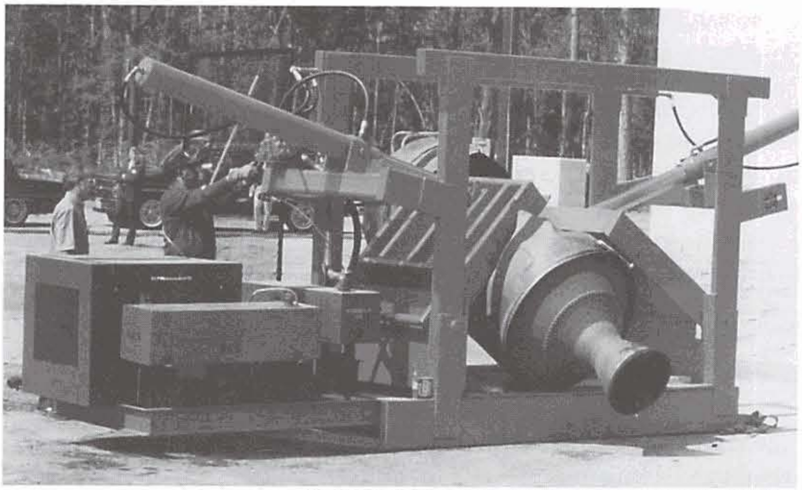
VOLUME 6 NO. 4 and VOLUME 7 NO. 1 OCTOBER 1998

Science FOR Democratic Action

AN IEER PUBLICATION

Achieving Enduring Nuclear Disarmament

BY: ARJUN MAKHIJANI



US ARMY/US AIR FORCE (COURTESY NATURAL RESOURCES DEFENSE COUNCIL)

The rocket motor stage of a Pershing II missile is destroyed at the Longhorn Army Ammunition Plant in Karnack, TX, September 8, 1988. This was the first of more than 200 that were destroyed as a result of the 1987 INF Treaty.

Despite increasing calls for nuclear disarmament throughout the world and among a growing list of prominent figures, the world's nuclear weapon powers seem intent on maintaining nuclear weapons for the indefinite future. Those nuclear weapon states that could offer the greatest leadership on disarmament measures, notably the United States, have shown by their actions and statements that they have no plans to eliminate their nuclear arsenals. Steps towards disarmament are halting, inadequate and reversible. Moreover, they are piecemeal and too narrow in scope, and are undermined by a prevailing reliance on nuclear weapons. Many of them seem oriented to non-proliferation to the exclusion of disarmament by the nuclear weapons states.

To create and implement a more comprehensive and enduring plan for nuclear disarmament we must address a broad range of issues: socioeconomic factors (especially economic inequality and instability), collective security needs, energy policy, and the whole range of issues related more directly to the research, development, testing, production, and deployment of nuclear weapons, including the environmental and public health consequences of those activities. A great deal of the problem lies in the extremely inequitable world military and economic system, in which the powerful make and enforce rules for the weak, but change or break rules with impunity when they find it expedient (see article on treaties, page 5).

For these reasons, the achievement of enduring nuclear disarmament will be a long and complex process. Further, the process must ensure, to the extent possible, that reversion to a nuclear-armed state after the complete elimination of nuclear weapons (or in the words of the International Court of Justice, nuclear disarmament "in all its aspects") will not happen.

Hope for drastically reducing nuclear dangers in the short term by creating an effective moratorium on nuclear weapons use and threats arises largely from the fact that nuclear weapons are undermining the security of the powerful themselves. Indeed, the nuclear weapons states are the ones

SEE **DISARMAMENT**, PAGE 2

About this Issue

This special double issue of *Science for Democratic Action* and *Energy & Security* addresses various aspects of nuclear disarmament. This long-desired goal has many facets, ranging from short-term measures to de-activate nuclear weapons, to an enforceable, equitable treaty that will result in the dismantlement of all nuclear weapons and the infrastructure, materials, and facilities associated with them. Further, for a state of disarmament to endure, global security structures must be much more democratic, and there must be at least a modicum of social and economic justice in the world. Equity considerations must include addressing the public health and environmental

SEE **ABOUT**, PAGE 2

Special Double Issue on Disarmament

INSIDE

ABOUT

FROM PAGE 1

contamination problems that have resulted from nuclear weapons production and testing.

In this newsletter, we explore these issues in varying degrees of detail, both conceptually and topically, including:

- post-Cold War conditions that have increased security risks and the threat of accidental nuclear war;
- ongoing threats to disarmament, such as new facilities and research into pure fusion explosions which could lead to the development of qualitatively new nuclear weapons;
- the technical requirements and some economic reforms that must accompany treaties in order for them to be effective or have lasting impact, and initial steps such as de-alerting which can help reduce nuclear threats in the short-term while disarmament efforts continue;
- some issues related to the series of underground tests conducted by both India and Pakistan in May, 1998.

We have also tried to set forth a nuclear disarmament program that addresses how the worst nuclear dangers can be realistically reduced in the short term, and how these steps can be linked to more thorough interim measures and to the eventual complete and permanent elimination of nuclear weapons. We welcome your comments.

DISARMAMENT

FROM PAGE 1

most at risk today of devastation from these weapons. Yet, achieving even a moratorium will require a huge effort to convince recalcitrant nuclear establishments.

Still, a nuclear weapons moratorium will not by itself lead to enduring nuclear disarmament even if it is codified in a treaty. The latter will require broad reforms to make the world's political, economic and security arrangements more equitable and democratic. It will also require a global energy system that can respond to the challenges of simultaneously meeting economic, environmental, energy, and nuclear non-proliferation and disarmament goals. Without these changes, a treaty banning nuclear weapons is likely to contain provisions allowing withdrawal from it and maintenance of production and testing facilities, all of which would create long-term dangers and security risks that would be difficult to reverse.

How to change the underlying power relationships sufficiently to achieve a satisfactory and enduring nuclear disarmament treaty is beyond the scope of this newsletter. But we cannot fail to point out that our analysis as well as the experience of past treaties clearly indicates that at least modest reforms towards global economic equity and greater democracy in the international order are needed to make nuclear disarmament irreversible. For example, fewer than 400

SEE **DISARMAMENT**, PAGE 12

SCIENCE FOR DEMOCRATIC ACTION

Science for Democratic Action is published four times a year by the Institute for Energy and Environmental Research:

6935 Laurel Avenue, Suite 204
Takoma Park, MD 20912, USA
Phone: (301) 270-5500
FAX: (301) 270-3029
E-mail: ieer@ieer.org
Web address: www.ieer.org

The Institute for Energy and Environmental Research (IEER) provides the public and policy-makers with thoughtful, clear, and sound scientific and technical studies on a wide range of issues. IEER's aim is to bring scientific excellence to public policy issues to promote the democratization of science and a healthier environment.

Thank You to Our Supporters

We gratefully acknowledge our funders whose generous support has made possible our project to provide technical assistance to grassroots groups working on nuclear weapons-related issues, and our nuclear materials outreach project.

W. Alton Jones Foundation • John D. and Catherine T. MacArthur Foundation • Public Welfare Foundation • C.S. Fund • HKH Foundation • John Merck Fund • Ploughshares Fund • Unitarian Universalist Veatch Program at Shelter Rock • Town Creek Foundation • Beldon II Fund • Turner Foundation • New Land Foundation • Working Assets •

Thanks also to the SDA readers who have become donors to IEER. Your support is deeply appreciated.

Credits for This Issue

Production and graphics: Pat Ortmeyer
Additional production: Joe Ortmeyer

Science for Democratic Action is free to all readers.

Managing Editors: Anita Seth and Pat Ortmeyer

The Nature of Post-Cold War Nuclear Dangers

BY: ARJUN MAKHIJANI

It is a common belief that the end of the Cold War ended the danger of all-out nuclear war between the United States and Russia, despite the emerging threat of nuclear confrontation in South Asia. The specter of thousands of nuclear warheads destroying civilization and leaving a huge trail of death from widespread fallout seems to have been replaced by a belief that a new era has begun, where children need no more scurry under their desks in fearful rehearsals of orderly behavior in the face of approaching Armageddon. Political leaders have reinforced this notion. They point to the major reductions in nuclear arsenals and the "detargeting" of cities and military installations by the United States, Russia, and China as proof that all is well.

> While it is true that the end of the Cold War and the disintegration of the Soviet Union have reduced some risks, others have actually increased.

The potential to create such a new era exists, but the world's people — including the people and governments of many non-nuclear weapons states — will have to lead the governments of the nuclear weapons states and their allies to it. This is because the nuclear weapons states are showing by their actions and plans that they are determined to hold on to and modernize their nuclear arsenals. The current widespread complacency that nuclear dangers are evaporating is therefore wrong and grievously misplaced.

While it is true that the end of the Cold War and the disintegration of the Soviet Union have reduced some risks, others have actually increased. This article will examine nuclear dangers as they relate to the United States and Russia. Articles beginning on page 8 will address the situation in South Asia. The problems in both areas and in the potential scenarios that may cause them to intersect make clear the urgent need for enduring nuclear disarmament — proposals for which are also discussed in this newsletter (see pages 16 and 17).

Accidental Nuclear War

A number of factors have contributed to a considerable rise in the danger of accidental nuclear war. Russia and the United States are reducing their nuclear arsenals, but the global count still amounts to about 36,000 warheads, all but about 1,500 of which belong to the United States and Russia.[1] (See table, page 20.) Thus, despite arms reductions, the total explosive power of the world's nuclear weapons is still hundreds of thousands of times that of the bomb that destroyed Hiroshima. It is more than enough to cause total devastation.

The production of nuclear materials in military programs has slowed greatly, but the global stockpile of commercial plutonium, which can also be used to make nuclear weapons, is growing so fast that it will exceed total military stocks in the next two to three years.[2] The risk of black markets in fissile materials of both military and commercial origin is now far greater than it was during the Cold War, making proliferation problems far more complex and immediate.

The most dramatic illustration of the heightened risks is provided by the incident of January 25, 1995, when Russian nuclear forces were put on alert and "President Boris Yeltsin was brought his black nuclear command suitcase."[3] The proximate cause of the false alert was a US-Norwegian research rocket fired from an island off Norway's northwestern coast, which adjoins Russia's northern Arctic coastline. According to a former CIA official, Peter Pry, the four-stage rocket "resembled a U.S. submarine-launched, multiple-stage ballistic missile."[4]

The immediate causes of the event appear to be:

- lack of a high priority and high profile notice from the US and Norway to Russia even though the research rocket resembled a missile and was larger than any previous research rocket fired by Norway;
- lack of coordination in notifying Russia of the rocket launch;
- hair-trigger response to a perceived attack, due to continued adherence by Russia to a high-alert "use-it-or-lose-it" policy. (Both the US and Russia maintain this policy despite the end of the Cold War.)

There were underlying problems that may have contributed to the the crisis, but the role of each is difficult to estimate. These include low and uncertain pay, low morale, poor working and living conditions most likely facing Russian radar crews, lack of funds to maintain infrastructure and deterioration of US-Russian relations. We should note, however, that despite the reduction of radar surveillance due to the break-up of the Soviet Union, the launch was detected by Russian radar. The US tendency to treat Russia simply as the defeated party in the Cold War may have contributed to the fact that an appropriately high-level warning was not given to the Russian government about the unusual launch.

SEE **DANGERS**, PAGE 4
ENDNOTES, PAGE 28

DANGERS
FROM PAGE 3

It was, so far as we know from public information, the closest the world has come to all-out nuclear war since the Cuban missile crisis. But in contrast to that crisis, when decisions about global life and death were being deliberated in the United States and the Soviet Union in councils of government over a period of days, the 1995 crisis developed over minutes, unknown to all but a few Russian military and civilian leaders.

The possibility of destruction on a global scale now hinges, more than ever, on factors such as the proper functioning of aging equipment in Russia that can no longer be well-maintained, and the coherence of nuclear command structure in times of economic distress and of low military morale and budgets. De-targeting will not help. Missiles launched in case of such a misunderstanding would be reprogrammed to hit US targets. Even accidentally launched missiles that have been de-targeted may revert to their old target coordinates when launched. As was the case during the Cold War, nuclear war can also be initiated by accidents in the United States or other nuclear weapons states. There have been many false nuclear alarms in US nuclear history.[5]

The threat of nuclear war today is aggravated by the fact that Russia is more reliant on its nuclear forces for its military strength than during the Cold War. Since the the decline in its conventional military strength, Russia has adopted a first-use posture similar to the one that NATO has had and continues to have. A state of high alert, especially during times of crisis, is an important corollary of a policy of first-use of nuclear weapons. And the dangers of heightened alert in present-day Russia are grave, as the 1995 incident described above demonstrates.

Today, as during the Cold War, the only serious threat of utter physical devastation to the United States is from a large-scale nuclear attack upon it by design or by accident. The collapse of the Soviet Union has eliminated the essential antagonism that brought the world to the brink of nuclear catastrophe by design, leaving accidents and mistakes as the major triggers of all-out war.

Nuclear terrorism is also a severe danger. The 1995 bombing of the Alfred P. Murrah federal building in Oklahoma City was a grim reminder that great devastation can also occur through terrorist attacks. The failure to bring all nuclear-weapons-usable materials into secure, accountable, and verifiable storage has created a heightened risk that such attacks may become nuclear. Once substantial quantities of these materials are diverted, it will be extremely difficult or impossible to bring them back into control. As with the danger of accidental nuclear war, the solution lies in prevention.

Expanding Programs for Unusable Weapons

The many crises and wars of the past half a century, such as those in Korea, Viet Nam and Afghanistan, have shown that nuclear weapons are essentially unusable in war. That is even more so today, for a variety of political, military, environmental, and legal reasons. Moreover, terrorism cannot be credibly or effectively dealt with by the use of nuclear weapons. For instance, they are of no use whatsoever in dealing with incidents such as the Oklahoma City bombing or the attacks upon US troops in Saudi Arabia or on its embassies in Nairobi, Kenya and Dar es Salaam, Tanzania.

Despite the dangers and the lack of utility of nuclear

SEE **DANGERS**, PAGE 26

NUCLEAR DISARMAMENT: NOT JUST A GOOD IDEA—IT'S A LEGALLY-BINDING CONSTITUTIONAL OBLIGATION

Article VI of the Nuclear Non-Proliferation Treaty:

Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a Treaty on general and complete disarmament under strict and effective international control.

-Signed by the United States, Great Britain, the Soviet Union and 59 other countries on July 1, 1968. Entered into force in 1970. Indefinitely extended in 1995. Currently signed by 185 countries, including China and France, but not India, Pakistan or Israel.

International Court of Justice Advisory Opinion on the Legality of Nuclear Weapons:

There exists an obligation to pursue in good faith *and bring to a conclusion* negotiations leading to nuclear disarmament *in all its aspects* under strict and effective international control. (emphases added)

-Unanimous ruling, July 8, 1996

Article VI of the US Constitution:

This Constitution, and the laws of the United States which shall be made in pursuance thereof; and all treaties made, or which shall be made, under the authority of the United States, shall be the supreme law of the land...

-Excerpt from Article VI of the US Constitution, signed September 17, 1787

Treaties Are Not Enough

BY: ARJUN MAKHIJANI

Since 1945, the world has acquired a virtual alphabet soup of treaties and other formal agreements to accompany the huge nuclear arsenals that nuclear weapons states have constructed (see table on pages 6 and 7). They are a mixed bag. Some have the effect of legitimizing nuclear weapons, such as those that incorporate nuclear weapons into the "defense" of groups of countries. Other treaties restrict the development of nuclear weapons and related technologies. Some are complex and contain contradictory features.

Broadly, treaties involving nuclear weapons can be classified into five categories:

1. Treaties creating alliances in which nuclear weapons states claim to provide "nuclear umbrellas" to their partners. The most prominent remaining example of this kind of treaty is the North Atlantic Treaty Organization (NATO), led by the United States.

2. Treaties by which nuclear weapons states agree to some restraints on their nuclear weapons or related programs. Examples are the Partial Test Ban Treaty of 1963, the Strategic Arms Reduction Treaties between the United States and Russia (START I and START II), and the Comprehensive Test Ban Treaty (CTBT).

> The actual behavior of nuclear weapon states indicates that treaties are not going to be enough to create complete and enduring nuclear disarmament.

3. Treaties to prevent the spread of and promote the elimination of nuclear weapons. The Nuclear Non-Proliferation Treaty (NPT) imposes restraints on the development of nuclear weapons by non-nuclear weapons states and obligates the five nuclear weapons states that are signatories to pursue nuclear disarmament. It also commits all signatories to share commercial nuclear technology with one another.

4. Bilateral basing agreements or treaties. (The strategic functions of these treaties are of great interest — see note, page 40.)[1]

5. Treaties restricting nuclear weapons-related activities, such as those creating "nuclear weapon free zones." These agreements place various restrictions on nuclear weapons within the specified zone, such as non-deployment of weapons in a country or on the seabed or in Antarctica. These treaties generally do not effectively restrict all nuclear weapons-related activities. For instance, transit of nuclear weapons can still take place through many such zones.

There have been other agreements about nuclear weapons among countries besides treaties. These are bilateral or multilateral agreements to share and/or restrict trade in nuclear technologies. An important one is an agreement between a group of industrialized countries called the Nuclear Suppliers Group (led by the United States) that restricts exports of nuclear technologies to countries that are not members of the group, independent of the countries' compliance with the NPT. There are also local (sub-national) laws or regulations that restrict or ban nuclear weapons and/or other nuclear activities (for example, municipalities that have declared themselves nuclear weapon free zones).

Some of these treaties have made important contributions to nuclear arms reductions. The two recent Strategic Arms ReductionTreaties (START) and the Intermediate Nuclear Forces Treaty (INF) are the most important examples. However, the status of START II is unclear, since it gives certain advantages to the United States. The Russian Duma has so far not ratified it, despite President Yeltsin's urging that it do so. Russia would like to have far deeper cuts than START II requires because the specific pattern of cuts under START II would mean Russia must build new weapons if it is to maintain nuclear parity with the United States, which it cannot afford. But the United States, having agreed to a framework for modest reductions beyond START II, has not agreed to a further treaty until the Russian Duma ratifies START II. In the meantime, the dangers of accidental nuclear war continue to mount.

Among these treaties and agreements, five nuclear weapons states, the United States, Russia, China, Britain, and France, have committed themselves to nuclear disarmament in only one treaty, the NPT. Article VI of the NPT does not explicitly state that signatory nuclear weapons states must actually achieve nuclear disarmament within a reasonable time frame. But the International Court of Justice of the United Nations (also called the World Court), in a unanimous advisory opinion in July 1996, found that the treaty does require the signatory nuclear weapons states to actually achieve complete nuclear disarmament (see box, page 4).

