

isfy the mission need, with the goal of fielding an NBC-specific strike capability.”¹¹² The United States is examining what kinds of weapons will be necessary to attack a chemical or biological weapons site, with the capability to destroy those weapons in any such attack. Such a capability could be conventional or nuclear.

The Secretaries of Defense and Energy have described the need for the program as follows:

Physical destruction of hard and deeply buried structures is not enough if the WMD – for example, a biological agent stored inside the facility – remains viable or is released into the environment. This could cause casualties to innocent civilians and allied forces, and result in environmental contamination – either of which could hinder allied forces operations and/or movements.¹¹³

A comprehensive description of the ADW program comes from the same report:

The Air Force Agent Defeat Weapon Program was initiated in response to a Combat Air Force Mission Need Statement. The objective of the current Concept Exploration and Definition acquisition activity is to develop an agent defeat weapon to neutralize, destroy, or deny access or immobilize CW/ BW agents and their associated weapon and delivery systems. All agent defeat weapon concepts will minimize collateral damage and effects and be deliverable by current Air Force platforms... The Agent Defeat Warhead (ADW) Demonstration (ADWD) program objective is to develop and demonstrate a warhead with a payload specifically tailored for use against fixed ground targets associated

with the development, production, and storage of chemical (C) agents, biological (B) agents, and CB weapons (CBW). The U.S. Air Force is conducting the Agent Defeat Weapon (ADW) program to develop the capability to destroy, neutralize, immobilize, or deny an adversary access to biological and chemical agents with little or no collateral damage. The effort is currently in concept exploration. Studies are being performed to identify and evaluate concepts to satisfy the mission need, with the goal of fielding an NBC specific strike capability. All concepts must comply with relevant arms control treaties. Analysis tools being developed to support ADW include Agent Release models, Internal Dispersion and Venting models, and a Lethality model to evaluate inventory and conceptual weapon effectiveness against NBC/M targets.¹¹⁴

Both these programs may lead to the development of modified or new nuclear weapons. They also have inspired ideas for new capabilities. It is likely that the development of a range of new, smaller yield nuclear weapons tailored for specific purposes would lead to military and political pressure for their use. Certainly, there is an enhanced risk that tailored effects nuclear weapons would be seen as more useable. This is discussed in the next section of this report.

A Role for Nuclear Weapons

In both the ADW and the HDBT programs, nuclear weapons are thought to be essential. A report to Congress in October 2001 made the role of nuclear weapons in the destruction of enemy NBC weapons clear.

The *Report on the Defeat of Hard and Deeply Buried Targets* from DOE and DoD to Congress was

¹¹² *Proliferation: Threat and Response, op. cit.*, Section II, p. 90.

¹¹³ *Report to Congress on the Defeat of Hard and Deeply Buried Target*, Section 2.3, The Challenge of WMD, p. 10.

¹¹⁴ Description of the ADW Program found at <http://www.globalsecurity.org/military/systems/munitions/adw.htm> on June 29, 2003.

mandated by Section 1044 of the National Defense Authorization Act for Fiscal Year 2001, inserted after a push led by Senators John Warner (R-VA) and Wayne Allard (R-CO). It was scheduled for delivery to Congress by July 1, 2001, but was finally submitted in October 2001. The document shows clearly that nuclear weapons are an intrinsic part of defeating hard and deeply buried targets, and chemical and biological agents. If DoD 'has not defined a requirement' for a nuclear weapon for this purpose, it is only because DoD is *currently* defining such a requirement. This requirement would meet a Mission Needs Assessment (MNA) identified by the Air Force and the United States Strategic Command (USSTRATCOM) in 1994, for a weapon to defeat Hard and Deeply Buried Targets (HDBT) and NBC weapons. The report also describes the intrinsic value of lower-yield nuclear weapons.

A classified study called *Project Sand Dune* started to address the role of nuclear weapons in HDBT defeat in 1997. The study was completed in the first quarter of 1999. This study was undertaken because "...the HDBT Defeat AoA [Analysis of Alternatives] had focused on conventional solutions and highlighted an inability to destroy all HDBTs with current or projected weapons..."¹¹⁵ The study looked at nuclear weapons that could fulfill the Air Force and USSTRATCOM Mission Needs Analysis (MNA) from 1994 for a HDBT Defeat Weapon.

