
NORTH ATLANTIC TREATY
ORGANISATION



AC/323(HFM-073)TP/65

RESEARCH AND TECHNOLOGY
ORGANISATION



www.rta.nato.int

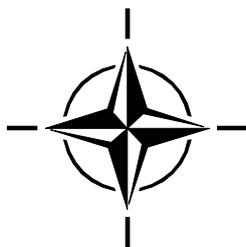
RTO TECHNICAL REPORT

TR-HFM-073

The Human Effects of Non-Lethal Technologies

(Impacts humain des
technologies non létales)

The Final Report of NATO RTO HFM-073.



Published August 2006

Distribution and Availability on Back Cover



NORTH ATLANTIC TREATY
ORGANISATION



AC/323(HFM-073)TP/65

RESEARCH AND TECHNOLOGY
ORGANISATION



www.rta.nato.int

RTO TECHNICAL REPORT

TR-HFM-073

The Human Effects of Non-Lethal Technologies

(Impacts humain des
technologies non létales)

The Final Report of NATO RTO HFM-073.

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 System Analysis and Studies 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.

The content of this publication has been reproduced directly from material supplied by RTO or the authors.

Published August 2006

Copyright © RTO/NATO 2006
All Rights Reserved

ISBNs 92-837-0045-7 / 978-92-837-0045-6

Single copies of this publication or of a part of it may be made for individual use only. The approval of the RTA Information Management Systems Branch is required for more than one copy to be made or an extract included in another publication. Requests to do so should be sent to the address on the back cover.

Table of Contents

	Page
List of Figures/Tables	vi
Human Factors and Medicine Panel	vii
Executive Summary and Synthèse	ES-1
Chapter 1 – Background to NATO Activities on Non-Lethal Weapons (NLW)	1-1
1.1 Initial NATO NLW Activity: 1994 – 1997	1-1
1.2 NATO Policy on NLW: 1998 – 1999	1-1
1.3 NATO Roadmap for NLW: 1999 – 2000	1-2
1.4 NATO Technical Teams on NLW & NLT: 2000 – 2004	1-3
1.5 The Human Factors and Medicine Panel	1-3
1.6 The NATO Science Committee	1-5
1.7 References	1-5
Chapter 2 – Overview of the Human Effects of NLT	2-1
2.1 What Are Human Effects?	2-1
2.2 Human Effects of NLT	2-2
2.3 Impact of Human Effects Data on NLW	2-3
2.3.1 Evaluating Operational Utility	2-3
2.3.2 Technical Feasibility and Weapons Design	2-4
2.3.3 Policy Acceptability	2-4
2.3.4 Developing Health and Safety Human Exposure Standards	2-4
2.4 Existing and Proposed Technologies for NLW	2-5
2.5 A Glossary of NLW Terms	2-5
2.6 Scientific Workshops including Human Effects of NLW	2-5
2.6.1 European Symposia on Non-Lethal Weapons	2-5
2.6.2 The NLT Technical and Academic Research Symposia (NTARS)	2-6
2.6.3 Jane’s Meeting on Non-Lethal Weapons	2-7
2.6.4 National Defence Industrial Association (NDIA) Conferences	2-7
2.6.5 Organized by the Institute of Defence and Government Advancement (DGA)	2-7
2.6.6 Organized by NATO Science Program	2-7
2.7 Closing Comments	2-7
Chapter 3 – Database Issues for NLT	3-1
3.1 The Need for a Database	3-1
3.2 Issues in Developing an HFM-073 NLT Database	3-1

3.2.1	Choice of Computer Software	3-1
3.2.2	Obtaining Sufficient Resources	3-1
3.2.3	Restricted Information	3-2
3.2.4	Data Availability	3-2
3.3	A Multi-Tiered Database Structure	3-2
3.3.1	Tier 1 – Primary Source Material	3-3
3.3.2	Tier 2 – The Human Effects of Non-Lethal Technologies	3-3
3.3.3	Tier 3 – The Human Effects of Non-Lethal Weapons	3-4
3.3.4	Tier 4 – Commanders Aid	3-4
3.4	The Future of an NLT/NLW Human Effects Database	3-4