The World Court is the only authoritative official body to have rendered any kind of interpretation of Article VI. Its opinion must therefore be regarded as

SEE **TREATIES**, PAGE 34

NUCLEAR WEAPON TREATIES BY TYPE

Treaty and Year	Signatories	Comments	Status
"Nuclear Umbrella"			
North Atlantic Treaty Organization (NATO) 1949	Original: Belgium, Canada, Denmark, France, UK, Iceland, Italy, Luxembourg, the Netherlands, Norway, Portugal, and the US. Added later: Greece, Turkey, Germany, Spain.	First nuclear alliance. US provides "security" assurances including possible first use of nuclear weapons.	Expanding
Warsaw Pact, 1955	Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and USSR.	Soviet response to NATO	Dissolved in July 1991
Bilateral Security Agreements			
US-Japan Security Treaty, 1952	US, Japan	Similar "security" assurances as NATO	In force
Restraint on Use or Development			
Limited Test Ban Treaty (LTBT), 1963	US, USSR, UK. France and China are not signatories.	Banned all but underground nuclear explosions.	Attempts to make this a comprehensive ban failed.
Nuclear Non-Proliferation Treaty (NPT) 1968	US, USSR (Russia), UK, France, China are signatories. India, Pakistan, and Israel are not. Total signatories: 185 (as of Jan. 1997).	Limits ownership of nuclear weapons to five states, requires progress on nuclear disarmament, promotes commercial nuclear technologies, permits "peaceful nuclear explosions."	Extended indefinitely in 1995
Strategic Arms Limitation Treaty I (SALT I) 1972	US, USSR	Limits nuclear weapons, but allowed for some arsenal expansion.	Ratified and implemented.
Anti-Ballistic Missile Treaty (ABM), 1972 Protocol, 1974	US, USSR	Bans development of more than one anti-ballistic missile system. Bans development of space-based systems.	US wants to loosen to allow certain space-based anti-missile systems.
Threshold Test Ban Treaty (TTBT), 1974	US, USSR	Limits nuclear explosions to 150 kilotons	
Underground Peaceful Nuclear Explosions Treaty (PNE), 1976	US, USSR	Governs n. explosions outside declared test sties. Limits yield to 100 kt. No use of data for weapons purposes.	Entered into force Dec. 1990
SALT II 1979	US, USSR	Increasing limits on ICBMs, SLBMs and heavy bombers. Other limits on MIRVs, bombers with long-range missiles, and MIRVed ICBMs.	Was to remain in effect through 1985. Not ratified.
Intermediate Nuclear Forces Treaty (INF) 1987	US, USSR	Bans intermediate range and shorter-range missiles	Entered into force June, 1988.

ICBM= Intercontinental Ballistic Missile; **SLBM**=Submarine Launched Ballistic Missile; **MIRV**= Multiple Independently-Targetable Re-entry Vehicle; **NWS**= Nuclear Weapon State

Sources: US Arms Control and Disarmament Agency website, (www.acda.gov), William Arkin, et al, *Taking Stock*, (NRDC March, 1998), *CIA World Factbook 1997*, (www.cia.gov/cia/publications/factbook/index.html), Association of Southeast Asian Nations webpage, (http://www.asean.or.id/politics/pol_agr7.htm).

Treaty and Year	Signatories	Comments	Status
Restraint on Use or Development, cont'd			
Strategic Arms Reduction Treaty (START I), 1991, 1992	US, USSR	Limits number of heavy bombers, ICBMs and SLBMs; also limits ICBM and SLBM launchers and warheads.	In force. Most reductions in Russia due to removal of warheads in Belarus, Kazakhstan and Ukraine.
START II 1993	US, Russia	Limits US and Russian strategic arsenals to 3,500 warheads (tactical and spares not included).	US ratified 1996; Russia not yet ratified citing, in part, NATO expansion and US ballistic missile defense programs. Implementation period extended to 2007.
Comprehensive Test Ban Treaty (CTBT) 1996	Signed by 150 countries, including five major nuclear powers and Israel. Ratified by 20 countries (as of 9/98), but not yet by US, Russia, or China.	Bans all nuclear explosions, including "peaceful nuclear explosions." Objections raised over allowances for computer-based and subcritical testing.	India, Pakistan and North Korea are not yet signatories. Their signatures and ratification are required for entry into force.
START III (framework agree-ment only), 1997	US, Russia	If implemented, it would reduce strategic weapons to 2,000 - 2,500	In early stages of discussion. Stalled by US as Russia has not yet ratified START II.
Restrictive Treaties and Nuclear Weapon Free Zones (NWFZ)			
Antarctic Treaty 1959	12 signatories, including France, US, UK, USSR. China and India acceded in 1983.	Prohibits nuclear explosions and disposal of radioactive waste on Antarctica, subject to future agreements. Peaceful uses OK.	In force
Outer Space Treaty 1967	Signed, ratified by US, UK, USSR, France, India, 58 other coun-tries. China acceded in 1983.	Prohibits nuclear or other weapons of mass destruction from being placed in space (including Earth orbit). Peaceful uses OK.	In force
Treaty of Tlatelolco (Treaty for the Prohibition of Nuclear Weapons in Latin America) 1967	Begun by Mexico, Brazil, Chile, Bolivia and Ecuador. 29 regional signatories, US party to Protocols I and II.	Prohibits testing, production, possession or acquisition of n. weapons in Latin Am. Protocol I: states with territorial interests keep Latin Am. n. weapon-free zone. Protocol II: NWS parties to treaty cannot "use or threaten to use" n. weapons against parties to protocol.	First to exclude n. weapons from inhabited region of globe.
Seabed Treaty 1971	Ratified by US, UK, USSR. China acceded in 1991. France did not sign. 66 states ratified.	Prohibits placement of n. weapons or weapons of mass destruction on seabed and ocean floor beyond a 12-mile coastal zone.	Entered into force in 1972. Multiple review conferences have upheld the treaty.
South Pacific Nuclear Free Zone (Treaty of Raro-tonga), 1985	Protocols I, II, and III signed by US, UK, France in 1996.	Prohibits manufacture, possession or testing of nuclear devices, prohibits dumping of nuclear waste.	Entered into force in 1986. Russia (1986) and China (1987) acceded to protocols II and III.
Southeast Asia Nuclear Weapons Free Zone (Treaty of Bangkok), 1995	Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam.	Prohibits development, testing, stationing, transport, manufacture, possession of n. weapons. Also prohibits dumping n. waste. Allows n. energy ("peaceful use").	Entered into force in 1997, but US, UK, Russia, France, China do not support it.
African Nuclear Weapons Free Zone (Treaty of Pelendaba), 1996	49 regional signatories. US, France, UK, Russia China signatories to Protocols I and II -- France to Protocol III.	Prohibits all nuclear weapons in NWFZ, and requires destruction of any existing nuclear devices. Calls for NWS to provide negative security assurances.	Not yet ratified.
Mutual Defense Treaties			
Australia, New Zealand-US (ANZUS), 1951	Australia, New Zealand, US.	Nuclear security guarantee to NZ, Australia.	Effective, 1952. NZ n. wea-pons free law enacted in 1984. US suspended secur-ity obligations to NZ in 1986.

India

Since India's nuclear tests in May 1998, much attention has been focused on the internal political dynamic in India that brought the BJP-led coalition to power. The BJP included the creation of a Hindu homeland ("*Hindutva*") in its electoral platform, and gave the go-ahead to actually carry out the tests. Indeed, the BJP had long held the position that India should become a declared nuclear weapons state. But to see the decision as having come from one part of the Indian political spectrum would be a limited and distorted view of India's nuclear weapons program. The tests could not possibly have been carried out without years of scientific preparation, the commitment of many political parties (including the Congress Party), and substantial budget allocations.

Until 1964, Indian leaders, including Jawaharlal Nehru, India's first prime minister and a bearer of the torch of nuclear disarmament on behalf of India and the non-aligned movement, had recognized the potential that India could develop nuclear weapons as a result of its nuclear power development. There were advocates of such a course in and out of the nuclear establishment. But India did not begin a bomb program even after its defeat in the 1962 India-China border war. As M.V. Ramana, a physicist who has studied India's nuclear program, has noted: "Nehru maintained that the cost and effort involved in making nuclear weapons and the hypocrisy of doing so, while asking others to give them up, did not justify the small psychological benefit of nuclear status."[1]

But things changed in 1964, a watershed year in Indian politics. Nehru died in May of that year. And in October, China conducted its first nuclear test. While China's nuclear

SEE **INDIA**, PAGE 30
ENDNOTES, PAGE 31

TIMELINE OF NUCLEAR WEAPONS DEVELOPMENT IN SOUTH ASIA

1960: 40 MWt CIRUS (Canadian-Indian Reactor United States) research reactor begins operation in India. The reactor was so named because it was bought from Atomic Energy of Canada, Ltd. (AECL), and the heavy water was provided by the US.

1962: Border conflict arises between China and India. Other Indo-Chinese tensions, such as those over Tibet, predispose China toward providing Pakistan with military assistance.

1963: India signs contract with General Electric for two 210-MWe light water reactors at Tarapur. A 30-year contract is signed with the US to supply fuel for the plant. Fuel shipments suspended after the 1974 Indian test.

1964: China tests nuclear weapons; Homi Bhabha (head of Indian Department of Atomic Energy) says India can build a nuclear bomb in 18 months.

Trombay reprocessing facility, nominal capacity 50 metric tons of spent fuel per year, opens at the Bhabha Atomic Research Centre (BARC) in India. It was shut down in 1974 due to corrosion, reconstructed, and re-opened in 1983 or 1984.

1965: Second India-Pakistan war

5 MWt research reactor given by US is built at Pinstech in Nilore, Pakistan. Upgraded to 8-10 MWt with help from France.

Pakistani Prime Minister Ali Bhutto declares that if India develops nuclear weapons, Pakistan will "eat grass or leaves, even go hungry" in order to develop a program of its own.

1971: Pakistan-Bangladesh-India war. West Pakistani repression leads to a crisis in the region, including a secessionist movement in East Pakistan, which later becomes Bangladesh. India intervenes on the side of Bangladesh. US orders the nuclear-armed aircraft carrier, *Enterprise,* to the Bay of Bengal.

1972: KANUPP heavy water reactor, purchased from Canada, begins operation in Pakistan.

1974: May 18: Indian government conducts a nuclear test at Pokhran, which they term a "peaceful nuclear explosion." Pakistan steps up its bomb program.

TIMELINE OF NUCLEAR WEAPONS DEVELOPMENT IN SOUTH ASIA

1976: Engineering Research Laboratories (ERL) is established in Pakistan to enrich uranium using gas centrifuge technology.

1977-80: Pakistani plant to produce uranium hexaflouride is constructed; parts provided by Germany.

1979: Pilot uranium enrichment facility starts up at Sihala, Pakistan; construction begins on full-scale facility at Kahuta.

April: The US imposes sanctions on Pakistan after learning about its enrichment program.

PREFERE reprocessing plant opens at Tarapur (near Bombay, India). It has a capacity of 100-150 tons/year.

Iranian revolution. Hostage crisis begins at the US embassy in Tehran.

December: Soviet troops occupy Afghanistan.

1981: US Congress grants Pakistan a 6-year exemption from the Symington Amendment, which prohibits aid to any non-nuclear country engaged in illegal procurement of equipment for a nuclear weapons program. Pakistan accepts a $3.2 billion, six-year aid package from the US that includes the sale of F-16 planes.

1982: Cold test of "New Labs" small-scale reprocessing plant in Pakistan.

1984: Jan-July: Dr. A. Q. Khan (known as the father of Pakistan's uranium enrichment program) announces that the Kahuta plant has succeeded in enriching uranium (although not to weapons-grade); other developments lead to increasing evidence of Pakistan's nuclear program.

September: US President Ronald Reagan sends Pakistani President Gen. Mohammed Zia a letter threatening "grave consequences" if the Kahuta plant is used to enrich uranium to greater than 5% U-235.

1985: US Congress enacts the Pressler Amendment, which obligates the president to certify every year that Pakistan does not possess a nuclear weapon before disbursing aid.

CONTINUED ON PAGE 36

Pakistan

The goal of Pakistan's nuclear weapons program historically has been to address India's military might — both to offset India's superiority in conventional forces, and to keep from "falling behind" as India embarked on a nuclear program. The situation in the disputed territory of Kashmir also figures prominently in Pakistan's nuclear calculus, as it has been central to the Pakistan-India conflict.

Due to its relatively scarce technical and economic resources, Pakistan has relied heavily on foreign sources for both equipment and technology for its nuclear program. Since 1962, it has received assistance from China, Canada, Germany, France, Britain, and the United States. The US built the first reactor in Pakistan as a part of the "Atoms for Peace" program (see timeline). Discussions on developing nuclear weapons began in the mid-1960s under Prime Minister Zulfikar Ali Bhutto, but did not really take off until 1972, after Pakistan's defeat in the 1971 war with India. The Pakistani nuclear program took on new urgency after India's "peaceful nuclear explosion" in 1974.

Until the recent series of tests in May 1998, Pakistan, like India, never formally declared its nuclear weapons program, despite the widespread knowledge of its existence. After India's nuclear tests on May 11 and May 13, Pakistan was faced with either not testing, which would leave it open to speculations about its capability (or lack thereof) by the Indian BJP government, or conducting nuclear tests and facing US sanctions. Moreover, a few days after India's tests, the Indian Home Minister, Mr. Lal Krishna Advani pointedly told Pakistan to recognize the new strategic realities in relation to its position on Kashmir. With Kashmir being central in the Pakistani view of its relationship with India, this implicit threat probably affected Pakistan's decision to test.

US reaction to Pakistan's program has

SEE PAKISTAN, PAGE 31
ENDNOTE, PAGE 31

De-Alerting: A First Step[1]

BY: ARJUN MAKHIJANI

De-alerting is a generic term for de-activating nuclear weapons. It is one way to address urgent needs to reduce nuclear dangers in the immediate and short term. Specific techniques range from pinning open switches of missile motors to removing warheads from delivery systems, storing them, and putting them under international monitoring.

The elimination of first strike threats and of large-scale nuclear war by accident or miscalculation are some of the most urgent priorities for de-alerting. However, de-alerting should be carried out in such a way as to represent the clearest and most significant progress towards complete nuclear disarmament, in fulfillment of Article VI of the Nuclear Non-Proliferation Treaty (NPT), as interpreted by the World Court in its advisory opinion (see page 4). In other words, partial de-alerting measures cannot be seen as ends in themselves, any more than dismantling some nuclear weapons can be a substitute for complete nuclear disarmament.

> De-alerting should be carried out in such a way as to represent the clearest and most significant progress towards complete nuclear disarmament.

In the immediate term, de-alerting measures can proceed even without a prior commitment to complete nuclear disarmament since nuclear weapons can be returned to alert status. However, de-alerting all nuclear weapons will essentially eliminate the risk of large-scale accidental nuclear war, and greatly lower the risk of war by miscalculation.[2] Therefore, de-alerting can allow for a nuclear weapons stand-down that will allow the political room and the time to achieve complete nuclear disarmament in a safe and verifiable way.

It can also allow for a process in which the five nuclear weapons states parties to the NPT can bring the other three nuclear weapons states into a process that neither denies the existence of their arsenals, nor legitimizes them. This is important, as stable maintenance of a state of complete de-alerting will require participation in verification by all eight nuclear weapons states.[3] Specifically, a verifiable halt to production of new nuclear weapons will be required in order to prevent clandestine deployment.

However, there is ample room for unilateral actions. For instance, partial de-alerting does not require prior agreement on verification, and can be carried out in order to test verification procedures and build confidence. Partial or even complete de-alerting can also be carried out unilaterally by any nuclear weapon state that subscribes to a second-strike deterrence policy, regardless of the differences in political and strategic situations of different nuclear weapon states.

Further, de-alerting measures are complementary to existing arms reduction processes, such as those which are occurring under START I and are scheduled to occur under START II. Most of the world's countries and many other leaders and NGOs have been insistently calling for nuclear disarmament, and de-alerting is widely seen as a crucial first step. For instance, the Canberra Commission endorsed de-alerting, as have retired US Admiral Stansfield Turner (former CIA director), and General Lee Butler (former chief of the US Strategic Air Command). The recent initiative by Brazil, Egypt, Ireland, Mexico, New Zealand, Slovenia, South Africa, and Sweden calls on the nuclear weapons states

> ...to abandon present hair-trigger postures by proceeding to de-alerting and de-activating their weapons. They should also remove non-strategic nuclear weapons from deployed sites. Such measures will create beneficial conditions for continued disarmament efforts and help prevent inadvertent, accidental or unauthorized launches.[4]

Short-term De-alerting Measures

There are three main approaches to de-alerting: a) removing warheads from delivery systems; b) prolonging missile firing time; and c) reducing risks of first-strike and accidental launch. Generally speaking, explicit abandonment of first-use and first-strike options or launch-on-warning postures broadens the range of possible de-alerting measures, enhances their verifiability, and improves their connection to the process of complete nuclear disarmament.

a) Removing warheads from delivery systems

The surest way of preventing accidental large-scale nuclear war is through *sequestration* - that is, removing all warheads from their delivery vehicles and storing them at remote locations.[5] The time it would take to put such warheads on re-alert would depend on how far the warheads were stored from the delivery system, what other means of disabling warheads had been implemented, and whether any multilateral monitoring and verification of de-alerted warheads had been implemented. The surest and most stable de-alerting arrange-

SEE **DE-ALERT**, PAGE 11
ENDNOTES, PAGE 30

ment would be tagging, disabling, and storing all warheads at considerable distances from their delivery systems, under physical monitoring of all eight nuclear weapons states and some non-nuclear weapons states. Disabling of delivery vehicles and its verification would complement these steps.

There are varying degrees of technical difficulty in achieving sequestration of nuclear weapons. Bombs can be separated from bombers easily and stored apart from them. They routinely are. For example, this was done for all nuclear bombs included in the unilateral de-alerting ordered by President Bush in September 1991 in the wake of the coup attempt in the Soviet Union, which was followed by a similar step by President Gorbachev. De-alerting bombs can be accomplished within a few hours or days, depending on the total number of warheads and locations involved. By the same token, this de-alerting measure can be simply and quickly reversed, depending on the distance bombs are stored from the bombers capable of carrying them.

Complete de-alerting with multilateral monitoring can be viewed as a verifiable no-first-use policy.

Tactical nuclear weapons were also withdrawn from deployment on a large scale in 1991, as part of the same US and Soviet actions mentioned above. These withdrawals from surface ships, attack submarines, bombers, and land-based delivery systems (such as artillery guns) were accomplished relatively easily and quickly (within days, weeks, or months, depending on the specific circumstances).[6]

Land-based missiles pose greater complications. While their warheads can be separated from their missiles, the large numbers of warheads involved may require that new storage facilities be built. Moreover, given the dangers of diversion, it may be safer in some cases to store disabled warheads within missiles than to remove warheads from the missiles, until appropriate storage, monitoring and verification arrangements can be made.

Strategic nuclear missiles on submarines present the most difficult case for complete removal from delivery systems. This is because strategic submarines represent the most "survivable" part of nuclear arsenals and are essentially invulnerable once deployed at their launch sites.[7] According to present nuclear doctrine, nuclear weapons states rely on them for assured retaliatory capability in case land-based systems and aircraft are destroyed in a surprise nuclear first-strike. Thus, submarine launched ballistic missiles (SLBMs), hidden at sea and relatively invulnerable to detection and surprise attack, are considered the best deterrent to a surprise nuclear first strike. By contrast, land-based multiple warhead missiles are regarded as the most attractive target for a first strike, thus making them a candidate for earlier de-alerting by removal of the warheads from their delivery systems.

