

Verification of Nuclear Arms Reductions

The Role of the U.S. National Security Laboratories

Monterey Nonproliferation Strategy Group

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The U.S. national security laboratories have a long history of supporting and enabling arms control and nonproliferation.

1970s

Nonproliferation Treaty

Nuclear

Nonproliferation Act

Proliferation Detection

Technologies



- Satellite Verification

- Safeguards Technology

- Ground-based Sensors

- IAEA Physical Protection Missions

1980s

INF Treaty
Convention on the
Physical Protection of
Nuclear Materials



- Verification Strategy (Treaty On-Site Inspection)
- Arms Control Technology Options
- IAEA Unattended Monitoring Technologies

1990s

START I and II
Nunn-Lugar Cooperative Threat Reduction
Warhead Safety and Security Exchange



- Russian MPC&A Program
- FSU Threat Reduction
- Fissile Material Monitoring



- Cooperative Monitoring Center

2000s

Multilateral Cooperation on Interdiction (PSI)
UNSCR 1540, GICNT



- Information Assurance
- Warhead Monitoring
- Bilateral Transparency



- Megaports
- Second Line of Defense



- Radiological Threat Reduction
- WMD Detection
- IAEA Support
- Next Generation Safeguards

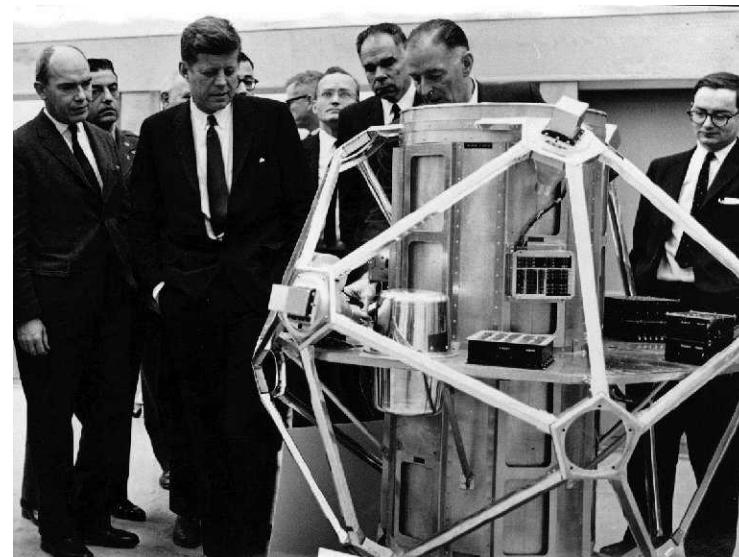
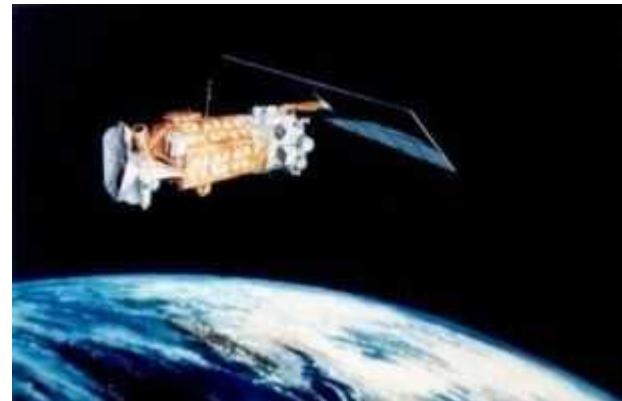
Historical Contributions: National Technical Means

Detection of Atmospheric Nuclear Explosions

- **Satellite systems**
- **Developed optical and EMP sensors for satellite deployment**
- **Ground-based radionuclide detectors**
- **Data systems and analysis**



Bhangmeter (optical sensor)



President Kennedy inspecting the VELA satellite

Historical Contributions: Development of Verification Systems

US-USSR Joint Verification Experiment

Soviets Prepare For Verification At Nevada Site

SANDRA BLAKESLEE, Special to the NY Times
Monday, August 15, 1988

For the first time, teams of Soviet scientists have converged on the nuclear test site in the Nevada desert.

One team has lowered Russian-made cables into a shaft 36 feet from a 2,020-foot-deep shaft holding an American-made nuclear device, and a second team has set up instruments on the California-Nevada border to monitor shock waves from the nuclear device when it is detonated on Wednesday.

"This is unquestionably an historic event," said Ambassador C. Paul Robinson, chief United States negotiator at the United States-Soviet Nuclear Testing Talks in Geneva. 'Joint Verification Experiment'.

