Weapon Storage Technology Demonstration Facility

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Abstract

The goals of the Weapon Storage Technology Demonstration Facility is to (1) improve monitoring of weapons storage facility security status, (2) to improve detection of unauthorized access into the storage facilities, and (3) enhance inventory accounting of weapons in storage. The All-Russian Research Institute of Automatics (VNIIA, Moscow), with the support of Sandia National Laboratories has established the Weapon Storage Technology Demonstration Facility (STDF) and is currently using the test bed to evaluate various technologies for ensuring the safety and security of hazardous item storage.

The test bed is composed of a simulated storage facility and a remote (15km) monitoring facility. The STDF is used to test various combinations of components and subsystems and to demonstrate the operational performance of such devises before deployed to storage sites. The STDF facility has the flexibility and capacity to test a variety of systems in different configurations. As a "hands-on" laboratory, the STDF is designed to meet a wide range of operational needs for storing a variety of hazardous items including radioactive explosive materials. It is particularly applicable to testing the integration of technical devices with operations procedures used at storage facilities.

In the future, the STDF will be used as tested for demonstrating various technologies related to disarmament, transparency during dismantlement, and the spectrum of arms control technical issues. In particular, VNIIA is adapting warhead authentication technologies using the gamma spectroscopy equipment with secure information capabilities for characterizing material type and quantity in storage containers. Advanced non-nuclear techniques are also being investigated and tested at the STDF. These techniques include enhanced tags, seals, x-ray graphics, and ultrasonic methods. The test bed is equipped for conducting tests with pulsed power and constant radiation sources (neutron, x-ray generators, isotopic sources, etc.) for the purposes of container/cargo characterization.

VNIIA invites other Russian institutes, the European Institutes, and the US National Laboratories to take advantage of the Weapon Storage Technology Demonstration Facility in Moscow. This facility has been designed as a multi-program testing facility and is prepared to host the testing of a full spectrum of storage technologies in a simulated operational storage environment.

Introduction

The All-Russian Research Institute of Automatics (VNIIA) in Moscow, with the support of Sandia National Laboratories, has established the Weapon Storage Technology Demonstration Facility (STDF).

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000.

DISCLAIMER

The demonstration facility, as seen in Figures 1, provides a flexible and centrally located test bed facility that is designed to meet the cooperative technology demonstration requirements for a wide range of U.S. and Russian initiatives involving the safety, security, and accounting of nuclear warheads. This open-access facility provides a unique opportunity and capability for testing technical options for supporting arms control and weapon dismantlement activities. The STDF is located in Moscow and therefore offers the unique advantage for (1) implementing technical design concepts, (2) easy access to Russian made equipment, (3) installing and performing integrated testing of equipment and procedures, and (4) facilitating technical demonstrations between US program managers and Russian decision makers.

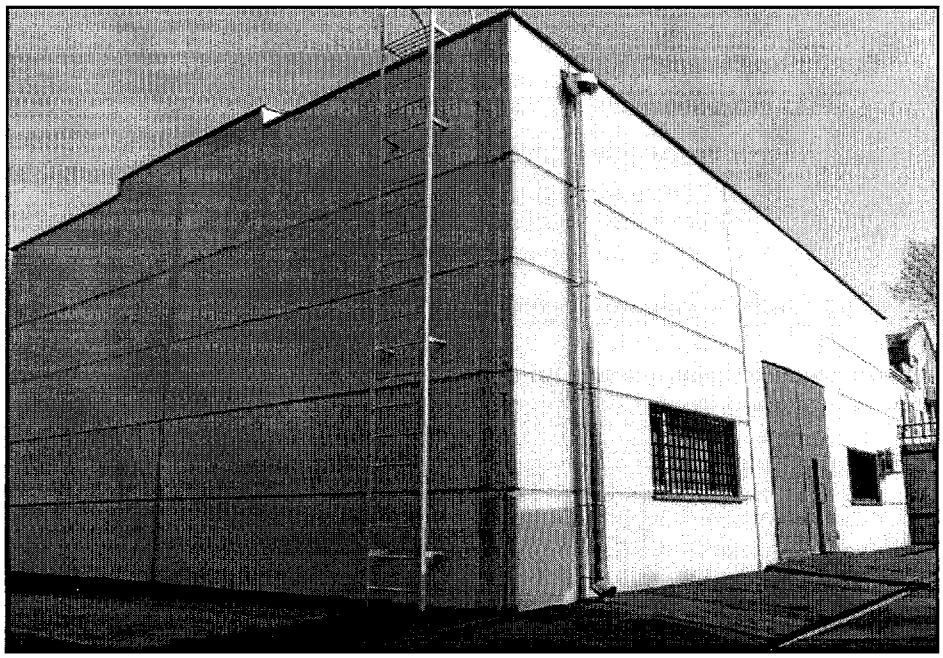

Figure 1: Storage Technology Demonstration Facility (STDF) in Moscow provides easy access to both Russian and US experts.

