

# SPHINX – A Web-Based Tool for CAX Preparation and Capitalization

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## **ABSTRACT**

*The working group NMSG-106 SPHINX « Enhanced CAX Architecture, Design and Methodology » responds to issues raised by the theme of the seminar « Integrating M&S in the Military Training Curriculum » : the difficulty for officers commanding exercises to benefit from the simulation.*

*The exercise sponsors are reluctant to rely on simulation to support exercises because of their lack of knowledge and the fear of complexity that can bring simulation. The SPHINX tool facilitates the preparation of simulation exercises and their capitalization to benefit future periods.*

## **1.0 DEFINITION OF A CAX (COMPUTER ASSISTED EXERCICE)**

There is a lot of definitions to tell what a CAX is.

A good one is what the Joint Warfare Centre from ACT wrote :

« A CAX is an exercise where electronic means are used :

- to immerse the training audience in a realistic environment,
- and to help the exercise planning group and the exercise control staff for controlling the exercise process so that it achieves the objectives effectively. »

This definition allows to focus on three components of the CAX :

- a realistic environment
- the exercise control which suppose to be able to register data and to exploit them for after action review for instance
- data management with the concern of consistency

A CAX can be a complicated operation which needs organization and strong support from the training audience. A NATO document BI-SC 75-3 describes the process to build, organize and conduct an exercise. The aim of the NMSG-106 is to complete it with a focus on the distributed training with simulation tools.

## **2.0 STAKEHOLDERS OF A CAX**

In 2009, the NATO Modelling and Simulation Master Plan established for the first time four stakeholders for simulation :

- the **Coordinator** who has the task to insure that the objectives of the activities supported by the simulation are fulfilled.
- **Suppliers** who provide the means needed to accomplish the activity. It includes simulation tools.
- **Users** who are responsible for the organization of the activity under the authority of the coordinator. They use the means provided by suppliers, especially simulation systems.

- **Customers** who are the target of the activity. Generally, they don't use simulation tools.

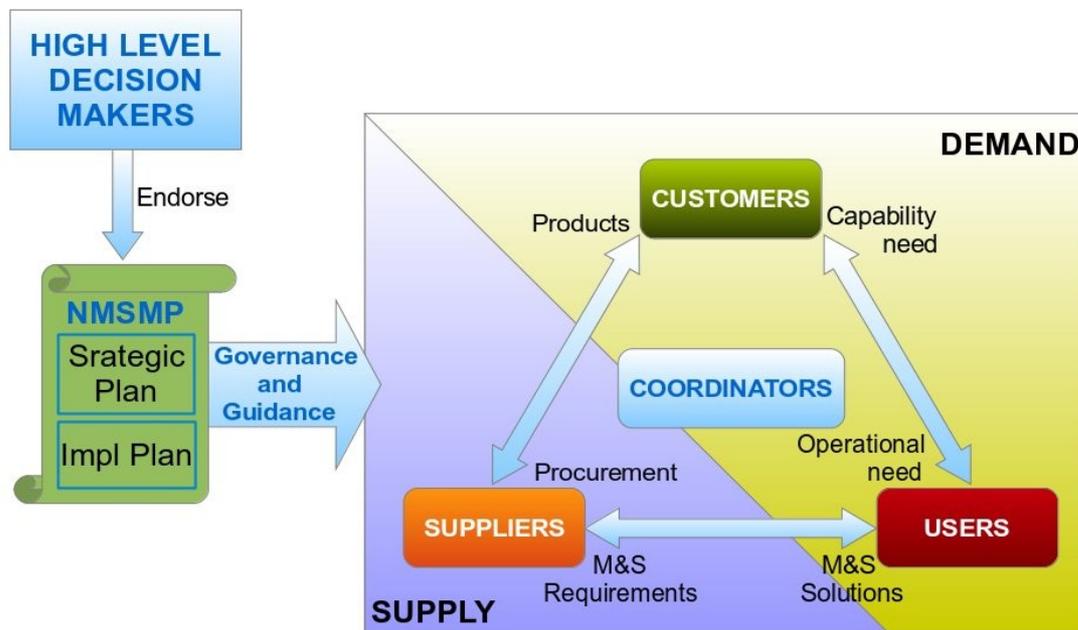


Figure 1 : simulation stakeholders described in the NATO M&S Master Plan of 2009

In the case of a CAX, these different stakeholders become :

