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OFFICE OF TECHNOLOGY ASSESSMENT
WASHINGTON, DC 20510-8025

ER 88-2275X

May 27, 1988

The Honorable William H. Webster
Director
Central Intelligence Agency
Washington, DC 20505

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Dear Mr. Webster:

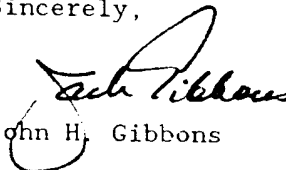
I am pleased to enclose OTA's Report, Seismic Verification of Nuclear Testing Treaties.

As you know, the debate over nuclear testing has many facets. Verification, however, is a central issue to the consideration of any treaty. The force of an underground nuclear explosion, like an earthquake, creates seismic waves that travel through the Earth. A seismic network must be able both to *detect* an underground nuclear explosion and to *distinguish* it from earthquakes and other sources of seismic waves. In the case of monitoring a treaty that limits testing below a certain size of 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 analyzes the issues of detection, identification, yield estimation and evasion to address two critical questions: (1) Down to what size explosion can underground testing be seismically monitored with high confidence? and (2) How accurately can the yields of underground explosions be measured? To answer these questions, OTA 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. These questions provide the technical information that lies at the heart of the political debate over: (1) Down to what yield can we verify Soviet compliance with a test ban treaty? (2) Is the 1976 Threshold Test Ban Treaty verifiable? and (3) Has the Soviet Union complied with present testing restrictions?

I hope you will find the Report useful and informative.

Sincerely,


John H. Gibbons

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SEISMIC VERIFICATION of Nuclear Testing Treaties

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Cover design by John Bergling

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 present 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's contractors who prepared background analysis, the U.S. Government agencies and private companies who contributed valuable information, the project's 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

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