Seismic Verification of Nuclear Testing Treaties

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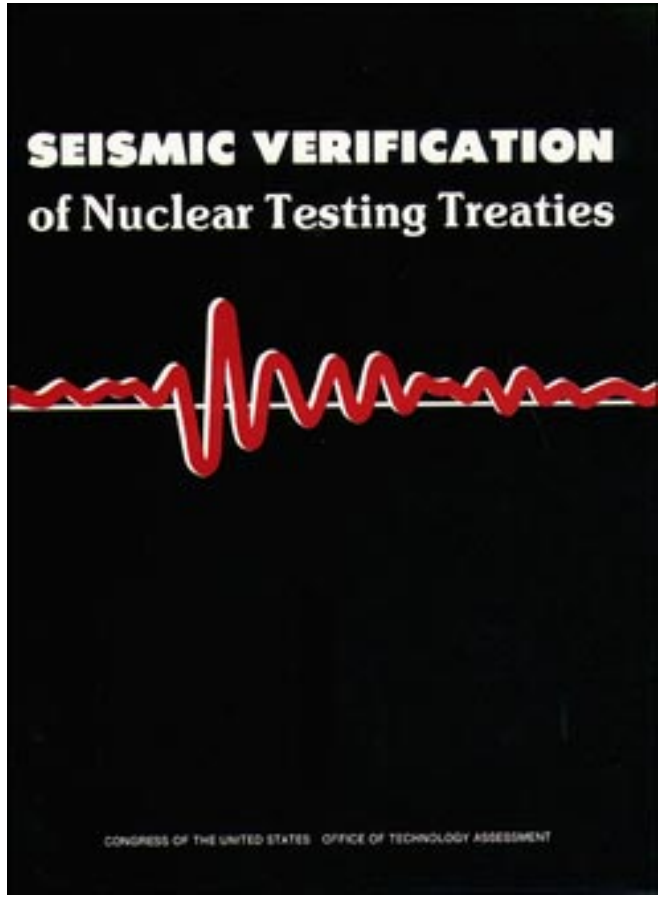

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Foreword

Since the advent of the atomic bomb there has been interest from both an arms control and environmental perspective to restrict the testing of nuclear weapons. Although the debate over nuclear testing has many facets, verification is a central issue to the consideration of any treaty. At the requests of the Senate Select Committee on Intelligence, the House Committee on Foreign Affairs, and the House Permanent Select Committee on Intelligence, OTA undertook an assessment of seismic capabilities to monitor underground nuclear explosions.

Like an earthquake, the force of an underground nuclear explosion creates seismic waves that travel through the Earth. A satisfactory seismic network to monitor such tests must be able to both detect and identify seismic signals in the presence of "noise," for example, from natural earthquakes. In the case of monitoring a treaty that limits testing below a certain size explosion, the seismic network must also be able to estimate the size with acceptable accuracy. All of this must be done with an assured capability to defeat adequately any credible attempt to evade or spoof the monitoring network.

This report addresses the issues of detection, identification, yield estimation, and evasion to arrive at answers to the two critical questions:

- Down to what size explosion can underground testing be seismically monitored with high confidence?
- How accurately can the yields of underground explosions be measured?

In doing so, we assessed the contribution that could be made if seismic stations were located in the country whose tests are to be monitored, and other cooperative provisions that a treaty might include. A context chapter (chapter 2) has been included to illustrate how the technical answers to these questions contribute to the political debate over:

- Down to what yield can we verify Soviet compliance with a test ban treaty?
- Is the 1976 Threshold Test Ban Treaty verifiable?
- Has the Soviet Union complied with p-resent testing restrictions?

In the course of this assessment, OTA drew on the experience of many organizations and individuals. We appreciate the assistance of the project contractors who prepared background analysis, the U.S. Government agencies and private companies who contributed valuable information, the project advisory panel and workshop participants who provided guidance and review, and the many additional reviewers who helped ensure the accuracy and objectivity of this report.

JOHN H. GIBBONS
Director

Seismic Verification of Nuclear Testing Treaties Advisory Panel

Howard Wesley Johnson, Chair
Honorary Chairman of the Corporation
Massachusetts Institute of Technology

Walter Alvarez
Professor
Department of Geology and Geophysics
University of California, Berkeley

Thomas C. Bache
Manager, Geophysics Division
Earth Sciences Operation
Science Applications International Corp.