- the OSE (Officer Scheduling the Exercise) responsible for the level of readiness of his units. He delegate the conduct of the exercise to the **OCE** (Officer Conducting the Exercise). Aims and objectives are decided by the OSE.
- Suppliers are identified by the **federation protocols**. The protocols are the link between the tools of the federation. It allows communication and interoperability between the tools. Distribute training involves several tools like simulation systems or C2 systems.
- **Training centres** are the users. They are directly under the conduct of the OCE. They are training experts. Distributed training involves several training centres with needs of coordination.
- **Training audience** is units or headquarters who are trained according to the objectives given by the OCE. Nowadays, several training audience are often trained during a same exercise.

### 3.0 ROLES OF THE STAKEHOLDERS

#### 3.1 Customers

They are the training audience. They are the target of the training exercise according to the training objectives given by the OCE. They perform missions than are part of operation types. The main activity of a training audience is to transmit and receive operational messages like reports or orders. A training audience needs services to fulfil its missions. These services are provided by suppliers and users threwh their exercise control cells. They bring the exercise control to the OCE. Until recently, it was used to train only one training audience like a command post. Now, exercises host several training audiences at the same time. They participate at the same missions. Operational interoperability is condition for the success of the mission. The operational scenario (the “storyboard” of the exercise scenario) is written with the participation of the training audience. NMSG-106 wrote a guideline for non CAX experts.

### **3.2 Users**

The training centres are the users. They are the main help of the OCE to conduct the organization of the exercise. NOTA wrote a standard document to help this organization. The BI-SC 75-3 “BI-SC collective training and exercise directive” provides a very detailed process for collective training and managing exercises. The main concern of a training centre is exercise data. Exercise data are built from operational scenario and help to write the conceptual scenario. A conceptual scenario describes precisely, step by step, the exercise with the different events, tools, actions, etc. A training centre provides exercise control training cells in order to create a realistic environment based on the capabilities of the customers. The capabilities are vignettes. Vignettes are part of a operation type and must be implemented by tools or taken in account by a training centre. Several training centres can be involved in the support of an exercise. It means communication and coordination between the different training centres so it needs an animation interoperability. NMSG-106 wrote the AMSP-03 (Allied Modelling and Simulation Publication) to support this interoperability and to describe services needed in an exercise.

### **3.3 Suppliers**

The main concern of the OCE in an exercise is not industry which provides the tools. In fact, it is the capability of the tools to communicate. So it is the federation protocols. The tools are not only simulation systems but also C2 systems or even MEL/MIL tools. So, technical interoperability means not only simulation-simulation interoperability but also simulation-C2 systems interoperability or even simulation-real systems interoperability with data-links, for instance. The design of the tools federation can be supported by the DSEEP process (Distributed Simulation Engineering and Execution Process). The suppliers provide tools and exercise support cells for services. The aim of the suppliers is to brings space-time consistency in the data management. This consistency can be found in a country book which is the repository of all the elements concerning the theatre where the scenario will take place : geography, history, armed forces, politics, media, etc. Operational messages and exercise data can be built with the content of a country book. The suppliers write the technical scenario. It is the adaptation of the conceptual scenario to the tools. NMSG-106 dealt with a part of the technical interoperability. It focussed on HLA (High Level Architecture) and the FOM NETN (Federation Object Model NATO Education & Training Network) in order to maintain and improve it. It has been already used successfully in distributed training.

## **4.0 SPHINX CONCEPTUAL MODEL**

All these roles and objects involved in an exercise are part of a conceptual model to describe what an exercise is. A conceptual model is a static representation of a system in order to provide a clear and consistent picture of the data handled by the system with the semantic (the meaning of the data) and the relationship between the data. The description model of each data are not part of a conceptual model. It means that a conceptual model can be adopted by a community without imposing a unique description model for each data. Each member of the community can apply the conceptual model to its own reference description models of data.

