

**C2 Modeling & Simulation**  
- Challenges For The Future -  
From A User's View

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"Tell me and I will forget,  
Show me and I will remember,  
Engage me and I will understand"

Modern version of Confucius

**Abstract**

The need for high quality in Command and Control is for everybody imminent. As the costs for live exercises all the time go up there has to be substitutes developed with which the personnel involved in C2 can be trained and thereby not only retain but also enhance their abilities. Use of simulators to represent both military units, police forces and civilian "operators" gives us a variety of prospects when talking about C2 training where the trained personnel will experience their situation as reality. A computer-assisted C2 exercise can be executed on all levels depending just how small units the computers are developed to simulate. The American system JTLS can be used primarily on joint level, while the Swedish system TYR can be used both on joint and component levels as well as down to battalion/company.

The major advantages with use of simulators will be the cost-reduction, lesser need for personnel "playing the units", no need of access to "live training areas" but also the freedom to choose when, where and whom to train.

For the future the development of simulation-capability will make it possible to use the instrument not only for training but also for assessing alternatives and testing orders before execution. It will be possible to "mirror" the true geographical datas to further enhance the realism in the simulation

## 1. Why Modeling And Simulation?

Every state faces today a reduction in budget to the Armed Forces. At the same time will the costs for major exercises increase. So the alternative for training of Command and Control, especially on joint level but also on army corps and division level will be to simulate the subordinated units by use of adequate models and thereby keeping the total cost down. By simulating there will be a lesser need for lots of "players", they can be "substituted" by computers. It will also give each commander a freedom to choose time, place and scenario for exercise whenever and wherever he finds it appropriate.

By use of models and simulators instead of live units it will be plausible to reach a cost-effectiveness through

*"many trained by a few"*

A computerized simulation-system will thus give us, if rightly used, possibilities to raise the overall quality of the courses of events. The major advantages with a computerized game-engine are:

- Creation of dynamic courses of events
- New inputs as result of calculations and decisions taken
- Increased possibilities to create a continuous flow of courses of events
- Enhanced realism
- Reduced need for personnel both during the preparation and the execution phases.

The main issue is to balance the level and complexity of interaction between the counterparts in the simulated conflict with the aim and objectives for the exercise.

## 2. What Is A C2-Simulation?

On all levels in an organization where decisions are to be taken influencing others you may talk about "Command and Control". It is however of utmost importance to clarify that in our language "C2" corresponds to the levels above units, where on the other hand the main training is about how to handle the personnel and equipment in real "fights". ( See more in para 4)

It is possible to divide C2 exercises from three different main purposes:

- CPX where rules and routines are to be trained.
- Decision-making exercises where the decision-maker's and the organization's ability to handle different situations is to be trained.
- "Study-games" which test and evaluate a certain organization or plan especially before final decision on implementation.

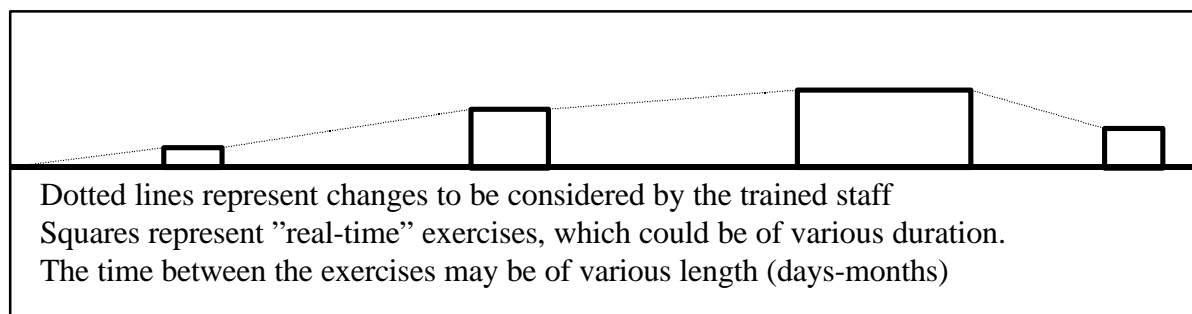
For all those different "types" of exercises simulators can preferably be used. It is however essential to bear in mind that C2 exercises based upon simulations are **today** primarily CPXs and decision-making exercises where the "truth" in every result of a duel is of minor importance.

