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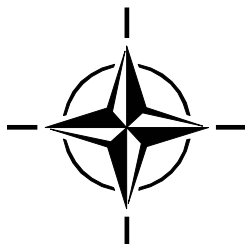
RTO MEETING PROCEEDINGS MP-094

MSG-020

NATO-PFP/Industry/National Modelling and Simulation Partnerships

(Les partenariats OTAN-PPP/Industrie/Nations en
matière de modélisation et de simulation)

Papers presented at the NATO RTO Modelling and Simulation Conference
held in Paris, France, 24-25 October 2002.



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The Research and Technology Organisation (RTO) of NATO

RTO is the single focus in NATO for Defence Research and Technology activities. Its mission is to conduct and promote co-operative research and information exchange. The objective is to support the development and effective use of national defence research and technology and to meet the military needs of the Alliance, to maintain a technological lead, and to provide advice to NATO and national decision makers. The RTO performs its mission with the support of an extensive network of national experts. It also ensures effective co-ordination with other NATO bodies involved in R&T activities.

RTO reports both to the Military Committee of NATO and to the Conference of National Armament Directors. It comprises a Research and Technology Board (RTB) as the highest level of national representation and the Research and Technology Agency (RTA), a dedicated staff with its headquarters in Neuilly, near Paris, France. In order to facilitate contacts with the military users and other NATO activities, a small part of the RTA staff is located in NATO Headquarters in Brussels. The Brussels staff also co-ordinates RTO's co-operation with nations in Middle and Eastern Europe, to which RTO attaches particular importance especially as working together in the field of research is one of the more promising areas of co-operation.

The total spectrum of R&T activities is covered by the following 7 bodies:

- AVT Applied Vehicle Technology Panel
- HFM Human Factors and Medicine Panel
- IST Information Systems Technology Panel
- NMSG NATO Modelling and Simulation Group
- SAS Studies, Analysis and Simulation Panel
- SCI Systems Concepts and Integration Panel
- SET Sensors and Electronics Technology Panel

These bodies are made up of national representatives as well as generally recognised 'world class' scientists. They also provide a communication link to military users and other NATO bodies. RTO's scientific and technological work is carried out by Technical Teams, created for specific activities and with a specific duration. Such Technical Teams can organise workshops, symposia, field trials, lecture series and training courses. An important function of these Technical Teams is to ensure the continuity of the expert networks.

RTO builds upon earlier co-operation in defence research and technology as set-up under the Advisory Group for Aerospace Research and Development (AGARD) and the Defence Research Group (DRG). AGARD and the DRG share common roots in that they were both established at the initiative of Dr Theodore von Kármán, a leading aerospace scientist, who early on recognised the importance of scientific support for the Allied Armed Forces. RTO is capitalising on these common roots in order to provide the Alliance and the NATO nations with a strong scientific and technological basis that will guarantee a solid base for the future.

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NATO-PFP/Industry/National Modelling and Simulation Partnerships

(RTO MP-094 / MSG-020)

Executive Summary

Introduction

The 3rd NATO Modelling and Simulation (M&S) Conference was held at the *Ecole Nationale Supérieure des Techniques Avancées* (ENSTA) in Paris, France, during the period 24-25 October 2002. It was organised by the NATO Modelling and Simulation Group (NMSG), administered by the NATO Modelling and Simulation Co-ordination Office (NMSCO), and was entitled “NATO-PFP/Industry/National Modelling and Simulation Partnerships”.

Participation

The Conference was open to members of NATO nations and Partners for Peace nations (PfP), and was attended by 111 delegates. These were drawn from 26 nations, with France, the United Kingdom (UK) and the United States (US) having most representation, respectively. The non-NATO nations represented were: Armenia, Bulgaria, the Former Yugoslavian Republic of Macedonia (FYROM)*, Romania, Russia, Slovakia, Sweden, Ukraine and Uzbekistan. Of these, Bulgaria, the FYROM*, and Uzbekistan provided authorship of papers; the remaining authors originated from Canada, France, Germany, Italy, Poland, Spain, Turkey, the Netherlands, the UK and the US.

Most of the participants were NATO or national Defence employees, or representatives of commercial companies; 21 were from (military or civilian) academic institutions, 9 of which were authors of 4 associated papers; only 4 were drawn from civilian universities, 1 of which was the author of a paper, and 1 the author of this report. This would suggest that there is room for expanding the involvement of civilian academia in the activities of the Conference without distorting its Defence orientation.

