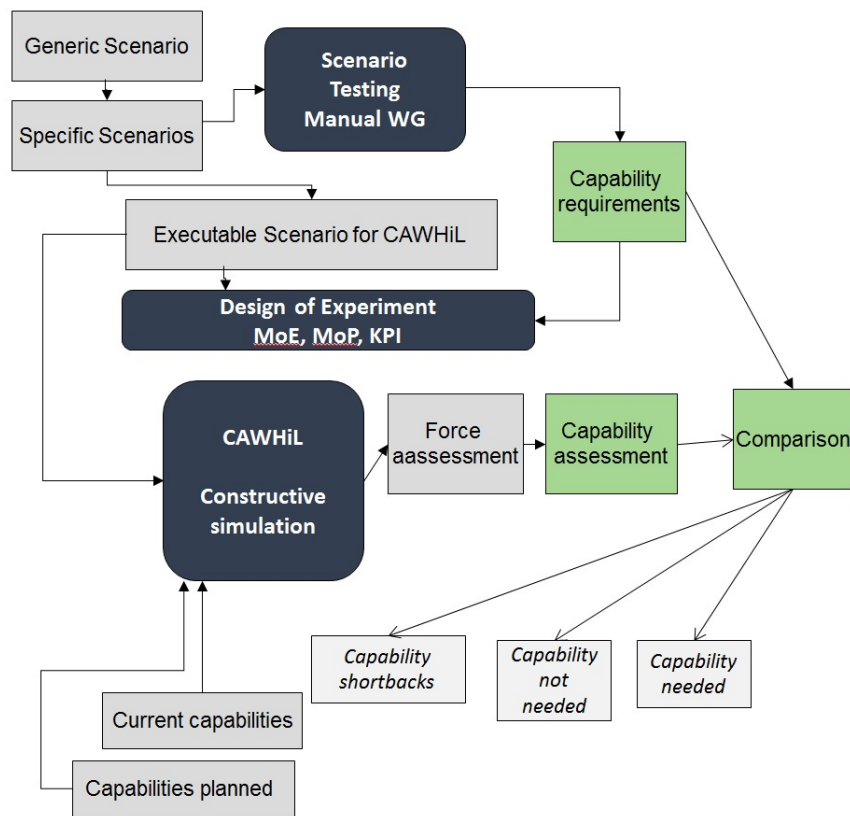


Figure 1-3: CAWHil and MWG in the capability planning.

## 5 CONCLUSION

The paper showed that in the domain of wargaming is important to explicitly define forms of wargames and its limitation mainly from the analysis point of view. Capability planning is complex problem and wargaming must be integral part of its process. The Case Study demonstrated the proposed architecture of capability planning process supported by Manual and Computer Assisted Wargame with the Human in the Loop. The first experiment with proposed architecture will be run in late 2018.

## ACKNOWLEDGEMENTS

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