VNIIA recognized the need for the Storage Technology Demonstration Facility in 1998. At that time, Sandia National Labs and VNIIA began developing a concept for the Warhead Storage Monitoring Experiments and needed a facility for integrating and testing the effectiveness of equipment to ensure the safety and security of hazardous items during long-term storage. The STDF, located in the southern section of Moscow, was refurbished and began test bed operations in December 1999.

The project goals of the Warhead Storage Monitoring Experiments were (1) to improve monitoring of weapons storage facility security status, (2) to improve detection of unauthorized access into the storage facilities, and (3) to enhance inventory accounting of weapons in storage. To meet these goals, VNIIA proposed the configuring the STDF as an unclassified representation of the functional activities that are typically performed at Russia's Ministry of Defense (MOD) weapon storage

facilities. Figure 2 illustrates the test bed's current configuration used by VNIIA to conduct tests on the Advanced Monitoring Inventory System (AMIS).

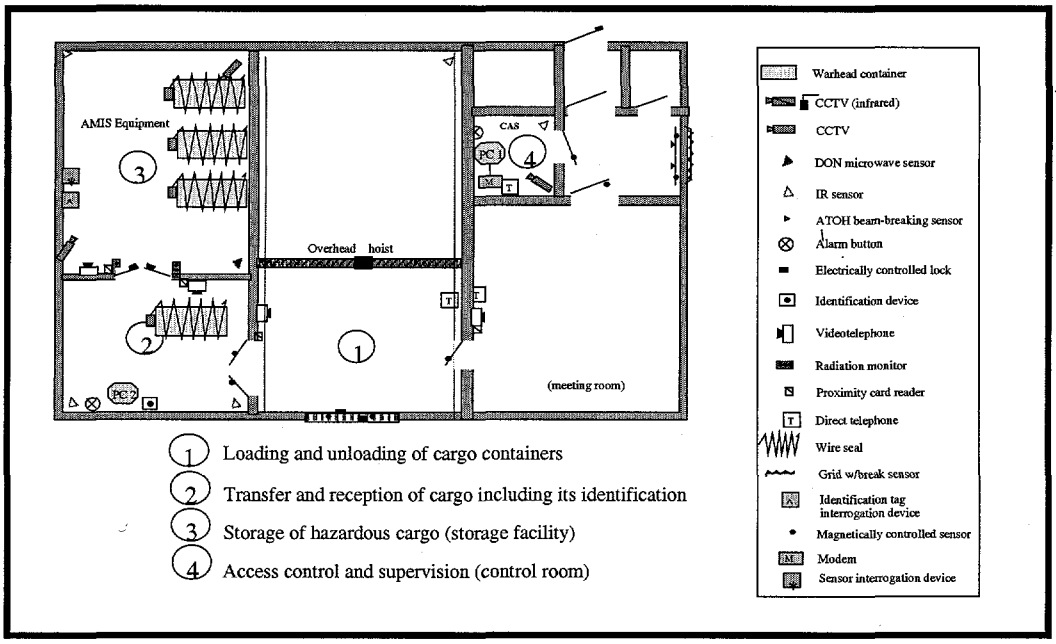

Figure 2. The STDF configured for testing the Advanced Monitoring Inventory System (AMIS).

The Advanced Monitoring Inventory System (AMIS) is an excellent example of the importance of having a test bed that permits objective prototype testing of concepts. The test bed provides a low cost and flexible facility for evaluating both the technical performance of hardware and the development of preliminary operational procedures.
For example, SNL, and VNIIA researchers in cooperation with Eleron experts on physical protection and MOD experts are together exploring potential roles for technology in remote monitoring of stored warheads.

