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Nuclear Weapons and International Security

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INTRODUCTION

These are perilous times for international security and the advance of civil society. Although the Cold War between the Soviet Union and the West is over, and the fear and enmity have largely dissipated, on the order of half of the strategic weapons remain in existence, although fewer are deployed under the START I agreement that is now in force. Russia deserves enormous credit for having recovered all tactical nuclear weapons from outside the country in 1992, and all strategic weapons by 1996, except for those deployed on the strategic submarines. The political and economic chaos in Russia creates great concern over the security of nuclear weapons and fissionable materials against international theft, and the weapons that remain in the military forces are commanded and guarded by human beings who must be distracted by the events of the times. Elsewhere, covert nuclear weapon states have tested (India and Pakistan), demonstrating nuclear weapons of yield comparable with those that destroyed Hiroshima and Nagasaki. The nuclear weapon program in Iraq is in abeyance, and portions of the program in North Korea have been halted by the 1994 Framework Agreement in return for the 500,000 tons of fuel oil annually, while two light-water power reactors are being constructed in North Korea.

The Chemical Weapons Convention and the Biological Weapons Convention (CWC and BWC) have near-universal adherence, but many of the states that have signed still have CW and BW programs. And once BW procedures are perfected, and the means of delivery, everything can be sterilized and the system be weeks away from a capability to load and deliver tons of highly infectious (and in some cases contagious) diseases.

International terrorism has killed hundreds in a single incident, using cars or trucks loaded with explosives, and Aum Shinrikyo in Toyko has killed with chemical weapons delivered highly inefficiently, and attempted to kill multitudes with biological weapons.

At such a time, the 6th ISODARCO Beijing Seminar on Arms Control is an important opportunity to understand the problems and to sort out possible solutions. There is a hazard, however, in focusing on detailed research that concerns only a small part of the problem. So I will make comments on several of the main subjects of the Conference, and refer the interested reader to papers I have written recently that may be interest.

Some of the topics of the Conference have inevitable interactions. For instance, arms control and nuclear disarmament should facilitate non-proliferation, but the feeling that nuclear weapons and nuclear weapon materials are excess reduces greatly the value placed on them by their possessors, and tends to reduce the level of security that the society is willing to provide to protect them.

ARMS CONTROL AND NUCLEAR DISARMAMENT

For the first seven months of 1998, I served as a member of the nine-person Commission to Assess the Ballistic Missile Threat to the United States, chaired by former Secretary of Defense Donald H. Rumsfeld. The product-- a classified 207-page report-- was presented to the Congress on July 15, and at the same time a 30-page Executive Summary was made freely available, containing all the major conclusions of the Report. That Summary is available on the Web[1]. Our Commission unanimously concluded that international technical assistance was a major component of the evolution of long-range ballistic missiles, and that of the countries with declared enmity toward the United States, North Korea and Iran could have a test of an ICBM capable of reaching the United States within five years of making a decision to achieve it, given the infrastructure they have achieved for the development and manufacture of short-range missiles, and so good have countries become at hiding their activities that we might not know that the decision had been made for several of those years. A flight test of a multi-stage missile would be observed, but following a successful flight test, a country could have several probably rather inaccurate ICBMs within a year or two. Because of the destruction of the missile infrastructure in Iraq, the Commission judged that it would take Iraq up to ten years to have an ICBM after the United Nations constraints are removed.

Earlier than the threat from ICBMs, however, the Commission noted the potential for launching short-range ballistic or cruise missiles from ships close to U.S. shores, especially from merchant ships in international waters that might not be suspected until they launched.

Finally, the Report notes the availability of bomblets for BW and CW payloads. In the interest of military effectiveness, it would be foolish to send a 500-kg or one ton payload of anthrax at a single point within a city. A nation capable of developing a long-range multi-stage missile could readily divide the BW or CW agent among 20 or 100 bomblets, dispensed as soon as the rocket engines had given the payload the specified velocity, so that each of the bomblets would penetrate to the ground before bursting.

NATIONAL MISSILE DEFENSE?

The fact that there are undoubted capabilities to reach the United States with long-range missiles carrying nuclear warheads from Russia, Britain, France, and a few from China does not mean that the United States should deploy a National Missile Defense. There are many questions involved in making such a decision, but the first must be that the defense would be effective against the threat which provokes its deployment. Unfortunately, the kind of National Missile Defense that has been under consideration in the United States, using hit-to-kill interceptors to destroy incoming reentry vehicles above the atmosphere, has no likelihood of even minimal effectiveness by the time it is deployed, not only against the nations now possessing ICBMs but also against the missiles that might be built by North Korea or Iran.

[1] At http://www.fas.org/rlg.

The reasons are expressed in detail in several papers available on the Web site[2]. The simple reason is that any nation capable of building a long-range multi-staged missile would be equally capable of providing it with penetration aids against these exo-atmospheric intercepts. One of the most useful penetration aids is a large balloon, perhaps 30 meters in diameter, that would inflate with the aid of a few-hundred grams of gas (in the vacuum of space) so that the interceptor when it struck the balloon would be unlikely to strike the warhead. And if the defense had enough time to strip the balloon with a specialized net and then attack the warhead that was revealed (by a second interceptor), one could use a second enclosing balloon.