The following picture is based directly on the descriptions of the customers, the users and the suppliers :

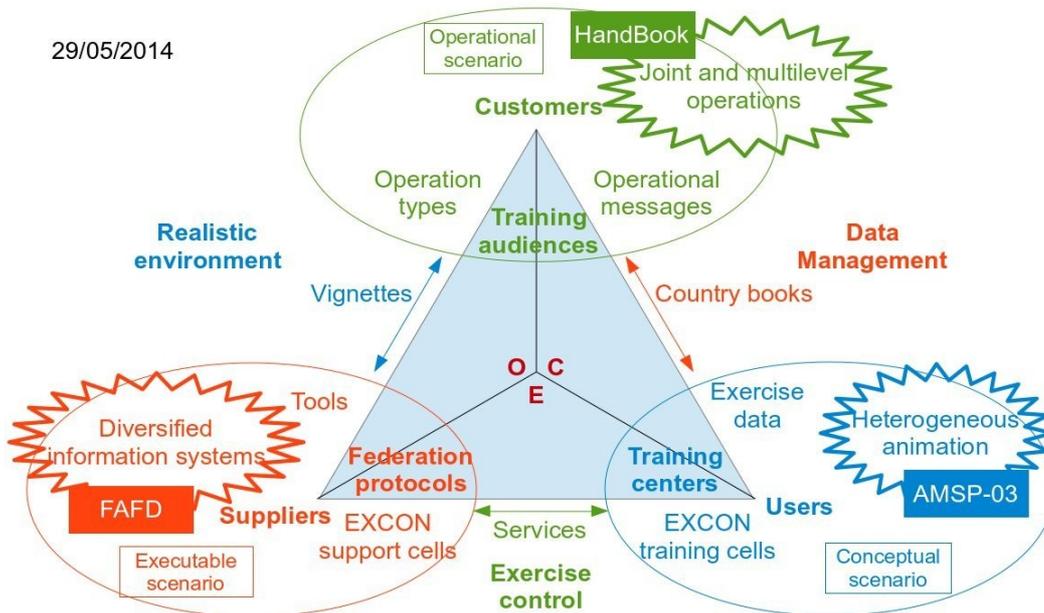


Figure 2 : SPHINX conceptual model - 2D view

The picture means that vignettes, country books and services are interface between the stakeholders. Customers and Suppliers will use vignettes (or use cases) to be sure that the tools will fit with the missions. Customers and Users will find or put in the country books all the information needed for operational messages or exercise data. Users and suppliers will both provide EXCON cells to support services on technical support and animation training perspectives. These interfaces are success keys to manage interoperability (also called external interoperability) between the different stakeholders.

In each bubble, there is several actors of the same area : training audience, training centres, federation protocols. Because there is several of each one, because each one address several entities of the same family, an internal interoperability is needed. The FAFD (Federation Architecture and FOM Design), the AMSP-03 and the handbook also called guideline for non CAX experts try to bring a part of the solutions to manage the internal interoperabilities.

According to the Guideline on Scenario Development for (Distributed) Simulation Environments of the NMSG-086, a scenario is composed of three parts :

- Operational scenarios are authoritative descriptions provided by SMEs (Subject Matter Experts) using their specific terminology of the real world that need to be represented in the simulation environment, if simulation is used.
- The conceptual scenarios provide a coarse description of the intended situation and its dynamics, but usually do not contain enough information for deriving a conceptual model and designing a simulation environment.
- Once the simulation environment is designed and set up, the conceptual scenarios have to be made available to all simulation systems and other member application of the simulation environment. For this purpose, the conceptual scenrios need to be transformed into “executable scenarios”.

The process of writing the different scenarios are part of the DSEEP.

A 3D representation has been done as well :

