Beyond the NPT:
A Nuclear-Weapon-Free World

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INESAP Study Group 'Beyond the NPT'

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Addresses:
INESAP c/o IANUS, Technical University of Darmstadt,
Hochschulstr. 4a, 64283 Darmstadt, Germany
phone: +49–6151–16–4368/–2316, fax: +49–6151–16–6039
email: INESAP@hrzpub.tu-darmstadt.de or IANUS@hrzpub.tu-darmstadt.de
Homepage: http://www.inesap.org

INES,
Fehrbelliner Straße 38,
D-10119 Berlin
phone: +49–30-44010498, fax: +49–30-44010497
email: INES.Office@web.de
Homepage http://www.inesglobal.com

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Contributors:[1] Ulrich Albrecht, Germany; Fernando Barros, Brazil; Praful Bidwai, India; Li Bin, China; Frank Blackaby, UK; Shaun Burnie, Netherlands; Barry M. Casper, USA; Wade Crow, USA; Anatoli Diakov, Russia; William Epstein, Canada; Richard Falk, USA; Harald Feiveson, USA; Dana Fisher, USA; Eloi Glorieux, Belgium; Lisbeth Gronlund, USA; Peter Hayes, USA; Janice Heppell, USA; Martin Kalinowski, Germany; Christian Küppers, Germany; George Lewis, USA; Wolfgang Liebert, Germany; Liu Huaqiu, China; Lora Lumpe, USA; Edward Lyman, USA; Luis Masperi, Argentina; Sanae Y. Matsuzaki, Japan; Zia Mian, Pakistan; Eugene Miasnikov, Russia; Tom Milne, UK; Vivek Monteiro, India; Bahig Nassar, Egypt; Abdul Nayyar, Pakistan; Marco Antonio Martinez Negrete, Mexico; Götz Neuneck, Germany; Stephen Noerper, USA; John Pike, USA; Reuven Pedatzur, Israel; Joseph Rotblat, UK; Michael Sailer, Germany; Jürgen Scheffran, Germany; Mycle Schneider, France; Aaron Spitzer, USA; Dingli Shen, China; Jinzaburo Takagi, Japan; Maxim Tarasenko, Russia; Spenta Wadia, India; David Wright, USA.

Further active members of the study group: Colin Archer, Switzerland/UK; Pervez Hoodbhoy, Pakistan; Otto Jäckl, Germany; Egbert Kankeleit, Germany; Kumao Kaneko, Japan; Yong Liu, China; Kathryn Nixdorff, Germany; Jan vande Putte, Belgium; Tariq Rauf, Canada; Barbara Rosenberg, USA; Hartwig Spitzer, Germany; Johan Swahn, Sweden; Achin Vanaik, India.

Organizational work: Wolfgang Baus, Sandra Kelley-Noell, Ivo Sarges, Jörg Weidenfeller

[1]Note regarding authorship: All views expressed are those of the authors and contributors as indicated. No organization should be identified with these views.

Introduction

The intention of this study is to present a scientific document which looks beyond the Non-Proliferation Treaty (NPT) and outlines the transformation process of the traditional non-proliferation regime towards a Nuclear–Weapon–Free World (NWFW) regime.

A number of related proposals have already been made at the first conference of the International Network of Engineers and Scientists Against Proliferation (INESAP) in Mülheim in August 1993 and later on. Some have been written down in the proceedings of this meeting[2] and in the founding declaration of the International Coalition for Nuclear Non-proliferation and Disarmament "Working Together for a Nuclear–weapon–free World" (December 1993), which is related to the work and goals of INESAP.[3]

In the summer of 1994 INESAP formed its Study Group **"Beyond the NPT"**. A first meeting of the Study Group took place at the Protestant Academy Mülheim (Germany) in November 1994. More than 30 papers were presented there which formed the base for the current work, in particular for this first document of the study group. The contents and the names of contributors were fixed in late 1994, including more than 50 scientists and engineers, joined by experts from other fields. The contributors are coming from 17 countries. In the middle of February 1995 a follow-on special meeting "Nuclear Weapons Convention as the cornerstone of the nuclear–weapon–free world" was organized in London with support of the London Pugwash office.

The intention of the study done by INESAP is to present a scientific document which transcends the NPT and outlines the transformation process of the traditional non-proliferation regime into a Nuclear–Weapon–Free World (NWFW) regime. Preliminary results of the INESAP study group are formulated in this document **"Beyond the NPT: A Nuclear–Weapon–Free World"**. It is a contribution to the work of the *International Coalition for Nuclear Non–Proliferation and Disarmament*, which INESAP is a part of. The document is

[2]See Liebert, W.; J. Scheffran (eds.): *Against Proliferation – Towards General Disarmament.* Proceedings of the First Conference of the International Network of Engineers and Scientists Against Proliferation (INESAP), Münster: agenda, 1995.

[3]The International Coalition has been formed in 1993 by the International Peace Bureau (IPB), the International Physicians for the Prevention of Nuclear War (IPPNW), the International Association of Lawyers against Nuclear Arms (IALANA) and by INES/INESAP.

presented within the framework of the International Coalition's *Forum for the Elimination of Nuclear Weapons* taking place in New York on April 25/26, 1995.

We hope that this document will find the interest of the delegations and diplomats as well as the news media being present at the 1995 NPT Conference in New York. But it is also intended to be a source of arguments and proposals for interested citizen's and non-governmental organizations (NGO's).

This document is preliminary with regard to the findings of the study group. Due to time constraints it was not possible yet to finalize the discussion process within the study group. As a result, there are various kinds of authorship and responsibility for the views expressed as indicated at the appropriate places in footnotes. No single author is responsible for the whole document. The time constraints affected the shape of the document as well. Especially language editing has not been carried out in all sections by native speakers.

The overall objective of the study group is to transform the (short-term) public interest in the NPT issue towards the long-term goal of a Nuclear-Weapon-Free World.

There is no question that the Nuclear Non–Proliferation Treaty (NPT) has to be extended, since it is the only existing barrier against proliferation and it does also call for nuclear disarmament. However, the non–proliferation and disarmament agenda which will be required beyond the NPT extension has urgently to be addressed. This agenda is all the more important, since the diplomatic tug-of-war in the run–up to the NPT Review and Extension Conference has focused mainly on the narrow question of NPT extension. The need for nuclear disarmament and effectively stopping nuclear proliferation is not answered simply by extending the NPT.

This INESAP document is promoting the elimination concept in the hope that the extension of the NPT is followed by multi–lateral negotiations on a Nuclear Weapon Convention (NWC). It examines what the goal could look like and analyzes how it could be reached and what it would imply to go from here to there, based in both cases on the technical expertise of international scientists and engineers. If complete nuclear disarmament is to become a reality, and not just remain an utopian dream, we need to describe in detail how a world free from nuclear weapons would function; we need to be quite clear about our goals, and we need to devise a strategy which sets out the steps by which those goals can be reached. Furthermore, we would like to encourage people to act on these ideas in the future. This is a challenge for the next decades, but the 1995 NPT Conference (though not necessarily the outcome itself) can be perceived as a turning point for global nuclear policy. We would like to see that the 1995 NPT Conference (maybe in its final document) will give a mandate to the Conference on Disarmament to start negotiations towards a NWC.

The INESAP study group welcomes any comments from readers (address see imprint). A later book publication, intended for the research community and experts in the decision making process, is planned to work out some of the proposals in more detail.

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Executive summary

Fernando Barros, Praful Bidwai, Frank Blackaby, Mike Casper, Martin Kalinowski, Wolfgang Liebert, Marco Martinez, Luis Masperi, Zia Mian, Abdul Nayyar, Götz Neuneck, Joseph Rotblat, Jürgen Scheffran, Dingli Shen, Jinzaburo Takagi

1. The case for a Nuclear–Weapon–Free World (NWFW)

1.1 A NWFW: a necessary objective

A NWFW is no longer a fanciful idea. It is taken seriously by strategists, military experts, even former US Secretaries of State for Defense. This is because they now concede the point – which peace movements have been making for years – that nuclear weapons diminish, rather than enhance, the security of nuclear weapon states. This process, by which Cold War thinking is being eroded will help the non-declared weapon states as well to abandon their nuclear weapon options.

Nuclear weapons appear not to be useful or necessary to deter possible threats by other nuclear weapon states or to prevent the risk of major war. On the contrary, if a smaller number of states continue to possess nuclear weapons and have plans to use them to enforce regional security interests, that will certainly increase the perceived 'value' of these weapons and thus dangers of proliferation.

However, some of those who accept this general argument refuse at the last fence. They postpone the final elimination of nuclear weapons more or less indefinitely.

This will not do. There is no permanent stability at low numbers. There are only two options: one is a progression down to zero; in the absence of a move to zero, the other option is the spread of nuclear weapons to many nations. The first of these two options is to be preferred, because it is very much less dangerous than the second.
In a 'lower–salient' nuclear world, where the nuclear weapon powers claim to have adopted a policy of 'minimum deterrence', it would probably be more difficult to prevent proliferation than it is now.

The decision to go for zero would help a great deal to change thinking about the use of military power – any kind of military power – in relations between states. It would strengthen the move towards the acceptance of international law and lead to wider acceptance of the principle of peaceful settlement of international disputes. Furthermore, it would comply with the commitment by the nuclear weapon states to complete nuclear disarmament, under Article VI of the NPT.

1.2 Transformation of the non-proliferation regime

The central criticism of the NPT is that it is de–jure discriminatory, because it legitimizes the division of the world into nuclear–weapon states and non–nuclear–weapon states; it imposes stringent control measures on the latter while the obligations of the former are not set out in a strict and enforceable way.

The non–proliferation regime, in practice, is even more discriminatory, because it implies the establishment of a three–class system of technology access. As long as industrial allies of the nuclear weapon states insist on an unrestrained use of all nuclear technologies, unilateral export control will be perceived as a discrimination by the supplier countries.

Another central defect of the NPT is that it ignores the insurmountable dual–use character of many nuclear technologies. As long as weapon-usable materials can be produced they may be diverted for making nuclear weapons. This concerns also the unfortunate double–role of the International Atomic Energy Agency (IAEA) as promoter and 'controller' of nuclear energy. The promotion resulted in a wide spread of nuclear technology providing many states with the prerequisites for weapon programmes. Despite current proposals for strengthening the IAEA safeguards system the control on these technologies will remain imperfect – partly due to technical reasons.

The bargaining strategy of the NPT (access to nuclear technology in exchange for renunciation of nuclear weapons) has lost its strength. Furthermore, it is increasingly unrealistic that the non–proliferation regime, in its existing form, is the right remedy for stopping proliferation. However, it is true, that the vast majority of non–nuclear weapon states will not follow Iraq's example: most states do not break treaties they have signed simply because international control and enforcing techniques are weak.

At the NPT Review and Extension Conference it would be highly desirable for the nuclear weapon states to commit themselves unequivocally to the objective of zero. Their statements on this issue have been vague, ambiguous, and have consigned the objective to a very distant future. It would be even more useful if these states accepted a time–bound programme for achieving zero. In this respect indefinite extension of the NPT might be unfortunate effect since it would reduce the international pressure towards that end. Though it would not legitimize the permanent possession of nuclear weapons, an indefinite extension might in practice mean the indefinite postponement of complete nuclear disarmament.

As long as possession of nuclear weapons and weapon–usable materials by a handful of states are seen as legitimized, this will create 'desire' in some other countries and the global nuclear threat will endure and ever increase.
With the end of the Cold War it has become possible to start a stepwise transformation process of the old non–proliferation regime into a new much more effective Nuclear–Weapon–Free World regime. This requires a time–fixed goal for the elimination of nuclear weapons. As things stand now, each year more weapon–usable material is being produced, and it is becoming easier to get access to it. This process must be reversed.

1.3 A Nuclear Weapon Convention (NWC)

In its final document the NPT Review and Extension Conference should, in its call for decisive steps towards a NWFW, include a mandate for the Conference on Disarmament to start negotiations on a Nuclear Weapon Convention (NWC). The pattern has to be that which has already been set by the Biological Weapons Convention (BWC) and the Chemical Weapons Convention (CWC) – a total ban.

The NWC would have to ban not only the possession and production of nuclear weapons; it would also prohibit all kinds of acquisition (including research), transfer, deployment (or any preparations for re–deployment), use and threat of use. The convention would call for the elimination of the whole infrastructure serving the manufacture and possession of nuclear warheads and their means of delivery. It would provide a system of international control for guarding and accounting for all remaining weapon-usable fissile material. The convention would incorporate, and thus replace, other existing relevant treaties as bans on nuclear weapon tests, and on the production of weapon-grade fissile material – it would make these bans universal. The convention would replace the NPT itself.

Once approved by the required number of states, the NWC would have to be made binding on all states by a Security Council resolution; it would also have to be of unlimited duration – without allowing a withdrawal of its parties.

A NWFW could not come into existence unless it had the support of all declared nuclear weapon states, who not only judged it to be in their interest but also capable of being safe-guarded against violation.

1.4 Stated objections

It is claimed that nuclear weapons have prevented the outbreak of conventional war. There is no reason to believe that nuclear weapons deterred war between NATO and WTO. If this claim had any validity, one would have expected non-nuclear weapon states to be deterred

from engaging in war with nuclear weapon states. The examples of Korea, Vietnam and Argentina show that this was not the case.

It has been suggested that the threat of nuclear weapons can be deterred only by nuclear weapons. However, this need not be so; as soon as it becomes apparent that a nuclear weapon state has retained some warheads or as soon as a new nuclear weapons programme has been identified, the renegade state will be adequately dealt with by the international community without the need to resort to nuclear weapons (see 1.6).

It is said that nuclear weapons are needed to deter the possible use of biological and chemical weapons. The BWC already has 131 adherents, and the CWC should come into force soon. There is no reason to think that nuclear weapons are needed to prevent violations.

It is argued that nuclear weapons cannot be disinvented. However, this is not a reason to keep them. If the teams which developed and maintained these weapons were dispersed, the reinvention could take some time, thus introducing further barriers and escallation steps and allowing time for the international community to react. In addition, the deployment of the main delivery systems for nuclear weapons should be prohibited. In this way any military use of re-invented nuclear weapons would be further delayed.

1.5 Control and verification

Technical means for verifying the absence of nuclear weapons are in principle available.

There will of course have to be "any time any place" inspection without the need to seek permission from the state concerned. Moreover, in order to remove any suspicion of clandestine activities, all research and development should be open to the extent necessary for that purpose.

The Convention should include the requirement that all states make it a citizen's duty to report any suspected infraction to an international authority. There may be states where citizens will be afraid to do this, and the international processes of inspection in these states will have to be more intense.
Scientists, engineers, and technical staff who work in civilian nuclear research activities and in nuclear power generation must understood that they have a special resposibility to ensure the integrity of the NWC.

1.6 Security in a NWFW and enforcement

Any illegal development, threat of use of nuclear weapons, or actual use, could adequately be dealt with a whole variety of measures ranging from diplomatic efforts, mediation, peace

keeping, non–military intervention and economic sanctions to the threat of the use, or actual use, of conventional military force as a last resort.

The use or threat of use of nuclear weapons has played no significant part in the world security structure for 50 years and there is no reason why this should not continue; the disappearance of nuclear weapons will in no way damage the existing security structure. Indeed we have already given reasons for thinking it would be strengthened (see 1.1).

It is reasonable to assume that a world in which states have agreed to move towards a NWFW would be one in which the world security structure has already been improved in other ways – for instance, in agreeing that the use of military power is generally discouraged and its only legitimate use as a last resort should be under the auspices of the UN or a body recognized by the UN as a regional security organisation. The UN Security Council should be made more democratic; there should be no bias in favour of the current nuclear weapon states.

1.7 Agenda for moving towards a NWFW

The immediate part of the agenda towards a NWFW includes steps such as the agreed reductions in nuclear arsenals, a Comprehensive Test Ban Treaty (CTBT), as well as the closure and dismantling of the military facilities for the production of nuclear material. A vital part of the programme is a No–First–Use Treaty, which should be concluded very soon.

The intermediate part of the agenda towards a NWFW includes further deep reductions in nuclear arsenals of the five recognized nuclear weapon states; constraints on the deployment of nuclear weapons on territories of other countries; and the removal of nuclear warheads from strategic and tactical missiles and storage in national repositories. The programme will, furthermore, see the establishment of Nuclear-Weapon-Free Zones (NWFZ), a global moratorium on further production and development of nuclear weapons and a production cut-off of weapon-grade fissile material. This will be supplemented by an international inventory of fissile material and enforcement of improved safeguards and monitoring systems on all remaining nuclear facilities.
Additional steps include a ban on testing ballistic delivery systems, full implementation of the CWC with global adherence, development of a verification system for the BWC and a comprehensive UN register of conventional and nuclear arms as well as UN reports on military expenditure.

Once the terms of the Nuclear Weapon Convention have been agreed all nuclear arsenals should be reduced to zero, rather than held at a low level. The suggestion that the UN have a cache of nuclear weapons under its direct control is not a practical way to avoid the unstable situation caused by small numbers of nuclear weapons. The UN will never be able to maintain a nuclear deterrent in a convincing way. So long as any nuclear weapons remain, the nuclear weapon states will be most unwilling to give up control of them to UN personnel

coming from non–nuclear weapon states. This means that there would be a danger that the former nuclear powers could easily regain control of their nuclear weapons.

The final part of the agenda towards a NWFW will transform all five recognized nuclear weapon states as well as the de-facto nuclear weapon states into non-nuclear weapon states, possibly via regional approaches. The remaining global nuclear arsenal will be dismantled under international inspection. The Nuclear Weapon Convention will come into force. All weapon-usable material will be transferred to an international authority for possible civilian use or final disposal in the future. Nuclear technologies and activities like separation of plutonium and high enrichment of uranium for the production and refinement of weapon-usable material will be made illegal.

Some selected major steps are dealt at greater length in the second part of this document.

2. Major steps towards a NWFW

2.1 'Disarmament race' between the nuclear weapon states

Further nuclear disarmament is not only necessary for strengthening international security and peace but also for reinforcing article VI of the NPT. The START II Treaty limits the US and Russian deployed strategic nuclear warheads to 6.500 in the year 2003, but exceeds the arsenals of the medium nuclear weapon states by a factor of 5 to 8. Further reduction to 1.000 warheads each for the US and Russia in the framework of a START III treaty would be a solid basis for the inclusion of the smaller nuclear weapon states. Negotiated limits on the remaining tactical nuclear weapons should be envisioned. It is time now that the smaller nuclear powers should join the negotiations.

The reduction and dismantlement of nuclear warheads should be irreversible and requires a cutoff of the production of fissile material for weapon purposes. A US-Russian collaboration to establish a verifiable control regime for their weapon fissile material could pave the way for the inclusion of the medium nuclear weapon states. International safeguards for the retired fissile material is necessary to build up international confidence. Unsafeguarded fissile material production should be prohibited.

A first step in this direction would be the exchange of information about surplus stockpiles as well as the remaining arsenals. An international organization could carry out the monitoring of the fissile material. To improve crisis stability and to prevent accidental and unintentional use of nuclear weapons, the USA and Russia should separate the warheads from their delivery systems.

2.2 Cutoff of production and disposal of nuclear-weapon-usable materials

A large surplus of weapon-grade fissile materials and tritium exists already and will increase in the near future. Civilian stocks of weaponusable plutonium will exceed military stocks shortly after the turn of the century. Any attempt to control the potential use of weapon-usable material for weapon purposes has to include both military and civilian production and handling of weapon-usable material.

There are formidable arguments – economic, ecological, security, and waste disposal arguments – against extraction (i.e. reprocessing of spent fuel) and use of plutonium. Today, research reactors are the only civilian users of highly enriched uranium but these can be converted to the use of low enriched uranium.

A sustainable solution for dealing with weapon–usable nuclear material within the framework of a NWFW (or an irreversible transformation process aiming at this goal) requires a total ban on its use and the most sensitive production technologies. In the long run, such a ban has to cover particularily highly enriched uranium, plutonium in all isotopic compositions and tritium, since it must be made as difficult as possible for any state to begin the production of nuclear weapons again. Therefore, negotiations should strive for a Comprehensive Cut–off Convention in a stepwise process. The first step should be a multilateral agreement on a production cut–off for weapon purposes.

The immediate steps should be to take nuclear weapons off deployment, put them into national repositories, count them and tag them under international monitoring. There, they should be dismantled, and the fissile material resulting from that should be stored, safeguarded and prepared for demilitarization at the earliest possible time.

For reasons of timing, non-proliferation and credibility, vitrification may appear the best method for disposing of the plutonium which results from nuclear weapon dismantlement. Though the overall costs of the MOX option and vitrification are about the same, costs should be secondary to security policy and environmental safety in choosing the best method. However, none of various proposed options to demilitarize plutonium is sufficiently safe and technically proven yet and more research efforts are necessary.

2.3 Beyond the MTCR: Non-proliferation and disarmament of nuclear capable delivery systems

A number of possible measures for limiting systems that could be used to deliver nuclear weapons, going beyond the current Missile Technology Control Regime (MTCR), could complement and facilitate the elimination of nuclear weapons: The ballistic missile threat could be removed most effectively by a Ballistic Missile Convention (BMC). A Flight Test Ban (FTB) for ballistic missiles would be an initial step in stopping the development of new

missile types. An international control body could be set up to verify that space technology was not used for the development and production of ballistic missiles.
Cruise missiles potentially pose a proliferation threat comparable to that of ballistic missiles and attack aircraft. Cruise missile non-proliferation efforts, such as the MTCR, should be continued and, if possible, expanded. However, it may be necessary to adopt arms control approaches that deal with the similarities between attack aircraft and cruise missiles, and between their underlying technology bases.
Many countries have deployed aircraft for national defense which could be used to deliver weapons of mass destruction. To prevent military aircraft proliferation, states could include limits on the numbers and capabilities of military aircraft in their regional arms control regimes. A global ban on new types of combat aircraft would prevent both vertical and horizontal proliferation in a non-discriminatory way.
To address the possibility that nuclear weapons could be deployed much more widely on submarines, a first step would be the creation of an international control regime, similar to the MTCR, focusing on technologies critical for advanced submarines. Joint naval task groups operated by the UN could monitor, and if necessary, control the operation of diesel submarines during crises.

