MEGA MEETING MÜNCHEN CConVV&A

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Preliminary Convention Report

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Executive Summary

Several international working groups have the tasking to develop, evaluate, and harmonize guidelines and a "best practice" for Verification, Validation, and Accreditation (VV&A) with the objective to define common guidelines and standards for VV&A. In fall of 2004 the Combined Convention of International VV&A Standardization Endeavors (CConVV&A) took place with the intention to bring together the members of the different working groups and to coordinate future inter-group communication. For this event, four currently active international working groups tasked with standardization issues in the domain of VV&A were invited:

1. The NATO Modeling and Simulation Group 019, Task Group 016, "Verification, Validation, and Accreditation of Federations"
2. The International Test Operations Procedure (ITOP) Working Group of Experts (WGE) 7.2 "Verification and Validation"
3. The Western European Armament Group THALES Joint Program 11.20, "A Common Verification, Validation, and Accreditation Framework for Simulations" and
4. The Simulation Interoperability Standardization Organization (SISO) Product Development Group (PDG) "Verification, Validation, and Accreditation of Federations"

Although focusing on different aspects of VV&A, these working groups have numerous related topics and areas of interest. With them presenting the current state of their work, the convention attracted an audience not only from the "VV&A community", but also from the model developers and program managers.

At the convention VV&A was confirmed to be the key enabler for the responsible application of cost and time-efficient Modeling and Simulation (M&S) for even more critical tasks than today. The following issues were addressed:

1. Harmonization of the standardization efforts and the development of a commonly accepted terminology and methodological foundation
2. The practitioner's need for guidance for V&V planning and implementation
3. Particular challenges for the VV&A of component-based simulation models
4. Benefits of a mature level concept for the appreciation of the sufficiency of a V&V effort
5. The harmonization and co-ordination of the individual working group approaches:

The future technical, methodological, and organizational goals identified at the conference were:

1. The establishment of a common data/information/knowledge repository
2. Creation of a VV&A expert network
3. Further evolvement of standards
4. Finally the development of a commonly accepted understanding of the technological and organizational foundations of VV&A

To achieve the above goals, the good intentions formulated at the convention must be followed by actions. The need for a common roadmap outlining interim objectives toward the overall objective of a mature, scientifically sound, and applicable VV&A methodology was stressed during the event. The working groups identified the need to establish a common understanding of the relationship between their products, which requires that they

1. define the intended relationship between their products;
2. develop a vision how to integrate their products into a higher, unified framework, and
3. establish an information exchange mechanism making use of the processes and methodological assumption available.

It is necessary to clearly define the scope of M&S VV&A, to develop reasonable expectations about what VV&A can and cannot support, and to define its relationship with system engineering, in particular software engineering, hardware engineering, and quality assurance in those disciplines.
In order to establish a common, precise terminology in the long term, one of the first steps to be taken, should be the agreement on abstract, high level definitions, from which more detailed definitions can be derived, as soon as the working groups concepts converge.

This document gives an overview of the working groups involved and major outcomes of the convention.

Important note to the reader:
This is a preliminary convention report compiled by the convention committee to effectively capture the results of the convention. Please send your feedback on this preliminary report to the conference committee no later than May 01, 2005, to make sure it can be considered for the final workshop report.

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Acronyms

AFDRG	
CConVV&A	Combined Convention of International VV&A Standardization Endeavors
DMSO	(US) Defense Modeling and Simulation Office
DoD	(US) Department of Defense
FEDEP	Federation Development and Execution Process
FR	France
GE	Germany
HLA	High Level Architecture
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Standardization Organization
ITESC	International Test and Evaluation Steering Committee
ITOP	International Test Operations Procedure
JP	Joint Program
M&S	Modeling and Simulation
NATO	North Atlantic Treaty Organization
NIAG	NATO Industrial Advisory Group
PDG	Product Development Group
REVVA	Nickname of WEAG THALES JP11.20
RPG	DMSO's Recommended Practices Guide
SISO	Simulation Interoperability Standardization Organization
SIW	Simulation Interoperability Workshop
THALES	???
UK	United Kingdom
US	United States of America
V&V	Verification and Validation
VV&A	Verification, Validation, and Accreditation
WEAG	Western European Armament Group
WGE	Working Group of Experts

1 Purpose of the Workshop

With increasing need to apply cost and time efficient Modeling and Simulation (M&S) more often and in more critical contexts than today, the requirements for ensuring and assessing correctness, validity, and trustworthiness of M&S products grow. By complementing and substituting live fire tests, training lessons, or prototypes by virtual ones, and by systematically supporting the decision making process with simulation results, this new, stronger role of M&S has the potential to significantly decrease program time and cost. However, it then also bears the risk of disastrous consequences, if the applied M&S products do not reliably yield valid simulation results.

One of the objectives of Verification, Validation, and Accreditation (VV&A) is increasing the applicability of M&S by providing methods and tools, which facilitate the rigorous examination of simulation models and results for early detection and elimination of invalidity and incorrectness. Several international working groups have tasks to develop, evaluate, and standardize guidelines and a "best practice" for Verification, Validation, and Accreditation (VV&A). These working groups include:

- The NATO Modeling and Simulation Group 019, Task Group 016, "Verification, Validation, and Accreditation of Federations" (in the following referred to as NMSG);
- The International Test Operations Procedure (ITOP) Working Group of Experts (WGE) 7.2 "Verification and Validation" (in the following referred to as ITOP on V&V);
- The Western European Armament Group THALES Joint Program 11.20, "A Common Verification, Validation, and Accreditation Framework for Simulations" (WEAG THALES JP11.20, in the following referred to as REVVA);
- The Simulation Interoperability Standardization Organization (SISO) Product Development Group (PDG) "Verification, Validation, and Accreditation of Federations" (in the following referred to as SISO PDG).

Although focusing on different aspects of VV&A, these working groups have numerous related topics and common areas of interest, which were discussed during this event. With the above working groups presenting the current state of their work, the convention attracted audience not only from the “VV&A community”, but also from model developers, and program managers.

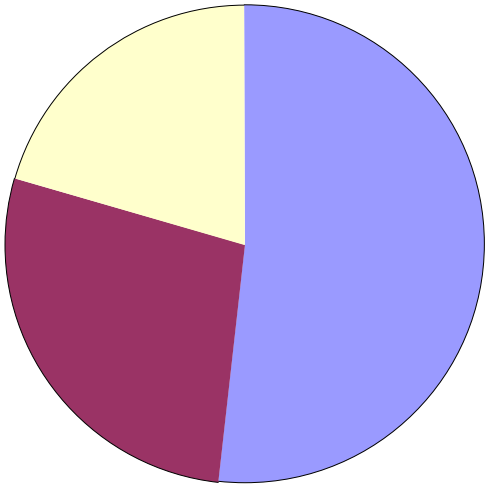
1.1 Convention Objectives

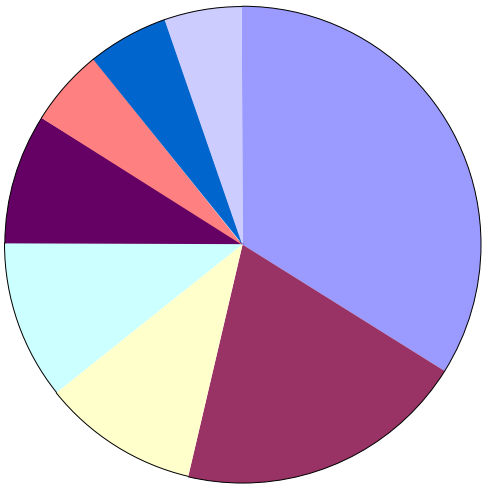
The main objectives of the convention were:

- to identify critical issues related to VV&A theory and practice,
- to ensure that VV&A stays practice oriented by reviewing and reconfirming the practitioner’s and user’s needs,
- to encourage the development of good training, guidance and support products by communicating current VV&A achievements to M&S practitioners, users, and managers,
- to co-ordinate future planning and inter-group information exchange to avoid duplicative work and to take advantage of synergetic effects to achieve the superior objective to foster the economic handling of time, money, and human resources in the field of VV&A.

