Chapter 2 – OBJECTIVE OF MSG-058 EFFORT

In April 2008, then, the NMSG originated a Task Group (MSG-058) to develop a guidance document on conceptual models, which can be used in the future by NATO to support its M&S requirements. The major objectives of this Task Group, according to its Technical Advisory Panel (TAP) Terms Of Reference (TOR) charter of June 2007, enclosed as Annex A and B respectively are:

1) Clarify the "Conceptual Model" concepts, discuss the terminology, and emphasize the utility to better formalize conceptual models, understand the relationship between conceptual modeling and related concepts (scenario definition, etc.);
2) Investigate methodologies, simulation and software engineering processes, initiatives and technologies useful for the establishment and content of conceptual models;
3) Draft a guidance document on conceptual models that can be used by different stakeholders (sponsor/ user, project manager, subject-matter experts, V&V agents, developers, etc.);
4) Foster the establishment of the guidance document as a SISO standard;
5) Identify the relevant stakeholders of conceptual models and considering whether a prioritization is needed;
6) Address the needs of M&S community, identifying the way conceptual models may contribute to M&S development, and providing guidance to implementation; and
7) Provide guidelines for standards in conceptual modeling for M&S; thereby specifying a conceptual model to be (re)usable by users with similar knowledge and to be accepted by the computer science community.

The Task Group's first objective was to clarify what a conceptual model for M&S is and what it represents. A common understanding from the outset of the effort was that a conceptual model should serve as a frame of reference for simulation development by documenting important entities/concepts, their properties, and their key actions and interactions. That is, a conceptual model should bridge between the requirements and simulation design. The use of simulation in military applications such as training and decision support requires that the simulations are fit for use. V&V can be applied to evaluate if this fitness for use is achieved. The quality of the end-product (i.e., the simulator) is, however, largely dependent on the quality of the intermediate products. To be more specific, a large portion of the problems with the end-product come from a poor understanding of the customer's situation which leads to a low quality of the requirements. Explicitly building a conceptual model is one of the ways to improve the quality of the end-product by allowing for a good starting point for its development. In order for the conceptual model to be able to really improve the quality of the consequent simulation, the quality of the conceptual model itself must be sufficiently high. Building the conceptual model is *the* step in simulation development in which the actual modeling takes place. Therefore validation (determining whether the abstractions taken during the modeling are allowed) of the conceptual model against the stakeholders' purpose is important for the simulation's fitness for purpose. From a project management point of view, the conceptual model is the last step in simulation development where correcting errors, such as having erroneously left out important parts that should be represented in the end-product, is still relatively easy, quick and cheap. If design and implementation starts, correcting mistakes quickly becomes much more costly. Therefore V&V of the conceptual model is an important form of risk mitigation.

Therefore, the Task Group endeavoured to clarify and rigorously define the core terminology associated with conceptual models and conceptual modeling, and the relationship among those terms. Among the issues the Task

Group addressed was clarification of key concepts in respect to which are framed the needs each of these stakeholders in a conceptual model and the level of abstraction at which conceptual models should be expressed to meet various stakeholders' needs. Conceptual Models are one of the key concepts in the development and employment lifecycle of M&S. As such it is related to other concepts such as scenario development, simulation software requirements development, and test plan development. As part of the first objective, the Task Group defined the relationships among conceptual models and these other activities.

The second objective of this Task Group was to investigate methodologies, simulation engineering and software engineering processes, initiatives and technologies useful for the establishment and content of conceptual models. While the objective of this Task Group was not to develop or identify a single standard for the representation of conceptual model content, this Task Group did identify a range of such solutions that can be employed in conceptual models. In order to take advantage of the work covered by others regarding to this issue, it was very important to collect and analyze as much as possible of the documentation available on conceptual models – especially those related to the M&S field. Lesson learnt by them helped to avoid some recurrent problems, to reduce the risk of developing simulation not adapted to the requirements and to get the greatest benefit from the effort of this Task Group. The Task Group explored the potential of a variety of processes and knowledge representation approaches to examine their potential for conceptual modeling. Through this objective, the Task Group synthesized existing practices to identify the state-of-the-art of conceptual modeling. By doing this, the Task Group maximized the reuse of previous effort in the development of a recommended practice.