The ABM Treaty, which restricts US and Russian strategic defense systems, still has a vital role to play in bringing about further reductions of nuclear weapons and in helping to stem nuclear proliferation. The attempt by the United States to modify the ABM Treaty, in order to be able to legally develop and deploy some of its planned theater missile defense systems, could damage the arms control and non-proliferation efforts of many nations.

International space cooperation and aerospace conversion efforts could both facilitate and benefit from a transition to a nuclear weapon free world. Long-term and irreversible conversion strategies need to include conversion of the large R&D complexes and preventive arms control measures aimed at restricting destabilizing technical developments. A new regime ("Rockets for Peace"), established under a World Space Development Organization (Fund), would provide new nations with access to space using the capabilities of the established space powers. Space weapons should be outlawed.

2.4 Regional approaches towards a NWFW

In Latin America, a regional Nuclear–Weapon–Free Zone (NWFZ), together with the Argentine–Brazilian agreement for joint accounting and control of nuclear materials, has proved to be a successful way for keeping a region nuclear–weapon–free. The process of negotiating such agreements naturally involves the introduction of confidence–building measures and mutual security arrangements. As in Latin America, such regional agreements can also include an additional safety system, with the participation of the IAEA.

Regional NWFZ negotiations including the five NPT nuclear weapons states is one way of

looking at the process these states have to undertake to comply with their NPT Article VI obligation 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..." That is what they promised to do in the treaty and that is precisely what a NWFZ negotiation is aimed at. Despite significant progress in the START and INF negotiations in reducing the nuclear arsenals of the United States and Russia, these negotiations do not have zero as their explicit final target, and so are unlikely to reach that end.

NWFZs are an important way in which the non-nuclear weapon states can seize the initiative in the non-proliferation arena, by declaring their regions to be off-limits for nuclear weapon deployment, use, or threat of use. As such off-limits regions spread around the world, international pressure will build up on the nuclear weapons states to accept the idea of a NWFW and reciprocate fully.

Part 1

The case for a Nuclear-Weapon-Free World

Coordinators: Wolfgang Liebert, Joseph Rotblat

1.1 Critique of nuclear doctrines: paving the way for a Nuclear–Weapon–Free World[1]

Two major options to deal with nuclear weapons are available for the future. Firstly, one could seek to lower the salience of nuclear weapons and to halt their further proliferation, but to support their continued possession by the original five nuclear powers.[2] The end result would be a "low–salience nuclear world" that would be much the same as today's. Another similiar approach of a new–shaped nuclear world is expressed with the term 'minimal deterrence'. The alternative future is a nuclear–weapon–free world (NWFW)[3], and would require the priviledged nuclear powers to adopt the firm and serious policy goal of a NWFW. Achievable in principle, the major obstacle is a mind–set shaped by the Cold War, which inhibits in particular Western officialdom from addressing this challenge seriously. The first option is by no ways to be seen as a way–station 'en route' to a NWFW. The difference between the two worlds involves fundamental technical, attitudinal and political factors.

Currently, five tasks are being identified as allegedly requiring a continuing nuclear capability[4]. But their further need is questionable, and it is worthwhile to discuss the differ-

[1]This section draws mainly on the arguments (and partly also the formulations) developed by Michael MccGwire and are used with his full permission (see in particular [MccGwire (1994)]). The section is edited by Wolfgang Liebert.

[2]See [Quinlan (1993)]

[3]See [Rotblat/Steinberger (1993)]

[4]See [Quinlan (1993)]; [Panowsky/Bunn] (1994)]

ent options which in the following are formulated as questions.

1. Is there still a need for nulcear weapons to deter possible threats by other nuclear weapon states?

Within a NWFW there would be no nuclear–weapon state, hence this particular requirement would disappear. It is obvious that for the other option a nuclear capability is essential to deter possible aggression by other nuclear–weapon states.

But it is so obvious? For instance, what is the Western nuclear capability meant to deter? It is the use of nuclear weapons, or also deterrence against conventional superiority of the 'another side' or even any hostile aggression? The doctrine of 'flexible response' still in NATO use seems to underline the latter. Which states are to be covered by this Western deterrent? Clearly not Georgia or Ukraine if Russia is the aggressor; nor Laos or Vietnam in the case of China. 'Extended deterrence' has always been a shaky concept, which is why India and Israel sought their own capability. It was credible only where it could be made to appear that the deterrer's own vital interests were at stake, as seemed the case with the US umbrella over NATO Europe and Japan. Even here, there was considerable room for doubt. So what is being deterred? Is it a premeditated nuclear attack by Russia or China on a Western nuclear–weapon state? Is it the invasion of Japan by Russia or China? Or is it the invasion of Europe at some future date by a resurgent Russian empire? How plausible is that first threat? And is nuclear capability the only way of countering the other two threats, whether they are plausible or not?

Deterrence theory provided a continual stimulus to the strategic arms race and was used to justify those very large numbers of the arsenals. But this was not its only adverse effect. The need to maintain the credibility of deterrence, to continually demonstrate the possessor state's will to inflict 'unacceptable punishment' on its opponent and to suffer, if need be, massive devastation itself, this provoked domestic opposition against the 'irrational' and even 'immoral' attitude of the proponents. At the same time, the central assumption of deterrence theory led political–military establishments in the West to deny the possibility of nuclear war, except as a result of Soviet aggression.

2. Could nuclear capabilities be used to prevent or reduce the risk of major war?

It is argued that after end of the Cold War warfighting could again become an option for settling difficulties between major powers, in the belief that it could be dependably held to tolerable levels of destructiveness. By claiming a preventive role of nuclear capabilities in such cases the underlying assumption is that the very existence of nuclear weapons accounts for the absence of serious war between major developed states during the last half century.

Obviously, this is unprovable either way, but it is used to state that the fear of nuclear escalation is needed to deter advanced military powers from seeing major war as a way of settling their differences, and that alone would warrant their continued possession of nuclear weapons.

But war does not stem only from deliberate aggression, which can be deterred by threats of unacceptable punishment. History is replete with examples of inadvertent hostilities, such as the Cuban missile crisis, triggered by mutual misunderstanding or the momentum of events. And in times of tension there is the new possibility of accidental war, a consequence of nuclear–armed missiles. Analysts now know that the command, control, and communications systems of U.S. and Soviet strategic forces during the Cold War were subject to a significant probability of procedural and systems malfunction and hence mistaken activation of strike plans.

The world was immensely fortunate that neither side made a fatal mistake during the decades of bipolar confrontation of the past. But what lies ahead is a multipolar game of indefinite duration, where the new players command, control and communications will be more prone to system errors, and each players understanding of the others' thought processes will be even rudimentary.

However, the most that can be claimed is that the existence of nuclear weapons accounts for the absence of war between the superpowers and/or the two alliences. Of much more importance is that for both sides, the Second World War had reaffirmed that serious war between major states was not a 'rational instrument' of policy and must be avoided at almost any cost. The new danger of nuclear escalation merely underlined that point. For industrially advanced nations, the world military capabilities and geostrategy has now been replaced by a world of economic strength and geofinance, in which national power derives from export industries and currency markets. In the future, the ecological dimension will also play an increasing role.

In sum, the pattern of war avoidance was established well before the threat of bilateral nuclear escalation emerged. Since that point, the costs of conventional war have risen to include the devasting results of enemy attack on chemical plants and nuclear power stations. There are, therefore, no grounds for arguing that the fear of nuclear escalation is needed to deter advanced military powers from seeing major war as a way of settling their differences. They are well aware that major war is dysfunctional, that the components of power have shifted and that economic strength in a ecologically sustainable future is now the crucial factor.

However, NATO has stated since decades that they are ready to use nuclear weapons as 'Weapons of Last Resort'. In particular, after end of the Cold War it is urgent to get an answer on the question: weapons of last resort against whom? Is it not true, that the hostile opponent of NATO's strategic concept has vanished? Even if one considers seriously NATO's case for first use of nuclear weapons against a major conventional attack which seems not to

be matched by own conventional forces, then one has to ask what would be the consequence of such a nuclear attack? Who is striving to 'defend' his homeland by the use of nuclear weapons has to face a devasting counter–strike by 'the other side'. What would be the realistic pay–off using such a strategy in practice?

It is hardly to imagine that this realistic point of view is disregarded by possessors of nuclear weapons inside the northern hemisphere. But, nevertheless, the argument is used that possession of nuclear weapons is important for survival as a sovereign state. Putting this argument forward, obviously one has to admit that this kind of argumentation is also valid for more then the existing old and de–facto Nuclear Weapon States. But a globalization of this argument is highly dangerous. Therefore, it should be quite clear that it has an tremendous impact on proliferation risks to adopt or maintain such kind of nuclear doctrines.

3. Is the possesion of nuclear weapons useful to discourage potential new nuclear weapon states or to prevent a risk–taking state from the temptation (in a NWFW) to make a clandestine dash to sole nuclear possession?

In the main, proliferation has been driven by the need for a countervailing nuclear capability. The USSR responded to the emerging US capability, China to the Soviet, India to the Chinese, Pakistan to the Indian, and Iraq to the Israeli. Nuclear weapons as the great equalizer was a key consideration for beleagured Israel and South Africa. The urge for independence in foreign affaires was a primary consideration in the British and French decision and, together with prestige, was an added factor in the original Iraqi decision. The above claimed task for nuclear weapons stems from the perception as a convenient instrument of policy. They might deter less–developed states from resorting to weapons of mass destruction; however, their use in this role is certainly not essential, and is seen by many as counterproductive. On the other side, potential proliferators are not expected to accept a hegemonial role of the five nuclear powers for an indefinite future. Playing the nuclear card against them it might be more likely to promote their desire to join the nuclear club.

Besides the unanswered question of what to do about those states, their existence underlines the fact that the NPT does not serve the interests of all states in a world, where possession of nuclear weapons persists by a few states, specifically those with a perceived need for a countervailing capability. This need has been the main engine of nuclear proliferation to date, and will inevitably continue to play that role in the future.

Until the final step of adopting a NWFW, the danger of breakout comes under the general requirement to police non–proliferation, and this will be facilitated by adopting the goal of a NWFW. The seriousness of the mentioned threat then depends on two factors: the probability of its occuring, and the scale of the calamity should it do so. The probability will depend on the potential advantages, and the chances of achieving them; and the chance of success will depend on the effectiveness of the regime's policing system, the measures that

can be applied if it fails, and the certainity of their application. This inherent constraint applies to the 'rogue state' that acquires a minimal capability, to the high–tech state that engineers a major breakout, or to Russia or China should they manage to hold back a sizeable arsenal from the dismantling process. And how could either of the latter be certain that one of the other four old nuclear powers had not also kept back some warheads and be able to match its call?

How effectively would the NWFW regime be policed? By the final stage of moving to a NWFW, interlocking global and regional systems of control and verification would be in place. It can be assumed that the advanced industrialized states will have sacrified their commercial interest in favour of comprehensive and rigorous controls on the production and movement of all relevant equipment and material, and that the nuclear–weapon states, particularly the United States, will have accepted the kind of intrusive verification procedures that will be essential. In such circumstances, there is every reason to be confident that the probability of detecting a significant breach of the NWFW regime would be high. Furthermore, such a breach would be indisputable and would clearly threaten the interests of all other states, rich or poor, large or small. A whole range of diplomatic, financial and economic instruments would be brought to bear. If a 'rogue state' did detonate one or more weapons, retribution could be devasting, using conventional weapons whose destructive capability is also remarkable.

4. Could the threat–potential of nuclear weapons be seen as preventing the use of non–nuclear weapons of mass destruction?

Given the political inhibitions about using nuclear weapons against states of the developing world, is the lurking threat of a major nuclear power's strike a more effective deterrent than the certainity of a massive conventional response, or even a response in kind? And can we afford to ignore the possibility that one of those leaders we label as 'irrational' and 'irresposible' might even welcome a nuclear response as a means of polarizing world opinion against e.g. the West?

There is a strong body of professional opinion that believes nuclear weapons should not be used to deter chemical attack. At best these weapons are 'nice to have' in this role and are certainly not essential. Meanwhile, under a NWFW regime we will have a greater confidence that the very strict provisions of the 1993 Convention banning the possession and production of chemical weapons would be strictly enforced. These general considerations apply equally to biological weapons, although, for the time being, a comparable ban would be much harder to verify and enforce. However, even if the Biological Weapons Convention could not be improved in terms of verification in the near future, the very nature of the underlying problems means that deterrence (nuclear or conventional) is not the best way of preventing the use of biological or toxic agents.

5. Could nuclear weapons provide a low–key element of insurance in support of an intended kind of world order or could they be used to enforce regional security or regional interests of possessors of nuclear weapons?

It is not clear how the purpose of this 'non–specific concept' is distinct from that of the four other tasks. There is no example of how nuclear weapons have played such a role in the past or might do so in the future. This task seems to be a manifestation of 'nuclearism' – the perception of one's nuclear capability as a general reserve, as a cover against policy blunders and unforseen contingencies, as an all–purpose security blanket.

Nevertheless, there are discussions about developing 'mini and tiny nukes' which could be used for attacks against hardened facilities or widespread disruption of electronic communications. The question is whether these new weapons (or weapon–ideas) implemented as unspecific eventual concepts would more encourage threshold states or so–called 'rogue states' in acquiring nuclear capabilities than to forgoe these options forever. Who gives way to plan the use of nuclear weapons in some region of the world would immediately again increase the perceived 'value' of these weapons, which is the most counter–productive development in respect to both future nuclear options.

Lessons to be drawn

After discussing and disapproving the five still claimed tasks for nuclear weapons, the conclusion could be made that there is a clear case for moving decisively towards the NWFW regime: vanish all kind of nuclear postures. The explicit goal of a NWFW and the progressive introduction of measures to achieve it would make it easier to halt proliferation. In a 'lower–salient' nuclear world, where the the established nuclear weapon powers claim to have adopted a policy of 'minimum deterrence', the diffculties of preventing proliferation can only increase. Much of the dissatisfaction with the NPT would disappear if the West were to resusciate Gorbachev's 1986 proposal to eliminate nuclear weapons within 15 years, although we now know a great deal more about the difficulties of dismantling nuclear weapons and the problems of verification and control, and realize that this timetable was to optimistic.

Progress towards a NWFW would be paced by the process of establishing the necessary politico–legal regime and its associated means of control, verification and enforcement. In such circumstances, the pressures that have driven nuclear proliferation would be steadily reduced. The security requirement for countervailing power would be progressively removed; the urge to preserve independence in foreign affaires through a nuclear capability would be assuaged by the levelling–down process.

The agnostics who acknowledge the logic of the NWFW arguments but favour 'the devil

they know' should ask themselves whether they have given sufficient consideration to the longer term and how that 'devil' is likely to mutate and grow in the next 20–30 years. The optimists who believe that the marginalisation of nuclear weapons is already under way should consider the analogy of a forest fire. As long as there is any fire at all, a change in the wind can produce a major conflagration. So too with nuclear weapons. A change in the international climate can provoke a new and more deadly arms race, reigniting the danger of global nuclear war.

1.2 Analysis of the existing non-proliferation regime: need for transformation into a Nuclear-Weapon-Free World

William Epstein, Wolfgang Liebert

Historical background

The present regime for preventing the proliferation of nuclear weapons consists of a number of separate components of which the 1968 Treaty on the Non–Proliferation of Nuclear Weapons (NPT) is the cornerstone. Other components include, in the order of their establishment, the following:

The *International Atomic Energy Agency (IAEA)* was established in 1957 to promote the peaceful uses of atomic energy in all member states. The IAEA created a system of safeguards to monitor compliance with the condition that no nuclear material or equipment provided to other states is allowed to be diverted to making nuclear weapons. The IAEA safeguards system, however, has a number of shortcomings which are dealt with below.

The *Partial Test Ban Treaty* (PTBT) (1963) prohibits nuclear explosive tests in the atmosphere, outer space and under water but not underground. It was negotiated by the US, UK and Russia and they are the only nuclear parties altough China or France, which are not parties, now do abide by the treaty and conduct only underground tests. The treaty also calls for the discontinuance of all nuclear weapon tests for all time. However the three nuclear depositary governments have refused to agree to use the amendment provisions of the treaty to ban underground tests.

The *Treaty of Tlatelolco* (1967) creates a nuclear weapon free zone for the states of Latin America and the Caribbean. As the last state of the zone, Cuba has recently announced that it will become a party to the treaty which prohibits the testing, production, deployment or use of nuclear weapons by the parties. All five nuclear powers have become parties to Protocol II of the treaty and have thereby agreed to abide by all the provisions of the treaty; in addition they have undertaken not to use or threaten to use nuclear weapons against the parties to the treaty. These legally binding prohibitions go far beyond any obligations or limitations assumed by the nuclear parties to the NPT, and the treaty has therefore been hailed as establishing a more fair balance of obligations between the nuclear and non–nuclear parties and as a model for other nuclear weapon free zones.

After completion of the PTBT, the attention turned to non–proliferation. On November 19, 1965 resolution 2028 (XX) adopted by the U.N. General Assembly declared the main principles, which a treaty to prevent the proliferation of nuclear weapons should be based

upon. The most important of these is: The treaty should embody an acceptable balance of mutual resposibilities and obligations of the nuclear and non–nuclear powers.

The eight non–aligned members of the negotiating body referred to this principle throughout the negotiations[5]. They made clear that in exchange for their agreeing to end the 'horizontal' proliferation of nuclear weapons (further spread) the nuclear powers should agree to end their 'vertical' proliferation (increasing the quantity and quality of their arsenals). In particular, they listed 'five demands' as steps heading to the elimination of nuclear wepons which have not been realized to this day: 1. A comprehensive nuclear test ban; 2. A complete cessation of the production of fissionable material for weapons purposes; 3. A freeze on, and a gradual reduction of, nuclear weapons stocks and their means of delivery; 4. A ban on the use of nuclear weapons; and 5. Security assurances to the non–nuclear states by the nuclear powers.

When the NPT was negotiated in the 1960s, the declared nuclear powers wanted a treaty of indefinite duration. But many of the non-nuclear states insisted on review conferences every five years and an extension conference at the end of 25 years. That was to give the non-nuclear nations leverage in forcing the nuclear powers to ensure that the purpose of the preamble and the provisions of the treaty would be realized. In absence of a binding legal commitment by the nuclear powers to eliminate their nulcear weapons by a fixed date, the non-aligned nations argued – as they do also today – that an indefinite NPT would simply legitimize the possession of these weapons by the nuclear powers indefinitely[6].

Although the nuclear powers agreed to make greater efforts to abide by their treaty obligations, in particular, the disarmament provisions, the 1975 and 1985 review conferences were barely successful in achieving consensus on final declarations, and the 1980 and 1990 conferences failed altogether to reach a compromise on final declarations. At all the review conferences, the non–nuclear countries consistently maintained that they had lived up to their commitments under the NPT, but in particular many non–aligned claimed that the nuclear powers had not and had disregarded their disarmament obligations set forth in the preamble and article VI of the treaty.

The origin of the NPT in its existing form was the result of a compromise. In order to make progress towards nuclear disarmament, as a first step, the proliferation of nuclear weapons was tackled, though the prohibitions of horizontal proliferation were legally binding while those for vertical proliferation were not. This was accepted by the non-nuclear weapon states, trusting in the credibility of the disarmament commitments by the established nuclear weapons states and believing that the latter would persue negotiations in good faith for the elimination of their nuclear weapons.

With the end of the Cold War and the diminishing need for nuclear weapons, and with the growing realization of their uselessness as weapons of war, the time may have come for the nuclear powers to halt and completely reverse the vertical proliferation of nuclear weapons,

[5]See [Epstein (1993)]
[6]See [Epstein/Szasz (1993)]

and finally to eliminate them.

Shortcomings of the NPT and the non–proliferation regime

The NPT suffers several shortcomings and contradictions which have long–term counterproductive effects[7]:

1. The NPT is de–facto and de–jure discriminatory. The treaty in effect declares five nuclear weapon states as permament, provides no safeguarding procedures for these states, and in practice establishes a three-class system of technology access for its members. The first class of states is entitled to possess nuclear weapons and to improve of their arsenals indefinitely. The second class of (mainly industrialized) states are denied access to nuclear weapons, but all sensitive nuclear technologies enabling access to weapon-uasable highly enriched uranium and plutonium is available to them under safeguards. The third class of states, are denied not only access to nuclear weapons but also to certain sensitive nuclear technologies, because of fears that they might attempt to "go nuclear". Additionally imposed unilateral export control measures by major supplier countries of nuclear technology can maintain this system in a rough and ready way. In order to be able to implement export control rules a group of nuclear supplier countries met in London in 1975 and established export guidelines. Thus, on the one hand, export controls may be inadequate for some industrial states, and, on the other hand, export controls have led to a technology embargo against some developing countries which give rise to harsh criticism from the South.

2. No set path to disarmament and particularly to nuclear disarmament has been fixed. Though the goal is made clear in article VI[8] and the preamble, the steps to realization are not legally binding. The four steps set out in the preamble are, first, a comprehensive nuclear test ban, second, the cessation of all manufacture of nuclear weapons, third, the liquidation of all stockpiles and fourth, the elimination of nuclear weapons and their means of delivery pursuant to a treaty on general and complete disarmament. Even 25 years after negotiation, the nuclear weapon states perceive the formulations of the treaty as non binding declarations of intention for the long–term future rather than as firm obligations. That is why most of the non–aligned parties to the NPT and Non Governmental Organisations appear to believe that the best way to achieve the goals of the NPT is by a step–by–step program of nuclear disarmament spread over series of five or ten year fixed periods. In that way they hope that nuclear weapons can be eliminated from all national arsenals in 20 or 25 years[9].