Content, Structure and Organisation

The abstracts for 36 papers were submitted to the Conference Committee, of which 17 were selected for presentation. The selection approach used by the Conference Committee was firstly to evaluate the abstracts on quality, clarity and relevance to the Conference theme. A second sift was then undertaken to maintain a balance of papers from a broad cross-section of NATO and, in particular, PfP countries. 5 further papers were invited contributions which, together with the 3 keynote addresses, resulted in 25 presentations during the two days of the Conference.

Following the keynote addresses and (4 of the 5) invited papers, the Conference was divided into 5 sessions, with the last devoted to co-operation between NATO and PfP nations (which also contained a deferred invited presentation). The keynote addresses provided a useful context for the Conference, particularly with respect to the role of M&S within NATO and Defence, with Rear Admiral Gallagher’s presentation setting an excellent standard at the outset. The invited papers and those in Session V then provided presentations which were closely allied to the theme of the Conference, reporting mainly on collaborative projects which had taken place, or providing useful information for those wishing to embark upon such collaborative ventures. In contrast, the papers of Sessions I – IV were less allied to the theme of the Conference, but provided useful material concerning activities associated with the usage (I & II) and development (III & IV) of M&S technology.

General Technical Assessment

The theme of the Conference was not specifically concerned with technical matters, so it would be wrong to judge its effectiveness on technical grounds alone. Moreover, technical assessment is very subjective, inevitably reflecting the technical background and sympathies of the evaluator. With these caveats, the bulk of the technical material of the Conference was contained in Sessions II – IV, and was generally of a good standard. Paper #11, presented by Ms Harrison, and Paper #16, given by Dr Menzler, were particularly impressive; the first, illustrating how far M&S has come in absorbing and extending the state-of-the-art in software engineering, to achieve reusability and interoperability; the second, providing a highly-relevant conceptual understanding of the issues involved in the

* Turkey recognizes the Republic of Macedonia with its constitutional name

interfacing of operational command systems with M&S. Other technical papers, of a more theoretical nature, were also of a good academic standard, but failed to engage the audience to the same extent, possibly reflecting the need for a bridge between this NATO M&S conference and academia, which would benefit both communities.

Key Outcomes and Conclusions

The Conference has clearly demonstrated the value of M&S as a vehicle for promoting and enabling collaboration and co-operation between national Governments, and between Governments and Industry. This derives from both the development and usage of networked simulations, particularly in the fields of Advanced Distributed Learning (ADL), Computer Assisted Exercises (CAX), Simulation Based Acquisition (SBA) and Synthetic Environment Based Acquisition (SeBA). However, there remain many areas where further work is needed if the potential benefits of M&S are to be fully realised, in this respect, and some key points are enumerated, below.

- Modern capability-led Defence acquisition approaches, which are being adopted by NATO Governments, will need ‘system-of-systems’ modelling, requiring:
 - non-technical issues such as doctrine, organisations and people, to be represented;
 - vertical and horizontal integration of models, and the need for M&S to operate at multiple levels of resolution within the mission space.
- The increasing need to support C4ISR¹ and NCW² operational concepts, will demand:
 - an improvement in the modelling of command & control and decision-making processes;
 - cost-effective techniques for interfacing operational command systems with simulations.
- Simulation Based Acquisition will require:
 - greater interoperability between disparate M&S software;
 - substantial changes of culture towards M&S sharing and reusability.
- Essential improvements in the interoperability and reusability of M&S will require:
 - greater emphasis on the Conceptual Modelling phase of simulation development;
 - architectural and development frameworks above that provided by the DoD’s High Level Architecture (HLA) (which can remain as an effective foundation).
- Verification, Validation and Accreditation (VV&A) of M&S remains a major risk to the attainment of widespread reuse and interoperability, because:
 - there is no widely agreed VV&A framework between application domains;
 - there is a lack of standards, particularly at the Conceptual Modelling phase, and above.

In order to address these issues, it is vital that national Governments and Industry continue to invest in this field, particularly with regard to the development of standards, tools and infrastructures. Moreover, much more should be done to engage academia in this work, as recently proposed by a US National Research Council (NRC) study³, and future NATO conferences in this series could play a pivotal role in encouraging this.

¹ Command, Control, Communications, Computers, Surveillance and Reconnaissance

² Network Centric Warfare

³ See Paper #17 in Appendix A of this report.

