NORTH ATLANTIC TREATY ORGANISATION

RESEARCH AND TECHNOLOGY ORGANISATION

AC/323(MSG-028)TP/15

www.rta.nato.int

RTO MEETING PROCEEDINGS **MP-MSG-028**

Modelling and Simulation to Address NATO's New and Existing Military Requirements

(Le rôle de la modélisation et de la simulation dans la prise en compte des besoins militaires nouveaux et existants de l'OTAN)

Papers presented at the NATO RTO Modelling and Simulation Conference held in Koblenz, Germany, on 7 and 8 October 2004.

Published October 2004

NORTH ATLANTIC TREATY ORGANISATION

RESEARCH AND TECHNOLOGY ORGANISATION

AC/323(MSG-028)TP/15

www.rta.nato.int

RTO MEETING PROCEEDINGS **MP-MSG-028**

Modelling and Simulation to Address NATO's New and Existing Military Requirements

(Le rôle de la modélisation et de la simulation dans la prise en compte des besoins militaires nouveaux et existants de l'OTAN)

Papers presented at the NATO RTO Modelling and Simulation Conference held in Koblenz, Germany, on 7 and 8 October 2004.

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.

Published October 2004

ISBN 92-837-1137-8

Modelling and Simulation to Address NATO's New and Existing Military Requirements

(RTO-MP-MSG-028)

Executive Summary

The role of Modelling and Simulation (M&S) for NATO transformation is increasingly gaining recognition. The NATO M&S Master Plan already comprises the guidelines and requirements for M&S to be used within NATO in the various application domains, of which, in particular training and support of operations have been identified as high priority areas. When analysing the new and existing military requirements for NATO it becomes obvious that experimentation and transformation belong to the emerging areas of M&S support to NATO forces. In general, NATO is in the process of radical change through the NATO Transformation process and the development of new military requirements while not neglecting the existing ones. Collaborative efforts to improve joint, combined capabilities are undertaken in all domains by the two strategic commands: Allied Command Operations (ACO) and Allied Command Transformation (ACT). ACT is responsible for the continuing transformation of military capabilities and for promoting interoperability. M&S has been recognised within NATO as a key element in addressing the resulting new and existing military and organisational requirements and challenges of the NATO Transformation process in order to able to instantiate the necessary new capabilities.

M&S methods can support the evaluation of new capabilities, such as requirement analyses for distributed missions and operations, counter terrorism activities or the effects of own and hostile organisations, including but not limited to military forces. New studies and analyses are not only illuminating the underlying technical processes, but organisational and human behaviour are migrated with underlying technical solutions into new models of socio-technical systems, increasingly integrating the results of neighboured fields, such as psychology. In order to support the evaluation and analyses process, new measures of merits are needed as well, which have to be taken into account when implementing new models. Furthermore, the currently used gap analyses must be replaced with capability evaluation within new scenarios. A common theme coping with organizational as well as technical aspects is the increasing use of web-based collaboration tools supporting the design, implementation, execution and evaluation of M&S exercises and events as well as aligning the underlying processes.

On the technical side, the increasing use of open and commercially viable standards, such as the Extensible Mark-up Language (XML) and web services is reported in several papers. The requirement for overarching frameworks facilitating reuse, composability and orchestration as well as some prototypical implementations is another theme addressed. Additional technical topics still of great interest in the area of new and existing requirements are the coupling of command and control information systems with simulation systems as well as the support of analysis of the command and control process and the support of command and control by information technology (IT) means. These topics increasingly gain value within new developments in net centric operations and warfare and net-enabled capabilities, which must include the use of M&S functionality. The use of the Command and Control Information Exchange Data Model (C2IEDM) – also used in the Multilateral Interoperability Programme (MIP) of NATO to couple command and control information systems – was recommended and discussed in several papers.

In summary, the papers and keynotes presented during the conference and contained in these proceedings provide; a good overview of current M&S capabilities and ongoing efforts in NATO, its Nations and its Partners, and where additional R&D is needed.