[7] See [Liebert (1994a)]

[8] Article VI of the NPT: 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.

[9] See [Epstein (1994)]

3. The NPT aims at the prevention of the military use of nuclear energy and associated materials in the non–nuclear weapon states but allows and promotes the civilian use of nuclear energy. The long gone enthusiasm for nuclear energy led to the contradictary and fatal basic assumption that the further spread of nuclear weapons could be halted despite the corresponding further spread and development of 'civilian' nuclear technology. Ignoring the civil–military ambivalence and dual–use potential of nuclear research and technology is a crucial shortcoming of the treaty. The civilian-use of nuclear energy and its unrestrained further development cannot not be promoted without it resulting in the further spread, maintaining or improvement of the scientific–technological prerequisists for a nuclear weapon capability. Because of the provisions of Article IV of the treaty promoting the access to nuclear technology, a party to the treaty which wants to manufacture nuclear weapons would be able to obtain the nuclear material, equipment and technology required to develop a nuclear weapon capability. Even under IAEA safeguards, it could prepare a stockpile of plutonium or highly enriched uranium for allegedly peaceful purposes and research its weaponization and, at a time of its choosing, give three months notice of withdrawal from the Treaty, and begin to assemble a stockpile of nuclear weapons after the withdrawal took effect.

4. The admission in Article V of the usefulness of 'peaceful' nuclear explosions (PNE), undertaken by nuclear explosive devices, is in contradiction to the aim of the treaty. A so–called 'peaceful' nuclear device is indistinguishable from a nuclear weapon. In particular, the environmental catastrophes generated by these PNEs – especially in the territories of the former Soviet Union – show that there is no justification for them. The provisions of Art. V of the NPT demonstrate that the treaty is outdated and flawed in this respect.

5. In relation to the NPT, but not as a direct shortcoming of the treaty, the double–role of IAEA as promotor and 'controller' of nuclear energy has to be mentioned. This double–role has led to the inadequacy of the safeguards of the IAEA. This was particularly obvious in the case of the Iraqi nuclear programme, which had been recognizable for some time. Proposals for strengthening the safeguards system are now under consideration. A far–reaching reform of the IAEA is on the agenda[10]. Shortcomings of the IAEA system include: 1. It is mandatory for all non–nuclear parties, but does not apply to any nuclear party unless it voluntarily agrees to accept safeguards; 2. The extent and scope of the IAEA safeguards system are not comprehensive or all inclusive but are limited to those set out in the standard safeguards agreements which proved to be inadequate to reveal clandestine activities to divert materials to nuclear weapons programmes; 3. Due to technical reasons the so–called MUF–strategy (material–unaccounted–for) applied for most sensitive 'bulk–handling' facilities such as reprocessing or enrichment plants is in principle insufficient; 4. The IAEA has very limited powers of enforcement

[10]For proposed suggestions in the context of safeguards, see [Liebert/Kalinowski (1994)]

> even when violations are suspected or discovered. A further shortcoming of the IAEA safeguards system is the exclusive limitation on the flux of materials, although in this way it is actually being used to cover an important element of the fuel cycle which one could hope to bring under control.[11]

In assessing the performance of the NPT several further problems can be determined. Security issues are not dealt with in the treaty. A no–use policy of the Nuclear Weapon States, which is highly desirable, is not in sight. Even with respect to no–first–use, there is a step–back due to the new Russian nuclear doctrine. No procedures are foreseen by the treaty as how to convince de–facto or threshold states that are not parties to join the treaty and what status they would have on joining. Furthermore, no procedures are provided for a verifiable, transparent and effective de–nuclearization of nuclear weapon states within the treaty or new member states which have already achieved a nuclear weapons capability, as in the case of South Africa. To some extent, this concerns also successor states of the Soviet Union, like Ukraine.

These obvious shortcomings and contradictions of the NPT have to be addressed if a successful implementation of an effective non–proliferation and disarmament regime is to be achieved in a global basis. A sign of hope is that the Tlatelolco Treaty already goes beyond the NPT. But, the nuclear wepaon states are refusing now, what they have agreed in that treaty.

Nuclear reality and civil–military ambivalence of nuclear technology

After the NPT entered into force in 1970, the technologically dominated arms race between the western and the eastern blocs was intensified. Vertical proliferation, i.e. the expansion and improvement of nuclear arsenals, was increasingly pursued.

Worldwide, 45,000 warheads are still intact. This is due to the fact that the process of dismantlement in U.S. and Russia is comparibly slow (only 1,500 or 2,500 warheads per year) and unofficially, an unpublished number of warheads will be retained as ‘nuclear reserve’. Even five years after the end of the Cold War the strategic arsenals of the U.S. and the former S.U. included more warheads (8380 rsp. 9650) then in 1970 (about 4200–5240 and below 2000 or 2210 respectively). More then 22,000 warheads were held within the arsenals of the five declared nuclear powers. The overall destructive power compares to more then 500,000 Hiroshima bombs.

Even after the reductions planned under START II for 2003 with American and Russian strategic arsenals down to 3500 or 3000 warheads respectively, they will still possess about 10,000 warheads with a multiple overkill–capacity. Meanwhile, the planned expansion or

[11] How one could build a bomb is no longer a great secret. The important threshold for the capability of making nuclear weapons is actually the access to weapon–grade material. But for the production of these materials nuclear facilities are needed which are not thoroughly covered by safeguards.

modernization of British and French, and in particular, Chinese nuclear forces appears to continue. Also the nuclear ambitious states – Israel, India and Pakistan – have not slowed down or reversed their programmes. Iraq, a signatory of the NPT, was not prevented from establishing its own nuclear weapon programme in the 1980s, and North Korea is suspected of having such a programme.

An important source of both horizontal and vertical proliferation is the civil–military ambivalence of nuclear research and technology[12]. The world–wide established 'civilian' nuclear programmes lower the threshold for developing nuclear weapon programmes[13] and could be lead to the improvement of existing capabilities. An annual enrichment capacity of at least 10,000 tons of low enriched uranuim (LEU) is needed to fuel the more than 400 nuclear power plants. In principle, this could provide the technology to produce weapon–grade highly enriched uranium (HEU) for use in nuclear weapons. Roughly 70 tonnes of plutonium are produced within civilian power reactors per year. If separated from nuclear waste this could be the source material for nuclear weapons. The safeguarding measures of the International Atomic Energy Agency (IAEA), have reduced the problem caused by the civilian use of nuclear energy, but could not solve it. The present IAEA safeguards system has inherent loopholes revealing fundamental technical limits to detect the possible diversion of weapon–grade materials[14] , in particular regarding 'bulk–handling' facilities.

The use of weapon–grade HEU in research reactors has not been halted world–wide. Plutonium is weapon–usable independent of its isotopic composition. This is valid not only for the specially produced 'weapon–plutonium', but also for the so–called 'reactor–plutonium' which is automatically produced in the majority of power reactors[15]. Nearly 270 tons of 'weapon–plutonium' have been produced world–wide and some 100 tons should be released from warheads by the year 2003 according to the American–Russian disarmament declarations. On the other hand, more than 900 tons of 'reactor–plutonium' have been produced, of which more than 180 tonnes have been separated up until now. At least 100 tonnes of so–called civilian plutonium are stored in separated form – sufficient for at least 20,000 nuclear weapons.

At this time, more than 20 countries have access to at least one of the sensitive technologies of uranium enrichment or fuel reprocessing, which, in principle, enable the production of weapon–usable fissile material and therefore creates the prerequisits for weapon–programmes. These scientific–technological advances took place mainly after NPT's coming into force and was by no means prevented by the NPT.

Need for transformation

The NPT was negotiated in a particular historical situation. The concept of nuclear de-

[12]See e.g. [Liebert/Kalinowski (1994)]

[13]See Holdren (1989)]

[14]The sufficient amount of fissile material would be (depending on the available detonation technology) several kilograms plutonium or roughly 10 – 20 kilogram HEU (enrichment 90% or more) respectively.

[15]See [Kankeleit/Küppers/Imkeller (1993)]; NAS (1994)]

terrence was the prevailing doctrine during the East-West confrontation and its associated arms-race. The striving for superiority by the superpowers and their allies could not be halted by the NPT and vertical proliferation continued after the signing of the NPT. Another important contradiction was the concern about the further world–wide spread of nuclear weapons and, at the same time, the wish to proliferate the civilian uses of nuclear energy. The euphoria concerning nuclear energy of the sixties was driven both by economic interests of the industrialized countries and the hopes for development of the developing countries.

The NPT, in its core, was a double–bargain. Most important was the renunciation of nuclear weapons by developing countries in exchange for support regarding the 'peaceful' use of nuclear energy. Additionally, steps toward comprehensive global disarmament by the nuclear weapon states were promised. The NPT also includes a renunciation of the aquisition of nuclear weapons by some industrialized countries, such as Germany, Japan, Canada or Sweden, while permitting large-scale civilian use of nuclear energy in these countries as well as 'controlled' nuclear exports. This second part of the bargain was also important, even if it was not so clearly expressed. This double–bargain could not be successfully completed since it served not only security interests but also decisively business interests. The NPT has encouraged the 'proliferation' of nuclear technology in a quantitative and qualitative manner, thus providing prerequisites for weapons programmes too. Moreover, despite the promise of Article IV, the developing world has not achieved a significant share of electricity production by nuclear power.

The unrestricted promotion of nuclear energy has disminished world–wide, due to economic, safety, environment, waste disposal and development policy reasoning. Furthermore, the ending of the Cold War has removed the need for nuclear deterrence. Is it not time to consider a new approach to non-proliferation? The East-West confrontation reflected the status quo of the balance of power, as did the NPT, which allows the possession of nuclear weapons by some of the opposing powers, as long as nuclear disarmament down to zero is not the serious possibility. The bargain envisioned by the NPT has lost its actuality.

At present, the non–proliferation regime presents itself as a workable system of measures only against horizontal proliferation. The NPT is regarded as the cornerstone of this discriminatory regime. Non–possessors of nuclear weapons are facing possessors of them. The NPT is surrounded by several other agreements or procedures like export control rules, the IAEA safeguards system, the START agreements or the Partial Test Ban Treaty which form the entire regime. While article VI and the preamble of the NPT deal with nuclear disarmament (even more, complete and general disarmament) it is hard to see how such a process could be seriously accelerated and be made comprehensive within this framework. In reality the non–proliferation regime is a 'non–further–spread' regime instead of a 'non–spread' regime.

The NPT seems now to be a historical document stemming from the time of bloc-confrontation and nuclear euphoria of the past. After the end of Cold War it is time to think about the transformation of the old non–proliferation regime to a new nuclear–weapon–free

regime[16]. Of course, this has to be a gradual step by step process without loosing the advantages of the present regime but by removing its disadvantages and defects. This means: the NPT has to be extended and maintained, temporarily (not indefinitely!). Accompanying steps should be introduced. This reflects also the fact that if the non–proliferation and disarmament agenda is to have relevance for the present and the future, it must go far beyond the NPT.

The overall question is: How to introduce a process aiming at a Nuclear-Weapon-Free World? There is now an opportunity to end the nuclear arms race and to move rapidly towards the reduction and then stepwise to the total elimination of all nuclear weapons. Then, the three–class system of technology access and the related barriers could be terminated. The surest and best way to end the danger of nuclear proliferation and to rid the world of the nuclear threat is to set a time fixed goal for the elimination of nuclear weapons.

Of importance for this transformation process are:

- unilateral binding declarations by the nuclear powers and self–restrictions going beyond provisions of the NPT
- multilateral agreements seeking a new embediment of the NPT which could endure within the intended Nuclear-Weapon-Free regime
- new global treaties ensuring a secure transition towards the nuclear–weapon–free world.

Under the guiding questions for finding the appropriate steps for the gradual transformation process are: How to prevent the preservation of scientific–technological prerequisites and materials useful for nuclear weapon programmes (including improvements)? Is there a feasible way of secure containment of military options within a context of civilian use of nuclear energy and research, which has to be specified and re–assessed? How the process could be made irreversible? What is verifiable and how? How the process of 'disinvention' could be supported?[17]

In order to make the transformation process complete a nuclear weapons convention must to be negotiated in the near future which should serve as the cornerstone of the newly to be developed Nuclear-Weapon-Free regime. This regime should not be discriminatory but shaped so that it could endure indefinitely.

The way to a Nuclear-Weapon-Free World is long and troublesome, but the decision in favour of that vision has to be made now. Otherwise, the nuclear weapons will be retained by the 'haves' as a measure of their power forever; this will inevitably lead to aquisition of nuclear weapons by some other countries and the global threat will endure and increase. The political and technical realization of the desired goal will remain a challenge for the next decades.

[16]See [Liebert (1994b)]
[17]See [Rotblat et al. (1993)]

1.3 Outline substance of a proposal for a Nuclear Weapon Convention (NWC)[18]

Wolfgang Liebert

There is a growing support for the idea of the re–establishment of a world free of nuclear weapons. Most surprisingly were several encouraging comments by members of the defence community of the superpower number one, the U.S., which were made in the last few years.[19]

If one is seriously aiming at a Nuclear-Weapon-Free World (NWFW), a new legally binding framework has to be found. The *establishment of a NWFW requires an international treaty providing a permanent and binding structure*. Such a treaty, *a Nuclear Weapon Convention (NWC)*, should endure indefinitely without any right of withdrawal. The pattern has to be that which has already been set by the Biological Weapons Convention (BWC) and the Chemical Weapons Convention (CWC) – a total ban.

The convention would incorporate, and thus replace, other existing relevant treaties as bans on nuclear weapon tests and on the production of weapon-grade fissile material or agreements on regional nuclear weapon-free zones – it would make these bans universal[20]. Therefore, the convention must learn from their provisions and experiences.

In particular a NWC, when in force, would *replace the NPT*. The NPT suffers several shortcomings and contradictions which have long–term counterproductive effects (cf. section 1.2.). Therefore, a NWC has to strive to eliminate the shortcomings, defects and loopholes of the NPT. The CWC could partly serve as a model for the NWC.

The *main objectives of a NWC* would be:

- reduction of the arsenals of the 'five' nuclear weapon powers down to zero
- elimination of stockpiles of weapon–grade materials and, as far as existing, nuclear warheads in de–facto nuclear weapon and threshold states

[18]This part was written using input by Joseph Rotblat, Frank Blackaby, Michael MccGwire and others. Most helpful were the following publications: [Rotblat et al. (1993)], [Lewis (1992)], [MccGwire (1994)], [Calogero et al. (1991)]

[19]Cf. the statements by the former U.S. Secretary of Defense in the Kennedy and Johnson administration, Robert S. McNamara: "We should seek to return to a non–nuclear world" (The New York Times, 15 Oct. 1992). Paul Nitze: "Is it time to junk our nukes? The New World Disorder makes them obsolete." (The Washington Post, 16 Jan. 1994). General Charles Horner, head of the U.S. Space Command: "The nuclear weapon is obsolete. I want to get rid of them all. I want to go to zero." (San Francisco Chronicle, 16 July 1994).

[20]At least, an overlap with other international agreements, such as a CTBT or different forms of cutoff (hopefully then in place) is to be expected. Partly, it could be forseen to refer to such treaties instead of stating again specifications within the NWC.

- providing assurance that all states will retain their non–nuclear status forever.

A NWC will have to state:

- the rights and obligations of its parties
- definition of violations and its means of determination by verification methods
- modes of enforcement.

The NWC would have to ban not only the possession and production of nuclear weapons; it would also prohibit all kinds of acquisition (including research), transfer, deployment (or any preparations for re–deployment), use and threat of use. More precisely, the *provisions of the treaty without any discrimination have to include:*

- cessation of any production of nuclear weapons
- elimination of existing stockpiles of nuclear warheads and their means of delivery
- prohibition of acquisition, possession, transfer, deployment and use of nuclear weapons (including threat of use)
- exclusion of any preparation for re–deployment
- ban on research in and all kind of testing for nuclear weapons
- elimination of the whole infrastructure serving the manufacture and possession of warheads and means of delivery, such as bases, factories and storage sites (temporarily, part of the facilities could be converted to destroy weapons and material stocks)
- physical protection of all remaining stocks of weapon–usable material under international control (international authority as possessor) and provisions for its final elimination
- international control over all remaining nuclear infrastructures related to a possible production of weapon–usable materials and related international technology and material transfer
- control or limits on civilian science and technology strongly related to scientific–technological prerequisits for nuclear weapon programmes.

To give all states and citizens the assurance that the nuclear disarmed world will remain nuclear–weapon–free *verification of this is of vital importance.* It has been emphasized that verifying the absence of nuclear weapons is seen to be much easier and cheaper than low

limits of them. At least, verification means will have to include remote–sensing by aircraft and satellites as well as routine and challenge on–site inspections. The admittance of inspectors 'any time and any place without the right of refusal' is of utmost importance. A country suspected of attempted violation would be subject to a challenge inspection, and if the suspicion was confirmed, the country would be liable to punishment under international law.

The enforcement capabilities have to be discussed in terms of the tasks and structure of the (reformed) UN Security Council or an appropriately powered new UN agency, but definitely not in terms of nuclear deterrence against nuclear 'break–out' which would be in contradiction to global elimination.

A *new international agency* for world–wide supervision and coordination of all efforts to monitor compliance seems to be necessary. This could be a new UN agency cooperating with other agencies like the International Atomic Energy Agency (IAEA). While it is admitted that the powers and procedures of the IAEA are partly insufficient and ineffective and that the existing IAEA safeguards have defects, there is nevertheless wide spread agreement that a reformed and strengthend IAEA[21] could be the appropriate body to verify compliance with part of the provisions of a NWC. The distinctions between nuclear and non–nuclear states for the purpose of safeguards will then no longer exist.

A main characteristic of the proposed system will be *openness* and transparency, because the best way to prevent clandestine activities (and related suspicions) is to do away with secrecy. Therefore, the NWC has to ban all military nuclear research and development (R&D). Measures of *preventive arms control* striving to put some limits and control on all R&D, which is relevant for nuclear weapons, seems to be necessary.

It is not quite clear whether a NWC should only describe and fix the final state of an already nuclear–weapon–free world after a process of global elimination of nuclear weapons or include the *final part of the process down to zero itself* and govern the transition to the aim of a nuclear–weapon–free world. Since the transition process is crucial it is more likely that procedures fixing that have to be considered as a substantial part of a NWC. For a while, unilateral reductions will probably play the major role and will be more important than negotiated agreements, as in present times, but this could not replace a binding global agreement describing the elimination process down to zero.

The *transitional period from small number arsenals to the total elimination* is particularly problematic, since small hidden quantities of weapon–usable materials, warheads, weapon systems or even clandestine facilities related to weapon production would have a strong impact on the break–out problem. Therefore, it might be better to go from levels of several hundred directly to a point of zero. Otherwise, with low limits on nuclear weapons all infrastructure will continue to exist with the inherent danger of worst case scenarios where some states feel encouraged to try to hide clandestine potentials. Since this phase of elimination

[21] This could include the splitting up of the IAEA into a pure control agency and an International Energy Agency emphazing renewables and nuclear safety.

is very vulnerable to small increases or retention of weapon–usable materials (oe warheads) by clandestine activities, appropriate provisions should be stated within the NWC. Here, at least two options are available: the reduction to smaller and smaller numbers at different places or to one or two landbased deployment areas in each country which have to be monitored. The impact on stability and the need for verification has to be studied carefully. At the latest at this stage, a verified nuclear weapon register using tags etc. is crucial.

The *transition of existing nuclear doctrines* to their elimination have also to be discussed in a gradual approach towards a NWC which will represent the cornerstone of the new nuclear–weapon–free regime.

The NWC could not come into force unless it had support of all declared nuclear weapon states, who not only judged it to be in their interest but also capable of being safeguarded against violation. Once approved by the required number of states, the *NWC has to be made binding on all states*. This could be done by a Security Council resolution. All currently existing nuclear weapon states could be made to depositairies of the treaty.

Negotiations for a NWC are expected to take a long time. Therefore, this process should be started as soon as possible. *In its final document, the NPT Review and Extension Conference should*, in its call for decisive steps towards a NWFW, *include a call for a mandate for the Conference on Disarmament to start negotiations on a Nuclear Weapon Convention.*

Most important questions which have to be clarified:

1. What definitively should be covered by a NWC, and what explictly not?
2. Which treaties should be replaced by the NWC, and which not? How much overlap to other agreements is admitted?
3. In which way final stages of the nuclear disarmement process down to zero could be (or must be) fixed within the NWC? On what stage should the NWC be put in force?
4. To what extent civilian use of nuclear research, technology and material should be included or limited, respectively?
5. How tight a verification/safeguards regime could (or must) be?
6. What is/are the appropriate agency/agencies administering the verification/safeguards regime?
7. How violations would be defined and what kinds of enforcement should be proposed?

1.4 Objections to a Nuclear-Weapon-Free World

Joseph Rotblat

Introduction

A study of the steps towards a nuclear-weapon-free world (NWFW), must make a convincing case for such a world. While enumerating its desirable features, it must also consider and refute the alleged negative aspects of a NWFW, the various reasons that have been presented in the literature[22] for not eliminating nuclear weapons. This is the purpose of this paper.

The objections to a NWFW come under several categories: nuclear weapons prevent wars; nuclear weapons cannot be disinvented; a world without nuclear weapons would be a dangerous world; a nuclear weapons convention cannot be safeguarded adequately; a NWFW would require a repressive regime.

However, apart from these arguments there is opposition to a NWFW for reasons that are not stated openly, even though they are important; indeed, they may even be denied by those who want to hold on to nuclear weapons. One such reason is the high prestige that the possession of nuclear weapons is perceived to bestow: it secures a place at the high table. For France and the UK this was undoubtedly the main reason for starting work on the atom bomb, but it still provides a strong motivation for keeping the nuclear arsenals; it gives the illusion of grandeur, even though their empires were dissolved long ago. Russia is still smarting from the loss of its status as a superpower, and insists - among other reasons - on keeping its nuclear weapons as a vestige of its past eminence. The prestige factor would be weakened if its most visible element, a permanent seat on the Security Council, were removed. The holding of a permanent seat on the Security Council should not be identified with the possession of nuclear weapons.