1.2 Participants

The CConVVA was well perceived and attended by numerous individuals from nine nations recognized as experts in the fields of VV&A and M&S from academia, industry, and military. Notable was also the interest of program managers and M&S users in the advance of the VV&A state of the art, who raised their needs for future VV&A achievements during the discussions. Depending on the day's theme and its participation restrictions (see section 1.3), the number of participants varied. It achieved its maximum of over 60 attendees on Wednesday 20th and Thursday 21st, when external guest where also admitted.





Government:	30	Germany:	19	France:	5
Industry:	16	UK:	11	The Netherlands:	3
Academia:	12	USA:	6	Denmark:	3
		Sweden:	6	Italy:	3

For a list of participants please refer to Appendix 6.3.

1.3 Convention Program

With the objective to bring together four major international working groups, which are involved in M&S VV&A and include members from several continents, one whole week was blocked for the convention. The international working groups took the opportunity to schedule their individual working group meetings adjacent to the CConVV&A, mainly Monday 18th, Tuesday 19th, and Saturday, 23rd. Rooms and technical equipment were provided by the organizers. Figure 1 gives a graphical overview over the meeting timeline.

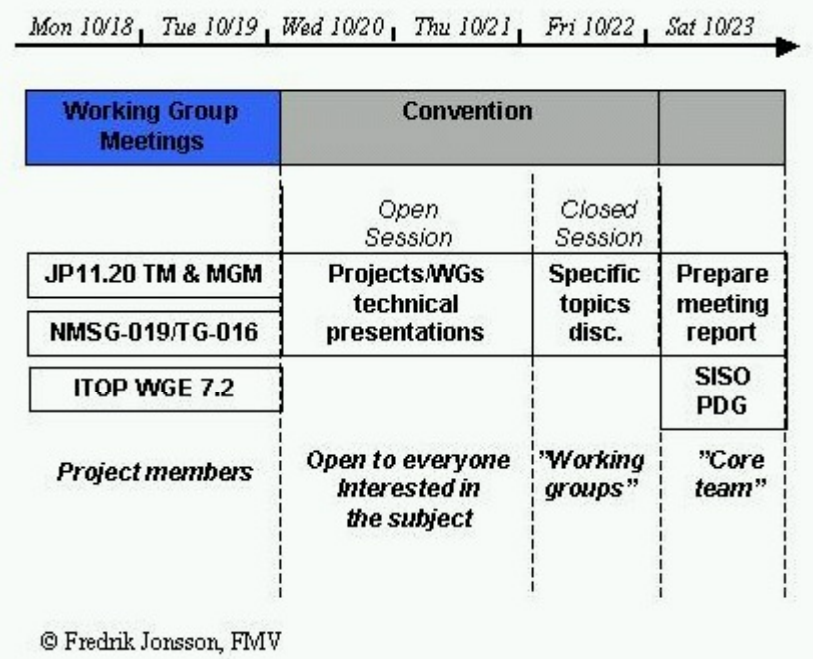


Figure 1: Convention Schedule

The convention itself lasted three and a half days, October 20th - 23rd, 2004.

The first two days, Wednesday 20th and Thursday 21st, were dedicated to presenting and discussing the work conducted in the individual working groups, with half a day reserved for each working group. Participation during the first two days was open to members of the technical working groups, their management groups (if applicable), and M&S practitioners, program managers, and other individuals interested in the subject.
The third day, Friday 22nd, was a day of moderated discussions between the members for the working groups, addressing important issues identified during the first two days of the meeting. Those issues included, but were not limited to:

- VV&A terminology,
- V&V of component-based simulations
- levels of VV&A, and
- a common future roadmap.

On the fourth day, Saturday 23rd, the conference committee and interested members of the technical working groups started the compilation of a convention report.
For more details on organization and schedule please refer to the detailed agenda provided in Appendix 6.9

2 Participating Working Groups

A first impression of the current commonalities, existing differences, potential synergy, and common future objectives can be gained from the executive summaries of the working group objectives, tasks, and responsibilities, reproduced in the following subsections:

2.1 WEAG THALES JP11.20 ("REVVA")

REVVA (JP11.20) was a project running under the auspices of the WEAG/THALES MoU which provides a mechanism for multinational defense research collaborations among Western European Union nations. The objective of REVVA was to develop the basis for a common methodological framework for the verification, validation and accreditation (VV&A) of data, models and simulations. The project timeline was March 2003 - September 2004, and the project was funded by 5 nations: France (lead nation), Denmark, Italy, the Netherlands and Sweden.

The REVVA research effort relied on past and existing efforts coming from many institutional sources (including DMSO, NATO, ITOP, and AFDRG), as well as usual scientific contributions. The REVVA approach is based on a set of assumptions which are used to focus the efforts to produce a methodology which must be: stakeholders oriented; product oriented; customizable; and, M&S development neutral, as far as possible.

The presentations planned for the CConVV&A workshop highlighted the rationale, the status and the achievements of REVVA. These achievements are:

- conceptual: clarification of the Validity/Validation concepts: V&V terminology; V&V taxonomies,
- technical: identification of V&V products; V&V techniques and tools,
- methodological: V&V generic process; V&V tailoring issues and topics; V&V organizations and impact of these V&V organizations.

A follow-on program for REVVA is under preparation with the objective of producing draft documents for the standardization of a generic VV&A methodology framework.

2.2 SISO PDG on V&V of HLA Federations

The need for a VV&A overlay to the FEDEP has been recognized from the early stages of FEDEP definition. Discussions related to a VV&A overlay can be traced back to 1998 with a presentation given at the Fall SIW that was entitled "A VV&A Overlay to the HLA Federation". As IEEE 1516.3 the "High Level Architecture (HLA) Federation Development and Execution Process (FEDEP)" was being developed, 'hooks' were put into place to allow for the eventual development of a VV&A overlay to the FEDEP. Now that the FEDEP has been matured and taken through a standardization process thus providing a solid foundation, a logical next step is to produce an overlay for the VV&A of federations.

In addition to the interest at SIW, there are several communities that have a vested interest in building guidance to address VV&A of federations. DoD policy requires VV&A be performed. Information describing 'how to' is therefore critical to the DoD M&S community. NATO has a strong emphasis on distributed simulation, therefore interoperability (both technical and substantive) are of critical importance. Consistent guidance regarding VV&A terminology, concepts, methodology, and product requirements allows for a common technical foundation.

The proposed SISO VV&A guidance document would mirror the FEDEP, addressing overall VV&A methodology, roles and responsibilities, tasks, resulting products, and challenges. As with the FEDEP, material for the document would be based on lessons learned derived from the community that have been matured to the point where the proposed methodologies are "accepted" or recommended practice. Community buy-in will be a key component to the development of the document.

2.3 ITOP on V&V

As military operations include more multinational operations, standardization and interoperability are becoming vital issues. Based on the implementation of the four-nation Memorandum of Understanding (FR, GE, UK, U.S.) – Sweden is involved in ITOP as an observer – on the mutual acceptance of test and evaluation, the International Test and Evaluation Steering Committee (ITESC) oversees the standardization and documentation of test operating procedures produced by specific Working Groups of Experts (WGE).

