DEPARTMENT OF DEFENSE

MODELING AND SIMULATION

RELATED STANDARDS

AND

BEST PRACTICES GUIDE

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1. INTRODUCTION

The Department of Defense (DoD) Modeling and Simulation (M&S) Related Standards and Best Practices Guide, referred to as the M&S Standards Guide, provides a set of M&S standards and best practices descriptions to support decision making on options for the use of M&S standards in support of DoD M&S activities. A standards guide is a compilation of standards citations that provides information about standards that may be required by a specific organization, program or project. Rather than having each DoD program/project attempt to encompass all DoD mandates and other industry standards, this guide provides a set of standards that can be applied to address DoD M&S organizations and programs and/or applied to project requirements.

The guide development effort is led by the DoD M&S Coordination Office (M&S CO) in coordination with M&S Communities and Services. The designated review team, made up of representatives from the M&S Communities and Services, approves the set of standards selection criteria to be applied to identify, recommend and confirm the selected M&S standards for the guide. Specific standards are evaluated in accordance with the M&S Standards Management Process based on the approved standards selection criteria. For each standard selected, a description is provided in compliance with the DoD Information Technology Standards Registry (DISR) metadata requirements.

1.1. Purpose

The DoD M&S Standards Guide describes a set of M&S standards intended to provide guidance to DoD organizations that have requirements to effectively use M&S in support of DoD M&S activities. The guide supports M&S management, integration, coordination, and collaboration and encourages participation and consensus in the M&S standards development process to maintain a viable collection of M&S standards.

This document supports the Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) in the role of Principal Staff Assistant and advisor to the Secretary of Defense for all matters relating to M&S; and the establishment of standards and protocols promoting interoperability, data exchange, open system architecture, and software reusability.

1.2. Scope of DoD M&S Standards Guide

The DoD M&S Standards Guide was developed to encourage and facilitate DoD-wide M&S interoperability and information sharing by assisting M&S managers and those involved in M&S activities in making informed decisions when choosing standards and best practices to meet their M&S requirements.

The DoD M&S Standards Guide provides a collection of government, industry, and international standards descriptions. Standards selected to be included in this document were analyzed based on the approved standards criteria considerations described in section 2.0, organized and described in a set of M&S categories.

This document will evolve through DoD-wide participation in the ongoing technical standards approval process. The status of standards listed in this document will be reflected in the updates of this DoD M&S Standards Guide submitted to the M&S Technical Working Group (TWG) for recommendation to be placed in the DoD Information Technology Standards Registry (DISR).

1.3. Background of DoD M&S Standardization

On April 26, 2004, the Defense Standardization Program (DSP) Office designated the DoD M&S Office (DMSO) as the Lead Standardization Activity (LSA) for Modeling and Simulation Standards and Methodologies (MSSM).[1] The DMSO evolved to become the DoD M&S Coordination Office (M&S CO)[2] and the LSA role for MSSM was retained. The designation is reflected in the Standardization Directory (Publication SD-1) and in the DSP electronic directory and databases. As the DSP LSA for MSSM, the M&S CO has the responsibility to: Direct DSP standardization activities in the MSSM Area; Act as the Technical Focal Point for the MSSM Area; Ensure implementation of DSP policies; and Approve standardization projects. As the LSA for MSSM the M&S CO, also coordinates the adoption of non-Governmental standards, supports the development of standards and facilitates the review of documents from other standardization areas. The M&S CO also maintains a liaison and/or participates in the activities of non-Governmental organizations that are involved with standards that impact M&S applications.

The Information Technology Standards Committee (ITSC) is one of the principal organizations with which the M&S standardization program must maintain a close liaison. Standards approved the ITSC are registered DoD Information Technology Standards Registry (DISR). In addition, guidance documents such as standards profiles, are available through the DISR.

The ITSC establishes technical working groups (TWGs) to oversee standards application areas. The M&S CO chairs the M&S TWG and represents M&S interests as a member of the ITSC and on other TWGs. Members of the M&S TWG act as subject matter experts for M&S standards and guidance documents. The M&S TWG is responsible for recommending updates to the DISR with respect to M&S. Participants in the M&S TWG include technical standards representatives from the ITSC membership.

1.4. Ownership and Distribution

Ownership for individual standards is established by the Standards Development Organization (SDO) for that standard. The SDO retains distribution right for individual standards.

1.5. Document Overview

The DoD M&S Standards Guide is organized into seven main sections and four appendices as described below.

1. ***Introduction*** – provides an overview and background information on the guide.
2. ***Standards Selection Criteria and Considerations*** – introduces a standards selection evaluation methodology and proposed set of initial criteria.
3. ***Modeling and Simulation Standards*** – provides background information on DoD M&S standards development for the guide development effort.

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[1] Memorandum for Director, Defense Modeling and Simulation Office, Subject: Establishment of New Standardization Area for Modeling and Simulation (M&S) and Designation of Defense Modeling and Simulation Office (DMSO) and Lead Standardization Activity (LSA, Department of Defense, Defense Standardization Program Office, April 26, 2004.

[2] www.msco.mil

4. ***Management of the M&S Standards Guide*** – provides criteria for including standards in the M&S Standards Guide and update information.
5. ***Standards of Interest*** – provides a summary of M&S standards selected for each of the functional area listed in this document. Detailed descriptions of the standards are provided in Appendix B.
6. ***M&S Standards Guide Gaps*** – provides a discussion on the identified gaps in M&S standards developments related to each functional area in section 4.
7. ***Conclusions and Recommendations*** – provides a summary of research findings on the M&S Standards Guide and recommendations on ways to improve and maintain the guide.

Appendix A: Standards Description Template – provides a template for describing a standard in compliance with the DISR metadata.

Appendix B: Standards Descriptions – provides descriptions of standards listed in section 4 using the template detailed in Appendix A.

Appendix C: Acronyms – provides a preliminary list of acronyms used in this document.

Appendix D: Glossary – provides a preliminary list of definitions of selected terms used in this document.

2. STANDARDS SELECTION CRITERIA AND CONSIDERATIONS

In order to determine the standards to be included in the DoD M&S Standards Guide, several types of standards selection criteria illustrated in Figure 2-1 were considered. Standards are evaluated in accordance with the M&S Standards Management Process.

2.1. DoD M&S Communities That May Use / Benefit from Standards Guide

The Standards Selection Criteria support the DoD M&S Communities enabled by M&S that apply and benefit from the use of the standards selection. The communities include: Acquisition, Analysis, Experimentation, Intelligence, Planning, Testing and Training.

Selection criteria to support the DoD M&S Communities supports the M&S Standards Management Process and includes confirming user interest/need, the technical maturity of the standard and the value the resulting standard provides to the community.

2.2. Meeting DISR Standards Evaluation Criteria

The Standards Selection Criteria include a cross reference to applicable DISR Standards evaluation criteria. These criteria include:

- Interoperability: How does this technology provide users the ability to access applications and services through Web services (an information environment comprised of interoperable computing and communication components)?
- Technical Maturity: Identify how technically mature and stable, the standard is. Does it have strong support in the commercial marketplace? What commercial products exist for this standard? How long has this standard been used? Is a follow-on standard in development? When is its estimated completion date? Should the sunset status be added to the current mandated status?
- Public Availability: Where does a PM get a copy of this standard? Is it free or must it be purchased?
- Implementability: Who is using this standard? What commercial organizations have developed implementations of this standard?
- Authority: What standards body developed and maintains this standard? Is it an international, national, or military standard? Is there an open process for maintaining and developing this standard?

More information about these standards selection criteria is available in the Department of Defense (DoD) Information Technology Standards Program (ITSP) Management Plan, dated 19 January 2007, and specifically, in Appendix B, Standards Selection Criteria.

I. DoD M&S Communities That May Use / Benefit from Standards Profile

- Acquisition
- Analysis
- Experimentation
- Intelligence
- Planning
- Testing
- Training

II. Meets DISR Standards Evaluation Criteria

- Interoperability
- Technical Maturity
- Public Availability
- Implementability
- Authority

III. Meets DSP Goals

- **Improve Military Operational Readiness by:**

  -Achieving Interoperability of Systems, Subsystems and Equipment
  - Improving Logistics Support
  - Improve Reliability, Maintainability and Safety
  -Modernizing Existing Systems, Subsystems and Equipment

- **Reduce Total Ownership Costs by:**

  - Reducing Number of Nonstandard Parts
  - Facilitating Competition
  - Promoting Use of Common Processes and Open Systems
  - Promoting Standard Commercial Processes and Practices
  - Reducing Training Costs
  -Optimizing Systems Engineering Requirements

- **Reduce Cycle Time by:**

  - Using Readily Available Standard Items
  - Identifying Interchangeability and Interoperability Requirements

IV. Additional Business, Technical or Operational Considerations

- Required by DoD Policy
- Approved for use by the MSSM LSA for the DSP
- Approved for inclusion in DISR by the IT Standards Oversight Panel
- Referenced by higher level documents
- Complies with DoD acquisition guidance
- Addresses operational problems or issues
- Supports specific operational requirements

Figure 2-1 – Criteria for Standards Selection

2.3. Meets DSP Goals

The Standards Selection Criteria include a cross reference to applicable DSP Standards Goals. These goals include:

- Improve military operational readiness by:
  - Achieving interoperability of systems, subsystems, and equipment with our allies and among the Military Departments.
  - Improving logistics support by reducing the variety of supply items.
  - Improving the reliability, maintainability, and safety of systems and supply items.
  - Modernizing existing systems, subsystems, and equipment through insertion of new technology and parts.
- Reduce total ownership costs by:
  - Reducing the number of nonstandard parts.
  - Facilitating competition.
  - Promoting the use of common processes and open systems.
  - Promoting standard commercial processes and practices.
  - Reducing training costs.
  - Optimizing systems engineering requirements by reaching consensus on requirements.
- Reduce cycle time by:
  - Using readily available standard items.
  - Identifying interchangeability and interoperability requirements to permit rapid introduction of new technologies.

These goals are referenced under the DoD 4120.24-M, Defense Standardization Program (DSP) Policies and Procedures [March 2000].

2.4. Additional Business, Technical or Operational Considerations

The Standards Selection Criteria include a cross reference to additional business, technical or operational considerations. These considerations include but are not limited to:

- Required by DoD Policy
- Approved for use by the MSSM LSA for the DSP
- Approved for inclusion in DISR by the IT Standards Oversight Panel
- Referenced by higher level documents
- Complies with DoD acquisition guidance
- Addresses operational problems or issues
- Supports specific operational requirements

3. MODELING AND SIMULATION STANDARDS

3.1. DoD Definitions of a Standard

Definitions of defense standards are provided below, referenced by DoD 4120.24-M, The Defense Standardization Program (DSP) Policies and Procedures, March 2000. Additional standards definitions are available in the glossary provided in Appendix D.

Defense Standard.[3] A document that establishes uniform engineering and technical requirements for military-unique or substantially modified commercial processes, procedures, practices, and methods. There are five types of defense standards: interface standards, design criteria standards, manufacturing process standards, standard practices, and test method standards.[4]

- Interface Standard. A standard that specifies the physical, functional, or military operational environment interface characteristics of systems, subsystems, equipment, assemblies, components, items or parts to permit interchangeability, interconnection, interoperability, compatibility, or communications.
- Design Criteria Standard. A standard that establishes military-unique design or functional criteria that must be adhered to in the development or upgrade of systems, subsystems, equipment, assemblies, components, items, or parts.
- Manufacturing Process Standard. A standard that states the desired outcome of manufacturing processes or specifies procedures or criteria on how to perform manufacturing processes.
- Standard Practice. A standard that specifies procedures on how to conduct certain nonmanufacturing functions. Standard practices are developed for functions that, at least some of the time, are obtained via contractor from private sector firms.
- Test Method Standard. A standard that specifies procedures or criteria for measuring, identifying, or evaluating qualities, characteristics, and properties of a product or process.

Non-Government Standard (NGS). A national or international standardization document developed by a private sector association, organization, or technical society that plans, develops, establishes, or coordinates standards, specifications, handbooks, or related documents. This term does not include standards of individual companies. Non-Government standards adopted by the DoD are listed in the ASSIST database.[5]

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[3] DoD 4120.24-M, “Defense Standardization Program (DSP) Policies and Procedures”, March 2000.

[4] MIL-STD-962C, "DoD Standard Practice for Defense Standards and Handbooks,” October 20, 1995.

[5] DoD 4120.24-M, “Defense Standardization Program (DSP) Policies and Procedures”, March 2000.

4. MANAGEMENT OF THE M&S STANDARDS GUIDE

4.1. Criteria for Standards Inclusion

Standards that are considered for inclusion:

a. M&S development, integration and employment standards that have been widely adopted and commonly used, and standards that have the potential to be used by and available to DoD.

b. Standards specific to M&S and general purpose standards for systems and software engineering (e.g. programming language standards) with specific implications for M&S.

c. Technical interoperability standards such as the High level Architecture (HLA), data standards such as the Synthetic Environment Data Representation and Interchange Specification (SEDRIS) and best practices such as the HLA Federation Development and Execution Process (FEDEP).

In terms of maturity the following will be considered for inclusion

a. Existing standards applicable to M&S development, integration and employment that are within the scope.

b. Standards under development that are mature enough for application.

The M&S Standards Guide will not include:

a. Standards that will require a fee to implement. For example, if those implementing the standard must pay a royalty fee to the publisher of the standard, it will not be considered. This does not imply that a standard will be precluded just because products based on the standard are sold or licensed. Also, this does not mean that the standard guide excludes standards that the user must pay a fee to obtain a copy.

b. General information technology and software standards (e.g. programming languages such as C++) unless they have a specific implication for M&S.

The M&S Standards Guide will consider:

only ‘open’ standards as defined as those standards upon which government and commercial organizations may develop products freely. This means that the user of the standard has full unfettered license to view, modify, adapt, translate, transport, or convert all or any portion of the codes, algorithms, data, or methods of the product into any other software or computing platform without consultation, permission, or acknowledgement of or by the original author. Candidate standards can be developed by internationally recognized SDOs, industry consortiums, governmental organizations/agencies or vendors.

4.2. Procedures for Maintaining the M&S Standards Guide

The M&S Standards Guide document will be reviewed annually. The process for updating the M&S Standards Guide will be developed prior to the first revision.

5. STANDARDS OF INTEREST

Based on the approved standards selection criteria and a set of nine different categories, the following subsections provide an initial listing of the M&S standards.

For each standard listed in the following subsections, a description is provided in Appendix B to support the metadata item listing outlined in the template provided in Appendix A.

Implementation information metadata items have been added for each standard in the metadata listing and over time information will be researched and provided:

- Implementation Guidance
- Implementation Training Resources
- Implementation Vendor Support
- Implementation Literature References

5.1. Data Standards

This section also includes Data Mediation and Exchange, Data Production and Data Engineering standards.

Applicable Standards include:

- Coalition - Battle Management Language (C-BML)
- Integration Definition for Information Modeling (IDEF1X)
- International Standard ISO/IEC 18023-1:2006(E) Information Technology - SEDRIS - Part 1: Functional Specification (DRM, APIs, and STF)
- International Standard ISO/IEC 18023-2:2006(E), Information Technology - SEDRIS - Part 2: Abstract Transmittal Format
- International Standard ISO/IEC 18023-3:2006(E), Information Technology - SEDRIS - Part 3: Transmittal Format Binary Encoding
- International Standard ISO/IEC 18024-4:2006(E), Information Technology - SEDRIS Language Bindings - Part 4:C
- International Standard ISO/IEC 18025:2005(E), Information Technology - Environmental Data Coding Specification (EDCS)
- International Standard ISO/IEC 18026: 2006(E), Spatial Reference Model (SRM)
- International Standard ISO/IEC 18041-4(E) EDCS Language Bindings Part 4: C
- International Standard ISO/IEC 18042-4:(E), Information Technology - Spatial Reference Model (SRM) Language Bindings - Part 4: C
- Joint Command, Control and Consultation Information Exchange Data Model (JC3IEDM).
- MIL-STD-2407, Department of Defense Interface Standard for Vector Product Format

- Performance Specification Digital Terrain Elevation Data (DTEDTM)

5.2. M&S Interoperability

Applicable Standards include:

- IEEE Std 1278.1-1995, IEEE Standard for Distributed Interactive Simulation (DIS) - Application Protocols
- IEEE Std 1278.1a-1998, Standard for Distributed Interactive Simulation (DIS) - Application Protocols
- IEEE Std 1278.2-1995, Standard for Distributed Interactive Simulation (DIS) - IEEE Communication Services and Profiles
- IEEE Std 1278.3-1996, IEEE Standard for Distributed Interactive Simulation (DIS) - Exercise Management and Feedback
- Institute of Electrical and Electronics Engineers (IEEE) 1516-2000 IEEE Standard for Modeling and Simulation (M&S) High Level Architecture (HLA) - Framework and Rules
- IEEE Std 1516.1-2000, Standard for Modeling and Simulation (M&S) High Level Architecture (HLA) - Federate Interface Specification
- IEEE Std 1516.2-2000, Standard for Modeling and Simulation (M&S) High Level Architecture (HLA) - Object Model Template (OMT) Specification
- SISO-STD-004.1-2004, Dynamic Link Compatible HLA API Standard for the HLA Interface Specification
- The Test and Training Enabling Architecture (TENA) Reference Document

5.3. M&S Miscellaneous

Applicable Standards include:

- SCORM Simulation Interface Standards
- Sharable Content Object Reference Model (SCORM)

5.4. M&S-Scenarios

Applicable Standards include:

- SISO-STD-007-2008, Standard for: Military Scenario Definition Language (MSDL)

5.5. Modeling

This section also includes Conceptual Modeling and M&S Representation standards.

Applicable Standards include:

- Base Object Model (BOM)
- Integration Definition for Function Modeling (IDEF0)
- NETWARS Model Development Guide

- SISO-STD-001.1-1999, Real-time Platform-level Reference Federation Object Model (RPR FOM)
- SISO-STD-002-2006, Standard for: LINK 16 Simulations
- Standard for LINK 11/11B Simulation
- Standard Interface for Multiple Platform Link Evaluation (SIMPLE)
- Unified Modeling Language™ - UML
- Systems Modeling Language (SysML)
- XML Metadata Interchange

5.6. Simulation System Engineering

This section also includes M&S Processes and Systems Engineering standards.

Applicable Standards include:

- DoD Architecture Framework (DoDAF)
- IEEE Recommended Practice for Distributed Simulation Engineering and Execution Process (DSEEP)
- IEEE Std 1516.3-2003, Recommended Practice for the High Level Architecture (HLA) Federation Development and Execution Process (FEDEP)
- NATO Architecture Framework (NAF)
- Synthetic Environment Development and Exploitation Process (SEDEP)

5.7. Software Engineering

Applicable Standards include:

- Common Object Request Broker Architecture (CORBA)
- Model-Driven Architecture (MDA)

5.8. Verification and Validation (V&V)

Applicable Standards include:

- Common Verification, Validation and Accreditation (VV&A) Framework for Simulation
- General Procedure for Modeling and Simulation Verification & Validation Information Exchange
- Guidance for a Generic Methodology (GM) for Verification and Validation (V&V) and Acceptance3 of Models, Simulations and Data.
- IEEE Std 1278.4-1997, IEEE Trial-Use Recommended Practice for Distributed Interactive Simulation (DIS) - Verification, Validation, and Accreditation
- IEEE Std 1516.4-2007, IEEE Recommended Practice for Verification, Validation and Accreditation (VV&A) of a Federation — An Overlay to the High Level Architecture (HLA) Federation Development and Execution Process (FEDEP)

- MIL-STD-3022, Department of Defense Standard Practice Documentation of Verification, Validation, and Accreditation (VV&A) For Models and Simulations
- Verification, Validation & Accreditation (VV&A) Recommended Practices Guide (VV&A RPG)

5.9. Visualization

Applicable Standards include:

- ISO/IEC 19775-1:2004, Computer graphics and Image Processing Extensible 3D (X3D) - Part 1: Architecture and Base Components Mandated Display;
- ISO/IEC 19775-2:2004, Computer graphics and Image Processing X3D - Part 2: Scene Access Interface (SAI) OpenFlight Scene Description Database Specification ®

6. M&S STANDARDS GUIDE GAPS

The M&S standards listed in Section 5 may not satisfy all the needs for M&S standards throughout the DoD Communities enabled by M&S. Potential gap areas are discussed below within several of the M&S standards category areas to capture potential future needs or current shortfalls.