Basic Assumptions

It needs to be made clear from the outset that the problem of safety in a NWFW is here largely treated in relative terms. There can be no absolute safety in a human society. The main question is whether the world will be a safer place without nuclear weapons than with them.

The aims, substance and structure of a Nuclear-Weapons Convention (NWC) are dealt with in another section of this document (see section 1.3), but for the purpose of this section two premises need to be stated: it is assumed that

- all current nuclear weapon states have agreed to the terms of the Nuclear Weapons Convention and are its depositaries;

[22] See e.g. [Bailey (1995)]; [Waldergrave (1989)]; [Groves (1954)]; [Rifkind (1993)]; [Quinlan (1993)]

- once agreed and ratified by a certain number of nations, the NWC will be declared by the Security Council to have universal validity and be binding on all nations, whether they have signed it or not.

It is important to emphasize these premises because some of the critics of a NWFW use arguments pertaining to the world as it is now, and not as it will be after the NWC has come into force, or what it would be in 30 years from now if there were no NWC. Thus, the article by Kathleen Bailey "Why we have to keep the bomb"[23] is logically flawed because her scenario envisages complete nuclear disarmament by the United States but the world political situation remaining as it is now (or rather, as perceived by her: the Cold War still going on and Russia the arch enemy). On this basis she makes the nonsensical prediction that some nations will acquire nuclear weapons as soon as the USA got rid of theirs.

Nuclear weapons prevent wars

This argument, which is being put forward continually in order to justify the further retention of nuclear weapons, needs to be examined in two parts:

- nuclear weapons have prevented the outbreak of a Third World War;
- nuclear weapons prevent all types of war.

Prevention of World War

Based on dubious analysis and a misinterpretation of history, this argument is largely of the past: after the collapse of Communism the danger of a global war has greatly diminished. Nevertheless, it is still being advanced to create the feeling that nuclear weapons have a positive quality, that they safeguard the peace in the world.

Typical of this argument is the statement by a British Foreign Office Minister, William Waldergrave:[24] "Nuclear deterrence has certainly prevented world war - that world war which would otherwise have inevitable broken out sometime, somewhere, after 1945 between America and her allies and Russia and hers." By constant repetition this has become accepted as the gospel truth, without any evidence to support it. Recently released documents give no indication that the Soviets ever considered an invasion of Western Europe.

Indeed, one could advance the opposite argument - also hypothetical - that the danger of a third world war arose mainly from the development of nuclear weapons.

The fact that two world wars have occurred in this century does not mean that world wars must break out periodically at relatively short intervals. Both World Wars have started in Europe, and the main adversaries were Germany on one side, and France and the UK

[23] See [Bailey (1995)]
[24] See [Waldergrave (1989)]

on the other. But since the Second World War, the political configuration of Europe has changed radically; nobody, in their right senses, would now think of a war between the former European antagonists.

The alleged danger of the "inevitable" world war refers to a conflict with the Soviet Union, but although the Soviet Union had been in existence for many years (and an ally of France and the UK in both World Wars), the danger began to be perceived as real only after the advent of nuclear weapons.

From the very beginning, nuclear weapons were seen by some political and military leaders in the United States as a powerful tool in the ideological struggle. General Leslie Groves, the head of the Manhattan Project, said:[25] "There was never from about 2 weeks from the time I took charge of this project any illusion on my part but that Russia was our enemy and that the project was conducted on that basis."

The US monopoly on nuclear weapons ended when the Soviets tested an atom bomb in 1949. This started the arms race in which both sides kept manufacturing huge numbers of ever more powerful nuclear warheads; an insane race, which threatened to erupt at any time into an uncontrolled military confrontation. The nearest we came to World War 3 was during the Cuban Missile Crisis of 1962, which was caused by the Soviet attempt to set up nuclear bases near the United States.

At no time during the Cold War was either side satisfied that its nuclear weapons ensured its security. Despite the tens of thousands of warheads in the arsenals, President Reagan found it necessary to seek security in the extremely costly Strategic Defence Initiative. The Soviet Union would have felt compelled to follow suit, although the effort to stay in the arms race had already brought economic ruin to the country. Had the arms race continued, it is very likely that it would have led to a nuclear holocaust. It was a stroke of luck that a sane leader, Mikhail Gorbachev, came on to the scene and called a halt to the madness.

The understanding of the destructiveness of nuclear weapons has probably contributed to greater caution about getting into military confrontation. Nevertheless, the danger of a world war was increased rather than decreased by the existence of nuclear weapons.

Prevention of wars

In an analysis of the UK nuclear policy, another British Minister, Secretary of State for Defence Malcolm Rifkind said:[26] "The value of nuclear weapons .. lies not .. just in deterring the use of nuclear weapons by an adversary, but in actually preventing wars." This is clearly untrue as far as the past is concerned: wars have been fought throughout the whole post-Second-World-War period including the post-Cold War years. There is no definite evidence that any conflict has been prevented by the existence of nuclear weapons. While one cannot prove or disprove a negative conclusion, the frequency, casualty rates, causes and conduct of

[25] See [Groves (1954)]
[26] See [Rifkind (1993)]

the wars do not seem to have been affected by the existence of nuclear arsenals. The nuclear powers themselves were active belligerents in the most bloody of these wars: Korea, Vietnam, Cambodia, Afghanistan, Falklands, and the Gulf. Their possession of nuclear weapons does not appear to have helped them to prevent the wars, nor to have given them extra military advantage.

Nuclear weapons cannot be disinvented

This is the most frequent argument against a treaty to eliminate nuclear weapons. Thus, in the analysis quoted above Malcolm Rifkind said: "... nuclear weapons cannot be disinvented. The knowledge exists and cannot be expunged." The "disinvention" argument is an argument against disarmament in general; if accepted it would mean that there should be no disarmament of any kind of weapon.

The fallacy of this argument lies in its conclusion, that the only way to prevent some state or group acquiring nuclear weapons is to keep them oneself. It ignores other ways of preventing the acquisition of nuclear weapons, by making it a crime, an illegal act which is punishable by international law. This is the usual way for society to deal with harmful or dangerous products. It is a hallmark of a civilized society that it can control the undesirable creations of its ingenuity by national laws or international treaties. These laws prescribe the quantities of hazardous materials that can be allowed, or prohibit them altogether. Nuclear weapons come in the latter category (vide the numerous resolutions of the UN); the proposed Nuclear Weapons Convention would make the possession of nuclear weapons illegal and a crime against international and national laws.

The strongest illustration of the absurdity of the "disinvention" argument is the attitude to the Chemical Weapons Convention, which - although not yet ratified - has been accepted by 80 per cent of the countries of the world. Chemical weapons too cannot be disinvented. Indeed, it is much easier to reinvent them than nuclear ones, because precursors of chemical weapons are in daily household use. This makes the verification of a ban on chemical weapons extremely difficult. Nevertheless, after many years of study and debate, such a verification system has been devised and accepted.

One given reason for the acceptance is the cynical view that a violation of the CWC would not matter because it could be dealt with by the threat of using nuclear weapons. But there is no provision in the CWC that its integrity is to be assured by nuclear weapons. It is sheer hypocrisy to use the "disinvention" argument to nuclear weapons but not to chemical ones.

A world without nuclear weapons would be a dangerous world

According to Michael Quinlan, "a purportedly non-nuclear world would be likely to be a more dangerous world."[27] Insofar as it relates to war prevention this argument is, in fact,

[27]See [Quinlan (1993)]

the same as discussed in the previous two sections. If nuclear weapons have really prevented war, then it would be justified to claim that the absence of these weapons may induce war and thus create a dangerous situation. However, since this premise was shown to be wrong, therefore the conclusion must also be wrong.

The real problem behind this argument is whether a convention to eliminate nuclear weapons could be made sufficiently watertight to prevent a break-out. This is discussed in the next section.

A nuclear weapons convention cannot be adequately safeguarded

This statement, which is related to the "disinvention" argument, was presented by Michael Quinlan as follows: "For the rest of history humanity has to live with the reality that almost any substantial and reasonably advanced independent state could eventually, if it so chose and was not forcibly prevented by others, construct a nuclear armoury to support its external goals, be they offensive of defensive."

This is the "break-out" issue, which, as defined there, includes both the clandestine retention of a small nuclear arsenal during the disarmament process and the build-up of such sometime later.

The two important qualifications in the above quotation are "if it so chose" and "was not forcibly prevented by others." The Nuclear Weapons Convention will be intended to deal with both. Its main aim will be to remove the incentive for acquiring nuclear weapons; should a nation nonetheless embark on a weapons programme there must be a safeguards system designed: first, to enable early detection, and second, to stop the violation by force. Under the dual technological and societal verification regimes envisaged, the chances of undetected break-out will be very small. The terms of the NWC will provide that a country suspected of attempted violation would be subject to a challenge inspection, and if the suspicion was confirmed, the country would be liable to punishment under international law.

All the same, there can be no absolute assurance against an undetected violation of the NWC, and one has to confront the issue of the consequences of such a violation. These will depend on the reasons for a country attempting a break-out. Several scenarios need to be considered.

The most difficult case would be if the violator were one of the present nuclear powers. Having agreed to abolish its nuclear weapons, what might drive a country to develop them again? It is most unlikely that a conflict with a lesser military power would call for an illicit nuclear arsenal. As already stated, even when they possessed huge arsenals legally, these states did not use them in the wars they fought. As Kathleen Bailey rightly (though in a wrong argument) pointed out, the Gulf War was extremely expensive, and its goal could have been achieved quicker and much more cheaply by the use of nuclear weapons. This was not done, and is most unlikely that in a NWFW a great military power will develop nuclear weapons to deal with a lesser military power.

This leaves the possibility of a political situation that deteriorates so badly between two great military powers that they feel compelled to resort to military measures, even leading to the use of nuclear weapons. But such a crisis would not crop up overnight; it would be seen coming a long time. In that case both sides may start to rebuild their nuclear armouries. Should they do this, we will be back to the situation that exists at the present time. Such a regression would of course be highly regrettable, but the outlook would still be better than at present. It would take some time to construct the nuclear arsenals, and that time would be used to resolve the conflict by negotiation.

A more likely scenario is an attempt by a small power to build up clandestinely a nuclear armoury for aggressive purposes, to threaten another country. However, once the threat is made, the combined conventional military might of the whole world would come down on the aggressor to defeat its objective, and the retribution would be much harsher if there actually was a nuclear attack. No rational leader is likely to take such a risk for gains that are bound to be short-lived.

The situation is quite different with an irrational leader, or with a fundamentalist regime bent on launching a holy war. A military reprisal would not be a deterrent in such cases. Similarly, reprisals could not be applied against a group of terrorists, that had somehow acquired nuclear weapons. These cases could really create a dangerous situation. But such cases are unmanageable now, with all the thousands of nuclear warheads. However, here too, the hazard will be less in a NWFW, because the chance of the acquisition of nuclear weapons by such countries or groups would be much smaller in a world in which there are no nuclear weapons or facilities to make them, than in the present situation with so many nuclear arsenals.

The conclusion, therefore, is that a nuclear-weapon-free world, while not absolutely safe, will be safer than one with nuclear weapons.

A NWFW will necessitate a repressive regime

It is frequently alleged that in order to prevent the illegal acquisition of nuclear weapons by a state, or by a criminal organization, an extremely rigid system of controls will have to be established, which would restrict the freedom of the individual to such a degree that it will in effect create a totalitarian rule, a 1984 regime in which citizens will be encouraged to spy on each other.

This assertion is a complete misrepresentation of the situation that is envisaged for a NWFW. In fact, the opposite will be the case. A chief characteristic of the proposed system will be openness, because the best method to prevent clandestine operations is to do away with secrecy.

As envisaged, the system will be based on an open society, in contrast to the secrecy which characterizes present society, especially in nuclear issues. More transparency will be called for in all aspects of community life. The Nuclear Weapons Convention will ban all military

nuclear research and development. The nuclear research establishments, Los Alamos and Livermore, Chelyabinsk and Arzamas, Aldermaston and Limeil-Valenton, will have either to close down or to convert to peaceful research carried out openly. All research in universities and industrial establishments will be conducted openly, as the very nature of scientific research demands; the results of the research will be published in open journals, subject to satisfying patent requirements. The employment of scientific personnel, the procurement of specialized equipment will all be on public record. The control of the flow of sensitive nuclear materials in reactors, and other facilities connected with the peaceful uses of nuclear energy, will be much more diligent than at present, but this will be achieved by more precise instrumentation, rather than by imposing more secrecy. The auditing of materials will be open to public scrutiny. All these are requirements for the societal verification system, but they will also have a beneficial effect on society as a whole.

A nuclear-weapon-free world will be a more open world, as well as being a safer world.

1.5 Security aspects

1.5.1 Security in a Nuclear-Weapon-Free World

Frank Blackaby

Nuclear Weapons, although they are part of the military equipment of nuclear weapon states, are not part of their security structure, in the sense of enhancing their security. Indeed there is an increasing amount of comment, even from those who have in the past been proponents of nuclear weapons, suggesting that now they detract from the security of nuclear weapon states rather than enhance it. Without reopening the debate about whether nuclear weapons ever had a positive function, certainly they do not have one now.

The "mutal deterrence" structure between the two old power blocs is obsolote. Since it is no longer conceivable that Russia would intentionally launch nuclear weapons against the USA, or the USA against Russia, nuclear deterrence is no longer needed, and the nuclear deterrence structure can be abandonned. As long as the nuclear weapons are still there, the risk of a nuclear accident remains; this certainly does nothing to enhance security.

The use of nuclear weapons for war-fighting in Europe is no longer a possibility. All the nuclear weapon states (NWS) have given security assurances in some form or other to the non-nuclear weapon states (NNWS) which are members of the Non Proliferation Treaty - that they, the NWS, will never use or threaten to use nuclear weapons against them, the NNWS. These assurances in effect exclude the use of nuclear weapons from virtually all the Southern hemisphere.

If, therefore, nuclear weapons disappeared from the arsenals of all the nuclear weapon powers, it would not leave a gap which had to be filled. Indeed it would probably make possible a reduction in military expenditure across the board. This is because security is essentially a matter of cooperative relations between states, rather than matter of antagonistic military deployments. A move to a NWFW would be a clear sign that the whole idea of war between the major military powers was becoming a fantasy, and consequently that military preparations - conventional as well as nuclear - for such a war were no longer needed and most military spending in the world is addressed to the threat of a war of this kind.

The main military requirement of a NWFW is that adequate conventional military forces could be at the disposal of the Security Council. In all probability the move away from national nuclear weapons would only occur in a world in which this need had already been recognised: for of course such UN-controlled forces are, and will be, needed for many other functions apart from the last-resort enforcement of a NWFW. By the time a NWFW came into force, the rule would in all probability have been widely accepted - that it was only under UN auspices that military force could be used across national borders. Control over substantial military forces should by then have been transferred to the UN.

The defects of present arrangements for such a transfer are well known. Now, when the UN is called on to intervene, a force has to be laboriously assembled from states which have the option of refusing the UN's request. There is delay; the mix of weapon systems is often inappropriate; the forces offered may well not be trained for the particular duty which is required; and there are almost always problems in moving forces quickly enough. There will have to be adequate conventional forces, under UN command, equipped for power projection, ready for rapid reaction anywhere in the world.

Two points: first, this development of UN forces is likely to be needed for many other purposes as well as any last- resort enforcement of a NWFW. Secondly, the cost would be only a small proportion of the total present aggregate military expenditure of UN states.

1.5.2 Security challenges in a world without nuclear weapons

Richard Falk

The main security concern in a world without nuclear weaponry would be to reassure governments and peoples that no state or political movement could reasonably acquire and credibly threaten to use such weaponry. And further, that such high levels of reassurance would not depend on totalistic forms of surveillance and control by those agencies of governance entrusted with verification of compliance with whatever agreed arrangements established security in a nuclear-disarmed world. In essence, the search is for confidence and reliability without any likely encroachment on either the basic modalities of constitutional democracy or upon the realisation of human rights of a civil and political character.

The satisfaction of such security requirements is not feasible in the world as now constituted. To superimpose immediately a security system of reasonable reliability is not now a politically credible project, given present levels of authoritarian control in many states, current governmental links with terrorist groups, and black market operations relating to nuclear weapons. Even to contemplate such a nuclear disarmed world taking hold at present would seem to presuppose a huge interventionary capability and the vesting of virtually totalitarian prerogatives in an enforcement agency. The political will for such an undertaking is extremely unlikely to materialise under any foreseeable set of circumstances as the security provided by deterrence and non-proliferation is likely to be regarded as preferable by most elites and their citizenrys, despite such a posture being unsound prudentially over a long time period and indefensible morally (and legally) at all times because of the inherent indiscriminateness and destructiveness of the weaponry. But such scepticism does not support the dismissal of a nuclear-disarmed world, but merely underscored that it must be achieved by confidence-building stages. Further, that considerations of feasibility only inhibits proceeding from a world that is almost nuclear- disarmed to one that is totally so , and that such a final stage can be deferred indefinitely if necessary. Finally, the effort to climinate nuclear weapons,

if done responsibly, is itself of value in the sense of denuclearization, even if it never fully succeeds. At least, it reduces and tests seriously the abolitionist option.

At present, a regime of unconditional prohibition has been established with respect to biological weapons, and although some claims of non-compliance have been alleged, the regime remains in place, being regarded as universally applicable. The Chemical Weapons Treaty extends the prohibition on threat or use to possession and development, establishing a regime that promises to achieve a world without chemical weapons. These weapons of mass destruction were successfully prohibited even during the Cold War, during a period of intense distrust and conflict at the strategic level. Why has it been so much more difficult to establish a comparable regime for nuclear weapons? The same considerations apply, perhaps more so. One main difference, however, is that nuclear weapons are mainly controlled by powerful countries, and non- proliferation as a strategy has generally, so far, succeeded. Also, the use of atomic vomits to end a just war has never been repudiated, giving nuclear weapons a somewhat ambiguous status as compared to their chemical and biological counterparts. Finally, a nuclear weapons establishment emerged that engaged many leading scientists and military intellectuals in a manner that makes it politically and psychologically more difficult to challenge their security roles, especially given their integration into military establishments over a long period of time and the avoidance of any challenge to the status quo that might have been mounted hat post-Nagasaki catastrophes occurred. These factors are important to bear in mind as indicative of the difficulty of superseding the security roles played by nuclear weaponry. Let us also not project a world that is free of serious conflicts or that has move decisively in the direction of non-violent modalities of resolution. Such presuppositions make the inquiry about acceptable security given the elimination of nuclear weaponry at once too easy (security threats are virtually ruled out by definition) or too unreal (the emergence of such conditions on a sufficient scale given the current world situation seems remote to the point of irrelevance). In this paper the presupposition is made that serious international conflict will persist indefinitely and that adversaries may have recourse to military means. A further presupposition is made that governments retain non-nuclear military capabilities at least during the early years subsequent to the elimination of nuclear weapons.

Given this framing of the security concern, it seems useful to draw a distinction between achieving a nuclear-disarmed world as part of a wider process of demilitarisation and achieving a nuclear-disarmed world in the context of approximately current levels of militarization with no significant shifts occurring in the prevailing security mind-set. In the former instance, there is an emergent mind-set that places less and less weight on violence and military capabilities to achieve acceptable security, while in the latter instance the role of violence and military capabilities is kept more or less constant, with the elimination of nuclear weapons becoming a forbidden weapon leading to a regime of prohibition somewhat equivalent in the end to what has been achieved in relation to biological and chemical weapons (assuming full implementation of the treaty).

With respect to either type of scenario it is required that there be a convincing reconciliation

between the elimination of nuclear weaponry and the maintenance of an acceptable political atmosphere. This would seem to depend on two sets of developments:

- a confidence-building process that is deepened as nuclear disarmament proceeds to its final stages, especially to the last stage when existing nuclear weapons states move from very small arsenals to zero;
- a set of political preconditions that includes high degrees of transparency and sufficient freedom to entrust citizens as well as formal authorities with monitoring and verification responsibilities.

The dynamics of confidence-building would seem quite different in our two types of scenarios for a nuclear-disarmed world. In a demilitarising scenario (of course, there are many variations as to degree and time horizons), the stress on security would progressively shift to non-military approaches, especially transparency eight respect to retained military capabilities, increased reliance on non-military forms of dispute- settlement, support for citizen whistle-blowing, and expanding peacekeeping and preventive diplomacy roles for the United Nations and regional organisations. In effect, getting rid of nuclear weapons would ultimately be dependent upon creating a more peaceful world, involving at the very least the nuclear weapons states and other major states. In this regard, a nuclear-disarmed world would be one in which there was almost no expectation of strategic warfare, and one in which verification and response capabilities seemed sufficient to identify and deal effectively with any actor that embarked on a program of covert acquisition. In other words, the core states would have to chive a more co-operative approach to security and depend to a large degree upon an operative framework of global governance.

In the constant militarization scenario (again there are a range of variations in terms of proliferation prospects and threat perceptions), the main security stress would be upon compensatory means of military capability to ensure security. In other words, the deterrent role currently played by nuclear weapons would be taken over by other types of weapons and tactics, as reinforced by appropriate doctrines and deployments. Of course, as nuclear weapons were being eliminated a strong concern would centre on whether such compensatory capabilities existed and would remain successful. The final stage of elimination would not occur unless sufficient confidence in alternative military means existed, perhaps bolstered by reliable monitoring capabilities. It should be realised that since 1945 no nuclear weapon has been used (atomic bombs being considers as nuclear for this purpose) in an active sense, but only in a variety of threat modes.