In 1997 the new area of Modeling and Simulation (M&S) was introduced and a Management Committee (MC7) was set up because of the increasing importance of integrating M&S into other ITOP areas. Two WGE have been appointed by the M&S Management Committee to develop ITOPs. WGE 7.2 is concerned with Verification and Validation procedures. ISSUE 1.0 of ITOP 01-01-002 "General Procedure for M&S V&V Information Exchange." was ratified and released in May 2004. It has been distributed within each participating nation for comment, with a view of working towards a second issue.

The ITOP comprises procedures and guidance for planning, implementing, and documenting V&V efforts of Models and Simulations (M&S). The intention is to identify the strengths and weaknesses of M&S, input data and simulation results so others may judge their usability for a purpose and reusability for any subsequent purpose. It provides:

- Modular cases for separate V&V of the model, the data, and model use
- A structured approach for organizing claims, arguments (i.e., reasoning) and evidence as a basis for an informed accreditation decision
- A concept of level of impact and factors that have an influence on V&V
- A workbook template for the uniform documentation of the modular cases, which contain the claims, arguments and evidence.
- An agreed definition of modeling and simulation, and verification and validation terminology.

2.4 NATO MSG 019 / TG 016

The NATO Modeling and Simulation Group 019 (also referred to as the NATO Research and Technology Agencies Task Group 016, VV&A of Federations) was proposed during the 5th NATO Modeling and Simulation Group (NMSG) meeting in July 2000. Following initial preliminary discussions over the Internet and a short meeting by interested parties in September 2000 at the United States Defense Modeling and Simulation Office (DMSO), it became clear that sufficient interest and substance existed for the formation of a Task Group on the subject.

Interest focused on credibility which is critical to the effective and appropriate use of models and simulations (M&S) when used independently or combined in a federation. The cornerstone to establishing M&S credibility is a robust VV&A process. There is a widely disparate understanding of the VV&A process within the NATO/PfP community. Therefore the need exists to establish a consistent baseline of terminology, philosophy, and methodology.

Building a federation that incorporates representations appropriate to the needs of a federation application is the heart of the VV&A problem. Just as the High Level

Architecture (HLA) initiative provides the framework that addresses technical interoperability (e.g., issues related to connectivity and data exchange), a well-defined VV&A process supports the establishment of substantive interoperability (e.g., issues related to representations, consistency, etc.).
In order to produce a consensus-based VV&A process, a task group consisting of members from France, Germany, Sweden, the UK, and the US was chartered to produce a technical report describing the VV&A baseline. In producing the baseline, the task group would leverage existing products (e.g., US DMSO VV&A Recommended Practices Guide (RPG), NATO Industry Advisory Group (NIAG)'s Study Group 60's VV&A study, etc) wherever possible.

3 Convention Key Issues and Impressions

This section summarizes the key issues identified during the convention days and the first impressions of the Conference Committee. The participants were encouraged to take the opportunity to indicate other issues important from their perspective and to express their opinion on the topics discussed to the convention committee by filling in the "CConVV&A Feedback Form" as shown in Appendix 6.2.
The key issues of the CConVV&A which were addressed during the focused discussions in the workshop included:

- Standardization Areas and Terminology: How to improve the communication between those who are going to use, build, examine, and assess simulation models and results, to create a common standard level of consistent and useful VV&A guidance, and to increase the distribution of this guidance;
- V&V Planning and Implementation: How to systematically guide those who are confronted with that task to verify, validate, and accredit a simulation model or simulation results;
- V&V of Component-Based Simulation: How to approach the VV&A of simulation models that have been composed from reusable "building blocks";
- Levels of V&V: How to move towards a solution of the problem that under given time and budget constraints V&V cannot prove the correctness and validity of a simulation model or results and one needs to determine "how much V&V is enough for acceptance or accreditation"; and
- Future working group interaction: How to avoid duplicative efforts, to harmonized future activities, to ensure a regular and frequent information exchange, and to support mutual leveraging of achievements.

The strong interrelationship between most of the key issues becomes apparent during the more detailed illumination below.

3.1 Standardization Areas and Terminology

Currently all four working groups have achieved or are heading for standardization or official ratification of their product:

- The ITOP on V&V was ratified in 2004 according to the rules and regulations of the associated MoU between Germany, France, UK, and USA, and addresses the exchange of structured V&V information, organized in "cases". Although it is already accepted, the group plans to revise, improve, and maintain the document, based on feedback from the user community.
- REVVA identified several potential standardization bodies for their VV&A methodology and guidelines, including SISO, IEEE, and ISO. However, at the current state, the REVVA methodology is not mature enough and needs further development during the follow-on project. Submission of reference documents to a standardization body is planned for the last working period of the REVVA follow-on program, which is expected to be fall 2007.
- The SISO PDG heads for standard guidance to supplement the existing IEEE1516.3 standard. The group's work is specialized on the VV&A of HLA federations. The draft for the balloting process is scheduled for the end of 2005.
- The NMSG019/TG016 develops a NATO standard for the VV&A of HLA federations. The contents of the work strongly overlap with the SISO PDG, and it seems desirable from a technical point of view to join the SISO PDG and the NMSG.

Several proposals were made concerning the future road those four groups may take to standardization, including the development of

- one integrated universal standard for VV&A;
- up to three harmonized standards, addressing (1) the methodology and formal foundations of VV&A (REVVA), (2) the structured representation and communication of V&V results (ITOP), and (3) the specialized, directly, and practically applicable guidance on the VV&A of HLA federations (NMSG/PDG);
- a set of common standardized sub-elements or components of the three distinct VV&A methodologies, such as a common VV&A standard terminology, a common standard modeling process, or a common standard VV&A process.

The impression left from the convention is that with the currently given time frames and the difference in maturity of the approaches developed, it is not promising to develop one single unified integrated standard. However, compatibility between the approaches shall be ensured by regular and frequent exchange, synchronization, and harmonization between the working groups. Appropriate action to ensure communication between the groups must be taken, including the development of a common terminology.
Furthermore, for each standard, the target audience and the standard's objective need to be clearly identified, to ensure that the standard can be understood and applied by the targeted audience and is likely to produce the desired results. The workings must be distinguished between an efficient, problem-oriented guidance for limited, special cases of application, and a fundamental, exhaustive, consistent, and formalized framework that serves as a stable foundation for the improvement of the scientific state of the art in M&S VV&A.
Among the main objectives on the road to a common terminology is to reuse as many existing definitions from related areas as possible, and not to come up with new ones. For this purpose commonly accepted terminology sources need to be identified and distributed over the working groups. A major challenge is to bring the terminology from

several communities together, because those who use simulations have a different educational background than those who develop them. It was recognized that a debate on terms is extremely difficult and requires an ongoing dialogue rather than first shot solutions. To achieve a common terminology, a common shared understanding of the underlying concepts is required not only between the working groups, but within the whole community. Therefore, the task of the working groups now is to identify, develop, analyze, review, and evaluate VV&A methodologies and concepts for consistency and completeness, and to create the desired shared understanding.

3.2 V&V Planning and Implementation

A key issue raised by the extended group of workshop participants (including users, project managers, and M&S practitioners) on Wednesday and Thursday is the wish for detailed, practically applicable guidance for V&V planning and implementation. For HLA federations this guidance is likely to be made available by the SISO PDG and the NMSG soon in form of a VV&A overlay for the Federation Development and Execution Process (FEDEP IEEE1516.3). However, the ITOP group provides only basic guidance on how to develop the claim-argument-evidence structure for their three cases, which combines and integrates the available examination results ("Items of Evidence") into a closed picture. Also REVVA's "Guide for the Development of the Target of Acceptance" does not address and solve all challenges associated with the development of the Target of Acceptance (ToA) and the Target of Verification and Validation (ToVV) for particular application cases still has many questions unanswered. Potential for direct cooperation between ITOP and REVVA lies in the development of a detailed guidance how to develop claim-argument-evidence structures or the Target of Acceptance and the Target of Verification and Validation, respectively, for various M&S application domains. It was a recommendation to establish communication, coordination, and co-operation between the working groups, to ensure convergence between VV&A processes and V&V results of the HLA federation VV&A process (SISO PDG / NMSG), the REVVA methodology, and the ITOP approach.