William E. Colby
former Director of Central Intelligence Agency

F. Anthony Dahlen
Professor
Department of Geological and Geophysical Sciences
Princeton University

H.B. Durham
Distinguished Member of Technical Staff
Sandia National Laboratories

John R. Filson
Chief, Office of Earthquakes, Volcanos, and Engineering
U.S. Geological Survey

W. J. Hannon, Jr.
Assistant Program Leader
Analysis & Assessment
Verification Program
Lawrence Livermore National Laboratory
University of California

Roland F. Herbst
Member of President's Staff
RDA Associates

Eugene T. Herrin, Jr.
Professor
Department of Geological Sciences
Southern Methodist University

Franklyn K. Levin
former Senior Research Scientist, Exxon

Raymond J. McCrory
former Chief, Arms Control Intelligence Staff
Central Intelligence Agency

Karen McNally
Director, Charles F. Richter Seismological Laboratory
University of California, Santa Cruz

John R. Murphy
Program Manager and Vice President
S-CUBED

Wolfgang K.H. Panofsky
Director Emeritus
Stanford Linear Accelerator Center
Stanford University

Paul G. Richards
Professor
Department of Geological Sciences
Lamont-Doherty Geological Observatory
Columbia University

Jack Ruina
Director, Defense & Arms Control Studies Program
Center for International Studies
Massachusetts Institute of Technology

Lynn R. Sykes
Higgins Professor of Geological Sciences
Lamont-Doherty Geological Observatory
Columbia University

Thomas A. Weaver
Deputy Group Leader, Geophysical Group
Los Alamos National Laboratory
University of California

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OTA Project Staff—Seismic Verification of Nuclear Test Ban Treaties

Lionel S. Johns, *Assistant Director, OTA*
Energy, Materials, and International Security Division

Peter Sharfman, *International Security and Commerce Program Manager*

Gregory E. van der Vink, *Project Director*

Administrative Staff

Jannie Home Marie C. Parker Jackie Robinson

Contractors

Steven M. Day Zoltan A. Der Frederick K. Lamb Robert P. Masse´

Acknowledgments

In addition to the advisory panel and contractors, OTA gratefully acknowledges the valuable contributions made by the following:

Ralph W. Alewine, III, Defense Advanced Research Projects Agency
Shelton S. Alexander, Pennsylvania State University
Charles B. Archambeau, University of Colorado
Robert R. Blandford, Defense Advanced Research Projects Agency
John S. Derr, United States Geological Survey
Don Eilers, Los Alamos National Laboratory
Jack Evernden, United States Geological Survey
Frederick E. Followill, Lawrence Livermore National Laboratory
Robert A. Jeffries, Los Alamos National Laboratory
James F. Lewkowicz, Air Force Geophysics Laboratory
J. Bernard Minster, Scripps Institute of Oceanography
Otto W. Nuttli, St. Louis University
Mary Peters, Naval Research Laboratory
Robert A. Phinney, Princeton University
Keith Priestley, University of Nevada
Alan S. Ryan, Center for Seismic Studies
Robert H. Shumway, University of California
Stewart Smith, Incorporated Research Institutions for Seismology
Sean Solomon, Massachusetts Institute of Technology
Jack Rachlin, United States Geological Survey
Irvin Williams, Department of Energy
Robert Zavadil, Air Force Technical Applications Center
Department of Energy, Office of Classification

Workshop I: Network Capabilities

Stewart Smith, *Chair*
President, Incorporated Research Institute for Seismology

Charles B. Archambeau
Professor
Cooperative Institute for Research in Environmental Science
University of Colorado, Boulder

Thomas C. Bache
Manager, Geophysics Division
Earth Sciences Operation
Science Applications International Corp.