To carry this line of analysis further would require very specific consideration of security threats, and plausible non-nuclear means of meeting them either through diplomacy (that is, settlement), deterrence (counter-threats), and defence (that is, by engaging in warfare). The generic threat to the major nuclear weapons states would be an enemy armed with nuclear weapons, but it could also be a smaller state that relies on nuclear weapons to deter a

larger state or states with superior non-nuclear capabilities. Indeed, this latter circumstance could prove quite intractable unless solid security guarantees could be provided, perhaps consisting of pre-positioned forces of a major allied state. The hardest case might be the politically isolated state that relied on nuclear weapons to deter hostile neighbours, yet perhaps such a circumstance is less real than it appears. Cuba has managed to uphold its security despite being non-nuclear, as well as surrounded and strongly opposed by the sole surviving superpower. Indeed, Cuban security was most threatened when it moved to acquire a nuclear deterrent on its territory!

In the mid-1990s there is no immediate prospect that either type of scenario for a world without nuclear weapons is likely to take hold. The main emphasis of nuclear weapons tats is upon non-proliferation sweetened by some limitations upon the size of stockpiles and on the right to go on testing. But such an apparent consensus could collapse rapidly if important breaches in the non-proliferation dike occur, as might happen in Asia, or if a serious nuclear accident occurs, or even if the black market in nuclear weapons materials creates high degrees of unpredictability as to who might emerge with nuclear weapons in the future. In this sense both scenarios are plausible routes to a world without nuclear weapons, each proceeding by stages, one with confidence in an improving political environment, the other one with confidence in the deterrent capabilities of non-nuclear weapons and tactics. It is important to make the case that moving down either path is an exploratory process that need not go further without sufficient positive feedback for all participants. It will not be simple, but neither will be an indefinite continuation of a world with an ever-increasing number of nuclear- armed states.

1.6 Agenda for moving towards a Nuclear-Weapon-Free World

Zia Mian, Abdul Nayyar, Martin Kalinowski

There are three fundamental constraints within which any global nuclear disarmament scheme must function:

a) The nuclear weapons states are unwilling to lose the military capability they feel is created by nuclear weapons unless they are certain that their strategic dominance will remain unchallenged.

b) The de-facto nuclear weapons states will retain if not develop their nuclear option unless there is a move towards global nuclear disarmament.

c) Nuclear energy production, and therefore the processing of potential nuclear weapons material, will remain in place for several decades.

The disarmament scenario outlined below attempts to take care of these constraints in the following way. We are already in the initial stage in which the nuclear weapons states will reduce their nuclear weapons arsenals. China, France and Great Britain will join disarmament measures. They will however be allowed to retain some nuclear weapons but will be required to change their patterns of nuclear weapons deployment and their strategic doctrines. During this stage no new weapons will be produced by any state as part of a global moratorium, and further development restricted by a comprehensive test ban treaty. The development of missile based delivery systems will be restricted by a flight test ban on missiles. At the same time the possibility of threshold states becoming full nuclear weapons states will be effectively eliminated. But these states will be allowed to retain their "nuclear capabilities." This will include retaining any nuclear weapons-usable material they may have produced, but only under a more stringent and transparent international inspection and monitoring system as part of a global fissile material production cut-off treaty.

The second stage involves removal of all nuclear weapons from deployment by the recognized as well as by de-facto nuclear weapons states. The whole nuclear weapons production complexes will be closed and dismantled. An international inventory of fissile material will accompany this. The existing stocks of fissile material will be taken into internationally controlled repositories.

The third stage will require the total dismantlement of all nuclear weapons and the demilitarization of the fissile material and tritium coming out of them. It will see also the complete elimination of all reprocessing technologies and a ban on national enrichment facilities. The elimination of national enrichment and reprocessing facilities will entail that only internationally controlled enrichment will be allowed to produce fuel for existing reactors.

Detailed steps towards a Nuclear Weapons Free World may be grouped in these three phases.[28] The immediate part of the agenda towards a nuclear-weapon-free world includes the following steps. The order of the following items does not imply a chronological preference:

- Reduction in nuclear arsenal and deployment (as in START etc.);
- Nuclear test moratorium and Comprehensive Test Ban Treaty
- Closure and dismantling of dedicated military nuclear material production units in the nuclear weapon states;
- No-First-Use Treaty;
- A treaty to ban the use and threat of use of nuclear weapons;
- Global moratorium on further production and development of nuclear weapons;
- Test ban for ballistic delivery systems;
- Production cut-off of weapon-grade fissile material, and initiation of definite moves to eliminate national reprocessing and enrichment technologies; simultaneously, enforcement of improved safeguards and monitoring system on all nuclear facilities;
- Ban on the production of Tritium;
- Full implementation of Chemical Weapons Convention and of the verification sytem for the Biological Weapons Convention;
- UN register of conventional arms and UN reports on military expenditure.

The intermediate part of the agenda towards a nuclear-weapon-free world includes the following steps:

- Further deep reductions in nuclear arsenals of the five recognized Nuclear Weapon States;
- Constraining the deployment of nuclear weapons to territorial bounds (particularly of nuclear weapons-carrying submarines and other naval craft);
- Nuclear-weapon-free zones to be established in Africa, Southeast Asia and other regions;

[28] Similar disarmament phases in five year steps have been proposed in [Epstein (1994)]

- Removal of nuclear warheads from strategic and tactical missiles into national repositories under international inspection;
- An international inventory of fissile material, whether already cast for weapons or otherwise, for general information on who possesses what.

Final part of the agenda:

- Transforming all five recognized Nuclear Weapon States to Non-Nuclear Weapon States;
- Dismantling the remaining global nuclear arsenal under international inspection;
- All fissile material to be taken into international control;
- Ban on national uranium enrichment and spent fuel reprocessing facilities.
- Nuclear Weapons Convention.

1.7 References

[Bailey (1995)] Bailey, K.: *Why we have to keep the bomb.* Bulletin of the Atomic Scientists, Jan./Febr. 1995, pp30-37.

[Calogero et al. (1991)] Calogero, F.; M. Goldberger; S. Kapitza (eds.): *Verification – Monitoring Disarmament, A Pugwash Monograph.* Westview Press, Boulder, 1991.

[Epstein (1993)] Epstein, W.: *The Non–Proliferation Treaty and the Review Conferences – 1965 to the Present.* In: R.D.Burns (ed.): *Encycolpedia of Arms Control and Disarmament.* New York: Charles Scribner's Sons, 1993, p.855-875.

[Epstein (1994)] Epstein, W.: *Give more to get more.* The Bulletin of the Atomic Scientists, Nov./Dec. 1994, p.15-18.

[Epstein/Szasz (1993)] Epstein, W.; P.C.Szasz: *Extension of the Nuclear Non–Proliferation Treaty: A Means of Strengthening the Treaty.* Virginia Journal of International Law, Vol. 33, No. 4 (1993), p.735-763.

[Groves (1954)] L. Groves quoted in: *In the Matter of J. Robert Oppenheimer.* Transcript of Hearings, U.S. Atomic Energy Commission, Washington D.C., 1954, p.573.

[Holdren (1989)] Holdren, John P.: *Civilian Nuclear Technologies and Nuclear Weapons Proliferation*, in: C.Schaerf, B.H.Reid, D.Carlton (eds.), *New Technologies and the Arms Race*, Basingstoke: Mac–Millan, 1989, pp.161.

[Kankeleit/Küppers/Imkeller (1993)] Kankeleit, E.; C.Küppers, U.Imkeller: *Report on the Usability og Reactor–Plutonium in Weapons*, UCRL–TT–112792, Livermore, 21 Jan. 1993 (Translation of the German original from 1989).

[Lewis (1992)] Lewis, P.: *Verification of nuclear weapon elimination.* in: R.Cowen Karp (ed.): *Security Without Nuclear Weapons?*, SIPRI, Oxford Univ. Press, 1992, p. 128-153

[Liebert (1994a)] Liebert, W.: *How Should We Proceed with the Nuclear Non–Proliferation Treaty? – A Path to a Nuclear Weapon–free World or A Curbing of the Spread of Nuclear Weapons by Maintaining Nuclear Deterrence ?* in: Proceedings of the 44^{rd} Pugwash Conference on Science and World Affaires, A World at the Crossroad: New Conflicts, New Solutions, Kolymbari, Crete, Greece, 30 June – 6 July 1994 (fothcoming).

[Liebert (1994b)] Liebert, W.: *Improvements around the extension of the nuclear non-proliferation treaty* in: W.Liebert, J.Scheffran (eds.): *Against Proliferation - Towards General Disarmament* Münster: agenda publisher, 1994, p. 112-115.

[Liebert/Kalinowski (1994)] Liebert, W.; M.Kalinowski: *Scientific–technological aspects of nuclear non–proliferation and nuclear disarmament*, Proceedings of the 43^{rd} Pugwash Conference on Science and World Affairs, Hasseludden, Sweden, June 1993, Singapore/London: World Scientific, 1994, S.271-282.

[MccGwire (1994)] MccGwire, M.: *Is there a future for nuclear weapons?* International Affaires, Vol. 70,2 (1994), p. 211-228).

[NAS (1994)] National Academy of Science, CISAC: *Mangement and Disposition of Excess Weapons Plutonium*, Washington D.C., 1994.

[Panowsky/Bunn (1994)] Panofsky, W.; G.Bunn: *The Doctrine of Nuclear–Weapon States and the Future of Non–Proliferation*, Arms Control Today, July/August 1994, p.3-9.

[Quinlan (1993)] Quinlan, M.: *The future of nuclear weapons: policy for Western possessors* International Affaires 69,3 (1993), pp.485-496.

[Rifkind (1993)] Rifkind, M.: *UK Defence Strategy: A Continuing Role for Nuclear Weapons?* Speach delivered at the Centre for Defence Studies, 16 November 1993.

[Rotblat et al. (1993)] Rotblat, J.; J. Steinberger; B.Udgaonkar (eds.): *A Nuclear-Weapon-Free World – Desirable? Feasible?*, A Pugwash Monograph, Westview Press, Boulder 1993

[Rotblat/Steinberger (1993)] Rotblat, J.; J.Steinberger ; B.Udgaonkar (eds.): *A nuclear weapon–free world – Desirable? Feasable?*, A Pugwash monograph, Boulder: West View Press, 1993

[Waldergrave (1989)] Waldergrave, W., British Foreign Office Minister, The Times, 6 January 1989.

Part 2

Major steps towards a Nuclear-Weapon-Free World

2.1 Disarmament race between the nuclear weapon states

Coordinators: Götz Neuneck, Martin Kalinowski

2.1.1 Beyond START II - nuclear disarmament in the United States and Russia

Lisbeth Gronlund, David Wright

The nuclear weapon programs of the United States and Russia are currently restricted by several treaties. The Intermediate-Range Nuclear Forces (INF) treaty prohibits both countries from deploying nuclear weapons on ground-based missiles with ranges of 500 to 5,500 kilometers. Assuming that both the United States and Russia ratify and implement the START II treaty on schedule, by early next century the United States will deploy no more than 3,500 strategic nuclear warheads and Russia will deploy no more than 3,000. In addition, both countries can be expected to sign the Comprehensive Test Ban when its negotiations are completed.

However, a full agenda remains to be implemented if nuclear disarmament is to be achieved in the US and Russia (and other countries). Future agreements should be negotiated to:

- require that weapons reduced by treaty be verifiably dismantled and the fissile material placed under safeguards;

- prohibit unsafeguarded fissile material production and restrict unsafeguarded stockpiles of fissile material;
- require deeper cuts in deployed nuclear weapons, including negotiated limits on tactical nuclear weapons; and
- place greater restrictions on the deployment mode of allowed nuclear weapons.

We discuss each of these points below. (The order in which these issues are discussed is not meant to imply the order in which they should be implemented.)

Irreversible Reductions

While the START treaties will lead to significant cuts in strategic nuclear deployments, they do not make these cuts difficult to reverse. For example, START II requires Russia to destroy its SS-18 missiles, but both START I and II permit all other missiles and all withdrawn warheads to be stored. While both countries are currently dismantling some of their withdrawn warheads, they are doing so without verification and are placing the resulting fissile material in their stockpiles where it could be reused for weapons.

Measures should be implemented to insure that START cuts are difficult to reverse: the United States and Russia should conclude an auxiliary agreement to verifiably dismantle all withdrawn warheads and destroy all withdrawn missiles, and to place the fissile material from dismantled warheads under international safeguards to preclude its future use for weapons. Weapons that have already been dismantled could be accounted for since the pits are being stored.

Controls on Fissile Material Production and Stockpiles[1]

Currently, the nuclear powers may produce and store unlimited amounts of fissile material for weapons. One measure to address this problem–a "Cutoff Convention" prohibiting further production of fissile material for weapons–is under preliminary discussion at the Conference on Disarmament (CD).

The United States and Russia should announce their support for such a convention and their intention to sign it. This would be a small step for both countries. The United States is no longer producing highly enriched uranium (HEU) or separated plutonium. Russia continues to operate several plutonium production reactors that also provide heat to neighboring cities, but has pledged to shut down these dual- purpose reactors by 2000 assuming that alternative power can be provided. In the meanwhile, the United States and Russia are discussing ways to verify that the plutonium produced is not used for weapons.

[1]For more about this issue see section 2.2

While US and Russian support for a production cutoff would be important politically, it would be essentially meaningless in terms of limiting their abilities to produce new weapons since both countries have large military stockpiles of unsafeguarded fissile material that could be used for weapons. Because fissile material in weapons can be recycled and remanufactured into new weapons, the size of fissile material stocks needed to maintain a fixed arsenal is very small, since it is only needed to compensate for losses during manufacturing or possible loss of weapons, e.g., if a submarine were lost at sea. Additional stocks are needed only to increase the size of the arsenal.

The United States announced in 1994 that it will declare as "excess" and place under IAEA safeguards that part of its military fissile material stockpile that it no longer needs for its deterrent, and Russia has indicated that it will consider doing so as well. However, to date the US has declared only small amounts of its fissile material as excess, and its remaining "reserve" stock is very large, thus allowing substantial future increases in its arsenal. While unilateral reductions are welcome, the size of reserve stocks maintained by each nuclear-weapon state should be restricted by treaty rather than determined unilaterally.

The negotiating mandate for the Cutoff Convention has not yet been decided in the CD, and one of the unsettled issues is whether existing stocks will be covered. Including existing stocks would make it politically difficult for the undeclared nuclear weapon states to sign a Cutoff Convention since it would effectively force them to declare their nuclear status. An alternative is to negotiate a separate treaty (a "Stockpile Treaty") limiting the amount of fissile material that can be held outside of international safeguards for weapons purposes, either in nuclear weapons or in material stockpiles. A Stockpile Treaty would be intended for signature by the declared nuclear powers.

The Stockpile Treaty would impose a ceiling on the total amount of unsafeguarded fissile material possessed by each country, whether in deployed weapons, stockpiled warheads, or fissile material stocks. This ceiling could initially be higher for the United States and Russia, or the treaty could impose equal limits on all signatories. However the limits were set, the treaty would require the greatest cuts by the United States and Russia since their stockpiles are much larger than those of the other nuclear-weapon states. Nonetheless, it will be important to involve the other nuclear powers from the beginning to stress the universality of these limits.

What is most important is that the Stockpile Treaty specify either a limit that will decrease with time or require that there be periodic renegotiations of a lower ceiling. For example, the treaty could specify the maximum quantities of unsafeguarded fissile material that the signatories could possess at five year intervals. Alternatively, it could require that the original limit be renegotiated every five years. Any material in excess of the negotiated limits would be placed under international safeguards.

Signatories to a Stockpile Treaty would be required to declare the total amount and isotopic composition of their unsafeguarded fissile material, including that contained in stored

warheads and deployed weapons. In addition, each state would be required to provide information on the operating histories of its reactors, enrichment facilities and plutonium separation facilities to provide confidence in the declared stockpile sizes.

The United States and Russia need not and should not wait until negotiation of a Stockpile Treaty to make declarations of their fissile material stocks or to place significant portions of their existing stocks under safeguards.

Deeper Cuts

After START II ratification, the United States and Russia should begin negotiations of a new round of nuclear reductions (START III), which should reduce arsenals to 1000 or fewer strategic weapons and require verified dismantlement of the warheads removed from deployment and placement of the resulting fissile material under safeguards. START III should also limit the number of tactical nuclear weapons that may be deployed. Tactical weapons are not covered by any previous treaties and although Presidents Bush and Gorbachev announced in 1991 that all land-based tactical nuclear weapons would be dismantled and all sea-based tactical weapons placed in storage, both countries retain large numbers of air-and sea- based tactical weapons.

Once the United States and Russia reduce their deployed arsenals to START III levels, it will be appropriate to include the other nuclear powers in negotiations for further reductions. Attaining such cuts in nuclear weapons may require maintaining the viability of the ABM Treaty (see section 2.3.3).

Restrictions on Deployment Mode

An agreement to separate warheads from their delivery systems and store the warheads at a separate site would reduce the risk of accidental use and significantly increase the reaction time in a crisis. The United States and Russia should agree bilaterally to remove warheads from delivery systems in advance of an agreement involving all the nuclear weapon states.

In addition, several different types of restrictions on the deployment mode of nuclear weapons have ben proposed and merit consideration. One proposal is to ban ballistic missiles, which would leave nuclear weapons only on bombers. One motivation for this proposal is that bombers are recallable and have longer flight times that do ballistic missiles. A second proposal is to restrict nuclear deployments to the national territories of the owner countries. In this case, submarine- and ship-based nuclear weapons would be prohibited, as would deployment of US weapons in Europe.

Russian sea-based strategic forces: current problems and prospects

Eugene Miasnikov

The sea-based leg of Soviet and Russian strategic forces traditionally constituted nearly one third of the total strategic nuclear arsenal of the country. After the START II Treaty cuts, which include all land based MIRV-ed missiles, the portion of the Russian sea-based strategic forces should achieve at least 50% of a total 3000-3500 nuclear warheads. Therefore, Russian as well as US, British and French SSBNs will play a key role in ensuring strategic deterrence.

However, there is a strong basis to suppose that in the beginning of the next decade Russia will be unable to maintain 1750 warheads deployed at sea – the maximum level which is allowed by the START II Treaty. The following trends suggest this conclusion.

- The financing for strategic forces has substantially diminished because of the economic and political crisis in Russia and the cuts in the defence budget. In particular, the Strategic Rocket Forces (SRF) have received less than 50% of their needs in 1994[2]. The Navy budget, a quarter of which is spent on strategic forces maintenance[3], achieved only 22-25% of its requirements by July 1994[4]. This situation will likely worsen in 1995, because even before the sharp rise of inflation last December, the planned budget has been less than half of what the Ministry of Defense asked.

- The leadership of the Ministry of Defense and governmental organizations continue to consider the SRF as the main element of the Russian nuclear shield and provide the most favorable conditions for developing land-based strategic forces. Plans exist to deploy 900-1000 silo and mobile single-warhead SS-25 missiles by the year 2003. This would mean increasing missile production rate to 100 a year by the end of the decade. A wide campaign to support this decision is propagated in the Russian press. In particular, the national security of Russia is said to be in danger if the number of deployed land-based missiles diminishes to 300-400. A substantial number of Russian decision- makers share the opinion that SSBNs are vulnerable and unable to carry out the mission of strategic deterrence.

- The Russian SSBN service life lasts 20-25 years. In the beginning of 1993 there was a claim that Russia would have 24 - 27 SSBNs after the START II cuts. According to the last statements of officials and experts, by the year 2003, Russia will have 13-18 SSBNs[5], and after the year 2005, all SSBN will end their service except of the seven most modern Delta IVs[6]. The problem is aggravated by the inability to provide

[2]See [Dolinin (1994)]
[3]See [Ovcharenko (1994)]
[4]See [Maryukha (1994)]
[5]See [Maryukha (1994)] ; [Ovcharenko (1994)]
[6]See [Arbatov (1994)]

timely repairs of submarines. This will likely result in retirement of SSBNs before the schedule. At the same time, according to officials, the commissioning of the first SSBN of a new class is not planned before 2003[7].

- One of the reasons for the accelerated decommissioning of Russian SSBNs is the limited service life of SLBMs, which is about 10 years. Because of the lack of financing, current level of missile production is much lower than needed. In particular, the future of "Typhoon" submarines, whose missiles are supposed to be replaced by new ones, is unclear.

According to the most optimistic forecasts, by the year 2003 Russian sea-based strategic forces will consist of no more than 1400-1650 warheads. The SRF possess nearly 500 missiles, not covered by the START II Treaty, and half of which will be taken off alert because of the end of their service life. There is little chance that the air based leg of the Russian strategic forces will remain at least at the same level of 500 warheads. Taking into account these considerations, Russia will be able to deploy no more than a total of 2000-2500 strategic warheads, unless it undertakes a wide production and deployment of new missiles.

Such circumstances open a wide perspective for the further disarmament of strategic arsenals in the world:

- The most effective step could be concluding the next START agreement by the US and Russia, which restricts the maximum number of deployed warheads to 2000-2500 or even less.
- In order to speed up the achievement of such a treaty Russia could announce that on a unilateral basis, it will not deploy more than 2000-2500 strategic warheads. Such a decision would not weaken national security. Moreover, it allows Russia to save substantial resources.
- The steps suggested would promote disarmament in other nuclear weapon states and enforcement of important international treaties such as the NPT and the ABM-Treaty.

Irreversibility of nuclear arms reduction

Anatoli Diakov

The START II Treaty sets the limit for the U.S. and Russia of the total deployed strategic nuclear warheads at 3,000- 3,500. Under the Treaty the Russian Federation will eliminate 580 ICBM launchers, 424 SLBM launchers and 79 heavy bombers. The following categories of warheads will being entirely or partially eliminated by the year 2003:

[7]See [Voronin (1994)]

- All strategic and tactical warheads withdrawn from Belarus, Kasakhstan and Ukraine;
- The strategic warheads located in Russia which are to be reduced under START II;
- All nuclear warheads for ground-based tactical missiles, artillery shells and land mines;
- Half of the tactical bomb inventory of the Air Force;
- Half of the nuclear warheads for anti-aircraft missiles and one third of sea-based tactical warheads.