3.3 V&V in Component-Based Simulation Models

A sub-discipline of M&S, which is expected to be of high relevance in the near future, is "Component-based Simulation". In essence, reusable simulation components shall be made available in repositories, facilitating a quick and cost-efficient assembly of large-scale simulation models just in time when needed. For specialized areas, such as Integrated Circuit Design, this approach has already been demonstrated to be economically reasonable and current academic attempts to enable Component-based Simulation for general purpose M&S look promising. Several (both prototypical and commercially distributed) technical frameworks to support the composition of simulation models for both local and distributed hardware environments exist, with the High Level Architecture as the most widely recognized within the defense area. The component-based construction method for simulation models holds benefits, but also disadvantages concerning VV&A.

During discussions on the topic, it was confirmed that verified and validated components do not automatically imply validity and correctness of the composed simulation model. However, the question "What exactly has to be verified on component level in order to implicitly ensure correctness on composition level?" remained unanswered. It was raised that for automatic verification of the composition, a completely

formalized composition environment is required, which may significantly constrain the range of simulations this technique is applied to. It was Generally recognized that simulation components can be verified once and do not need to be re-verified for each composition they are used in – but this is a statement that does not hold concerning the component's validity, because each time the component is reused, the intended purpose for which it was validated might change. It was raised that semantic and pragmatic interoperability among components is most likely to be an achievable goal, if the components are created based on the same assumptions (abstraction, idealization) about the overall system from which the modeled subsystems originate.

3.4 Levels of V&V

The concept of "Levels of VV&A" was generally recognized as useful to balance the required V&V effort against the risks and benefits associated with the intended use of the simulation model. Nevertheless, it also was found difficult to develop a meaningful and consistent system of levels. Beside the approaches taken to the definition of VV&A related levels in the REVVA group and the ITOP group, during the convention the following approaches to defining or applying levels were briefly reviewed:

- Confidence Levels in Model Behavior[1]
- The Evaluation Environment[2]
- Levels of Impact[3]
- Likelihood of Failure[4]
- Validation Process Maturity Model
- SW-Capability Maturity Model[5]
- Calculating belief[6]

One of the critical issues associated with levels discussion is the necessity that levels must be defined in a manner that it is understood in the same way by all roles involved in M&S use, development, and VV&A. Those who might suffer from an invalid model (those who accept the risk of using it) are interested in the severity of potential consequences (level of impact), and the post-V&V likelihood that they are actually affected by those impacts. This was identified to be a multi-dimensional problem, which cannot be solved using a one-dimensional risk calculation rule.

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[1] Flight Mechanics Panel Working Group WG-12 on Validation of Missile Simulation. 1985. Final Report, AGARD Advisory Report No. 206.

[2] Balci, O. 2001. A Methodology for Certification of Modeling and Simulation Applications. In ACM Transactions on Modeling and Computer-based simulation 11 (4), pp 352-377.

[3] Muessing, P., D. R. Laack, and J. J. Wrobleski, Jr. 1997. Optimizing the Selection of VV&A Activities: A Risk/Benefit Approach, Proceedings of the 1997 Summer Computer Simulation Conference, Society for Computer Simulation International. Mugridge, C. 1999. Verification, Validation and Accreditation of Models and Simulations Used for Test and Evaluation – a Risk/Benefit Based Approach. Internal Report, Technical Development Group, Defense Evaluation and Research Agency UK.

[4] Rosenberg, L.H. 2001. Technical Report: Verification and Validation Implementation at NASA. NASA, Goddard Space Flight Center.

[5] Paulk, M.C., B. Curtis, M.B. Chrissis, and C.V. Weber. 1993. Technical Report: „Capability Maturity Model for Software, Version 1.1" CMU/SEI-93-TR-024, ESC-TR-93-177. Software Engineering Institute, Carnegie Mellon University, Pittsburgh, PA.

[6] Shafer G. 1976. A Mathematical Theory of Evidence, Princeton University Press. Dubois, D. and H. Prade. 1988. Possibility Theory: An Approach to Computerized Processing of Uncertainty. Plenum Press, New York and London.

To ensure objective expressiveness, a level must be based on a set of relevant factors. Clear guidelines are required how to derive the level from the rating achieved for the factors. Objective metrics must be available to measure the factor ratings. The more subjective the factor metrics, the more subjective the derived level will be. At the current state of the art, VV&A lacks objective measures for many relevant factors, and one is forced to apply quite subjective metrics. Attempts to transfer concepts and methods from Uncertainty Theory, Decision Theory, Utility Theory and Statistics are on their way, but not yet ready for application. Quantitative measures alone do not necessarily lead to an objective ranking, but also objective assessment methods are required.
Relationships between levels identified in the context of the working groups were established during the discussion. The Validation Process Maturity Model (DMSO) was projected to the convincing forces of the arguments and the probative forces of the items of evidence (ITOP/REVVA). It was also stressed that in all of the working group approaches a (subjective) level is just an indication, which does not allow "automated reasoning", and must not replace responsible decision making activities.

3.5 Working Group Interaction

Prior to the CConVV&A, there was interaction between individual members of the different working groups at the working level. One objective of the convention was to provide a platform for networking and information exchange among all members of the working groups. On the technical level there is now a good understanding for the approaches taken, and a formal line of coordination and communication has been established with the setting up of a "council of chairs" that shall meet regularly at targets of opportunity. Some of the working groups' commonalities and differences and the approaches to their harmonization and integration are identified in the following:

3.5.1 Commonalities and Differences

The concepts developed in the four working groups have been found to be similar, related, or at least compatible. As a result of discussing the concepts, it became obvious that there is a consistency: All four groups share the common assumptions that there is a V&V process, which is linked to a model development process, and that it should be made explicit by a process model which of the V&V-phases and products are relevant. The V&V products should contain information concerning the correctness and validity of the simulation model. Synchronization of M&S development and VV&A activities is desirable to efficiently improve the overall quality of simulation models in general. All groups recognize that there are not only technical, but also organizational needs to help resolve potential conflicts of interest most efficiently. More subtle commonalities, but also differences are addressed below in the following areas:

- Representation and documentation of VV&A results: REVVA and ITOP share the idea of "building blocks" in form of case structures, and both address the desire to express some V&V achievements in levels. The activity outcomes from the NMSG and the SISO PDG approach can be directly projected to the REVVA and ITOP cases, and organized according to their featured hierarchical breakdown structures (claim-argument-evidence, ToA and ToVV, respectively). The different concepts on which the standards are based are compatible, facilitating the development of a hierarchy of standards.

- Coverage of VV&A topics and procedural approach taken: Although all working groups consider VV&A as an activity or process(es) that are distinct from model development, the SISO PDG and the NMSG are going to contain a detailed activities description closely linked to HLA federation development as encouraged by the FEDEP. The REVVA methodology tries to completely formulate the terminologies, taxonomies, and concepts underlying VV&A, with a strong focus on the VV&A requirements engineering part and the assessment of conducted V&V. The ITOP on V&V just provides a very abstract "V&V how-to" and concentrates on the identification of information that as a minimum needs to be contained in the V&V results, and how this information can be structured. To summarize,

  - ITOP supports documentation exchange,
  - REVVA develops a complete methodology (framework),
  - SISO/NATO provide practical guidance for HLA federations needs,
  - the REVVA group primarily aims on building a formal foundation under consideration of practical constraints, and
  - SISO PDG and NMSG head for a maximum of applicability and efficiency during federation development.

