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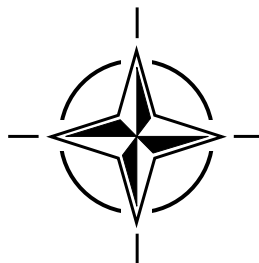
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RTO LECTURE SERIES 222

# Simulation of and for Military Decision Making

(La simulation des prises de décisions militaires en vue de leur amélioration)

*The material in this publication was assembled to support a Lecture Series under the sponsorship of the Studies, Analysis and Simulation Panel (SAS) and the Consultant and Exchange Programme of RTO presented on 15-16 October 2001 in Rome, Italy, 18-19 October 2001 in Stockholm, Sweden, 23-25 October 2001 in Virginia, USA and on 10-11 December 2002 in The Hague, The Netherlands.*



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**RTO LECTURE SERIES 222**

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# The Research and Technology Organisation (RTO) of NATO

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- 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 cooperation 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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# **Simulation of and for Military Decision Making**

**(RTO EN-017 / SAS-032)**

## **Executive Summary**

The current NATO-environment with reduced forces and decreasing military budgets, but new military tasks and types of operations, calls for the need to co-operate between services as well as between nations, and for new concepts and systems. NATO and Nations need adequate means to explore future military environments. The rapid acquisition of advanced technology by our adversaries will require us to develop dramatically new capabilities, likely based on information intensive systems. In turn, new doctrines will evolve whose forces structures and command structures are different than today's. New types of military operations are expected to become more common; for example, out of area operations, shorter preparation time, and involvement with the non-NATO PFP nations. The support of the Military Decision Making during operations is a vital need.

Modelling and Simulation (M&S) can be used as a tool to support the development and operational use of new concepts and systems for the future. M&S also help to better train and use existing forces and equipment and to improve operations in the new environment. The simulation of the Military Decision Process is a critical part in the use of M&S for this purpose.

Computer Generated Forces (CGF) and Human Behaviour Representation (HBR) can be used as a tool to support the development and operational use of new concepts and systems for the future. They also help to better train and use existing forces and equipment and to improve operations in the new environment. Emerging technologies will have a great impact on the implementation and on the military use of such CGF and HBR in the future. It offers support in different application areas; examples are thinking automated opposing forces (training and exercise), closed simulation systems (defence planning), Decision Support Tools (support to operations), and virtual environments (acquisition). The use of such systems will have great military implications and will save money and personnel in the future.

The aim of this Lecture Series is to provide an overview on the use of M&S of the Military Decision Process in the different application areas of training and exercising, support to operations, analysis and acquisition, and to provide a review of the state-of-the-art in the respective areas. These lectures are especially appropriate for scientific researchers and engineers involved in the development and use of M&S tools.

The material in this publication was assembled to support a Lecture Series under the sponsorship of the Studies, Analysis and Simulation (SAS) Panel and the Consultant and Exchange Programme of RTO presented on 15-16 October 2001 in Rome, Italy, on 18-19 October 2001 in Stockholm, Sweden on 23-25 October, 2001 in Norfolk, USA and on 10-11 December 2002 in The Hague, The Netherlands.

# **La simulation des prises de décisions militaires en vue de leur amélioration**

**(RTO EN-017 / SAS-032)**

## **Synthèse**

La situation actuelle de l'OTAN qui est caractérisée par des forces réduites et des budgets militaires en diminution, mais aussi par de nouvelles missions militaires et de nouveaux types d'opérations, nécessite de faire appel à une coopération non seulement entre forces armées mais aussi entre pays, ainsi qu'à des concepts et des systèmes nouveaux. L'OTAN et ses pays membres ont besoin de moyens adéquats pour étudier les environnements militaires futurs. L'acquisition rapide de technologies avancées par nos adversaires nous oblige à développer de façon urgente de nouvelles capacités, vraisemblablement basées sur des systèmes à forte intensité d'information. A leur tour, de nouvelles doctrines seront développées dont les structures de forces et de commandement seront différentes de celles d'aujourd'hui. On s'attend à ce que de nouveaux types d'opérations militaires deviennent plus courants; par exemple: opérations hors-zone, délai de préparation plus court, et participation de pays PpP non-OTAN. Le soutien de la prise de décisions militaires pendant les opérations est un élément indispensable.