The current situation on both HDBT defeat and NBC weapons agent defeat is set out in Section 5 of the report to Congress. On nuclear weapons for HDBT it says:

There is no current program to design a new or modified HDBT Defeat nuclear weapon. However, DoD and DOE continue to consider and assess nuclear concepts that could address the validated mission needs and

CRD [Capstone Requirements Document]. They have formed a joint Nuclear Planning Group to define the appropriate scope and option selection criteria for a possible design feasibility and cost study.¹¹⁶

The report is even more explicit concerning the role of nuclear weapons in NBC weapons Agent Defeat, they are described as having "a unique ability to destroy both agent containers and CBW agents."¹¹⁷ Accuracy and penetration are important as, given those characteristics, the report says that a lower-yield weapon can be used with less collateral damage. The report also notes that current weapons are not well adapted for this purpose. Interestingly, seemingly referring to the B61-11 which is a 'dial-a-yield' bomb with yields as low as 0.3kt, it says that the lower yield version of this earth-penetrating nuclear weapon has not been certified.

...it is possible to employ a much lower-yield weapon to achieve the needed neutralization. The ability to use a lower-yield would reduce weapon-produced collateral effects. The current nuclear weapons stockpile, while possessing some limited ground penetration capability and lower yield options (not yet certified), was not developed with this mission in mind.¹¹⁸

To fill this gap, Project Sand Dune led to a planning study that was due to report in early 2002. Due to the classified nature of the study, its outcome is unknown to the author.

The HDBT report to Congress further states that, "The overall objective of HDBT and NBC weapons Agent Defeat S&T Programs is to redress shortfalls in current operational capabilities against future threats. Elements include: ... nuclear weapons"¹¹⁹ and later elaborates, "For

¹¹⁵ *Ibid.*, Section 3, Accomplishments to Date, p. 11.

¹¹⁶ *Ibid.*, Section 5, Programs Responsive to the Capstone Requirements Document, p. 18.

¹¹⁷ *Ibid.*, Section 5, Programs Responsive to the Capstone Requirements Document, p. 19.

¹¹⁸ *Ibid.*

¹¹⁹ *Ibid.*, Section 6, S&T Meeting Future Threats, p. 20.

destruction of more deeply buried facilities, DoD and DOE are studying the sensitivities and synergies of nuclear weapon yield, penetration, accuracy and tactics.¹²⁰ The FY2003 Defense Authorization Act mandated a study on the need for, and possible effects of, a nuclear bunker buster. In addition, Pentagon sources have said on several occasions in private meetings that a military requirement for the RNEP is being prepared, and is expected to be ready by early 2004.

The HDBT report says, "Any development and procurement of advanced nuclear capabilities would be considered in the broad context of nuclear stockpile policy, plans and priorities, as well as future DoD strategic programs."¹²¹ The administration has sent an implementation plan for the NPR to Congress, and is preparing a stockpile memorandum. These documents would provide the necessary context.

Any such full-scale development of a weapon with a yield of less than 5kt would, of course, need to be preceded by the repeal of the Furse-Spratt provision from the FY94 National Defense Authorization Act passed in 1993. Although interpretations of the Furse-Spratt law vary, it seems that current work does not break that law as the concept and feasibility studies precede the research and development phases of the design of a new weapon. The lower-yield version of the B61-11 is a complicating factor, if that is the weapon referenced in the HDBT report, as it needs only to be certified, no research and development would be involved. The administration also has stated during 2002 that larger weapons, such as the B83 are being studied as potential candidates for the HDBT defeat weapon. Due to the larger yield of this weapon, no breach of Furse-Spratt would be entailed.

In its draft FY04 National Defense Authorization Bill, the DoD requested the repeal of the Furse-Spratt legislation. This would allow work on a range of new warhead concepts. To clarify the situation both the House and the Senate have

passed legislation that would allow research work through Phase 6.2a, while obliging the administration to return to Congress to obtain permission to start Phase 6.3 development engineering work, or 'bending metal' as it is colloquially expressed. (See Table 2 for details.) It is unlikely that, with the current Congress and administration, there will be any problems in obtaining permission in future to move from paper studies, to actual development of a new or modified weapon.