In total about of 7,500 of Russian strategic nuclear warheads will be eliminated. The U.S. should reduce approximately the same number of its strategic nuclear warheads. However, even after these deep cuts of strategic arms, the U.S. and Russia will continue to have significant nuclear arsenals which are much bigger than those of other nuclear states.

While the process of real nuclear disarmament has just started, it is time to think how to assure its positive outcome for the security of the world and what further measures should be undertaken to lead to the total the nuclear disarmament. Both tasks will be determine those measures which could be implemented not only after finishing the reduction of nuclear arms but also during the process of the planned dismantling.

From this point of view there are at least three basic problems which should be resolved in near term. First is the irreversibility of nuclear arms reduction. Second is strengthening of the nuclear non-proliferation regime. Third is a creation of such favorable conditions to involve into the process of nuclear disarmament of others nuclear states. All these problems are closely connected and mutually reinforcing. For example, without continual reduction of the world nuclear arms it's rather difficult to think that non-nuclear states would collaborate on the strengthening of non-proliferation regime.

The solution of the first problem requires a cutoff of the production of weapons fissile material and determination of the future for fissile material recovered from retired nuclear warheads. Apparently, it should be committed for peaceful use and placed under international safeguards thereby preventing their re-use for military purposes. It seems that the achievement of such agreement is the prime task for today.

During the last two years significant joint work has been made in a U.S.-Russian collaboration to establish a control regime for their arsenal of weapons fissile material. Russia has committed to shutting down the three remaining production reactors by the year 2000 and currently negotiations are in the progress between the U.S. and Russia for their earlier shutdown. In addition, Russia has promised that since beginning October 1, 1994, it has not been not producing plutonium for use in nuclear weapons. Also, after the construction of a Russian storage facility for the retired fissile material, the U.S. will have the opportunity to verify that these materials are not used for military purpose. The U.S. announced their

readiness to put some excess of weapons fissile material under international control. All these initiatives create a good basis for the implementation of international safeguards.

Evidently, to achieve a regime of international safeguards for the retired fissile material it is necessary to build up international confidence. However, achievement of this objective will be blocked if unacceptably large uncertainties persist regarding the weapons-usable fissile material inventories held by Russia, the United States, and other nuclear weapon states. Hence all these initiatives should be coupled with verified bilateral or international cutoff in the production of new weapon fissile materials as well as with the revealing of comprehensive information on stockpiles of produced fissile materials. The procedure for proper accounting and safeguarding of these materials should also be elaborated too.

As the first step, an agreement on the exchange information about excess weapons fissile material and monitoring of the non re-use of fissile material recovered from retired nuclear warheads could be achieved on a bilateral basis between the U.S. and Russia. Eventually it will be desirable to monitor these materials under international safeguards and it seems that IAEA is more appropriate international organization to carry out such monitoring. The next step would be the comprehensive exchange of information about nuclear arsenals of both the U.S. and Russia and the elaboration of the monitoring procedure.

All these measures will demonstrate the willing and readiness both nuclear weapon states to follow the course of nuclear disarmament and create conditions for the involvement in this process of other nuclear states. Moreover, it will create a favorable atmosphere in which non-nuclear states would not need to pursue their own nuclear weapons and will further increase the moral authority of nuclear weapon states to pressure potential proliferants. In addition, all developed technical and political requirements for the verification of these agreements could be used in the case of extension of the process to other nuclear states.

2.1.2 Nuclear disarmament in France, United Kingdom, and China

French nuclear weapons policies – today and tomorrow

Mycle Schneider

In May 1992, the French government announced the "immediate and final" end to its Hades program of land based tactical nuclear weapons production. For many the announcement came as a complete surprise. Two years ago, in February 1993, the specialized weekly "Air et Cosmos Aviation magazine international" revealed that 90% of the Hades missiles had been built anyway, "by counter order", as the French daily "Le Monde" put it[8]. In any

[8]See [Le Monde (1903)]

other Western nuclear weapon State that information would have generated an up-roar of public opinion. In France, "Le Monde" ran the story on page 10... This episode is typical for the problem of evaluating the French nuclear weapons program as well as current and future strategies. What is part of public knowledge, what is not? The secret decision on the "mothballing" of Hades also means that the complete number of that missile category has to be accounted for in future disarmament talks involving the French weapons systems. The international implications are therefore particularly significant. The French National Assembly nevertheless had not been consulted on the Hades decision - as the French representatives of the public had never been asked about the nuclear weapons program in the first place. Today, the French nuclear forces include land and submarine based ballistic missiles, air to surface tactical and strategic missiles as well as about 30 land based Hades. The total number of warheads stands probably around 500. But developments in France are currently particularly significant on the strategic front and on the implications of technological choices and developments. Relevant issues include nuclear testing, the Franco-German axes and the European integration, a rapidly expanding plutonium industry and the laser isotope separation technology.

On the *testing* issue, French Prime Minister and potential future President Edouard Balladur declared in his landmark speech in front of the Institut des Hautes Etudes de Defense Nationale on may 10, 1994[9], day-by-day 13 years after Franois Mitterrands accession to power, that France has promissed to "participate actively in the negotiation of such a treaty". But the Balladur perspective is paved with conditions:

- it is "not in any case" the question to envisage the elimination of nuclear weapons; any dynamic in this direction "will meet France's opposition"; (Art. VI of the NPT has obviously not caught the French PM view yet...);
- threshold countries have to be integrated in the forum of negotiation;
- the CTBT could not come into force without signature of the threshold countries;
- verification procedures have to be implemented which are capable of dissuading any violation;
- "no obligation of whatever timeframe" exists on the negotiation of a CTBT;
- "we refuse in particular that the NPT extension during the conference in may 1995 depends on the conclusion of a CTBT"; (it should be rather the other way round: no NPT extension could jeopardize willingness to negotiate a CTBT);
- entering the negotiation of a CTBT and the restart of the testing is "by no means incompatible".

[9]See [Dfense Nationale (1994)]

The current and future French government wanted to make clear very early that it is going the set the stakes high on the negotiation of a CTBT. The *Franco-German Axes* as the key element of the European defence integration has gained remarkable attention again over the last couple of years. Various articles to that regard have appeared in the French specialized press[10]. But the question is being discussed in the context of the more recent Eastern European integration. The overwhelming (economic) status of Germany in that regard is being stressed by a French defence analyst: "When it comes to mediteranean countries, worried about the venue of States from Central and Eastern Europe - which will dispute them community givings condemned to be less and less generous - what can they refuse to Germany providing, in 1994, 30% of the Union's budgetary ressources?"[11]

The Germans have money, France and Britain have nuclear arms. But beyond that somewhat superficial approach to the European defence question what about common strategy discussions? The political difficulty in Germany to discuss its potential role in a European Defence based on a common nuclear strategy has encountered some raised eyebrows in France. "Defense Nationale", in its comparison of "Three European White Papers on Defence" stated in a rather blunt way its surprise about the absence of the nuclear component in the German paper: "One could have thought though that the helping hand [la perche tendue] streched by France concerning the extension of the nuclear deterrent to the whole of Western Europe would have been picked up by Germany to, at least, discuss the problem"[12]. Recent discussions with German representatives at the UN disarmement conference and NPT PrepCom suggest that a German participation in a European nuclear defence is indeed an issue which is not being discussed but which is very clearly seen as an option.

France has not only its military nuclear program, but it has launched the world's most ambitious *"civil" plutonium production* program. Currently France produces more than 10 tons of plutonium at its facilities in La Hague and Marcoule. The production of "weapons" grade plutonium has officially ended last year, but the production of "reactor" grade plutonium is increasing steeply and will reach soon a yearly output of over 15 tons. Until now, about two thirds of the reprocessed spent fuel is of foreign origin. This situation might change though very rapidly as foreign electricity utilities increasingly favor the direct storage option. This eventually leaves France with a very large plutonium production capacity on its own.

At the same time, France actively develops laser isotope separation capacities which, in a few years, will enable the country to transform its stocks of reactor grade plutonium into weapons grade plutonium in a very short time. This potentially will make France in the near future to the biggest holder of weapons usable material worldwide. Unfortunately France does not seem prepared to discuss the matter as negotiating item in the context of the NPT review and extension conference. French presidency in the European Union during the negotiations of the follow up of the NPT constitutes therefore not necessarily the most promissing of all

[10] See e.g. [Colard (1994)]; [Normand (1994)]
[11] See [Defarges (1994)]
[12] See [de Bressy (1994)]

possibilities...

The prospects for French defence policy will depend as much on the economics as on the European dimension. France has shown little sensitivity to foreign protests on its weapons testing in the Pacific. But the sensitivity increases significantly as soon as there are unwanted financial consequences involved. The foreign clients of COGEMA's plutonium production plants, for example, do have potentially a very large influence on whether plutonium program in France - with all its strategic implications - will continue to grow or not. When COGEMA's only competitor, British Nuclear Fuels, after 15 years of fierce opposition finally got the licence to operate, COGEMA was at the party. Why ? Because they know that "you cannot be right alone for long". On the nuclear weapons issue, it also depends on the international community whether it follows France into isolation. There is still a chance that the next party will not take place.

UK nuclear weapons: post–Start II steps

Tom Milne

The government states: "The United Kingdom's independent nuclear forces remain the ultimate guarantee of our country's security, underpinning our defence strategy and providing a significant contribution to Alliance deterrent forces." UK nuclear forces are said by the government to be a minimum deterrent.

The Trident submarine is the future of the UK nuclear deterrent. The Trident D5 missiles it carries will, by the middle of the next decade, represent the UK's only nuclear weapons. The UK will deploy four submarines, which should be operational and undertaking regular patrols by the turn of the century. Trident is expected to last until at least 2020.

Changes to UK policy after end of Cold War: In response to the end of the Cold War, NATO and the UK have adjusted their nuclear doctrines and postures. NATO has changed its policy (away from flexible response) to reflect a reduced reliance on nuclear weapons, stating that nuclear weapons are now weapons of "last resort."

UK nuclear forces are no longer targetted at Russia. The government has lowered (from 128 to 96) the number of warheads that may be deployed on each Trident submarine. The UK is withdrawing its tactical weapon (the WE-177 freefall bomb) from service and has cancelled plans to replace it.

The UK's nuclear disarmament policy: The NPT commits the UK (one of its three depositary states) to work for disarmament. The government affirms in the 1994 Statement

on the Defence Estimates that "complete and general nuclear disarmament remains a desirable ultimate goal." However, the government believes that it is neither realistic nor desirable to work for complete nuclear disarmament unless and until there has been substantial conventional disarmament.

The government has said that it will include UK strategic forces in disarmament negotiations when the superpower arsenals have reached a low enough level but has not said what that level would be. The government emphasises that the UK arsenal will be only a small fraction of the size of the US and Russian arsenals after the START II reductions have been made. The danger of break-out is the government's main reservation about the very idea of a nuclear-weapon-free world (NWFW).

The government supports a test ban. It stresses the importance of verification. The government supports a cut-off in production of fissile materials.[13] The government says that it is a strong supporter of the NPT, wishes to see it extended indefinitely and unconditionally, and believes that the treaty's verification provisions should be strengthened. The UK broadly supports all supply-side non-proliferation mechanisms.

Post-START II steps: There are many things that the UK could do to contribute to post-START II nuclear disarmament. How much effect any will have on global disarmament is a subject for discussion. These are not steps specifically relevant to the UK. All the measures could be taken by any of the nuclear-weapon states.

- The UK could increase transparency in nuclear matters, for example by declaring the number of warheads that it deploys.
- The UK could declare a policy of no first use. Following this it could draft and propose a treaty banning any first use of nuclear weapons.
- The UK could try to put the elimination of nuclear weapons on the agenda of the Conference of Disarmament in Geneva.
- The UK could establish a disarmament unit at Aldermaston to work on technical obstacles to eliminating nuclear weapons. Currently only 10-12 staff (out of a workforce of 5000) work in this field.
- The UK could keep its Trident submarines in dock and store the warheads and missiles on shore.

The government opposes all these measures. The main opposition party (Labour) has a manifesto commitment to a policy of no first use, though this is currently under review. The Liberal Democrats support the idea of a nuclear weapons register.

[13]British Nuclear Fuels will continue to separate plutonium at its Thermal Oxide Reprocessing Plant (THORP).

Unilateral nuclear disarmament: Unilateral nuclear disarmament is not currently a popular policy in the UK. There is virtually no chance of a major political party countenancing the idea at the next general election.

One cannot discount completely the possibility that attitudes to nuclear weapons will change in the UK in the not too distant future. There are three main reasons for thinking this. First, UK nuclear weapons policy has been centred around the perceived threat from the Soviet Union. The government agrees that a revival of this threat is so unlikely that policy no longer needs to cater for this eventuality. The whole rationale for UK weapons has thus dissolved. Second, the defence budget has been squeezed in recent years. There may now be an opportunity to portray nuclear weapons as useless and a waste of money, detracting from overall fighting capability. In these terms nuclear disarmament would appeal to many politicians and armed forces' chiefs. Third, the future of the Atomic Weapons Establishment looks highly uncertain. No warhead is being developed, nor is there likely to be a government requirement for one for many years. It is doubtful that it can maintain a viable operation in these circumstances over an extended period of time.

It is suggested by some that the UK should relinquish its nuclear weapons in return for corresponding reductions in the superpower arsenals. No consideration should be given to this option. The UK's is widely supposed to have around 200-300 warheads which is far too few for such a deal to make any sense.

Facilitating global nuclear disarmament

Dingli Shen[14]

As INF, START I and START II Treaties have clearly ushered in the era of true nuclear disarmament, there emerges a call for studying the relevance of global nuclear disarmament process. Especially, for the upcoming extension of Nuclear Non- Proliferation Treaty (NPT), be it extended indefinitely or with fixed period(s) of years, nuclear weapon states as a whole need to make greater commitments to deeper and global nuclear disarmament. The recent U.S. decision, by removing irreversibly 200 tons of weapon-grade (WG) fissile materials out of its arsenal, seems to be an action of a single nuclear weapon state to facilitate the extension of the NPT in this spring.

Should the U.S. and Russia fulfill their commitment to the two treaties on strategic nuclear weapons reduction, their strategic nuclear warheads will be substantially lowered to the level of 3,000-3,500 respectively. This signifies a deeper cut than 50reduction compared with their nuclear arsenals few years ago. Therefore, there appear questions as to when the medium (smaller) nuclear weapon states would join in the global nuclear weapons reduction. There

[14]The opinions expressed in this writing do not represent that of the author's affiliations and that of the government of China

have been reports that the U.S. has pressed the U.K. to give up some of the British Trident weapons systems.

The medium nuclear weapon states, however, may have a different view as to when they have to join in the global nuclear weapons reduction process. To their viewpoint, even with the assumption that both START Treaties will be ratified and implemented according to the schedule, by 2003 the U.S. and Russia will still retain some three thousands of strategic nuclear warheads each. Undoubtedly, this is a level at which those medium nuclear powers seem to be reluctant to immediately make their own commitment to nuclear disarmament.

From sources existed in the public domain, the nuclear arsenals of the U.S. and Russia, after deeper cut mandated by the two STARTs, will be still some ten times bigger than each of that of the medium nuclear weapon states, even if assuming the latter's nuclear arsenals are freezed at the current level in the next decade. Consequently, it is quite understandable that the smaller nuclear powers need to wait for more suitable situation under which they can make commitment.

What might constitute a ripe occasion? This author would consider the following three basic elements:

- further reduction by the U.S. and Russia to an appropriate level;
- WG fissile materials disarmament;
- a security guarantee regarding use of nuclear weapons.

Further reduction: One may argue that the medium nuclear powers will not dismantle their nuclear weapons unless the U.S and Russia reduce their own weapons to a much lower level, say, as low as that of the medium nuclear powers. There should exist more realistic approaches, as a less stringent condition would more facilitate a global nuclear disarmament process. A model Richard Garwin proposed many years ago is that the U.S., and the Russia too, have to deep cut their nuclear arsenal to the combined level of all three medium nuclear arsenals. This means a much reduced level with lower bound at 1,000 nuclear weapons or somehow higher.

Chinese side has traditionally supported a thorough destruction and total elimination of all nuclear weapons. There has been Western analysis indicating that the Chinese have been drifting away from their earlier commitment to joining the global process.[15] A balanced study with understanding of modern Chinese history would indicate otherwise. At any rate, should the U.S. and Russia make further reduction beyond START-II, there will be a real test for the medium nuclear powers as to their commitment to nuclear disarmament involving themselves.

[15]See [Malik (1994)]

Fissile materials: With the process of strategic nuclear disarmament, huge amount of WG fissile materials are being separated from active arsenals. Including the reserved stockpile of WG fissile materials and those dismantled from tactical nuclear weapons, the total amount of WG fissile materials of the U.S. and Russia far exceed what can be justified in the post-Cold War era. Though the U.S. is moving toward reducing its stockpile of such materials, either the U.S. or Russia has to make much greater effort to reduce these stockpiles. As long as the nuclear arsenals of the U.S. and Russia are reduced to a sufficiently low level, and as long as this trend is made irreversible in the short term, the medium nuclear weapon states will have less reason not to join the global nuclear disarmament movement.

Security assurance: Among the medium nuclear weapon states, at least China is enthusiastic in achieving a security assurance arrangement among the nuclear five. China urges that nuclear weapons not be used first by any of the weapon states, and, such weapons not be used against nuclear have-nots and nuclear-weapon-free zones. The rationale is simple: before eliminating all nuclear weapons one has to reduce the risk that nuclear weapons are to be used. Accommodating China's reasonable proposal can only make a global nuclear disarmament more likely.

From a personal perspective, those elements outlined above, once met, will help pave the way toward global nuclear disarmament involving all weapon states. A world free of nuclear weapons is in the interests of all humankind.

2.1.3 Incorporating de-facto nuclear weapons states into the disarmament process

The example of India and Pakistan

Zia Mian

Efforts to involve India and Pakistan in the disarmament process have a long history. As long ago as 1974 Pakistan proposed a NWFZ for South Asia, but the offer was rejected by India. In 1978 Pakistan suggested a joint declaration renouncing nuclear weapons. Pakistan has also suggested that both countries sign the NPT together (1979) and simultaneous acceptance of IAEA safeguards (1979). None of these has met with any success, and in the intervening years both countries have developed nuclear capabilities. What has been missing is a combination of regional and global initiatives.

Global agreements that seem to be on the horizon, such as the CTBT and the fissile material cutoff in themselves will not suffice. The first important step will have to be a declaration of no-first use by the nuclear weapon powers. The US could (should) make a unilateral declaration, and ask Russia to go back to its earlier postion. As a long standing Chinese

demand, it may actually create the conditions under which China may be prepared to sit in to a START III process. And where China leads India will follow, sooner or later.

Particularly promising in this respect is the recent Indo-Chinese deal to supply uranium for Indian reactors at Tarapur. Since China is building and will be fuelling the 300 MW reactor at Chashma (Pakistan), an interesting confluence of needs has been created. Neither India nor Pakistan will be able to risk such fuel supplies, and China may be able to lever some kind of Chinese-based safeguards on these facilities. This would create a precedent for other cooperative activities, with China sharing a neutral, but engaged role between India and Pakistan.

In addition to a no-first–use the US would need to commit to major reduction below the START II limits. A START III could then be negotiated where the other nuclear weapons powers would be at the table, if not actually negotiating. If the START III limits came down say to a few hundred warheads each, then China, France, Brtitain, and Israel would all become players. At this level of armamaents, India too would begin to figure, given that estimates of its plutonium stockpile suggest it has accumulated a few hundred bombs worth.

This is particularly problematic in light of the recent US defence Dept. "Nuclear Posture Review", which seems to imply that the US has called a halt to further disarmament, once the START II limits have been reached. This policy will have to change. Retaining up to 3500 warheads, ten times the number of the next largest nuclear arsenal, would leave the US and Russia with a major advantage as seen through Chinese, and Indian eyes.

The third crucial step is for the US and the other nuclear powers to open up all their facilities to full-scope safeguards. One of the key discriminatory features of the NPT would be eroded. There is nothing in the Treaty that says a nuclear weapons state cannot volunteer to open all its facilities, and be treated the same as a nonnuclear weapons state.

One possibility that does arise out of the fissile material cutoff is a bilateral atmospheric radioactivity surveillance system between lndia and Pakistan. Both countries may be prepared to agree to the positioning of radiation monitors as part of an international network of such stations. This would create some confidence that uranium was not being enriched in Pakistan, and Plutonium not being recovered in India.[16]

The most difficult problem is a missile flight test ban. It is almost impossible to verify by national technical means available to either country. It may be that a first practical step to incorporating such weak-nuclear weapons states, with a history of armed conflict (unlike the situation that prevailed between Argentine and Brazil) into disarmament is to enhance their verification capabilities.

An international verification agency along the lines of the IAEA may be an idea woth developing. It would creat confidence that the US was not restricting the flow of information about some states because of any particular strategic interests it may have. The intervention

[16]For a discussion of this at a little greater length see section 2.2.2.

of US intelligence agencies in feeding the IAEA in both Iraq and North Korea is grounds for legitimate concern.

Drawing South Asia into the nuclear disarmament process – global and regional imperatives

Praful Bidwai

Any effort at drawing South Asia into a global nuclear disarmament process must start with the premise that both India and Pakistan already possess a nuclear weapons capability and have few incentives to cap, roll back or dismantle that capability in the absence of a change in the postures of the nuclear weapons states (NWSs). Indeed, their policy of nuclear ambiguity is now coming under increasing pressure from hawks as the U.S. proceeds with informal negotiations aimed to extract assurances from both governments that they will reach an agreement to cut off the production of fissile materials and to ban nuclear tests even though they might not sign the NPT.

Both New Delhi and Islamabad have in the past indicated that they would observe nuclear restraint and support a universal fissile materials cutoff and a CTBT. New Delhi actively campaigned for a CTBT in the 1950s and 1960s and proposed a fissile material cutoff as early as in 1982. However, for domestic political reasons, neither government might find it easy to sign bilateral or regional agreements on these issues, or even to make a commitment to reaching future agreements, which their hawkish opponents argue, are a means of enforcing the NPT by the back door.

