

OVERVIEW

O.1 PURPOSE

This document is intended to have the following consequential effects:

- Clarify “Conceptual Model” (CM) 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.);
- Investigate methodologies, simulation and software engineering processes, initiatives and technologies useful for the establishment and content of conceptual models;
- 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.);
- Foster the establishment of the guidance document as a SISO standard;
- Provide identification of the relevant stakeholders of conceptual models and considering whether a prioritization is needed;
- Address the needs of M&S community, identifying the way conceptual models may contribute to M&S development, and providing guidance to implementation; and
- 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.

O.2 SCOPE AND LIMITATIONS

The scope of this guidance is nominally for NATO military M&S. However, the approach taken herein is to provide comprehensive guidance that can easily be adapted and tailored to individual enterprises. It can be generalized to apply to alternative domains. NATO and national defence establishment M&S communities-of-practice are *de facto* enterprises in this spirit when the investment, development, maintenance, and use of M&S assets are concerned. While the application of this guidance is intended to be broad, its scope is targeted to the CM development process, and only provides limited best-practices pertaining to the rest of the CM life cycle.

O.3 SPECIAL ISSUES (PROCEDURES)

Five topics were identified as critical to the TR-MSG-058 Task Group’s efforts that required special attention to achieve an appropriate outcome to the Groups work-product. Those issues included:

- 1) Sensitivity to stakeholder analysis and context;
- 2) Precise specification of study scope and definition of terms;
- 3) Explication of relationships of conceptual modeling practice and products to existing standards;
- 4) Specification of conceptual model management process; and
- 5) Specification of resulting conceptual model documentary artifacts.

O.4 SIGNIFICANT CONSIDERATIONS, ANALYSIS/RESULTS

Two particular considerations assumed special prominence during the effort of the Group's deliberations. In each case the Group made every effort to appreciate the underlying nature and logical entailments of these considerations and to produce analyses and work-product results that were reasonably commensurate both the implications of these considerations and the need for practitioners to deal with those implications in straight-forward pragmatic ways.

The first consideration is the fact of 'ontological relativism' whereby every abstraction of a referent domain by way of conceptualization has inherent systematic biases that depend strongly on the perceptual frame of the modeler and that may so particularize a consequent conceptual model that alternative models, while drawn from the same reality, are not in fact 'complementary' or semantically consistent. Conceptual modeling process and conceptual model product artifacts recommended by the Study Group were particularly conceived and phrased so as to make this risk to re-use and interoperability of conceptual models and consequent simulations apparent and to provide such guidance as could be made prescriptive whereby this risk might be ameliorated.

The second consideration of import addressed by the Group was the question of whether simulation conceptual models should be in some significant way simulation-implementation independent. By designating fully simulation independent abstractions of the referent world as 'conceptual system-reference-models' rather than conceptual simulation-models, the Group proceeded to include both the objective system-space and the simulation-space in its scope. Consequently, the decisions that are recommended to be made during the conceptual model design inevitably will be informed by the underlying need for a simulation capability or an enterprise interest. The value of this guidance to enterprises is the provision of a broad and flexible process with defined products which can be mapped against current approaches and future plans. Common terminology can also be derived from this guidance to enable better communication of concepts between enterprises.

O.5 DECISIONS AND RECOMMENDATIONS, MILITARY/NATO SIGNIFICANCE OF THE STUDY

- NATO Nations should adopt this guidance as best-practice for their national and international M&S efforts to enable interoperability and reuse.
- The M&S community should incorporate CM development into their M&S development processes, based on the best-practice provided in this guidance.
- Each enterprise should specify its own conceptual modeling process and CM products, using this guidance as a point of reference.
- VV&A of CMs should be integral to the development process. Use of the ISO/IEC 9126 standard on software quality is a starting point for the derivation of CM quality criteria, and use of the (draft) GM-V&V standard is applicable to V&V of CMs.
- Every customization of the guidance should be published to contribute to the body of knowledge of conceptual modeling, to build a valuable experience base for standardization initiatives.
- The M&S community and the Simulation Interoperability Standards Organization, should use this best-practice guidance as a basis to initiate an international standard for CM development.