NUCLEAR WEAPONS OPTIONS FOR COUNTERPROLIFERATION MISSIONS

The development of counterforce mission needs are now fueling ever more insistent demands for the development of new nuclear weapons. This work now has the explicit support of the administration in the Nuclear Posture Review and in budget requests. One earth-penetrating nuclear weapon (of admittedly limited capability) is already available, but the administration has sought support for another, the Robust Nuclear Earth Penetrator (RNEP), and for a range of capabilities under the Advanced Concepts Initiative (ACI) rubric. All these advanced weapons concepts build on ideas that were developed in the early 1990s. While these plans have accelerated under President Bush, Republican efforts to revive nuclear weapons research and design began during the last years of the Clinton presidency.

Senators Warner and Allard introduced section 1018 of the FY2001 Defense Authorization bill in the spring of 2000. Their intent was to allow a study on "the defeat of hardened and deeply buried targets" and includes "any limited research and development that may be necessary to conduct such assessment." This would have been the first step in overturning the Furse-Spratt legislation of 1993 that prevents the United States from developing new nuclear weapons with explosive yields of less than 5kt.

As the *Washington Post* reported in June 2000, the purpose of the study is to develop "a deep

¹²⁰ *Ibid.*, Section 6 S&T Meeting Future Threats, p.21.

¹²¹ *Ibid.*, Executive Summary, p.4.

TABLE 2: PHASES 6.X LIFE EXTENSION PROCESS

Phase	6.1	6.2	6.2A	6.3	6.4	6.5	6.6
Title	Concept Assessment	Feasibility Study & Option Down-Select	Design Definition & Cost Study	Development Engineering	Production Engineering	First Production	Full-Scale Production
Approval Authority	DOE or DOD (Note 1)	NWC (Note 2)	DOE and DOD	NWC (Note 2)	DOE	DOE	NWC (Note 2)
Estimated Length of Phase	Outgoing process updated annually	9-18 Months	3-6 Months	1-3 Years	1-3 Years	3-6 Months	Variable
Documentation	Phase 6.1 Report	<ul style="list-style-type: none"> · MIR · Phase 6.2 Report · Updated MCs, STS & ICDs · Draft DPP & HPP · PID · IPR Report 	<ul style="list-style-type: none"> · WDCR · Phase 6.2 A Report · DPP & JIPP · Draft PCP · IPR Report 	<ul style="list-style-type: none"> · AERs · Draft Addendum to the FWDR · PCP & BCR · Updated DPP & JIPP · Preliminary DRAAG Report · Approved MCs, STS & ICDs · Preliminary NWSSG Report · IPR Report 	<ul style="list-style-type: none"> · CERs · QERs · PMD · Updated DPP & JIPP · SEP · IPR Report 	<ul style="list-style-type: none"> · MAR · Final DRAAG Report · Addendum to the FWDR and Certification Letter · Updated DPP & JIPP · Pre-Operational NWSSG Report · IPR Report (Note 5) 	<ul style="list-style-type: none"> · End-of-Project Report · Final DPP · IPR Report (Note 5)
Major Reviews (Notes 3 and 4)		IPR	IPR	Preliminary DRAAG Preliminary NWSSG IPR	IPR	Final DRAAG Pre-Operational NWSSG IPR (Note 5)	IPR (Note 5)

Note 1 – For Phase 6.1 activities that are jointly conducted by the DOD and DOE, the NWCSSC will be informed in writing before the onset of the activity.

Note 2 – The NWC may delegate its authority to the NWCSSC at any time.

Note 3 – This does not include the required DOE management reviews or reviews initiated by the cognizant laboratories.

Note 4 – The NWCSSC will periodically conduct reviews to evaluate program milestones, requirements and strategies (e.g. annual POG briefings to the NWCSSC).

Note 5 – An IPR and IPR Report will be required if a conditional MAR is released or an issue develops in Phases 6.5 or 6.6.