Another problem with removal of warheads from SLBMs is that the submarines must be brought to port, where they are more vulnerable to surprise attack. Hence, removal of SLBM warheads must be done in proper sequence or in conjunction with other de-alerting and verification methods (see below).

b) Prolonging missile firing time

Missile firing can be made more difficult by various means. They include:

- pinning open the motor ignition switches of missiles, making it impossible to fire them until the pins have been manually removed;[8]
- removing the pneumatic systems that enable the missile covers of land-based missiles to be opened automatically. Re-alerting would require the opening of the missile cover by a crane or by reinstallation of the pneumatic system, introducing delays of hours;
- putting mobile land-based systems in garrisons and putting appropriate barriers on their roofs. This does not introduce much delay but provides greater verifiability than if the systems are actually being moved around (though the measure also makes such systems more vulnerable to a first strike);
- covering missile silos with large mounds of earth: Richard Garwin, a long-time consultant to the US government on nuclear weapons issues, has suggested 20-meter mounds to introduce "some hours" of delay;[9]
- ordering crews not to prepare SLBMs for rapid launch by foregoing procedures such as removal of flood plates from launch tubes and inspection of weapons systems to ensure they are ready for rapid launches. This could buy eighteen hours of delay.[10]

c) Reducing first-strike and accident risks

First-strike dangers have sometimes been addressed in arms control debates by appeal to adoption of a "no-first-use" policy. In this context, we use the phrase "first-strike" to mean a nuclear attack on an adversary's nuclear arsenal with a view to destroying it. ("No-first-use" covers no-first-strike as well as all other possible

SEE DE-ALERT, PAGE 12

DE-ALERT

FROM PAGE 11

first-use situations.) For instance, China has stated that it has a no-first-use policy and has called on other states to adopt the same. However, the policy consists essentially of a declaration that is not verifiable and is subject to quick reversal. There is some experience with such a reversal. The Soviet Union had a no-first-use policy, but in 1993 Russia reversed it though it had been in place for over a decade. Thus, while it is a useful confidence building measure, the durability and utility of no-first-use declarations have often been questioned.

Complete de-alerting with multilateral monitoring can be viewed as a verifiable no-first-use policy. Since all weapons will be under monitoring, the threat of a first strike would be eliminated. Such a policy would be robust, because even if weapons states cheated by hiding a few warheads or delivery systems, they could not achieve the objectives of a first strike. The purpose of a first strike is to disable and destroy essentially all of an opponent's nuclear weapons, but this would require more than "a few warheads."

A complete zero-alert requires changing SLBM warhead capabilities to ensure that a first strike is not possible. US SLBM warheads such as the W88 are very accurate and can be used for first strikes. To reduce this first-strike threat, highly accurate warheads could be replaced with types whose yields and accuracies are relatively low.

i) Removing tritium bottles

Removing the tritium bottles from all nuclear-boosted fission and thermonuclear warheads and bombs is an option to eliminate first-strike threats that require warheads with large yields. These kinds of first-strike threats are against weapons stored in hardened silos or other hardened locations. The tritium could be mixed with helium and stored under multilateral monitoring. Such a measure would still allow the first fission stage of the fission explosive to function, though not to its design explosive power.[11] Since the booster would be eliminated, the secondary would not function. Hence the warhead could not be used for a first strike, as defined above. However, it could still be used for nuclear retaliation, since the weapons still would deliver

SEE **DE-ALERT**, PAGE 28

DISARMAMENT

FROM PAGE 2

people control more wealth than two billion of the world's poorest. History shows that such inequality is incompatible with preserving peace or with democracy. On the contrary, repression, militarism, and violence of all kinds are an inevitable consequence of a system in which child laborers produce toys they cannot purchase, and farmers fruit they cannot afford. The inequity of the NPT has clearly played a role in nuclear proliferation in South Asia. It continues to exacerbate proliferation pressures in the Middle East (see Treaties article on p. 5).

It is necessary to recognize the connections between these issues in order to define enduring nuclear disarmament, to set forth the conditions under which it is likely to endure, and to outline the steps that will be needed to get there. We will address the connections of militarism and economic injustice to nuclear weapons and environmental destruction in future issues and publications.

In this article, we will briefly address four of these areas: global security arrangements, financial and institutional inertia, nuclear power, and the economic crisis in Russia.

Global security arrangements

While agreements are in place to ban chemical and biological weapons, the United States and possibly other countries have plans that include vast qualitative leaps in other armaments and techniques of warfare. Specifically, the United States is planning or considering extensive changes in non-nuclear warfare techniques that go under the general rubric of "revolution in military affairs" or "RMA." For instance one study states:

> Most analysts believe the current RMA will have at least two stages. The first is based on stand-off platforms, stealth, precision, information dominance, improved communications, computers, global positioning systems, digitization, "smart" weapons systems, jointness, and use of ad hoc coalitions. The second may be based on robotics, nonlethality, pyschotechnology, cyberdefense, nanotechnology, "brilliant" weapons systems, hyperflexible organizations, and "fire ant warfare." If this idea is correct, change that has occurred so far will soon be dwarfed by even more fundamental transformation.[1]

The Pentagon's plans include the domination of space. For instance, the long-range plan of the US Space Command, extending out to the year 2020, has the following "vision" for, "*dominating* the space dimension of military operations to protect US interests and investment" (emphasis in the original):

> Today, the United States is the pre-eminent military power in space. USSPACECOM's Vision for 2020 maintains that pre-eminence – providing a solid foundation for our future national security.[2]

Plans for the domination of space include plans for ballistic missile defenses seeking the following as an "end state":

SEE **DISARMAMENT**, PAGE 13
ENDNOTES, PAGE 15

DISARMAMENT
FROM PAGE 12

> By 2020, a robust and fully integrated suite of space and terrestrial capabilities provides dominant battlespace awareness enabling **on-demand** targeting and engagement of all ballistic and cruise missiles; and if directed by the NCA [National Command Authority], the ability to identify, track and hold at risk designated high value terrestrial targets.[3]

There are legitimate security issues involved in space, such as protection of commercial satellites. These parallel older, still crucial issues such as protection of sea-lanes for commercial shipping. But plans such as those described above, which explicitly include the deployment of ballistic missile defenses, will make it even more difficult if not impossible to achieve nuclear disarmament. Global security arrangements can and must be made without the militarization of space.

On broader questions of global security, the world is now dominated either by NATO or by the five permanent members of the United Nations Security Council, all of whom are nuclear weapon states and also hold the only veto power in the UN on security questions. Further, it is clearly recognized in Russia and elsewhere that nuclear weapons are the card that provide status on the world stage, separating a country from, say, Indonesia (the most commonly cited example). While nuclear disarmament is clearly in the interests of all the world's people, including those of Russia and the United States, this argument is unlikely to carry the day in the face of explicit plans by the United States or any other country to dominate the world.[4]

It seems clear from the foregoing that qualitative restrictions on non-nuclear weapons and other military systems, as well as more democratic global security arrangements, must be pursued to improve the chances of achieving nuclear disarmament.

Financial and institutional inertia

In every nuclear weapons state, nuclear establishments have successfully argued to maintain large flows of money into the nuclear weapons complexes under the cover of national security. From the bombing of Hiroshima and Nagasaki in 1945 to the "stockpile stewardship" programs of the 1990s, money has been a principal concern.

While the decision to bomb Hiroshima and Nagasaki was a complex one, considerations relating to money were crucial.[5] The Manhattan Project had spent $2 billion of precious wartime resources and had nothing to show for it even as World War II was drawing to a close. Project leaders, including General Leslie Groves, who headed it, were very concerned that unless the Project was shown to have contributed something to the war effort, they would be relentlessly investigated. Indeed, in March 1945, James Byrnes, who was Secretary of State when Hiroshima was bombed, wrote to President Roosevelt in his capacity as Director of the Office of War Mobilization that "if the [Manhattan] project proves a failure, it will be subjected to relentless investigation and criticism."[6] Showing that nuclear weapons contributed to the war effort was crucial to proving that the project was not a failure. The weapons were used as soon as they were ready and the weather permitted. Thus, from the earliest days of the nuclear age, money was one of the most powerful forces driving the use of nuclear bombs.

Closer to our own time, spending on nuclear weapons design and testing as part of the US "stockpile stewardship" program is greater than average Cold War spending levels. And China's long insistence during the negotiations for the Comprehensive Test Ban Treaty on retaining the option of conducting "peaceful nuclear explosions" (eventually given up) was at least partly the result of pressure from its own laboratories to continue to spend money in this area. The numbers of weapons that were built, the inter-service rivalries, and the idea that each part of the military had to have its own "deterrent" capacity can all at least partly be traced to the magnetic pull of money. The amounts of money involved and the context of these spending decisions has been discussed in a recent detailed book, *Atomic Audit*.[7] The US government itself has never conducted such an audit. Neither has the government of any other nuclear weapons state, so far as we are aware. It will be difficult to change direction on this front.

> While nuclear disarmament is clearly in the interests of all the world's people, it is unlikely to be achieved in the face of explicit plans to dominate the world by the US or any other country.

Part of the problem is that some disarmament goals may involve an increase in the amount of money going to nuclear establishments; for example, for clean-up and for managing nuclear materials. This consideration has not been effectively brought into the policy discussion.

Aside from the amount of funds, there is significant resistance within nuclear establishments, especially among some scientists, to working on such issues *instead of* nuclear weapons design and production. Weapons design and testing functions often re-appear dressed up as peaceful applications. For instance, one proposal, (to all appearances no longer active), by scientists at

SEE **DISARMAMENT**, PAGE 14

DISARMAMENT

FROM PAGE 13

Lawrence Livermore National Laboratory would have used one-kiloton underground nuclear explosions to generate electrical power. About two million such explosions per year would be required to generate just 20 percent of US electrical energy supply. The scientists observed that such explosions would have to be exempt from the proposed CTBT.[8] The current version of this idea is to use smaller pure fusion explosions, which would be in violation of the CTBT (see article, page 18). This problem should be addressed by a firm, unwavering, and unequivocal commitment at the level of the heads of government and international bodies, buttressed by vigilance at the grassroots, that there shall be no reliance on nuclear explosions for any purpose whatsoever.

Nuclear power

Continued reliance on nuclear power is another complex obstacle to nuclear disarmament. Nuclear power was developed as a tool in the ideological competition of the Cold War[9] and developed in tandem with nuclear weapons programs. A fundamental problem is that the technologies needed for each are largely the same, as are the materials. Second, and at least as important, the bureaucracies and scientific establishments that have created nuclear weapons have a large overlap with those promoting commercial nuclear power. There has been a modest amount of separation in the United States over the last 25 years, but even that is being eroded by proposals to make tritium for weapons in power reactors and by projects for converting surplus weapons plutonium into a reactor fuel.

Long-term development of nuclear power from fission will likely depend either on plutonium-239 or uranium-233 (derived from thorium-232) as a fuel, both of which can be used in weapons in separated form. This presents a serious problem for disarmament efforts, as the presence of commercial plutonium and/or uranium-233 stocks would lower the political and financial barriers to reverting to a nuclear-armed state. In fact, nuclear establishments may use nuclear power as a cover behind which to maintain readiness to resume nuclear weapons production. Such a possibility was explicitly raised in 1946 by J. Robert Oppenheimer, chairman of the General Advisory Committee of the Atomic Energy Commission, in the context of a convention on international control of nuclear weapons and nuclear disarmament:

> We know very well what we would do if we signed such a convention: we would not make atomic weapons, at least not to start with, but we would build enormous plants, and we would call them power plants — maybe they would produce power: we would design these plants in such a way that they could be converted with the maximum ease and the minimum time delay to the production of atomic weapons, saying, this is just in case somebody two-times us; we would stockpile uranium; we would keep as many of our developments secret as possible; we would locate our plants, not where they would do the most good for the production of power, but where they would do the most good for protection against enemy attack.[10]

Qualitative restrictions on non-nuclear weapons and other military systems must be pursued to improve the chances of achieving nuclear disarmament.

Finally, if nuclear power continues to be a source of energy, nuclear terrorism would continue to pose risks, even if disarmament is achieved.

Although a complete phase-out of nuclear power is a process, like disarmament, that will take a considerable time, plutonium separation can be stopped immediately. It should be — there is neither a military nor commercial rationale for it. An orderly plan for the phase-out of nuclear power in a manner compatible with electric power system reliability and with the reduction of greenhouse gas emissions should be carried out. Of course, this means that no new nuclear power plants should be built (see SDA Vol. 6 No. 3).

Economic crisis in Russia

The economic crisis in Russia is, in many ways, similar to economic crises in many other countries. The reforms that we discuss below (pages 16 and 17) are also needed for broader goals of economic equity and democracy. But in Russia these problems have become joined to the nuclear crisis. The risk of nuclear black markets arising from the economic crisis in the former Soviet Union and especially Russia has been recognized for some years. But over the past year, the crisis has greatly worsened.

The roots of the crisis are complex and involve both domestic and international factors. They are political as well as economic. For instance, the "privatization" of national assets put vast resources into a few private hands through the close links between government and the people who got control of the assets. These assets are now being used not only for private profit but, by all accounts, to channel foreign exchange earnings into illegal exports of money. Such illicit foreign accounts may now hold a vast amount of Russia's wealth, frustrating domestic and international attempts at reform.

SEE **DISARMAMENT**, PAGE 15

DISARMAMENT
FROM PAGE 14

The international reform attempts have themselves come under fire for favoring rich speculators and rash and inequitable privatization over employment and wage stability. The formulas of the International Monetary Fund, which are supposed to restore the economy to health, have at best been ineffective and at worst a part of the problem.[11]

Since 1997, the Russian economic crisis has been coupled to that in Asia. Now several problems, domestic and foreign, are reinforcing one another at a rapid rate, contributing to the danger that Russia might disintegrate. In part, the fate of tens of thousands of nuclear weapons, and of nuclear materials sufficient to make many more, hangs precariously on economic formulas that do not seem to work, even as they worsen the living conditions for ordinary people. Only continued large-scale exploitation of the vast natural resources of Russia has prevented the situation from being even worse. It is noteworthy that the fall in oil prices has been an important factor in the deterioration of the Russian economy over the past year.

The risk of nuclear black markets arising from the economic crisis in the former Soviet Union and especially Russia has greatly worsened over the past year.

A moderate reform of international currency and banking rules to curb the most egregious practices is now urgently needed to reduce the risk that Russia will disintegrate. These same measures are also needed to reduce financial speculation that is contributing to the risk of collapse in other countries as well. To be sure, such reforms cannot address many internal political and financial issues connected to the economic, and potentially, the nuclear crisis. But they are an essential condition to reverse the drain on the Russian economy that has been a major factor in preventing Russia from applying the revenues from exports to domestic economic development.

IEER's Disarmament Plan

On pages 16 and 17 we set forth IEER's suggestions for nuclear disarmament measures. The measures apply to the five nuclear weapon states that are NPT signatories as well as India, Pakistan, and Israel, unless specific countries are named or a particular state does not possess the types of weapons and/or materials specified.

We recognize that this is an extensive list. It is our view of what it will take to implement the nuclear disarmament clause of Article VI of the NPT. Given the present state of leadership and politics in the nuclear weapons states, the serious problems in US-Russian relations, and conditions in South Asia and the Middle East, it is unlikely that the entire list of measures will be implemented (barring transformative events within the nuclear weapons states).

The dangers of accidental nuclear war, nuclear black markets, or regional nuclear war are, however, so great that it is imperative that governments take certain actions within the next year to ensure that we actually get to the next century with reasonable prospects of long-term survival. Thus, several urgent steps are outlined first, from among those in the more extensive list of short-, medium-, long-term and continuing measures.

1 See for instance a paper by a professor and an analyst at the US Army War College, Steven Metz and James Kievit, "Revolution in Military Affairs: From Theory to Policy," at http://carlisle-www.army.mil/usassi/ssipubs/pubs95/rmastrat/smrmastc.htm
2 United States Space Command, *Long Range Plan: Executive Summary*, Foreword signed by General Howell M. Estes III, Commander in Chief, US Air Force, March 1998, p. 4.
3 Ibid., p. 8. (emphasis in the original).
4 A former CIA official has noted, in reference to the US bombings in August 1998 of targets in Afghanistan and Sudan, "In our understandable frustration, are we resorting to a modern form of the same 'gunboat diplomacy' that proved so counter-productive for the dying European empires at the end of the 19th century?" Raymond Close, "Hard Target: We Can't Defeat Terrorism With Bombs and Bombast," *The Washington Post*, 30 August, 1998, Outlook Section, p. C5.
5 For details, see Arjun Makhijani, "Japan: 'Always' the Target?", *Bulletin of the Atomic Scientists*, May/June 1995.
6 James F. Byrnes, "Memorandum for the President, March 3, 1945," Record Group 227, Modern Military Branch, National Archives, Washington, DC.
7 Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940*. (Washington, D.C.: Brookings Institution Press, 1998). Specifically, see pages 151-160, and 184-89. At one point, a US Army official estimated that the Army alone needed 151,000 nuclear weapons (p. 189). One analyst, John Midgely, Jr., has noted that "by the mid-1960s, the nuclear battlefield was merely a façade, useful in justifying procurement but lacking any explicit military rationale" (p. 155, note 114). *Atomic Audit* is available from the US Nuclear Weapons Costs Study Project, The Brookings Institution, (202) 797-6030, "www.brook.edu/pub/books/atomic.htm."
8 Abraham Szöke and Ralph W. Moir, "A Practical Route to Fusion Power," *Technology Review*, July 1991, pp. 21-27. See also a letter about this proposal by Arjun Makhijani, *Technology Review*, February/March 1992.
9 Arjun Makhijani and Scott Saleska, *The Nuclear Power Deception*, (Takoma Park: Institute for Energy and Environmental Research, 1996). To be published as a book by Apex Press, New York, in 1999. Also forthcoming in Russian and French editions.
10 J. Robert Oppenheimer, "International Control of Atomic Energy," in Morton Grodzins and Eugene Rabinowitch, eds., *The Atomic Age: Scientists in National and World Affairs*, (New York: Basic Books, 1963), p. 55.
11 Third world debt has worsened in the last decade and a half by repeated application of the IMF formulas. It has gone up from about $600 billion in 1982 to about $2 trillion today (current dollars). For a discussion of the international monetary system, see Arjun Makhijani, *From Global Capitalism to Economic Justice*, (New York: Apex Press, 1992), chapters 3, 11, and the Appendix.

Urgent Measures to Pull the World Back From the Nuclear Brink

1 Completion of at least one de-alerting measure (other than withdrawal of tritium reservoirs) for all nuclear weapons in all eight nuclear weapons states that would effectively eliminate the risk of nuclear war by miscalculation or accident, or possible "Year 2000" computer problems.

2 Withdrawal of tritium reservoirs from all warheads that contain them and storage of the tritium at locations remote from the warheads.

A comprehensive set of measures needed for nuclear disarmament is presented below, grouped into time frames, with one section reserved for continuing measures with no definite end point that we would specify at the present time. Details for Urgent Measure #1 are provided in points A1-3. For brevity, Urgent Measures #2-6 are not repeated below.

Short-Term Nuclear Disarmament Measures
(to be completed before the end of 1999)

A. De-alerting

1. Separation of all bombs from bombers.

2. One de-alerting measure for all missiles, land-based as well as SLBMs.

3. Complete de-alerting by India, Pakistan and Israel by removing or not placing warheads on delivery systems.

4. Permanent removal from the US and Russian arsenals of all remaining "tactical" weapons.

5. Stuffing of all pits of all warheads removed from arsenals.

6. Initiation of steps for multilateral verification of de-alerting measures, materials, and weapons inventories.

B. Other short-term measures

1. In addition to ratification of the CTBT by the six remaining nuclear weapons states, (see #3 in "Urgent Measures"), cancellation of the large laser fusion projects being built by the United States and France (see article on page 18).