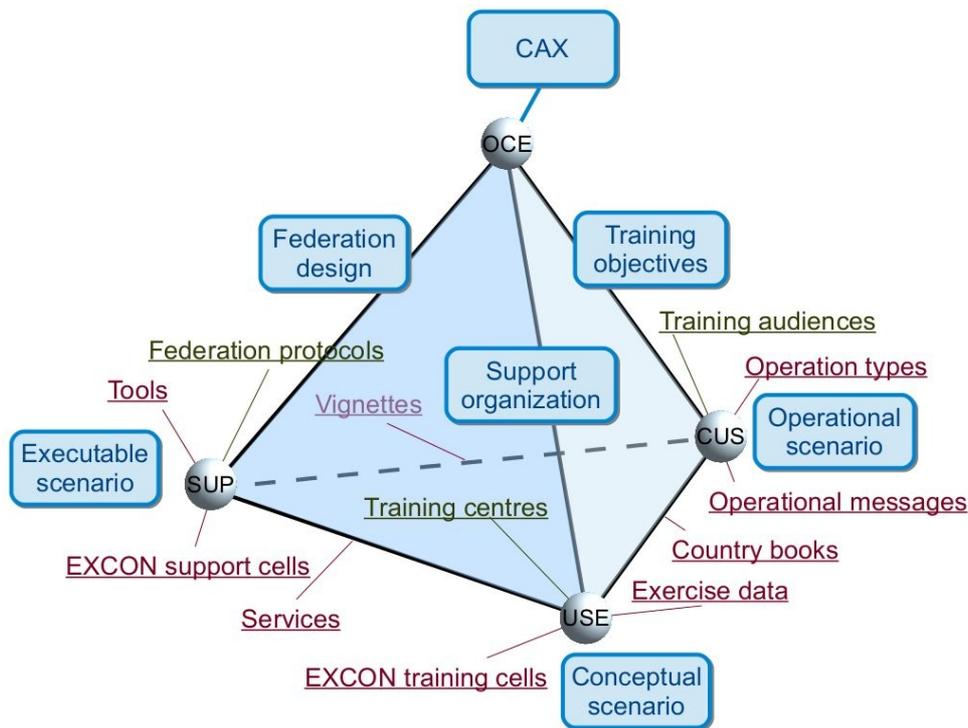


Figure 3 : SPHINX conceptual model - 3D view

## 5.0 A WEB-BASED TOOL FOR PREPARATION AND CAPITALIZATION OF CAX

This tool has been made for the OCE. Sometimes (or often ?) OCE are designed lately to organize a CAX. Sometimes, there is several OCE for one exercise because of a long preparation and the summer transfers of military people. This tool may become the main tool of the OCE. It means as well that vocabulary and words must be understood by the OCE. Experts words are prohibited.

The SPHINX tool can provide two services to a sponsor of an exercise :

- **Support for preparation** : resolution of internal interoperability issues of customers (training audience), the users (training centres), the suppliers (manufacturers tools) and the external interoperability issues, i.e. between these three stakeholders in pairs. For preparation, the tool can be used along the preparation process. It allows to share a common view of the status of the level of preparation of the exercise.
- **Capitalization** : the structuring of data provides the ability to store exercises and experiments in order to develop relationships between items and thus to enrich the debate for the preparation of new exercises or experiments. Capitalization can directly benefit from the work provided by the preparation. The most useful document for capitalization is the EXPLAN written by the OCE.

In fact, the tool is not so important. Each nation can feel free to make its own tool. This tool brings interoperability around the object CAX. Interoperability is founded on standardized data models and not on tools. So, the most important is the rigorous application of the SPHINX conceptual model. If done, then exchanges and shared understanding become possible.

A tool has been made on a web interface technology developed in PHP / MySQL language in order to validate the conceptual model.

Two result of the implementation of a CAX with the tool is composed of two main parts :

- **General description** : dates, pilots, a short description, exercise types, exercise aims and objectives, organization, federation design. Some files can be attached at each part of the description.