AERs – Advanced Engineering Releases

BCR – Baseline Cost Report

CERs – Complete Engineering Releases

DOD – Department of Defense

DOE – Department of Energy

DPP – DOE Project Plan

DRAAG – Design Review and Acceptance Group

FWDR – Final Weapon Development Report

ICDs – Interface Control Documents

IPR – Interlaboratory Peer Review

JIPP – Joint Integrated Project Plan

MAR – Major Assembly Release

MCs – Military Characteristics

MIR – Major Impact Report

NWC – Nuclear Weapons Council

NWCSSC – NWC Standing and Safety Committee

NWSSG – Nuclear Weapons System Safety Group

PCP – Product Change Proposal

PID – Planning Information Document

POG – Project Officers Group

PMD – Program Management Document

QERs – Qualification Evaluation Release

SEP – Stockpile Evaluation Plan

STS – Stockpile-to-Target Sequence

WDCR – Weapon Design and Cost Report

Source: Department of Energy

penetrator that could hold at risk a rogue state's deeply buried weapons" or "threaten a bunker tunneled under 300 meters of granite without killing the surrounding civilian population"¹²² This proposed change in the law was supported by influential figures in the nation's weapons labs such as Paul Robinson, Director of the Sandia National Laboratory who told the *Post* that, "The United States will eventually need a new, low-yield nuclear weapon" because the explosive power of silo-busting thermonuclear warheads designed for the Cold War is "too high" to deter small nations in today's multipolar world.¹²³

As noted in the previous chapter, the Bush administration has now formally requested the repeal of Furse-Spratt. Its draft of the Defense Authorization bill contains the following language:

Section 3136 — the so-called PLYWD legislation — has negatively affected U.S. government efforts to support the national strategy to counter WMD and undercuts efforts that could strengthen our ability to deter, or respond to, new or emerging threats.

A revitalized nuclear weapons advanced concepts effort is essential to (1) train the next generation of nuclear weapons scientists and engineers, and (2) restore a nuclear weapons enterprise able to respond rapidly and decisively to changes in the international security environment or unforeseen technical problems in the stockpile. PLYWD has had a "chilling effect" on this effort by impeding the ability of our scientists and engineers to explore the full range of technical options. It does not simply prohibit research on new, low-yield warheads, but prohibits any activities "which could potentially lead to pro-

duction by the United States" of such a warhead.

It is prudent national security policy not to foreclose exploration of technical options that could strengthen our ability to deter, or respond to, new or emerging threats. In this regard, the ... NPR urged exploration of weapons concepts that could offer greater capabilities for precision, earth penetration (to hold at risk deeply buried and hardened bunkers), defeat of chemical and biological agents, and reduced collateral damage. The PLYWD legislation impedes this effort.

Repeal of the so-called PLYWD law falls far short of committing the United States to developing, producing and deploying new, low-yield warheads. Such warhead concepts could not proceed to full-scale development, much less production and deployment, unless Congress authorizes and appropriates the substantial funds required to do this.¹²⁴

Since the administration is so keen to revive the work done by Project PLYWD, what was that project? What weapons were intended for development under this name, and for what purposes?

Project PLYWD

In 1991, U.S. European Command and Los Alamos National Laboratory were both pressing for development of new tactical nuclear weapons. The Air Force established Project PLYWD (Precision Low-Yield Weapons Design) to research options for new nuclear weapons to meet emerging threats. The weapons labs already had prepared some ideas that formed the basis for the new weapons programs. For example:

¹²² Pincus, Walter, "Senate Bill Requires Study of New Nuclear Weapon," *Washington Post*, Monday, June 12, 2000, p. A02.

¹²³ *Ibid.*

¹²⁴ Sec. 221 of the Department of Defense Draft Defense Authorization Bill for FY 2004.

In Fall 1991, two Los Alamos scientists recommended the development of mini-nukes to counter “well-armed tyrants” in the Third World in an article in *Strategic Review*. The authors suggested four nuclear weapons designs:

- a 10-ton yield penetrating “micro-nuke” to destroy bunkers;
- a 100-ton yield “mini-nuke” to counter ballistic missiles;
- a 1000-ton yield “tiny-nuke” for battle-field attacks; and
- exotic technology warheads.¹²⁵

In 1992 Congress learned that these proposals had become research programs, and that some in the labs were discussing so-called ‘tailored effects weapons’ for use in contingencies in the Third World. As Kristensen and Handler note:

The Energy Department matched its words with deeds. The Department of Energy budget request for FY 1995 specified several Phase I and Phase II studies having taken place in FY 1993 in support of Defense Department missions involving low-yield nuclear weapons, including a “phase I study for Air Force Low Yield Warhead Design.”