2. Unilateral declarations by all eight nuclear weapons states that they will adhere to the unanimous interpretation of Article VI of the NPT by the World Court.

3. Unilateral commitments by France and Britain not to "Europeanize" their nuclear weapons (see p. 34, col. 1).

4. Unilateral declarations by all members of the US-led nuclear alliance, notably Germany and Japan, that no-first use policies on the part of nuclear weapons states are compatible with their own security, and that they would not break out of the NPT if such a policy were implemented.

5. Unilateral declarations of no-first-use policies by all nuclear weapons states (China and India have already made such declarations).

6. Unilateral commitments by all nuclear weapons states to stop production of all nuclear weapons, and to forego any weapons modifications.

7. Unilateral permanent commitments by all nuclear weapons states not to design new nuclear weapons.

8. A halt to all "stockpile stewardship" activities other than those oriented to checking warhead safety. Warheads that are found unsafe should be dismantled. The halt should cover sub-critical tests.

9. An end to commercial plutonium separation and the placement of all stocks of weapons-usable fissile materials that are not in arsenals under international, multilateral, or bilateral safeguards (applies to all countries).

10. Shut-down of all nuclear weapons production and testing facilities, except those required for dismantlement.

Continuing Measures

1. Clean-up of the contamination arising from production and testing of nuclear warheads, delivery systems, weapons-usable materials, and related facilities

2. Dismantlement and decommissioning of all nuclear weapons production and testing sites.

3. Provision of assistance to those whose health may have been affected by those processes, independent of national origin or location.

4. Dismantlement of nuclear weapons and creation and implementation of plans to put all nuclear weapons-usable materials into non-weapons-usable forms.

3. Ratification and entry into force of the CTBT, with strict adherence to its provisions even before that time.

4. Strict adherence by both the United States and Russia to the ABM treaty as signed in 1972.

5. Return of all US tactical weapons based in Europe; Russian commitment not to increase tactical weapons west of the Urals (each party acting unilaterally); and reduction of US and Russian strategic arsenals to less than 1,000 warheads each, with no reserve warheads or materials.

6. Shut-down of production of all weapons-usable radioactive materials for military purposes (plutonium, highly enriched uranium, and tritium).

11. Complete declarations of numbers of warheads and weapons-usable fissile materials (though not necessarily their locations).

12. Introduction of international economic reforms that would introduce an element of stability and equity to the Russian economy, reducing the risk of collapse and disintegration, including:

a) A small tax on all substantial foreign exchange transactions, say over $1,000, including those involving trade in currencies and financial instruments such as stocks and bonds. Such a tax has been suggested by Nobel Prize-winning economist James Tobin as a way of curbing rampant speculation in currencies.

b) A requirement that all banks and other institutions participating in foreign exchange transactions, or in providing accounts to non-residents of countries, report the existence of those accounts and all interest and other revenues derived from them to the governments of the holders' countries. The names of non-resident holders of large bank or other financial accounts (institutions as well as persons holding accounts say over $250,000) should be public.

c) Suspension of IMF practices requiring governments to assume the burden of acquiring the foreign exchange obligations of private investors. Repayment of private foreign loans should be guaranteed by private insurance purchased by the investors. This would be far more in conformity with open trading and market principles than the current IMF policy of converting private debt into sovereign debt.

Medium-Term Measures
(from 2000 to 2003)

1. Removal of all nuclear warheads from all nuclear weapons and multilateral monitoring of their storage

2. Withdrawal of all delivery systems from deployment and monitoring of their storage

3. Pit stuffing of all nuclear warheads

4. Mixing all tritium (other than small amounts needed for commercial and research applications) with helium gas and storing it under multilateral monitoring.

5. Creation of local, national, regional, and global plans that would address economic needs, reduction of greenhouse gas emissions, and the phase-out of nuclear power.

6. Conversion of the IAEA into a regulatory agency only, ending its functions for the promotion of nuclear power.

Long-Term Measures
(from 2003 to 2008)

1. A nuclear weapons convention signed by all parties that would permanently eliminate nuclear arsenals as irreversibly and as verifiably as possible. The convention should forbid the use or threat of use of nuclear weapons even in retaliation for such use.

2. Explicit commitments under that convention that there would be no withdrawal from that treaty under any circumstances, including nuclear weapons use.

3. Establishment of a verification organization that would oversee the achievement of nuclear disarmament in all its aspects. There should be explicit provision for verification by non-governmental parties, including by persons who are not citizens of the country being inspected.

5. Creation of sound waste management policies and institutions, so that damage to the environment and the health of future generations may be as little affected by the era of nuclear weapons as possible.

6. Establishment of materials accounts for all nuclear weapons-usable materials that have been produced, and continual refinement of these accounts as more data are analyzed and the accounts are refined.

7. Destruction of the designs of nuclear weapons that have been dismantled.

8. Progressive elimination of secrecy in the nuclear establishment.

9. Destruction of delivery vehicles.

10. Banning of production of ballistic missiles and strict verification procedures to ensure that no space launch vehicles can be used as nuclear weapon delivery vehicles

11. Strict controls on and verification of all dual-use (nuclear and non-nuclear) items and technologies, such as cruise missiles and bombers.

Pure Fusion Weapons?

BY: HISHAM ZERRIFFI AND ARJUN MAKHIJANI

This article is based on an recently-released IEER report on the potential for fusion weapons, Dangerous Thermonuclear Quest. *For ordering information, contact IEER.*

A large qualitative change in the nature of nuclear weapons occurred four-and-a-half decades ago when nuclear fission (the splitting of atoms) and nuclear fusion (the fusing, or joining of atoms) were combined into thermonuclear weapons, known more generally as "hydrogen bombs." So far, only a fission explosion has generated the high temperatures and pressures necessary to trigger the thermonuclear explosion in a hydrogen bomb. For this reason, all current generation thermonuclear weapons have a fission "primary" that sets off a fusion explosion in the "secondary." However, pure fusion weapons, that is, weapons that would not need a fission trigger, have long been thought of as "desirable" by nuclear weapons designers, in part because they would not produce fission-product fallout.

The scientific feasibility of pure fusion weapons has not yet been demonstrated, but if the technical hurdles are overcome, the use of nuclear weapons as instruments of war could be fundamentally transformed.

The scientific feasibility of pure fusion weapons has not yet been demonstrated, but if the technical hurdles are overcome, the use of nuclear weapons as instruments of war could be fundamentally transformed, introducing new proliferation dangers and radically reducing the chances of getting complete and enduring nuclear disarmament.

Thermonuclear explosions, unlike explosions caused by chain reactions in fissile materials like plutonium, do not require a minimum critical mass. Thus, pure fusion weapons could be made with very low yields, and would not produce fallout, blurring the distinction between conventional explosives and nuclear explosives. Yet, the lethality of the weapons, due to neutron radiation and explosive force, would still be great.

For instance, the lethal area of a pure fusion weapon with an explosive force of one ton of TNT equivalent would be on the order of a hundred times larger than a conventional bomb with the same explosive force. This is because most of the lethality of pure fusion weapons would derive from the intense neutron radiation rather than the explosion. In fact, the radius of lethality of small pure fusion weapons *per unit of explosive power* would be far greater than that of large fission weapons.[1] For instance, the destructive area per ton of TNT equivalent of the Hiroshima bomb was about 500 square meters (about 600 square yards), which is a hundred times smaller than the estimated lethal radius of a one-ton TNT equivalent pure fusion bomb. The adverse implications of this military arithmetic for nuclear nonproliferation and disarmament would be profound.

Explosive Confinement Fusion (ECF)[2]

Fusion reactions release energy when two light nuclei combine. (Fission, on the other hand, releases energy through the splitting of heavy nuclei.) The underlying reason for the energy release is the same as that for fission — that is, the nuclei that are present initially are heavier than the products of the nuclear reaction; the difference in mass shows up as energy.

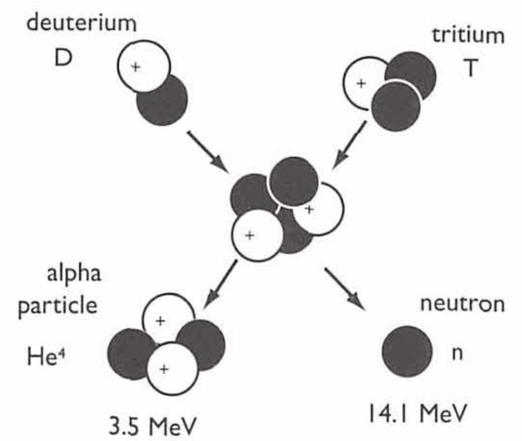
Pure fusion weapons (as well as fusion energy) have been unattainable so far because it is very difficult to create the conditions that enable a large enough number of nuclear fusion reactions to occur and generate a net output of energy without using a fission trigger. At close range, positively-charged nuclei exert repulsive (opposing) electrical forces on each other. These forces must be overcome if the nuclei are to be brought close enough together to sufficiently increase the probability of fusion reactions occurring. This is done by heating the fuel to extremely high temperatures (hence the term "*thermo*nuclear") — comparable to or higher than temperatures in the interior of the sun. This allows the kinetic energy (the energy of motion) of the nuclei to be large enough to overcome the repulsive force.[3]

The most common man-made fusion reaction, and the one responsible for most of the fusion energy release in thermonuclear explosions, involves two isotopes of hydrogen: deuterium (D) and tritium (T).[4] Deuterium is a non-radioactive isotope, with one proton and one neutron in the nucleus. Tritium, which has one proton and two neutrons in its nucleus, is highly radioactive.[5] A fusion reaction between these two isotopes produces an alpha particle, which is a helium nucleus and a neutron (see diagram next page).

The total energy released per D-T fusion reaction is 17.6 MeV, most of which is the kinetic energy of the neutron. While not achieving the levels of thermo-nuclear bombs, laboratory ECF facilities have achieved a

SEE **FUSION,** PAGE 19
ENDNOTES, PAGE 25

DEUTERIUM-TRITIUM FUSION REACTION



$D + T \rightarrow He^4 + \text{neutron}$

Energy Multiplication: About 450:1

FUSION

FROM PAGE 18

significant number of fusion reactions (10^{12} to 10^{13} neutrons per shot).

All ECF schemes have two basic components: the fuel pellet and the driver. The fuel pellet contains the fuel, typically a mixture of deuterium and tritium, as well as other components. The driver provides the energy to the pellet to compress it to the high densities and temperatures needed to initiate the fusion reaction. Types of drivers that have been considered include lasers, light and heavy ion beams, chemical explosives, and electromagnetic energy sources.

The ratio between the fusion energy output and the driver energy output is called *gain*. A gain of one is required to prove the scientific feasibility of any fusion scheme. When the gain is less than one, there is a net energy loss and the fusion scheme is not viable.

There are two essential scientific and technical accomplishments that are needed to make pure fusion weapons. First, their scientific feasibility must be established. Second, they must be made small enough to be deliverable weapons. The National Ignition Facility (NIF), under construction in California, and a similar one under construction near Bordeaux in France (Laser Mégajoule, or "LMJ") are designed to establish the scientific feasibility of pure fusion explosions. While the laser beams they use cannot be miniaturized into weapons, the goal of the devices is to achieve a gain greater than one. The ignition of the fuel pellet would result in small fusion explosions (see below for a definition of ignition and of nuclear fusion explosions).

The lessons learned from these laser fusion experiments could be used in experiments using other drivers with a potential for miniaturization into weapons. For example, experiments on NIF could be used to design optimal targets for experiments using high-energy capacitors or drivers using combinations of chemicals and electromagnetic energy that can be made compact enough for weapons. Experiments with these types of devices are being conducted at Los Alamos National Laboratory and Sandia National Laboratory in New Mexico, the former in collaboration with Russia. One result of these combined efforts could be significant advances towards the design of pure fusion weapons.

Disarmament and Non-Proliferation Implications

Though scientific feasibility has yet to be proven, the research on pure fusion explosions itself raises serious questions. At the very least, it sends a dangerous signal about the intent of the nuclear weapons powers to continue to develop and enhance their arsenals. The effects on disarmament and nonproliferation efforts are already grave. India's refusal to sign the Comprehensive Test Ban Treaty (CTBT) was, in part, a reaction to this type of research by the nuclear weapons states. In turn, its subsequent decision to conduct underground nuclear tests was partly related to its conclusion that the CTBT had changed from a non-discriminatory instrument designed to promote both non-proliferation and disarmament into a tool for non-proliferation alone. Furthermore, some fusion research appears to violate the CTBT, as we discuss below.

Other potential problems include:

- the possibility that pure fusion weapons, a long-time goal of the nuclear weapons designers, will be achieved;
- the development by the United States (and possibly other nuclear weapons states) of new fission-fusion thermonuclear weapons designs;
- the possibility of the US withdrawing from the CTBT under the "Supreme National Interest" clause to test either new generations of weapons or modifications to existing designs of thermonuclear weapons;
- the spread of information and computer codes on the physics of thermonuclear explosives, since there are non-weapons research aspects to most of these facilities. (For example, astrophysics experiments would be conducted at the National Ignition Facility, and experiments at entirely unclassified facilities are carried out in non-nuclear weapon states such as Germany and Japan).

Official US planning documents for the Stockpile Stewardship program demonstrate that the DOE plans

SEE **FUSION**, PAGE 23

THE NUCLEAR NUMBERS

	US	Russia	Britain	France	China[1]	India[1]	Pakistan	Israel[2]
WEAPONS								
bombers/aircraft	1,800	806	160	65	150			
missiles	5,650	5,434		384	~125			
non-strategic	970	4,000			120			
Total operational	8,420	10,240	160[4]	449	~400	n/a[5]	n/a[6]	reportedly 100 to 200
Awaiting dismantlement	1,350	~12,000[3]	220	50	~50			
Reserve	2,300							
TOTAL	**12,070**	**~22,500**	**380**	**~500**	**~450**			
NUCLEAR TESTS								
atmospheric	217[7]	207	21	50	23	-	-	
underground	836	508	24[9]	160	22	6	6	
TOTAL	**1,053**	**715**[8]	**45**	**210**	**45**	**6**	**6**	
CTBT STATUS	signed	signed	ratified	ratified	signed	not signed[10]	not signed[10]	signed[11]
PLUTONIUM STOCKS[a]								
military[12]	99.5[b]	150[b, 13]	3.1	5.0	2-6	~0.4	~0	0.88
commercial	1.5	~30	51.9[c]	35.6[c]		~0.3		
TOTAL:	**101.0**	**~180**	**55.0**	**40.6**	**2-6**	**~0.7**	**~0**	**0.88**
HEU STOCKS[a]	645	1,050[14]	8	24	20	0	0.21, maybe more	

a. in metric tons
b. before losses
c. IAEA Dec. 1996

1 China and India are the only nuclear states with a no-first-use policy.
2 Israel is the only remaining undeclared nuclear weapons state.
3 May include some reserves.
4 100 WE-177 tactical aircraft bombs were retired in early 1998, leaving only Trident II deployed.
5 Number of assembled weapons unknown; materials estimated enough for 80 warheads.
6 Number of assembled weapons unknown; materials estimated enough for 10 to 15 warheads, possibly more.
7. Includes the bombings of Hiroshima and Nagasaki.
8 Includes 156 "peaceful nuclear explosions."
9 Jointly with US.
10 Has announced a unilateral moratorium on nuclear testing.
11 Not ratified as of 9/9/98.
12 Total in and out of warheads.
13 May be as high as about 190 metric tons.
14 Russia has agreed to sell to the US 500 metric tons of HEU after dilution to low enriched reactor fuel. The deal is in trouble.

Sources: William M. Arkin, Robert S. Norris, Joshua Handler, *Taking Stock: Worldwide Nuclear Deployments 1998*, (Washington: Natural Resources Defense Council, March 1998); David Albright, Frans Berkhout and William Walker, *Plutonium and Highly Enriched Uranium 1996*, (Oxford: Oxford University Press, 1997); and US DOE Openness Press Conference Fact Sheet, Dec. 7, 1993.

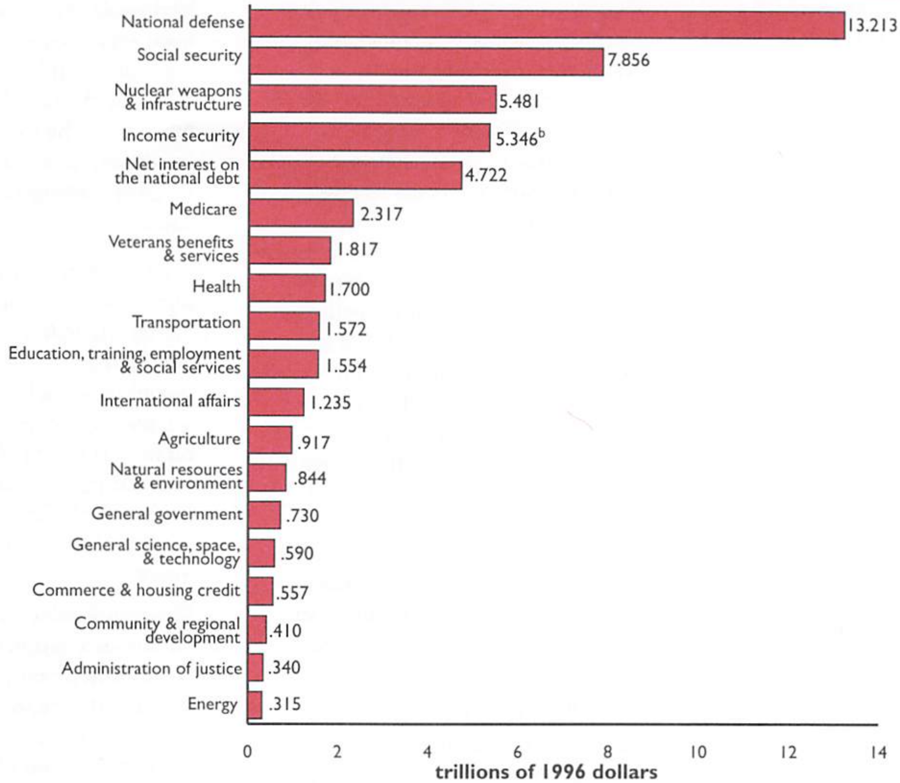
COMMERCIAL PLUTONIUM STOCKS (non-nuclear weapon states)

in metric tons

Japan	20.1
Germany	~15.0
Belgium	2.7
Italy	~1.0
Switzerland	0.7
Netherlands	~1.3

Sources: IAEA Information Circulars: INFCIRC/549/Add.1, March 31, 1998; INFCIRC/549/Add.3, March 31, 1998, and INFCIRC/549/Add.4/1, May 28, 1998. Germany, Italy and the Netherlands estimated through Dec. 1996 based on Albright, Berkhout, Walker, 1997. Estimates are for stocks and exclude plutonium irradiated in fast breeder and light water reactors.

US GOVERNMENT HISTORICAL OBLIGATIONS BY FUNCTION, 1940-96[a]



Notes: National defense category has been adjusted to exclude nuclear weapons and infrastructure costs. Nuclear weapons costs are a combination of actual and estimated expenditures. Program totals do not match overall total because of rounding and the addition of undistributed off-setting receipts (not shown).

a. Total = $51,557,983,000,000

b. Income security as defined by the Office of Management and Budget includes programs such as federal employee retirement and disability, unemployment compensation, housing assistance, and other "welfare" programs.

