EXECUTIVE SUMMARY

At the March 21, 1997, Helsinki Summit, Presidents Clinton and Yeltsin underscored their interest in further nuclear warhead reductions beyond START I and START II, as well as the need to monitor nuclear warhead inventories, nuclear warhead dismantlement, and fissile materials resulting from warhead reductions. Progress in these areas would further U.S. efforts to reduce the nuclear danger and strengthen strategic stability and nuclear security. In anticipation of an agreement requiring further warhead reductions and the monitoring of warhead dismantlement, the Department of Energy (DOE) Office of Arms Control and Nonproliferation commissioned a technical study in the Fall of 1996 to identify ***transparency*** and ***verification*** options that could be implemented at DOE facilities to monitor warhead dismantlement. For the purposes of this study, **transparency** refers to measures that provide ***confidence*** that a declared activity is taking place, and **verification** refers to measures that ***confirm*** that a declared activity is ***actually*** taking place.

A nuclear warhead generally consists of an assembly containing a "pit", a Canned SubAssembly (CSA), high explosive (HE), and other non-nuclear components. As defined by DOE, the warhead dismantlement process, which includes activities that occur at the Pantex and Y-12 facilities, involves the storage of nuclear warheads, onsite transportation, warhead disassembly, plutonium (Pu) and highly enriched uranium (HEU) component storage, and non-nuclear component disposition. A warhead is considered to be fully dismantled when the HE is removed from the "pit." After dismantlement takes place, the "pits" are stored at Pantex in Zone 4 and the CSAs are shipped to the Oak Ridge Y-12 Plant for disassembly and storage. The "pits" stored at Pantex await future disposition, which is beyond the scope of this study.

Options for Monitoring Warhead Dismantlement

The DOE study group identified ten (10) key activities that could be used as part of a warhead dismantlement monitoring regime:

- *Declarations of dismantlement schedules, warheads, and components resulting from the dismantlement process;*
- *Spot checks of the weapons receipt and storage areas and component storage areas to confirm the declarations, including the use of radiation signatures of the weapons and components;*
- *Remote monitoring of the weapons receipt and storage areas and component storage areas;*
- *Chain-of-custody of warheads and components from the storage areas to the dismantlement areas;*
- *Portal Perimeter Continuous Monitoring (PPCM) to inspect every item that passes into and out of a segregated portion of the dismantlement area;*
- *Chain of custody of warheads and components within the dismantlement area;*
- *Sweeping or sanitizing the disassembly bay or dismantlement cell before and after dismantlement;*
- *Remote monitoring or direct observation of the dismantlement process;*
- *Chain-of-custody of nuclear components from the dismantlement areas to the component storage areas after dismantlement has occurred;*
- *Monitoring of the non-nuclear components of the warhead, such as the high explosive and warhead electronics, after dismantlement has occurred.*

The range of options available for monitoring warhead dismantlement is considerable. Based on the ten monitoring activities listed above, four options were considered in this report with varying levels of confidence in dismantlement and intrusiveness:

Option 1: Monitoring of warheads and components in the storage area and chain of custody monitoring to and from the gate to the dismantlement area.

Option 2: Option 1 ***plus*** portal perimeter continuous monitoring (PPCM) of a segregated portion of the dismantlement area dedicated to monitored dismantlement.

Option 3: Option 1 ***plus*** further chain of custody procedures to monitor warheads and components within the dismantlement area and to and from the disassembly bays and dismantlement cells (without PPCM).

Option 4: Option 1 ***plus*** direct observation or remote monitoring of the dismantlement process inside the disassembly bays and dismantlement cells.

As a result of the significant cultural changes regarding openness at DOE and its nuclear weapons complex over the past four years, all of the dismantlement monitoring options listed above could be applied at either the ***Confidential/National Security Information (C/NSI)*** level or at the ***Restricted Data/Formerly Restricted Data (RD/FRD)*** level, with differing levels of confidence that dismantlement is occurring.

Each of the four options was evaluated against the following seven evaluation criteria:

- ***Level of confidence*** - *the level of confidence that dismantlement has taken place produced by each option.*
- ***Negotiability*** - *a judgment of the relative ease with which the monitoring option may be accepted by the Russian Federation.*
- ***Inadvertent loss of classified information*** - *the possibility that a Russian inspector, by being present at a dismantlement facility, could either accidentally or intentionally gain access to classified information not intended to be shared with the inspectors.*
- ***Impact on operations*** - *the disruption to on-going operations at the DOE nuclear weapons complex not related to the dismantlement of excess nuclear weapons, such as stockpile surveillance and maintenance activities.*
- ***Operational readiness*** - *the time needed for a DOE dismantlement facility to be ready to host inspections, including the time required for construction and physical modifications, if needed.*
- ***Cost to prepare for and host the first inspection*** - *including any physical or procedural modifications that would need to be made to prepare for and host the first inspection.*
- ***Routine cost of hosting each inspection*** - *the recurring cost of each routine inspection after the initial inspection has taken place.*

The results of the analysis of the four dismantlement monitoring options are summarized below.