In 1993, the Joint Chiefs of Staff also endorsed the utility of low-yield nuclear weapons. In their new “Doctrine for Joint Nuclear Operations,” the Chiefs advocated that, “a selective capability of being able to use lower-yield weapons in retaliation, without destabilizing the conflict, is a useful alternative for the U.S. National Command Authority (NCA).”¹²⁶

This work was brought to an end by the adoption of the Furse-Spratt provision in the FY94 National Defense Authorization Act, prohibiting research and engineering development on warheads with a yield below 5kt. The provision states that:

a) UNITED STATES POLICY — It shall be the policy of the United States not to conduct research and development which could lead to the production by the United States of a new low-yield nuclear weapon, including a precision low-yield warhead.

(b) LIMITATION — The Secretary of Energy may not conduct, or provide for the conduct of, research and development which could lead to the production by the United States of a low-yield nuclear weapon which, as of the date of the enactment of this Act, has not entered production.¹²⁷

However, it was still possible for new nuclear capabilities to be produced within the restrictions of the Act, above the specified threshold. During the 1990s one modified weapon with a new capability entered the arsenal.

The B61-mod 11

The first of these new weapons modifications to reach the nuclear arsenal is the B61-mod 11. This is the eleventh modification of the B61, a bomb that first entered the arsenal in 1968. The B61 is deployed with the U.S. Air Force in strategic and tactical roles. It is believed to be the only U.S. nuclear weapon type now deployed in Europe.

The B61-11 has a wide range of available yields depending on the task for which it is to be used. A DOE report in early September 1995¹²⁸ said that the forthcoming modification could be compared

¹²⁵ Kristensen, Hans, Handler, Joshua, *Changing Targets: Nuclear Doctrine from the Cold War to the Third World*, Greenpeace International, March 1, 1995.

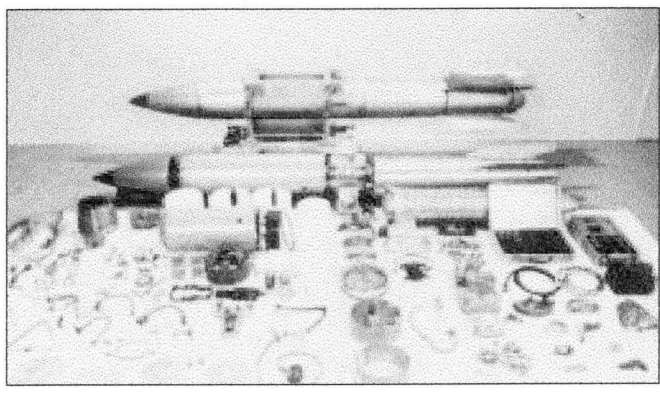
¹²⁶ *Ibid.*

¹²⁷ National Defense Authorization Act for Fiscal Year 1994 (PL 103-160): Sec. 3136. Prohibition on Research and Development of Low-Yield Nuclear Weapons.

¹²⁸ Johnson, Kent, et al., *Stockpile Surveillance: Past and Future*, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, and Sandia National Laboratories, September 1995.

but B1/B2??

7? ↗



B-61

in its effects to the B61-7, which has yields from 10 to 340 kilotons (kt). The B61 can be configured to a yield as low as 0.3kt. The lower end of the yield range would be ideal for military counterproliferation tasks.

And these are exactly the tasks that the military has in mind for the B61. An official of Los Alamos confirmed in 1995 that, “[t]he services are looking at redeploing an existing weapon in such an earth penetrating warhead to address hardened targets...”¹²⁹ The B61-11 is thought to be able to burrow up to 20ft before exploding.

As the British American Security Information Council writes:

) About 50 B61-11 bombs are in the operational stockpile. This weapon is the newest in the U.S. arsenal. First originated in 1993, the Mod 11 is designed as a “bunker buster” — capable of attacking hardened targets underground. The B61-11 is a replacement for the B53, which was assigned the bunker buster role because of its large yield. The Mod 11 is designed to penetrate targets before exploding, and thus in theory does not need as large a yield to fulfill its mission.¹³⁰

The B61-11 was deployed to Europe in 1997, and full deployment was completed in 1998. The United States and NATO have the capability in the European theater to carry out nuclear counterproliferation missions for the defeat of hardened and buried targets, as well as biological and chemical agents.

A New Generation of Nuclear Weapons?