A second countermeasure would be a small enclosing balloon around the reentry vehicle, together with a considerable number of similar balloons that were empty. Measures have long been published for matching the infrared signature of the warhead in its balloon. "Anti-simulation" plays an important role-- covering the warhead so that it resembles an inexpensive decoy, rather than building decoys to match a warhead with a form finely crafted at great expense.

NON-PROLIFERATION AND INTERNATIONAL SECURITY

In this regard, one of the major concerns is the acquisition of fissile materials to make nuclear weapons by nations that have agreed not to do so, or by non-national groups. There has been a persistent myth that reactor-grade plutonium from the power reactor fuel cycle cannot be used to make nuclear explosives, but this myth is entirely wrong.

According to highly reliable publications[3] making a nuclear weapon from reactor-grade plutonium is little different in kind from the use of weapon-grade material. A more detailed analysis of this is to be found in a recent paper[4] published in Japanese and now available also in English on the FAS Web site.

Much has been written about the hazards of fissile materials, to which literature I have contributed[5]. There is, in addition to the more than 100 tons of separated reactor-

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[2] Garwin, R.L. "Keeping Enemy Missiles at Bay," Op-Ed in *The New York Times*, July 28, 1998.

[3] Holdren, J.P., (Chair), Kelleher, C.M., (Vice Chair), Panofsky, W.K.H., (Plutonium Study Chair), Baldeschwieler, J.D., Doty, P.M., Flax, A.H., Garwin, R.L., Jones, D.C., Keeny, S.M., Lederberg, J., May, M.M., Patel, C.K.N., Pollack, J.D., Steinbruner, J.D., Wertheim, R.H., Wiesner, J.B. "Management and Disposition of Excess Weapons Plutonium," Report of the National Academy of Sciences, Committee on International Security and Arms Control, Chair, January 1994, (available at www.nap.edu).

[4] Garwin, R.L., "Reactor-Grade Plutonium Can be Used to make Powerful and Reliable Nuclear Weapons: Separated plutonium in the fuel cycle must be protected as if it were nuclear weapons," published in Japanese Newsletter *NIS* (Nuclear Information Service), August 26, 1998.

[5] Garwin, R.L. "Two tracks are better than one", Letter to the Editor in *Bulletin of the Atomic Scientists*, March/April 1997, p. 3,60.

Garwin, R.L, "Disposition of Excess Weapon Plutonium and Uranium," presented at 4th Pugwash Workshop on The Future of the Nuclear Weapons Complexes of the U.S. and Russia, Moscow and Snezhinsk, September 9-13, 1997.

J.P. Holdren (Co-Chair), J. Ahearne, R.L. Garwin, W.K.H. Panofsky, J.J. Taylor, and E.P. Velikhov (Co-Chair), A.A. Makarov, F.M. Mitenkov, N.N. Ponomarev-Stepnoi, F.G. Reshetnikov "Final Report of U.S.-Russian Independent Scientific Commission on Disposition of Excess Weapons Plutonium", 1 June 1997. Garwin, R.L. "Post-Cold War World and Nuclear Weapons Proliferation" grade plutonium from reprocessing of power-reactor fuel, a lot of excess weapon-grade material from the armories of Russia and the United States, as these nations build down toward the START-II and (I hope) START-III levels and below. This will amount to more than 50 tons of weapon-grade plutonium on each side, and hundreds of tons of U-235. An important move to prevent this material dispersing or being stolen is the contract by the United States to buy 500 tons of Russian high-enriched uranium (HEU) over a period of 20 years, for a price on the order of $12 billion. On the U.S. side, the United State Enrichment Corporation (USEC) was made the executive agent, but the situation is complicated by the privatization of USEC July 1, 1998. While USEC maintains that it is committed to executing the HEU deal, it is clearly in the interests of its stockholders to do this as slowly as possible, because USEC wants to sell uranium with which it was provided by the U.S. government, and furthermore wants to sell enrichment services, which are cheaper than the enrichment costs built into the Russia HEU. An account of a Council on Foreign Relations discussion of this problem will soon be found at the Council Web site--www.foreignrelations.org.

NUCLEAR SAFEGUARDS

I suppose that my writings in this field might better fall under the topic "Non-Proliferation and International Security", insofar as they deal with activities under a Comprehensive Test Ban Treaty. I do not believe that the United States can design, build, and stockpile nuclear weapons in which it can have confidence without nuclear testing. Of course, there are some weapons which would very probably work, as is the case with the gun-type U-235 weapons, but the U.S. and (I believe) the other four nuclear weapon states will find it in their interests largely to reproduce a relatively small number of weapon types to maintain them in their inventory indefinitely.

The United States has a large $4.5-billion annual funds program to ensure the viability of the nuclear weapon stockpile. The Science Based Stockpile Stewardship Program is a substantial part of this, and it consists of enhanced surveillance of the weapons, understanding of the origins of aging and of the results of aging. It supports also analyses of the small variations in manufacturing process or materials and their possible influence on the safety and reliability of the nuclear weaponry.