Source: Adapted from Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons since 1940*, (Washington: Brookings Institution Press,1998), p. 5. Used with permission.

BREAKDOWN OF TOTAL ACTUAL AND ESTIMATED US EXPENDITURES FOR NUCLEAR WEAPONS 1940-96 (billions of 1996 dollars)

Activity	Cost
Building the bomb	409.4
Deploying the bomb	3,241.0
Targetting and controlling the bomb	831.1
Defending against the bomb	937.2
Dismantling the bomb	11.1
Nuclear waste management & environmental remediation	45.2
Victims of the bomb	2.1
Costs and consequences of nuclear secrecy	3.1
Congressional oversight of the bomb	0.9
Total	5,481.1

Source: Adapted from: Schwartz, ed., 1998, p. 4. Used with permission.

excerpts from

The Morality of Nuclear Deterrence: An Evaluation by Pax Christi Bishops in the United States

Issued on the 15th Anniversary of *Challenge of Peace, God's Promise and Our Response*, June 1998

Dear Sisters and Brothers,

For the past fifteen years, and particularly in the context of the Cold War, we, the Catholic bishops of the United States, have reluctantly acknowledged the possibility that nuclear weapons could have some moral legitimacy, but only if the goal was nuclear disarmament. It is our present, prayerful judgment that this legitimacy is now lacking.

Instead of progressive nuclear disarmament, we are witnessing the institutionalization of nuclear deterrence. The recent Presidential Decision Directive on nuclear weapons policy, partially made known to the public in December 1997, makes this point clear. The Directive indicates that the United States will continue to rely on nuclear weapons as the cornerstone of the nation's strategic defense, that the role of these weapons has been increased to include deterring Third World non-nuclear weapons states and deterring chemical and biological weapons, as well as other undefined vital US interests abroad.

Clearly the present course of US policy threatens to ignite a new arms race both among the existing nuclear weapons states as they collaborate and compete in the development of computer-simulated design and testing programs and among those non-nuclear armed nations that perceive the institutionalization of nuclear deterrence as a threat to their societies.

The policy of nuclear deterrence has always included the intention to use the weapons if deterrence should fail. Since the end of the Cold War this deterrent has been expanded to include any number of potential aggressors, proliferators and so-called "rogue nations." ... Because of the horrendous results if these weapons should be used, and what we see as a greater likelihood of their use, we now feel it is imperative to raise a clear, unambiguous voice in opposition to the continued reliance on nuclear deterrence.

Moral Conclusions

Sadly, it is clear to us that our strict conditions for the moral acceptance of nuclear deterrence are not being met. Specifically,

a) the policy of nuclear deterrence is being institutionalized. It is no longer considered an interim policy but rather has become the very "long-term basis for peace" that we rejected in 1983.

b) the role of nuclear deterrence has been expanded in the post Cold War era well beyond the narrow role of deterring the use of nuclear weapons by others. The role to be played now by nuclear weapons includes a whole range of contingencies on a global scale.

c) although the United States and the republics that made up the former Soviet Union have in recent years eliminated some of their huge, superfluous stockpiles of nuclear weapons, our country, at least, has no intention, or policy position of eliminating these weapons entirely. Rather, the US intends to retain its nuclear deterrent into the indefinite future.

We cannot delay any longer. Nuclear deterrence as a national policy must be condemned as morally abhorrent because it is the excuse and justification for the continued possession and further development of these horrendous weapons. We urge all to join in taking up the challenge to begin the effort to eliminate nuclear weapons now, rather than relying on them indefinitely.

Signed by 71 bishops from the United States, the Virgin Islands, and Guam.

COURTESY US NATIONAL ARCHIVES 77-AEC-52-4453

Nagasaki after the US atomic bombing, August 9, 1945. The buildings in the foreground are the remains of the Nagasaki Medical College.

to maintain and exercise the ability to design new nuclear weapons. It is quite conceivable that DOE weapons scientists would conduct at least preliminary design investigations of pure fusion weapons once the necessary data were available. According to the DOE's rationale, it is not only necessary to have advanced facilities to interest and retain scientists, it is also necessary to allow them the opportunity to practice their design skills.[6] We note that the DOE has denied that it intends to design pure fusion weapons. But the technical work DOE is doing could lead to such weapons nonetheless because it is compatible with pure fusion weapons research and development.

Potential energy applications have been claimed for the various explosive fusion programs. However, energy devices should be justified on the merits of comparison with other approaches to solving energy problems, especially given the enormous expense of these devices and the very long time frame it is likely to take for this research to lead to fruition (several decades or more). There are far more promising approaches to dealing with energy issues than ECF schemes.[7]

Does Fusion Research Violate the CTBT?

The legality of fusion research under the Comprehensive Test Ban Treaty is a complicated and as yet unresolved question. There are two key issues involved: interpretation of the treaty language, and the precise definition of a "nuclear explosion."

Language of the CTBT

Article I of the Comprehensive Test Ban Treaty states that:

> 1. Each State Party undertakes not to carry out any nuclear weapon test explosion or any other nuclear explosion, and to prohibit and prevent any such nuclear explosion at any place under its jurisdiction or control.
>
> 2. Each State Party undertakes, furthermore, to refrain from causing, encouraging, or in any way participating in the carrying out of any nuclear weapon test explosion or any other nuclear explosion.

The United States government, both in previous statements and in its submission of the treaty to the US Senate for ratification, has stated that ECF experiments are not covered by the treaty. The US position has been based on an interpretation of the Nuclear Non-proliferation treaty, which bans the use of "nuclear explosive devices" by non-nuclear weapons states. However, the CTBT goes further, banning *any* "nuclear explosion," including "peaceful nuclear explosions" by any state, and is intended to constrain weapons development by all states.

CTBT negotiations involved extensive discussion of allowing some fission explosions. Initially, the US wanted the CTBT to allow for hydronuclear testing which would yield up to four pounds of nuclear explosive energy. However, it changed this position in 1995 and argued for a "zero-yield" treaty, which was the version of the treaty that was adopted. Unfortunately, zero-yield was not defined, though the negotiating record for hydronuclear explosions clearly indicates that this should be well under four pounds of TNT equivalent. As a result, the parties to the CTBT are not permitted to conduct hydronuclear experiments. However, the US and Russia believe that they are permitted under the treaty to continue "sub-critical" experiments involving both plutonium and conventional explosives, because the plutonium would not reach criticality.

Our research indicates that NIF, the Laser Mégajoule project, and all other facilities designed to create thermonuclear explosions of even a few pounds of TNT equivalent are illegal under the CTBT.

Our research indicates that NIF, the Laser Mégajoule project ("LMJ"— a fusion research facility in France roughly equivalent to NIF), and all other facilities designed to create thermonuclear explosions of even a few pounds of TNT equivalent are illegal under the CTBT. Even their construction is illegal since the CTBT requires the *prevention* as well as the prohibition of explosions. Parties are also enjoined from "causing, encouraging, or in any way participating in" any nuclear explosions. The intent of these facilities is to cause nuclear explosions. Only a legally binding, permanent, and verifiable commitment under the CTBT not to use tritium fuel in these machines would render their construction legal. However, in that case the machines would be useless since their entire purpose is to achieve ignition.

Defining a "nuclear explosion"

The clarification of Article I of the CTBT requires that a nuclear explosion be defined. It is clear that nuclear yields that derive from super-critical explosions, however small, as is the case for all present nuclear weapons, are illegal. But this does not allow us to set a numerical limit for what explosive force deriving from nuclear reactions of other kinds, for instance, sub-critical

SEE FUSION, PAGE 24

reactions, would be illegal. Hence, finding a precise definition is quite complex.

An explosion is an interplay between the total amount of energy released, energy density, and the time in which the energy is released. The time factor is perhaps the easiest to define. While there is no exact definition of reaction time for an explosion, we use one millisecond as a reasonable value to distinguish a steady-state regime from an explosive regime.[8] This is because all nuclear explosions of possible military consequence are expected to occur in well under one millisecond. Other physical criteria are also needed to define a nuclear explosion:

Criticality: As we have noted above, the US has used the threshold of criticality to define nuclear explosions of fissile materials. Under this definition, the sub-critical experiments involving high explosives and fissile materials conducted at the Nevada Test Site are deemed to be allowable under the CTBT.

The knowledge that the nuclear weapons states are engaging in new fusion weapons design activities could lead other states to view this as a reversal of momentum towards disarmament.

Specific Energy Release: A 1987 Los Alamos report on the testing moratorium of 1958-1961 states that "a nuclear explosion has never been defined officially, but we consider a reasonable definition to be a specific fission energy release that is comparable to or greater than that of high explosive itself, about one kilocalorie per gram."[9] In other words, the release of nuclear energy in an explosive fashion is not really an explosion unless the energy released is greater than the energy used to initiate the explosion.

Ignition: Another criterion which is especially helpful in defining *fusion* explosions is ignition. It has been defined in two different ways:

1. The creation of a self-propagating burn wave in the fuel pellet. This is a concept somewhat analogous to the concept of criticality in fission explosions.[10]

2. A gain of one. In other words, the fusion energy output of the fuel pellet is equal to or greater than the driver energy output.[11]

We propose that the definition of explosions as those achieved in ECF systems with a gain of one is a minimally satisfactory definition for the purposes of CTBT compliance. The advantage of this proposal is that it is not limited to any particular technology or an arbitrary yield, but rather is based on a comparison of energy use and energy production. To be in compliance, the fusion reactions would have to have an energy release that is *less than* the driver energy input into the fuel pellet. In that case, the conditions for establishing scientific feasibility of pure fusion explosions would not be achieved.

Any definition of a fusion nuclear explosion geared to ignition would still allow a considerable loophole for pure fusion weapon development even though it would meet the letter of the CTBT. This is because a great deal of research on weapons applications can be conducted at gains just under one — that is, just below the ignition threshold. Therefore, it would be helpful to set other limits to constrain the development of new weapons. The following two limitations have been proposed by experts with experience in nuclear weapons issues:

The Garwin limit: This proposal, by Richard Garwin, a long-time consultant to various US government agencies on nuclear weapons issues, would limit neutron production to 10^{14} neutrons/shot. This corresponds to an explosion of 0.1 gram of high explosives. Since this limit has already been approached by Magnetized Target Fusion experiments (10^{13} neutrons) and reportedly by Russian high explosive research (10^{14} neutrons), this would effectively freeze the program until such time as a review of fusion experiments has been completed.[12] Similarly, experiments at facilities such as NIF would be limited, but not prohibited, by this proposal.

The Kidder limit: A proposal by Ray Kidder, a retired LLNL senior weapons scientist and one of the pioneers of laser fusion research, would ban tritium use in systems driven directly or indirectly by high explosives. Facilities designed to achieve ignition or burn in D-T fuel pellets would be unlikely to accomplish these goals in fuel pellets without tritium due to the greater difficulty in achieving other fusion reactions, such as the D-D reaction, in sufficient numbers in a single shot.[13] High-explosive-driven components will most likely be key to the miniaturization of pure fusion devices — a necessary step towards pure fusion weapons. This potential is the reason behind the proposed ban on tritium in combination with high explosives. However, such a ban would not impose any limits on laser-driven or ion-beam driven research or even the Sandia wire-array z-pinch — all potential contributors to the development of pure fusion weapons. The wire-array z-pinch also has some potential to be reduced in size so as to be usable as a weapon (see "Dear Arjun," page 37).

While each of these limitations by itself leaves significant loopholes, collectively they could provide reasonable protection against development of fusion weapons while allowing some fusion research to continue. This would allow for the continuation of all research on non-explosive magnetic confinement fusion,

SEE **FUSION**, PAGE 25

FUSION

FROM PAGE 24

as well as most experiments at existing laser facilities, such as the NOVA laser at Livermore Laboratory. However, many new or planned facilities would be illegal.

Conclusions

While our technical review of the record indicates that facilities such as NIF and Laser Mégajoule are illegal under the CTBT, there is as yet no official interpretation of the CTBT in regard to fusion explosions. Hence, the US and other countries are proceeding as if their plans are legal under the CTBT. An official opinion by the CTBT review conference, which defines an explosion for the purposes of the treaty and sets limitations on research based upon that definition, is needed. This should take into account the facts set forth above as well as the clear intent of the CTBT to constrain new weapons development. The present US interpretation, shared by several other states, is clearly unacceptable. It deems explosions in NIF and Laser Mégajoule to be legal. If this is accepted, there would be no upper limit to pure fusion explosions under the CTBT, which would severely undermine it in the long-term and possibly render it meaningless.

Facilities and experiments such as NIF and Magnetized Target Fusion devices pose threats to both the CTBT and the disarmament process. If ignition is demonstrated in the laboratory, the weapons labs and the DOE (or their equivalents in other countries) would likely exert considerable pressure to continue investigations and to engage in preliminary design activities for new generation weapons (even if the goal is simply to keep the designers interested and occupied). Ignition would also boost political support and make large-scale funding of such activities more likely.

Even without the construction of actual weapons, these activities could put the CTBT in serious jeopardy from forces both internal and external to the nuclear weapons states pursuing this research. Internally, the same pressures that could lead to the resumption of testing of the current generation of weapons could also lead to the testing of new weapons (to replace older, and supposedly less safe or reliable weapons). Externally, the knowledge that the nuclear weapons states are engaging in new fusion weapons design activities could lead other states to view this as a reversal of momentum towards disarmament. Indeed, as noted elsewhere in this newsletter, this scenario has already occurred with the Indian and Pakistani nuclear tests.

Recommendations

The following recommendations, taken together, are aimed at preventing the development of pure fusion weapons:

- Ignition of the fusion fuel should be used as the definition of a fusion nuclear explosion for purposes of CTBT compliance. This would prohibit all ignition experiments as well as planning or construction of all facilities designed to achieve ignition. This appears to be the minimum necessary to meet the letter of the CTBT. Construction of NIF and LMJ should be stopped.

- The total fusion energy output should be limited to 10^{14} neutrons/shot (as proposed by Richard Garwin). This would prevent attempts to gain weapons-related information by increasing the energy of the driver and fusion energy output while staying below ignition.

- The use of tritium should be banned in all systems that use high explosives (as proposed by Ray Kidder).

1 As nuclear weapons get larger, the destructive area per unit of explosive power declines.

2 In this article, we designate all devices that could activate pure fusion explosions by various confinement schemes under the rubric of "explosive confinement fusion" or ECF.

3 Due to space limitations, this is by necessity a simplified description of thermonuclear fusion. For example, the physics of plasmas, indeed the definition of a plasma, is significantly more complex and precise than what is presented here. However, this explanation of fusion is sufficient in order to understand the issue. A more detailed description can be found in the report, *Dangerous Thermonuclear Quest*.

4 Here we use the chemical symbols for elements to represent their nuclei, since at the temperatures involved in thermonuclear fusion, all atoms are converted into free electrons and nuclei — that is, into plasmas.

5 The specific activity of tritium is about 9,600 curies per gram. Its half-life is 12.3 years.

6 See H. Zerriffi and A. Makhijani, *The Nuclear Safety Smokescreen*, (IEER, May 1996).

7 See *Science for Democratic Action*, Vol. 6 No. 3 for articles on energy options for reducing greenhouse gas emissions. See also A. Makhijani and S. Saleska, *The Nuclear Power Deception*, (IEER, 1996), chapter 9. (Soon to be published in book form by Apex Press.)

8 Richard L. Garwin "The Future of Nuclear Weapons Without Nuclear Testing," *Arms Control Today*, Vol. 27, No. 8 November/December 1997, p. 9. Garwin proposes that one millisecond is a good number to separate the explosive regime from the steady-state regime.

9 Robert N. Thorn and Donald R. Westervelt, *Hydronuclear Experiments*, (Los Alamos, NM: Los Alamos National Laboratory, LA-10902-MS, DE87007712, February, 1987), p. 4.

10 John Lindl, "Development of the Indirect-Drive Approach to Inertial Confinement Fusion and the Target Physics Basis for Ignition and Gain," (Lawrence Livermore National Laboratory preprint, publication numbers UCRL-JC-119015 and L-19821-1, November 1995), p. 6. Published in *Physics of Plasmas*, Vol. 2, No. 11, (November 1995), pp. 3933-4023.

11 National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Committee for the Review of the Department of Energy's Inertial Confinement Fusion Program, *Review of the Department of Energy's Inertial Confinement Fusion Program: The National Ignition Facility*, (Washington: National Academy Press, 1997), pp. 10-11.

12 Suzanne L. Jones and Frank N. von Hippel, "The Question of Pure Fusion Explosions Under the CTBT," *Science and Global Security*, Vol. 7, 1998, pp. 5-6.

13 Ibid., p. 5.

DANGERS

FROM PAGE 4

weapons, all five nuclear weapons states that are signatories to the Nuclear Non-Proliferation Treaty (the United States, Russia, Britain, France, and China) have been modernizing their nuclear arsenals. For example, China is developing long-range submarine-launched ballistic missiles. The United States has a $4.5 billion per year program largely to ensure maintenance of weapons design and testing capability, weapons production capacity, and weapons modification capacity. The five nuclear weapons states have now been joined by India, which conducted five nuclear weapons tests in May 1998, (including one thermonuclear explosion[6]), and Pakistan, which announced that it conducted six nuclear tests later in that same month.[7] The five plus India have declared programs for laboratory testing and computer simulations of nuclear explosions. All of them have used the primary rationale that "deterrence" is the basis of their nuclear weapon programs.

Deterrence

Nuclear deterrence has been described and defended in a number of different ways. Two of the most common arguments are that:

- using or threatening to use nuclear weapons will deter a conventional attack
- threatening nuclear retaliation will deter another nuclear weapons state from conducting a first strike

We will discuss each briefly.

Deterrence of conventional attack:

The main claim of nuclear deterrence proponents has been that nuclear weapons have prevented war in Europe for half a century. A more extreme version of this view has been that these weapons have prevented world war and have kept the peace since World War II. There is little historical or analytical basis for this claim even as it relates to the specific presence of nuclear weapons in Europe. We cannot now know whether the horror of the destruction in Europe and Russia during World War II may have been sufficient without nuclear weapons to deter war in Europe. This is because the nuclear bombings of Hiroshima and Nagasaki, and thus the start of the

SEE **DANGERS**, PAGE 27

DETERRENCE AND PROLIFERATION

The history of nuclear weapons shows that the deterrence doctrine is related to nuclear weapons proliferation. When a large and powerful country has felt a nuclear threat from another, it has often resorted to producing nuclear weapons or to developing the capacity for making them:

- The U.S. developed nuclear weapons during World War II in response to a perceived German nuclear threat. In considering targets for its own weapons, the US was deterred by German nuclear capability and targeted Japanese forces instead.[1]
- The Soviet Union began a large-scale nuclear weapons program after the bombing of Hiroshima and the veiled threat it represented.
- China developed nuclear weapons in response to US nuclear threats and then also in response to Soviet nuclear threats.
- India developed nuclear weapons capability after the Chinese nuclear test in 1964 and after a veiled US nuclear threat during the December 1971 South Asian war.
- Pakistan developed nuclear weapons in response to India.
- Israel's arsenal was developed after the 1956 Suez crisis, partly out of fear of the potential for Soviet nuclear weapons being arrayed on the Arab side.
- North Korea, which faced US nuclear weapons on its border with South Korea, developed nuclear weapons capability after it lost confidence in its alliance with the Soviet Union in the mid-1980s.