La modélisation et simulation (M&S) peut servir d'outil de soutien pour le développement et l'utilisation opérationnelle de nouveaux concepts et systèmes dans le futur. La M&S contribue aussi à mieux former et à mieux utiliser les forces et les moyens actuels et à améliorer les opérations dans le nouvel environnement. La simulation du processus de prise de décisions militaires est un élément essentiel de la mise en œuvre de la M&S à cet effet.

Les programmes de forces créés par ordinateur (CGF) et de représentation du comportement humain (HBR) peuvent être utilisés comme outil de soutien pour le développement et l'utilisation opérationnelle de nouveaux concepts et systèmes dans le futur. Ils contribuent aussi à mieux former et à mieux utiliser les forces et les moyens actuels et à améliorer les opérations dans le nouvel environnement. Les technologies naissantes auront un impact important sur la mise en œuvre et l'utilisation militaire de ces programmes CGF et HBR dans le futur. Ceux-ci permettent un soutien dans différents domaines d'application; par exemple, les forces adverses automatisées intelligentes (entraînement et exercices), les systèmes fermés de simulation (planification de la défense), les outils d'aide à la décision (soutien des opérations), et les environnements virtuels (acquisition). L'utilisation de ces systèmes aura d'importantes implications militaires et permettra de faire des économies d'argent et de personnel à l'avenir.

Ce cycle de conférences a pour objectif de faire un tour d'horizon sur l'utilisation des outils M&S pour le processus de prise de décisions militaires dans les différents domaines d'application: entraînement et exercices, soutien des opérations, analyse et acquisition, et de faire le point des connaissances dans ces domaines respectifs. Ces conférences sont plus particulièrement destinées aux chercheurs et aux ingénieurs impliqués dans le développement et l'utilisation des outils M&S.

Cette publication a été rédigée pour servir de support de cours pour le cycle de conférences organisé par la commission Etudes, Analyse et Simulation (SAS) dans le cadre du programme des consultants et des échanges de la RTO du 15 au 16 octobre 2001 à Rome, Italie, du 18 au 19 octobre 2001 à Stockholm, Suède du 23 au 25 octobre, 2001 à Norfolk, USA et du 10 au 11 décembre 2002 à La Haye, Pays-Bas.

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# Acknowledgements

The first Computer Assisted Exercise (CAX) in ACE took place in 1989 (ACE 89). This was the impetus for the NATO research and technology organization (at that time the Defence Research Group) to take a closer look at the military operational requirements for CAX, and subsequently at the technologies, architecture and layout associated with such events. One of the initiators of the Long Term Scientific Study (LTSS) on CAX was the scientific advisor of SACEUR Dr. Herb Fallin, who is now the Division Chief of the OR and Functional Systems Division at NC3A, which supports NATO exercises.

The simulation of military decision-making was identified as having a major role to play in CAX. Therefore the LTSS on CAX proposed to initiate an LTSS on Computer Generated Forces (CGF), their architectures and relevant technologies. The CGF technology was seen to have not only a use in CAX but also in other military areas such as support to operations. In a third LTSS Human Behaviour Representation, seen as a kernel technology for simulation of and for military decision-making, was investigated.

I would like to thank NATO RTO and especially the former Panel 1 and now SAS-Panel for their interest in this work. They made it possible to bring a team of experts together to discuss these technology areas and the associated potential military uses. I would also like to register my thanks to the nations for supporting this activity (especially Germany for taking the lead in this research and enabling me to chair these LTSSs).

This Lecture Series would have been impossible without participation in the LTSSs of all the experts from the different nations and the NATO commands. I would like to thank all of them for their supreme contributions. Also I would like to thank all the hosts of the different meetings we have had during the conduct of the LTSSs for their excellent support and their hospitality. In particular thanks are due to the ISL in Saint Louis, France, the IDA in Alexandria, USA and the Air Force Agency for Modelling & Simulation in Orlando, USA as hosts of the Multinational Exercises.

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- Stockholm, Sweden at the Swedish Defence Research Institute  
Point of Contact was B. Backstrom.
- Norfolk, VA USA at the Virginia Modelling, Analysis and Simulation Center (VMASC)  
Point of Contact was Dr. R. Willis.