General observations include the need for:

- Better standards for data that would improve interoperability and reusability of models and simulations,
- Incentivizing industry to adhere to open standards, and
- Standards for a "common operating environment" (synthetic natural environment (SNE), terrain, etc.) and more emphasis on "processes" instead of "technology".

6.1. Verification, Validation and Accreditation (VV&A) Gaps:

- Standards that lead to criteria and methods for model specification and certification independent of software implementation.
- Standards that lead to well defined software component (and subcomponent) specifications and interfaces that "encapsulate" model specifications and can be used to automate the composition and assembly of reusable components.
- Methodology/process supporting the V&V of behavioral modeling of Computer-Generated Forces (CGF) / Semi-automated Forces (SAF) behaviors.

6.2. M&S Interoperability Gaps:

- New interoperability standards to spare the industry duplicative effort for fidelity accreditation standards.
- Clarification on usage and implementation of multiple interoperability standards such as the IEEE DIS and HLA, the US DoD TENA and the civil OMG CORBA.
    - This activity is largely open to the international community and is known as LVC AR (Live, Virtual, Constructive Architecture Roadmap). The results of this study are important to the evolution of this guide. Even if there seems to be some redundancy between the above mentioned standards, it should be underlined that:
        - They address different interests and show different capabilities and are not all targeting the same type of applications (e.g. real-time simulations versus non real-time simulations).
        - They all address "technical" interoperability rather than "substantive" interoperability.
        - Only HLA is a promulgated standard.
- The NATO Modeling and Simulation Standards Subgroup (MS3) group identified a real gap in addressing higher levels of interoperability between simulations and also between the simulated world and the real world.

- Another gap is related to event-driven simulations, which are widely used in the military M&S domain:
    - There is only academic work and early-bird SISO work to clarify this concept (Discrete-Event Systems Specification (DEVS), Simulation Reference Markup Language (SRML) and Open M&S Architecture).
    - There is a lack of interoperability of the numerous COTS products available (this gap should be probably covered by the emerging SISO CSPI standard (COTS Discrete Event Simulation Package Interoperability)).
    - Interoperability between event-driven simulations and real-time applications is already addressed by the HLA but there is room for improvement.

6.3. Data Standards Gaps:

- Procedures to increase information sharing effectiveness by establishing standardization of data elements, database construction, accessibility procedures, data maintenance and control.
- Understanding the relationship and purpose of related DoD M&S data management systems and projects such as the MSRR, M&S Catalog and M&S COI Discovery Metadata Specification (MSC-DMS).
- Asset quality management.
- Data management standards.
- A roadmap for development of common data standards

6.4. M&S Miscellaneous Gaps – Architectures:

- Standards for conceptual modeling language to support searching repositories for components.
- Standards for developing a seamless, collaborative, scalable, reconfigurable, immersive simulation network for:
    - System of systems concept exploration,
    - Experimentation,
    - Development,
    - Test and evaluation,
    - Training,
    - Operations, and
    - Lessons learned in a Joint, Interagency, and Multi-National environment.
- M&S Asset Development / Composition processes.

6.5. M&S Miscellaneous Gaps – Reuse:

- Specifications/standards for M&S reuse.

- Preserve investment in M&S: Insure backwards compatibility when versions change, Transitional products such as RPRFOM, Environmental simulation standards (SEDRIS) and Distributed Product Definition Standards.

6.6. M&S Miscellaneous Gaps – Acquisition / Administrative:

The business of establishing M&S standards and to administrative issues surrounding M&S standards development and use:

- Incentives to support Acquisition Reform with the means to entice/encourage developers in the profit-oriented private sector to participate in the development of and agree to adhere to M&S standards.
- Business Process Standards for the following areas:
    - Asset Discovery and Acquisition,
    - Contracting Standards and Guidance,
    - Framework for VV&A of federations,
    - Conceptual model elements,
    - Fidelity decomposition,
    - Service Oriented Architecture,
    - Model driven architecture, and
    - Software Factories.
- Increased compatibility and cooperation between C4I, M&S and Testing capabilities with a focus on similarities, not differences.
- Standards for both technology and methodology.
- Standards that can be verified.
- Overall long-term viability and short-term practical usefulness of M&S standards.
- People Standards: Body of Knowledge, Certification.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1. Preliminary Observation

Considering the large number of standards and guidance documents mentioned in this guide it is tempting to declare that the situation is rather satisfactory. Unfortunately, there are 2 observations that temper this opinion. First, many listed standards are not coming from the M&S community like MDA or SIMPLE. Second, a quick assessment shows that there are overlapping standards in some specific areas and some obvious gaps in other ones. When there are too many "standards" in support of a particular domain it means "no real standard but many working technologies or methodologies".

A previous chapter of this guide identifies gaps. There is a need that DoD cooperate with the overall M&S community and, particularly, SISO, trying to fill main gaps and align overlapping standards.

7.2. Conclusions

The objective of this publication is to provide guidance regarding modeling and simulation (M&S) standards and processes to the DoD communities enabled by M&S, as well as DoD organizations that have to effectively use M&S in support of their requirements.

In support of this objective it was concluded that:

- Given the continuously evolving nature of M&S standards and processes, timely updates and review of the guidance document are required to maintain currency of the information.
- Given the role and mandate of the M&S CO, and as the Lead Standardization Activity for DoD M&S Standards, M&S CO is the appropriate body to implement and manage the task of developing and maintaining this publication on the long term; in addition, the role of the M&S CO as a permanent office in charge of supporting this activity and the focal point is to be emphasized.
- That a framework structure was required, taking into account functional areas of M&S as well as maturity levels of the various standards and processes.
- That there are benefits to identifying and using common open standards, recognizing that due to breadth of application of M&S there is no "one size fits all".
- There are many standards in existence that have or may have an indirect impact on M&S activities, however only those standards directly applicable to M&S development, integration, and employment are considered for inclusion; this document is not intended to be an encyclopedia of standards.
- A specific procedure for submission and subsequent evaluation of a candidate standard be utilized to ensure consistency of acceptance for standards into the document.
- Gaps exist within current standards development regarding certain functional areas of M&S, or gaps exist within current standards regarding breadth of application in a functional area.

- Specific efforts should be made by the M&S CO to encourage specific focus on gap areas.

7.3. General Recommendations

It is recommended that:

- This M&S Standards Guide be the document for meeting the DoD M&S guidance objectives, and that copy be maintained by the M&S CO and made available including via DISRonline.
- DoD communities enabled by M&S be encouraged to contribute additional standards for consideration, and consider active participation in the M&S TWG.
- Review and update of the publication be done at least once per year.
- Review of the framework of functional areas and maturity levels be included in the annual review.
- Review of the selection criteria be part of the annual review.
- The submission procedure be given widest distribution.
- The DoD actively solicit support of standards development organizations to address gap issues.
- Considering the number of current standards identified and those emerging it could be time to elaborate a strategy about standardization, distinguishing what type of technology should be standardized and which topics are not of interest for standardization.

7.4. Specific Recommendations

As far as the categories of standard are concerned:

- Additional efforts need to occur to align national and international efforts on V&V; cultural differences of nations are slowing down the elaboration of international standards.
- Standardization trends in the development of engineering processes dedicated to simulation is generally satisfactory considering current harmonization efforts taking place in SISO; nevertheless there is a need to integrate, in the emerging DSEEP, main concepts developed in Architecture Framework efforts which are currently too diverse.
- Efforts on standards for describing, archiving and reusing scenarios need to be continued and even reinforced in cooperation with the C3I community based on its preferred standards like JC3IEDM that is the current reference; the M&S community should carefully follow JC3IEDM development.
- Considering modeling aspects, requirements of modeling standards are really specific to some communities of interest such as Tactical Data Link domain or the Virtual Ship effort; those communities are encouraged to draft their own standards as required and publish them to contribute to the M&S body of knowledge.

- The M&S community cannot influence software engineering evolutions but shall seriously monitor what is happening in this domain to take profit of emerging technologies as it was successfully done in the past.
- M&S interoperability is a primary concern of DoD; efforts have to be maintained to improve the current situation of overlapping standards and make progress in direction to substantive interoperability.
- Data standards are a weak area of the overall standardization activity; there is a need to start a general reflection about the data issue in DoD, all the more important as DoD is initiating large simulation programs in support of education and training.
- Data standardization efforts targeted to representation and visualization of simulated natural and human-made environment are even more critical realizing that “de facto” standards, commercial products and SEDRIS are competing; there is a lack of coordinated effort in this domain and the idea of a collective reflection should be promoted and better specified.

APPENDIX A : STANDARDS DESCRIPTION TEMPLATE

Standard Title: Full title of the standard

Standard Identifier: Unique identifier; could be the one provided by a standards development organization (SDO)

Version Identifier: Alpha indicators designating Editions and Amendments

Standard Development Organization: Name of the organization

SDO Periodic Review Date: The date the standard is scheduled for periodic review by the SDO

DSP Document Identifier: If listed in the DSP/ASSIST, the standard unique identifier

DSP Status: If listed in the DSP/ASSIST, the status of the standard noted in the ASSIST

DISR Document Identifier: If listed in the DSIR, the standard unique identifier

DISR Status: If listed in the DISR, the status of the standard noted in the current DISR baseline

STANAG Identifier: If listed as a STANAG, the standard unique identifier

STANAG Status: (Study Draft, Approval/Ratification Draft, Ratif. Withdrawn, Promulgated, Inactive, Superseded, Cancelled)

Abstract: Description of the standard

Technical Maturity: Description of how mature the standard is, e.g., how long it has been in evolution or existence, have implementations been developed, etc.

Applicability: The intended uses of the standard

Information on Implementation: Specific examples of how the standard has been used in programs and products

Implementation (Guidance): Available implementation guidance

Implementation (Training Resources): List of training opportunities

Implementation (Vendor Support): List of potential supporting vendors

Implementation (Literature References): Sources of literature references

Limitations of this Standard: Description of standard's limitations

Standards Category: One of the categories used to classify standards listed in the guide.

Standard Type: General M&S, M&S Interoperability, Simulation Software Standards, Data Standards, etc.

Public Availability: How the standard can be accessed by the general public

Cost of Standard: The cost required to acquire the standard

URL or Instructions to Access or Acquire: Standard location

Metadata Input Date: Date the standard was included in the guide

Metadata Last Updated: Date of last update for the standards metadata in the guide

APPENDIX B : STANDARDS DESCRIPTIONS

For standards described in the DoD M&S Standards Guide the metadata template provided above in Appendix A is applied.

The standards are described below and are sorted first by their category and then alphabetically by standard title.

CATEGORY:

Data Standards

(Including Data Mediation and Exchange, Data Production and Data Engineering)