Le rôle de la modélisation et de la simulation dans la prise en compte des besoins militaires nouveaux et existants de l'OTAN

(RTO-MP-MSG-028)

Synthèse

L'importance de la modélisation et de la simulation (M&S) est de plus en plus reconnue au sein de l'OTAN. Le plan directeur M&S de l'OTAN tient déjà compte des directives et besoins relatifs à la mise en œuvre de la modélisation et de la simulation dans les différents domaines d'application, parmi lesquels l'entraînement et le soutien des opérations ont été identifiés comme éléments hautement prioritaires. L'analyse des besoins militaires nouveaux et existants de l'OTAN démontre que l'expérimentation et la transformation font partie des nouveaux domaines de soutien M&S des forces de l'OTAN. D'une manière générale, l'OTAN connaît une période de changement radical, due à l'application du processus de transformation et à l'élaboration de nouveaux besoins militaires, sans négliger les besoins existants. Des projets en coopération, visant à améliorer les capacités interarmées internationales sont entrepris dans tous les domaines par les deux commandements stratégiques, à savoir le Commandement allié Opérations (ACO) et le Commandement allié Transformation (ACT). L'ACT est responsable de la transformation continue des capacités militaires, ainsi que de l'amélioration de l'interopérabilité. La M&S a été reconnue au sein de l'OTAN en tant qu'élément clé de la satisfaction des besoins et défis militaires et organisationnels nouveaux et existants associés au processus de transformation de l'OTAN, qui permettra d'instancier les nouvelles capacités demandées.

Les méthodes M&S sont adaptées à l'évaluation des nouvelles capacités, telles que les analyses de besoins relatives à des missions et à des opérations réparties, aux activités de contre-terrorisme, ainsi qu'aux effets d'organisations amies et ennemies, y compris, mais sans y être limitées, les forces militaires. De nouvelles études et analyses mettent en lumière les processus techniques fondamentaux, tandis que des comportements humains et organisationnels, associés à des solutions techniques sous-jacentes migrent dans de nouveaux modèles de systèmes socio-techniques, intégrant ainsi de plus en plus les résultats obtenus dans des domaines voisins, tels que la psychologie. De nouvelles classifications de valeurs, à prendre en considération lors de la mise en œuvre de nouveaux modèles, sont également demandées pour le soutien des processus d'évaluation et d'analyse. En outre, les analyses de carence actuellement employées seraient à remplacer par des évaluations de capacité dans les nouveaux scénarios. L'un des sujets qui englobe les aspects tant organisationnels que techniques est l'emploi de plus en plus fréquent d'outils de collaboration en ligne pour la conception, la mise en œuvre, l'exécution et l'évaluation d'exercices et de manifestations M&S, ainsi que pour l'alignement des processus fondamentaux.

Du point de vue technique, l'adoption de plus en plus fréquente de normes ouvertes et commercialement valables, telles que le langage de balisage extensible (XML) et de services Web est évoquée dans de nombreuses communications. La demande de schémas globaux, facilitant le réutilisation, la composabilité et l'orchestration, ainsi qu'un certain nombre de mises en œuvre prototypiques est également examinée. D'autres sujets techniques qui demeurent d'un grand intérêt dans le domaine des besoins existants et nouveaux sont le couplage des systèmes d'information pour le commandement et le contrôle avec des systèmes de simulation, ainsi que le soutien de l'analyse du processus de commandement et de contrôle et de ses moyens de technologie de l'information (IT). Ces questions deviennent de plus en plus intéressantes avec les nouveaux développements dans les domaines de la guerre et des opérations centrées sur les réseaux, ainsi que les capacités réseautiques, qui comprennent forcément des fonctionnalités M&S. La mise en œuvre du modèle d'échange de données de commandement et de contrôle (C2IEDM) – utilisé également dans le programme d'interopérabilité multilatérale (MIP) de l'OTAN pour coupler les systèmes d'information pour le commandement et le contrôle – a été recommandé et commentée dans bon nombre des communications.

En résumé, les communications et discours d'ouverture présentés lors de la conférence et inclus dans le compte rendu de conférence constituent un bon aperçu des moyens M&S actuels et des projets OTAN en cours dans ce domaine, lequel exige des efforts supplémentaires en matière de R&D.