  The only groups who explicitly formulate the required information access (i.e., availability of developmental products) are the NMSG and the SISO PDG by clearly identifying FEDEP products as targets of well-defined V&V tasks. The generality of the ITOP and REVVA approaches make referencing developmental products unnecessary (at the expense of helpful guidance). However, the availability of information becomes obvious when reviewing the claims (ITOP) and the "data, information, and knowledge repository" (REVVA).
- Targeted audience and main objectives: The target audience of the four groups is different but complementary. Although mainly stakeholder-oriented with its focus on VV&A requirements identification and definition (ToA, ToVV, and assessment of the conducted V&V), the REVVA methodology addresses a wide spectrum of roles within the VV&A context. The NMSG and SISO PDG address the V&V practitioners, while the ITOP again is rather stakeholder-oriented by structuring V&V results in a uniform format, and thereby supporting easier access and understanding. The addressed domains of use range from the whole M&S customer community (REVVA) over the T&E community with the remark to be also transferable to other communities (ITOP), to the clearly demarked V&V of HLA federations. The NMSG and SISO PDG approaches strongly emphasize the conducting of V&V in parallel to federation development, whereas the ITOP does not explicitly state when (during or after simulation model development) the V&V evidence workbook may be filled in. The REVVA methodology is sufficiently generic to facilitate V&V in parallel to simulation model development, but the focus was on the assumption that the model is already developed.
- Maturity of Products: The degree of maturity of the four groups' products varies. None of the four approaches can claim to be "in use", although case studies have been implemented for both the ratified ITOP and the REVVA, the latter will be

succeeded by a three years follow-on program to adequately address the magnitude of problems to be solved. The NMSG and SISO PDG both benefit from the clear and narrow scope of the tasks, and the group internal agreement to base their work on the IEEE 1516.3 and to reuse as many of its concepts as possible.

3.5.2 Integration and Harmonization

It became obvious that the NMSG and the SISO PDG, being based on the same model development process (FEDEP), addressing the same target audience, and giving the same type of guidance, have the highest potential for easy integration. As a guideline on how to structure and present V&V information, the ITOP is considered to be complementary to the approach taken by the NMSG and the SISO PDG. Both SISO PDG and REVVA stress the importance of recognizing model development and VV&A as distinct activities; however, the direct projection of VV&A activities to the model development process is missing in the REVVA approach. The ITOP's hierarchical breakdown structure (CAE) is an integral part of the REVVA methodology for the documentation of the ToA and the ToVV.

The different working groups address different aspects of VV&A, all of them important for practical application and efficient implementation of VV&A on the one hand, or for the transformation from an art into a science on the other. Rather than integrating all of the working groups into one, at least three of them will be maintained. To ensure that duplication of work is avoided, a "council of chairs" will be established, and the cooperation on working level intensified.

4 Conclusions and Recommendations

Verification, Validation, and Accreditation (VV&A) were confirmed to be the key enablers for the responsible application of cost and time efficient Modeling and Simulation (M&S) for even more critical tasks than today. During the "Combined Convention of International VV&A Standardization Endeavors" four major international VV&A working groups presented their current results to an audience, which consisted of M&S practitioners, project managers, and university researchers, for review and discussion. During the convention the following issues were addressed:

1. Harmonization of the standardization efforts and the development of a commonly accepted terminology and methodological foundation: The creation of a commonly accepted, consistent, and stable VV&A methodology and theory as a foundation for practically applicable guidelines was recognized as desirable, but – at the moment – hard to achieve. Although there was no official coordination so far, but only a limited exchange on the technical working level, no significant duplication of work was observed. Systematic co-ordination of the working groups shall generate synergetic effects. Frequent and regular exchange among the working groups shall ensure convergence of the group's terminologies.
2. The practitioner's need for guidance for V&V planning and implementation: Users and developers recognize the potential benefits of VV&A and are willing to incorporate VV&A requirements and activities into their acquisition and development procedures. However, the guidelines so far available offer too little help to the wider community in order to progress this in the short term. The working groups are encouraged to co-operate to provide better practitioner-oriented VV&A guidelines.

3. Particular challenges for the VV&A of component-based simulation models: Component-based simulation already plays an important role in M&S, and its importance is expected to increase. Requirements for VV&A originating from this situation must be taken into account, in particular the accreditation or certification of components and V&V support in composition frameworks will require special attention.
4. Benefits of a mature levels concept for the appreciation of the sufficiency of a V&V effort: With the inability to prove a simulation model correct and valid, there always remains some uncertainty associated with each certification or accreditation. V&V levels are perceived as useful to balance the V&V budget against the criticality of the planned application of the simulation model. The related field of Software Quality Assessment provides "Software Integrity Levels", which can give inspiration – to a certain degree. The concepts of "uncertainty" (as used in the artificial intelligence community) and "statistical confidence" hold potential for a more mature definition of the metric that shall be addressed in the levels discussion and must be further explored.
5. The harmonization and co-ordination of the individual working group approaches: The individual working group members are encouraged to stay in contact and to exchange technical ideas whenever appropriate. A "council of chairs" was established, which shall take for example, international M&S conferences as opportunities for information exchange.

As a presentation forum for the approaches taken by the four invited VV&A working groups and as a platform for the technical information exchange between their individual members, the convention was found to be a success.

4.1 Future Goals

The future technical, methodological, and organizational goals identified at the conference can be summarized as follows:

- Establish a common data/information/knowledge repository: A platform shall be created, where the working groups can make the material they have developed and the supplementary information that they are using available to the members of the other working groups.
- Create a VV&A expert network: Communication links shall be established, not only within the "council of chairs", but also among the individual members of the working group for regular and frequent information exchange. As a first contribution to the creation of this expertise network, the complete list of workshop attendees and their contact information is found in Appendix 6.3. It is strongly encouraged that members of the expertise network support each other willingly and openly for the constructive solution of complex VV&A problems.
- Evolve the standards: The standards that are currently under development must be completed in such a manner that they are consistent with each other. To ensure convergence, the common repository and/or the expertise network shall be excessively used.
- Develop a commonly accepted understanding of the technological and organizational foundations of VV&A: Finally, with VV&A matured, all efforts will constitute a building block within a unified VV&A methodology. The achievement of this ultimate objective includes the evolution of

- theoretical VV&A knowledge based on sound, existing theories and empirical observation and
- practical guidelines, which can be applied by the practitioner to actual problems without an in-depth understanding of the underlying theory.

4.2 The Road Ahead

To achieve the above goals, the good intentions must be followed by actions. The need for a common roadmap outlining interim objectives toward the overall objective of a mature, scientifically sound, and applicable VV&A methodology was stressed during the convention.

The working groups need to establish a common understanding of the relationship between their products, which requires that they

- define the intended relationship between the products;
- develop a vision how to integrate products into a higher, unified framework, and
- establish an information exchange mechanism making description of the processes and methodological assumption available.

It is urgently necessary to clearly define the scope of M&S VV&A, to develop reasonable expectations about what VV&A can and cannot support, and to define its relationship to system engineering, in particular software engineering, hardware engineering, and quality assurance in those disciplines.

To establish a common, precise terminology in the long term, one of the first steps to be taken shall be the agreement on abstract, high level definitions, from which more detailed definitions can be derived, as soon as the working groups concepts converge.

Whenever possible, the opportunity for exchange may be taken. As potential targets of opportunity, conferences on VV&A, or other conferences offering VV&A tracks have been identified, in particular

- SISO workshops
- SCS conferences
- I/ITSEC conferences
- Foundations 06
- DMSO's International VV&A Summit
- The second CConVV&A

It was also raised that there is potential benefit in inviting members of another working group to the own working group meeting.