Only the British nuclear arsenal is largely explained as an artifact of a fading empire determined not to pass the baton to the U.S. without a place at the bargaining table. The French determination to have nuclear weapons was at least partially out of their desire to remain independent of US power. Their desire for a large influence in a Europe in which the U.S.-Soviet confrontation would otherwise always be decisive was also a big factor.[2]

1 Arjun Makhijani, "Japan: 'Always' the Target?", *The Bulletin of the Atomic Scientists*, May/June 1995.
2 Chapters 6 through 11 in Arjun Makhijani, Howard Hu, and Katherin Yih, eds., *Nuclear Wastelands*, (Cambridge: MIT Press, 1995), contain brief histories of the development of nuclear weapons in the declared and undeclared nuclear weapons states.

nuclear age, occurred at about the same time.

The claim that nuclear weapons have kept the world at peace is very narrow and misleading at best and false at worst, arising largely from Eurocentrism. A more realistic claim for the US-Soviet nuclear confrontation during the Cold War would be that it induced a fear in these two countries and across the European political-military divide of yet another war on the soil of Europe. Nuclear weapons therefore contributed to the cynical export of war to the Third World. (There have been, to be sure, causes of war and violence unrelated to the Cold War during this period, as for instance the conflicts over Kashmir in South Asia, or those in Northern Ireland.) The proxy wars of the Cold War, often carried out via favored local regimes and dictators, have directly caused the deaths of millions of people, created millions of refugees, and resulted in impoverishment, economic devastation, and disease for millions more, greatly increasing the death toll. Further, as the campaign against land-mines has shown, the ill-effects of these wars are still killing large numbers of people and preventing many more from pursuing normal lives. Nuclear weapons have contributed to untold misery in the world, largely outside Europe, among people caught up in the US-Soviet ideological competition in circumstances they could not hope to control.

The claim that nuclear weapons have kept the world at peace is very narrow and misleading at best and false at worst. A more realistic claim would be that it induced a fear across the European political-military divide of yet another war on the soil of Europe.

But the people of the countries where these arsenals were built were not exempt from the harm that was inflicted. They were on the frontlines in Korea, Viet Nam and Afghanistan. And both countries inflicted enormous health and environmental damage on their own people as well as on the rest of the world in the process of building and testing their nuclear arsenals. The number of weapons required to generate the level of fear required for this export of war will remain open to debate. However, the fact that nuclear arsenals were built to a level where total destruction of everything of value to both sides was possible speaks to the stark irrationality of the process.

Deterrence of attack by nuclear threats was carried to extremes during the Cold War. US policy was formulated in NSC-68, the 1950 National Security Council memorandum that spelled out the containment policy thought necessary to win the Cold War. It was premised on the idea that the Soviets would ruthlessly attack US interests and undermine them, counting on hesitations and delays in the US response, and that the US had to threaten global annihilation to prevent Soviet success:

> "The risk that we may thereby be prevented or too long delayed in taking all needful measures to maintain the integrity and vitality of our system is great....For example, it is clear that our present weakness would prevent us from offering effective resistance at any of several vital pressure points. The only deterrent we can present to the Kremlin is the evidence we give that we may make any of the critical points which we cannot hold the occasion for a global war of annihilation."[8]

The readiness for deliberate global annihilation came closest to actualization in 1962, during the Cuban missile crisis.

Deterrence of a first-strike nuclear attack:

The deterrence of nuclear attack at first sight appears to be a more straightforward concept. It is also known as second-strike deterrence. The goal of such a policy is to prevent an adversary from launching a nuclear strike by threatening a devastating nuclear response. There has been considerable debate on how many weapons it would take to have an effective second-strike deterrence policy. There is no fixed answer to this question. However, the history of nuclear weapons makes it clear that second-strike deterrence can be achieved at a vast range of numbers of nuclear weapons, ranging from zero to no practical upper limit.[9]

In practice, the US-Soviet "deterrence" process since the 1950s was to build large numbers of ever more sophisticated nuclear weapons in reaction to one another's weapons systems, and thereby to increase the number of targets that the weapons were supposed to destroy. The huge numbers of nuclear weapons and weapons-usable materials that resulted are now at the root of the grave dangers we face after the Cold War.

Further, whether a second strike can actually be carried out has been and remains an open question, given the large number of US and Russian nuclear weapons that are targeted on each other and on command and control systems.[10] This uncertainty has led to a hair trigger posture on both sides, known variously as "launch-on-warning" or a "use-it-or-lose-it" policy. This means that a decision to launch a retaliatory attack must be made within a few minutes of detection of a first strike. There have been many false alarms – the worst,

SEE DANGERS, PAGE 28

DANGERS

FROM PAGE 27

so far as we know, is the 1995 Russian incident discussed above. Hence, even second strike-deterrence has become an unstable policy practically indistinguishable from a first strike posture.

The doctrine of deterrence has, moreover, been the main engine of nuclear proliferation. The process started with Manhattan Project during World War II. It was started because of the fear that Nazi Germany might acquire nuclear weapons. The crash Soviet program to build nuclear weapons was a response to the Manhattan Project, which included the use of nuclear weapons on Japan.[11] China built nuclear weapons in response to the US program and later to its conflict with the Soviets. The connections between deterrence and proliferation are summarized in the box on page 26.

In sum, the doctrine of deterrence provides the main rationale for the possession of nuclear weapons. It was central to the creation for the first time in history of the possibility of total destruction. It is therefore not only an irrational idea that has been at the core of proliferation, it is also an immoral one, as the Catholic bishops conference of the United States (among others) has recently pointed out. (See excerpts in the box on page 22.) It is therefore essential that nuclear weapons states abandon this doctrine as part of their obligations to achieve and maintain complete nuclear disarmament.

1 William M. Arkin et al., *Taking Stock; Worldwide Nuclear Deployments 1998*. (Washington DC: Natural Resource Defense Council, March 1998), pp. 1 and 16. Great Britain, France and China have an estimated 1,330 warheads total. The US has 150 warheads stored in seven NATO countries: Germany, Great Britain, Turkey, Italy, Greece, the Netherlands, and Belgium.

2 For information on stocks of military plutonium, see David Albright, Frans Berkhout and William Walker, *Plutonium and Highly Enriched Uranium 1996: World Inventories, Capabilities and Policies*, (Oxford: Oxford University Press, 1997), Chapter 3. For information on projections of commercial plutonium stocks, see pp 190-191.

3 *The Washington Post*, March 15, 1998, p. A1. Unless otherwise mentioned, this front-page *Washington Post* article is the source for the description of the January 25, 1995 event.

4 As quoted in *The Washington Post*, March 15, 1998, p. A24.

5 See Stansfield Turner, *Caging the Nuclear Genie, An American Challenge for Global Security*, (Boulder, CO: Westview Press, 1997), pp 17 and 18.

6 There has been some speculation that this may have been a boosted fission weapon explosion, rather than a thermonuclear device involving both a primary and a secondary component. But the Indian government has reaffirmed that it was a thermonuclear explosion with a force of 43 kilotons of TNT equivalent.

7 According to an Indian news report citing an official Pakistani statement, Pakistan apparently conducted four "sub-kiloton" tests and two larger tests at two test sites on May 28 and May 30, 1998. Amit Baruah, "Pak 'clears' mystery over nuclear tests," *The Hindu*, June 30, 1998. IEER attempted to obtain this official statement from the Embassy of Pakistan but was unsuccessful.

8 NSC-68, as published in Thomas H. Etzold and John Lewis Gaddis, *Containment: Documents on American Policy and Strategy 1945-1950*. (New York: Columbia University Press, 1978), p. 414. The documents in this volume help to put US nuclear weapons policy into the context of the Cold War, and show how it was connected to other parts of that policy, such as containment of the Soviet Union, covert actions undertaken by the US government via the CIA, conventional war, and economic policy. This is a good place to begin research on containment policy and its relation to deterrence.

9 Stephen I. Schwartz, ed., *Atomic Audit*, (Washington: Brookings Institution Press, 1998), pp. 3-27.

10 For a detailed discussion of hair-trigger alert policies see Bruce G. Blair, *Global Zero Alert for Nuclear Forces*, (Washington, DC: Brookings Institution Press, 1995).

11 Japanese forces had been targeted since May 5, 1943. Germany was ruled out as a target on that date, partly because of fear of nuclear retaliation. See Arjun Makhijani, "Japan: 'Always' the Target?", *The Bulletin of the Atomic Scientists*, May/June, 1995.

DE-ALERT

FROM PAGE 12

a huge explosion (from hundreds to thousands of tons of TNT equivalent). For instance, a few hundred tons of TNT equivalent is roughly a hundred times larger than the bomb that destroyed the Alfred P. Murrah federal building in Oklahoma City.

Under these circumstances, nuclear arsenals, with the exception of their use regionally by India, Pakistan or Israel, would be limited to retaliatory deterrence, and the explosive power of nuclear weapons would be sharply diminished from thousands of megatons (global total) to roughly a hundred megatons total, perhaps less. This would greatly reduce the consequences of accidental nuclear war. Further, the replacement of tritium reservoirs would become politically and militarily impossible, since a demand for withdrawing tritium from storage would be tantamount to announcing the intention of a first strike. Moreover, mixing the tritium with helium would introduce a considerable delay in the recovery of tritium, making it even more unlikely that it would be withdrawn.

The removal of tritium bottles from warheads could be done at any stage of de-alerting and is compatible with all other methods of de-alerting. While complete verifiability would be difficult, since some uncertainties regarding materials accounting will remain, storage under multilateral monitoring of almost all tritium would ensure that nuclear weapon systems would not be used for a first strike. To accomplish the same goal for India, Pakistan, and Israel would require sequestration because in these regions a first strike may be contemplated with relatively low-yield warheads.

Removing tritium bottles and disabling the boosting and thermonuclear portions of warheads would obviate any need for those parts of stockpile stewardship programs that deal with thermonuclear reactions. Thus, inertial confinement fusion programs would become unnecessary for stockpile stewardship, though they may

SEE **DE-ALERT**, PAGE 29

DE-ALERT
FROM PAGE 28

or may not be pursued for other reasons. Plans for tritium production for use in nuclear warheads, which in themselves exacerbate nonproliferation efforts, would also become superfluous.

ii) Pit Stuffing

After removing tritium bottles it would also be possible to disable nuclear warheads quickly without dismantling them. The method, developed at Los Alamos National Laboratory to deal with weapons deemed to be unsafe, is called "pit stuffing."[12] In this method, the warhead is disabled by stuffing a wire into the tube through which the tritium is "fed" into the primary. The wire fills the hollow portion of the pit, and is stuffed so that it is tangled inside. Once the end is stuffed into the pit, the warhead cannot be re-activated except by completely re-manufacturing the pit. Pit stuffing can be done relatively quickly and does not require the construction of expensive storage facilities for warheads or for pits prior to the complete and permanent disablement of large numbers of nuclear warheads. As with other de-alerting and disarmament measures, verification issues would need to be addressed.

iii) Reducing risks from the Y2K Problem

The need for de-alerting should also be considered in the context of the potential problems associated with computer hardware and software expected at the turn of the century (called the Year 2000 or Y2K problem). In view of the considerable uncertainties associated with the operation of command, communication, and control systems within and associated with nuclear weapons, it would be prudent to implement at least one physical de-alerting measure for all nuclear warheads as much before the end of 1999 as technically possible. Y2K dangers include possible blacking-out of radar screens and malfunctioning of command and control systems. Such occurrences might provide no information or wrong information to those responsible for making decisions to launch nuclear weapons. As a result, the dangers associated with "use-it-or-lose-it" hair trigger postures could increase considerably. One de-alerting measure to address the Year 2000 problem would be to disable the warheads so that the explosives in them cannot be ignited by any malfunction of the electronic system. For instance, this could be achieved by putting a wire into the pit in a manner analagous to the pit stuffing described above, but with the end of the wire left in a position that allows it to be removed and the warhead restored to operability.

De-alerting and Nuclear Disarmament

Most de-alerting can be carried out by nuclear weapons states unilaterally. In fact, it will likely be necessary for the US to undertake some unilateral de-alerting before it can engage Russia in a bilateral program. For instance, Bruce Blair of the Brookings Institution and others have presented a detailed plan under which the United States could unilaterally reduce its nuclear warheads to about 600 and immobilize (for instance by pit stuffing) or dismantle the rest.[13] The specific mix of measures taken to de-alert nuclear weapons will depend on their design, on verification measures, and on the delays that are to be introduced by the de-alerting. For instance, a retaliatory deterrence posture does not require as many as eight or even four warheads per SLBM. The number of warheads per SLBM could be reduced to one, and the nature of the warheads changed from large yield (in the hundreds of kilotons) to relatively low-yield. The number of submarines on patrol at any one time could also be greatly reduced. These measures, if undertaken unilaterally by the United States, would greatly increase confidence on the part of Russia, whose submarine fleet cannot be maintained at sea at anywhere near full strength due to lack of funds. Specifically, it would increase the likelihood of Russia's participation in a global de-alerting process.

All tactical nuclear weapons as well as nuclear bombs can be de-alerted by storing the warheads apart from the delivery systems, and establishing physical as well as remote technical means of verification. This can be done rapidly, unilaterally, and in the near term, without any coupling to any other measure. Withdrawal of all weapons from foreign bases is another de-alerting measure for nuclear weapons that would enhance the prospects of complete disarmament. At present, only the United States has nuclear weapons based abroad. An estimated 150 US warheads are based in Europe. The unilateral measures most likely to reduce Russian concerns would be de-alerting of weapons based near Russia, such as those in Europe and in the Arctic region.

Medium and Long-Term Steps

De-alerting as a part of an approach to enduring nuclear disarmament should be carried out in phases. We have laid out some steps of the first phase above. The next phase, described below, would be very close to disarmament, but may be better described as "deep de-alerting." The basic technical approaches are similar to short-term steps, but are more complete. As they would involve greater multilateral verification and control, they would be politically and technically more difficult to reverse. Both phases would enhance efforts to reach a

SEE **DE-ALERT**, PAGE 30

DE-ALERT

FROM PAGE 29

much longer term third stage, a state of enduring nuclear disarmament that is far more resistant to attempts to reverse it in time of crisis.

Medium-term de-alerting measures include:

- removal and remote storage of all warheads separately from delivery systems under multilateral monitoring;
- storage of all guidance systems at locations remote from delivery systems under multilateral monitoring;
- multilateral verification of all materials accounts for weapons-usable materials to ensure compatibility of warhead declarations, numbers of de-alerted warheads, and stored weapons-usable materials.

The technical aspects of these measures could take many months to a few years to complete, as time will be needed to design and implement verification systems, and design and construct storage facilities.

Interim-alerting measures would be enhanced if all eight states possessing nuclear weapons would put all their commercial and military weapons-usable fissile materials that are not actually in warheads or in classified shapes under the safeguards system of the International Atomic Energy Agency (IAEA). In any case these materials should be put into some kind of bilateral or multilateral accounting, monitoring and verification scheme (such schemes often go under the rubric of "transparency measures").

The longest-term de-alerting approaches slide into disarmament measures. They include dismantlement of warheads and storage of all weapons-usable fissile materials under IAEA safeguards or in non-weapons usable forms. It would take one or more decades to accomplish the technical requirements of these measures, depending on the technologies chosen to implement them. They would be considered part of a de-alerting process if the facilities to reconstitute nuclear arsenals are maintained. They would be part of nuclear disarmament if the warhead and associated materials production and processing facilities are also dismantled.

1 This article is largely based on a forthcoming piece by the author in the newsletter of the United Nations Institute for Disarmament Research.

2 An early article advocating de-alerting was: Bruce G. Blair and Henry W. Kendall, "Accidental Nuclear War," *Scientific American*, Vol. 253, December 1990, pp. 53-58.

3 According to Bruce Blair, "only Russia and the U.S. today maintain [their nuclear] forces on high combat alert under normal conditions. The others maintain a de facto policy of de-alert." Personal e-mail communication, 30 August 1998. That might change if Pakistan carries out its threat to arm its delivery vehicles and if India follows suit.

4 Statement of Brazil, Egypt, Ireland, Mexico, New Zealand, Slovenia, South Africa, and Sweden, 9 June 1998.

5 Arjun Makhijani and Katherine Yih, "What to Do at Doomsday's End," *The Washington Post*, 29 March 1992.

6 Bruce G. Blair, Harold A. Feiveson. and Frank N. von Hippel, "Taking Nuclear Weapons Off Alert," *Scientific American*, November 1997, pp. 74-81.

7 Bruce G. Blair, *Global Zero Alert for Nuclear Forces*, (Washington: Brookings Institution, 1995), pp. 90-107.

8 Ibid., p. 87.

9 Richard L. Garwin, "De-alerting of Nuclear Retaliatory Forces," presented to the Amaldi Conference, Paris, France, November 20-22, 1997.

10 Blair, 1995, op cit., pp. 88-89.

11 The idea of removing tritium bottles from nuclear weapons has been proposed as a qualitative de-alerting measure by Martin Kalinowski in "Qualitative Disarmament by Tritium Control," INESAP Information Bulletin, Issue No. 15, April 1998, p. 48. In an earlier paper, Kalinowski and Colschen have calculated that the yields of various US warheads would be reduced from a typical level of several hundred kilotons to yields in the range of a few hundred tons to a few kilotons of TNT equivalent in all but one case. In the case of the W89, the removal of the tritium bottle would cause the warhead not to operate. The overall effect of removing tritium from all warheads is estimated to be a reduction of yield by two orders of magnitude or more. See Martin B. Kalinowski and Lars C. Colschen, "International Control of Tritium to Prevent Horizontal Proliferation and to Foster Nuclear Disarmament," *Science and Global Security*, Vol. 5, 1995, pp. 131-203.

12 Matthew Bunn, "'Pit-Stuffing:' How to Disable Thousands of Warheads and Easily Verify Their Dismantlement," and Richard L. Garwin, "Comment on Matt Bunn's 'Pit-Stuffing' Proposal," in *F.A.S. Public Interest Report*, Journal of the Federation of American Scientists, Vol. 51, No. 2, March/April 1998. Available at: "www.fas.org/faspir/pir0498.htm."

13 Blair, Feiveson, and von Hippel, 1997.

INDIA

FROM PAGE 8

weapons program was a response to US nuclear threats and to the pullout of Soviet support in the late 1950s, the test reverberated in India, which had lost a short border war with China in 1962. The Chinese test gave India's nuclear establishment the opening it needed to successfully argue for a nuclear weapons program. Since that time, development of India's nuclear program has had the support of every government.

While its nuclear weapons program was developed in an Asian context, India has long had global political ambitions. For instance, for many years it has wanted a permanent seat on the U.N. Security Council. But despite the fact that it is the world's most populous democracy, it has not been able to obtain it.

The five permanent members of the Security Council are nuclear weapon states; therefore, according to the reasoning in New Delhi, obtaining global political clout was associated with one of two roads: either India would be a leader in nuclear disarmament, or it would become a nuclear weapons state. Its attempts to lead in disarmament have not met with success.

It has refused to sign the Nuclear Non-Proliferation Treaty (NPT) since its creation in 1968, because the treaty allows the five nuclear weapon states parties to the NPT to retain nuclear weapons without a specific schedule for nuclear disarmament. The treaty, said India, was discriminatory; it created two classes of states

SEE **INDIA**, PAGE 31

INDIA

FROM PAGE 30

— the nuclear "haves" and the "have-nots." But India's entreaties and initiatives never attracted support or even serious attention from the nuclear weapon states.