John S. Derr
Geophysicist
U.S. Geological Survey

Jack Evernden
Research Geophysicist
U.S. Geological Survey

Frederick E. Followill
Seismologist
Lawrence Livermore National Laboratory
University of California

Willard J. Hannon
Assistant Program Leader for Analysis & Assessment
Verification Program
Lawrence Livermore National Laboratory
University of California

Keith Nakanishi
Assistant Program Leader for Seismic Research
Lawrence Livermore National Laboratory
University of California

Paul G. Richards
Professor
Department of Geological Sciences
Lamont-Doherty Geological Observatory
Columbia University

Robert J. Zavadil
Chief, Evaluation Division
Directorate of Geophysics
Air Force Technical Applications Center

Workshop II: Identification

J. Bernard Minster, *Chair*
Visiting Professor of Geophysics
Scripps Institute of Oceanography
University of California, San Diego

Charles B. Archambeau
Professor
Cooperative Institute for Research in Environmental Science
University of Colorado, Boulder

Thomas C. Bache
Manager, Geophysics Division
Earth Sciences Operation
Science Applications International Corp.

Robert R. Blandford
Program Manager for the Nuclear Monitoring Office
Defense Advanced Research Projects Agency

Jack Evernden
Research Geophysicist
U.S. Geological Survey

Willard J. Hannon
Assistant Program Leader for Analysis & Assessment
Verification Program
Lawrence Livermore National Laboratory
University of California

John R. Murphy
Program Manager and Vice President
S-CUBED

Keith Priestley
Professor
Seismological Laboratory
University of Nevada

Jack Rachlin
Geologist
U.S. Geological Survey

Paul G. Richards
Professor
Department of Geological Sciences
Lamont-Doherty Geological Observatory
Columbia University

Robert H. Shumway
Professor
Division of Statistics
University of California, Davis

Lynn R. Sykes
Higgins Professor of Geological Sciences
Lamont-Doherty Geological Observatory
Columbia University

Robert J. Zavadil
Chief, Evaluation Division
Directorate of Geophysics
Air Force Technical Applications Center

Workshop III: Evasion

Sean C. Solomon, *Chair*
Professor, Department of Earth, Atmospheric & Planetary Science
Massachusetts Institute of Technology

Charles B. Archambeau
Professor
Cooperative Institute for Research in Environmental Science
University of Colorado, Boulder

Thomas C. Bache
Manager, Geophysics Division
Earth Sciences Operation
Science Applications International Corp.

Robert R. Blandford
Program Manager for the Nuclear Monitoring Office
Defense Advanced Research Projects Agency

Jack Evernden
Research Geophysicist
U.S. Geological Survey

Willard J. Harmon
Assistant Program Leader for Analysis & Assesmsent
Verification Program
Lawrence Livermore National Laboratory
University of California

Eugene T. Herrin, Jr.
Professor
Department of Geological Sciences
Southern Methodist University

Keith Priestley
Professor
Seismological Laboratory
University of Nevada

Jack Rachlin
Geologist
U.S. Geological Survey

Lynn R. Sykes
Higgins Professor of Geological Sciences
Lamont-Doherty Geological Observatory
Columbia University

Workshop IV: Yield Determinations

Robert A. Phinney, *Chair*
Chairman, Department of Geological & Geophysical Sciences
Princeton University

Ralph W. Alewine, III
Director of Nuclear Monitoring Office
Defense Advanced Research Projects Agency

Charles B. Archambeau
Professor
Cooperative Institute for Research in Environmental Science
University of Colorado, Boulder

Thomas C. Bache
Manager, Geophysics Division
Earth Sciences Operation
Science Applications International Corp.

Donald Eilers
Associate Group Leader
Los Alamos National Laboratory
University of California

Willard J. Hannon
Assistant Program Leader for Analysis & Assessment
Verification Program
Lawrence Livermore National Laboratory
University of California

Eugene T. Herrin, Jr.
Professor
Department of Geological Sciences
Southern Methodist University

Robert A. Jeffries
Program Director for Verification & Safeguards
Los Alamos National Laboratory

Frederick K. Lamb
Professor
Department of Physics
University of Illinois, Urbana

Keith Priestley
Professor
Seismological Laboratory
University of Nevada

Paul G. Richards
Professor
Department of Geological Sciences
Lamont-Doherty Geological Observatory
Columbia University

Alan S. Ryall
Manager of Research
Center for Seismic Studies

Robert H. Shumway
Professor
Division of Statistics
University of California, Davis

Lynn R. Sykes
Higgins Professor of Geological Sciences
Lamont-Doherty Geological Observatory
Columbia University

Robert J. Zavadil
Chief, Evaluation Division
Directorate of Geophysics
Air Force Technical Applications Center