Standards Title:	Coalition - Battle Management Language (C-BML)
Standard Identifier:	SISO-REF-016-2006
Version Identifier:	Under development.
Standards Development Organization:	Simulation Interoperability Standards Organization (SISO)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	A Battle Management Language (BML) is an unambiguous language used to: a. Describe command and control forces and equipment conducting military operations. b. Provide for situational awareness and a shared, common operational picture. It can be seen as a standard representation of a digitized commander's intent to be used for real troops, for simulated troops, and for future robotic forces. BML is particularly relevant in a network centric environment for enabling mutual understanding. A Coalition BML developed and applied by the all Services and by coalition members would not only allow interoperability among their C4ISR systems and simulations, but also among themselves. As it is almost impossible to imagine a situation in the future when a single Service will be unilaterally employed, these efforts must be embedded into international standards. Because future military operations, and a significant amount of training, will be Joint in nature, it is critical that a Joint Service approach be taken to the BML development effort.
Technical Maturity:	This language is under development. Different experimentations have been completed which prove the validity of this concept.
Applicability:	One significant effort to leverage interoperability between C4I systems and simulations.
General Implementation Information:	Many experiences in different nations with predecessor activities that have led to the current standardization effort.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	www.sisostds.org
Limitations:	Still different approaches being considered.
Standards Category:	Data Standards (Including Data Mediation and Exchange, Data Production and Data Engineering)
Standards Type:	Data Standards
Public Availability:	Via SISO web site
Cost of Standard:	
URL:	www.sisostds.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	Integration Definition for Information Modelling (IDEFIX)
Standard Identifier:	Federal Information Processing Standards Publications (FIPS PUBS) Number 184
Version Identifier:	none
Standards Development Organization:	The US National Institute of Standards and Technology (NIST)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	Describes the IDEF1X modelling language (semantics and syntax), and associated rules and techniques, for developing a logical model of data. IDEF1X is used to produce a graphical information model which represents the structure and semantics of information within an environment or system. Use of this standard permits the construction of semantic data models which may serve to support the management of data as a resource, the integration of information systems, and the building of computer databases. [Reference: FIPS PUBS Number 184]
Technical Maturity:	The standard was approved in 1993. Multiple products exist that implement the standard.
Applicability:	This standard is the reference authority for use by information modelers required to utilize the IDEF1X modelling technique, implementers in developing tools for implementing this technique, and other computer professionals in understanding the precise syntactic and semantic rules of the standard. [Reference: FIPS PUBS Number 184]
General Implementation Information:	Multiple commercial tools implement the IDEF1X language. The language is widely used in documenting data standards, such as the JC3IEDM maintained by the Multinational Interoperability Programme.
Implementation Guidance:	
Implementation Training Resources:	http://www.idef.com/
Implementation Vendor Support:	http://www.idef.com/ http://www.kbsi.com/COTS/index.htm
Implementation Literature References:	http://www.idef.com/
Limitations:	Based on relational theory; does not address object modeling.
Standards Category:	Data Standards (Including Data Mediation and Exchange, Data Production and Data Engineering)
Standards Type:	Data Standards
Public Availability:	The standard can be accessed on the NIST website under the list of FIPS publications.
Cost of Standard:	Specification Free; Multiple Vendor Tool Costs
URL:	http://www.itl.nist.gov/fipspubs/by-num.htm and choose FIPS number 184.
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	International Standard ISO/IEC 18023-1:2006(E) Information Technology - SEDRIS - Part 1: Functional Specification (DRM, APIs, and STF)
Standard Identifier:	ISO/IEC 18023-1:2006(E)
Version Identifier:	Version 2006 (year of publication)
Standards Development Organization:	International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) Joint Technical Committee 1 (ISO/IECJTC 1) Sub-Committee 24. (SC 24)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	ISO/IEC 18023-1:2006(E)
DISR Status:	Emerging
STANAG Identifier:	Part of STANAG 4664
STANAG Status:	Ratification in process.
Abstract /Description:	SEDRIS is a series of 8 ISO standards addressing: • (a) the representation of environmental data, and, • (b) the interchange of environmental data sets. To achieve the first, SEDRIS offers a data representation model (DRM), augmented with its environmental data coding specification (EDCS) and spatial reference model (SRM), so that one can articulate one's environmental data clearly, while also using the same representation model to understand others' data unambiguously. Therefore, the data representation aspect of SEDRIS is about capturing and communicating meaning and semantics. While a data representation model is a necessary component of a standard, it is not sufficient to allow effective use. Thus the second aspect of SEDRIS addresses data interchange. In SEDRIS, data interchange is standardized through a SEDRIS Application Programming Interface (API) and a transmittal format (SEDRIS Transmittal Format or STF). The transmittal format and API are semantically coupled with the data representation model. SEDRIS is introduced in the order of 3 corresponding STANAGs (4662 to 4664) that are under ratification process: Abstract: This part of ISO/IEC 18023 addresses the concepts, syntax and semantics for the representation and interchange of environmental data. It specifies: • (a) data representation model for expressing environmental data, • (b) the data types and classes that together constitute the data representation model, and • (c) an API that supports the storage and retrieval of environmental data using the data representation model.
Technical Maturity:	
Applicability:	SEDRIS (ISO/IEC 18023) may be applied to the representation of any environmental data including: (a) terrain, (b) ocean, (c) atmosphere, and (d) space.
General Implementation Information:	Used widely in the US, most frequently by ground forces. Some use in other nations (France, for example).
Implementation Guidance:	
Implementation Training Resources:	http://www.sedris.org/
Implementation Vendor Support:	
Implementation Literature References:	http://www.sedris.org/
Limitations:	None identified
Standards Category:	Data Standards (Including Data Mediation and Exchange, Data Production and Data Engineering)
Standards Type:	Data Mediation and Exchange Standards
Public Availability:	The standard can be accessed on the website at http://iso.org
Cost of Standard:	
URL:	http://standards.sedris.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	International Standard ISO/IEC 18023-2:2006(E), Information Technology - SEDRIS - Part 2: Abstract Transmittal Format
Standard Identifier:	ISO/IEC 18023-2:2006(E)
Version Identifier:	2006 (year of publication)
Standards Development Organization:	International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) Joint Technical Committee 1 (ISO/IECJTC 1) Sub-Committee 24. (SC 24)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	ISO/IEC 18023-2:2006(E)
DISR Status:	Emerging
STANAG Identifier:	Part of STANAG 4664
STANAG Status:	Ratification in process.
Abstract /Description:	SEDRIS is a series of 8 ISO standards addressing: • (a) the representation of environmental data, and, • (b) the interchange of environmental data sets. To achieve the first, SEDRIS offers a data representation model (DRM), augmented with its environmental data coding specification (EDCS) and spatial reference model (SRM), so that one can articulate one's environmental data clearly, while also using the same representation model to understand others' data unambiguously. Therefore, the data representation aspect of SEDRIS is about capturing and communicating meaning and semantics. While a data representation model is a necessary component of a standard, it is not sufficient to allow effective use. Thus the second aspect of SEDRIS addresses data interchange. In SEDRIS, data interchange is standardized through a SEDRIS Application Programming Interface (API) and a transmittal format (SEDRIS Transmittal Format or STF). The transmittal format and API are semantically coupled with the data representation model. SEDRIS is introduced in the order of 3 corresponding STANAGs (4662 to 4664) that are under ratification process: SEDRIS Part 2 defines the abstract semantics and abstract structure used to encode SEDRIS transmittals. The Abstract Transmittal Format (ATF) defines how concrete encodings are developed so that conversion can be performed with a minimum of effort. ATF also ensures that SEDRIS API implementations behave consistently regardless of transmittal encoding.
Technical Maturity:	
Applicability:	SEDRIS (ISO/IEC 18023) may be applied to the representation of any environmental data including: (a) terrain, (b) ocean, (c) atmosphere, and (d) space.
General Implementation Information:	Used widely in the US, most frequently by ground forces. Some use in other nations (France, for example).
Implementation Guidance:	
Implementation Training Resources:	http://www.sedris.org/
Implementation Vendor Support:	
Implementation Literature References:	http://www.sedris.org/
Limitations:	None identified
Standards Category:	Data Standards (Including Data Mediation and Exchange, Data Production and Data Engineering)
Standards Type:	Data Mediation and Exchange Standards
Public Availability:	The standard can be accessed on the website at http://iso.org
Cost of Standard:	
URL:	http://standards.sedris.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	International Standard ISO/IEC 18023-3:2006(E), Information Technology - SEDRIS - Part 3: Transmittal Format Binary Encoding
Standard Identifier:	ISO/IEC 18023-3:2006(E)
Version Identifier:	2006 (year of publication)
Standards Development Organization:	International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) Joint Technical Committee 1 (ISO/IECJTC 1) Sub-Committee 24. (SC 24)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	ISO/IEC 18023-3:2006(E)
DISR Status:	Emerging
STANAG Identifier:	Part of STANAG 4664
STANAG Status:	Ratification in process.
Abstract /Description:	SEDRIS is a series of 8 ISO standards addressing: • (a) the representation of environmental data, and, • (b) the interchange of environmental data sets. To achieve the first, SEDRIS offers a data representation model (DRM), augmented with its environmental data coding specification (EDCS) and spatial reference model (SRM), so that one can articulate one's environmental data clearly, while also using the same representation model to understand others' data unambiguously. Therefore, the data representation aspect of SEDRIS is about capturing and communicating meaning and semantics. While a data representation model is a necessary component of a standard, it is not sufficient to allow effective use. Thus the second aspect of SEDRIS addresses data interchange. In SEDRIS, data interchange is standardized through a SEDRIS Application Programming Interface (API) and a transmittal format (SEDRIS Transmittal Format or STF). The transmittal format and API are semantically coupled with the data representation model. SEDRIS is introduced in the order of 3 corresponding STANAGs (4662 to 4664) that are under ratification process: Abstract: SEDRIS Transmittal Binary Encoding defines the binary coding for Data Representation Model objects.
Technical Maturity:	
Applicability:	SEDRIS (ISO/IEC 18023) may be applied to the representation of any environmental data including: (a) terrain, (b) ocean, (c) atmosphere, and (d) space.
General Implementation Information:	Used widely in the US, most frequently by ground forces. Some use in other nations (France, for example).
Implementation Guidance:	
Implementation Training Resources:	http://www.sedris.org/
Implementation Vendor Support:	
Implementation Literature References:	http://www.sedris.org/
Limitations:	None identified
Standards Category:	Data Standards (Including Data Mediation and Exchange, Data Production and Data Engineering)
Standards Type:	Data Mediation and Exchange Standards
Public Availability:	The standard can be accessed on the website at http://iso.org
Cost of Standard:	
URL:	http://standards.sedris.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	International Standard ISO/IEC 18024-4:2006(E), Information Technology - SEDRIS Language Bindings - Part 4:C
Standard Identifier:	ISO/IEC 18024-4:2006(E)
Version Identifier:	2006 (year of publication)
Standards Development Organization:	International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) Joint Technical Committee 1 (ISO/IECJTC 1) Sub-Committee 24. (SC 24)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	ISO/IEC 18024-4:2006(E)
DISR Status:	Emerging
STANAG Identifier:	Part of STANAG 4664
STANAG Status:	Ratification in process.
Abstract /Description:	SEDRIS is a series of 8 ISO standards addressing: • (a) the representation of environmental data, and, • (b) the interchange of environmental data sets. To achieve the first, SEDRIS offers a data representation model (DRM), augmented with its environmental data coding specification (EDCS) and spatial reference model (SRM), so that one can articulate one's environmental data clearly, while also using the same representation model to understand others' data unambiguously. Therefore, the data representation aspect of SEDRIS is about capturing and communicating meaning and semantics. While a data representation model is a necessary component of a standard, it is not sufficient to allow effective use. Thus the second aspect of SEDRIS addresses data interchange. In SEDRIS, data interchange is standardized through a SEDRIS Application Programming Interface (API) and a transmittal format (SEDRIS Transmittal Format or STF). The transmittal format and API are semantically coupled with the data representation model. SEDRIS is introduced in the order of 3 corresponding STANAGs (4662 to 4664) that are under ratification process: The SEDRIS language binding defines a language dependent layer for the C programming language based on the 18023-1 Application Program Interface (API).
Technical Maturity:	
Applicability:	SEDRIS (ISO/IEC 18023) may be applied to the representation of any environmental data including: (a) terrain, (b) ocean, (c) atmosphere, and (d) space.
General Implementation Information:	Used widely in the US, most frequently by ground forces. Some use in other nations (France, for example).
Implementation Guidance:	
Implementation Training Resources:	http://www.sedris.org/
Implementation Vendor Support:	
Implementation Literature References:	http://www.sedris.org/
Limitations:	None identified
Standards Category:	Data Standards (Including Data Mediation and Exchange, Data Production and Data Engineering)
Standards Type:	Data Mediation and Exchange Standards
Public Availability:	The standard can be accessed on the website at http://iso.org
Cost of Standard:	
URL:	http://standards.sedris.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	International Standard ISO/IEC 18025:2005(E), Information Technology - Environmental Data Coding Specification (EDCS)
Standard Identifier:	ISO/IEC 18025:2005(E)
Version Identifier:	2006 (year of publication)
Standards Development Organization:	International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) Joint Technical Committee 1 (ISO/IECJTC 1) Sub-Committee 24. (SC 24)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	ISO/IEC 18025:2005(E)
DISR Status:	Emerging
STANAG Identifier:	Part of STANAG 4662
STANAG Status:	Ratification in process
Abstract /Description:	SEDRIS is a series of 8 ISO standards addressing: • (a) the representation of environmental data, and, • (b) the interchange of environmental data sets. To achieve the first, SEDRIS offers a data representation model (DRM), augmented with its environmental data coding specification (EDCS) and spatial reference model (SRM), so that one can articulate one's environmental data clearly, while also using the same representation model to understand others' data unambiguously. Therefore, the data representation aspect of SEDRIS is about capturing and communicating meaning and semantics. While a data representation model is a necessary component of a standard, it is not sufficient to allow effective use. Thus the second aspect of SEDRIS addresses data interchange. In SEDRIS, data interchange is standardized through a SEDRIS Application Programming Interface (API) and a transmittal format (SEDRIS Transmittal Format or STF). The transmittal format and API are semantically coupled with the data representation model. SEDRIS is introduced in the order of 3 corresponding STANAGs (4662 to 4664) that are under ratification process: Abstract: EDCS specifies objects used to model environmental concept. EDCS includes a collection of nine dictionaries that define environmental concepts, objects, attributes, and quantitative measures of objects. EDCS supports the encoding and communication of qualitative and quantitative information associated with physical environments, both real and virtual. This is accomplished by specifying nine EDCS dictionaries of environmental concepts and the EDCS application program interface. EDCS specifies labels and codes and environmental phenomenon to provide a standard way of identifying concepts.
Technical Maturity:	
Applicability:	SEDRIS (ISO/IEC 18023) may be applied to the representation of any environmental data including: (a) terrain, (b) ocean, (c) atmosphere, and (d) space.
General Implementation Information:	Used widely in the US, most frequently by ground forces. Some use in other nations (France, for example).
Implementation Guidance:	
Implementation Training Resources:	http://www.sedris.org/
Implementation Vendor Support:	
Implementation Literature References:	http://www.sedris.org/
Limitations:	None identified
Standards Category:	Data Standards (Including Data Mediation and Exchange, Data Production and Data Engineering)
Standards Type:	Data Mediation and Exchange Standards
Public Availability:	The standard can be accessed on the website at http://iso.org
Cost of Standard:	
URL:	http://standards.sedris.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	International Standard ISO/IEC 18026: 2006(E), Information Technology - Spatial Reference Model (SRM)
Standard Identifier:	ISO/IEC 18026: 2006(E)
Version Identifier:	2006 (year of publication)
Standards Development Organization:	International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) Joint Technical Committee 1 (ISO/IECJTC 1) Sub-Committee 24. (SC 24)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	ISO/IEC 18026: 2006(E)
DISR Status:	Emerging
STANAG Identifier:	Part of STANAG 4663
STANAG Status:	Ratification in process.
Abstract /Description:	SEDRIS is a series of 8 ISO standards addressing: • (a) the representation of environmental data, and, • (b) the interchange of environmental data sets. To achieve the first, SEDRIS offers a data representation model (DRM), augmented with its environmental data coding specification (EDCS) and spatial reference model (SRM), so that one can articulate one's environmental data clearly, while also using the same representation model to understand others' data unambiguously. Therefore, the data representation aspect of SEDRIS is about capturing and communicating meaning and semantics. While a data representation model is a necessary component of a standard, it is not sufficient to allow effective use. Thus the second aspect of SEDRIS addresses data interchange. In SEDRIS, data interchange is standardized through a SEDRIS Application Programming Interface (API) and a transmittal format (SEDRIS Transmittal Format or STF). The transmittal format and API are semantically coupled with the data representation model. SEDRIS is introduced in the order of 3 corresponding STANAGs (4662 to 4664) that are under ratification process: SRM provides aspects of spatial positioning of location, direction, distance, mapping, charting, geodesy, imagery, topography, etc. SRM provides for the description, and transformation or conversion, of geometric properties within or among spatial reference frames. SRM also supports specification of the positions, directions, distances, and times associated with spatial information. The SRM may be, and has been, used independently of the other components of SEDRIS standards.
Technical Maturity:	
Applicability:	SEDRIS (ISO/IEC 18023) may be applied to the representation of any environmental data including: (a) terrain, (b) ocean, (c) atmosphere, and (d) space.
General Implementation Information:	Used widely in the US, most frequently by ground forces. Some use in other nations (France, for example).
Implementation Guidance:	
Implementation Training Resources:	http://www.sedris.org/
Implementation Vendor Support:	
Implementation Literature References:	http://www.sedris.org/
Limitations:	None identified
Standards Category:	Data Standards (Including Data Mediation and Exchange, Data Production and Data Engineering)
Standards Type:	Data Mediation and Exchange Standards
Public Availability:	The standard can be accessed on the website at http://iso.org
Cost of Standard:	
URL:	http://standards.sedris.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	International Standard ISO/IEC 18041-4(E) EDCS Language Bindings Part 4: C
Standard Identifier:	ISO/IEC 18041-4:2007(E)
Version Identifier:	2007 (year of publication)
Standards Development Organization:	International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) Joint Technical Committee 1 (ISO/IECJTC 1) Sub-Committee 24. (SC 24)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	ISO/IEC 18041-4:2007(E)
DISR Status:	Emerging
STANAG Identifier:	Part of STANAG 4662
STANAG Status:	Ratification in process
Abstract /Description:	SEDRIS is a series of 8 ISO standards addressing: • (a) the representation of environmental data, and, • (b) the interchange of environmental data sets. To achieve the first, SEDRIS offers a data representation model (DRM), augmented with its environmental data coding specification (EDCS) and spatial reference model (SRM), so that one can articulate one's environmental data clearly, while also using the same representation model to understand others' data unambiguously. Therefore, the data representation aspect of SEDRIS is about capturing and communicating meaning and semantics. While a data representation model is a necessary component of a standard, it is not sufficient to allow effective use. Thus the second aspect of SEDRIS addresses data interchange. In SEDRIS, data interchange is standardized through a SEDRIS Application Programming Interface (API) and a transmittal format (SEDRIS Transmittal Format or STF). The transmittal format and API are semantically coupled with the data representation model. SEDRIS is introduced in the order of 3 corresponding STANAGs (4662 to 4664) that are under ratification process: EDCS language binding specifies the binding of the Application Program Interface (API) defined in ISO 18023-6 to the C Programming language.
Technical Maturity:	
Applicability:	SEDRIS (ISO/IEC 18023) may be applied to the representation of any environmental data including: (a) terrain, (b) ocean, (c) atmosphere, and (d) space.
General Implementation Information:	Used widely in the US, most frequently by ground forces. Some use in other nations (France, for example).
Implementation Guidance:	
Implementation Training Resources:	http://www.sedris.org/
Implementation Vendor Support:	
Implementation Literature References:	http://www.sedris.org/
Limitations:	None identified
Standards Category:	Data Standards (Including Data Mediation and Exchange, Data Production and Data Engineering)
Standards Type:	Data Mediation and Exchange Standards
Public Availability:	The standard can be accessed on the website at http://iso.org
Cost of Standard:	
URL:	http://standards.sedris.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	International Standard ISO/IEC 18042-4:2006(E), Spatial Reference Model (SRM) Language Bindings - Part 4: C
Standard Identifier:	ISO/IEC 18042-4:2006(E)
Version Identifier:	2006 (year of publication)
Standards Development Organization:	International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) Joint Technical Committee 1 (ISO/IECJTC 1) Sub-Committee 24. (SC 24)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	ISO/IEC 18042-4:2006(E)
DISR Status:	Emerging
STANAG Identifier:	Part of STANAG 4663
STANAG Status:	Ratification in process.
Abstract /Description:	SEDRIS is a series of 8 ISO standards addressing: • (a) the representation of environmental data, and, • (b) the interchange of environmental data sets. To achieve the first, SEDRIS offers a data representation model (DRM), augmented with its environmental data coding specification (EDCS) and spatial reference model (SRM), so that one can articulate one's environmental data clearly, while also using the same representation model to understand others' data unambiguously. Therefore, the data representation aspect of SEDRIS is about capturing and communicating meaning and semantics. While a data representation model is a necessary component of a standard, it is not sufficient to allow effective use. Thus the second aspect of SEDRIS addresses data interchange. In SEDRIS, data interchange is standardized through a SEDRIS Application Programming Interface (API) and a transmittal format (SEDRIS Transmittal Format or STF). The transmittal format and API are semantically coupled with the data representation model. SEDRIS is introduced in the order of 3 corresponding STANAGs (4662 to 4664) that are under ratification process: This part of ISO/IEC 18041-4 specifies the language dependent layer for the C programming language based on the API defined in ISO/IEC 18026.
Technical Maturity:	
Applicability:	SEDRIS (ISO/IEC 18023) may be applied to the representation of any environmental data including: (a) terrain, (b) ocean, (c) atmosphere, and (d) space.
General Implementation Information:	Used widely in the US, most frequently by ground forces. Some use in other nations (France, for example).
Implementation Guidance:	
Implementation Training Resources:	http://www.sedris.org/
Implementation Vendor Support:	
Implementation Literature References:	http://www.sedris.org/
Limitations:	None identified
Standards Category:	Data Standards (Including Data Mediation and Exchange, Data Production and Data Engineering)
Standards Type:	Data Mediation and Exchange Standards
Public Availability:	The standard can be accessed on the website at http://iso.org
Cost of Standard:	
URL:	http://standards.sedris.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	Joint Command, Control and Consultation Information Exchange Data Model (JC3IEDM)
Standard Identifier:	JC3IEDM
Version Identifier:	Version 3.1b
Standards Development Organization:	Multilateral Interoperability Programme (MIP) NATO Data Administration Group (NDAG) in cooperation with the Multilateral Interoperability Programme (MIP) Data Modeling Working Group (DMWG)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	5525
STANAG Status:	STANAG 5525 is currently under ratification.
Abstract /Description:	JC3IEDM specifies the minimum set of data that needs to be exchanged in coalition or multinational operations. JC3IEDM is intended to represent the core of the data identified for exchange across multiple functional areas and multiple views of the requirements. Toward that end, it lays down a common approach to describing the information to be exchanged in a command and control (C2) environment.
Technical Maturity:	Highly mature in use in numerous nations and in NATO. Incontinuous development since 1984. Current version released in 13-Dec-2007.
Applicability:	For the specification of NATO C3 systems and national systems wherever required to aid full interoperability of NATO Forces. In general for facilitating the timely flow of accurate and relevant information using the Information Exchange Mechanisms specified by MIP between the different national C2IS.
General Implementation Information:	This standard has been used in programs and products within NATO and non-NATO nations. It is the basis for developing simulation data standards like C-BML and MSDL. More information can be found on the MIP website: www.mip-site.org
Implementation Guidance:	http://www.mip-site.org/035_Public_Organ_DMWG.htm
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	http://www.mip-site.org/035_Public_Organ_DMWG.htm
Limitations:	None Identified
Standards Category:	Data Standards (Including Data Mediation and Exchange, Data Production and Data Engineering)
Standards Type:	Data Mediation and Exchange Standards
Public Availability:	From the MIP website.
Cost of Standard:	
URL:	www.mip-site.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	MIL-STD-2407, Department of Defense Interface Standard for Vector Product Format
Standard Identifier:	MIL-STD-2407
Version Identifier:	VMAP-1 (Future version VMAP 2i)
Standards Development Organization:	US Defense Mapping Agency
SDO Periodic Review Date:	
DSP Identifier:	MIL-STD-2407
DSP Status:	Active
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	A vector-based collection of Geographic information system (GIS) data about Earth at various levels of detail. An updated and improved version of the US National Imagery and Mapping Agency's (NIMA) Digital Chart of the World (DCW). Also known as Vector Smart Map; formerly known as Digital Chart of the World-DCW. The vector map product comes in three flavours: low resolution (level 0), medium resolution (level 1) and high resolution (level 2).
Technical Maturity:	Used since 1993 in nations and NATO.
Applicability:	Used to represent culture for Geographic Information Systems on applications such as synthetic natural environments.
General Implementation Information:	The use of VMAP is extremely widespread although more modern alternatives are now often preferred.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	None.
Standards Category:	Data Standards (Including Data Mediation and Exchange, Data Production and Data Engineering)
Standards Type:	Data standard.
Public Availability:	Yes
Cost of Standard:	
URL:	
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	Performance Specification Digital Terrain Elevation Data (DTEDTM)
Standard Identifier:	MIL-PRF-89020B
Version Identifier:	23 May 2000
Standards Development Organization:	
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	DTED (or Digital Terrain Elevation Data) is a standard of digital datasets which consists of a matrix of terrain elevation values. This standard was originally developed in the 1970s to support aircraft radar simulation and prediction. DTED supports many applications, including line-of-sight analyses, terrain profiling, 3-D terrain visualization, mission planning/rehearsal, and modeling and simulation. DTED is a standard National Geospatial-Intelligence Agency (NGA) product that provides medium resolution, quantitative data in a digital format for military system applications that require terrain elevation.
Technical Maturity:	
Applicability:	
General Implementation Information:	
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	
Standards Category:	Data Standards (Including Data Mediation and Exchange, Data Production and Data Engineering)
Standards Type:	
Public Availability:	Distribution of DTED® and the Digital Data Products catalog is authorized to the Department of Defense, U.S. DoD contractors, and to U.S. Government agencies that support DoD functions (by authority of the Director, National Geospatial-Intellignece Agency
Cost of Standard:	
URL:	https://www1.nga.mil/ProductsServices/TopographicalTerrestrial/DigitalTerrainElevationData/Pages/default.aspx
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

CATEGORY:

M&S Interoperability

Standards Title:	IEEE Std 1278.1-1995 (Revision of IEEE Std 1278-1993), IEEE Standard for Distributed Interactive Simulation (DIS) - Application Protocols
Standard Identifier:	IEEE1278.1
Version Identifier:	IEEE 1278.1-1995
Standards Development Organization:	"DIS workshops" organization until 1997, presently SISO, as a Standards Sponsor of The Institute of Electrical and Electronics Engineers, Inc. (IEEE)
SDO Periodic Review Date:	
DSP Identifier:	IEEE1278.1
DSP Status:	Active
DISR Identifier:	IEEE 1278.1-1995
DISR Status:	Emerging
STANAG Identifier:	No current STANAG: former STANAG 4482; "Standardized Information Technology Protocols for Distributed Interactive Simulation (DIS)", was adopted in 1995 but retired in 1998.
STANAG Status:	An updated version of STANAG 4482 was not ratified in 1999 and 4482 was declared SUPERSEDED by the future STANAG on HLA (4603).
Abstract /Description:	IEEE 1278.1 defines the format and semantics of data messages, also known as Protocol Data Units (PDUs), that are exchanged between simulation applications and simulation management. The PDUs provide information concerning simulated entity states, the type of entity interactions that take place in a DIS exercise, and data for management and control of a DIS exercise. IEEE 1278.1 also specifies the communication services to be used with each of the PDUs.
Technical Maturity:	More than 15 years of use in many NATO countries; very mature technology.
Applicability:	Distributed Interactive Simulation (DIS) is a protocol for linking simulations of various types at multiple locations to create realistic, complex, virtual worlds for the simulation of highly interactive activities. This protocol can be used to bring together systems built for separate purposes, technologies from different eras, products from various vendors, and platforms from various services, and permits them to interoperate. DIS exercises are intended to support a mixture of virtual entities with computer controlled behavior (computer generated forces), virtual entities with live operators (human-in-the-loop simulators), live entities (operational platforms and test and evaluation systems), and constructive entities (wargames and other automated simulations).
General Implementation Information:	Many operational implementations in various nations. Best example is the US Air Force Distributed Mission Operation (DMO) program.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	The primary limitation of this standard is that it is applicable to only real time (simulated time = wall clock time) simulation and has a fixed object model defined at the platform level.
Standards Category:	M&S Interoperability
Standards Type:	M&S Interoperability.
Public Availability:	Available to the public with an IEEE copyright and a fee.
Cost of Standard:	$68.00 (Non Member)
URL:	www.ieee.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	IEEE Std 1278.1a-1998 (Supplement to IEEE Std 1278.1-1995), IEEE Standard for Distributed Interactive Simulation (DIS) - Application Protocols
Standard Identifier:	IEEE1278.1A
Version Identifier:	IEEE 1278.1A-1998
Standards Development Organization:	"DIS workshops" organization until 1997, presently SISO, as a Standards Sponsor of The Institute of Electrical and Electronics Engineers, Inc. (IEEE)
SDO Periodic Review Date:	
DSP Identifier:	IEEE1278.1A
DSP Status:	Active
DISR Identifier:	IEEE 1278.1A-1998
DISR Status:	Emerging
STANAG Identifier:	No current STANAG: former STANAG 4482; "Standardized Information Technology Protocols for Distributed Interactive Simulation (DIS)", was adopted in 1995 but retired in 1998.
STANAG Status:	An updated version of STANAG 4482 was not ratified in 1999 and 4482 was declared SUPERSEDED by the future STANAG on HLA (4603).
Abstract /Description:	IEEE 1278.1A is a supplement to IEEE 1278.1. It defines the format and semantics of data messages, also known as protocol data units (PDUs), that are exchanged between simulation applications and simulation management. The PDUs provide information concerning simulated entity states, types of entity interactions that take place in a DIS exercise, data for management and control of a DIS exercise, simulated environment states, aggregation of entities, and the transfer of control of entities. IEEE 1278.1A also specifies the communication services to be used with each of the PDUs.
Technical Maturity:	More than 15 years of use in many NATO countries; very mature technology.
Applicability:	Distributed Interactive Simulation (DIS) is a protocol for linking simulations of various types at multiple locations to create realistic, complex, virtual worlds for the simulation of highly interactive activities. This protocol can be used to bring together systems built for separate purposes, technologies from different eras, products from various vendors, and platforms from various services, and permits them to interoperate. DIS exercises are intended to support a mixture of virtual entities with computer controlled behavior (computer generated forces), virtual entities with live operators (human-in-the-loop simulators), live entities (operational platforms and test and evaluation systems), and constructive entities (wargames and other automated simulations).
General Implementation Information:	Many operational implementations in various nations. Best example is the US Air Force Distributed Mission Operation (DMO) program.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	The primary limitation of this standard is that it is applicable to only real time (simulated time = wall clock time) simulation and has a fixed object model defined at the platform level.
Standards Category:	M&S Interoperability
Standards Type:	M&S Interoperability.
Public Availability:	Available to the public with an IEEE copyright and a fee.
Cost of Standard:	$68.00 (Non Member)
URL:	www.ieee.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	IEEE Std 1278.2-1995, IEEE Standard for Distributed Interactive Simulation (DIS) IEEE Communication Services and Profiles
Standard Identifier:	IEEE1278.2
Version Identifier:	IEEE 1278.2-1995
Standards Development Organization:	"DIS workshops" organization until 1997, presently SISO, as a Standards Sponsor of The Institute of Electrical and Electronics Engineers, Inc. (IEEE)
SDO Periodic Review Date:	
DSP Identifier:	IEEE1278.2
DSP Status:	Active
DISR Identifier:	IEEE 1278.2-1995
DISR Status:	Emerging
STANAG Identifier:	No current STANAG: former STANAG 4482; "Standardized Information Technology Protocols for Distributed Interactive Simulation (DIS)", was adopted in 1995 but retired in 1998.
STANAG Status:	An updated version of STANAG 4482 was not ratified in 1999 and 4482 was declared SUPERSEDED by the future STANAG on HLA (4603).
Abstract /Description:	IEEE 1278.2 defines the communication services required to support the message exchange described in IEEE 1278.1. In addition, IEEE 1278.2 provides several communication profiles that meet the specified communications requirements.
Technical Maturity:	More than 15 years of use in many NATO countries; very mature technology.
Applicability:	Distributed Interactive Simulation (DIS) is a protocol for linking simulations of various types at multiple locations to create realistic, complex, virtual worlds for the simulation of highly interactive activities. This protocol can be used to bring together systems built for separate purposes, technologies from different eras, products from various vendors, and platforms from various services, and permits them to interoperate. DIS exercises are intended to support a mixture of virtual entities with computer controlled behavior (computer generated forces), virtual entities with live operators (human-in-the-loop simulators), live entities (operational platforms and test and evaluation systems), and constructive entities (wargames and other automated simulations).
General Implementation Information:	Many operational implementations in various nations. Best example is the US Air Force Distributed Mission Operation (DMO) program.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	The primary limitation of this standard is that it is applicable to only real time (simulated time = wall clock time) simulation and has a fixed object model defined at the platform level.
Standards Category:	M&S Interoperability
Standards Type:	M&S Interoperability.
Public Availability:	Available to the public with an IEEE copyright and a fee.
Cost of Standard:	$68.00 (Non Member)
URL:	www.ieee.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	IEEE Std 1278.3-1996, IEEE Recommended Practice for Distributed Interactive Simulation (DIS)- Exercise Management and Feedback
Standard Identifier:	IEEE1278.3
Version Identifier:	IEEE 1278.3-1996
Standards Development Organization:	"DIS workshops" organization until 1997, presently SISO, as a Standards Sponsor of The Institute of Electrical and Electronics Engineers, Inc. (IEEE)
SDO Periodic Review Date:	
DSP Identifier:	IEEE1278.3
DSP Status:	Active
DISR Identifier:	IEEE 1278.3-1996
DISR Status:	Emerging
STANAG Identifier:	No current STANAG: former STANAG 4482; "Standardized Information Technology Protocols for Distributed Interactive Simulation (DIS)", was adopted in 1995 but retired in 1998.
STANAG Status:	An updated version of STANAG 4482 was not ratified in 1999 and 4482 was declared SUPERSEDED by the future STANAG on HLA (4603).
Abstract /Description:	IEEE 1278.3 provides guidelines are established for exercise management and feedback in Distributed Interactive Simulation (DIS) exercises. Guidance is provided to sponsors, providers, and supporters of DIS compliant systems and exercises as well as to developers of DIS exercise management and feedback stations. The activities of the organizations involved in a DIS exercise and the top-level processes used to accomplish those activities are addressed. The functional requirements of the exercise management and feedback process are also addressed. This standard is one of a series of standards developed for DIS to assure interoperability between dissimilar simulations for currently installed and future simulations developed by different organizations.
Technical Maturity:	More than 15 years of use in many NATO countries; very mature technology.
Applicability:	Distributed Interactive Simulation (DIS) is a protocol for linking simulations of various types at multiple locations to create realistic, complex, virtual worlds for the simulation of highly interactive activities. This protocol can be used to bring together systems built for separate purposes, technologies from different eras, products from various vendors, and platforms from various services, and permits them to interoperate. DIS exercises are intended to support a mixture of virtual entities with computer controlled behavior (computer generated forces), virtual entities with live operators (human-in-the-loop simulators), live entities (operational platforms and test and evaluation systems), and constructive entities (wargames and other automated simulations).
General Implementation Information:	Many operational implementations in various nations. Best example is the US Air Force Distributed Mission Operation (DMO) program.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	The primary limitation of this standard is that it is applicable to only real time (simulated time = wall clock time) simulation and has a fixed object model defined at the platform level.
Standards Category:	M&S Interoperability
Standards Type:	M&S Interoperability.
Public Availability:	Available to the public with an IEEE copyright and a fee.
Cost of Standard:	$68.00 (Non Member)
URL:	www.ieee.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	IEEE Std 1516.1-2000, IEEE Standard for Modeling and Simulation (M&S) High Level Architecture (HLA) - Federate Interface Specification
Standard Identifier:	IEEE 1516.1-2000 (Federation Interface Specification)
Version Identifier:	Version 2000 (year of publication)
Standards Development Organization:	Institute of Electrical and Electronics Engineers (IEEE) with the Simulation Interoperability Standards Organization (SISO) acting as an IEEE standards sponsor.
SDO Periodic Review Date:	
DSP Identifier:	IEEE1516.1
DSP Status:	Active
DISR Identifier:	IEEE 1516.1
DISR Status:	Mandated
STANAG Identifier:	4603
STANAG Status:	Promulgated 2nd July 2008
Abstract /Description:	The High Level Architecture for M&S (HLA) is defined by 3 technical documents. The standards contained in this architecture are interrelated and need to be considered as a product set, as a change in one is likely to have an impact on the others. As such, the HLA is an integrated approach that has been developed to provide a common architecture for simulation. The Framework and Rules is the capstone document for a family of related HLA standards. It defines the HLA, its components, and the rules that outline the responsibilities of HLA federates and federations to ensure a consistent implementation. The Federate Interface Specification defines the standard services of and interfaces to the HLA Runtime Infrastructure (RTI). These services are used by the interacting simulations to achieve a coordinated exchange of information when they participate in a distributed federation. The Object Model Template provides a specification for describing object models that define the information produced or required by a simulation application, and for reconciling definitions among simulations to produce a common data model for mutual interoperation.
Technical Maturity:	The initial document was published on January 1, 2000, copyrighted on February 1. 2000. HLA is considered a mature standard and is in use in numerous countries.
Applicability:	The High Level Architecture is a technical architecture developed to facilitate the reuse and interoperation of simulation systems and assets. The HLA provides a general framework within which developers can structure and describe their simulation systems and/or assets and interoperate with other simulation systems and assets. The HLA consists of three main components. The first component specifies the Framework and Rules. The second component provides the interface specifications. The third component describes the Federation Object Model requirements in the Object Model Template (OMT) Specification.
General Implementation Information:	Widely implemented within NATO and PfP nations; limited implementation of HLA in NATO federations. There are a wide variety of commercial, open source and government support tools.
Implementation Guidance:	
Implementation Training Resources:	http://www.aegistg.com/MS_Training.htm http://www.simulation.com/Training/courses/hla/index.html
Implementation Vendor Support:	http://www.mak.com/products/rti.php http://www.pitch.se/products/prti
Implementation Literature References:	www.sisostds.org
Limitations:	HLA is not “plug and play”. Some parts of the standards are left open to the RTI implementer, thus different RTIs are not guaranteed to interoperate.
Standards Category:	M&S Interoperability
Standards Type:	M&S Interoperability
Public Availability:	Copies of this standard may be purchased from IEEE.
Cost of Standard:	$390.00 for Series (Non-Member)
URL:	http://ieeexplore.ieee.org/servlet/opac?punumber=7179
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	IEEE Std 1516.2-2000, IEEE Standard for Modeling and Simulation (M&S) High Level Architecture (HLA) - Object Model Template (OMT) Specification
Standard Identifier:	IEEE 1516.2-2000 (Object Model Template)
Version Identifier:	Version 2000 (year of publication)
Standards Development Organization:	Institute of Electrical and Electronics Engineers (IEEE) with the Simulation Interoperability Standards Organization (SISO) acting as an IEEE standards sponsor.
SDO Periodic Review Date:	
DSP Identifier:	IEEE1516.2
DSP Status:	Active
DISR Identifier:	IEEE 1516.2
DISR Status:	Mandated
STANAG Identifier:	4603
STANAG Status:	Promulgated 2nd July 2008
Abstract /Description:	The High Level Architecture for M&S (HLA) is defined by 3 technical documents. The standards contained in this architecture are interrelated and need to be considered as a product set, as a change in one is likely to have an impact on the others. As such, the HLA is an integrated approach that has been developed to provide a common architecture for simulation. The Framework and Rules is the capstone document for a family of related HLA standards. It defines the HLA, its components, and the rules that outline the responsibilities of HLA federates and federations to ensure a consistent implementation. The Federate Interface Specification defines the standard services of and interfaces to the HLA Runtime Infrastructure (RTI). These services are used by the interacting simulations to achieve a coordinated exchange of information when they participate in a distributed federation. The Object Model Template provides a specification for describing object models that define the information produced or required by a simulation application, and for reconciling definitions among simulations to produce a common data model for mutual interoperation.
Technical Maturity:	The initial document was published on January 1, 2000, copyrighted on February 1. 2000. HLA is considered a mature standard and is in use in numerous countries.
Applicability:	The High Level Architecture is a technical architecture developed to facilitate the reuse and interoperation of simulation systems and assets. The HLA provides a general framework within which developers can structure and describe their simulation systems and/or assets and interoperate with other simulation systems and assets. The HLA consists of three main components. The first component specifies the Framework and Rules. The second component provides the interface specifications. The third component describes the Federation Object Model requirements in the Object Model Template (OMT) Specification.
General Implementation Information:	Widely implemented within NATO and PfP nations; limited implementation of HLA in NATO federations. There are a wide variety of commercial, open source and government support tools.
Implementation Guidance:	
Implementation Training Resources:	http://www.aegistg.com/MS_Training.htm http://www.simulation.com/Training/courses/hla/index.html
Implementation Vendor Support:	http://www.mak.com/products/rti.php http://www.pitch.se/products/prti
Implementation Literature References:	www.sisostds.org
Limitations:	HLA is not “plug and play”. Some parts of the standards are left open to the RTI implementer, thus different RTIs are not guaranteed to interoperate.
Standards Category:	M&S Interoperability
Standards Type:	M&S Interoperability
Public Availability:	Copies of this standard may be purchased from IEEE.
Cost of Standard:	$390.00 for Series (Non-Member)
URL:	http://ieeexplore.ieee.org/servlet/opac?punumber=7179
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	IEEE Std 1516-2000, IEEE Standard for Modeling and Simulation (M&S) High Level Architecture (HLA) - Framework and Rules
Standard Identifier:	IEEE 1516-2000 (Framework and Rules)
Version Identifier:	Version 2000 (year of publication)
Standards Development Organization:	Institute of Electrical and Electronics Engineers (IEEE) with the Simulation Interoperability Standards Organization (SISO) acting as an IEEE standards sponsor.
SDO Periodic Review Date:	
DSP Identifier:	IEEE1516
DSP Status:	Active
DISR Identifier:	IEEE 1516
DISR Status:	Mandated
STANAG Identifier:	4603
STANAG Status:	Promulgated 2nd July 2008
Abstract /Description:	The High Level Architecture for M&S (HLA) is defined by 3 technical documents. The standards contained in this architecture are interrelated and need to be considered as a product set, as a change in one is likely to have an impact on the others. As such, the HLA is an integrated approach that has been developed to provide a common architecture for simulation. The Framework and Rules is the capstone document for a family of related HLA standards. It defines the HLA, its components, and the rules that outline the responsibilities of HLA federates and federations to ensure a consistent implementation. The Federate Interface Specification defines the standard services of and interfaces to the HLA Runtime Infrastructure (RTI). These services are used by the interacting simulations to achieve a coordinated exchange of information when they participate in a distributed federation. The Object Model Template provides a specification for describing object models that define the information produced or required by a simulation application, and for reconciling definitions among simulations to produce a common data model for mutual interoperation.
Technical Maturity:	The initial document was published on January 1, 2000, copyrighted on February 1. 2000. HLA is considered a mature standard and is in use in numerous countries.
Applicability:	The High Level Architecture is a technical architecture developed to facilitate the reuse and interoperation of simulation systems and assets. The HLA provides a general framework within which developers can structure and describe their simulation systems and/or assets and interoperate with other simulation systems and assets. The HLA consists of three main components. The first component specifies the Framework and Rules. The second component provides the interface specifications. The third component describes the Federation Object Model requirements in the Object Model Template (OMT) Specification.
General Implementation Information:	Widely implemented within NATO and PfP nations; limited implementation of HLA in NATO federations. There are a wide variety of commercial, open source and government support tools.
Implementation Guidance:	
Implementation Training Resources:	http://www.aegistg.com/MS_Training.htm http://www.simulation.com/Training/courses/hla/index.html
Implementation Vendor Support:	http://www.mak.com/products/rti.php http://www.pitch.se/products/prti
Implementation Literature References:	www.sisostds.org
Limitations:	HLA is not “plug and play”. Some parts of the standards are left open to the RTI implementer, thus different RTIs are not guaranteed to interoperate.
Standards Category:	M&S Interoperability
Standards Type:	M&S Interoperability
Public Availability:	Copies of this standard may be purchased from IEEE.
Cost of Standard:	$390.00 for Series (Non-Member)
URL:	http://ieeexplore.ieee.org/servlet/opac?punumber=7179
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	SISO-STD-004.1-2004, Dynamic Link Compatible HLA API Standard for the HLA Interface Specification
Standard Identifier:	SISO-STD-004.1-2004
Version Identifier:	Version 2006 (year of publication)
Standards Development Organization:	Simulation Interoperability Standards Organization (SISO)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	This standard defines link compatible C++ and Java Application Programmer Interfaces (API) consistent with the High Level Architecture Interface Specification and is applicable to HLA Runtime Infrastructures and federates developed in compliance with that specification. The primary objective of this standard is to provide a mechanism to permit federates to utilize RTIs developed in compliance with the High Level Architecture and this specification, without recompiling or relinking federate code.
Technical Maturity:	In use for 2 years and currently being incorporated into the next version of the core IEEE HLA specification.
Applicability:	Applicable to the HLA federates using the C++ and Java interfaces to implement the IEEE 1516-2000 series of HLA specifications.
General Implementation Information:	Unknown within NATO applications.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	www.sisostds.org
Limitations:	This standard is intended to establish the C++ and Java API specifications but it is not intended to facilitate functional compatibility.
Standards Category:	M&S Interoperability
Standards Type:	M&S Interoperability
Public Availability:	Via the SISO web site.
Cost of Standard:	Free
URL:	www.sisostds.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	The Test and Training Enabling Architecture (TENA) Reference Document
Standard Identifier:	None
Version Identifier:	Release 5.2; Release 6 due out in 2009.
Standards Development Organization:	US Department of Defense Test Management Resource Center under the Central Test and Evaluation Investment Program (CTEIP)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	TENA is a product of the Foundation Initiative 2010 (FI 2010) project, sponsored by the Central Test and Evaluation Investment Program (CTEIP). The core of TENA is the TENA Common Infrastructure, including the TENA Middleware, the TENA Repository and the TENA Logical Range Data Archive. TENA also specifies the existence of a number of tools and utilities, including those necessary for the efficient creation of a logical range. Range instrumentation systems (also called range resource applications) and all of the tools interact with the common infrastructure through the medium of the TENA object model. The TENA object model encodes all of the information that is transferred between systems during a range event. It is the common language with which all TENA applications communicate.
Technical Maturity:	Widely used with the US range community and actively managed through an Architecture management Team.
Applicability:	Live Range Interoperability, LVC Interoperability, Test Interoperability
General Implementation Information:	The initial implementation for TENA is to interoperate the US National Test and Training Ranges. Has been used at USJFCOM to incorporate Live and Range assets into LVC Training exercises. See https://www.tena-sda.org/display/intro/news for extensive listi
Implementation Guidance:	
Implementation Training Resources:	www.tena-sda.org/display/intro/Documentation#Documentation-TENAFactSheets
Implementation Vendor Support:	
Implementation Literature References:	https://www.tena-sda.org/display/intro/Documentation
Limitations:	Currently targeted for real-time applications only.
Standards Category:	M&S Interoperability
Standards Type:	M&S Interoperabilty (although targeted toward range interopability)
Public Availability:	See https://www.tena-sda.org for detailed information. Some restrictions on non-US citizens. (US will establish exact restrictions /releasability)
Cost of Standard:	Free
URL:	This standard is accessible at https://www.tena-sda.org. An account is required for some information.
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