Table of Contents

SESSION II: JOINT TRAINING

SESSION III: DEVELOPMENT OF NEW CONCEPTS

SESSION IV: INTEGRATION OF NEW TECHNOLOGY

SESSION V: RESPONSE TO NEW THREATS

NATO Modelling and Simulation Group

GROUP OFFICERS

NMSG Chairman:

Mr. A. FAWKES
Head of SECO & RD (Ses, Simulation and Support)
MOD/UK/SECO - DG(R&T)
Room 601 - Northumberland House
Northumberland Avenue
London WC2N 5BP
UNITED KINGDOM
Tel: +44 20 721 895 58
Fax: +44 20 721 864 81
Email: Andy.Fawkes108@mod.uk

NMSG Vice-Chairman:

Dr. J.-L. IGARZA
NMSCO Chief Scientist, RTA
B.P. 25
F-92201 Neuilly sur Seine Cedex
FRANCE
Tel: +33 (0)1 55 61 22 77
Fax: +33 (0)1 55 61 22 99
Email: jean-louis.igarza@dga.defense.gouv.fr

PROGRAMME COMMITTEE

Chairman

Mr. G.J. BURROWS
Head, Modelling and Simulation Coordination Office
Research and Technology Agency
BP 25
92201 Neuilly-sur-Seine Cedex
FRANCE
Tel: +33 (0) 1 55 61 22 90
Fax: +33 (0) 1 55 61 96 12
Email: burrowsg@rta.nato.int

Members

Cdr. G. AMEYUGO CATALAN
Deputy NMSCO, RTA
Tel: +33 (0) 1 55 61 22 92
Fax: +33 (0) 1 55 61 22 99
Email: ameyugog@rta.nato.int

Mr. A. FAWKES
Head of SECO & RD
Tel: +44 20 721 895 58
Fax: +44 20 721 864 81
Email: Andy.Fawkes108@mod.uk

Dr. G.J. JENSE
Head, Simulators Group
TNO-FEL
P.O. Box 96864
2509 JG The Hague
THE NETHERLANDS
Tel: +31 70 374 0024/28
Fax: +31 70 374 0652
Email: jense@fel.tno.nl

Col. A. WIMMEL
BWB 1 FE I 3
Ferdinand Sauerbruch Str. 1
56073 Koblenz
GERMANY
Tel: +49 261 400 68 85
Fax: +49 261 400 48 00
Email: albertwimmel@bwb.org

Col. M. FINNERN
DMSO
1901 N. Beauregard St., Suite 500
Alexandria, VA 22311
UNITED STATES OF AMERICA
Tel: +1 703 998 06 60
Fax: +1 703 998 06 67
Email: mfinnern@dmso.mil

Dr. M.G. SURSAL
HN-5313 Operations Research Section
SACLANT Headquarters
7857 Blandy Road, Suite 100
Norfolk, VA 23551-2490
UNITED STATES OF AMERICA
Tel: +1 757 445 33 86
Fax: +1 757 445 32 42
Email: sursal@act.nato.int

Mr. G.E. SCHULZ
BWB FEI 3
Ferdinand-Sauerbruch Str. 1
56057 Koblenz
GERMANY
Tel: +49 261 400 68 64
Fax: +49 261 400 66 12
Email: GustavSchulz@bwb.org

Mr. B. WITHERDEN
NC3 Agency
Chief Exercise, Design & Scenario
Development Branch
P.O. Box 174
2501 CD The Hague
THE NETHERLANDS
Tel: +31 70 374 36 31
Fax: +31 70 374 30 69
Email: brian.witherden@nc3a.nato.int

NATO Modelling and Simulation Co-ordination Office
(RTA/NMSCO)

Mr. G.J. BURROWS (Head)
Cdr. G. AMEYUGO CATALAN (Deputy Head)
Mrs. I. DEBRAINE (Assistant)
Research and Technology Agency
BP 25
92201 Neuilly-sur-Seine Cedex
FRANCE

REPORT DOCUMENTATION PAGE

1. Recipient's Reference	2. Originator's References	3. Further Reference	4. Security Classification of Document
	RTO-MP-MSG-028 AC/323(MSG-028)TP/15	ISBN 92-837-1137-8	UNCLASSIFIED/ UNLIMITED

5. Originator

Research and Technology Organisation
North Atlantic Treaty Organisation
BP 25, F-92201 Neuilly-sur-Seine Cedex, France

6. Title

Modelling and Simulation to Address NATO's New and Existing Military Requirements

7. Presented at/Sponsored by

The NATO RTO Modelling and Simulation Conference held in Koblenz, Germany, on 7 and 8 October 2004.