| Glossary              | Exercise summary  |   |
|-----------------------|---|---|
| nom / name            | VIKING-2014   |   |
| classification        | UNCLASSIFIED  |   |
| dates_begin_end       | 31 March - 10 April 2014  | dates_begin_end<br>VIKING-2014_timeline.jpg<br>VIKING-2014_TECH-timeline.jpg<br>VIKING-2014_exercise-schedule.jpg   |
| pilot                 | OCE : Swedish Armed Forces / Carl Fredrik KLEMAN carl-fredrik.kleman@mil.se   | pilot<br>20140330_VIKING-2014_EXPLAN1.4-U-joasva03.pdf  |
| exercise_description  | &gt; 7th VIKING Exercise : 2 500 participants (15 % civilian), 50 + countries, 90 + organizations, 8 exercise sites<br>&gt; Exercise VIKING is a training platform designed to prepare civilians, military and police together for deployment to a peace or crisis response mission area.<br>&gt; Developed and implemented in 'the Spirit of NATO's Partnership for Peace'   | exercise_description<br>VIKING-2014_introduction-to-VIKING-14.pdf<br>cax_description-overview.jpg   |
| exercise_types        | &gt; A distributed computer-assisted (CAX) command post exercise (CPX) co-chaired by Swedish Armed Forces and the Folke Bernadotte Academy supported by a large number of partner nations and organisations.<br>&gt; The exercise is multidimensional, multifunctional and multinational, with an emphasis on realism and current operational concepts.   |   |
| exercise_aim          | The aim of VIKING 14 is to train and educate participants - civilian, military and police - to meet the challenges of current and future multidimensional crisis response and peace operations. This includes planning and conducting a UN mandated Chapter VII peace operation in an unstable environment and based on a comprehensive approach, focusing on co-operation and co-ordination with all relevant actors, understanding their interdependencies and relations  |   |
| exercise_objectives   | (not in priority order)<br>&gt; Understand and apply a comprehensive approach to international peace operations, including the role of the host nation.<br>&gt; Promote mutual understanding, confidence, co-operation and interoperability among all contributing and affected forces, organisations, offices and personnel.<br>&gt; Understand and apply mission command/management, staff roles and functions, procedures and structures and co-ordinated planning processes.<br>&gt; Understand and apply current operational concepts reflecting present and future challenges in international peace operations   |   |
| training_objectives   | A. Understand and apply the interdependencies, roles and responsibilities of various contributors to a multidimensional peace operation.<br>B. Conduct organisational tasks and activities in line with mission plans and mandates.<br>C. Conduct effective and appropriate interaction, coordination and cooperation between all relevant actors including the host nation, in line with mission plans and mandates.<br>D. Develop and implement effective and appropriate mechanisms for sharing information between all relevant actors, including the host nation.<br>E. Conduct medium term planning, coordinated with relevant actors.<br>F. Conduct long term planning, coordinated with relevant actors.<br>G. Develop a shared situational awareness and, where appropriate, conduct common assessments of the mission area.<br>H. Apply current concepts and methods related to peace operations and practice organisational Standing Operating Procedures.<br>I. Apply relevant international, regional and local conventions, laws, declarations, resolutions, agreements and guidelines.<br>J. Practice civil-military coordination activities with respect to humanitarian law and principles. ... and sub training objectives... | CUSTOMER<br>training-audience-organisation-development.jpg<br>20140530_VIKING-2014_training-objectives.pdf<br>operational-scenario 20140530_VIKING-2014_training-objectives.odt |
| exercise_organization |   | USER<br>exercise-data<br>viking-2014-vignettes.jpg<br>viking-2014_exercise-control-structure.jpg<br>conceptual-scenario   |
| federation_design     | Country book : <a href="https://portal.jedss.mil.se/sites/viking14/wwwCrisisWeb/default.aspx">https://portal.jedss.mil.se/sites/viking14/wwwCrisisWeb/default.aspx</a>  | SUPPLIER  |

Figure 4 : SPHINX web-based general description of a CAX

- **Data inventory** : training audience, training centres, federation protocols, operation types, operational messages, exercise data, EXCON training cells, EXCON support cells, tools, vignettes, country books, services.

Each data contains a list of items which will growth with the use of the data. For instance, list of tools, or training centres, or country books will be richer and richer when more and more exercises will be implemented in the tool. Informations will become more precise as well.

The web-based tool presented here links each data with a hypertext link. So that the user is able to browse his complete database by clicking on the links. It is one of the strongest benefit of the tool : it provides the ability to compare, to find similarity or differences between the exercises, it allows to know quickly the definition of each item used in the exercise. It is the base of capitalization.