5 Acknowledgements

To set up a convention always requires commitment and support of quite a number of individuals and organizations. The conference was hosted by Siegfried Pohl (Institut für Technik Intelligenter Systeme) and Axel Lehmann (Universtität der Bundeswehr München), and heavily relied on the professional support of the technical and scientific staff of the Institut für Technik Intelligenter Systeme and the Universtität der Bundeswehr München. The conference program was organized by Dirk Brade, (Totalförsvarets Forskningsinstitut/Försvarets Materielverk), Siegfried Pohl (Institut für Technik Intelligenter Systeme), and Simone Youngblood (Defense Modeling and Simulation Office). The convention was co-sponsored by the Universität der Bundeswehr München (Neubiberg, Germany), the Institut für Technik Intelligenter Systeme e.V. (Neubiberg, Germany), the Defense Modeling and Simulation Office (Arlington, USA), the Totalförsvarets Forskningsinstitut (Stockholm, Sweden), and the Försvarets Materielverk (Stockolm, Sweden). The convention committee thanks QinetiQ (Boscombe Down, United Kingdom) for sponsoring the convention dinner.

6 Appendices

6.1 Convention Committee Contact Information (in alphabetic order)

Dirk Brade, Totalförsvarets Forskningsinstitut/Försvarets Materielverk
dirk.brade@foi.se

Axel Lehmann, Universtität der Bundeswehr München
lehmann@informatik.unibw-muenchen.de

Siegfried Pohl, Institut für Technik Intelligenter Systeme
pohl@informatik.unibw-muenchen.de

Simone Youngblood, Defense Modeling & Simulation Office
syoungblood@dmso.mil

6.2 CConVV&A Feedback Form

Please download:
http://www.itis-ev.de/megameeting/feedbackform.doc

6.3 List of Attendees

Name	First Name	Organisation	City	Country	Email
Arnold	Norbert	Bw. Center for Transform.	Munich	Germany	Norbert.Arnold@ZASBw.de
Atkins	Kevin	QinetiQ	Salisbury	UK	katkins@qinetiq.com
Bardani	Nello	Ministry of Defence	Roma	Italy	n.bardani@tiscali.it
Batini	Curzio	DATAMAT	Rom	Italy	curzio.batini@datamat.it
Bel Haj Saad	Samah	ITIS	Munich	Germany	saad@informatik.unibw-muenchen.de
Best	Michael	ITIS	Munich	Germany	Michael.Best@informatik.unibw-muenchen.de
Bouc	Pierre	ALEKTO	Marseille	France	alekto@Wanadoo.fr
Brade	Dirk	KTH	Stockholm	Sweden	dirk.brade@foi.se
Brain	Colin	SEValidation Ltd.	Salisburg	UK	cjb@sevalidation.com
Cegla	Ingo	BWB U1.3 Leitst. Sim. U1.3	Koblenz	Germany	ingocegla@bwb.org
Chew	Jennifer	US Army	Aberdeen	USA	
Cleland	George	Adelard	London	UK	glc@adelard.com
Dall'Acqua	Emiliano	DATAMAT	Rom	Italy	emiliano.dallacqua@datamat.it
Dumble	Mark	Aegis Sim. Tech. UK Ltd	Chard	UK	mdumble@aegissim.co.uk
El Abdouni K.	Rachid	UniBw INF4	Munich	Germany	rachid@informatik.unibw-muenchen.de
Francis	Cathryn	NNC Ltd	Knutsaford	UK	cathryn.francois@Entegra-nnc.co.uk
Gabard	Jean-Francois	ONERA	Toulouse	France	gabard@cert.fr
Harmon	Scott	ZETETIX	Myrtle Creek	USA	spain@zetetix.com
Heerlein	Danny	Bw. Center for Transform.	Munich	Germany	Danny.Heerlein@ZASBw.de
Horn	Lars	UNI-C	Lyngby	Denmark	lars.horn@uni-c.dk
Jacquart	Renè	ONERA	Toulouse	France	Rene.Jacquart@cert.fr
Jobson	Michael	QinetiQ	Farnborough	UK	
Jones	Martin	BAE SYSTEMS	Preston	UK	martin.jones@baesystems.com
Jonsson	Fredrik	FMV	Stockholm	Sweden	fredrik.jonsson@fmv.se
Kam	Lui	DGA/DSP/STTC/SC	Paris	France	lui.kam@dga.defense.gouv.fr
Köster	Andreas	ITIS	Munich	Germany	koester@informatik.unibw-muenchen.de
Kraus	Michael	ITIS	Munich	Germany	kraus@informatik.unibw-muenchen.de
Lagerström	Häkan	FMV	Karlsborg	Sweden	hakan.lagerstrom@fmv.se
Lightner	Gary M.	AEgis Technologies Group	Orlando	USA	Mlightner@aegistg.com
Maguire	Richard L.	QinetiQ	London	UK	RLMAGUIRE@Qinetiq.com
Marquardsen	Hans	DDRE	Copenhagen	Denmark	hm@ddre.dk
Masys	Antony	Synthetik Env. Coord. Office/DND	Ottawa	Canada	masys.aj@forces.ga.ca

Mattausch	Kornelia	ITIS	Munich	Germany	matt@informatik.unibw-muenchen.de
Moth	Jören	UNI-C	Lyngby	Denmark	jorgen.moth@uni-c.dk
Mühle	Daniela	UniBw INF4	Munich	Germany	muehle@informatik.unibw-muenchen.de
Nilsson	Sten-Ake	FOI	Stockholm	Sweden	nil@foi.se
Peyras	Gerard	DGA/ETBS	Bourges Cedex	France	gerard.peyras@dga.defense.gouv.fr
Pohl	Siegfried	ITIS	Munich	Germany	pohl@informatik.unibw-muenchen.de
Pugh	Gareth	QinetiQ	London	UK	gmpugh@QinetiQ.com
Qian	Julan	ITIS	Munich	Germany	
Reindl	Ingo	Bw. Center for Transform.	Munich	Germany	IngoReindl@Bundeswehr.org
Schaetz	Peter	EADS/LFK	Munich	Germany	peter.schaetz@lfk.eads.net
Schneider	Wolfgang	Bw. Center for Transform.	Munich	Germany	Wolfgang.Schneider@ZASBw.de
Schrörs	Hans	BWB	Koblenz	Germany	
Siemers	Hartmut	Bw. Center for Transform.	Munich	Germany	Hartmut.Siemers@ZASBw.de
Simpson	Michael	UK MOD, Dstl	London	UK	masimpson@dstl.gov.uk
Solick	Susan	TRAC	Ft Leavenworth	USA	susan.solick@us.army.mil
Steinkamp	Dieter	IABGmbh	Meppen	Germany	steinkamp@iabg.de
Sullivan	Cindy	U.S.Army Yuma Proving Gr.	Yuma	USA	Cindy.Sullivan@us.army.mil
van Emmerik	Martijn	TNO	Soesterberg	The Netherlands	vanemmerik@tm.tno.nl
van Lier	Ad C.	Niederl. Armee		The Netherlands	ac.vanlier@hccnet.nl
Virding	Robert	FMV	Stockholm	Sweden	robert.virding@fmv.se
Voogd	Jeroen	TNO	The Hague	The Netherlands	voogd@fel.tno.nl
Wang	Zhongshi	ITIS	Munich	Germany	wang@informatik.unibw-muenchen.de
Williams	Jane	MOD	London	UK	gbadvid5@dpa.mod.uk
Yi	Choong-Ho	FOI	Stockholm	Sweden	choong-ho.yi@foi.se
Youngblood	Simone	DMSO	Alexandria	USA	syoungblood@dmso.mil

6.4 Working Group Presentations

The working group presentations held at the meeting can be downloaded at:
http://www.itis-ev.de/megameeting/workinggrouppresentation.zip

6.5 Discussion Openers

The discussion opener presentations held at the meeting can be downloaded at:
http://www.itis-ev.de/megameeting/discussionopeners.zip

6.6 Terminology

COMBINED CONVENTION ON INTERNATIONAL VV&A STANDARIZATION ENDEAVOURS 2004

List of the core terms for the Terminology discussion track

1. Introduction

This document is a non exhaustive list of the VV&A terms identified as crucial for the terminology harmonization discussion. For each term, existing available definitions are recalled with the their origin references; the main underlying concepts are highlighted with underscored words in each definition.