In a number of papers[6] I have written either individually or as part of the JASON group of consultants to the U.S. government, I have discussed these matters.

(as delivered) presented 04/19/96 at The 29th JAIF Annual Conference, Session 5 *"Nuclear Nonproliferation and Plutonium"*, Nagoya, JAPAN.

Garwin, R.L. "I. Nuclear Warhead Dismantlement, Storage and Disposal" subtopic of the NATO Workshop on Global Stability Through Disarmament, 18th Session of the Planetary Emergencies Seminars, Ettore Majorana Centre for Scientific Culture, Erice, Sicily.

[6] Garwin, R.L. "The Future of Nuclear Weapons Without Nuclear Testing," in Arms Control Today, Nov./Dec. 1997.

Garwin, R.L. "Nuclear Arms Builders Move From Creators to Custodians," Letter to the Editor, *The New York Times*, January 7, 1997

Garwin, R.L. and Simonenko, V.A. "Nuclear Weapon Development Without Nuclear Testing?", prepared for the Pugwash Workshop on PROBLEMS IN ACHIEVING A NUCLEAR-WEAPON-FREE WORLD, October 25-27, 1996, London, ENGLAND.

It is not true that the greatly expanded Accelerated Scientific Computing Initiative (ASCI) has the purpose of allowing the United States to simulate in all detail what goes on in a nuclear explosion in order to replace nuclear explosive testing by computation in making new nuclear weapons. It should be used, in my opinion, to enhance the confidence one has in the reliability of nuclear weapons that are conservatively remanufactured, making as few changes as possible in the materials and in the processes. I emphasize in my own advice to the U.S. government that it is likely to cost far less and be more satisfactory to reproduce what might be imagined to be obsolete processes in making remanufacturing parts of nuclear weapons that cannot be fully tested. Of course, the firing capacitors, radar fuzes, power supplies, and all such elements of a nuclear weapon are fully subject to test without a nuclear explosion. They can and should be replaced and upgraded on an economics-driven basis. That is, when the cost of building the systems to origin design (like the electro-mechanical elements of the Permissive Action Link) becomes high enough, then a development program is worthwhile to use modern low-cost electronics to do the same job. But because so few weapons will remain in the inventory in comparison with the peak stockpile numbers, the day when this needs to be done is put off.

The United States will need to produce tritium at a certain level on the order of 1 kg per year ultimately to maintain a stockpile in the START-II range. But it will not be necessary to have new tritium supplies until the year 2010 at the earliest, since one can scavenge tritium from obsolete weapons which existed in much greater numbers. Because tritium has a 12-year half-life, if the number of nuclear weapons that need to be provided with tritium is reduced by a factor two or more every 12 years, one will never need to make new tritium. And if one delays the acquisition of a source of tritium, the amount that needs to be supplied annually (in the face of ongoing reduction) will be smaller. Some technologists and some localities (and their representative in Congress) favor a large proton accelerator to regenerate tritium from its decay product He-3. The alternative major source under consideration is for the U.S. government to buy an operating commercial (or to complete a partially finished) power reactor and to make tritium from Li-6 targets within the reactor, while producing and selling electrical energy.

A third approach would be for the United States to buy tritium from Russia, which would be available at much lower prices than the domestic production of tritium even in a commercial reactor.

It is important for economy and for the work that would otherwise be done in the U.S. military and nuclear weapons programs to obtain the tritium at the least reasonable cost, and that is why I urge that the U.S. obtain its tritium from Russia. The next least costly approach would be to irradiate Li-6 targets in commercial reactors, and there the U.S. ought to buy an operating but not very profitable reactor for a few tens of millions of dollars rather than pay the $1 billion or more that is required to complete a reactor that was partially built by the Tennessee Valley Authority (TVA).

Garwin, R.L. "The Maintenance of Nuclear Weapon Stockpiles Without Nuclear Explosion Testing", 24th Pugwash Workshop on Nuclear Forces "Nuclear Forces in Europe", London, ENGLAND, September 22-24, 1995.

CONCLUSIONS

With the end of the Cold War, I fear that the United States takes less seriously real international security needs, such as supporting and fully funding the Comprehensive Test Ban Treaty; supporting the Non-Proliferation Treaty and the IAEA; and enhancing the safeguards regime.

Little attention has been paid to multilateral security assurances, especially positive security assurances that would credibly enhance a nation's security more than would the acquisition of nuclear weapons of its own. The latter is fraught with danger, especially for nations that have adversaries on their borders, as is the case with Pakistan and India. It may well be that the result of the nuclear tests by India and Pakistan in May, 1998, will be the signing of the CTBT by those countries, but it may also be a nuclear explosion on the territory of one of those countries. It is very dangerous to have conventional war at a substantial scale between two participants, both of which have nuclear weapons available. If that happens, I suppose that it will advance the non-proliferation agenda, but at a terrible price to the citizens of India or Pakistan.