While a clear military requirement has not yet been presented by the Pentagon regarding new roles and capabilities, the NPR stated a mission for nuclear weapons in counterproliferation. Congress has provided small amounts of funding for research work on new capabilities. President Bush spoke in favor of a ‘flexible’ nuclear arsenal during his campaign, and on May 1, 2001, in his major defense policy speech he said:

...[T]his is still a dangerous world; a less certain, a less predictable one. More nations have nuclear weapons and still more have nuclear aspirations. Many have chemical and biological weapons. Some already have developed a ballistic missile technology that would allow them to deliver weapons of mass destruction at long distances and incredible speeds, and a number of these countries are spreading these technologies around the world.¹³¹

He continued:

In such a world, Cold War deterrence is no longer enough to maintain peace, to protect our own citizens and our own allies and friends. We must seek security based on more than the grim premise that we can destroy those who seek to destroy us.¹³²

¹²⁹ *B61-11 Concerns and Background* by the Los Alamos Study Group. This report is available at www.lasg.org and is excellent background reading on the B61-11 bomb.
¹³⁰ Young, Stephen, *Taking the Pulse: Nuclear Warheads*, www.basicint.org available on June 29, 2003.
¹³¹ President Bush’s Speech at the National Defense University, Washington DC, May 1, 2001.
¹³² *Ibid.*

With the NPR release and from subsequent leaked classified sections of the NPR, it became clear that the President was calling for the development of a new nuclear capability. As NNSA Deputy Administrator for Defense Programs, Everett Beckner told Congress in his statement to the Senate Armed Service Committee on March 14, 2002:

The Nuclear Posture Review (NPR) states that the number, composition, and character of the nation's nuclear forces ought to reflect the reality that the Cold War is over and that required capabilities may now need to be different. For example, current weapons in the stockpile cannot hold at risk a growing category of potential targets deeply buried in tunnel facilities, possibly containing chemical, biological, nuclear, or command and control facilities. As a result the NPR endorsed NNSA's Advanced Concepts Initiative that could provide the Nation with options that could be considered for future production and deployment. Also, as required by the NPR, it would provide an opportunity for NNSA and its contractors to exercise critical skills necessary for the long-term sustainment of the nation's defense. By direction of the Nuclear Weapons Council, and in response to an Air Force requirement, the initial focus of the Advanced Concepts Program will be the Robust Nuclear Earth Penetrator (RNEP), for which \$15.5 million is requested in FY 2003 as part of the Directed Stockpile Research and Development activity. The three-year RNEP Feasibility Study will assess the feasibility of modifying one of two candidate nuclear weapons currently in the stockpile to provide enhanced penetration capability into hard rock geologies and develop out-year costs for the subsequent pro-

duction phases, if a decision is made by the Nuclear Weapons Council to proceed.

In response to subsequent questioning, he named the B61-11 and the B83 as the two candidate bombs for the task of striking the hardest and most deeply buried targets.

The B83 was first produced in June 1983. The United States is thought to have deployed some 650 of these weapons. The B83 has a yield of up to 1.2 megatons, a huge explosive capacity. It is likely that this weapon could be modified for use against the deepest of buried and hardened targets because of its potentially enormous explosive yield.

Despite the denial in the legislation that there is any intent at this stage to deploy the weapons that would be developed, media reports suggest otherwise. For example, in an interview with the *San Jose Mercury News*, Fred Celec, the deputy assistant to the secretary of defense for nuclear matters stated strong support for the RNEP saying that if the research is successful, "It will ultimately get fielded."¹³³ Weapons scientists told the *Mercury News* that, "The United States has worked on nuclear earth penetrators for decades, and scientists involved in the project say they expect to succeed..."¹³⁴ According to the paper:

The design contest between Livermore and Los Alamos is expected to last two to three years and cost about \$15 million per year. The winning lab will then shift to an engineering phase, a move that would require congressional approval and funding.¹³⁵

The administration is pressing ahead with the RNEP. Recent reports indicate that after meeting reporting requirements, the planned three year study on research design cost and feasibility will go forward, possibly on an accelerated schedule.

¹³³ Stober, Dan, "Administration Moves Ahead on Nuclear 'Bunker Busters'," *San Jose Mercury News*, April 23, 2003.