2. Basic glossary

Term	Definition	References
Verification	Confirmation by examination and provision of objective evidence that the specified requirements to which an end product is built, coded, or assembled have been fulfilled.	EIA 632
	The verification process is a process for determining whether a software of an activity fulfils the requirements or conditions imposed on them in the previous activities.	IEEE 12207
	The purpose of the Verification Process is to confirm that the specified design requirements are fulfilled by the system entity.	ISO 15288
	The process of determining that a model implementation and its associated data accurately represents the developer's conceptual description and specifications.	DMSO
	The process of determining the degree that a model, simulation, or data accurately represent its conceptual description and its specifications.	ITOP, 2004
	The process which is used to construct, under a set of time, cost, skills, and organizational constraints a justified belief about model correctness.	REVVA (JP11.20)
Belief	The affirmation, claim, or conviction of someone regarding the truth of a statement which could, actually, be either true or false.	REVVA (JP11.20)
Justification	The process or results of showing what is offered as ground for belief; the related activity has to do with the obligations, responsibilities and norms regarding beliefs and their substantiation by items of evidence.	REVVA (JP11.20)

Term	Definition	References
Justified belief	A belief which is grounded by a justification.	REVVA (JP11.20)
Correctness	The property of a simulation model to comply to formal rules and bodies of reference information for its representation and for the transformation of its representation into another one.	REVVA (JP11.20)
Validation	Confirmation by examination and provision of objective evidence that the specific intended use of an end product (developed or purchased), or aggregation of end products, is accomplished in an intended usage environment.	EIA 632
	The validation process is a process for determining whether a software and the final, as-built, system of software product fulfils its specific intended use.	IEEE 12207
	The purpose of the Validation Process is to provide objective evidence that the services provided by a system entity when in use comply with stakeholders' requirements.	ISO 15288
	Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.	ISO 8402
	The process of determining the degree to which a model and its associated data is an accurate representation of the real-world from the perspective of the intended uses of the model.	DMSO
	The process of determining the degree to which a model, simulation, or data is an accurate representation of the real world, from the perspective of the intended purpose of the model, simulation or data.	ITOP, 2004
	The process which is used to construct, under a set of time, cost, skills, and organizational constraints a justified belief about model validity.	REVVA (JP11.20)
Validity	The property of a simulation model to have, within a specific experimental frame, a behavior which is indistinguishable under a set of validation criteria from the behavior of the System of Interest (see definition in the list of additional terms).	REVVA (JP11.20)

Term	Definition	References
Acceptation	The informed decision of a M&S customer to use the results of a simulation for a specific purpose. The informed decision of a M&S customer to use a simulation, within an experimental frame, for a specific purpose.	REVVA (JP11.20)
Certification	The procedure by which an authoritative body gives written assurance that a product, process, or service conforms to specified characteristics.	REVVA (inspired by Rae, Robert, and Hausen 1995)
Accreditation	The procedure by which an authoritative body gives formal recognition that a body or person is competent to carry out specific tasks.	REVVA (Rae, Robert, and Hausen 1995)
	The official certification that a model, simulation, or federation of models and simulations is acceptable for use for a specific purpose.	DMSO
	An official certification that a model, simulation results or associated data set has been accepted for use for a specific purpose.	ITOP, 2004

COMBINED CONVENTION ON INTERNATIONAL VV&A STANDARIZATION ENDEAVOURS 2004

List of additional terms for the Terminology discussion track

1. Introduction

This document is a non exhaustive list of the VV&A terms identified as important additional terms for the terminology harmonization discussion. For each term, existing available definitions are recalled with the their origin references, the main underlying concepts are highlighted with underscored words in each definition.

2. Basic glossary

Term	Definition	References
Real world related terms		
Element	That which is discernible by reproducible measurement of its characteristics, includes matter, energy and information. Elements decompose hierarchically; they are Elements of Elements.	ISO/SC4
End product	The portion of a system that performs the operational functions and is delivered to an acquirer.	EIA 632
Enabling product	Item that provides the means for a) getting an end product into service, b) keeping it in service, or c) ending its service.	EIA 632
System	A system is an element with a well defined boundary with respect to all other elements outside of it, in the domain of interest, and with which it interacts. These interactions may be highly non linear. Systems decompose hierarchically; they are systems of systems. These hierarchies do terminate at the point at which the components of a given system are elements, but not systems in their own right.	ISO/SC4
	An aggregation of end products and enabling products to achieve a given purpose.	EIA 632
	An integrated composite that consists of one or more of the processes, hardware, software, facilities and people, that provides a capability to satisfy a stated need or objective.	IEEE 12207
	See Real System and System of Interest	REVVA (JP11.20)
Domain of interest	All elements of interest to the problem at hand.	ISO/SC4
Real system	Is a cut-out of the real world with a well-defined system border.	Brade, 2004

Term	Definition	References
System of Interest	Set of fictive or existing entities and their interactions subjected to modeling and simulation.	REVVA (JP11.20) derived from COBP
Experimental frame	Range of well-defined conditions, under which the model will be executed.	REVVA (in accordance with Zeigler, Praehofer & Kim 2000)
Referent	Codified body of knowledge, which summarises all gathered information about a real system and identifies sources of additional real system knowledge.	REVVA (JP11.20)
M&S products related terms		
M&S product	A product originating from M&S activities, e.g., a model, an simulation executable model, simulation results, an experimental frame, or sets of input data.	REVVA (JP11.20)
Model	To serve as a model as in IEEE 610.3	IEEE 610.3
	A physical, mathematical, or otherwise logical representation of system, entity, phenomenon, or process.	DoD
	An approximation, representation, or idealization of selected aspects of the structure, behavior, operation, or other characteristics of a real world process, concept, or system. Note: Models may have other models as components.	REVVA (JP11.20)
Conceptual Model	A presentation of the content and internal representations of a model, which are the user's and developer's combined initial concept of the model.	ITOP, 2004
	A statement of the content and internal representations which are the user's and developer's combined concepts of the model. It includes logic and algorithms and explicitly recognizes assumptions and limitations.	DoD
	The Conceptual Model describes the abstracted and idealized representation of the System of Interest (This includes its decomposition into interacting subsystems, and the representation of properties of interest in the form of attributes within a certain range of accuracy). It is communicative, i.e., written in language of the model's application domain.	REVVA (derived from Brade 2004)

Term	Definition	References
Formal model	The Formal Model is the platform-independent description of the Conceptual Model, and is compliant with a well-defined modeling formalism. It expresses the Conceptual Model quantitatively and unambiguously, and thereby prepares several methods for its solution.	REVVA (derived from Brade 2004)
Executable Model	The Simulation Executable Model (SEM) technically implements the Formal Model and provides the additional information that allows the model to be executed and operated on computing platforms. Examples for the required additional information include an event scheduler, a time advance mechanism, or the representation of real numbers, as applicable.	REVVA (derived from Brade 2004)
Simulation Conceptual Model		SISO Study Group
	The developer's description of what the model or simulation will represent, the assumptions limiting those representations, and other capabilities need to satisfy the user's requirements. A collection of assumptions, algorithms, relationship (i.e. architectures), and data that describe a developer's concepts about the simulation and its pieces from which the software that will make up the simulation can be built.	DMSO VV&A Technical Team
	See Conceptual Model	REVVA (JP11.20)
Simulation	The process of developing a model as in IEEE 610.3.	IEEE 610.3
	A method for implementing a model over time.	DoD
	A model that behaves or operates like a given system when provided a set of controlled inputs.	REVVA (JP11.20)
Output data	The data calculated during simulation in response to Input Data and time passing, usually for some external analysis or evaluation. The evaluation of the model behavior, which is defined by its input and output data yields simulation results.	Robert Shannon, 1975