Les partenariats OTAN-PPP/Industrie/Nations en matière de modélisation et de simulation

(RTO MP-094 / MSG-020)

Synthèse

Introduction

La troisième conférence de l'OTAN sur la modélisation et la simulation (M&S) s'est tenue les 24 et 25 octobre 2002 à l'*Ecole Nationale Supérieure des Techniques Avancées* (ENSTA) à Paris (France). Elle était organisée par le Groupe OTAN sur la modélisation et la simulation (NMSG), administré par le Bureau de coordination des activités de modélisation et de simulation de l'OTAN (NMSCO), sous le titre « Les partenariats OTAN-PPP/Industrie/Nations en matière de modélisation et de simulation ».

Participation

La conférence, qui était ouverte à la participation de ressortissants des pays membres de l'OTAN et des pays du Partenariat pour la Paix, a accueilli 111 délégués. En tout, 26 pays étaient représentés, la France, le Royaume-Uni, et les États-Unis comptant respectivement le plus de représentants. Parmi les pays non-membres de l'OTAN représentés figuraient l'Arménie, la Bulgarie, l'ex-République yougoslave de Macédoine (FYROM)*, l'Ouzbékistan, la Roumanie, la Russie, la Slovaquie, la Suède et l'Ukraine. La Bulgarie, la FYROM* et l'Ouzbékistan ont présenté des communications, tout comme l'Allemagne, le Canada, l'Espagne, les États-Unis, la France, l'Italie, les Pays-Bas, la Pologne, le Royaume-Uni et la Turquie.

La plupart des participants étaient soit des fonctionnaires de l'OTAN ou des fonctionnaires de la défense nationale, soit des représentants de sociétés commerciales. Vingt-et-un d'entre eux appartenaient à des établissements d'enseignement supérieur (militaires ou civils), dont neuf étaient les auteurs de quatre communications associées ; quatre seulement représentaient des universités civiles, dont un était l'auteur d'une communication et un autre l'auteur du présent rapport. Ce bilan laisse supposer qu'il y aurait lieu d'impliquer un peu plus les universitaires dans les activités de la conférence sans pour autant modifier son orientation axée sur la défense.

Contenu, structure et organisation

Les résumés de 36 communications ont été soumis au comité de la conférence, dont 17 ont été retenus pour être présentés. La méthode de sélection adoptée par le comité de la conférence consistait à évaluer dans un premier temps les résumés eu égard à leur qualité, leur clarté, et leur pertinence par rapport au thème de la conférence. Il a été procédé ensuite à un deuxième tri, destiné à assurer une bonne représentativité des différents pays de l'OTAN et des pays du Partenariat pour la Paix. En incluant cinq autres communications présentées sur invitation, ainsi que les trois discours d'ouverture, en tout, vingt cinq exposés ont été présentés au cours des deux journées de la conférence.

Après les discours d'ouverture et quatre des cinq communications présentées sur invitation, la conférence a été divisée en 5 sessions, dont la dernière était consacrée à la coopération entre l'OTAN et les pays du Pfp (y compris une communication présentée sur invitation reportée). Les discours d'ouverture ont permis de définir le contexte de la conférence, en particulier concernant le rôle de la M&S au sein de l'OTAN et de la défense, l'exposé du contre-amiral Gallagher établissant dès le début une communication d'excellent niveau. Les exposés sur invitation, ainsi que ceux de la session V, correspondaient parfaitement au thème de la conférence, puisqu'ils concernaient principalement des projets réalisés en collaboration, sources d'informations précieuses pour tous ceux souhaitant entreprendre de tels projets. À l'inverse, les communications des sessions I à IV étaient moins en relation avec le thème de la conférence, même si elles fournissaient des informations utiles concernant les activités associées à l'utilisation (I et II) et au développement (III et IV) des technologies de la M&S.

Evaluation technique générale

La conférence ne concernait pas spécifiquement des questions techniques. Par conséquent, il serait erroné d'évaluer son efficacité uniquement par rapport à des critères techniques. D'ailleurs, l'évaluation technique reste très subjective, reflétant inévitablement le cursus technique et les préférences de l'évaluateur. Avec ces réserves, nous constatons que la plupart des textes techniques ont été présentés lors des sessions II à IV et qu'en général ils étaient d'un bon niveau. La communication #11, présentée par Ms Harrison, et la communication #16, présentée par le Dr. Menzler, étaient particulièrement remarquables : la première démontrant les progrès réalisés par la M&S

* La Turquie reconnaît la République de macédoine sous son nom constitutionnel

dans la prise en compte et le développement des connaissances en génie logiciel en vue de la réutilisation et de l'interopérabilité ; la deuxième fournissant un aperçu conceptuel très pertinent des interfaces entre les systèmes de commandement opérationnels et la M&S. D'autres communications présentées, de caractère plus théorique, et qui étaient également d'un bon niveau académique, n'ont pourtant pas suscité le même intérêt auprès des participants, ce qui refléterait la nécessité de créer une passerelle entre cette conférence OTAN sur la M&S et les universitaires, au profit des deux communautés.