CATEGORY:

M&S Miscellaneous

Standards Title:	SCORM Simulation Interface Standards
Standard Identifier:	
Version Identifier:	
Standards Development Organization:	IEEE Simulation Interface Standards Study Group in a joint activity with SISO.
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	The ability to use the SCORM standard to successfully interface SCORM-compliant training with simulations. Information available through the IEEE SCORM-Simulation Interface Standards Study Group.
Technical Maturity:	
Applicability:	
General Implementation Information:	
Implementation Guidance:	
Implementation Training Resources:	http://www.adlnet.gov/Technologies/scorm/default.aspx
Implementation Vendor Support:	
Implementation Literature References:	http://www.ieeeltsc.org:8080/Plone/working-group/computer-managed-instruction-cmi-working-group-11/simulation-interface-standards-study-group/simulation-interface-standards-study-group
Limitations:	
Standards Category:	M&S Miscellaneous
Standards Type:	
Public Availability:	
Cost of Standard:	
URL:	
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	Sharable Content Object Reference Model (SCORM)
Standard Identifier:	SCORM 4th Edition
Version Identifier:	4th Edition Released (March 31, 2009)
Standards Development Organization:	ADL Initiative - DoD, Office of the Under Secretary of Defense for Personnel and Readiness (OUSD P&R)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	SCORM
DISR Status:	Emerging
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	Sharable Content Object Reference Model (SCORM) is a collection of standards and specifications for web-based e-learning. It defines communications between client side content and a host system called the run-time environment (commonly a function of a learning management system). SCORM also defines how content may be packaged into a transferable ZIP file. SCORM is a specification of the Advanced Distributed Learning (ADL) Initiative, which comes out of the Office of the United States Secretary of Defense. SCORM 2004 introduces a complex idea called sequencing, which is a set of rules that specifies the order in which a learner may experience content objects. In simple terms, they constrain a learner to a fixed set of paths through the training material, permit the learner to "bookmark" their progress when taking breaks, and assure the acceptability of test scores achieved by the learner. The standard uses XML, and it is based on the results of work done by AICC, IMS Global, IEEE, and Ariadne. . (en.wikipedia.org/
Technical Maturity:	Initiated 1999, Current Release 2009
Applicability:	SCORM is a collection of standards and specifications for web-based e-learning. It defines communications between client side content and a host system called the run-time environment (commonly a function of a learning management system). SCORM also defines how content may be packaged into a transferable ZIP file.
General Implementation Information:	
Implementation Guidance:	
Implementation Training Resources:	http://www.adlnet.gov/Technologies/scorm/default.aspx
Implementation Vendor Support:	
Implementation Literature References:	http://www.adlnet.gov/Technologies/scorm/SCORMSDocuments/SCORM%20Resources/Resources.aspx
Limitations:	
Standards Category:	M&S Miscellaneous
Standards Type:	
Public Availability:	
Cost of Standard:	
URL:	http://www.adlnet.gov/Technologies/scorm/default.aspx
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

CATEGORY:

M&S Scenarios

Standards Title:	SISO-STD-007-2008, Standard for: Military Scenario Definition Language (MSDL), 14 October 2008
Standard Identifier:	SISO-STD-007-2008
Version Identifier:	14 October 2008
Standards Development Organization:	Simulation Interoperability Standards Organization (SISO)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	The Military Scenario Definition Language (MSDL) is intended to provide a standard mechanism for loading Military Scenarios independent of the application generating or using the scenario. Standard MSDL is defined utilizing an XML schema thus enabling exchange of all or part of scenarios between (e.g.) Command and Control (C2) planning applications, simulations, and scenario development applications. XML based scenario representations can readily be checked for conformance against the standard's schema. The scope to MSDL is bounded by the situation, defined at one instant in time, combined with the course of action about to be taken in context to that situation. The intent is for MSDL to include that information which is either core or common to the situation and course of action (COA) of a military scenario. Definition of COA falls under the scope of the Coalition Battle Management Language (C-BML) SISO Product Development Group (PDG).
Technical Maturity:	MSDL Specification Version .01 is a product of the US OneSAF development provided the basis for the MSDL current version. MSDL v.01 has been matured through the development of the Close Combat Tactical Trainer Commander's Exercise Initialization Toolkit, the OneSAF Objective System (OOS) and the OneSAF Testbed Baseline (OTB), and currently through the enhancements proposed by the US MATREX federation, and through MSDL PDG comments to the originally proposed OneSAF MSDL specification. Additionally, the MSDL PDG established and executed a disciplined review process and associated change request form to affect modifications to MSDL. It is expected that MSDL will continue to evolve and that a disciplined change management process is critical to MSDL's long-term viability. MSDL 1.2 is currently balloted to become an official SISO standard.
Applicability:	MSDL provides the M&S community with the ability to create military scenarios that can be shared and reused among a variety of simulations. Furthermore MSDL provides a mechanism for reusing military scenarios between independent simulations and federated simulations. • Facilitation of interoperability for multiple military simulation products. • Real-world scenario data capture (e.g. C4I) easily ported to military simulations. • Easier comparison of military simulation products using the same initial conditions. • Enables third party products for military scenario design.
General Implementation Information:	Mainly used in the OneSAF Program.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	Mainly targeted to land operations; needs to be generalized to joint operations.
Standards Category:	M&S-Scenarios
Standards Type:	M&S scenarios
Public Availability:	Via SISO web site.
Cost of Standard:	
URL:	www.sisostds.org
Metadata Input Date:	1/15/2010

Metadata Last Updated:	1/15/2010

CATEGORY:

Modeling

(Including Conceptual Modeling and M&S Representation)

Standards Title:	Base Object Model (BOM)
Standard Identifier:	This standard is comprised of two documents: 1) SISO-STD-003-2006, Base Object Model (BOM) Template Specification 2) SISO-STD-003.1-2006, Guide for Base Object Model (BOM) Use and Implementation
Version Identifier:	SISO-STD-003-3006, SISO-STD-003.1-2006
Standards Development Organization:	Simulation Interoperability Standards Organization (SISO)
SDO Periodic Review Date:	
DSP Identifier:	SISO-STD-003 SISO-STD-003.1
DSP Status:	Active
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	Base Object Models (BOMs) provide a component framework for facilitating interoperability, reuse, and composability. The BOM concept is based on the assumption that pieceparts of models, simulations, and federations can be extracted and reused as modeling building-blocks or components. The interplay within a simulation or federation can be captured and characterized in the form of reusable patterns. These patterns of interplay are sequences of events between simulation elements. The representation of the pattern of interplay is captured in the first BOM document. [Reference SISO-STD-003-2006]. The second document, the "Guide for Base Object Model (BOM) Use and Implementation", introduces methodologies for creating BOMs and implementing them in the context of a larger simulation environment. The document is a means of familiarizing the reader with the concept of BOMs and providing guidance for BOM development, integration, and use in supporting simulation development. [Reference SISO-STD-003.1-2006]
Technical Maturity:	One freeware tool implements the BOM standard. First use of BOMs are known to be successful.
Applicability:	The BOM template has constructs that allow the expression of 1) a conceptual model (in terms of events and states), 2) a data exchange model based on the HLA OMT, and 3) the relationships between 1 and 2. Parts 1 and 2 can be use independently or together in combination with part 3. BOMs are intended to improve the reusability and composability of models, simulations and federations.
General Implementation Information:	Some evidence of successful initial use in the US and France.
Implementation Guidance:	
Implementation Training Resources:	www.sisostds.org
Implementation Vendor Support:	www.sisostds.org
Implementation Literature References:	www.sisostds.org
Limitations:	A more concise, but less rich in semantics, as compared with other generalized modelling standards such as UML. Specifically targeted to, but not limited to M&S.
Standards Category:	Modeling (including Conceptual Modeling and M&S Representation)
Standards Type:	Modelling, M&S Interoperability
Public Availability:	The standard's specification and guide can be accessed on the SISO website under the "products" heading.
Cost of Standard:	
URL:	www.sisostds.org and www.boms.info
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	Integration Definition for Function Modeling (IDEF0)
Standard Identifier:	Federal Information Processing Standards Publications (FIPS PUBS) Number 183
Version Identifier:	
Standards Development Organization:	The US National Institute of Standards and Technology (NIST)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	Describes the IDEF0 modeling language (semantics and syntax), and associated rules and techniques, for developing structured graphical representations of a system or enterprise. Use of this standard permits the construction of models comprising system functions (activities, actions, processes, operations), functional relationships, and data (information or objects) that support systems integration. [Reference: FIPS PUBS Number 183]
Technical Maturity:	The standard was approved in 1993.
Applicability:	The use of this standard is strongly recommended for projects that: - Require a modeling technique for the analysis, development, re-engineering, integration, or acquisition of information systems; - Incorporate a systems or enterprise modeling technique into a business process analysis or software engineering methodology. [Reference: FIPS PUBS Number 183]
General Implementation Information:	Examples of current uses of IDEF0 are more evident in the examples of the use of the DoDAF OV-5 Operational View Diagrams. Some older examples of OV-5 can be found in the US DoD Architecture Framework Version 1.0 Deskbook dated 15 August 2003.
Implementation Guidance:	
Implementation Training Resources:	http://www.idef.com/
Implementation Vendor Support:	http://www.idef.com/ http://www.kbsi.com/COTS/index.htm
Implementation Literature References:	http://www.idef.com/
Limitations:	Strictly an activity modeling language. Does not include full process semantics (e.g., dependency and synchronization of operations)
Standards Category:	Modeling (including Conceptual Modeling and M&S Representation)
Standards Type:	Simulation Systems Engineering
Public Availability:	The standard can be accessed on the NIST website under the list of FIPS publications. URL or instructions to Access or Acquire
Cost of Standard:	
URL:	http://www.itl.nist.gov/fipspubs/by-num.htm and choose FIPS number 183.
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	NETWARS Model Development Guide, Version 2.1, 20 October 2006
Standard Identifier:	NETWARS MDG v2.1
Version Identifier:	NETWARS MDG v2.1
Standards Development Organization:	
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	NETWARS MDG v2.1
DISR Status:	Active
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	The purpose of the NETWARS Model Development Guide (MDG) is to provide modeling guidelines and standards for creating communications device models that are interoperable with the NETWARS system and model suite. The NETWARS MDG provides the standards for creating NETWARS communication device models and provides the instructions for modifying existing OPNET commercial off-the-shelf (COTS) models to become NETWARS standard models. This document provides engineers with the information necessary to develop device models that interoperate with existing NETWARS and OPNET COTS models within the NETWARS modeling framework. Any device model written to these standards will integrate seamlessly with the existing model libraries and will be able to take advantage of the benefits that the NETWARS modeling environment has to offer.
Technical Maturity:	Approved 20 October 2006
Applicability:	The NETWARS MDG will be used under the following circumstances (DISR): 1. Modify exisiting communications device models into the NETWARS standard model. 2. Develop new NETWARS standard communications device models. 3. Understand the NETWARS model development process. 4. Understand the NETWARS model architecture.
General Implementation Information:	
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	
Standards Category:	Modeling (including Conceptual Modeling and M&S Representation)
Standards Type:	Communications Device Model Development, DoD, Mode
Public Availability:	
Cost of Standard:	
URL:	
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	SISO-STD-001.1-1999, Real-time Platform-level Reference Federation Object Model (RPR FOM)
Standard Identifier:	SISO-STD-001.1-1999
Version Identifier:	Version 1.0. (Version 2.0 draft 18 still to be approved)
Standards Development Organization:	Simulation Interoperability Standards Organization (SISO)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	While the HLA Standards dictate how federates exchange data, it is a Federation Object Model (FOM) that dictates what data is being exchanged in a particular federation. HLA does not mandate the use of any particular FOM, however, several "reference FOMs" have been developed to promote a-priori interoperability. That is, in order to communicate, a set of federates must agree on a common FOM (among other things), and reference FOMs provide ready-made FOMs that are supported by a wide variety of tools and federates. Reference FOMs can be used as-is, or can be extended to add new simulation concepts that are specific to a particular federation or simulation domain. The RPR FOM is a reference FOM that defines HLA classes, attributes and parameters that are appropriate for real-time, platform-level simulations. Applications that have previously used DIS (or would have considered using DIS), often use the RPR FOM (or a derivative of it) when they playing in an HLA world. The RPR FOM was developed by a SISO Product Development Group (PDG). Its goal was not to just implement the DIS Protocol Data Unit structures within HLA object and interaction classes, but rather to provide an intelligent translation of the concepts used in DIS to an HLA environment. A companion document, known as the GRIM (Guidance, Rationale, and Interoperability Mappings) provides documentation for the RPR FOM. This document is known as SISO-STD-001-1999.
Technical Maturity:	RPR FOM 1.0 is based on the IEEE 1278.1-1995 version of the DIS Standard and became a SISO standard in 1999. It corresponds to the version US DoD 1.3 version of HLA. RPR FOM 2.0 will correspond to the IEEE 1516 version of HLA.
Applicability:	Enables federations of real-time, platform-based simulations, typically allowing DIS users achieve HLA compliance.
General Implementation Information:	In use in many HLA federations.
Implementation Guidance:	
Implementation Training Resources:	www.sisostds.org
Implementation Vendor Support:	
Implementation Literature References:	www.sisostds.org
Limitations:	Mainly targeted to entity-level simulations. Not suitable to be used at operation level.
Standards Category:	Modeling (including Conceptual Modeling and M&S Representation)
Standards Type:	Data standard (mediation).
Public Availability:	Via SISO web site
Cost of Standard:	Free to SISO Members
URL:	www.sisostds.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	SISO-STD-002-2006, Standard for: LINK 16 Simulations
Standard Identifier:	SISO-STD-002-2006 (approved 10 Jul 06)
Version Identifier:	Version 1.0 (10 June 2006)
Standards Development Organization:	Simulation Interoperability Standards Organization (SISO)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	No specific STANAG, but consistent with and in support of STANAG 5602 (edition 1)
STANAG Status:	Promulgated
Abstract /Description:	There are immediate operational requirements for existing military simulations to exchange Link 16 data using a single interoperable standard. The purpose of this standard is to meet this need by providing a standard for simulating the Link 16 protocol. This standard defines 5 fidelity levels, from message exchange only to Link 16 network modelling, including Return Trip Timing messages, Net Entry and Exit, Actual versus Perceived location, and encryption methods. The NATO STANAG 5602 "Standard Interface for Multiple Platform Link Evaluation" (SIMPLE) Link 16 standard is one such protocol. SIMPLE address not only Link 16 but all other Tactical Data Links. While SIMPLE is based on DIS, it was originally intended to test Link 16 terminal connections. That use has been expanded to include Link 16 training, and as such, does not adequately model some Link 16 network parameters. The SISO Link 16 standard addresses this in DIS using Transmitter and Signal PDUs, and HLA under the BOM and RPR FOM paradigms.
Technical Maturity:	In use for 2 years by the U.S. Air Force, Navy, and Marines for distributed simulation training. Regularly updated.
Applicability:	The main objective of Link 16 protocol is to establish a standard for Link 16 message exchange and JTIDS network simulation in the DIS and HLA interoperability paradigms. The intent is to prescribe the content of the standard fields of the Transmitter and Signal PDUs (and the corresponding RPR-FOM Transmitter Object and Signal Interaction) and establish procedures for their use. Compliance with these procedures will facilitate interoperability among Link 16 simulation systems.
General Implementation Information:	In use in NATO and partner countries.
Implementation Guidance:	
Implementation Training Resources:	www.sisostds.org
Implementation Vendor Support:	www.sisostds.org
Implementation Literature References:	www.sisostds.org
Limitations:	This standard applies only to Link 16/JTIDS/MIDS. It does not address Link 16 over SATCOM. Its consistency with the SIMPLE STANAG NATO STANAG 5602, edition 1, Standard Interface for Multiple Platform Link Evaluation (SIMPLE) 20 Feb 2001.
Standards Category:	Modeling (including Conceptual Modeling and M&S Representation)
Standards Type:	Data mediation, M&S Interoperability.
Public Availability:	On the SISO website.
Cost of Standard:	Free to SISO Members
URL:	http://www.sisostds.org/
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	Standard for LINK 11/11B Simulation
Standard Identifier:	SISO-STD-005-200x
Version Identifier:	Draft Version 1.4
Standards Development Organization:	Simulation Interoperability Standards Organization (SISO)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	No specific STANAG, but should be consistent with and in support of STANAG 5602
STANAG Status:	Promulgated
Abstract /Description:	A SISO standard that defines the methods to simulate a Link 11/11B Network within the Distributed Interactive Simulation (DIS) or High Level Architecture (HLA) framework. The SISO standard has 3 levels of fidelity, from message exchange only to Link 11/11B network modelling. The NATO STANAG 5602 "Standard Interface for Multiple Platform Link Evaluation" (SIMPLE) standard another protocol. SIMPLE address not only Link 11 but all other Tactical Data Links. While SIMPLE is based on DIS, SISO Link 11/11B standard will address both DIS using Transmitter and Signal PDUs, and HLA under the BOM and RPR FOM paradigms.
Technical Maturity:	Near Completion. September 2008 SISO conference will incorporate comments from draft 1.4, and release draft version 1.5, which will be ready for SISO standard balloting. Will benefit from the experience of the "Link 16 Simulation" standard (SISO-STD-002-2006, 10 Jul 06).
Applicability:	There are immediate and overdue operational requirements for existing military simulations to exchange Link 11/11B data using a single interoperable method.
General Implementation Information:	There will be a draft implementation soon from the Canadian Defense Ministry, as well as the U.K. E-3D training program. They are awaiting the final approved standard for official implementation.
Implementation Guidance:	
Implementation Training Resources:	www.sisostds.org
Implementation Vendor Support:	
Implementation Literature References:	www.sisostds.org
Limitations:	This standard should only apply to Link 11/11B.
Standards Category:	Modeling (including Conceptual Modeling and M&S Representation)
Standards Type:	Data mediation, M&S Interoperability.
Public Availability:	Draft 1.4 is available on the SISO Link 11/11B PDG website.
Cost of Standard:	
URL:	http://www.sisostds.org/
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	Standard Interface for Multiple Platform Link Evaluation (SIMPLE)
Standard Identifier:	EAPC(AC/322-SC/2)DS(2005)0001
Version Identifier:	EAPC(AC/322-SC/2)DS(2005)0001 (Edition 2, 12 September 2006)
Standards Development Organization:	NATO Consultation, Command and Control Board (NC3B), C3 Capabilities Coherence Sub-Committee (C3CCSC)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	5602 (Edition 2)
STANAG Status:	Promulgated (future version, Edition 3, in the ratification process)
Abstract /Description:	The aim of STANAG 5602 is to provide specifications for a common standard to interconnect ground rigs of all types (e.g. simulation, integration facilities etc.) for the purpose of Tactical Data Link (TDL) Interoperability testing. The STANAG specifies the distributed transfer using the IEEE Distributed Interactive Simulation (DIS) protocols which are defined in the IEEE Std.1278.1 and 1a.
Technical Maturity:	Second version of SIMPLE was promulgated in 2006 and the next version (edition 3) is under ratification. The standard is evolving thanks to feedback coming from a large basis of users.
Applicability:	SIMPLE STANAG specifies the requirements for transfer of data between remote sites in different locations to support interoperability testing of TDL implementations in the different platforms of NATO Nations and Organizations.
General Implementation Information:	In use in NATO
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	Not fully/only targeted to simulation interoperability. Was not originally designed to model Link 16 for training, but testing only. Standard does not model all Link 16 capabilities, such as net entry, net exit, perceived versus actual position, Link 16 relay, message encryption, and Time Slot Reallocation. Only based on DIS and does not address HLA federations' requirements. Applicable to Real Time simulation applications.
Standards Category:	Modeling (including Conceptual Modeling and M&S Representation)
Standards Type:	Data Standards, M&S Interoperability
Public Availability:	Available on the NATO NSA web site
Cost of Standard:	
URL:	http://nsa.nato.int
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	Systems Modeling Language (SysML)
Standard Identifier:	OMG SysML 1.1
Version Identifier:	Version 1.1
Standards Development Organization:	
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	SysML is a general purpose modeling language for systems engineering applications. It is a dialect of UML™, the industry standard for modeling software-intensive systems. It supports the specification, analysis, design, verification and validation of a broad range of systems and systems-of-systems. These systems may include hardware, software, information, processes, personnel, and facilities. The SysML Partners completed their SysML v. 1.0a open source specification draft and submitted it to the Object Management Group (OMG) in November 2005. A series of competing specification proposals was followed by a "SysML Merge Team" proposal submission to the OMG in April 2006, which was adopted by the OMG as OMG SysML™ in July 2006. (www.sysml.org)
Technical Maturity:	Version 1.1 approved November 2008; also see FAQ discussion at http://www.sysmlforum.com/FAQ.htm
Applicability:	Many systems engineering processes tend to be document-intensive (a.k.a. document centric) and employ a motley mix of diagram techniques that are frequently imprecise and inconsistent. In a manner similar to how software engineers sought a general-purpose modeling language (UML) to precisely specify software-intensive systems during the 1990s, systems engineers are now seeking a domain-specific modeling language to specify complex systems that include non-software components (e.g., hardware, information, processes, personnel, and facilities). UML cannot satisfy this need because of its software bias; hence the motivation for SysML. Even though SysML is based on UML, it reduces UML's size and software bias while extending its semantics to model requirements and parametric constraints. These latter capabilities are essential to support requirements engineering and performance analysis, two essential systems engineering activities. (see FAQ discussion at http://www.sysmlforum.com/FAQ.htm)
General Implementation Information:	
Implementation Guidance:	www.sysml.org
Implementation Training Resources:	http://sysmlforum.com/training.htm
Implementation Vendor Support:	http://sysmlforum.com/tools.htm
Implementation Literature References:	http://sysmlforum.com/pubs.htm
Limitations:	
Standards Category:	Modeling (including Conceptual Modeling and M&S Representation)
Standards Type:	
Public Availability:	www.sysml.org
Cost of Standard:	Free
URL:	www.sysml.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	Unified Modeling Language™ (UML)
Standard Identifier:	UML
Version Identifier:	Version 2.1.1
Standards Development Organization:	The Object Management Group™ (OMG™)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	UML is a standardized specification language for object modelling. UML is a generalpurpose modeling language that includes a graphical notation used to create an abstract model of a system, referred to as a UML model. UML is officially defined at the Object Management Group (OMG) by the UML metamodel, a Meta-Object Facility metamodel (MOF). Like other MOF-based specifications, the UML metamodel and UML models may be serialized in XML Metadata Interchange (XMI). UML was designed to specify, visualize, construct, and document software-intensive systems. UML has been a catalyst for the evolution of model-driven technologies, which include model-driven development (MDD), model-driven engineering (MDE), and model-driven architecture (MDA). UML is extensible, offering the following mechanisms for customization: profiles and stereotype. The semantics of extension by profiles have been improved with the UML 2.0 major revision.
Technical Maturity:	UML has matured significantly since UML 1.1. Several minor revisions (UML 1.3, 1.4, and 1.5) fixed shortcomings and bugs with the first version of UML, followed by the UML 2.0 major revision, which is the current OMG standard. The final UML 2.0 specification has been declared available and has been added to OMG's formal specification library. The other parts of the UML specification, the UML 2.0 infrastructure, the UML 2.0 Diagram Interchange, and UML 2.0 OCL specifications have been adopted. The current version available is 2.1.1 (August 2007) and is available in the form of an XMI 2.1 version of the UML 2.1 version.
Applicability:	Not dedicated to simulation, but in very general use in the M&S domain.
General Implementation Information:	Many commercial and free tools available
Implementation Guidance:	
Implementation Training Resources:	http://www.uml-forum.com/training.htm
Implementation Vendor Support:	http://www.uml-forum.com/tools.htm
Implementation Literature References:	http://www.uml-forum.com/pubs.htm
Limitations:	Very specialized, requires detailed understanding.
Standards Category:	Modeling (including Conceptual Modeling and M&S Representation)
Standards Type:	Conceptual modelling
Public Availability:	Via OMG web site.
Cost of Standard:	
URL:	http://www.uml.org/
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	XML Metadata Interchange (XMI)
Standard Identifier:	XML Metadata Interchange (XMI), v2.1.1
Version Identifier:	Version 2.1.1 - December 2007
Standards Development Organization:	The Object Management Group™ (OMG™)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	XMI ax
DISR Status:	Version 1.1: Mandated; Version 2.1: Emerging
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	The XML Metadata Interchange (XMI) is an Object Management Group (OMG) standard for exchanging metadata information via Extensible Markup Language (XML). (http://en.wikipedia.org/wiki/XML_Metadata_Interchange) XMI is a model driven XML Integration framework for defining, interchanging, manipulating and integrating XML data and objects. XMI-based standards are in use for integrating tools, repositories, applications and data warehouses. XMI provides rules by which a schema can be generated for any valid XMI-transmissible MOF-based metamodel. (www.omg.org).
Technical Maturity:	Version 2.1 - Release date: December 2007
Applicability:	XMI provides a mapping from MOF to XML. As MOF and XML technology evolved, the XMI mapping is being updated to comply with the latest versions of these specifications. Updates to the XMI mapping have tracked these version changes in a manner consistent with the existing XMI Production of XML Schema specification (XMI Version 2). (www.omg.org)
General Implementation Information:	
Implementation Guidance:	
Implementation Training Resources:	www.omg.org
Implementation Vendor Support:	www.omg.org
Implementation Literature References:	www.omg.org www.sisostds.org
Limitations:	
Standards Category:	Modeling (including Conceptual Modeling and M&S Representation)
Standards Type:	
Public Availability:	
Cost of Standard:	
URL:	http://www.omg.org/spec/XMI/2.1.1
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