When France and China signed the NPT in 1992, the treaty became a more viable instrument for US nonproliferation policy. That policy has been to hold onto nuclear weapons for an indefinite period, to maintain a first-use prerogative, and to prevent the overt expansion of the number of nuclear weapon states beyond the five declared powers — with a wink (and much silence) about Israel's ambitious but clandestine nuclear arsenal.

New difficulties developed during negotiation of the Comprehensive Test Ban Treaty (CTBT) in September 1996. The final treaty, the product of more than two years of negotiation, contained a provision that it could not enter into force unless India signed and ratified it, along with 43 other countries with nuclear reactors.

India was included in the 44-nation list against its express, repeated, and emphatic statements that it would never sign the CTBT unless it was accompanied by a "time-bound" commitment to complete nuclear disarmament. That this demand was unrealistic in the context of the test ban treaty did not seem to matter to India. The violation of its sovereignty by its inclusion in a treaty against its will incensed the Indian government, and helped set the stage for the May tests.

Since September 1996 there have been widespread discussions of a possible CTBT review conference in September 1999, at which parties that had ratified the treaty by then would pressure India by various means, including sanctions, to sign and ratify it.

By the time the BJP-led coalition came to power in March 1998, the Indian political scene had already shifted in favor of nuclear weapons. Because India had lost global political clout both in non-aligned forums and in the U.N. Conference on Disarmament, and because it was facing the prospect of sanctions by the turn of the century, there were few incentives not to test.

For more information on the Indian nuclear tests, see Arjun Makhijani, "A legacy lost," *The Bulletin of the Atomic Scientists*, July/August, 1998; and Arjun Makhijani, "The South Asian Nuclear Crisis," *Foreign Policy in Focus*, newsletter of the Interhemispheric Resource Center and the Institute for Policy Studies, Vol. 3, No. 18, June, 1998. Also see IEER's webpage, *www.ieer.org*. Some resources available by contacting IEER at 301-270-5500 or ieer@ieer.org.

1 M.V. Ramana, "The Indian Nuclear Bomb - Long in the Making," *PRECIS*, MIT Center for International Studies, Summer 1998.

PAKISTAN

FROM PAGE 9

been very uneven as well as opportunistic. US Cold War strategic plans and desire for a "partner" in the region, notably during the fight to get Soviet troops out of Afghanistan, led it to look the other way during the development of Pakistan's nuclear weapons program. Despite evidence of Pakistan's nuclear ambitions, the United States provided it with non-nuclear military equipment and significant financial support. After Soviet troops were driven out of Afghanistan, Pakistan was subjected to US sanctions and rebukes more often than neighboring India. The harsh US policy has been driven at least in part by a disproportionate US concern about proliferation in Islamic countries.[1] Because of Pakistan's economic weakness, the effect of US economic sanctions has been and is likely to continue to be far greater on Pakistan than on India.

Pakistan's vulnerable position vis-à-vis India has made it more open to steps for reciprocal, bilateral limitations on weapons programs. For example, it has linked its accession to the NPT to signature by India. In 1987, it proposed a bilateral ban on nuclear testing. Pakistani governments have also proposed at various times mutual acceptance of IAEA safeguards on nuclear installations, comprehensive bilateral nuclear inspections, establishment of a nuclear weapon free zone in South Asia, and formal pledges not to produce nuclear weapons. Pakistan has also used the occasion of its own status as a declared nuclear weapons state to get more attention to its longstanding call for an international (rather than bilateral) resolution of the Kashmir dispute. India has rejected most of Pakistan's bilateral proposals. However, the two countries signed a bilateral agreement in 1988 not to attack each other's nuclear facilities.

Sources for article and timeline:

Leonard Spector, *Nuclear Ambitions* (Boulder, Colorado: Westview Press, 1990).

Leonard Spector, *The Undeclared Bomb*, (Cambridge, Mass., Ballinger, 1988).

Thijs de la Court, Deborah Pick and Daniel Nordquist, *The Nuclear Fix: A Guide to Nuclear Activities in the Third World*, (Amsterdam: WISE publications, 1982).

David Albright, Frans Berkhout, and William Walker, *Plutonium and Highly Enriched Uranium 1996* (Oxford, UK: Oxford University Press, 1997).

Center for Nonproliferation Studies, Monterey Institute of International Studies factsheet, "Chronology of Pakistani Nuclear Development," web address: "http://cns.miis.edu/india/paknucchron.html"

1 See Pervez Hoodbhoy, "Myth-Making: The 'Islamic' Bomb," *Bulletin of the Atomic Scientists*, June 1993, pp. 42-49.

A CHRONOLOGY OF NUCLEAR THREATS

Since the bombings of Hiroshima and Nagasaki in 1945, nuclear weapons states have, on numerous occasions, threatened to use nuclear weapons. Some of these threats were implicit — made either by putting nu clear forces on a higher level of alert or by re-deploying them to a crisis area.

In addition, the very possession of nuclear weapons by any country presents a considerable implicit threat to those that the nuclear state might consider an adversary. It is also the case that a nuclear capability stood behind the deployments of non-nuclear military forces by the US and USSR during the Cold War.

We do not discuss this implicit violence inherent in nuclear weapons here, nor the threat of retaliation by a nuclear weapons state in response to nuclear weapons use against it. The chronology below lists first-use threats made by various nuclear weapons states since over the last fifty years.

Most of the threats listed below were made by the United States. There are at least two reasons for this. First, we have extensive documentation about US nuclear threats, but do not have comparable documentation for the threats made by other states, notably the Soviet Union. It is plausible that when the diplomatic and military history is better known, more Soviet threats will be documented. We should note in this context that China has an explicit no-first-use policy. We are not aware of China making any first-use threats such as those catalogued below.

Second, US policy since World War II was to integrate nuclear weapons into its armed forces structure. One reason was that the US saw its nuclear arsenal as a substitute for the use of troops. An outcome of this policy was that the US would put nuclear forces on alert or re-deploy them to areas of crisis. In this way, the US has implicitly made nuclear threats to non-nuclear states on many occasions.

Nuclear threats have generally been made in complex political and military situations and not always in wartime. We do not attempt to explain the details of these crises. Their interpretation is complex and often controversial. Our aim is simply to document the variety of conditions under which nuclear threats have been made.

1946:[1] President Truman is believed to have threatened to drop the "superbomb" on Moscow unless it withdrew from northern Iran, which it occupied during the war.

November: The US "ostentatiously" deploys nuclear capable bombers along the border of Yugoslavia after the downing of a US military aircraft.

1947: February: The US sends B-29 strategic bombers to a presidential inauguration in Uruguay.

1948: Berlin crisis: The US deploys and "display[s]" B-29s in Germany on three occasions.

1950: Nov. 30: President Truman announces that he is considering using nuclear weapons the day after US Marines are surrounded by Chinese Communist troops at the Chosin Reservoir in Korea.

1953: President Eisenhower secretly threatens to use nuclear weapons against China during the Korean War.

1954: Secretary of State John Foster Dulles secretly offers France three Mark 21 tactical nuclear weapons for use against Vietnamese troops which were surrounding French forces at Dienbienphu.

May: Strategic Air Command planes are sent to Nicaragua just before a CIA-supported coup against the elected government is carried out.

1956: October: President Eisenhower threatens the Soviet Union during the Suez Crisis.

1958: President Eisenhower sends troops to Lebanon and secretly authorizes the Joint Chiefs to use nuclear weapons following the onset of a crisis in Lebanon, a coup in Iraq, and fears that Egyptian President Nasser's influence would grow throughout the Middle East.

President Eisenhower secretly authorizes the use of nuclear weapons against China if they should invade the island of Quemoy, controlled by Chiang Kai-shek's troops.

1961: Berlin crisis: planned withdrawal of B-47 bombers is delayed.

1962: Cuban missile crisis. Both the US and USSR make threats — nuclear forces on both sides are on heightened alert; Soviet submarines are deployed to the Atlantic.

1968: The US considers using nuclear weapons in support of Marines surrounded at Khe Sanh, Vietnam.

North Korea seizes the *Pueblo*. The US deploys strategic (nuclear) aircraft in the western Pacific.

1969: The Soviet Union hints at the threat of a nuclear attack on China in connection with heightening border conflicts. Over the next few years, troop build-up along the border is accompanied by the stationing of nuclear missiles and tactical warheads.[2]

Part of 1960s and early 1970s:

Areas in Indochina are reportedly targeted with nuclear weapons as a part of a contingency "last resort" tactic to "save" US troops that might be trapped.[3]

1969-72:

President Nixon threatens escalation of the Viet Nam war, including possible nuclear attack in the North.

1971: The Soviet Union sends a naval task force to South Asia (nuclear status unclear).[4]

The US sends a nuclear-armed aircraft carrier into South Asian waters during the India-Pakistan-Bangladesh war — an implicit threat to India.[5]

1973: Middle East war: Superpower involvement in this conflict on opposite sides leads to a US decision to put its forces on alert.[6]

1980: January: The "Carter Doctrine," announced in the middle of the hostage crisis, declares a commitment to use "any means necessary, including military force" to keep the Soviets from advancing in the Persian Gulf (reaffirmed by President Reagan in 1981). These means included the use of nuclear weapons.

1991:[7] The US threatens to use nuclear weapons under certain contingencies during the Gulf War.

1996: April: A US Assistant Secretary of Defense announces that if the US decided to destroy an (alleged) underground chemical weapons facility, it would use nuclear weapons. The existence of a specific plan for this was later denied.

1997: November: Presidential Decision Directive 60 allows the targeting of "rogue states" with "prospective access" to nuclear weapons. In the context of the conflict in Iraq, the administration refuses to rule out any option.[8]

1998: February 4: Russian President Boris Yeltsin, apparently troubled by news reports of PDD 60 simultaneously with the crisis in Iraq, warns that the US could start a world war through its actions in Iraq. "One must be careful in a world that is saturated with all kinds of weapons," he noted.

May: After India tests nuclear weapons, but before Pakistan conducts its own tests, the Indian Home Minister L.K. Advani warns Pakistan to change its attitude towards the disputed territory of Kashmir in view of the changed strategic situation. This warning is issued despite the fact that India had already announced a no-first-use policy.[9]

---

1 Unless otherwise noted, entries through 1980 are from Daniel Ellsberg, "Call to Mutiny," in *Protest and Survive*, E.P. Thompson and Dan Smith, eds., (New York: Monthly Review Press, 1981); and Barry B. Blechman and Stephen S. Kaplan, *Force Without War* (Washington: Brookings Institution, 1978).

2 Stephen S. Kaplan, *Diplomacy of Power: Soviet Armed Forces as a Political Instrument* (Washington: Brookings Institution, 1981), pp. 270-288.

3 Jack Anderson, "U.S. Viet Plans Include A-Bombs," *The Washington Post*, 17 April 1972, page B17. Anderson's column was based on information provided by a former Air Force sergeant.

4 William Bundy, *A Tangled Web: The Making of Foreign Policy in the Nixon Presidency*. (New York: Hill and Wang, 1998), pp. 279-292. Bundy notes that this deployment was part of a general US-Soviet-Chinese-South Asian crisis that could have resulted in an overt superpower confrontation.

5 Ibid.

6 Henry Kissinger, *Years of Upheaval*, (Boston: Little, Brown and Company, 1982), pp 575-599.

7 Unless otherwise noted, entries 1990-1998 are from Stephen I. Schwartz "Miscalculated Ambiguity: US Policy on the Use and Threat of Use of Nuclear Weapons," *Disarmament Diplomacy*, No. 23, February 1998.

8 Jeffery Smith, "Clinton Directive Changes Strategy on Nuclear Arms Centering on Deterrence, Officials Drop Terms for Long Atomic War," *The Washington Post*, 7 December 1997, p. A1. The PDD-60 remains a classified document. Quotes are from Robert G. Bell, Special Assistant to the President for National Security Affairs and "a separate official."

9 Mr. Advani is reported as having said: "Islamabad should realize the change in the geo-strategic situation in the region and the world [and] roll back its anti-India policy, especially with regard to Kashmir." Mr. Advani recognized that India had a no-first-use pledge in the same press conference: India's nuclear capacity "has brought about a qualitatively new stage in Indo-Pakistani relations," he said. It "signifies — even while adhering to the principle of no first strike — [that] India is resolved to deal firmly with Pakistan's hostile activities in Kashmir." Kenneth J. Cooper, "Key Indian Official Warns Pakistan," *The Washington Post*, 19 May 1998, p. A15.

TREATIES

FROM PAGE 5

definitive until it rules on Article VI again in the process of an actual dispute brought before it involving the NPT. Moreover, the World Court's opinion is in accord with the views of the vast majority of NPT signatories.

Achieving Treaties But Not Disarmament

Apart from Article VI of the NPT, there is no clear pattern towards disarmament among these treaties. Some treaties legitimize nuclear arsenals and are significant roadblocks to nuclear disarmament. Foremost among these are NATO and the US-Japan Security Treaty. The sum total of these treaties, when coupled with the actual behavior of nuclear weapons states, indicates that treaties are not going to be enough to create complete and enduring nuclear disarmament. This is because the nuclear weapon states have come to see their security, their power, and their position in the world as being linked to the possession and deployment of nuclear weapons. Moreover, the United States, Russia, Britain, and France have not renounced first-use of nuclear weapons. In fact, the US and Russia have explicitly maintained that such use is their prerogative.

US spokespersons have also stated that the prerogative of first-use is being maintained because without it Japan and Germany might build their own nuclear weapons. How these countries and other members of military treaties with United States can be regarded as "non-nuclear states" under these circumstances is unclear under the terms of the NPT, which is silent on such treaty arrangements. The US and its allies maintain that an expansion of such arrangements is permitted under the NPT. But that interpretation has not been clarified by the World Court or any authoritative body.

Further, the legality of an integration of European Union member states into one large country with a common defense policy and common nuclear weapons is unclear. The practical effect is not. It would even further increase the number of people whose governments have access to the nuclear trigger.

Achieving enduring and complete nuclear disarmament that is stable will require popular pressure, amendments to or supercession of existing treaties, and a change in at least two central aspects of the nuclear weapons states' political culture as it is commonly expressed. The first is that which regards the five nuclear weapons states recognized by the NPT as the only legitimate and responsible guardians of nuclear weapons, while all others are seen as being "the wrong hands." This attitude is especially prevalent in the United States. However, there are no safe hands to possess nuclear weapons. Different hands simply bring different types of dangers. Even a perfunctory study of nuclear weapons history reveals the deep and intractable dangers in which the US and the Soviet Union put themselves and the world. Consider for instance that:

- the decision to bomb Hiroshima and Nagasaki was in part to justify huge expenditures of scarce resources on the Manhattan Project;
- during the Cuban missile crisis, both sides were ready to risk global catastrophe to get their own way;
- the US and Soviet Union have made a number of nuclear threats to non-nuclear weapons countries (see pages 32-33);
- nuclear weapons establishments have inflicted immense harm on the people of their own countries from nuclear weapons testing and production under cover of the secrecy afforded by "national security";
- the US and the Soviet Union built up nuclear weapons to such irrationally huge levels that dozens of warheads were targeted upon individual cities;
- although the US and the Soviet Union each had the explicit foreign policy goal of destroying the economic and political system of the other, neither side considered the consequences of the collapse of the other (such as "loose nukes" or black markets in fissile materials);
- despite the rising danger of accidental nuclear war, Russian and US leaders have so far failed to make preventing it a top priority.

The second problem that we must address is that dominant powers tend to disregard treaties when they become inconvenient. Unless there are independent mechanisms for enforcement of treaties in the most powerful countries, treaties meant to achieve progress in non-proliferation and disarmament will remain vulnerable to abrogation. Moreover, they may themselves contribute to the creation of new instabilities and problems, like the NPT and CTBT have done. We shall examine these more closely.

The NPT

Because the framework for the NPT was provided by the United States, it is not surprising that the commitment to disarmament was vague, but the legitimization of the possession of nuclear weapons by five countries and the requirement that other countries not acquire nuclear weapons were explicit. Though the disarmament aspect of the NPT has now been considerably tightened by the World Court's unanimous advisory

SEE **TREATIES**, PAGE 35

opinion, the US rejects this interpretation. The NPT also provides for the promotion of commercial nuclear technology among the signatories. Both of these aspects have had serious negative consequences.

The terms of the treaty meant that a number of threshold countries refused to sign, though pressures from the United States over the decades reduced the most important non-signatories to three: Israel, India, and Pakistan. However, US treatment of these three countries is markedly dissimilar. The United States has not only winked at the Israeli arsenal, it has provided Israel with extensive military assistance. By contrast, Pakistan, which is also a non-signatory, suffered US sanctions for developing nuclear capability, even prior to its May 1998 nuclear tests. India's program was similar to that of Pakistan, but larger, and it suffered only mild export restraints.

There are other inconsistencies:

- The controversy around whether a US satellite signal picked up an Israeli-South African nuclear test in 1978 has been smothered by silence.

- North Korea, which violated the terms of the NPT by trying to acquire nuclear weapons, has been rewarded for backtracking somewhat with a promise of two nuclear reactors.

- Iraq, which also violated the terms of its NPT commitments continues to face harsh sanctions that have resulted in the deaths of large numbers of people, especially children.

- Iran is in compliance with the safeguards requirements of the International Atomic Energy Agency, but the US suspects it of pursuing a nuclear weapons program, based on its own intelligence data. The US has subjected Iran to sanctions and is also attempting to prevent Russia from supplying Iran with nuclear power reactors that are legal under the NPT.

Sanctions have been used as a means of maintaining the reliance of the NPT, but they are not an appropriate response, because they are part of the double standard of nuclear politics.

The lack of commitment to disarmament and the inequity in the substance and process of NPT enforcement played a role in the decision of India to refuse to sign the NPT and to test nuclear weapons. With the overt expansion of the nuclear "club" there is now no way to accommodate the new realities within the NPT framework. If the NPT is amended to include the three other nuclear weapons states, it would be even more encouragement to others to create arsenals, thereby increasing dangers, especially in the Middle East and in East Asia. At the same time, India, Pakistan and Israel will not accede to the NPT as non-nuclear weapons states, thereby making the NPT less relevant to non-proliferation.

Sanctions have been used as a means of maintaining the reliance of the NPT, but they are not an appropriate response, because they are part of the double standard of nuclear politics. The main enforcers of the NPT are the very nuclear weapons states that are currently violating the treaty by refusing to agree to a plan for complete nuclear disarmament, or even for definitively ending the nuclear arms race.

The provisions promoting nuclear power in the NPT are similarly corrosive. They spread the technology and know-how for making nuclear weapons, creating new proliferation dangers — amply demonstrated by the case of Iraq. At the same time, signatory countries in good standing like Iran are being denied access to nuclear technology based on unilateral decisions of the United States, however well-founded US information might be about Iranian intentions.

In sum, the NPT has had considerable success over almost three decades in stemming the number of nuclear weapons states. But it is being corrupted and destroyed by some of its own provisions, by the arbitrariness of its implementation, and by the lack of good faith on the part of the nuclear weapons states to achieve complete nuclear disarmament, as required.