This is not the first time that the policy of nuclear ambiguity of India and Pakistan has come under pressure from those who urge them to cross the weapons threshold and declare themselves nuclear powers. The policy, involving the simultaneous assertion that the government does/does not possess a nuclear weapons capability, and has/does not have the intention to make the bomb, has always been hard to sustain in the absence of clarity in both countries about the place of nuclear weapons in overall security, and a doctrine for the use or threatened use of such weapons. There have also been rude exchanges which have prevented any discussion of nuclear restraint, especially since 1990.

What is new about the present conjuncture is, first, that it follows the virtual collapse of diplomacy between India and Pakistan, with the closure of consular offices and recall of a number of personnel. Secondly, it comes on the heels of the failure of a recent initiative for a multilateral dialogue on nuclear security in South Asia, involving the 5+2+2 formula, i.e., a conference of the five self-confessed NWSs, and Germany and Japan, besides India and Pakistan. And thirdly, the pressure from the hawks comes just when the NPT comes up for review.

India and Pakistan are not part of the review conference and only figure at the periphery of the NPT extension debate. And yet the urgency of reaching nuclear restraint and eventually disarmament in South Asia cannot be overemphasised in a situation of longterm strategic hostility, or a seemingly permanent state of Cold War, punctuated with three hot wars. Both states have enormous destructive capabilities without doctrines for their use. Efforts at confidence building have tended to fail. And the present state of political uncertainty and instability threatens to make both governments hostage to pressures to retain and augment their nuclear capabilities.

Can India and Pakistan be drawn into a process of nuclear restraint, arms reduction and, eventually, disarmament? What are the best means of doing so? Is it realistic to think of rapid progress in South Asia in spite of the many rivalries and tensions that mark the India-Pakistan relationship? We argue that a regional initiative leading to the establishment of a nuclear weapons-free zone in South Asia, coupled with substantial progress at the global level towards disarmament on an equitable and non-discriminatory basis, offers the best means of defusing the nuclear rivalry between India and Pakistan. It is hard to see how international or superpower pressure on New Delhi and Islamabad can produce the right results, or even spur them to open talks on nuclear restraint, unless a tangible process of delegitimising nuclear arms as a currency of power begins.

It is precisely the search for this currency, and an exalted status as significant powers through the nuclear route, rather than genuine considerations of security, that impelled New Delhi and Islamabad to acquire a nuclear weapons capability in the first place. India embarked on its nuclear programme on a broad technological front in the early years of Independence. It sought to develop its entire science and technology effort – a cornerstone of Nehru's idea of modernisation and nation-building-around the atomic energy establishment. Under Nehru, India followed a policy of voluntary abstinence in respect of nuclear weapons. However, in practice, the atomic energy establishment organised the nuclear programme in such a way that a future weapons option would not be foreclosed.

By 1964, India had in place a research reactor, CIRUS, built with Canadian and U.S. help, as well as a reprocessing plant – wholly indigenous and unsafeguarded – to separate plutonium from the reactor's spent fuel. However, it observed restraint in the face of the first Chinese nuclear explosion of October that year. In spite of its defeat in the 1962 China War, New Delhi did not see the Chinese nuclear weapons programme a direct security threat.

When Indira Gandhi decided to explode the Pokhran nuclear device in May 1974, it was with no larger game-plan in mind which addressed India's immediate security concerns, nor even a calculation of the likely consequences. The decision had more to do with domestic factors – a growing mass agitation against corruption, a railway strike that month, and threats to a number of Congress-ruled governments in the states – than with the limited objective of asserting and announcing its military preeminence in the region – again unrelated to security needs because there was no challenge worth the name after the Bangladesh War and the military defeat and break-up of Pakistan.

1974 remains an oddity, a strange, one-off, maverick episode unintegrated into a larger strategic perspective or a programme to develop an arsenal of nuclear weapons with well-defined objectives and purposes. India has since accumulated an estimated 200 to 300 kg of unsafeguarded plutonium, from a number of reactors, and has in place a highly efficient, large (100 MW thermal) plutonium producer (R-5 or Dhruva).

The plutonium is enough to make 40 to 60 bombs of the Nagasaki type, but India's capability may not have been weaponised on any scale. Nor is there a targeting philosophy, or clarity as to the purpose of nuclear arms in India's larger strategic scheme. The nuclear programme is driven by an obsessive concern not to miss out on opportunities to develop and expand the weapons option, and always to keep it open, without quite implementing or enforcing it.

Incoherent as its motivation might have been, the Indian programme greatly spurred the Pakistani effort. After Pokhran, Zulfiqar Ali Bhutto took personal charge of a vigorous effort to acquire a nuclear weapons capability whether by hook or by crook. After experimenting unsuccessfully with the plutonium route, Islamabad opted for uranium enrichment at Kahuta. The story of Pakistan's procurement of designs and various components of gas centrifuges by clandestine means is now well-documented. Pakistan's nuclear programme, unlike India's, is primarily military. Pakistan has only a 100 MW nuclear power reactor near Karachi.

Although estimates in the international strategic community of the size of Pakistan's uranium enrichment facility vary widely, there is broad agreement that the country has more or less mastered enrichment and may have stockpiled enough material for 10 to 15 fissile bombs of the Hiroshima type.

There is further evidence that both India and Pakistan have invested in programmes to develop auxiliary technologies such as miniaturisation, enhancement of explosive yields through efficient neutron reflectors, and highly accurate detonation devices. Thus, there is a clandestine, de facto, probably non- or semi-weaponised, nuclear rivalry between the two. But precisely because the competition is not overt, it has tended to generate a certain amount of complacency.

Efforts by the Big Powers to restrain the two governments have yielded poor results, e.g, the Pressler Amendment, or embargoes on nuclear supplies to India. In some ways, they have been counter-productive and generated strong nationalist sentiments and helped to strengthen hawkish positions.

The NPT shows up the limitations of the traditional Western non-proliferation initiative. India refused to sign it on the ground that it is unequal and discriminatory and does not impose adequate obligations on the NWSs to disarm themselves. While intrinsically correct, the Indian argument against the NPT as an unequal treaty is self-serving and opportunist. It is intended to create a veil behind which to keep the nuclear option open. Pakistan does not pretend to have a principled stand on the NPT but follows a reactive, "pragmatic" orientation. It was/is willing to sign the NPT if India too does so. However, in both countries,

the NPT is deeply unpopular and is seen as an example of Great Power arrogance.

Over the past decade, New Delhi and Islamabad have rejected several proposals for defusing nuclear rivalry – most notably, a five-nation-conference (suggested in 1990, involvingthe U.S., the former U.S.S.R and China, and India and Pakistan), the 5+2+2 formula, a regional treaty forswearing the development of nuclear weapons, and the creation of a nuclear weapons-free zone in South Asia, besides mutual or third-party inspection and verification of each other's facilities.

India has clearly been the more unreasonable and unyielding of the two and has tended to turn down all proposals without making a counter-proposal. Today there exists a highly precarious balance of covert nuclear terror between India and Pakistan. Even as efforts to enhance nuclear capabilities continue, there is some reluctance to go openly nuclear. This has been described as "de facto", "recessed", "non-weaponised" or "existential" deterrence. The bomb lobbies delight in the complacency this has bred, much like they did with MAD in its heyday.

However, this concept of deterrence is fraught. Like all deterrence, it has an unstable, degenerative character to be truly deterrent, threats must become more and more real and ominous, which they do only if the rivalry on the ground escalates. In addition, paucity of reliable information on nuclear activities in both countries, and Pakistan's fear of India's technological superiority, create peculiar forms of asymmetry, and more suspicion and insecurity–and hence instability.

Meanwhile, the two countries lurch towards a dangerous situation. They both have missiles development/acquisition programmes. The weapons systems under development are capable of carrying nuclear warheads/payloads and can cut flight time between the two countries to 15 minutes – less than half the interval at the height of East-West rivalry, but without any confidence-building measures or transparency whatever. In a crisis, the only reasonable strategic assumption, given a situation of opacity and mutual suspicion, is likely to produce a knee-jerk "launch-on-warning" response, with horrific consequences.

The economic, social and political case for nuclear restraint in South Asia is powerful. Should the present clandestine level of nuclear rivalry escalate to a higher, overt level, the two countries will have to spend considerably more to build a command, control, communications and intelligence infrastructure. This will mean a further reduction in their already poor commitments to health, education and social services, as well as a further deterioration in diplomatic relations, which always has a negative impact on Hindu-Muslim relations and the communal situation. No reduction in mutual tensions or improvement in inter-community relations can be brought about so long as the covert nuclear race continues.

The route to nuclear restraint and disarmament in South Asia cannot go via the NPT. Any restraint initiative must adequately address both governments' concern not to be singled out for disarmament while the Big 5 (and Israel) continue to possess big arsenals. What is needed is a combination of regional and global initiatives, where those who undertake it are

not seen to be pushing for disarming others, while making no proportional commitments themselves.

Global agreements such as CTBT, no first use and fissile production cutoff are a precondition for such an initiative, but they are not enough. To be really effective in breaking the South Asian impasse, they must be followed by deep cuts in strategic nuclear weapons of the five NWSs, a universalisation of the INF agreement, substantial reduction of strategic missiles and quick elimination of battlefield tactical weapons, and greater progress in verification agreements.

It goes without saying that the NPT should not be extended indefinitely, but only for a period of, say, five years during which major steps are taken to eliminate the bulk of the world's nuclear weapons.

This could generate a momentum which India and Pakistan will find it difficult to resist. They should and could then be persuaded to move towards an agreement to create a nuclear weapons-free zone in South Asia through specific steps: mutual agreement to stop producing fissile materials, coupled with intrusive verification agreements, a missile test flight ban, an agreement not to use nuclear capabilities against each other, and NWSs' guarantees that they will not target the region with nuclear weapons or transport them through it.

There are significant currents of opinion in both India and Pakistan which favour such an approach. They can be strengthened only if there is some progress internationally which expands the space available to them domestically. Such progress will allow India and pakistan to move from an unstable and dangerous situation of "non-weaponised deterrence" to a secure framework of restraint and genuine disarmament. There is a useful conceptual precedent that such a process could follow: the Rajiv Gandhi plan of 1987, which involves region-specific obligations and which in the post-Cold War period seems more feasible.

2.1.4 Controlling nuclear weapons relevant R & D

Martin Kalinowski

The progress of the negotiations for a Comprehensive Test Ban Treaty (CTBT) is disappointing. The issue of continued nuclear weapons research by Above Ground Experiments (AGEX) and other means[17] has not been given appropriate attention so far, though Indonesia and a few other countries put forward a related proposal earlier in the negotiations.
The question arises how the scope of the CTBT can be defined in a way that covers nuclear weapons research as far as possible. The following proposals to include nuclear weapons R&D in a CTBT are in principle possible:

(a) Include intention without specifying a ban other than on nuclear explosion tests

[17]See e.g. [Kalinowski (1994)] and [Zamora Collina/Kidder (1994)]

(b) Ban on technologies directly related to nuclear explosion tests to prevent rapid break out and cover up

(c) Ban on experiments with the pure purpose of developing new nuclear weapons

(d) Ban on diversion of R&D for nuclear weapons purposes as well as all endeavours to improve the scientific understanding of construction and use of nuclear weapons. This wording is modelled after the NPT which bans the diversion of nuclear energy for nuclear weapons purposes as well as all endeavours to manufacture one.

The five recognized nuclear weapon states are negotiating a yield threshold below which nuclear explosions should be exempted from the ban. However, the widely shared understanding is that no attempt should be made to define "nuclear expolsion tests" in the treaty because otherwise it would be very difficult to reach at an agreement on language. The effect would be that any kind of nuclear explosions would be covered by the treaty without explicitely exempting such experiments which have a very low nuclear explosive yield. Therefore, it is often suggested just not to talk on hydronuclear experiments (HNE) and to leave the question more or less open whether they are included in the ban or not. Thus, the conflict will be postponed to after the conclusion of the CTBT.[18] This might allow the nuclear weapon states to continue HNEs but such a CTBT would allow threshold countries to conduct HNEs as well.

There are even more unsolved issues which are linked to HNEs and may in fact retard the progress of negotiations even more, if HNEs are not banned. These are prohibitions on test preparations, confidence in correct activities at former test sites and provisions for on-site verification. If our understanding is correct, that HNEs for safety reasons have to be conducted underground, all the mentioned unsolved issues would be complicated, if the option for HNEs would be kept open. Just imagine the situation that one country drills a hole in the ground and fills it with a dummy nuclear explosive device prepared for an HNE and another country challenges it to be a nuclear explosion test. As Annette Schaper has demonstrated eslewhere,[19] it is for reasons inherent to the physics of nuclear explosions (the nuclear yield is exponentially dependant on the neutron multiplication factor) that the yield of hydronuclear explosions cannot be easily controlled, i.e. the risk of violating a CTBT, by accidental high yields of HNEs is high.

How to solve the problem? Excluding HNEs from a CTBT would send a dangerous message because allowing for hydronuclear experiments within a test ban would undermine the spirit of its purpose and would render it rather a partial test ban treaty II than a comprehensive one. The main benefit for declared nuclear weapon states would be to keep expert teams and facilities ready for quick resumption of full-scale nuclear testing.

[18] See e.g. [Arnett/Schaper (1994)]
[19] See [Schaper (1994)]

A better solution would be an **implicit ban** of HNEs and to solve all open questions with the understanding that no option for HNEs should be kept open and any alternative which makes HNEs impossible should be given preference without explicitely banning HNE due to the difficulties in drawing a line between allowed and prohibited tests. To make this possible, nuclear weapons states should - as Arnett and Schaper suggest[20] - unilaterally forgo the option to conduct HNEs. It should be striven at a CTBT that includes as much restrictions as possible in diverting research and development efforts to nuclear weapons purposes. Applying some wit and intelligence can be mobilized to find acceptable ways to do this without pressing unacceptable demands on any side. Even verification demands do not need to be as high as many analysts suggest. A comparison with the NPT might help to get this clear. Forbidden is the diversion of nuclear energy for nuclear weapons purposes. However safeguards concentrate on the detection of diversions of fissile materials. Likewise verification of the CTBT should concentrate on the detection of any kinds of nuclear explosions including HNEs. Any other activities to develope nuclear weapons should be banned at least in the preamble as well, especially Above Ground EXperiments (AGEX), without the need to define detailed verification procedures.

2.1.5 No-First-Use – an important step towards total ban of nuclear weapons

Liu Huaqiu, Joseph Rotblat

The implications of no-first-use of nuclear weapons

1. If all nuclear powers concluded a heaty on the no-first-use of nuclear weapons against each other, and if this were coupled with a declaration that the only use of nuclear weapons, while they still exist, is to deter a nuclear attack, then this would pave the way to the reduction of the nuclear arsenals, first by the USA and Russia and than by the other three nuclear states, gradually down to zero. No single country will need nuclear weapons if no-one else possesses them.

2. There are three situations in which nuclear weapons might be resorted to:

   (a) in a surprise pre-emptive attack aimed at disarming the advarsary by eliminating its strategic nuclear potential;

   (b) as an escalation of hostilities started with conventional weapons;

   (c) as a reprisal for nuclear attack.

[20] See [Arnett/Schaper (1994)]

A No-First-Use treaty would outlaw the use of nuclear weapons in the first and second situation. In practice, such a Treaty would be tantamount to a Non-Use Treaty, and it would make it easier to conclude a treaty specifically outlawing all nuclear weapons.

3. A No-First-Use Treaty would include the guarantees of non-use, or threat of use, of nuclear weapons against non-nuclear-weapon states and nuclear-free zones and thus it would enhance the non-proliferation regime.

4. The 1925 Geneva Protocol was in fact a no-first-use treaty in relation to chemical weapons. The negotiation of the Chemical Weapons Convention has shown that the route from non-use or no-first-use to total ban was correct and effective.

The case for a no-first-use treaty

1. The original reason against a commitment of no-first-use by the USA and its allies was that the former Soviet Union had a massive superiority in conventional weaponry in Europe, which could be balanced more cheaply by nuclear weapons. This argument ceased to be valid in the radically different situation after the end of the Cold War. Russia and the West no longer see each other as enemies. The forner Warsaw Pact countries are eager to join the security system of the West. Under these conditions, the USA and its allies have no reason to continue a first-use policy.

2. At present only China adheres formally to a no-first-use policy. The other four nuclear-weapon states continue with the policy of extended deterrence, i.e. that nuclear weapons are needed to repel an attack even with non-nuclear weapons. The main reason for this is the dogma that nuclear weapons prevent wars. There is an almost fanatical belief in the West that another World War would have inevitably occured if it were not for nuclear weapons. This is a fallacious argument with no evidence to support it. Indeed one can advance the opposite argument that the danger of a Third World War was due to the development of nuclear weapons. In any case, the fact is that many wars have been fought throughout the whole period since the end of the Second World War, and in some of them the nuclear states were themselves involved.

3. Anothor argument is that nuclcar weapons are needed as a last resort when a country faces total defeat. Paul Nitze has pointed out that modern smart conventional weapons are quite sufficient to overcome an attack with non-nuclear weapons. The only mortal peril that might justify the last resort response is an attack with nuclear weapons. Thus, in reality, the present deterrence policy amounts to the need to prevent an attack with nuclear weapons.

We can build on the argument our effort to convince the nuclear-weapon states to adopt the no-first-use policy until the nuclear arsenals are eliminated. This effort should concentrate on

the United States, where there is already much support of it. The present Clinton Administration, despite the hawkish attitude of its Department of Defense, is generally sympathetic to a simple deterrence policy. If the United States could be persuaded to such a change, there would be little difficulty with Russia, which nowadays follows faithfully the nuclear policy of the USA. The UK is too much dependent on the USA in nuclear weaponry to mount a strong opposition. The most difficult opposition would come from France, where the nationalistic element is very strong. But if it were put in the position of 4 against 1, France will eventually fall in with the others.

The framework of the no-first-use treaty

1. All nuclear-weapon states commit themselves to the policy of no-first-use of nuclear weapons and sign a Treaty under which they undertake never to be the first to use nuclear weapons or to threaten their use.

2. Under the terms of the treaty, the signatories will have to provide evidence that they have changed their millitary posture to a no-first-use strategy e.g. retaining only strategic forces, removal of first-strike capability and time-urgent stratetic retaliatory systems. An inspection regime, to verify that these changes have been made will have to be established, as well as a procedure for measures against transgrassion.

3. With the signing of the Treaty (and the change of doctrine to simple deterrence) there will be no need for separate positive and negative guarantees, which have some discriminatory character. All non-nuclear states will be automatically guaranteed against a nuclcear attack.

4. This Treaty shall be of unlimited duration.

2.1.6 References

[Arbatov (1994)] Arbatov, A.: *Nuclear Forces: Strategy, Sufficiency, Composition.* Nezavisimaya Gazeta, December 8, 1994, p.5.

[Arnett/Schaper (1994)] Arnett, E.; A. Schaper: *No Hydronuclear Ban.* The Bulletin of Atomic Scientists, November/December 1994, pp.22/23.

[de Bressy (1994)] de Bressy, B.: *Trois Livres blancs europens sur la defense.* Defense Nationale, 1994.

[Colard (1994)] Colard, D.: *Le couple franco-allemand apres l'unification.* Defense Nationale, no. 6, june 1994.

[Defarges (1994)] Defarges, P.M.: *Vers une Europe unie differencie?* Defense Nationale, december 1994.

[Defense Nationale (1994)] Defense Nationale, july 1994.

[Dolinin (1994)] Dolinin, A.: *Targeting Data are Nullified, but the Sense of Duty Has not Changed.* Krasnaya Zvezda, December 17, 1994, p.1.

[Kalinowski (1994)] Kalinowski, M.B.: *Military and Dual-Use Research aimed at Circumventing a Ban on Underground Nuclear Testing.* In: Liebert, W.; J. Scheffran (Eds.): *Against Proliferation - Towards General Disarmament.* Proceedings of the First INESAP Conference, Mühlheim 1994.

[Le Monde (1993)] Le Monde, february 11, 1993.

[Malik (1994)] Malik, J.M.: *China's Unprincipled Stand On Nuclear Disarmament.* Pacific Research, Vol.7, No.4 (1994), pp.6-10.

[Maryukha (1994)] Maryukha, V.: *Nuclear Powered Submarine Fleet - this is a Heritage, which Should not be Squandered.* Krasnaya Zvezda, July 2, 1994, p.1.

[Normand (1994)] Normand, J.-Y.: *Coopration europenne - Le pivot franco-allemand.* L'Armement, no. 43, july-august 1994.

[Ovcharenko (1994)] Ovcharenko, A.: *Prospects for Russian Naval Strategic Nuclear Forces.* Nezavisimaya Gazeta, September 6, 1994, p.5.

[Schaper (1994)] Schaper, A.: The problem of definition: Just what is a nuclear weapon test? In: Arnett, E. (Ed.): *Implementing the Comprehensive Test Ban.* SIPRI Research Report No.8, p.26-47. Oxford et al. 1994.

[Voronin (1994)] Voronin, G.: *What Underwater Fleet does Russia Need?* Nezavisimaya Gazeta, December 29, 1994, p.3.

[Zamora Collina/Kidder (1994)] Zamora Collina; T., R. Kidder: *Shopping Spree Softens Test-Ban Sorrows.* Bulletin of Atomic Scientists, July/August 1994, pp.23-29.

2.2 Cutoff of nuclear-weapons-usable materials

Coordinator: Martin Kalinowski

Contributors:[21] *Praful Bidwai, Shaun Burnie, Anatoli Diakov, Harald Feiveson, Eloi Glorieux, Lisbeth Gronlund, Martin Kalinowski, Christian Küppers, Wolfgang Liebert, Ed Lyman, Sanae Y. Matsuzaki, Zia Mian, Abdul Nayyar, Michael Sailer, Jinzaburo Tagaki, David Wright*

2.2.1 Rationale for a cutoff of civilian production and use of weapon-usable fissile material

The most dangerous source of fissile materials is military and it is widely accepted that the most important effort should be taken for cutting the military production. Therefore, here the discussion of rationale will be focused on civilian production of weapon-usable fissile materials from the point of view of the horizontal proliferation.