¹³⁴ *Ibid.*

¹³⁵ *Ibid.*

Other Advanced Concepts

Some nuclear enthusiasts fear that the B61-11 and other weapons in the arsenal may still be too large, or otherwise inadequate, to perform counterproliferation missions, and that they would cause excessive environmental damage and civilian casualties, thus rendering them unusable as the political consequences of their use would be too high. These advocates for a new nuclear arsenal have called for the development and deployment of so-called 'mini-nukes,' or nuclear weapons tailored for a variety of missions. The NPR also calls for other "nuclear weapon options that might provide important advantages for enhancing the nation's deterrence posture," including "possible modifications to existing weapons to provide additional yield flexibility" and "warheads that reduce collateral damage."

The advanced concepts that the weapons labs had in mind in the early 1990s have not disappeared. Rather, these concepts have been refined. Some idea of what may emerge from the ACL, which the administration initially wishes to fund at the level of \$6 million in FY04, and more in coming years, can be found in the Lawrence Livermore National Laboratory (LLNL) report *Whither Deterrence?* published in 2002.

The report, published by the Center for Global Security Research of LLNL, calls for the development of new warheads by 2015, including a 'Theoretical Enhanced Radiation' (TER) warhead for use against 'manpower intensive targets,' and a 'Reduced Residual Radiation Weapon' (RRR) which would be used to reduce collateral damage and make a nuclear weapon more 'useable politically.' Differing versions of these warheads would be produced for different targets, for example, a TER might be used against a biological weapons target.¹³⁶

On May 20, 2003 the Senate approved the repeal of the Furse-Spratt ban. The House had

previously voted to amend it. Either version would allow research to begin on the kinds of weapons described in this section.

Available Nuclear Weapons

In addition to new weapons research, the United States has a number of nuclear weapons designs already available that could be brought off the shelf and into the arsenal, possibly even without nuclear testing. This design archive has been built up over the years, and some of them are designed to function at the low- or sub-kiloton level required for a mini-nuke.

For example, the 1955 Operation Teapot tests at the Nevada Test Site consisted of 14 tests of low- or medium-yield nuclear devices. Devices tested included the XW-30 fission warhead, tested on February 22, 1955. Predicted to have a 4kt yield, it produced a 2kt yield. These tests were part of a series intended to produce a reduced fallout warhead.

On March 23, 1955, in the same series, the Ess test was of the Ranger Able U-235 core in a Mk-6 HE assembly. Ess stood for "Effects Sub-Surface, and this device was an atomic demolition munition, commonly called a nuclear mine. This produced a yield of 1.2kt.¹³⁷

Either of these devices probably could be manufactured in a form necessary to meet the requirement for a mini-nuke. However, the candidate warhead said to be most favored is the Davy Crockett — the W54.

The Davy Crockett was fielded in Europe from 1961 to 1971. It was designed to be fired from a recoilless rifle, and could even be mounted on a jeep for firing. This was the smallest and lightest nuclear weapon ever fielded by the United States, and also one of its most robust. In tests, the W54 produced yields as low as 0.01kt, or ten tons of TNT equivalent.¹³⁸

¹³⁶ *Whither Deterrence?* Final Report, Center for Global Security Research, Lawrence Livermore National Laboratory, 2002, p. 37.

¹³⁷ Full information on Operation Teapot and all U.S. nuclear weapons can be found at the web page of the Federation of American Scientists, www.fas.org.

¹³⁸ More detailed information about the Davy Crockett can be found at the U.S. Nuclear Weapons Cost Study Product page of the Brookings Institution website at www.brook.edu/FP/projects/nucwcost/davyc.htm.

New designs for weapons built around these warheads would need to be tested. If the warheads were simply rebuilt to original specifications, there would be no need from the pure design point of view to conduct full-scale nuclear tests. If significant modification to physics packages of old weapons designs were involved then a resumption of testing is likely.

However, military commanders are unlikely to accept weapons into the arsenal that have not been fully tested. There is a danger that the pursuit of these new nuclear capabilities, in particular for the Agent Defeat Weapon program, will lead to a resumption of nuclear testing. (This is-

sue is discussed in Chapter Eight.)

It is clear from this discussion that there are some in the DOE weapons labs, as well as amongst DoD civilian appointees who have a strong commitment to the research and development of new nuclear weapons capabilities. This drive for a new generation of nuclear weapons is intensely controversial, and is even the subject of debate in DOE and DoD. In Congress many, even on the Republican side of the aisle, doubt the utility of such weapons and worry about the effects of such policies on the global non-proliferation regime and on U.S. security. (These questions are discussed in Chapter Eight.)