JOINT VERIFICATION EXPERIMENT 2
Information Product
Semipalatinsk Explosion on September 14, 1988
Technical Reference Manual
Version 1.0
November 5, 1993
Contributed by

IGPP Institute of Geophysics & Planetary Physics	UN University of Nevada at Reno	UW University of Wisconsin at Madison	CU University of Colorado at Boulder	LDEO Lamont- Doherty Earth Observatory Columbia University	IPE Institute of Physics of the Earth Russian Academy of Sciences	DMC Data Management Center	GEOSCOPE Institut du Physique du Globe, Paris Institut du Physique du Globe, Strasbourg
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Prepared by

IRIS's Joint Seismic Program Center

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On September 14, 1988 the Soviet Union conducted an underground nuclear explosion in Eastern Kazakhstan, near the southern edge of the Shagan River subregion of the USSR's main nuclear weapons test site near Semipalatinsk. In this information product, we present seismic records of this explosion which were obtained both regionally and telesismically inside the USSR. In addition to records directly related to this experiment, included in this information product are seismograms observed at the Soviet Geophysical Observatory at Borovoye, Kazakhstan, at U.S. Global Seismological Network stations and at French GEOSCOPE stations outside of the U.S.S.R.

Historical Contributions: Development of Verification Systems

Verification Options for Intermediate Range Nuclear Forces (INF) Treaty

- Design and evaluation of portal-perimeter monitoring system
 - Technical On-Site Inspection (TOSI) facility on Kirtland Air Force Base
- Verification of permitted missile production
 - Radiographic methods
 - Physical measurements
- Technical cooperation with USSR to evaluate verification approaches
- Technical and operational support
 - Installation of monitoring systems at Votkinsk, Russia



TOSI facility at Kirtland Air Force Base



Model of Votkinsk monitoring system



Model of INF monitoring system

Historical Contributions: Development of Verification Systems

Participation in Group of Scientific Experts for CTBT

- International group of seismic experts developed basic design for international seismic monitoring system
- Coordinated national R&D efforts
- Conducted tests of data handling and analysis procedures
- Hands-on experience supported treaty text on verification

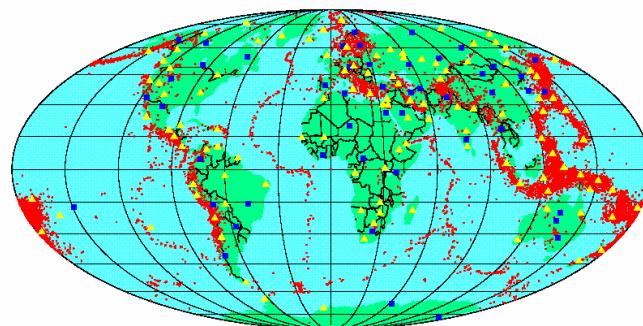


GSE Meeting March 1978



Ola Dahlman
Chair of GSE

Proposed IMS Auxiliary Seismic Stations



Historical Contributions: International Technical Cooperation

US / Russia Warhead Safety and Security Exchange (WSSX)

- **Agreement between the United States and the Russian Federation**
 - Signed in 1994, extended in 2000, expired in 2005
- **Provides for sensitive but unclassified technical exchanges in three areas**
 - Safety and security of nuclear warheads
 - Technologies for potential future nonproliferation initiatives
 - Technologies to combat nuclear-related terrorism
- **Examples of projects**
 - Warhead and fissile material monitoring
 - Warhead safety in storage
 - Warhead authentication
 - Tamper-indicating devices
 - Dismantlement transparency
 - Accident characterization and response
 - High explosives aging
 - Combating terrorism



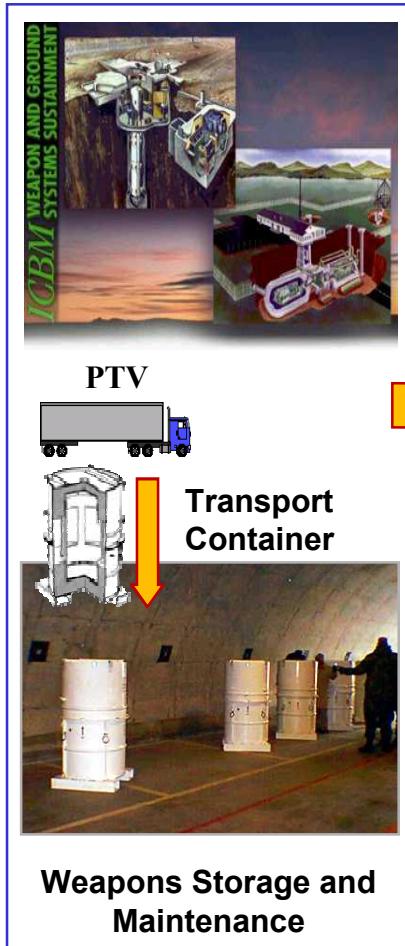
The national laboratories will play a critical role in development and evaluation of verification systems for future arms control