Since there will be no "interference" from use of proper areas and units it will give the commander full freedom to train whatever he wants, whenever and wherever. He may choose to remain in his peace-time HQ or to deploy the staff somewhere else.

Independently the scenario it's important that the staff gets a chance to "get into" the new situation from where the exercise starts. A C2 exercise should always be executed in real-time, at least CPXs and decision-making exercises.

The prologue to the "real-time exercise" may then be of various length in time but very essential is that the trained personell very early in the process will get a chance to affect the development even though the prologue not necessarily has to be played in real-time. It depends on the aim and objectives of the exercise.

With such a concept it will be possible to train with a long-term scenario where bits and pieces are "cut out" for real-time exercises.



Another very important question is the manning of these authorities, agencies and military units (response cells) with whom the staff has to cooperate. The trained staff-members must always find in their exercise that they deal with the "right" professionalism and CIS as if had been "reality". The superior, co-lateral and subordinate levels have thereby to be represented by officers and/or representatives of "the right kind".

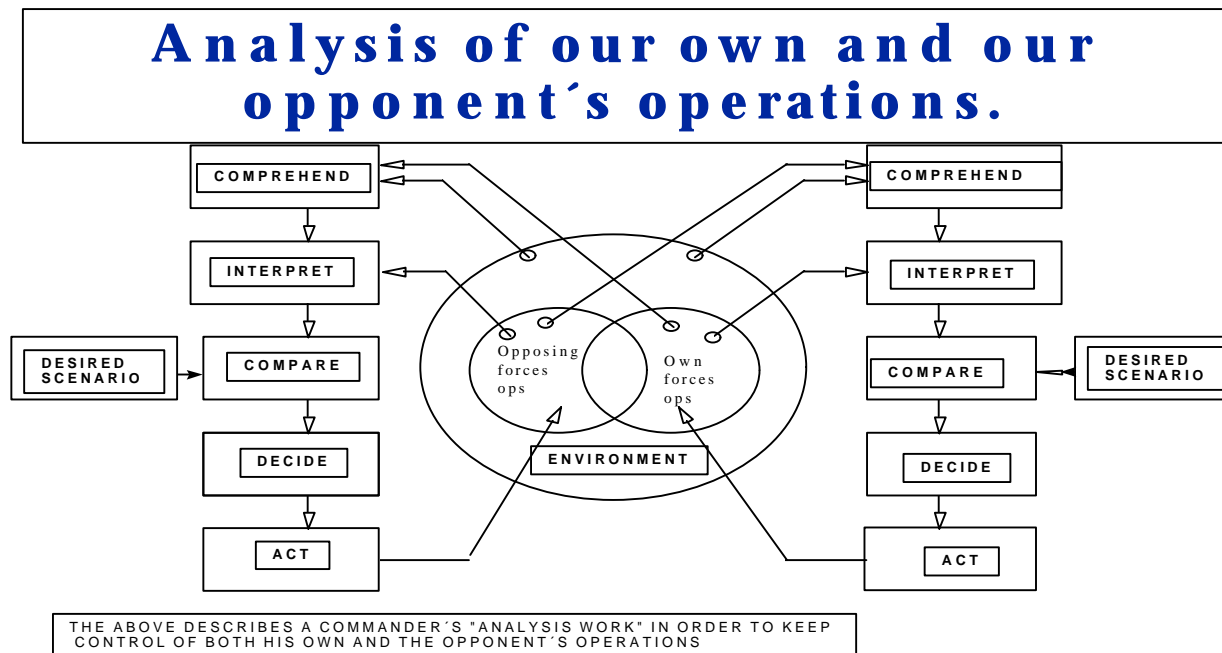
So therefore the simulation has to be of so to say two levels, at least, below primary trained level and the trained staff will not directly affect what's going on on unit-level (simulators).

Response cells give orders to and get reports from the units or groups, represented by the simulator ("game-engine") e.g. the Swedish TYR. Orders and reports should be issued inside the existing CIS on the represented levels. The Swedish communications-system, HUGIN, could then serve as a substitute in case the exercise director or some staff wants to look ahead and "computerize" all the way down in the Command and Control structure.

### 3. The Swedish Game Philosophy

The range of situations within which the skill of decision-making should be able to be trained, requires that different methods must be able to be used to achieve the intended goals and purposes. The most common forms are training seminars and event-driven real time games.