8. Author(s)/Editor(s)	9. Date
Multiple	October 2004
10. Author's/Editor's Address	**11. Pages**
Multiple	272 (text) 490 (slides)

12. Distribution Statement

There are no restrictions on the distribution of this document. Information about the availability of this and other RTO unclassified publications is given on the back cover.

13. Keywords/Descriptors

Battle Management Language (BML)
Command and Control Information Exchange Data Model (C2IEDM)
Computer Assisted Exercise (CAX)
Crowd modelling
Experimentation
Human and organizational behaviour presentation
Military requirements
Multilateral Interoperability Programme (MIP)
Modelling & Simulation (M&S)
Net centric operations and warfare
Net enabled capabilities
Simulation of terrorists' activities
Support to operations
Transformation
Urban warfare
Web-based collaboration tools

14. Abstract

NATO established the Allied Command for Transformation (ACT) to be able to effectively and efficiently meet its new and existing military requirements. Modelling and Simulation (M&S) will be used as an enabling technology as well as an enabling methodology to support the transformation of the NATO forces. The NATO Modelling and Simulation Group (NMSG) Conference (MSG-028) "Modelling & Simulation to support NATO's New and Existing Military Requirements" was conducted in Koblenz, Germany from 7 to 8 October 2004. All sessions of the Conference were unclassified.

The conference addressed organisational and technical aspects of this increasing challenge, and provided hints of applicable technologies to deal with crowd modelling, terrorists' activities and urban operations. The keynote speeches and papers presented covered NATO, national and Partnership for Peace efforts. The results contained in these conference proceedings will help to define future Research & Development domains and provides an overview of the contribution capability of the participating nations and organisations.

NORTH ATLANTIC TREATY ORGANISATION

RESEARCH AND TECHNOLOGY ORGANISATION

BP 25
F-92201 NEUILLY-SUR-SEINE CEDEX • FRANCE
Télécopie 0(1)55.61.22.99 • E-mail mailbox@rta.nato.int

DIFFUSION DES PUBLICATIONS

RTO NON CLASSIFIEES

Les publications de l'AGARD et de la RTO peuvent parfois être obtenues auprès des centres nationaux de distribution indiqués ci-dessous. Si vous souhaitez recevoir toutes les publications de la RTO, ou simplement celles qui concernent certains Panels, vous pouvez demander d'être inclus soit à titre personnel, soit au nom de votre organisation, sur la liste d'envoi.

Les publications de la RTO et de l'AGARD sont également en vente auprès des agences de vente indiquées ci-dessous.

Les demandes de documents RTO ou AGARD doivent comporter la dénomination « RTO » ou « AGARD » selon le cas, suivi du numéro de série. Des informations analogues, telles que le titre est la date de publication sont souhaitables.

Si vous souhaitez recevoir une notification électronique de la disponibilité des rapports de la RTO au fur et à mesure de leur publication, vous pouvez consulter notre site Web (www.rta.nato.int) et vous abonner à ce service.

CENTRES DE DIFFUSION NATIONAUX

ALLEMAGNE
Streitkräfteamt / Abteilung III
Fachinformationszentrum der
Bundeswehr (FIZBw)
Friedrich-Ebert-Allee 34, D-53113 Bonn

BELGIQUE
Etat-Major de la Défense
Département d'Etat-Major Stratégie
ACOS-STRAT – Coord. RTO
Quartier Reine Elisabeth
Rue d'Evère, B-1140 Bruxelles

CANADA
DSIGRD2
Bibliothécaire des ressources du savoir
R et D pour la défense Canada
Ministère de la Défense nationale
305, rue Rideau, 9e étage
Ottawa, Ontario K1A 0K2

DANEMARK
Danish Defence Research Establishment
Ryvangs Allé 1, P.O. Box 2715
DK-2100 Copenhagen Ø