		Confidence in Dismantlement	Negotiability	Inadvertent Classified Information Loss	Impact on Operations	Operational Readiness [1]	Cost of First Inspection [2]	Routine Inspection Cost [2,3]
Option 1	C/NSI	Low	High	Low	Low	1 year	$2.5 M	$0.12 M
	RD/FRD	Moderate	Low–Mod.	Low–Mod.	Low	1 year	$2.5 M	$0.12 M
Option 2	C/NSI	Moderate	Low	Low–Mod.	Moderate	2 years	$12.0 M	N/A[4]
	RD/FRD	High	Low	Moderate	Moderate	2 years	$12.0 M	N/A[4]
Option 3	C/NSI	Moderate	Moderate	Moderate	Moderate	1.5 years	$6.5 M	$0.2 M
	RD/FRD	Mod.–High	Low–Mod.	Mod.–High	Moderate	1.5 years	$6.5 M	$0.2 M
Option 4	C/NSI	Moderate	Low	High	High	2 years	$6.5 M	$0.2 M
	RD/FRD	High	Low	High	High	2 years	$6.5 M	$0.2 M

[1] Operational readiness refers , for example, to the time required for construction and physical modifications.

[2] Cost estimates are planning estimates only for Pantex and do not represent official estimates for budget purposes.

[3] Routine inspection costs are shown for one inspection, and several such inspections would likely be performed each year.

[4] Option 2 assumes permanent presence of inspectors at a cost of $5.5 million per year.

General Conclusions

Any treaty involving the monitoring of nuclear warheads, nuclear warhead dismantlement, and stockpiles of fissile materials will have a significant impact on DOE. By Presidential order, DOE has the nation's responsibility to maintain a safe, secure, and reliable nuclear warhead stockpile and to ensure that excess nuclear warheads are dismantled safely in accordance with arms control requirements. In order to minimize both the disclosure of sensitive information and the impact on stockpile surveillance and maintenance activities at Pantex, there may be some significant advantages in using a dedicated dismantlement facility such as the Device Assembly Facility (DAF) at the Nevada Test Site.

Assuming that the item which arrives at the dismantlement facility is a nuclear warhead, either warhead dismantlement ***transparency or verification can be achieved*** by implementing the monitoring activities identified in this report. Transparency in the warhead dismantlement process can be achieved by a combination of monitoring activities with up to a moderate level of confidence that dismantlement has taken place ***without requiring an Agreement for Cooperation*** to exchange classified information. Verification of warhead dismantlement will require the exchange of Restricted Data or Formerly Restricted Data (RD/FRD) under an Agreement for Cooperation.

Determining that an item to be dismantled is actually a nuclear warhead is much more difficult, and may require the use of both chain-of-custody procedures from Department of Defense (DoD) facilities (e.g., from a delivery vehicle, deployment site, or weapons storage depot) to the dismantlement facility and the use of warhead radiation signatures to correlate the signature of a given warhead with those of its components following dismantlement.

A distinction between strategic versus tactical nuclear warheads, or between warheads of different types, can only be made before the warhead arrives at the DOE dismantlement facility. Thus, if START III requires that such a distinction be made, a chain-of-custody regime may be needed beginning with the removal of the warhead from a delivery vehicle, deployment site, or from a DoD weapons storage depot.

Next Steps

Since a determination of specific warhead type, or of strategic versus tactical warhead, can only be made in conjunction with collateral information obtained outside of the DOE dismantlement facility, an analysis of potential warhead dismantlement monitoring procedures at DoD facilities should be conducted. Such a study should identify potential monitoring procedures that could be implemented at various stages of DoD custody of the warhead, including:

- *When the warhead is on the delivery vehicle and during the time of removal from the delivery platform;*
- *The appropriate starting point for chain-of-custody procedures for gravity bombs and cruise missiles, which are typically stored or staged in a location separate from the delivery system;*
- *When the warhead is at a weapon storage depot or other storage location where retired weapons are stored prior to being picked up by Safe, Secure Trailers (SSTs) for transportation to the DOE dismantlement facility.*

The U.S. should also undertake a study to identify and evaluate options for warhead dismantlement monitoring that could be implemented in the Russian nuclear weapons complex. Such a study should address issues associated with the significant asymmetries between the U.S. and Russian nuclear weapons programs, particularly the fact that whereas the DOE Pantex Plant is the only active U.S. dismantlement facility, Russia has four dismantlement facilities.

A more in-depth ***quantitative*** analysis is needed for all the options. This analysis should quantitatively evaluate the inadvertent loss of classified information, impact on operations, cost, and confidence level associated with each option.

In-depth analysis should also be conducted in the following areas:

- *Advantages and disadvantages of warhead radiation signature measurement methods;*
- *Security and vulnerability issues associated with radiation measurements on nuclear warheads and components;*
- *Cost, schedule, and impact issues associated with the use of a dedicated dismantlement facility such as the Device Assembly Facility (DAF) at the Nevada Test Site or a new, dedicated dismantlement facility incorporating monitoring measures;*
- *Options that can be implemented at DOE facilities to promote "...the* ***irreversibility*** *of deep reductions including the prevention of a rapid increase in the number of warheads," as required by the Helsinki Summit statement.*