In the latter the basic idea is that the commander and his staff shall act within his command and information system using "normal" rules and procedures



The commanding officers and their staffs are constantly put in situations which demand both decisions and actions.

It is often difficult to identify just what the key is to a commanding officer's success, since many factors influence the development of events.

Both the courses of events and the situations requiring decisions can be generated by "the game", which can help to identify possible key factors for success.

By simulating concrete situations which require decisions, and then confronting the decision-maker with examples of the ensuing consequences, the game can be used as a method to support the training and practice of commanding officers and their staffs.

An interactive and reciprocal game with realistic opponents, allies and "neutrals" whose actions are based on the same terms and conditions as the group being trained, creates a dynamic situation, and with that, the element of unpredictability in the game.

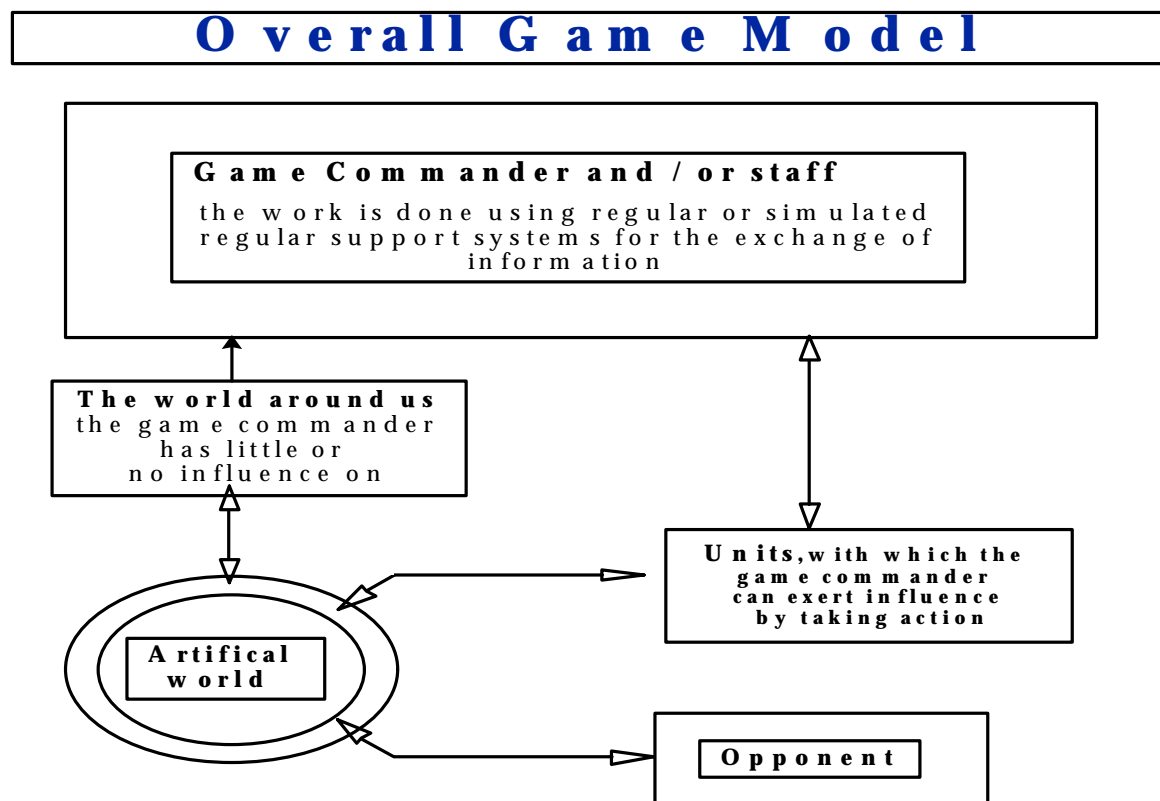
By practicing and confronting the unknown, commanding officers using games, can be trained in a wide range of complex issues in order to sharpen their skills when it comes to understanding, synthesis, and assessment.

The type of training to be conducted is decided after an analysis of the objective which has been stated by the exercise commander.

In an actual decision-making situation, the parties hardly have a complete or correct picture of reality.

In the game therefore, information to the participants is limited in different ways.