The STDF gives researchers and engineers the opportunity to experiment with a variety of equipment, software, and procedures in order to gain confidence on a limited scale. By conducting demonstrations at the facility, it gives project officers at Minatom and the Ministry of Defense (MOD) an opportunity to see the interactions between the technology and simulated operations. These demonstrations are important because they illustrate the capabilities and limitations of technologies for implementing policy directives involving the safety and security of warheads. It goes without saying that neither the US or Russian research laboratories are involved in policy development, however, they *develop the technical capabilities that compliment policy implementation*. This is the primary function of the STDF.

The following two projects are examples of how VNIIA is using the STDF as a tool to support technology development and to assist policy implementation.

In the first example, as mentioned earlier, the STDF is currently engaged is testing the Advanced Monitoring and Inventory System (AMIS). By configuring the STDF to represent the typical functions at a weapon storage facility, both engineers and operators have the opportunity to evaluate the proposed suite of AMIS equipment in an environment that offers numerous advantages:

- Flexible layout of equipment permits quick configuration changes
- "Building block design" permits the testing of equipment from component level, to subsystems, and also at complete systems level testing.
- Responsive technical support for equipment change outs and maintenance.
- Minimum investment and cost for acquiring critical data.
- Customers and users can get "hands on" experience with demonstrations.

Operationally, the AMIS "demonstration scenario" begins with the arrival of a weapon or hazardous cargo on a truck. The truck is cleared into the storage facility and is parked in room (1), where the cargo is offloaded using an overhead crane. The container is then moved by dolly into room (2). Room (2) is the transfer and reception area in which the container is inspected and the cargo is verified by both technical and procedural means. Also, in room (2), a security and inventory monitoring device is attached to the container and the cargo is registered into the inventory of the storage facility. Under strict procedures, access is granted to the vault of storage room (3) and the container is docked at a designated station in the vault (see Figure 3). Once the cargo is positioned in the storage room (3) and the room is secured, the remote monitoring systems for each container begin periodic reporting of both security and inventory status. All containers in storage periodically report their status to both the on-site central alarm station (4) and to the remote video and data monitoring site many kilometers away at VNIIA's main laboratory facility.

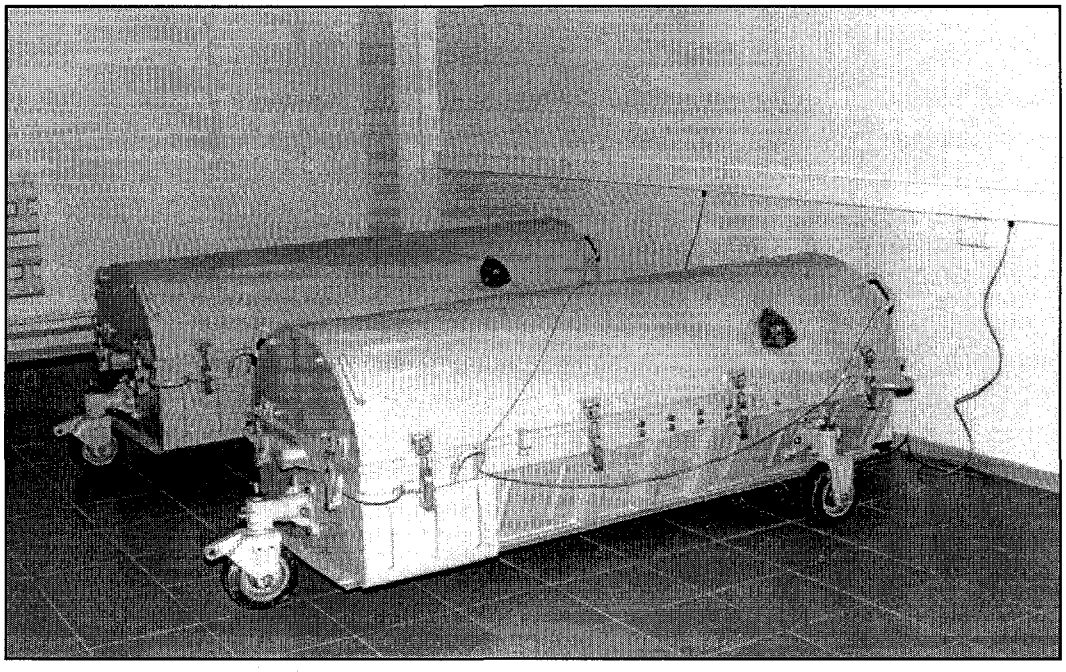

Figure 3. The test bed facilitates the test and evaluation of safety, security and inventory monitoring technologies.