- **Evaluation of impact of treaty options and development of verification technologies and approaches**
 - Fissile material declarations
 - Warhead declarations
 - Warhead dismantlement
 - Production infrastructure
- **US/Russia cooperation on development, testing, and demonstration of technologies and approaches**
- **Technical cooperation with P-5 and other states on verification and transparency**
- **Development of national capabilities for verification and detection**

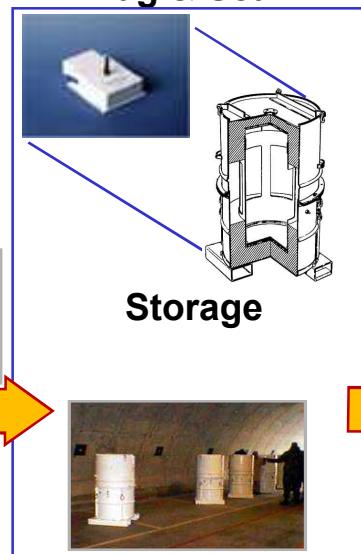
Preparation for the Future: Test and Evaluation of Monitoring Options

Warhead Monitoring Technology Project

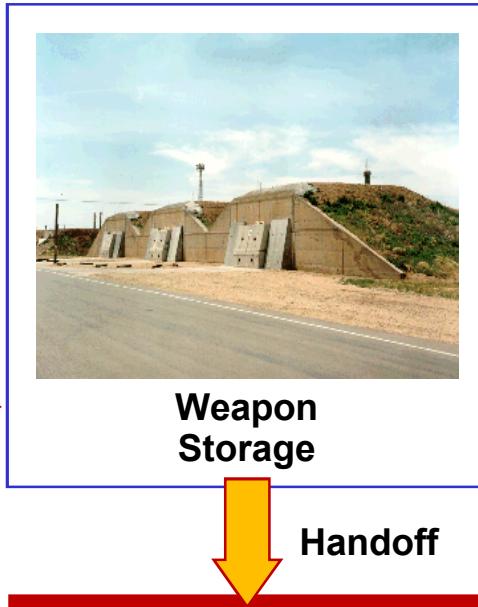
Main Operating Base Launch Facilities



Long-Term DoD Storage Tag & Seal



DOE/Pantex



Scenario Objectives:

1. Capture treaty-accountable warheads (TAI) in quantity during baseline inspection
2. Maintain safe, secure continuity of knowledge during transportation and storage
3. Minimize impact on site operations and protect classified information

Dismantlement



Preparation for the Future: Test and Evaluation of Monitoring Options

Russian “Warhead Safety and Security” Tests and Evaluations

- **Test Scenario**

- Operational site storage monitoring
- Monitored transportation (rail and road)
- Central storage monitored
- Russian military nuclear experts conducted testing

- **Testing Facilities**

- Storage Magazine
- Rail Car Test Beds
- Central Monitoring Facility

- **Test and Evaluation**

- Automated Monitoring and Inventory System – Storage (Apr 05)
- Automated Monitoring Inventory System - Transportation (Jun 07)
- End-to-End System Tests – projected for Mar 09 – Terminated (Dec 08)

St. Petersburg, RU Model Test Site (MTS)



Storage Magazine



Rail Car Test Bed



Kamaz Truck



Central Monitoring Facility



Storage T&E



Transportation T&E

Preparation for the Future: Test and Evaluation of Monitoring Options

The Cooperative Monitoring Center as Nuclear Arms Reduction Laboratory



Technology Training Demonstration Area

Facilities



CMC-Amman



NATO Bunkers:
Simulated Warhead Storage Monitoring



Outdoor Test Facility



DTRA TEAMS Site: Test and Evaluation of Radiation Detection

Partners

- Lawrence Livermore National Laboratory
- Los Alamos National Laboratory
- Other national laboratories
- Texas A&M University
- International Atomic Energy Agency
- UK Atomic Weapons Establishment
- Rosatom (VNIIA, VNIEF, VNIITF)
- Brazil: Lasal safeguards lab
- Fudan University, China

Capabilities

- Visiting Research Scholars
- International Business Infrastructure
- Test and Evaluation
- Training

Summary

- The U.S. national security laboratories have played a critical role in nuclear arms control since the 1960s
 - Development of national means for verification
 - Evaluation of impact of nuclear arms control measures
 - Technical support for treaty negotiations
 - Development of verification systems and approaches
 - Technical cooperation to develop international approaches to verification challenges
- The laboratories will be essential to developing credible approaches to future verification challenges
 - National and international test and evaluation of verification options
 - Development of new technologies and approaches