Just as they do in reality, commanding officers have to make judgments based on the information they have collected. Using that information, they make decisions, and give orders to their units.



The interchange of information between commanding officers is composed of exchanges of considered and evaluated positions as well as orders and status reports – not just a transmission of raw data. Just as in true reality, the issuing of reports and positions is a conscious action over which one has control.

Commanding officers and their staffs have to be **active** in order to obtain information; otherwise they may not know anything until it is possibly too late to act.

#### **4. Simulation Of C2 In War-Time Scenarios Compared To PSO And During Crisis-Management.**

The armed forces in every country is a tool for the government to impose its objectives. It is therefore essential that simulation can be provided the Commanders for all the different tasks the military component has to fulfill.

There are today models available for C2 exercises mirroring a war-time situation, even though a future war will never be similar to the previous ones. Those models are basically not developed with the civilian society in mind and therefore very seldomly take automatically into account decisions taken by civilian authorities.

Simulation of a joint operation has today in most cases therefore to be interpreted by a "supervisor" and the result has to be manually modified. However there are models, for example the Swedish TYR, which to a great extent has dealt with this issue, with lesser players on unit level as the result, even though much can and will be done.

The Swedish approach to more international cooperation for Peace Support Operations of various kinds has resulted in the development of tools for simulating these types of missions.

The CAX where this will be operational will be an exercise in the spirit of PfP called VIKING 99, conducted and controlled from Sweden with response-cells (= subordinated staffs/units) located outside Sweden. The simulation will be distributed with a system where the simulator can be handle remotely with use of ordinary telecommunication capability (telephone, cell phone)

When dealing with PSO it will be necessary to involve lower levels of decision-making since the operations will be executed to a great extent with smaller units and even with individual patrols. Models for PSO must therefore simulate smaller "units" in smaller areas and with a need for more detailed information of terrain for example.

Basically you could say that the simulation of something moving around follows the same rules independent what it is. The difference will be speed, size, capability and rules of engagement.

So simulating a battalion and/or a number of people on escape will basically be the same as the simulation of a military patrol and a police-vehicle

The major problem today is making models of the non-military activities in a conflict, no matter war or short of war. When we now work with tools for simulations of PSO a complete new set of rules has to be determined. That in itself is a new and difficult task where the human being cannot automatically be excluded from the play.

More difficult than that is to model and simulate activities inside societies where you don't know the leaders or even the groupings. To my mind it will for a foreseeable future be necessary to play that part of an exercise with a substantial amount of human players, experts and specialists.

## 5. Challenges For The Future

During the last year Sweden and the USA have reached an agreement in shape of a "Memorandum of Understanding" dated 18 November, 1998 on developing a "PfP Simulation Network" in cooperation.

The aim with this program, which has a duration of five years, is to develop, design and implement a simulation network which will support in  
**"Enhancing the ability to conduct operations within the PfP Framework".**

This aim has thereby a wider range than just military operations. It covers all types of missions carried out by partner-states lead by NATO and under a UN mandate. This could be humanitarian relief operations, disaster-relief operations, food support operations, health-care assistance all of which in one way or an other will involve the "three legs" in a PSO.

- Military units
- International police units
- Civilian governmental as well as non-governmental organizations, groups and individuals.

Design, develop and implement a simulation system should meet the needs for training on all levels of a PSO

- units
- components
- CJTF

The base for meeting this requirement is that the simulation starts at the lowest required level with a built-in model for aggregation to higher levels. The over-all system will hence admit the exercise director to shift level-wise during a training period subdivided in phases ( see para 2) of for example

- joint planning
  - component execution
  - unitwise verification
- in repeated steps.

The computer Assisted Exercise called VIKING 99 conducted by the Swedish Armed Forces and simulated through my unit, Swedish Defence Wargaming Centre, will be based upon