The third objective of the effort was to provide a tailorable set of guidance to the M&S community on conceptual modeling processes and products. This will guide users through the conceptual modeling effort by explaining how to apply it in practice. The process will be tailorable in that it is intended to be extended and modified by individual programs that apply it. Rather than being a one-size-fits-all rigid, single approach to conceptual modeling, the guidance will provide a starting point that individual programs can apply given their specific needs and resources. The guidance on the conceptual model content will state what should be in the conceptual model, and not mandate a specific format but suggestions for the selection and use of format, methodology, techniques and tools will be provided. The guidance will encompass the conceptual model process, conceptual model content and describe appropriate views on a conceptual model for different stakeholders. For example, the conceptual model process will describe the transformation from the users view, concerned with the problem domain, to the developers view, focused on the M&S domain.

The Task Group's fourth objective was to foster the establishment of the guidance document as a SISO standard. The current policy of NATO for standardization is to use civil standards where appropriate ones exist and to develop its own standards only when no civil standard exists. In the case of conceptual models for M&S or conceptual models in general, no civil standard exists. The requirement for M&S conceptual model is not specific to NATO or to the military domain. Thus it should be helpful to extend this work to a larger M&S community. With respect to this proposal, the Task Group broadened its guidance document to comprehend in its work-product the scope of an M&S standard product, developed through an open consensus-based standards body. The SISO is the best-suited organization for this standardization, since it has a strong background and current focus on military M&S, but also includes M&S practitioners from outside the military domain. Finally, the Task Group collaborated with SISO's Standing Task Group on Conceptual Modeling throughout the period of performance of the effort in order to facilitate to the greatest extent possible the acceptance of the Task Group's work-product as the basis of a successor SISO/IEEE standard.

In addressing the fifth objective, the Task Group identified the key stakeholders in conceptual modeling and their requirements with respect to conceptual models. Stakeholders will include those that are involved in the production of conceptual models and those that rely on conceptual models to perform their jobs.

In response to the sixth objective, the Task Group realized that the value of its eventual work product would be dependent upon the degree to which it provided value to practicing modeling and simulation professionals and to the stakeholders involved in the M&S enterprise wherein it is employed; the Group was anxious to appreciate and to make evident in, auditably traceable form, its perception of the wants and needs of the conceptual modeling stakeholder community, and the specific attributes desired of its effort and of the resulting work-product pursuant to that effort. To this effect, desiderata were compiled from a variety of sources relating to each of the following categories:

- Compliance – Degree of conformance of work-process and work-product to explicit and implicit guidance.
- Completeness – Degree of exhaustion of effort and resulting product with respect to the fundamental need to support enterprise conceptual modeling of military models and simulations.
- Correctness – Degree of appropriateness of operational process and conceptual modeling guidance documentation in subject enterprise environment … roughly the degree to which employment of the published best-practice specification is likely to result in satisfactory conceptual modeling practices and conceptual model artefacts, given requisite completeness.
- Consistency – Degree to which the efforts of the Task Group and its resulting work-product are mutually coherent and based on common precepts and assumptions.
- Utility – Degree to which the employment of the Task Group work-product is useful to stakeholders in generating, using and maintaining conceptual models in the NATO enterprise environment.

In response to the seventh objective, the Task Groups have to ensure that specific requirements (e.g., attributes of the Task Groups operating process and/or resulting product) were derived from task guidance, self-generated concept of operations of the Task Group, and the consensus of product structure, and content agreed upon by the Task Group during its deliberations. These requirements are documented in Annex C. The requirements serve both to:

- Indicate the sensitivities of the Task Group in executing its responsibilities and to provide persistent strategic and tactical guidance for execution of the Task Group effort; and
- Serve both the Task Group itself and the recipients of the Task Group’s work-product, by providing the means for evaluation of the work-product as against necessary and sufficient criteria.