CATEGORY:

Simulation Systems Engineering

(Including M&S Processes and Systems Engineering)

Standards Title:	DoD Architecture Framework (DoDAF)
Standard Identifier:	None
Version Identifier:	Version 1.5 dated 23 April 2007
Standards Development Organization:	The DoDAF Working Groups.
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	The DoDAF is a three-volume set that inclusively covers the concept of the architecture framework, development of architecture descriptions, and management of architecture data. - Volume I introduces the DoDAF framework and addresses the development, use, governance, and maintenance of architecture data - Volume II outlines the essential aspects of architecture development and applies the netcentric concepts to the DoDAF products - Volume III introduces the architecture data management strategy and describes the prerelease Core Architecture Datamodel (CADM) v1.5, which includes the data elements and business rules for the relationships that enable consistent data representation across architectures. [Reference: DoD Architecture Framework Version 1.5 dated 23 April 2007]
Technical Maturity:	Version 1.0 of the DoDAF was first approved in 30 August 2003. The C4ISR Architecture Framework was the predecessor to the DoDAF. Multiple commercial tools produce documentation consistent with the DoDAF.
Applicability:	The DoDAF provides the guidance and rules for developing, representing, and understanding architectures based on a common denominator across DoD, Joint, and multinational boundaries. It provides insight for external stakeholders into how the DoD develops architectures. The DoDAF is intended to provide a number of complementary and consistent views to ensure that architecture descriptions can be compared and related across programs, mission areas, and, ultimately, the enterprise, thus, establishing the foundation for analyses that supports decision-making processes throughout the DoD. [Reference: DoD Architecture Framework Version 1.5 dated 23 April 2007]
General Implementation Information:	Required for use within US DoD major acquisition programs. Adopted (e.g. France), and in some cases modified, by other nations (e.g. UK MODAF).
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	Limited support for systems of systems architectures.
Standards Category:	Simulation System Engineering (Including M&S Processes and Systems Engineering)
Standards Type:	Simulation System Engineering
Public Availability:	The DODAF is available publicly online in three volumes – see URLs below.
Cost of Standard:	Free
URL:	This standard has three volumes which are accessible at: http://www.defenselink.mil/cio-nii/docs/DoDAF_Volume_I.pdf http://www.defenselink.mil/cio-nii/docs/DoDAF_Volume_II.pdf http://www.defenselink.mil/cio-nii/docs/DoDAF_Volume_III.pdf
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	IEEE Recommended Practice for Distributed Simulation Engineering and Execution Process (DSEEP)
Standard Identifier:	IEEE P1730™
Version Identifier:	Version Draft Dv2.0
Standards Development Organization:	IEEE with SISO acting as an IEEE standards sponsor
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	The DSEEP is intended as a high-level process framework into which the lower-level systems engineering practices native to any distributed simulation user and can be easily integrated. DSEEP describes processes and procedures that should be followed by practitioners to develop and execute distributed simulation systems. This recommended practice is not intended to replace lowlevel management and systems engineering practices native to user organizations, but is rather intended as a higher-level framework into which such practices can be integrated and tailored for specific uses. DSEEP is intended to be a generic process and not linked to any specific interoperability standard; there are specific annexes covering HLA and DIS..
Technical Maturity:	Currently DSEEP is still a draft guidance document building on the experience of both the IEEE 1516.3 FEDEP and the European SEDEP effort (which will be superseded when the DSEEP becomes available).
Applicability:	It is likely that the DSEEP will be widely used in future projects as was the FEDEP in previous HLA federation developments.
General Implementation Information:	Draft, not yet implemented.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	Needs to be tailored for specific uses and interoperability standards selected.
Standards Category:	Simulation System Engineering (Including M&S Processes and Systems Engineering)
Standards Type:	Simulation Systems Engineering
Public Availability:	Copies of this standard may be purchased from IEEE when available. Current draft is available only to the DSEEP SISO Product Development Group (PDG) members.
Cost of Standard:	
URL:	www.ieee.org and www.sisostds.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	IEEE Std 1516.3-2003, Recommended Practice for High Level Architecture (HLA) Federation Development and Execution Process (FEDEP)
Standard Identifier:	IEEE P1516.3-2003
Version Identifier:	
Standards Development Organization:	IEEE with SISO acting as an IEEE standards sponsor
SDO Periodic Review Date:	
DSP Identifier:	IEEE1516.3
DSP Status:	Active
DISR Identifier:	IEEE 1516.3
DISR Status:	Emerging
STANAG Identifier:	4603
STANAG Status:	Promulgated 2nd July 2008
Abstract /Description:	This IEEE document is part of the 1516 Family on the High Level Architecture (HLA). The processes and procedures that should be followed by users of the HLA to develop and execute federations are defined in this recommended practice. This recommended practice is not intended to replace low-level management and systems engineering practices native to HLA user organizations, but is rather intended as a higher-level framework into which such practices can be integrated and tailored for specific uses.
Technical Maturity:	The document was published on January 1, 2003, copyrighted on February 1, 2003. This document is based upon a US Department of Defense (DoD) Defense Simulation and Modeling Office (DMSO) publication entitled High Level Architecture Federation Development and Execution Process (FEDEP) Model, version 1.5, dated December 8, 1999. A replacement for this recommended practice is under development--"IEEE P1730™ Recommended Practice for Distributed Simulation Engineering and Execution Process (DSEEP)". When IEEE P1730 is approved, the FEDEP standard will be retired.
Applicability:	The HLA has been designed to be applicable across a wide range of functional applications. The purpose of this document is describe a high-level process by which HLA federations can be developed and executed to meet the needs of a federation user or sponsor. It is expected that the guidelines provided in this document are generally relevant to and can facilitate the development of most HLA federations.
General Implementation Information:	Widely implement across NATO and PfP nations.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	Primarily meant for use with HLA-based federations. Distributed simulation environments constructed using other protocols will need to adapt this document to suit the needs to the particular environment.
Standards Category:	Simulation System Engineering (Including M&S Processes and Systems Engineering)
Standards Type:	Simulation Systems Engineering
Public Availability:	Copies of this standard may be purchased from IEEE.
Cost of Standard:	$85.00 (Non-Member)
URL:	www.ieee.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	NATO Architecture Framework (NAF)
Standard Identifier:	as above
Version Identifier:	Version v3 (2007)
Standards Development Organization:	NATO C3 Board (NC3B)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	NAF promotes the use of models to develop architecture core data and provides this data to architecture specialists. The purpose of an architectural framework such as NAF is to define the operational context (organizations, locations, processes, information flows, etc.), the system architecture (interfaces, data specifications, protocols, etc.), and the supporting standards and documents that are necessary to describe the enterprise. The information presented in an architectural framework is split into logical groupings – usually known as 'Views'. The same system and business elements may be present in more than one view, but the purpose of each view is different and so each provides a different viewpoint on the information. NAF views and subviews are created based on the architecture core data for the benefit of non-specialists. The views include Capability Views, Service Oriented Views and Programme Views. NAF has similarities with MODAF (and DODAF) Enterprise Architectures, but goes beyond these. The current version of NAF (v3) has seen extensions to improve support for Capability development, Service orientation as required by NATO Network enabled Capability (NNEC) and support for NATO transformation. NAF v3 supports Stakeholders so that an extensive analysis can be made to provide rationale for prioritization in decision making. NAF v3 has improved support for the achievement of NNEC and NATO transformation by facilitating the move from a system-oriented paradigm to a service-oriented paradigm, and by identifying mechanisms to handle the complexity of the relationships within the NATO federation of systems in a holistic manner. The NAF Meta-Model (NMM) and repository enable stakeholders and users to extract and exchange bespoke architecture information and make necessary analyses to support development, interoperability, acquisition or technical considerations.
Technical Maturity:	NAF v3 was approved by NC3B in Nov 2007.
Applicability:	NAF v3 is mandated for all NATO programs.
General Implementation Information:	Started immediately after approval.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	None
Standards Category:	Simulation System Engineering (Including M&S Processes and Systems Engineering)
Standards Type:	Systems Engineering
Public Availability:	Yes
Cost of Standard:	
URL:	http://www.nhqc3s.nato.int/HomePage.asp (follow link to 'architectures')
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	Synthetic Environment Development and Exploitation Process (SEDEP)
Standard Identifier:	Not Applicable
Version Identifier:	Version 2.0
Standards Development Organization:	
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	EUCLID7 RTP8 11.13 was a major initiative to promote the use of Synthetic Environments (SEs) in Europe. A SE is also called a Distributed Simulation or a Distributed System of Simulations or a Federation in some other nations. One of the main results from the programme was the concept of the SE Development Environment (SEDE) for creating and utilising SEs, which is analogous to an integrated development environment for developing software applications. The purpose of the SEDE is to provide a facility that will assist the different types of SE users, i.e. Problem Setters, Problem Solvers, and SE Implementers, so that SEs can be delivered faster, better and cheaper. The SEDE comprises of five main components: • the SE Development and Exploitation process (SEDEP) • Repository • SE Management Tool • SE tools (both COTS and those being developed in Euclid 11.13) • a Knowledge Base. The SEDEP was developed from FEDEP US DoD version 1.5 (1998) and its purpose is to provide additional information to the SE community not covered by the terms of reference of the FEDEP. In particular, it is a generic process that is not dedicated to one kind of interoperability technology and covers the complete SE lifecycle, from eliciting the user needs through to evaluating the results from operating the SE. In order to capture the work done in RTP 11.13, the FEDEP and SEDEP development teams worked together to pull-through applicable information into the IEEE 1516.3-2003 version of the FEDEP. Following the conclusion of RTP 11.13, further development of the SEDEP has stopped whilst a new 'owner' is found for it. However, the SEDEP version 2.0 is still publicly available (http://www.euclid1113.com) and SE developers are encouraged to use it since it complements the information provided by the FEDEP.
Technical Maturity:	Version 2 has been released and it's in use in various projects. Should be superseded by the new IEEE FEDEP version named Distributed Simulation Engineering and Execution Process (DSEEP)
Applicability:	The SEDEP is relevant to all military and civil applications of SEs and covers all aspects of their specification, development and operation. It is applicable to creating and utilising small SEs, involving a few networked simulations running on a local area network, through to large SEs, running on a wide area network across national borders. Although the SEDEP uses terms from the High Level Architecture e.g. federation, the process can be tailored to support other interoperability technologies e.g. DIS. The SEDEP is most relevant where there is an emphasis on reusing existing assets and making new assets available for reuse rather than the one-off standalone development of SEs. The SEDEP is initiated when either an SE is being considered to satisfy a particular user need or when a decision has already been taken to use an SE i.e. where a through life SE master plan has been defined to support a high-level process. It is intended to support all the stakeholders who are involved over the lifecycle of an SE.
General Implementation Information:	Specific examples of how the standard has been used in programs and products within individual Nations and in NATO.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	

Implementation Literature References:	
Limitations:	A generic standard; can be tailored to many different applications.
Standards Category:	Simulation System Engineering (Including M&S Processes and Systems Engineering)
Standards Type:	M&S process
Public Availability:	Via Euclid web site.
Cost of Standard:	
URL:	e-mail to nsmith@dstl.gov.uk
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

CATEGORY:

Software Engineering

Standards Title:	Common Object Request Broker Architecture (CORBA).
Standard Identifier:	CORBA
Version Identifier:	Version 3.0.3
Standards Development Organization:	The Object Management Group™ (OMG™)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	CORBA, the Common Object Request Broker Architecture, is OMG's open, vendorneutral architecture and infrastructure that computer applications use to work together over networks. Using the standard protocol IIOP®, a CORBA-based program from any vendor, on almost any computer, operating system, programming language, and network, can interoperate with a CORBAbased program from the same or another vendor, on almost any other computer, operating system, programming language, and network.
Technical Maturity:	Version 3.0.3 has been released. CORBA is a mature, standard middleware that combines the interoperability, deterministic execution, and absolute dependability required by distributed embedded systems.
Applicability:	Has been used for simulation interoperability even though it was not dedicated to simulation. Has been use by some HLA and TENA middleware designers.
General Implementation Information:	Many uses in different countries and on different platforms but few uses for simulations.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	Through its history, CORBA was plagued by shortcomings of its implementations.
Standards Category:	Software Engineering
Standards Type:	Software engineering
Public Availability:	Via OMG web site.
Cost of Standard:	
URL:	http://www.omg.org/docs/formal/04-03-12.pdf
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	Model-Driven Architecture (MDA)
Standard Identifier:	MDA™
Version Identifier:	Version 1.0.1
Standards Development Organization:	The Object Management Group™ (OMG™)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	MDA™ is a software design approach launched by the Object Management Group (OMG) in 2001. It is a variant of the Model Driven Engineering (MDE). The MDA principle is to create a Platform Independent Model (PIM) of a system which describes the business logic and rules behind a specification without taking care of its possible implementations. Then model transformations have to be defined to convert the PIM into Platform Specific Models (PSM) which contain implementation details. PSMs may need to be completed after the transformation. There are as many PSM as possible implementations. The PSM may then be transformed into an even more detailed PSM or into text (eg: code, documentation). Since MDA separates concerns, there is no need to be a technology expert to create a PIM but only a subject matter expert. To complete the PSM there is a need to be a technology expert not a business expert. Model transformation is the key of the MDA process and captures the best proven implementation practices on technologies. MDA is built on the solid foundation of well-established OMG standards, including: - Unified Modelling Language™ (UML®), UML which is a modelling notation used and supported by every major company in the software industry - XML Metadata Interchange (XMI®), which is the standard for storing and exchanging models using XML. - Query View Transformation (QVT) which is a standard for expressing model transformation. MDA main objectives are: - Portability, - Platform Independence - Domain Specificity, through Domain-specific models. - Productivity
Technical Maturity:	The MDA has proven its efficiency in Software Oriented Architecture in particular in the Web development.
Applicability:	Software design / engineering
General Implementation Information:	In use in various projects. Numerous tools are available including commercial or government-owned simulation frameworks.
Implementation Guidance:	
Implementation Training Resources:	http://www.omg.org/mda/
Implementation Vendor Support:	
Implementation Literature References:	http://www.omg.org/mda/
Limitations:	MDA major drawback lays on reverse engineering to keep PIM coherent with PSM/Code. The engineering process has in fact an iterative nature which may make it difficult to apply strictly the MDA theory.
Standards Category:	Software Engineering
Standards Type:	Software Engineering.
Public Availability:	Via OMG web site. Many UML tools (including free ones) conform nowadays to this approach.
Cost of Standard:	
URL:	http://www.omg.org/mda/
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

CATEGORY:

Verification and Validation (V&V)

Standards Title:	Common Verification, Validation and Accreditation (VV&A) Framework for Simulation
Standard Identifier:	REVVA1
Version Identifier:	Version 1 (2005)
Standards Development Organization:	This standard was developed by the former EUCLID4/CEPA5 11 organization (now disbanded) under the Joint Project JP11.20 consortium (France (lead nation), Denmark, Italy, The Netherlands, and Sweden).
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	Description of a common methodological framework for the VV&A of data, models and simulations.
Technical Maturity:	REVVA1 is a set of draft documents developed from 2003 to 2005 : definition documents, guideline documents, state-of-the-art documents, best practices documents and a VV&A process document. It has provided the foundation for the future GM V&V6 standard development (SISO) which should supersede REVVA.
Applicability:	Main objective was to produce the technical basis for a common VV&A methodology able to support and to facilitate the exchange of M&S products within the international M&S community.
General Implementation Information:	REVVA methodology has been tested on some VV&A cases as benchmarks, in different countries: the five REVVA-consortium nations and also in Germany and the UK.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	Some lack of maturity: should be superseded by the future GM V&V SISO standard.
Standards Category:	Verification and Validation (V&V)
Standards Type:	Verification and Validation (V&V)
Public Availability:	Freely available on request to the French MoD procurement agency (DGA, General Delegation for Armament).
Cost of Standard:	
URL:	send e-mail to Stephane.Chaigneau@dga.defense.gouv
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	General Procedure for Modeling and Simulation Verification & Validation Information Exchange
Standard Identifier:	ITOP 1-1-002
Version Identifier:	Version 1-1-002
Standards Development Organization:	International Test Operations Procedures (ITOP)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	This ITOP document describes general procedures for verification and validation (V&V) of Models and Simulations (M&S). It provides a standardized methodology to support the exchange of V&V information among the ratifying nations. It comprises procedures and guidance for planning, implementing, and documenting V&V efforts of M&S. It has influenced the work of the REVVA Consortium.
Technical Maturity:	The current version exists since 2004. This ITOP group has been disbanded in 2006.
Applicability:	Used as part of contracts for the development and procurement of defence technology in T&E.
General Implementation Information:	This standard has been used in programs and products within four individual Nations. More information can be found on the ITOP website: https://itops.dtc.army.mil/MA63.html
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	Restricted to Four-Nation MoU.
Standards Category:	Verification and Validation (V&V)
Standards Type:	Verification & Validation (V&V).
Public Availability:	Restricted to Four-Nation MoU
Cost of Standard:	
URL:	https://itops.dtc.army.mil/MA63.html (access is restricted)
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	Guidance for a Generic Methodology (GM) for Verification and Validation (V&V) and Acceptance of Models, Simulations and Data.
Standard Identifier:	GM V&V
Version Identifier:	Second Draft in discussion within SISO.
Standards Development Organization:	Simulation Interoperability Standards Organization (SISO)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	Abstract: This product will provide the international community with guidance for a generic V&V and Acceptance methodology for models, simulations and data. The product leverages and harmonizes with the contributions from other national and international V&V and Acceptance initiatives such as the current IEEE 1516.4 “Overlay of the HLA FEDEP”, the REVVA 1 project, the V&V International Test Operations Procedures (ITOP) Working Group, and the US DoD VV&A Recommended Practices Guide (RPG). The proposed products will include the following: • The User Manual, which will guide users through the V&V and Acceptance efforts and clarify their responsibilities by explaining how to apply the methodology in practice. It will describe the activities to perform and the products to produce, the interactions taking place among those involved, the flow of products, and how to tailor the methodology to the specific needs of a Modelling and Simulation (M&S) project. • The Reference Manual will document the underlying concepts of the methodology, including the foundations of the chosen terminology, the explanation of the dependencies between activities and products, their meaning for the V&V and Acceptance endeavour, and the rationale for their execution and creation. The reference manual will refer to whenever a deeper understanding of the methodology is required. • The Recommended Practices document will provide user specific guidance with regards to the selection and use of techniques and tools in support of the User Manual. This will include domain specific case studies thereby illustrating the application and tailoring of the methodology.
Technical Maturity:	In development: the Reference Manual and User Manual have already gone under one comment round in SISO. There is a first draft of the RPG to be discussed soon in SISO.
Applicability:	Is currently experienced in some benchmarking cases (in Canada ("MALO case") and in Europe ("NBC case")).
General Implementation Information:	Two testing cases will be introduced in future SISO 2008 workshops.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	Some lack of maturity. Too early to be identified.
Standards Category:	Verification and Validation (V&V)
Standards Type:	Verification and Validation (V&V)
Public Availability:	SISO open standard (available to SISO members under usual SISO copyright conditions).
Cost of Standard:	Free to SISO Members
URL:	www.sisostds.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	IEEE Std 1278.4-1997, IEEE Trial-Use Recommended Practice for Distributed Interactive Simulation (DIS) - Verification, Validation, and Accreditation
Standard Identifier:	IEEE1278.4
Version Identifier:	IEEE 1278.4-1997
Standards Development Organization:	"DIS workshops" organization until 1997, presently SISO, as a Standards Sponsor of The Institute of Electrical and Electronics Engineers, Inc. (IEEE)
SDO Periodic Review Date:	
DSP Identifier:	IEEE1278.4
DSP Status:	Active
DISR Identifier:	IEEE 1278.4-1997
DISR Status:	Emerging
STANAG Identifier:	No current STANAG: former STANAG 4482; "Standardized Information Technology Protocols for Distributed Interactive Simulation (DIS)", was adopted in 1995 but retired in 1998.
STANAG Status:	An updated version of STANAG 4482 was not ratified in 1999 and 4482 was declared SUPERSEDED by the future STANAG on HLA (4603).
Abstract /Description:	IEEE 1278.4 establishes guidelines for the verification, validation, and accreditation (VV&A) of DIS exercises. It provides "how-to" procedures for planning and conducting the VV&A for a DIS exercise.
Technical Maturity:	More than 15 years of use in many NATO countries; very mature technology.
Applicability:	Distributed Interactive Simulation (DIS) is a protocol for linking simulations of various types at multiple locations to create realistic, complex, virtual worlds for the simulation of highly interactive activities. This protocol can be used to bring together systems built for separate purposes, technologies from different eras, products from various vendors, and platforms from various services, and permits them to interoperate. DIS exercises are intended to support a mixture of virtual entities with computer controlled behavior (computer generated forces), virtual entities with live operators (human-in-the-loop simulators), live entities (operational platforms and test and evaluation systems), and constructive entities (wargames and other automated simulations).
General Implementation Information:	Many operational implementations in various nations. Best example is the US Air Force Distributed Mission Operation (DMO) program.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	The primary limitation of this standard is that it is applicable to only real time (simulated time = wall clock time) simulation and has a fixed object model defined at the platform level.
Standards Category:	Verification and Validation (V&V)
Standards Type:	M&S Interoperability.
Public Availability:	Available to the public with an IEEE copyright and a fee.
Cost of Standard:	$68.00 (Non Member)
URL:	www.ieee.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	IEEE Std 1516.4-2007, IEEE Recommended Practice for Verification, Validation, and Accreditation of a Federation—An Overlay to the High Level Architecture (HLA) Federation Development and Execution Process (FEDEP)
Standard Identifier:	IEEE Std 1516.4™-2007
Version Identifier:	IEEE Std 1516.4™-2007
Standards Development Organization:	Developed by the NATO NMSG Task Group 019 and the Simulation Interoperability Standards Organization (SISO, acting as a standards sponsor for The Institute of Electrical and Electronics Engineers, Inc. (IEEE)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	This recommended practice defines the processes and procedures that should be followed to implement Verification, Validation and Accreditation (VV&A) for federations being developed using the High Level Architecture (HLA) Federation Development and Execution Process (FEDEP). This recommended practice is not intended to replace existing VV&A policies, procedures, and guidance, but rather is intended to focus on the unique aspects of the VV&A of federations. It provides a higherlevel framework into which such practices can be integrated and tailored for specific uses.
Technical Maturity:	It is a relatively recent recommended practice document but it benefits from 10 years' practical experience.
Applicability:	Primarily targeted for users, developers and VV&A personnel working with simulations and simulation compositions based upon the HLA and the FEDEP. Users, developers and VV&A personnel working with simulations and simulation compositions not based upon the HLA and the FEDEP can also benefit from the guidance in this document since the activities that this overlay describes can be tailored to support any type of distributed simulation application.
General Implementation Information:	Has been applied to federations in multiple nations, including US and Canada.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	It provides implementation-level guidance to VV&A practitioners; however, it does not describe the individual techniques that might be employed to execute the VV&A processes for federations. It focuses upon the VV&A processes that apply to federations and not the VV&A processes associated with individual simulations (federates), but does consider using the information produced by those processes.
Standards Category:	Verification and Validation (V&V)
Standards Type:	Verification & Validation (V&V)
Public Availability:	Available to the public with an IEEE copyright and a fee.
Cost of Standard:	
URL:	www.ieee.org
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	MIL-STD-3022, Department of Defense Standard Practice Documentation of Verification, Validation, and Accreditation (VV&A) For Models and Simulations
Standard Identifier:	MIL-STD-3022. Supporting Data Item Descriptions (DIDs): Number: DI-MSSM-81750, Accreditation Plan Number: DI-MSSM-81751, Verification and Validation (V&V) Plan Number: DI-MSSM-81752, Verification and Validation (V&V) Report Number: DI-MSSM-81753, Accredit
Version Identifier:	MIL-STD-3022, 28 January 2008
Standards Development Organization:	U.S. Department of Defense
SDO Periodic Review Date:	
DSP Identifier:	MIL-STD-3022
DSP Status:	Active
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	This standard was developed by the U.S. Modeling and Simulation Coordination Office in coordination with the Military Departments. It establishes templates for the four core products of the Modelling and Simulation Verification, Validation, and Accreditation processes. The intent of this standard is to provide consistent documentation that minimizes redundancy and maximizes reuse of information. This promotes a common framework and interfacing capability that can be shared across all Modelling and Simulation programs within the U.S. Department of Defense, other government agencies and allied nations.
Technical Maturity:	Approved by the US DoD in January 2008.
Applicability:	This standard is approved for use by all Departments and Agencies of the U.S. Department of Defense.
General Implementation Information:	Not known
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	None identified
Standards Category:	Verification and Validation (V&V)
Standards Type:	Verification & Validation
Public Availability:	Yes, from U.S. Dept. of Defense MIL-STD-3022
Cost of Standard:	Free
URL:	http://www.assistdocs.com/
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	Verification, Validation & Accreditation (VV&A) Recommended Practices Guide (VV&A RPG)
Standard Identifier:	VV&A RPG Build 3.0
Version Identifier:	RPG Build 3.0, September 2006
Standards Development Organization:	U.S. Department of Defense
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	The VV&A RPG provides general instructions on how, when, and under what circumstances formal VV&A procedures should be employed. In particular it: • describes the interrelated processes that make up VV&A • defines roles and responsibilities of the participants • identifies special topics associated with VV&A • identifies tools and techniques • provides reference material on related areas. This set of documents also includes an informal discussion of the key concepts of VV&A – the principles, rationale, terminology, and general approach to conducting VV&A for models and simulations. It provides an analogy from everyday life intended to demonstrate the practicality of VV&A, and concludes with a summary of the costs and benefits and an introduction to the remainder of the RPG.
Technical Maturity:	Used on dozens of applications in the US. Date of latest revision – 15 Sep 2006.
Applicability:	This guide is applicable to the planning, conduction and documentation of all verification, validation and accreditation of models and simulations. Its recommendations should be tailored to the requirements of the specific M&S application.
General Implementation Information:	Use of the RPG is voluntary but recommended.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	None
Standards Category:	Verification and Validation (V&V)
Standards Type:	Verification & Validation
Public Availability:	May be accessed freely from the Websites below.
Cost of Standard:	Free
URL:	http://www.msco.mil/
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

CATEGORY:

Visualization

Standards Title:	ISO/IEC 19775-1:2004, Computer graphics and Image Processing Extensible 3D (X3D) - Part 1: Architecture and Base Components Mandated Display; ISO/IEC 19775-2:2004, Computer graphics and Image Processing X3D - Part 2: Scene Access Interface (SAI)
Standard Identifier:	ISO/IEC 19775-1:2004; ISO/IEC 19775-2:2004
Version Identifier:	
Standards Development Organization:	ISO/IEC (The International Organization for Standardization / The International Electrotechnical Commission)
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	X3D is a scalable and open software standard for defining and communicating real-time, interactive 3D content for visual effects and behavioral modeling. It can be used across hardware devices and in a broad range of applications including CAD, visual simulation, medical visualization, GIS, entertainment, educational, and multimedia presentations. X3D provides both the XML-encoding and the Scene Authoring Interface (SAI) to enable both web and non-web applications to incorporate real-time 3D data, presentations and controls into non-3D content.
Technical Maturity:	
Applicability:	X3D is a royalty-free open standards file format and run-time architecture to represent and communicate 3D scenes and objects using XML. It is an ISO ratified standard that provides a system for the storage, retrieval and playback of real time graphics content embedded in applications, all within an open architecture to support a wide array of domains and user scenarios.
General Implementation Information:	http://www.web3d.org/x3d/specifications/#x3d-spec
Implementation Guidance:	http://www.web3d.org/x3d/specifications/#x3d-spec
Implementation Training Resources:	http://www.web3d.org/x3d/learn/
Implementation Vendor Support:	
Implementation Literature References:	http://www.web3d.org/sitemap/
Limitations:	
Standards Category:	Visualization
Standards Type:	
Public Availability:	http://www.web3d.org/sitemap/
Cost of Standard:	
URL:	http://www.web3d.org/x3d/specifications/x3d/
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

Standards Title:	OpenFlight Scene Description Database Specification ®
Standard Identifier:	OpenFlight ®
Version Identifier:	Version 16.3
Standards Development Organization:	None – Owned and controlled by Presagis
SDO Periodic Review Date:	
DSP Identifier:	
DSP Status:	
DISR Identifier:	
DISR Status:	
STANAG Identifier:	
STANAG Status:	
Abstract /Description:	OpenFlight is a file format for describing 3D scenes and entities. The owner of the format, Presagis, sells software applications for creating and showing 3D scenes, but so do many other vendors because the standard is readily available. OpenFlight is intended for use in real-time systems and supports: multiple levels of detail, sound, animation sequences, bounding volumes for real-time culling, lighting effects, transparency, texture mapping, material properties, and many other features. Ref: OpenFlight® Scene Description Database Specification. Version 16.3, Revision A, November 2007. MultiGen-Paradigm Inc.
Technical Maturity:	OpenFlight is a very mature standard.
Applicability:	The actual specification is of most use to software developers but it is also of interest to model developers (visual artists) as it determines what visual effects can be modelled (e.g. transparency) and how they are represented.
General Implementation Information:	The standard is used in a very large number of end-user applications (e.g. flight simulators) and in software development tools from MultiGen- Paradigm/Presagis and other companies.
Implementation Guidance:	
Implementation Training Resources:	
Implementation Vendor Support:	
Implementation Literature References:	
Limitations:	OpenFlight is owned and controlled by Presagis and the standard or the open source availability of the standard may change at any time. It is protected under the copyright and trademark laws of the United States of America.
Standards Category:	Visualization
Standards Type:	Visualization
Public Availability:	The standard can be downloaded for free from MultiGen-Paradigm's website: http://www.multigen.com/support/dc_standards.shtml.
Cost of Standard:	
URL:	http://www.multigen.com/support/dc_standards.shtml
Metadata Input Date:	1/15/2010
Metadata Last Updated:	1/15/2010

APPENDIX C : ACRONYMS

A

AAP	Allied Administrative Publication
ADL	Advanced Distributed Learning
API	Application Programming Interface
AT&L	Acquisition, Technology and Logistics

B

BOM	Base Object Model

C

C-BML	Coalition Battle Management Language
C2	Command and Control
C3I	Command Control Communication and Information
CORBA	Common Object Request Broker Architecture
COTS	Commercial Off-The-Shelf
CSPI	COTS Discrete Event Simulation Package Interoperability

D

DEVS	Discrete-Event Systems Specification
DIS	Distributed Interactive Simulation
DISR	Department of Defense Information Technology Standards Registry
DOD	Department of Defense
DODAF	DoD Architecture Framework
DSEEP	Distributed Simulation Engineering and Execution Process
DSP	Defense Standardization Program
DTED	Digital Terrain Elevation Data

E

EDCS	Environmental Data Coding Specification

F

FEDEP	Federation Development and Execution Process
FOM	Federation Object Model (HLA)

G

GM V&V	Generic Methodology for Verification and Validation

H

HLA	High Level Architecture

I

IDEF0	Integration Definition for Function Modeling
IDEF1X	Integration Definition for Information Modeling
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc.
ISO	International Organization for Standardization
IT	Information Technology
ITOP	International Test Operations Procedures
ITSC	Information Technology Standards Committee

J

JC3IEDM	Joint C3 Interface and Exchange Data Model
JTC	Joint Technical Committee

L

LSA	Lead Standardization Activity

M

M&S	Modeling and Simulation
MDA	Model Driven Architecture
MDE	Model Driven Engineering
MODAF	MOD Architecture Framework (UK)
M&S CO	Modeling and Simulation Coordination Office
MSDL	Military Scenario Definition Language
MS3	Modeling and Simulation Standards Subgroup (NATO)
MSSM	Modeling and Simulation Standards and Methodologies

N

NAF	NATO Architecture Framework
NATO	North Atlantic Treaty Organization
NGA	National Geospatial-Intelligence Agency
NGS	Non-Government Standards
NMSG	NATO Modeling and Simulation Group
NIST	National Institute of Standards and Technology
NSA	NATO Standardization Agency

O

OMG	Object Management Group
OMT	Object Model Template

P

PDU	Protocol Data Unit
PfP	Partnership for Peace (NATO)

R

REVVA	Reference for VV&A
RPG	Recommended Practice Guide
RPR FOM	Realtime Platform Reference (RPR) FOM
RTI	Run Time Infrastructure

S

SC	Subcommittee
SCORM	Shareable Content Object Reference Model (ADL standard)
SCORM Sim	SCORM-Simulation Interface Standards
SDO	Standards Development Organization
SEDEP	Synthetic Environment Development and Exploitation Process
SEDRIS	Synthetic Environment Data Representation and Interchange Specification
SISO	Simulation Interoperability Standards Organization
SIMPLE	Standard Interface for Multiple Platform Link Evaluation
SNE	Synthetic Natural Environment
SRM	Spatial Reference Model
SRML	Simulation Reference Markup Language
STANAG	Standardization Agreement (NATO)
STF	SEDRIS Transmittal Format
SysML	Systems Modeling Language

T

TENA	Test and Training Enabling Architecture
TWG	Technical Working Group

U

UML	Unified Modeling Language
URL	Uniform Resource Locator

V

V&V	Verification and Validation
VMAP	Vector Map
VV&A	Verification, Validation and Accreditation (or Acceptation)

W

W3C	World Wide Web Consortium

X

X3D	XML 3-Dimensional
XMI	XML Metadata Interchange

APPENDIX D : GLOSSARY

Definitions for commonly used terms associated with M&S can be found in DoD 5000.59-M, the DoD M&S Glossary, DoDI 5000.61, DoD Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A), and other DoD M&S issuances. Definitions listed here are necessary to further understand information about standards and standards processes that are not strictly unique to M&S.