ESPAGNE
SDG TECEN / DGAM
C/ Arturo Soria 289
Madrid 28033

ETATS-UNIS
NASA Center for AeroSpace
Information (CASI)
Parkway Center, 7121 Standard Drive
Hanover, MD 21076-1320

FRANCE
O.N.E.R.A. (ISP)
29, Avenue de la Division Leclerc
BP 72, 92322 Châtillon Cedex

GRECE (Correspondant)
Defence Industry & Research
General Directorate, Research Directorate
Fakinos Base Camp, S.T.G. 1020
Holargos, Athens

HONGRIE
Department for Scientific Analysis
Institute of Military Technology
Ministry of Defence
H-1525 Budapest P O Box 26

ISLANDE
Director of Aviation
c/o Flugrad
Reykjavik

ITALIE
Centro di Documentazione
Tecnico-Scientifica della Difesa
Via XX Settembre 123
00187 Roma

LUXEMBOURG
Voir Belgique

NORVEGE
Norwegian Defence Research Establishment
Attn: Biblioteket
P.O. Box 25, NO-2007 Kjeller

PAYS-BAS
Royal Netherlands Military
Academy Library
P.O. Box 90.002
4800 PA Breda

POLOGNE
Armament Policy Department
218 Niepodleglosci Av.
00-911 Warsaw

PORTUGAL
Estado Maior da Força Aérea
SDFA – Centro de Documentação
Alfragide
P-2720 Amadora

REPUBLIQUE TCHEQUE
LOM PRAHA s. p.
o. z. VTÚLaPVO
Mladoboleslavská 944
PO Box 18
197 21 Praha 9

ROYAUME-UNI
Dstl Knowledge Services
Information Centre, Building 247
Dstl Porton Down
Salisbury
Wiltshire SP4 0JQ

TURQUIE
Milli Savunma Bakanlığı (MSB)
ARGE ve Teknoloji Dairesi Başkanlığı
06650 Bakanliklar – Ankara

AGENCES DE VENTE

NASA Center for AeroSpace Information (CASI)
Parkway Center, 7121 Standard Drive
Hanover, MD 21076-1320
ETATS-UNIS

The British Library Document Supply Centre
Boston Spa, Wetherby
West Yorkshire LS23 7BQ
ROYAUME-UNI

Canada Institute for Scientific and Technical Information (CISTI)
National Research Council
Acquisitions, Montreal Road, Building M-55
Ottawa K1A 0S2, CANADA

Les demandes de documents RTO ou AGARD doivent comporter la dénomination « RTO » ou « AGARD » selon le cas, suivie du numéro de série (par exemple AGARD-AG-315). Des informations analogues, telles que le titre et la date de publication sont souhaitables. Des références bibliographiques complètes ainsi que des résumés des publications RTO et AGARD figurent dans les journaux suivants :

Scientific and Technical Aerospace Reports (STAR)
STAR peut être consulté en ligne au localisateur de ressources uniformes (URL) suivant:
http://www.sti.nasa.gov/Pubs/star/Star.html
STAR est édité par CASI dans le cadre du programme NASA d'information scientifique et technique (STI)
STI Program Office, MS 157A
NASA Langley Research Center
Hampton, Virginia 23681-0001
ETATS-UNIS

Government Reports Announcements & Index (GRA&I)
publié par le National Technical Information Service
Springfield
Virginia 2216
ETATS-UNIS
(accessible également en mode interactif dans la base de données bibliographiques en ligne du NTIS, et sur CD-ROM)

NORTH ATLANTIC TREATY ORGANISATION

RESEARCH AND TECHNOLOGY ORGANISATION

BP 25
F-92201 NEUILLY-SUR-SEINE CEDEX • FRANCE
Télécopie 0(1)55.61.22.99 • E-mail mailbox@rta.nato.int

DISTRIBUTION OF UNCLASSIFIED RTO PUBLICATIONS

AGARD & RTO publications are sometimes available from the National Distribution Centres listed below. If you wish to receive all RTO reports, or just those relating to one or more specific RTO Panels, they may be willing to include you (or your Organisation) in their distribution.

RTO and AGARD reports may also be purchased from the Sales Agencies listed below.

Requests for RTO or AGARD documents should include the word 'RTO' or 'AGARD', as appropriate, followed by the serial number. Collateral information such as title and publication date is desirable.