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Many thanks also to RTA for the organization and the preparation of the educational notes. Jane Brooks from RTA supported the Lecture Series team in an excellent manner.

Last but not least I'd like to thank all lecturers for their splendid work in preparing the notes and in giving their presentations.

Dr. Uwe Dompke  
Study Director LTSS/40, LTSS/48, LTSS/51 and Lecture Series Director  
The Hague, January 2002

# List of Authors/Lecturers

## Lecture Series Director:

**Dr. Uwe K.J. Dompke**  
NC3A, ORFS Division  
Oude Waalsdorper Weg 61  
2501 CD The Hague  
NETHERLANDS  
Tel: +31 70 374 3636  
Fax: +31 70 374 3069  
Email: Uwe.Dompke@nc3a.nato.int

## Authors/Lecturers:

**Mr. Walter Schmidt**  
Leitweg 31  
A-6345 Koessen  
AUSTRIA  
Tel: +43 (5375) 29149  
GSM: +43 664 385 5767  
Email: whpschmidt@hotmail.com

**Cdr Gregorio Ameyugo**  
Deputy Head, NATO RTA MSCO  
BP 25 - 7 rue Ancelle  
F-92201 Neuilly-sur-Seine Cedex  
FRANCE  
Tel: +33 1 55 61 22 92  
Email: ameyugog@rta.nato.int

**Mr. Graham Burrows**  
Head, NATO RTA MSCO  
BP 25 - 7 rue Ancelle  
F-92201 Neuilly-sur-Seine Cedex  
FRANCE  
Tel: +33 1 55 61 22 90  
Email: burrowsg@rta.nato.int

**Dr. Jean-Louis Igarza**  
NATO RTA MSCO  
BP 25 - 7 rue Ancelle  
F-92201 Neuilly-sur-Seine Cedex  
FRANCE  
Tel: +33 1 55 61 22 77  
Email: igarzaj@rta.nato.int

**Dr. Andreas Tolk**  
Virginia Modelling Analysis  
Simulation Center  
Old Dominion University  
7000 College Drive  
Suffolk, VA 23435  
U.S.A.  
Tel: + 1 757 686 6203  
Fax: + 1 757 686 6214  
Email: atolk@odu.edu

**Dr. Dirk Coppieters**  
NC3A The Hague ORFS Division  
P.O. Box 174  
2501 CD The Hague  
NETHERLANDS  
Tel: +31 70 374 3544  
Fax: +31 70 374 3069  
Email: coppiet@nc3a.nato.int

**Dr. Peter Brooks**  
Institute for Defense Analyses (IDA)  
1801 Beauregard Street  
Alexandria, VA 22311-1772  
USA  
Tel: 001 703 845 2170  
Fax: 001 703 845 6809  
Email: pbrooks@ida.org

**Dr. Robert S. Jacobs**  
IDA Simulation Center  
1801 Beauregard Street  
Alexandria, VA 22311-1772  
USA  
Tel: +1 (818) 991-8455  
Fax: +1 (818) 991-8455  
Email: drbob@jacobs.net

**Mr. Richard K. Wright**  
IDA Simulation Center  
1801 Beauregard Street  
Alexandria, VA 22311-1772  
USA  
Tel: 001-703-845-6818  
Fax: 001-703-845-6809  
Email: rwright@ida.org

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<b>14. Abstract</b>			
<p>This Lecture Series gives an overview on the use of M&amp;S of the Military Decision Process in the different application areas of training and exercising, support to operations, analysis and acquisition, and provides a review of the state-of-the-art in the respective areas.</p> <p>The Military Operational Requirements for CAX systems are the basis for a CAX system architecture that is built on top of services. The coupling of the simulation system with the operational environment in form of the Command and Control Information System (CCIS) is essential. Practical examples and future needs are adduced.</p> <p>Computer Generated Forces (CGF) are computer representations of entities in simulations, which attempts to model human behaviour sufficiently so that the forces will take some actions automatically. There are different layouts and architectures possible depending on the use of the system. The integration in the operational environment is a crucial point.</p> <p>Human Behaviour Representation (HBR) offers support in different application areas; examples are thinking automated opposing forces (training and exercise), closed simulation systems (defence planning), Decision Support Tools (support to operations), and virtual environments (acquisition). Emerging technologies will have a great impact on the implementation and on the military use of such HBR in the future.</p>			

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