A

Accreditation. The official certification that a model or simulation is acceptable for use for a specific purpose. (DoD 5000.59-M M&S Glossary)

Accreditation Agent. The organization designated by the accreditation sponsor to conduct an accreditation assessment for a M&S application. (DoD 5000.59-M M&S Glossary)

Acceptance. The decision to use a simulation for a specific purpose while the term accreditation is the official certification that a model or simulation is acceptable for use for a specific purpose. (NATO M&S Standards Profile)

Accuracy. The degree of exactness of a model or simulation, high accuracy implying low error. Accuracy equates to the quality of a result, and is distinguished from precision, which relates to the quality of the operation by which the result is obtained and can be repeated. (DoD 5000.59-M M&S Glossary)

Aggregation. The ability to group entities while preserving the effects of entity behavior and interaction while grouped. See also: disaggregation. (DoD 5000.59-M M&S Glossary)

Algorithm. A prescribed set of well defined unambiguous rules or processes for the solution of a problem in a finite number of steps. (DoD 5000.59-M M&S Glossary)

Application Programmer's Interface (API). A library of function calls that allows a federate to interact with a software application. (NATO M&S Standards Profile)

Application Programming Interface (API). An interface implemented by a software program to enable its interaction with other software. It is similar to the way the user interface facilitates interaction between humans and computers. APIs are implemented by applications, libraries and operating systems to determine the vocabulary and calling conventions. The programmer should employ it to use their services. It may include specifications for routines, data structures, object classes, and protocols used to communicate between the consumer and implementer of the API. (http://en.wikipedia.org/wiki/Api)

Architecture. The structure of components in a program/system, their interrelationships, and the principles and guidelines governing their design and evolution over time. (DoD 5000.59-M M&S Glossary)

C

Closed Standard. See Proprietary Standard

Command and Control Communication System (C3I). A communication system which conveys information between military authorities for command and control purposes. (NATO M&S Standards Profile)

Command Post Exercise (CPX). An exercise in which the forces are simulated, involving the commander, his staff, and communications within and between headquarters. (NATO M&S Standards Profile)

Computer Assisted Exercise (CAX). Contained within the SYNEX grouping is the Computer Assisted Exercise (CAX) which is a CPX where computers simulate the operational environment and provide event resolution that may be used in a distributed or non-distributed form or a combination of both. (NATO M&S Standards Profile)

Computer-Generated Forces (CGF). A generic term used to refer to computer representations of forces in simulations that attempt to model human behavior sufficiently so that the forces will take some actions automatically (without requiring man-in-the-loop interaction). CGFs are also referred to as Semi-automated Forces (SAF). (NATO M&S Standards Profile)

Computer network. A network of data processing nodes that are interconnected for the purpose of data communication. (NATO M&S Standards Profile)

Conceptual Model. A statement of the content and internal representations that are the user's and developer's combined concept of the model. It includes logic and algorithms and explicitly recognizes assumptions and limitations. (DoD 5000.59-M M&S Glossary)

Configuration Management (CM). The application of technical and administrative direction and surveillance to identify and document the functional and physical characteristics of a model or simulation, control changes, and record and report change processing and implementation status. (DoD 5000.59-M M&S Glossary)

Constructive model or simulation. Models and simulations that involve simulated people operating simulated systems**.** Real people stimulate (make inputs) to such simulations but are not involved in determining the outcomes. Also see Live, Virtual and Constructive Simulation.

D

Data. The properties of an entity expressed in discrete parametric values describing its attributes. (NATO M&S Standards Profile)

Data. A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or by automatic means. (DoD 5000.59-M M&S Glossary)

Data Verification, Validation and Certification (VV&C). The process of verifying the internal consistency and correctness of data, validating that it represents real world entities appropriate for its intended purpose or an expected range of purposes, and certifying it as having a specified level of quality or as being appropriate for a specified use, type of use, or range of uses. The process has two perspectives: producer and user process. (DoD 5000.59-M M&S Glossary)

Disaggregation. The ability to represent the behavior of an aggregated unit in terms of its component entities. If the aggregate representation did not maintain state representations of the individual entities, then the decomposition into the entities can only be notional. (DoD 5000.59-M M&S Glossary)

Distributed exercise. An exercise where the training audience can be at different locations, i.e., different cities, countries or continents due to operational, technical or financial reasons. A distributed exercise can be supported by distributed or centralized models and simulations. (NATO M&S Standards Profile)

Distributed Interactive Simulation (DIS). (1) A government/industry initiative to define an infrastructure for linking simulations of various types at multiple locations to create a realistic, complex, virtual environment for the simulation of interactive activities. This infrastructure brings together platforms from different military services and systems built by various vendors using different technologies for different purposes and permits them to interoperate. (2) A time and space coherent synthetic representation of world environments designed for linking the interactive, free play activities of people in operational exercises. The synthetic environment is created through real-time exchange of protocol data units between distributed, computationally autonomous simulation applications in the form of simulations, simulators and instrumented equipment interconnected through standard interfaces. (NATO M&S Standards Profile)

Distributed simulation. A simulation that has multiple modules, which can be run on multiple processors. The processors can co-located in the same room or located in remote sites. (NATO M&S Standards Profile)

E

Entity. A distinguishable person, place, unit, thing, event, or concept about which information is kept. (DoD 5000.59-M M&S Glossary)

Environment. The texture or detail of the natural domain, that is terrain relief, weather, day, night, terrain cultural features (such as cities or farmland), sea states, etc.; and the external objects, conditions, and processes that influenqe the behavior of a system (such as terrain relief, weather, day/night, terrain cultural features, etc.). (DoD 5000.59-M M&S Glossary)

Environmental Representation. An authoritative representation of all or a part of the natural or man-made environment, including permanent or semi-permanent man-made features. (DoD 5000.59-M M&S Glossary)

Events. Events are major occurrences or a sequence of related incidents which are actions or situations that provide greater clarity to an event. (NATO M&S Standards Profile)

Event. A change of object attribute value, an interaction between objects, an instantiation of a new object, or a deletion of an existing object that is associated with a particular point on the federation time axis. Each event contains a time stamp indicating when it is said to occur. (DoD 5000.59-M M&S Glossary)

Exercise. A military maneuver or simulated wartime operation involving planning, preparation, and execution. It is carried out for the purpose of training and evaluation. It may be a combined, joint, or single service exercise, depending on participating organizations. (NATO M&S Standards Profile)

F

Federate. A member of a High Level Architecture Federation. All applications participating in a Federation are called Federates. This may include federation managers, data collectors, real-world ("live") systems (e.g., C4I systems, instrumented ranges, sensors), simulations, passive viewers and other utilities. (DoD 5000.59-M M&S Glossary)

Federation. A set of interacting simulations, real-world (“live”) systems (e.g., Communication and Information Systems (CIS), weapon system hardware, instrumented ranges) and utilities (e.g., federation managers, data collectors, passive viewers), collectively termed “federates,” which together provide users with a simulated system in which they can accomplish their objective. This term (and also the Federate term) were made popular by the HLA standard but

they are now in larger use in the distributed simulation community. (NATO M&S Standards Profile)

Federation. A named set of interacting federates, a common federation object model, and supporting Runtime Infrastructure, that are used as a whole to achieve some specific objective. (DoD 5000.59-M M&S Glossary)

Federation Object Model (FOM). An identification of the essential classes of objects, object attributes, and object interactions that are supported by a High Level Architecture federation. In addition, optional classes of additional information may also be specified to achieve a more complete description of the federation structure and/or behavior. (DoD 5000.59-M M&S Glossary)

Fidelity. The accuracy of the representation when compared to the real world. (DoD 5000.59-M M&S Glossary)

H

Highly aggregated model. Highly aggregated simulations are aggregate level simulations where collections of military assets, i.e., units, are the primary objects represented. They are designed for the higher military echelons such as corps level. They typically use lower resolution terrain data but they can simulate in very large areas as large as continents.

High resolution model. High resolution simulations are entity level simulations where singular military objects, e.g. a soldier, a tank, an aircraft, are the primary objects represented. They are typically designed for the lower military echelons such as platoon, company and battalion. They can also be used for operational level exercises. In high resolution models the resolution of terrain data is higher than high resolution models, i.e., sometimes up to the plans of individual buildings.

High Level Architecture (HLA). The High Level Architecture is composed of three parts: the HLA Rules, the HLA Interface Specification, and the Object Model Template (OMT). The HLA Rules describe the general principles defining the HLA, and delineate ten basic rules that apply to HLA federations and federates. The HLA Interface Specification defines the functional interface between federates and the Runtime Infrastructure (RTI). The Object Model Template Specification provides a specification for documenting key information about simulations and federations. Use of the OMT to describe Simulation and Federation Object Models (SOMs and FOMs) is a key part of the HLA. Major functional elements, interfaces, and design rules, pertaining as feasible to all DoD simulation applications, and providing a common framework within which specific system architectures can be defined. (NATO M&S Standards Profile)

High Level Architecture (HLA). Major functional elements, interfaces, and design rules, pertaining as feasible to all DoD simulation applications, and providing a common framework within which specific system architectures can be defined. (DoD 5000.59-M M&S Glossary)

Human-in-the-Loop (HITL). A model that requires human interaction. See: interactive model. (DoD 5000.59-M M&S Glossary)

I

Interactive Model or Simulation. A model or a simulation that requires human participation. Synonym: human-in-the-loop.

Interactive Model. A model that requires human participation. Synonym: human-in-the-loop. (DoD 5000.59-M M&S Glossary)

Interoperability (as applied to M&S). The ability of a model or simulation to provide services to, and accept services from, other models and simulations and to use the services so exchanged to enable them to operate effectively together. (This definition is a slight change from the special case definition in NATO Publication AAP-6.)

Interoperability. See: M&S Interoperability. (DoD 5000.59-M M&S Glossary)

L

Live simulation. See Live, Virtual and Constructive Simulation.

Live, Virtual, and Constructive Simulation. A broadly used taxonomy for classifying simulation types. The categorization of simulation into live, virtual, and constructive is problematic, because there is no clear division between these categories. The degree of human participation in the simulation is infinitely variable, as is the degree of equipment realism. This categorization of simulations also suffers by excluding a category for simulated people working real equipment (e.g., smart vehicles). (DoD 5000.59-M M&S Glossary)

- **Live Simulation.** A simulation involving real people operating real systems.
- **Virtual Simulation.** A simulation involving real people operating simulated systems. Virtual simulations inject human-in-the-loop in a central role by exercising motor control skills (e.g., flying an airplane), decision skills (e.g., committing fire control resources to action), or communication skills (e.g., as members of a C4I team).
- **Constructive Model or Simulation.** Models and simulations that involve simulated people operating simulated systems. Real people stimulate (make inputs) to such simulations, but are not involved in determining the outcomes.

Live exercise. An exercise where troops are deployed to a field.

M

M&S Interoperability. The ability of a model or simulation to provide services to and accept services from other models and simulations, and to use the services so exchanged to enable them to operate effectively together. (DoD 5000.59-M M&S Glossary)

M&S reuse. The use of M&S resources, (e.g., models, simulations, databases, algorithms, tools) for purposes beyond those for which they were originally developed. Reuse can occur within an organization or in different organizations, or in different application areas.

Model. A representation of a system, entity, phenomenon, or process. Software models of specific entities are comprised of algorithms and data. A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process. (NATO M&S Standards Profile)

Model. A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process. (DoD 5000.59-M M&S Glossary)

Modeling and Simulation (M&S). The use of models, including emulators, prototypes, simulators, and stimulators, either statically or over time, to develop data as a basis for making managerial or technical decisions. The terms "modeling" and "simulation" are often used interchangeably. (DoD 5000.59-M M&S Glossary)

Multi-Resolution Modeling (MRM). Represents aspects of the real world at more than one level of detail.

N

Network. An arrangement of nodes and interconnecting branches.

O

Object Model. A specification of the objects intrinsic to a given system, including a description of the object characteristics (attributes) and a description of the static and dynamic relationships that exist between objects. (DoD 5000.59-M M&S Glossary)

Open Standards. Standards that are widely used, consensus based, published and maintained by recognized industry standards organizations. (http://www.acq.osd.mil/osjtf/termsdef.html).

Open System. A system in which the components and their composition are specified in a non-proprietary environment, enabling competing organizations to use these standard components to build competitive systems. There are three perspectives on open systems: portability - the degree to which a system component can be used in various environments, interoperability - the ability of individual components to exchange information, and integration - the consistency of the various human-machine interfaces between an individual and all hardware and software in the system. (DoD 5000.59-M M&S Glossary)

P

Physical architecture. The identification and arrangement of the physical components of a system architecture into an orderly framework that describes the physical structure, the technical functions, design features and technical attributes that can be achieved by each component and by the system within specified constraints.

Proprietary Standard. A standard that is exclusively owned by an individual or organization, the use of which generally would require a license and/or fee.
(http://www.acq.osd.mil/osjtf/termsdef.html)

R

Real-Time. In modeling and simulation, simulated time advances at the same rate as actual time; for example, running the simulation for one second results in the model advancing time by one second. Contrast with: fast time; slow time. (DoD 5000.59-M M&S Glossary)

Real-World. The set of real or hypothetical causes and effects that simulation technology attempts to replicate. When used in a military context, the term is synonymous with real battlefield to include air, land, and sea combat. Syn: real battlefield. (DoD 5000.59-M M&S Glossary)

Representation. The portrayal of an entity or process provided by a model, simulation, or federation.

Representational resource. Knowledge about the real world (raw materials) used to develop a model, simulation, or federation. Representational resources fall into one of three categories:

- **Functional Description of the Mission Space (FDMS).** An operator's view of the entities, actions, relationships, interactions and environmental factors associated with a mission. Mission spaces may include any aspect of the real world, to include military operations, medical treatment, manufacturing, electrical power distribution, etc.
- **Characteristics and Performance Descriptions (C&PD).** An expert's identification of the entity's nature, which are comprised of (1) attribute definitions, (2) algorithms and (3) data limits.

- **Scenario-specific Data.** The particular information used by a given model, simulation or federation execution so that it may provide its representations in the context of a set of real world circumstances. Scenario-specific data include terrain databases, order of battle, weather, plans and other state data.

Resolution. The degree of detail and precision used in the representation of real world aspects in a model or simulation. See also: granularity. (DoD 5000.59-M M&S Glossary)

Runtime Infrastructure (RTI). The general purpose distributed operating system software that provides the common interface services during the runtime of a High Level Architecture federation. (DoD 5000.59-M M&S Glossary)

S

Scalability. The ability of a distributed simulation to maintain time and spatial consistency as the number of entities and accompanying interactions increase. (DoD 5000.59-M M&S Glossary)

Scenario. Description of an exercise. It is part of the session database that configures the units and platforms and places them in specific locations with specific missions; An initial set of conditions and time line of significant events imposed on trainees or systems to achieve exercise objectives. (DoD 5000.59-M M&S Glossary)

Semi-Automated Forces (SAFOR). Simulation of friendly, enemy and neutral platforms on the virtual battlefield in which the individual platform simulation are operated by computer simulation of the platform crew and command hierarchy. The term "semi-automated" implies that the automation is controlled and monitored by a human who injects command-level decision making into the automated command process. See also: Computer-Generated Forces. (DoD 5000.59-M M&S Glossary)

Simulation. The execution over time of models representing the attributes of one or more entities or processes. Human-in-the-Loop simulations, also known as simulators, are a special class of simulations. A method for implementing a model over time. (NATO M&S Standards Profile)

Simulation. A method for implementing a model over time. (DoD 5000.59-M M&S Glossary)

Simulation Centre. National facility which designs, develops and integrates all live, virtual, and constructive synthetic environments to support Concepts Development and Experimentation, Training, Exercises and Mission Rehearsal, and Research, Development and Acquisition.

Simulated Mission Space (SMS). A general term that describes the synthetic depiction of the real (or projected) world provided by a model, simulation, or federation.

Simulation Object Model (SOM). A specification of the intrinsic capabilities that an individual simulation offers to federations. The standard format in which SOMs are expressed provides a means for federation developers to quickly determine the suitability of simulation systems to assume specific roles within a federation. (DoD 5000.59-M M&S Glossary)

Standard. A document that establishes uniform engineering or technical criteria, methods, processes and practices. (DoD 4120.24-M, “Defense Standardization Program (DSP) Policies and Procedures”, March 2000)

System architecture. The logical structure and operating principles of a system.

V

Validation. The process of determining the degree to which a model or simulation is an accurate representation of the real-world from the perspective of the intended uses of the model or simulation. (DoD 5000.59-M M&S Glossary)

Verification. The process of determining that a model or simulation implementation accurately represents the developer's conceptual description and specification. Verification also evaluates the extent to which the model or simulation has been developed using sound and established software engineering techniques. (DoD 5000.59-M M&S Glossary)

Verification, Validation & Certification (VV&C). See Data VV&C.

Virtual Simulation. A simulation involving real people operating simulated systems. Virtual simulations inject human-in-the-loop (HITL) in a central role by exercising motor control skills (e.g., flying an airplane), decision skills (e.g., committing fire control resources to action), or communication skills (e.g., as members of a CIS team) See: Live, Virtual, and Constructive Simulation.