If you wish to receive electronic notification of RTO reports as they are published, please visit our website (www.rta.nato.int) from where you can register for this service.

NATIONAL DISTRIBUTION CENTRES

BELGIUM
Etat-Major de la Défense
Département d'Etat-Major Stratégie
ACOS-STRAT – Coord. RTO
Quartier Reine Elisabeth
Rue d'Evère
B-1140 Bruxelles

CANADA
DRDKIM2
Knowledge Resources Librarian
Defence R&D Canada
Department of National Defence
305 Rideau Street
9th Floor
Ottawa, Ontario K1A 0K2

CZECH REPUBLIC
LOM PRAHA s. p.
o. z. VTÚLaPVO
Mladoboleslavská 944
PO Box 18
197 21 Praha 9

DENMARK
Danish Defence Research Establishment
Ryvangs Allé 1
P.O. Box 2715
DK-2100 Copenhagen Ø

FRANCE
O.N.E.R.A. (ISP)
29, Avenue de la Division Leclerc
BP 72
92322 Châtillon Cedex

GERMANY
Streitkräfteamt / Abteilung III
Fachinformationszentrum der Bundeswehr (FIZBw)
Friedrich-Ebert-Allee 34
D-53113 Bonn

GREECE (Point of Contact)
Defence Industry & Research General Directorate, Research Directorate
Fakinos Base Camp, S.T.G. 1020
Holargos, Athens

HUNGARY
Department for Scientific Analysis
Institute of Military Technology
Ministry of Defence
H-1525 Budapest P O Box 26

ICELAND
Director of Aviation
c/o Flugrad, Reykjavik

ITALY
Centro di Documentazione Tecnico-Scientifica della Difesa
Via XX Settembre 123
00187 Roma

LUXEMBOURG
See Belgium

NETHERLANDS
Royal Netherlands Military Academy Library
P.O. Box 90.002
4800 PA Breda

NORWAY
Norwegian Defence Research Establishment
Attn: Biblioteket
P.O. Box 25, NO-2007 Kjeller

POLAND
Armament Policy Department
218 Niepodleglosci Av.
00-911 Warsaw

PORTUGAL
Estado Maior da Força Aérea
SDFA – Centro de Documentação
Alfragide, P-2720 Amadora

SPAIN
SDG TECEN / DGAM
C/ Arturo Soria 289
Madrid 28033

TURKEY
Milli Savunma Bakanlığı (MSB)
ARGE ve Teknoloji Dairesi Başkanlığı
06650 Bakanliklar – Ankara

UNITED KINGDOM
Dstl Knowledge Services
Information Centre, Building 247
Dstl Porton Down
Salisbury, Wiltshire SP4 0JQ

UNITED STATES
NASA Center for AeroSpace Information (CASI)
Parkway Center, 7121 Standard Drive
Hanover, MD 21076-1320

SALES AGENCIES

NASA Center for AeroSpace Information (CASI)
Parkway Center
7121 Standard Drive
Hanover, MD 21076-1320
UNITED STATES

The British Library Document Supply Centre
Boston Spa, Wetherby
West Yorkshire LS23 7BQ
UNITED KINGDOM

Canada Institute for Scientific and Technical Information (CISTI)
National Research Council
Acquisitions
Montreal Road, Building M-55
Ottawa K1A 0S2, CANADA

Requests for RTO or AGARD documents should include the word 'RTO' or 'AGARD', as appropriate, followed by the serial number (for example AGARD-AG-315). Collateral information such as title and publication date is desirable. Full bibliographical references and abstracts of RTO and AGARD publications are given in the following journals:

Scientific and Technical Aerospace Reports (STAR)
STAR is available on-line at the following uniform resource locator:
http://www.sti.nasa.gov/Pubs/star/Star.html
STAR is published by CASI for the NASA Scientific and Technical Information (STI) Program
STI Program Office, MS 157A
NASA Langley Research Center
Hampton, Virginia 23681-0001
UNITED STATES

Government Reports Announcements & Index (GRA&I)
published by the National Technical Information Service
Springfield
Virginia 2216
UNITED STATES
(also available online in the NTIS Bibliographic Database or on CD-ROM)

ISBN 92-837-1137-8