| Stakeholders and means involved in the exercise |                    |                   |
|---|--------------------|-------------------|
| trainingAudience                                | trainingCenter     | ederationProtocol |
| LCC   | SE_ACTS            | Standalone        |
| BFOR HQ   | SE_CCR             | L16               |
| ACC   | SE_LGR             | HLA 1516 E        |
| MCC   | SE_NWC             | NFFI              |
| Bde HQ  | RS_Serbie_Centre   | MIP               |
| CAOC  | BG_Bulgaria Centre | HTTP              |
| NTG   | GE_Georgia Centre  | HTTPS             |
| UNMIB HQ  | IE_Ireland Centre  | TCP/IP            |
| DSRSG Political                                 |                    |                   |
| DSRSG RC/HC                                     |                    |                   |
| UN Police                                       |                    |                   |
| UN Military                                     |                    |                   |
| UN Country Team                                 |                    |                   |
| Regional Office                                 |                    |                   |
| Sector HQ - UN                                  |                    |                   |
| Country Office                                  |                    |                   |
| Regional Office - UN                            |                    |                   |
| EUCAM HQ  |                    |                   |
| EUBG (F) HQ                                     |                    |                   |

| Interface data              |                    |                    |                     |                               |                  |
|-----------------------------|--------------------|--------------------|---------------------|-------------------------------|------------------|
| operation Type              | operationalMessage | excon TrainingCell | exerciseData        | tool                          | exconSupportCell |
| Chapter VII peace operation |                    | EXDIR              | MEL/MIL             | VBS2                          | PIC              |
|                             |                    | Senior Mentors     | ORBAT               | ICC                           | VOB              |
|                             |                    | EXEVAL             | Data organizations  | NIRIS                         | CISCON           |
|                             |                    | Command Group      | Relational schedule | JCATS                         | CAXCON           |
|                             |                    | JEC                | Target list         | EXONAUT                       | Security,        |
|                             |                    | OTTM               | Geodata             | ITC                           | RLS              |
|                             |                    | JEC Current Cell   | Map layers          | TYR                           |                  |
|                             |                    | JEC Plan Cell      | Buildings           | Sitaware                      |                  |
|                             |                    |                    |                     | Passerelle SIMU-Sitaware      |                  |
|                             |                    |                    |                     | FT                            |                  |
|                             |                    |                    |                     | Web portal                    |                  |
|                             |                    |                    |                     | VTC system Polyoom            |                  |
|                             |                    |                    |                     | Commercial Phone Lines        |                  |
|                             |                    |                    |                     | Internet Protocol (IP) Phones |                  |

| Interface                  |                     |                                |
|----------------------------|---------------------|--------------------------------|
| vignette                   | countryBook         | service                        |
| Safe & Secure Environment  | BOGALAND Crisis WEB | Announcements                  |
| Protection of Civilians    |                     | E-mail                         |
| Irregular Forces           |                     | VTC                            |
| Gender                     |                     | Exercise Management Service    |
| IDP's & Refugees           |                     | IP-Phones - VoIP               |
| Maritime Security          |                     | Simulation CGF                 |
| Cooperation & Coordination |                     | COP                            |
| Rule of Law                |                     | Faxes                          |
| Humanitarian Assistance    |                     | Phones                         |
| Human Rights               |                     | Document management service    |
| Statebuilding              |                     | Network - Internet             |
| Air Space Control          |                     | Network - Internet VPN-tunnel  |
|                            |                     | Network - Site LAN             |
|                            |                     | Network - Exercise LAN         |
|                            |                     | Simulation voice communication |
|                            |                     | Office suit                    |
|                            |                     | Calendar                       |
|                            |                     | Chat                           |
|                            |                     | CTP                            |
|                            |                     | Power Availability             |

Figure 5 : SPHINX web-based data inventory of a CAX

This tool is based on the innovative SPHINX conceptual model. It has been tested in France with more than 200 exercises and experimentations.

## **CONCLUSIONS**

This tool is the first one to propose, on one hand, a methodology for solving the interoperability issues in the organization of an exercise or experiment, especially when the stakeholders are several or international and, on the other hand, a way to capitalize exercises in a shareable, dynamic, way.

Interoperability is founded on standardized data models.

Benefits of the SPHINX conceptual model are :

- a structured and shared preparation of CAX (bilateral CAX)
- a structured capitalization (easier if built on a structured preparation)
- a clever exploitation based on links between data belonging to the model
- a key of understanding to exploit the resources

The SPHINX model needs now :

- to be integrated in the CAX preparation process
- a timeline that allow the OCE to know the level of preparation of his CAX

If such a tool is shared by the nations, they can exchange their exercises capitalized and easily organize multinational exercises.

[1] NATO Modelling & Simulation Master Plan - 14 September 2012

[2] NMSG-086 : simulation interoperability