Another key advantage in the testing of systems at the STDF is the relative ease of access to the technical opinions and advice of MOD and Minatom officials. This frequent and easy access is important for developing test plans, identifying operational requirements, and maintaining schedule milestones. VNIIA provides comprehensive technical and project support at the STDF, with emphasis on integrating functional performance and operational requirements in the development of test plans. Testing prototype systems typically includes an extensive review of the equipment's specifications and by analysis, extending the performance of individual items to the performance of the complete system in its intended operational environments. The objective, of course, is to ensure that the system does not inappropriately restrict normal operations or that its operation is not too difficult for personnel to perform in the field.

A second example of the utility of the STDF test bed is illustrated by cooperative work between VNIIA and PNNL on developing Non-Radiation Methods of Warhead Identification technology. This project is investigating three candidate methods of warhead identification:

1. Neutron interrogation.
2. X-ray interrogation.
3. Acoustic passport signatures.

The STDF is equipped for conducting tests with pulsed power and constant radiation sources (neutron generators, x-ray generators, isotopic sources, etc.) for the purpose of container and cargo characterization. Experts from the US, Israel, and Belarus, have collaborated with the Minatom experts and Russian military officers. VNIIA experts are directing the tests and have successfully completed the first phase of testing by evaluating neutron and x-ray interrogation/identification methods. Because of the flexibility of the building interior layout, excess power capacity, protection against radiation, 24-hour security, and meeting rooms, the project is progressing on schedule and the test bed has demonstrated its important mechanism for communication and technical exchange.

VNIIA plans to expand the effort at the STDF in FY01 to include testing or demonstrating various technologies related to disarmament, transparency during dismantlement, and the spectrum of arms control technical issues. In particular, VNIIA plans to expand its work using gamma spectroscopy equipment with secure information capabilities for characterizing material type and quantity of materials in storage containers. Other areas of development and testing will include enhanced tags, seals, and x-ray graphics, and the use of ultrasonic methods for material monitoring.

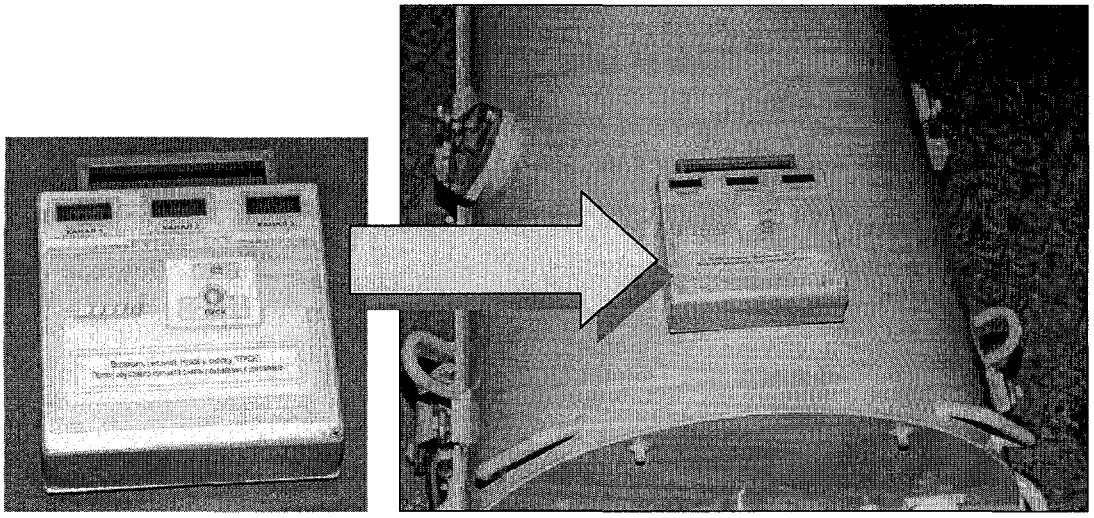

Figure 4. Gamma spectroscopy equipment and other nuclear materials monitoring devises are being used and tested at the STDF test bed.

VNIIA invites other Russian institutes, the European Institutes, and the US National Laboratories to take advantage of the Weapon Storage Technology Demonstration Facility in Moscow. The staff supporting the STDF is exceptionally qualified to conduct controlled experiments and the facility provides the versatility needed to evaluate diverse technical options supporting arms control and dismantlement transparency. This facility was designed as a open-access multi-program testing facility and is prepared to host the testing of a full spectrum of storage technologies in a simulated operational storage environment.