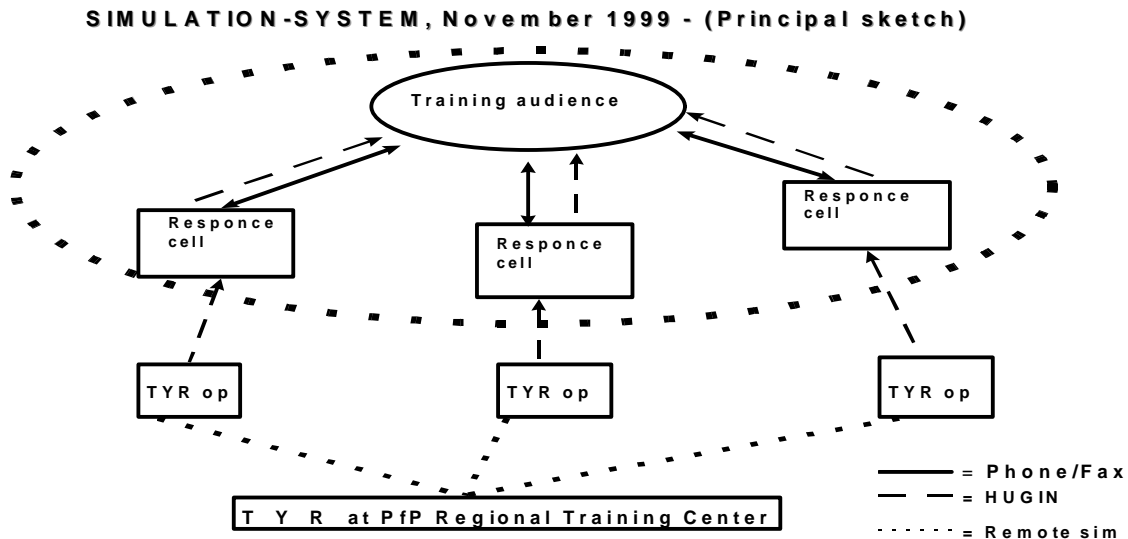
- a PSO scenario
- participation from military, police and civilian "units"
- simulated through distributed clients outside Sweden
- multinationality and multifunctionality in the staffs

The main challenges when talking about simulation to create a "realism in environment" to the trained personnel for this exercise and for the future beyond will be to make it possible to

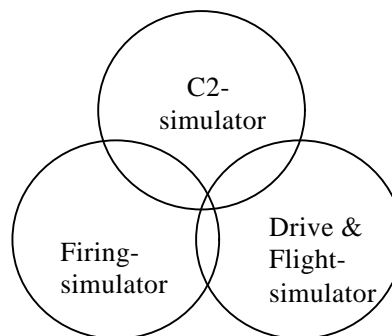
- expand to real distributed simulation (already presented during Washington Summit)
- expand to non-military operations and find ways to simulate infrastructural changes, human behavior in groups and as individuals, effects of attacks on non-military targets like telecom

installations, power stations and links, water reservoirs etc and also the use of military forces in roles others than armed (experiences gained during VIKING 99)

- develop VR-instruments, like 3D-sim of terrain, to enhance the feeling of reality for the decision-maker at least on a low (unit) level by simultaneous use of different simulation-capabilities
- expand to several levels simultaneously and thereby train the chain of command with its frictions and complexity
- interact between different simulation systems through for example HLA
- cooperation between different national or regional training centers



## Simulators



The above mentioned MoU and its amended planning guidances (which so far are only draft) says that within the next five years we should be able to

- Improve /Standardize M&S Capability
- Publish minimum requirements of communications technology and demonstrated systems architectures
- Develop a mechanism for Scheduling, Planning, and Conducting Exercises



- Identify Doctrine, Tactics, Techniques, and Procedures for Peace Support, Search and Rescue, Humanitarian Relief, and other PfP agreed Operations
- Coordinate technology with defense academies and PfP Training centers in common areas such as distance learning. (Tentative)

## 6. Conclusions

Use of simulators for C2-exercises will increase in the future, mainly of three reasons

- cost-reductions
- the computer-development with more powerful computers with rapid processing
- communication-links (Internet) and HLA-type of interconnection of systems

Simulation of "classical" war-time operations is fairly well developed. What is needed is a development of models for simulation of operations short of war, especially Peace Support Operations, with a heavy impact from different parts of the societies, NGOs, voluntary organisations and from various "non-democrating" factions and on several levels simultaneously.

The complexity in the non-military society will formulate the major challenge in order to create an environment where the "trainees" will find themselves comfortable and not argue the simulation.

Obviously there is a need for international cooperations as operations short of war most probably will be multinational as well as multifunctional. This cooperation will include sharing of models, use of regional training facilities and also distributed simulations over the nation-borders.