Term	Definition	References
Simulation results	The conclusions drawn from the observation of the model behavior during the series of simulation experiments, under consideration of the way in which the real system was idealized and abstracted. Needs to be distinguished from output data.	REVVA (JP11.20)
VV&A process related terms		
Method	A systematic procedure, technique, or mode of inquiry employed by or proper to a particular discipline or art.	MW, 2004
	Techniques that support implementation of process tasks.	EIA 632
Methodology	A body of methods, rules, and postulates employed by a discipline: a particular procedure or set of procedures.	MW, 2004
Domain of Validity	Complete set of all experimental frames in which the model is valid.	REVVA (inspired by Zeigler 2000)
Acceptability Criteria	The criteria that the Accreditation Agent expects to be met in order for the model/data/results to be acceptable for the intended purpose.	ITOP, 2004
	The criteria that the M&S product needs to meet to be acceptable for its intended purpose. Acceptability criteria should be objectively assessable.	REVVA (JP11.20)
Target of acceptance	Structural breakdown of the vague intended purpose statement into testable acceptability requirements.	REVVA (JP11.20)
Evidence	The complete set of items of evidence, generated as result of a quantitative or qualitative V&V effort, which support the arguments or claims. The evidence can be, but is not limited to, reports, subject-matter-expert opinion, test results, and previous experience.	REVVA (JP11.20)
Item of evidence	Justified atomic or elementary result of the implementation of verification or validation activities, e.g., the results of a distribution fit or the protocol of an expert interview. It must be transparent, how the item of evidence was created. Each item of evidence has a probative force.	REVVA (JP11.20)
Probative Force	An expression of the power of inspiring belief of an item of evidence. It is based on the used model information and system knowledge, the techniques used and procedures followed, and the experience and potential bias of the people involved. Whether it can be measured precisely (quantitatively) depends also on the mathematical foundation of the used V&V technique.	REVVA (JP11.20)

3. Detailed References:

Brade, 2004	Brade, D. 2004. A Generalized Process for the Verification and Validation of Models and Simulation Results. Dissertation, Fakultät für Informatik, Universität der Bundeswehr München.
DoD	DoD Directive 5000.59
EIA 632	Processes for Engineering a System
IEEE 12207	Standard for Information Technology - System Life Cycle Processes.
IEEE 610.3, 1989	IEEE 610.3. 1989. IEEE Standard for Modeling and Simulation (M&S) Terminology. IEEE 610.3. Institute of Electrical and Electronical Engineers.
ISO 8402	Quality Management – Quality Assurance
ISO 15288	System Engineering – System Life Cycle Processes.
ISO/SC4	Semantic Dictionary developed jointly by the MDSD AP233 and SysML Teams.
ITOP, 2004	Working Group of Experts on Verification and Validation of Models and Simulation Results. International Test Operations Procedure 1-1-002. 2004
MW, 2004	, http://www.merriam-webster.com/. Accessed in 2004
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6.7 Group Actions

The following action items have been identified for completion until October 05:

- Working groups: Investigate Archiving Options (community of interest, SISO reflectors)
- Working group chairs: Establish "Council of Chairs" and Plan Periodic Teleconferences
- Working group chairs: Initiate dialogue with sponsoring organization to lay groundwork for use cases (NATO)
- Working groups: Define processes to capture current terminological perspectives – through community of interest.
- Convention Committee: Develop SIW paper to describe results of this workshop
- Develop individual working group roadmap
- Council of chairs: Synthesize individual working group roadmaps into a global roadmap (eliminate duplication of effort), agree on the common VV&A roadmap
- Working groups: Conceptualize test cases

6.8 Website

The CCon Website was (and still is) http://www.itis-ev.de/megameeting

6.9 Detailed Convention Agenda

Wednesday, Oct 20th: (Open to everyone)	
0900 – 0930	Address of Welcome (Axel Lehmann, Universität der Bundeswehr München)
0930 – 1230	Thales JP 11.20 Session (Chair: Lui Kam, DGA) • Introduction REVVA program information, achievements, case studies • The REVVA Background, Rationale and Concepts • The REVVA Generic Process Standardizing the flow of VV&A products and activities independently from a particular model development and use process. • The REVVA products: Formalization of the "Intended Purpose Statement": Target of Acceptance and Target of V&V. • The REVVA techniques and support: Fitting model, Experimental Frame, Requirements Engineering, Design of Experiment, Repository. • The M&S and VV&A organizations: Roles, actors and responsibilities. • The REVVA Future
1230 – 1400	Lunch Break

1330 – 1630	SISO PDG "VV&A of Federations" Session (Chair: Simone Youngblood, DMSO) • Creating an industry standard for the V&V of IEEE 1516 HLA federations • Merging the FEDEP with a generally accepted VV&A-process
1630 – 1700	VV&A Overlay over the SEDEP (Chair: Keith Ford) • The SEDEP: A short explanation of this federation development process and its VV&A-overlay
1715 – 1800	Common Roadmap Discussion Day 1 (Chair: Lui Kam, DGA)

Thursday, Oct 21st: (Open to everyone)	
0900 – 1200	ITOP WGE 7.2 Session (Chair: Richard Maguire, QuinetiQ) • Standardizing exchangeable "VV&A Cases" for models, data, and simulation results • Organizing VV&A rationale and evidence: Claim-Argument-Evidence Structure • Filling in the workbook: Procedure and predefined claims
1200 – 1330	Lunch Break
1330 – 1630	NMSG-019/TG-016 Session (Chair: Simone Youngblood, DMSO) • What needs do be considered for verifying and validating HLA federations? • Scheduling VV&A tasks for the FEDEP phases
1630 – 1700	Common Roadmap Discussion Day 2 (Chair: Simone Youngblood, DMSO)
1700 – 1730	Final Brief Out

Friday, Oct 22nd: (Working group members only)	
0900 – 1030	The Terminology Issue (Chair: Lui Kam, DGA) • The intention of this talk is to agree on a common terminology used during the discussions • Definitions and terms, which are in use, are presented and reviewed
1030 – 1100	Coffee break
1100 – 1230	VV&A of Component Based M&S (Chair: Marco Hofmann, ITIS) • Do verified components and verified interfaces imply a verified composition? • Are there any model components that can be validated once and remain valid in all compositions afterwards? • Is there any use in validating a component before integration?

1230 – 1330	Lunch Break
1330 – 1500	Levels of V&V (Chair: Dirk Brade, FMV/FOI) • To prove that a model represents the real system under study detailed enough is often impossible or not affordable. Anything weaker than proving leaves room for doubt. How much uncertainty is acceptable, depends on the decision maker's willingness to accept a risk. • This leads to the desire to define "Levels of V&V", which make accreditation decisions more objective, and more comprehensible. • The state-of-the-art is reviewed and put to discussion.
1500 – 1530	Coffee Break
1530 – 1730	A Common Agreed Roadmap for VV&A (Chair: Simone Youngblood, DMSO) • This talk and discussion shall serve as a forum to sum up the discussions of the whole event • It shall be considered, whether there exists least common denominator, which can serve as a foundation for a common VV&A roadmap that all working groups can agree on • The outcome of this discussion will be the starting point for the compilation of the workshop report

Saturday, Oct 23rd: (Interested working group members)	
900 – 1200	Preparation of Workshop Report