The CTBT

The CTBT, long sought by the vast majority of the world's countries as an instrument of nuclear disarmament, is already being subverted even before it has been ratified. On one hand, it represents great progress towards nuclear disarmament in that it bans all nuclear explosions, including those by signatory nuclear weapons states. (India, Pakistan, and North Korea have not signed.) But the signatory nuclear weapons states are pursuing modernization of their arsenals by creating and maintaining expensive facilities for laboratory testing and computer simulation of nuclear weapon designs. They also insist that laboratory explosions that use only thermonuclear fuel are allowed, though the ban on all nuclear explosions in Article I clearly applies (see article on pure fusion weapons, page 18):

> Each State Party undertakes not to carry out any nuclear weapon test explosion or any other nuclear

SEE **TREATIES**, PAGE 40

TIMELINE OF NUCLEAR WEAPONS DEVELOPMENT IN SOUTH ASIA

CONTINUED FROM PAGE 9

1985: Summer: Pakistan successfully tests a non-nuclear triggering package for a nuclear weapon.

December: Pakistani President Zia and Indian Prime Minister Rajiv Gandhi meet in New Delhi.

1986: US sources report that Pakistan produces weapons-grade uranium (greater than 90% U-235).

December (to January '87): India conducts military exercises on the India-Pakistan border, entitled "Operation Brass Tacks."

1987: US Congress again waives the Symington amendment for Pakistan, this time for a period of two-and-a-half years.

1988: February: India tests short-range "Prithvi" ballistic missile.

Construction begins on 2nd uranium enrichment plant at Golra, Pakistan.

December: India and Pakistan sign a written agreement not to attack each others' nuclear facilities.

1989: February: Pakistan announces successful test of two new surface-to-surface ballistic missiles: Hatf I and II (with 80- and 300-km ranges).

May: India tests the "Agni" ballistic missile (~3500 km range).

June: Prime Minister Benazir Bhutto visits Washington DC. Before her trip, production of highly-enriched uranium is stopped, a step that is verified by the US. It is believed that production was re-started after heightening tensions over Kashmir in 1990. Pakistan apparently stopped HEU production in 1991, though the six tests it conducted in 1998 cast some doubt on commonly held assumptions about the amount and schedule of HEU produced.

July: Indian prime minister Rajiv Gandhi visits Islamabad.

1990: May: Kashmir situation deteriorates, tensions increase and war nearly breaks out between India and Pakistan. Unconfirmed reports, later believed to be untrue, indicate that Pakistan considered using nuclear weapons.[1]

June: Indian government leaks allegations that China has rejected Pakistan's request to use the Lop Nor nuclear weapons test site.

1995: The Nuclear Non-Proliferation Treaty (NPT) is extended indefinitely.

1996: The Comprehensive Test Ban Treaty (CTBT) is signed. India and Pakistan do not sign.

1998: April 6: Pakistan tests the Ghauri long-range missile.

May 11 and 13: India conducts 5 underground nuclear tests. Shortly after the tests, India announces a unilateral moratoriam on nuclear testing.

May 19: Indian Home Minister L.K. Advani issues a warning to Pakistan in light of India's tests, stating, "Islamabad should realize the change in the geo-strategic situation in the region and the world [and] roll back its anti-India policy, especially with regard to Kashmir."[2]

May 28 and 30: Pakistan conducts underground nuclear tests. (According to the Pakistani government, six tests were conducted.)

June 11: Pakistan announces a unilateral moratorium on nuclear testing.

1 Pervez Hoodbhoy, "Nuclear Myths and Realities," in Zia Mian, ed. *Pakistan's Atomic Bomb & The Search for Security*, (Lahore, Pakistan: Gautam Publishers, 1995).
2 Kenneth J. Cooper, "Key Indian Official Warns Pakistan," *The Washington Post*, 19 May, 1998, p. A15.

Dear Arjun

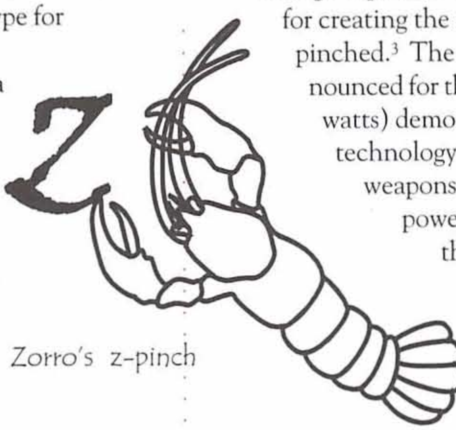
Dear Arjun,
What is a "z-pinch" and can it contribute to the development of new nuclear weapons?

-Nervous in Napoli

Dear Nervous,

Many years ago in Italy there lived a cavalier young lobster who was fond of wearing masks. He was most known for the disproportionate pleasure he derived from using his powerful claws on the vulnerable ankles of swimmers in the Mediterranean Sea. Local doctors, treating the lobster's victims, were puzzled. But one day, a bright intern (and part-time swimmer) realized with horror that the mark was actually a "Z," and the masked crustacean was none other than Zorro the Lobster. After that, Italian swimmers who suffered at the claws of Zorro were said to have gotten "z-pinch."

Today the term refers to a certain type of experimental set-up for the study of plasmas. The z-pinch facility at the Sandia National Laboratory in the United States may be the most important facility of its type for contributing to thermonuclear weapons development. The "wire-array z-pinch" is a pulsed power device (in which energy is released in a short "pulse" rather than over a long period of time) that has the potential to function as part of a non-fission energy source (called a "driver") for pure fusion weapons. (Such weapons have not yet been proven scientifically feasible, but current experimental work, including that on the Sandia z-pinch, could result in establishing that feasibility. See article page 18.)


Zorro's z-pinch

The name of the device derives from the fact that it is a cylindrical array of wires. The vertical direction of a cylinder is usually denoted by the letter "z," (for z axis), and the cylinder is "pinched" to a very small diameter — thus the name "z-pinch." In the z-pinch wire-array experiments a large current is passed through a large number of very thin wires arranged in a cylindrical bundle. As the current rises, the magnetic field associated with it increases. This in turn compresses the array of wires into a cylinder of progressively smaller diameter. At the same time, the high current is rapidly heating the wires, evaporating the wire material, and turning it into a plasma.[1] As this plasma is compressed further by the magnetic field, the electrons and ions forming the plasma come to an abrupt stop (this is called stagnation). This abrupt stop converts the kinetic energy of the particles into x-rays. The process is somewhat analogous to the conversion of the kinetic energy of a car into heat during sudden braking.

In order for atoms to fuse together and release huge amounts of energy, extremely high temperatures and pressures must be exerted in a very precise way on a fuel pellet (usually made up of deuterium and tritium.) Since x-rays can be used to compress a fusion fuel pellet, the high level of x-ray energy achieved by the wire-array z-pinch makes it very interesting to fusion researchers. Furthermore, unlike lasers and ion-beams (other "drivers" that can be used to compress fuel pellets), the wire-array z-pinch could possibly be miniaturized, increasing its suitability for weapons applications.

Significant improvements in the wire-array z-pinch have occurred at Sandia over the past few years. Recent experiments on the device have generated x-rays with an energy output of 2-megajoules,[2] a level comparable with that planned for the National Ignition Facility (NIF).

A large capacitor bank is used as the energy source for creating the current in the wires that are pinched.[3] The recent performance level announced for the wire-array z-pinch (290 trillion watts) demonstrates the potential of this technology for contributing to pure fusion weapons development, since levels of power only a few times greater than this would be needed to establish their scientific feasibility. The experiments have exceeded most of the milestones that have been set in a relatively short period of time.

Sandia has officially requested permission from the US Department of Energy to design the next generation of x-ray facility, the X-1. While no official design has been produced, there are articles indicating that conceptual designs have been completed, indicating that X-1 would produce x-rays of approximately 16 megajoules.[4]

Z-pinch technology goes hand in hand with DOE's other existing and planned explosive fusion research. For example, z-pinch experiments complement magnetized target fusion (MTF) experiments being conducted jointly by DOE and scientists from the Russian Ministry of Atomic Energy, as both technologies use a conductor carrying a high current in order to electromagnetically compress a plasma. Results of experiments at laser facilities like NIF and NOVA can study the shape of energy pulses that could be used to help design optimal pellets for x-ray technologies like z-pinch. According to

SEE **DEAR ARJUN**, PAGE 38

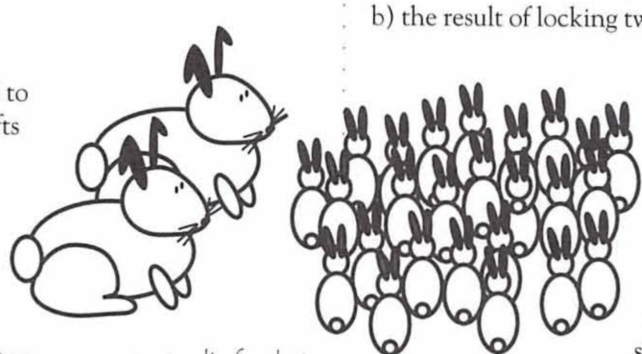
It pays to increase your jargon power with Dr. Egghead

1. **de-alerting:**

a) the act of turning off an alarm clock
b) what happens when they pour you decaf coffee by mistake
c) what the townspeople were doing the fifth time the little boy cried wolf
d) to remove nuclear weapons from alert status through one or several methods, such as removing warheads from delivery vehicles or pinning switches open to prevent firing of missiles.

2. **pit stuffing:**

a) a cottony substance used to fill abandoned mine shafts for safety purposes
b) an Italian turkey dressing made from ground olive seeds
c) fluffy material used to fill the center of nuclear weapon designers' plush toy weapons
d) disabling a nuclear warhead by inserting a wire through the tube through which the tritium is injected into the primary so that it fills the hollow portion of the pit and is tangled inside.



one result of explosive confinement fusion

3. **Y2K:**

a) C3PO's younger brother that never made it in acting
b) used as shorthand for "You're Too Kind," among very polite people
c) demographers' standard abbreviation for "Yuppie, 2 Kids," often used in neighborhoods with high baby boomer populations
d) "Year 2000 Problem" (usually "Y2K Problem"), referring to the possible massive disruption in computer-dependent systems, ranging from payment of Social Security checks to banking, to control of nuclear power plants and nuclear weapons, as a result of computer chips and software programs not properly recognizing the date on Jan. 1, 2000.

4. **explosive confinement fusion:**

a) a type of jazz characterized by guitars that blow up when certain chords are played in crowded bars
b) the result of locking two rabbits in a cage together
c) the phenomenon of tempers flaring when people are jammed too tightly together on a hot bus.
d) rapid compression of a fuel pellet to sufficient temperature and pressure so that light elements are fused together, creating an explosion.

5. **zero-yield:**

a) when someone's pockets are empty and it is their turn to pay
b) a term to describe stubborn people
c) a term used to describe stock dividends on bankrupt companies
d) a key term in the CTBT negotiations used to describe a test ban in which all tests that have a yield of nuclear explosive energy would be banned. "Zero-yield" was not precisely defined in the treaty, but the negotiating records shows that it should be well below four pounds of TNT equivalent.

answers: 1) d; 2) d; 3) d; 4) d; 5) d.

DEAR ARJUN

FROM PAGE 33

Donald Cook, director of Sandia's Pulsed Power Sciences Center, "Without the knowledge of target experiments at NIF, it would take considerably longer to achieve high yield on X-1, and the risk of failure would be greater."[5]

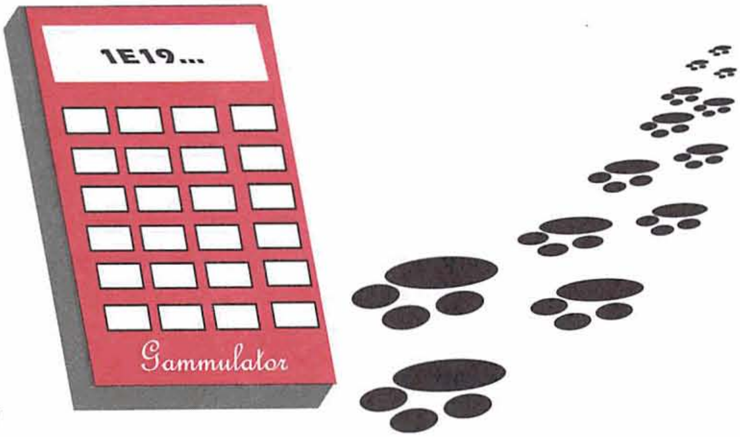
Besides its potential for assisting the development of pure fusion weapons, z-pinch technology can also be used for design of fission-triggered thermonuclear weapons.

Ghost-written by Hisham Zerriffi and Pat Ortmeyer

1 A plasma can be described as a collection of ionized atoms and free electrons which is electrically neutral overall. For a more technically-complete definition, see *Dangerous Thermonuclear Quest*.
2 A joule is a metric unit of energy, equal to one watt of power operating for one second. A megajoule is a million joules.
3 M. Keith Matzen, "Z Pinches as Intense X-ray Sources for High-Energy Density Physics Application," *Physics of Plasmas*, (Vol. 4, Issue 5, May 1997), p. 1525.
4 Juan J. Ramirez, "The X-1 Z-Pinch Driver," *IEEE Transactions on Plasma Science*, (Vol. 25, No. 2, April, 1997), p. 159.
5 Toni Feder, "As Part of DOE's Quest for Fusion, Sandia Wants a Bigger Pulsed Power Machine," *Physics Today*, Vol. 51 No. 6, June 1998, pp. 56-7.

Sharpen your technical skills with Dr. Egghead's
Atomic Puzzler

Gamma's New Job



Congratulations to Gamma, our trusty atomic dog! Gamma has a new job as a Citizen Inspector of United States nuclear weapons facilities. To get ready for the job, he is doing a few calculations on some proposed inertial confinement experiments at the National Ignition Facility under construction at Lawrence Livermore National Laboratory in California. He is wondering if these experiments will be in compliance with the CTBT, going on some information he found in his dog-eared copy of IEER's report, Dangerous Thermonuclear Quest.

Specifically, Gamma is wondering about an experiment that would have a laser output of 1.8 megajoules of energy which would be deposited into a fuel pellet. On the high yield experiments, the diagnostic equipment at NIF would detect approximately 10^{19} neutrons being released from the resulting fusion reactions. Each released neutron represents one fusion reaction (as he learned from the figure on page 19 in this newsletter), so that would indicate 10^{19} fusion reactions. Gamma knows that each fusion reaction releases about 17 MeV (mega-electron-volts) of energy. He needs to do a few more calculations to find out if this experiment is in compliance with the CTBT, but needs your help (those darned paws are just too big for the calculator keys).

1. How much energy is released from each fusion reaction (in joules)? (Hint: 1 MeV=10^6 eV and 1 eV = 1.6×10^{-19} joules (J))

____

2. How much energy is released from all 10^{19} fusion reactions?

____

3. Is this more or less than the amount of energy put into the fuel pellet?

____

4. Based on your answer to question #3, is this a "nuclear explosion?"

____

5. How many pounds of TNT equivalent is this? (Hint: There are approximately 2.1×10^6 J per pound of TNT)

____

6. Is this more or less than the four-pound hydronuclear experiments the United States agreed were banned under the CTBT?

____

Send us your answers via fax (301-270-3029), e-mail (ieer@ieer.org), or regular mail (IEER 6935 Laurel Ave., Suite 204, Takoma Park, MD 20912), postmarked by **November 15, 1998**. IEER will award 25 prizes of $10 each to people who send in a solution to the puzzle (by the deadline), right or wrong. There is one $25 prize for a correct entry, to be drawn at random if more than one correct answer is submitted. International readers submitting answers will receive a copy of *Dangerous Thermonuclear Quest* in lieu of a cash prize, due to exhange rates.

TREATIES
FROM PAGE 35

> explosion, and to prohibit and prevent any such nuclear explosion at any place under its jurisdiction or control.

During the negotiation of the CTBT, the five recognized nuclear weapons states also refused to make a commitment to disarmament, as demanded by India, whose Prime Minister Jawaharlal Nehru called for a test ban as an instrument of disarmament as early as 1954. Instead, they insist on the right to withdraw from the treaty on grounds of "supreme national interest" and on maintaining huge nuclear weapons design and testing infrastructures.

For instance, the United States currently spends more on nuclear weapons design and testing than the average of such expenditures during the Cold War. Only France has closed its test site as a result of signing the treaty and that only after conducting an extensive series of tests during CTBT negotiations. Finally, though India adamantly refused to sign the CTBT because the treaty had been essentially transformed into an instrument of non-proliferation only to the practical exclusion of disarmament, it was included on the list of countries that would need to ratify it before the CTBT could enter into force. India's isolation and the prospect of sanctions it faced were a contributing factor in its decision to test in May 1998. The great irony of the CTBT is that it has contributed to the decision to test by a country that had long sought a test ban, and in so doing, aggravated post-Cold-War nuclear disarray. Significantly, India announced its own "stockpile stewardship program" at the time of its nuclear tests.

While the NPT and CTBT provide important components to nuclear disarmament, it is clear that treaties are not enough when the powerful that must obey them want to subvert their intent. Given the increasing threats of accidental nuclear war, black markets in warheads or nuclear materials, and the emerging nuclear danger in South Asia, it is crucial that the lessons of the NPT and CTBT be applied to future disarmament efforts. The achievement of enduring nuclear disarmament will require not only a strong treaty abolishing nuclear weapons, but the creation and maintenance of conditions that make it more likely that there will be adherence to the letter and spirit of these treaties by all countries.

1 An important but neglected issue is whether the United States has provided a nuclear umbrella to Western Europe and Japan, or the latter provided battlefields that would divert nuclear fire away from the United States. For example, a 1945 planning document by the US Joint Strategic Survey Committee said this about US military bases in foreign countries: "Offensively, it is essential to transport the bomb to the internal vital areas of the enemy nation. The closer our bases are to those areas the more effectively can this be done and with the greater chance of success. Defensively, the farther away from our own vital areas we can hold our enemy through our possession of advance bases, the greater our security. Furthermore, if our enemy is forced to penetrate a defensive base system in depth, the greater are our chances of adequate warning, interception and destruction of the attacking force. All of this points to the great importance of expanding our strategic frontiers in the Atlantic and Pacific oceans and to the shores of the Arctic." (US Joint Chiefs of Staff, "Overall Effect of Atomic Bomb on Warfare and Military Organization: Report by the Joint Strategic Survey Committee," JCS 1477/1, October 30, 1945, p. 18. Includes a cover note by A.J. McFarland and C.J. Moore, Joint Secretariat.)

In fact, the acquisition of US bases around the world in the late 1940s and early 1950s did have nuclear weapons as a crucial consideration. See "Joint Chiefs of Staff Decision on J.C.S. 2215/1, A Report by the Joint Strategic Survey Committee on Joint Chiefs of Staff Views on Department of Defense Interest in the Use of Atomic Weapons," (J.C.S. 2215/1, National Archives Document Reference: RG 218 - CCS 471.6, Dec. 11, 1951), paragraph 2 of enclosure.

Science for Democratic Action is free to all readers. IEER is able to provide this newsletter and other resources due in part to the generous contributions of our supporters. If you would like to contribute, simply make your check out to IEER and mail to the address below. Donations are fully tax deductible. IEER is a 501(c)3 non-profit organization.

The Institute for Energy and Environmental Research
6935 Laurel Avenue, Suite 204
Takoma Park, MD 20912

Address correction requested.

NON-PROFIT
US POSTAGE
PAID
MERRIFIELD, VA
PERMIT #1112

Printed on recycled paper.

IEER PRESS