Résultats clés et conclusions

La conférence a clairement démontré l'intérêt de la M&S en tant qu'intermédiaire pour promouvoir et faciliter la collaboration et la coopération entre les gouvernements des pays membres ainsi qu'entre les gouvernements et l'industrie. Cet intérêt découle du développement des simulations en réseau et du recours à celles-ci, en particulier dans les domaines de l'apprentissage à distance avancé (ADL), des exercices assistés par ordinateur (CAX), de l'acquisition basée sur la simulation (SBA) et de l'acquisition basée sur les environnements synthétiques (SeBA). Cependant, il existe encore de nombreux domaines où des travaux supplémentaires sont nécessaires afin de pouvoir profiter de tous les avantages de la M&S. À ce propos, un certain nombre de points clés sont énumérés ci-dessous.

- Les approches modernes basées sur les capacités, adoptées par les gouvernements des pays membres de l'OTAN en matière d'acquisitions pour la défense, nécessiteront la modélisation de « systèmes de systèmes » impliquant :
 - la représentation d'éléments non techniques, tels que la doctrine, les organisations et le personnel ;
 - l'intégration verticale et horizontale des modèles, ainsi que la mise en oeuvre nécessaire de la M&S à de multiples niveaux de résolution au sein de l'espace opérationnel.
- La demande croissante de soutien pour les concepts opérationnels C4ISR¹ et NCW² nécessitera :
 - l'amélioration de la modélisation des processus de commandement et contrôle et de prise de décisions ;
 - des techniques rentables pour assurer l'interface entre les systèmes de commandement opérationnels et les simulations.
- L'acquisition basée sur la simulation nécessitera :
 - une plus grande interopérabilité entre les logiciels M&S disparates ;
 - une évolution considérable des mentalités en ce qui concerne le partage et les possibilités de réutilisation des moyens M&S.
- Des améliorations indispensables au niveau de l'interopérabilité et des possibilités de réutilisation de la M&S nécessiteront :
 - d'accorder plus d'importance à la phase de modélisation conceptuelle lors du développement de la stimulation ;
 - l'établissement de programmes de référence pour les architectures et pour le développement, en plus de ceux fournis dans le cadre de l'architecture de haut niveau (HLA) du DoD (lesquels peuvent être retenus car ils constituent des bases solides).
- La vérification, la validation et l'accréditation (VV&A) de la M&S représentent toujours un obstacle majeur à la généralisation de la réutilisation et de l'interopérabilité, puisque :
 - il n'existe pas de cadre VV&A communément accepté couvrant les différents domaines d'application ;
 - il manque des normes, en particulier en ce qui concerne la phase de modélisation conceptuelle et les phases supérieures.

Afin de permettre l'examen de ces questions, il est essentiel que les gouvernements des pays membres et les industriels continuent d'investir dans ce domaine, en particulier en ce qui concerne le développement de normes, d'outils et d'infrastructures. En outre, il conviendrait de faire beaucoup plus en vue d'impliquer les universitaires dans ces travaux, comme il a été proposé récemment dans une étude de l'US National Research Council (NRC)³. Ainsi, de futures conférences de l'OTAN sur ce même sujet pourraient jouer un rôle clé dans la promotion de cette démarche.

¹ Commandement, contrôle, communication, informatique, renseignement, surveillance et reconnaissance

² Conduite de la guerre orientée réseau

³ Cf. exposé #17 à l'appendice A au présent rapport.

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† Paper not available for Publication due to Classification.

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Gaming technology	Military requirements	Virtual prototypes	
Human Systems Simulation	Military training	VV&A (Verification,	
Integrated systems	Mission System Simulation	Validation and Acquisition)	
14. Abstract			
<p>The conference presented a series of papers in sessions that were designed to provide an overview of NATO-PFP/Industry/National - Modelling and Simulation Partnerships and Organisations. Other topics that were covered in the Conference included: Modelling & Simulation Practices and Policy, the Use of M&S to Support Operations (e.g. Training and Communication Systems), Future Trends in M&S (such as Virtual Forces and Artificial Intelligence, Gaming and Agent Technology), M&S Best Practices (such as Validation Verification & Accreditation (VV&A) and Standards).</p>			

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