Chapter 4 – Medical Issues for NLT **4-1**

4.1	General Considerations	4-1
4.2	Enabling a Spectrum of Response	4-1
4.3	Special Issues: Microwave and Radio Frequency (RF) Systems	4-1
4.4	Special Issues: Electrical Muscular Disruption Devices (EMD)	4-2
4.5	Special Issues: Barrier Systems	4-2
4.6	Special Issues: Acoustic Systems	4-2
4.7	Special Issues: Laser Systems	4-3
4.8	Special Issues: Blunt Impact (Kinetic) Weapons	4-3
4.9	Special Issues: Sedatives	4-4
4.10	Collection of After-Action Medical Data	4-4
4.11	References	4-4

Chapter 5 – Training Issues for NLT **5-1**

5.1	Towards a Policy with New Options	5-1
5.2	Rules of Engagement	5-1
5.3	Need for Instruction	5-4
5.4	Codification of Violence and Proportionality	5-4
5.5	Keep it Simple	5-5
5.6	Generalist Instructors	5-5
5.7	Various Phases of Learning	5-5
5.8	Creating Realism in the Scenarios	5-7
5.9	Continual Training is Essential	5-8
5.10	Need to Retain Lessons	5-9
5.11	Summary	5-9

Chapter 6 – Human Effects Issues Affecting NLW Development, Testing and Acceptance **6-1**

6.1	Introduction	6-1
6.2	Military Needs	6-1
6.3	Rules of Engagement	6-2
6.4	Legal Issues	6-3

6.5	Design and Development of NLT	6-5
6.5.1	Hazard and Risk	6-6
6.6	NLT General Concept	6-6
6.7	Conventions	6-8
6.8	Inhumane Weapons	6-10
6.9	Public and Political Attitudes and Expectations	6-11
6.10	Summary	6-12
6.11	References	6-12
Chapter 7 – Conclusions and Recommendations		7-1
7.1	Conclusions	7-1
7.2	Recommendations	7-1
Annex A – NATO Roadmap for Developing a NLW Capability		A
Annex B – NATO Organisations Active in Planning NLW Capability		B
Annex C – TAP and TOR for HFM-073		C
Annex D – Members and Meetings of HFM-073		D
Annex E – Statements from Participants in HFM-073		E
Annex F – Purview of HFM-073 Compared with SAS-035		F
Annex G – NLT and Their Human Effects		G
Annex H – Glossary of Terms Important to the Human Effects of Non-Lethal Technologies		H
Annex I – The Nature of Data		I
Annex J – Human Effects of RF Energy		J
Annex K – Human Effects of Electro-Muscular Devices (EMD)		K
Annex L – Human Effects of Mild, Non-Lethal Trauma		L
Annex M – Medical Aspects of the Moscow Theatre Hostage Incident		M
Annex N – After-Action Medical Reporting		N
Annex O – TAP and TOR for Proposed Follow-On Activities to HFM-073		O
Annex P – Abbreviations and Acronyms		P

List of Figures/Tables

Figures		Page
Figure 1	Idealized Dose-Response Curves for an NLT	2-3
Figure 2	A Multi-Tiered Database for the Human Effects of NLW	3-3
Figure 3	Increase in the Threat Perceived by the Soldier and the Proportionate Response	5-3
Figure K-1	Blood Pressure following X26 TASER Stimulation	K-2
Figure K-2	Safety Factor of TASER X25 Related to Body Weight of Subject	K-3
Figure M-1	Idealized Curves and Theoretical Useful “Envelope” for the Action of a Hypothetical NLW	M-11
Tables		
Table 1	Purview of Research on the Human Effects of NLT	2-1
Table 2	Human Effects Implications of Non-Lethal Weapons	2-2
Table 3	NLW Technologies and their Desired and Possible Undesired Human Effects	2-6
Table 4	The Phases of Learning as Applied to NLW	5-6
Table K-1	Safety Margin vs. Pulse Rate per Second (pps) in Pigs	K-4
Table K-2	Current Output Characteristics of X26 vs. M26	K-4
Table M-1	Characteristics of Opioids, Including Fentanyl Derivatives	M-9
Table M-2	Possible Substances Used in the Moscow Theatre	M-10

Human Factors and Medicine Panel

Chairman:

Col. Jean-Michel CLERE (FRA), MD, Ph.D.
WMD Center (Weapons of Mass Destruction)
Defence Policy & Planning Division
NATO Headquarters
Office J-249
B-1110 Bruxelles
BELGIUM

Vice-Chairman:

Dr. Robert FOSTER, Ph.D.
Director, Bio Systems
Office of the Secretary of Defense
1777 N. Kent Street
Suite 9030
Rosslyn, VA 22209
UNITED STATES

HFM-073 TASK GROUP

Chairman:

Dr. Michael R. MURPHY
Scientific Director, Directed Energy Bioeffects Division
US Air Force Research Laboratory
Human Effectiveness Directorate
8262 Hawks Road, Bldg 1184
Brooks AFB, TX 78235-5324
UNITED STATES

MEMBERS

Jiri Chaloupka
Czech Republic
chaloupk@pmfhk.cz

Michel Hugon
France
bio.sh@wanadoo.fr

Dieter Reimann
Germany
reimandreigett@aol.com

Klaus-Dieter Thiel
Germany
kdt@ict.fhg.de

Tony Gaillard
The Netherlands
gaillard@tm.tno.nl

Per Kristian Opstad
Norway
per-kristian.opstad@ffi.no

Mårten Risling
Sweden
marten.risling@foi.se

Ulf Sundberg
Sweden
ulf.sundberg@foi.se

David Humair
Switzerland
david.humair@vtg.admin.ch

Mike Forrest
United Kingdom
mrforrest@qinetiq.com

John Florio
United Kingdom
jflorio@dstl.gov.uk

Robert Inns
United Kingdom

Noel Montgomery
United States
montgomerynd@hqmc.usmc.mil

Mark Wrobel
United States

PANEL EXECUTIVE

CDR RNLN Marten MEIJER, Ph.D.

BP 25
92201 Neuilly-sur-Seine - France
Tel: +33 1 5561 2260/62
Fax: +33 1 5561 2298
E-mail: meijerm@rta.nato.int or pelatd@rta.nato.int



REPORT DOCUMENTATION PAGE			
1. Recipient's Reference	2. Originator's References	3. Further Reference ISBNs	4. Security Classification of Document
	RTO-TR-HFM-073 AC/323(HFM-073)TP/65	92-837-0045-7 978-92-837-0045-6	UNCLASSIFIED/ UNLIMITED
5. Originator Research and Technology Organisation North Atlantic Treaty Organisation BP 25, F-92201 Neuilly-sur-Seine Cedex, France			
6. Title The Human Effects of Non-Lethal Technologies			
7. Presented at/Sponsored by The Final Report of NATO RTO HFM-073.			
8. Author(s)/Editor(s) Multiple			9. Date August 2006
10. Author's/Editor's Address Multiple			11. Pages 156
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			
Alternative technology	Military operations	Projectiles	
Antipersonnel weapons	Mission profiles	Requirements	
Contingency	Non-lethal weapons	Reviewing	
Effectiveness	Operational effectiveness	Scenarios	
International cooperation	Operations research	Standardization	
Military equipment	Peacekeeping	Weapons effects	
14. Abstract			
<p>Human effects considerations and data are important to nearly every aspect of Non-Lethal Weapon (NLW) development, effectiveness assessment, and deployment, as well as to assuring human health and safety during NLW evaluation, testing, training, use, and maintenance. In response to NATO RTO tasking, based on the recommendations of the 2000 Defence Capabilities Initiative, to support preparations for a NATO NLW capability, the Human Factors and Medicine Panel (HFM) formed HFM-073 "The Human Effects of Non-Lethal Technologies (NLT);" this Technical Report addresses the conclusions and recommendations of HFM-073. HFM-073 addressed the human effects of NLTs from the perspective of both the target (effectiveness and non-lethality) and the operator/bystander (fratricide, injury, long-term health effects). A summary of NLT technologies and a Glossary of terms important to the human effects of NLT are included in the Report. The complicated issue of policy approval for new NLWs is addressed and the implications of NLWs on training and field medicine are reviewed. Special attention is directed to the issues involved in obtaining target response data of the type, quality, and quantity that would satisfy the methodology and models being developed by another NATO RTO Panel, SAS-035 "Non-Lethal Weapons Effectiveness Assessment." Human Effects information, in all its dimensions, is critical for the success of NATO's implementation of a NLW capability. The HFM Panel is the only RTO organization able to support NATO in this area.</p>			





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 et 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)
Gorch-Fock-Straße 7, D-53229 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, 9^e 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
P O Box 26
H-1525 Budapest

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

ROUMANIE

Romanian National Distribution Centre
Armaments Department
9-11, Drumul Taberei Street
Sector 6, 77305, Bucharest

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 Bakanlıklar – 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)



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)
Gorch-Fock-Straße 7
D-53229 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
P O Box 26
H-1525 Budapest

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

ROMANIA

Romanian National Distribution Centre
Armaments Department
9-11, Drumul Taberei Street
Sector 6, 77305, Bucharest

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)