Dangerous surplus in nuclear-weapons-usable materials from military and civilian sources[22]

Plutonium: Due to suspension and delay of plutonium utilization programs, large plutonium surplus is expected to result in countries where reprocessing of spent nuclear fuel has been pursued.

W. Dircks, the Deputy Director General of the IAEA, spoke to the 1992 annual meeting of the Japan Atomic Industry Forum:[23]

> "Even if one disregards the fissile material from nuclear warheads, the excess of isolated fissile plutonium from civilian nuclear programs poses a major political and security problem worldwide."
> "As a result of nuclear fuel reprocessing, and potentially as a result of nuclear weapons dismantling, in the foreseeable future, the supply of plutonium will far exceed the industrial capacity to absorb plutonium into peaceful, commercial nuclear industrial activities."

[21] Not all contributors are signing this whole section as authors, at least not at this preliminary stage of work of the work of the INESAP study group "Beyond the NPT". Where appropriate the authors who have drafted major parts are indicated in a footnote.

[22] Major inputs to this section came from Christian Küppers, Martin Kalinowski, Wolfgang Liebert, Sanae Y. Matsuzaki, Michael Sailer, and Jinzaburo Tagaki.

[23] See [Dircks (1992)]

Table 2.1: Approximate estimates of weapon–usable fissile material and tritium (end of 1994 and future) in metric tons

year	1994	2000	2010
HEU			
military arsenals	2,200	1,700	
use for naval propulsion	> 50		
use in research reactor fuel	20		
Plutonium			
military stocks	270		
produced in civilian reactors	960	1,400	2,200
(under IAEA safeguards)	(480)		
separated from waste, cumulative	180[25]	250-300[26]	300-550[26]
stockpiled in separated form	124[27]	170-180[28]	220-450[28]
Tritium			
military stocks	0.140	0.100	0.050
produced in civilian reactors	0.024	0.034	0.040-0.050
stockpiled in separated form	0.006	0.020	0.030

Only 4 tons[24] of plutonium per year can be processed into MOX (mixed oxide) fuel with the currently existing fuel fabrication plants in the world. It would require several decades to dry up the existing plutonium stocks, with building more MOX factories, processing MOX and irradiating it in light water reactors.

[24]In this paper weights are given in metric tons.

[25]The actual figure is not well known. This is rather an upper bound estimate

[26]Depending on the actual future capacity factor and assuming the construction of reprocessing facilities with the total capacity according to current plans.

[27]This is an upper bound estimate.

[28]Depending on future MOX use for LWRs and FBRs in Japan.

The current and estimated future stocks of plutonium can be seen in table 2.1. About 180 tons of plutonium have already been separated from spent fuel. Most of that is currently stored in separated form (may be as much as 124 t). The rest has been processed to fast breeder reactor fuel (40 t) or MOX fuel for light water reactors (16 t).

Because of the delay or cancellation of fast breeder reactors (FBR) and MOX burning programs as well as limited MOX fabrication capacity, the world's civilian plutonium stockpile will continue to increase, according to the current reprocessing plans. Our estimation suggests that the total inventory of separated civilian plutonium will exceed the world's military stocks shortly after the year 2000 and that Japan's stockpile alone could be as much as 80 tons by the year 2010, i.e. nearly one third of the military stocks. This would arouse serious international concern from the non-proliferation point of view.

Even though Japan has repeatedly stated officially in response to international concern that it does not and will not stockpile excessive plutonium, the plutonium surplus is rapidly accumulating in this country. According to the cumulative supply and demand figures made public by the Japanese Science and Technology Agency in November 1994,[29] Japan's total separated plutonium inventory was already nearly 11 tons as of end of 1993. About 80% of this is regarded as surplus.[30] Germany currently owns more than 8 tons of separated plutonium and at least two tons are stored in the "Plutonium Bunker" in Hanau. The old MOX fabrication facility is shut down for good and the new one is neither constructed completely nor has it a licence yet. According to earlier plans for retransport of plutonium to Germany the annual imports would go up by one order of magnitude to 5 tons per year.

The main reason why the reprocessing leads to surplus of separated plutonium is utilities' reluctance of using plutonium as fuel due to extremely poor economics of plutonium fuel (see next section). The question is why such reprocessing plans are continued.

Highly enriched uranium: The accumulation of highly enriched uranium (HEU) is much less dramatic. Civilian quantities are much lower than military stocks (see table 2.1). More than 2,000 tons HEU has been produced for nuclear weapons and about 70 tons for civilian research reactors. Most of this has been supplied by nuclear weapon states. The civilian inventories decreased over the past decade and are expected to decrease further as a result of joint international efforts to convert research reactors running with HEU to be fueled with low enriched uranium (LEU see section below). Currently about 150 research reactors are still operated with HEU and have a total demand of 1 to 2 tons per year. The full core loading for 30 of these reactors weights more than 5 kg.

However, it should be noted that the worldwide capacity to convert natural uranium to low enriched uranium is about 17,000 tons LEU per year, the actual demand is about 10,000 tons.

[29] See [JAEC (1994)]

[30] This is a 2.5 ton increase of surplus compared to the previous year. Of the 8.8 ton surplus, 2.6 ton was in Japan and 6.2 ton was in France and the U.K. as a product of reprocessing.

These facilities could be used to enrich the uranium further to weapon-usable quality.

Tritium: It should be noted that tritium is not a fissile material. However, it is used in nuclear weapons as a fusionable material, especially for boosting the yield of fission weapons. Assuming no further military tritium production,[31] military tritium stocks will decrease by radioactive decay, whereas inadvertent civilian production continues. The worldwide civilian inventory may reach the same size as military stocks around the year 2010. This poses an increasing danger for horizontal nuclear proliferation.

The main proliferation risk arises from the separation of tritium from tritiated heavy water. This activity is undertaken for the purpose of radiation protection. The same goal could be achieved without separating tritium in gaseous form. It was intended to sell the extracted tritium and the largest market was expected from fusion energy research. The expectations have not yet realized and the whole civilian world market cannot absorb more than about 0.4 kg per year.[32]

Arguments against the use of nuclear-weapons-usable materials for commercial and research purposes

Reprocessing of spent fuel: Reprocessing is the step that produces separated plutonium as a fissile material. During storage of the separated plutonium and fabrication of MOX the plutonium is always in a condition that is readily usable for military purposes until the MOX fuel is irradiated in a nuclear reactor.

The first nuclear reactors were built for the production of plutonium. The reprocessing technology for burned fuel was necessarily developed for that purpose. When commercial reactors were commissioned uranium recources were expected to be exhausted by the end of the century. Reprocessing was available and theoretically preferred as spent fuel management strategy to get plutonium as fuel for the future, although in practice most spent fuel has only been stored. Spent fuel from the British Magnox reactors and two Russian reactors was reprocessed with the argument that their rod material does not allow a storage of the spent fuel over years. Meanwhile, it has been demonstrated that dry storage of Magnox fuel is technically possible without corrosion.[33] Magnox fuel that had previously been put in wet storages could be re-cladded instead of being reprocessed.

[31] Due to nuclear disarmament, there will be no need for further tritium production in USA and Russia for sure even beyond the year 2010. The USA shut down the last tritium production reactors in the year 1988 for safety reasons and can probably do without fresh tritium until the year 2016, possibly until 2035. See [Kalinowski/Colschen (1995)]

[32] See [Kalinowski/Colschen (1995)]

[33] See e.g. [IAEA (no date)]. A dry storage facility has been operating at the Wylfa Magnox Plant since 1972. An Additional facility has been operating since 1980.

In the sixties all the major industrialized countries set up programs to develop breeder reactors in order to use the separated plutonium for electricity production. But uranium didn't run short. The low costs of uranium on the one hand and the exploding costs and technological problems of the breeder programs on the other hand caused a collapse of these programs in the USA, the United Kingdom, Germany, France, Russia and other industrialized countries. In Japan the breeder plans were far behind the former schedules. In this situation a reuse of plutonium in MOX fuel for Light Water Reactors (LWR) was pursued in some countries to "keep the technology available". The main countries were Germany, Switzerland, Belgium, France and Japan.

Most nuclear energy countries didn't choose such a strategy or stopped developments before a plutonium economy was created. The today's commercial reprocessings are pursued by Cogema in La Hague (France), BNFL in Sellafield (United Kingdom) and at the Chelyabinsk plant (Russia). European and Japanese electricity production companies have contracts with Cogema and BNFL, which will regulate the reprocessing for the next 15 years. Russian spent fuel is reprocessed at Chelyabinsk today and there are efforts by the operator to reprocess also fuel from Russian type WWER reactors in other countries. Smaller reprocessing plants are being operated in Tokai (Japan), Tarapur and Kalpakkam (both India). Other plants in Argentina, Brazil, Italy and Pakistan can be regarded as laboratory-scale or pilot plants. China also has plans to reprocess.

In the nearer past the industry's interest in reprocessing abroad is diminishing in two countries which reprocessed some fuel indegeniously in the past (Belgium and Germany). This has mainly economical reasons:[34] The volume of radioactive wastes actually is increased by reprocessing by a factor of 10 to 20 which causes additional costs for waste management and storage. Furthermore, the fabrication of MOX from the reprocessed plutonium is much more expensive than the fabrication of uranium fuel. The higher heat generation of spent MOX fuel[35] also results in a longer cooling time (for 80 years, compare to 40 years for standard fuel) and higher costs for safe long-term storage.[36]

According to the RAND report[37] there would be no economic advantage for utilizing plutonium fuel unless the yellow cake spot price would rise to more than $100/pound for LWRs and $220/pound for Fast Breeder Reactors (FBR). Since the current spot price of yellow cake is well below $10/pound, there is practically no prospect of the plutonium fuel having any commercial competitiveness in the foreseeable future. These figures are backed by considering the costs of MOX and ordinary fuel production in Germany.[38].

[34] See [Küppers/Sailer (1994)]

[35] The radioactivity and the heat production of spent MOX fuel is 2 to 3 times higher during the first 100 years in comparison to spent standard fuel.

[36] The concentration of actinides is several times higher in irradiated MOX-fuel than in spent standard fuel.

[37] See [Chow/Solomon (1993)]

[38] The costs for producing a uranium fuel element are about 800 DM per kilogram of heavy metal. The costs for MOX fuel are 5 times higher and for getting the required plutonium from reprocessing an additional

A special aspect in Germany was that the German atomic law forced the electricity producers to reprocess their spent fuel, at least in the laws interpretation of the law by the German Government. This situation changed in 1994 when the German atomic law was revised as to allow the direct disposal as well. It is expected that customers will cancel at least a major part of their post-2000 reprocessing contracts in the near future. German customers first cancelled certain reprocessing contracts with BNFL at the end of 1994. But if not all the reprocessing contracts by German customers with BNFL and Cogema will be cancelled some 40 tons of separated plutonium might be produced during the next years.

In December 1993 the Belgian parliament decided that a decision on the contracts between Belgian electricity producers and reprocessors would be postponed for five years. Within five years the direct disposal has to be reevalutated in Belgium according to this resolution.
While Japan is still officially sticking to the reprocessing policy mainly due to bureaucratic inertia and binding contracts as well, there is some uncertainty about whether the Rokkasho reprocessing plant whose construction started in 1993 will ever be completed because of the soaring construction costs. The latest estimate of cost is around $ 17 billion,[39] which is twice of the initial estimate and four times as costly as THORP. Despite all the evidence against reprocessing, it is likely that Japan will maintain a committment to reprocessing, even though it may be delayed and eventually be scaled back.

Another reason to stop reprocessing is the related environmental pollution. The existing reprocessing plants are the nuclear facilities with the most important releases of radioactivity to the environment. The total emission of radioactivity of the Sellafield plant to the Irish Sea, for example, is more than twice as much as the radioactivity inventory of nuclear waste dumped in the Barents Sea by the former USSR, although the dumped waste includes five submarine reactor cores.[40]

All in all, while there is no justification for reprocessing, there are serious well-founded concern over proliferation and regional instability associated with a reprocessing and plutonium utilization policy (see next section). In view of the ever-growing difficulty with the plutonium economy and the recent development in dry storage technology of spent fuel as well, now is a good time to talk internationally about freezing the existing reprocessing contracts and consider renouncing civil reprocessing. There are only few remaining cases in which fuel elements are reprocessed because they cannot be stored safely. They could be treated by a process which results in storable wastes without the plutonium being separated.

Highly-enriched uranium (HEU) in research reactors: The major reasons for the use of HEU are:

3 times of the uranium fuel costs has to be added. See [Hensing/Schulz (1995)]

[39] See [Tsushin (1994)]

[40] See [Küppers et al. (1994)]

1. Cores of much lower dimensions can be constructed with HEU. This leads to lower research reactor construction costs.

2. Less nuclear fuel is needed if HEU is used. This results in lower waste amounts and operational costs.

3. The highest ratio of neutron flux to thermal power can be gained by using HEU. Besides being attractive by achieving scientific "'world-records"' this is not of essential importance for nuclear physics reasons.

HEU is a material that is usable for the construction of nuclear weapons. The construction of a nuclear weapon based on HEU is even easier than if it is based on plutonium because the technically less complicated gun method can be used instead of the implosion method and because the material is of less radiological concern, i.e. can be handled with less complications. When a widespread interest in research reactors arised in a lot of countries, also in countries with probably military intentions, the weapons usability of HEU caused worldwide discussions. The International Nuclear Fuel Cycle Evaluation (INFCE)[41] investigated related problems at the end of the seventies. As a result a limitation of the enrichment of uranium-235 used in research reactors to 20% was recommended for non-proliferation reasons. This LEU is practically not weapon-usable. An important goal was a worldwide stop of civilian fabrication and handling of HEU.

After INFCE ended, national research programs were established to develop new fuel materials with higher uranium densities to get high uranium-235 concentrations even with lower uranium enrichment. In some reactors the HEU was changed to LEU (20% U-235) or at least to an enrichment degree of no more than 45% U-235. However, this is still called HEU and is weapon-usable, too. About 150 research reactors still use HEU fuel.
Germany got a de-facto exemption permit for the use of HEU in the German High Temperature Reactors with a HEU demand in the tons range. The two reactors, the AVR reactor (15 MWe) in Jülich and the THTR reactor (308 MWe) in Hamm-Uentrop were unforeseeably decommissioned in 1988 resp. 1989 because of technical difficulties. After the stop of the related fuel production a total amount of several 100 kg of HEU remained, one part as separated HEU, another part as unirradiated fuel elements. The actual storage site of this material is held classified.

Despite the worldwide acceptance of proliferation concerns and the endeavour to use proliferation resistant nuclear technologies, the core of a new research reactor at Munich (Germany), the FRM-2, has been planned for many years with HEU elements. Its realization would be the first new reactor with higher thermal power that uses HEU since the early eighties. The ANS (Advanced Neutron Source) research reactor at the ORNL (USA) was also planned with HEU for about ten years. But in early 1995 the Clinton administration cancelled this project. The non-proliferation policy has contributed to this decision. However, the Technical

[41] See [INFCE (1980)]

University Munich speculates on using HEU from the former Thorium High Temperature Reactor (THTR) program to by-pass a HEU boycott announced by several suppliers.[42]

There is no need to construct new research reactors with HEU as fuel, since more and more improved high density fuels have been developed, which serve the conversion of HEU reactors to facilities using low enriched uranium (LEU). Most of the 150 research reactors still using HEU can either be converted to LEU or have a life-long lasting core. There will perhaps be a very limited number of high–flux reactors constructed in the past decades which will remain to rely on HEU in the future. For research reactors and high–flux neutron sources, newly to be constructed in present and future, alternatives to HEU use are at hand.
The future needs of HEU for naval reactors and remaining HEU driven research reactors could be met by HEU released from nuclear weapons dismantlement. There is no need for further HEU production.

To eliminate reprocessing technology is relatively easier because the civilian uses of the end product are not indispensable. The enrichment technology, on the other hand, is so widely used in the civilian sector that it would require a planning spread over several decades before it can be made dispensable. The only way to achieve this and yet retain the option of nuclear power generation is to phase out the enriched uranium power reactors in favour of the natural uranium ones. However, the main concepts of power reactors operating with natural uranium are heavy water reactors. They can not be considered as a more proliferation resistant alternative, because plutonium can more easily be produced in them by inserting and removing breeding targets without the need to shut down the reactor.

Tritium for fusion energy research: The future of fusion is open. First energy producing fusion reactors using tritium as fuel are expected to be constructable not before the middle of the next century. It is quite unclear whether deuterium–tritium–fusion will become the accepted fusion reference case. However, without fusion energy programs there will be no civilian demand for the several kilograms of tritium that will be annually separated from tritiated heavy water especially in Canada. The worldwide demand for self-luminous paints and other applications is lower than 0.4 kg per year. Some of these applications should be abondoned for radiation safety purposes, in other cases tritium can be replaced by alternative technologies. The remaining demand can be met by a small dedicated production.

The unsafeguardable proliferation risk

Major problems for horizontal proliferation are caused by reprocessing of spent fuel. The ability to use reactor grade plutonium as nuclear weapons material now seems to have been

[42]In [FMRT (1994)] it is said: "The supply of the research reactor Munich II could be guaranteed for a longer period by existing HEU that was originally designated for the THTR." Another source, see [Böning (1993)], declared that in Germany 400 kg of HEU would be available at once to operate the research reactor Munich II over a period of 10 years.

recognized internationally. But in Japan and other pro- reprocessing countries there are arguments which insist that reactor-grade plutonium cannot be practically made into nuclear weapons and thus can be treated as virtually a non-weapons usable material. In view of the imminent proliferation and diversion risks of civil plutonium, the ability to use reactor-grade plutonium for nuclear weapons cannot be stressed too much.

Plutonium can be used for nuclear weapons in every mix of isotopes as far as the content of plutonium 238 is not artificially increased to more than 80%.[43] The reactor-grade plutonium was demonstrated as weapons-usable in a nuclear test conducted in the United States in 1962, which, according to the latest release of the US DOE (Department of Energy),[44] yielded a nuclear explosion of "less than 20 kilotons". The US National Academy of Sciences' report[45] states, "Virtually any combination of plutonium isotopes can be used to make a nuclear weapon". According to the RAND report,[46] the critical mass of reactor-grade plutonium is estimated to be merely 6.6 kg with a proper tamper, which is only 40% more than that of weapon-grade plutonium. J. Carson Mark, former nuclear weapons designer at Los Alamos also points out the difficulties of developing an effective design of the most straightforward type of nuclear weapons "are not appreciably greater with reactor grade plutonium" than those with weapon grade plutonium.[47]

There are severe and insurmountable obstacles in conducting sufficiently strict safeguards and physical control:

- For fundamental reasons related to measurement uncertainties, the existing IAEA safeguards based on accountancy at nuclear bulk-handing facilities are insufficient to detect the diversion of significant quantities because it may be covered up in the material unaccounted for (MUF).[48] For example, the minimum detectable amount of diverted plutonium in a large commercial reprocessing plant exeeds up to 30 significiant quantities of plutonium (240 kg, as defined by the IAEA),[49] Liebert/Kalinowski (1993)]. An effective control of separated plutonium therefore isn't possible.

- In practise, existing IAEA safeguards proof unreliable due to large and unspecified hold-ups. For example, in 1994, it was revealed that as much as 70 kg of plutonium remained unrecovered presumably inside glove boxes.[50] The operator had to admit

[43] See [Kankeleit/Küppers/Imkeller (1989/1993)]
[44] See [US DOE (1994)]
[45] See [CISAC (1994)]
[46] See [Chow/Solomon (1993)]
[47] See [Mark (1993)]
[48] MUF is the amount of material missing after closing of a material balance, i.e. the difference between book and physical inventory.
[49] See [Hahn/Sailer (1988)]
[50] The 70 kg hold-up resulted after handling of about 1 ton plutonium at PFPF (Plutonium Fuel Production Facility) for the fabrication of the initial Monju core MOX fuel at PFPF operated by PNC (Power Reactor and Nuclear Fuel Development Corporation).

that, despite the elaborate detecting system specially developed and equipped there to monitor small amount of plutonium in side the glove boxes, the nominal measurement error is 10-15 per cent, indicating that, with a hold-up of 70 kg, a loss of more than 8 kg of plutonium within one inventory period (typically one year), could be overlooked even if it were missing or elaborately diverted. The clean-out of the facility will take at least 2 and half more years to complete.[51] The timely detection criterium for MOX is 1 to 3 weeks as set by the IAEA and can obviously not be met.

- The use of MOX fuel requires a multiplication of transports and handling of separated Plutonium. During these manipulations plutonium-casks or fresh MOX fuel elements can be stolen.

An economically-unjustifiable civilian plutonium program gives rise to suspicion that a secret military nuclear program exists or at least that the country keeps a nuclear option open and might go nuclear someday. There is already serious concern over Japan's ambitious plutonium program, particularly among Asia-Pacific nations who had bitter experiences of Japan's past military invasions. Lack of transparency and democratic decision making in Japan enhances the concern.

Regardless of whether Japan really has military ambition or not, Japan's plutonium program could trigger a sort of "chain reaction" in the East Asia region. Already, this situation was used by North Korea as an excuse for its nuclear program. The United States put pressure on South Korea and Taiwan not to construct reprocessing plants and are urging North Korea forcefully to scrap its reprocessing program, while it appears as if the USA do not interfere in Japan's full scale plutonium program including reprocessing and even reprocessing of fast breeder spent fuel which could lead to separation of weapon-grade plutonium by treatment of FBR blanket fuel. This US policy is obviously discriminatory, and sooner or later, it will become difficult for the US to maintain it. Japan will also have difficulties being the only country in East Asia running a full scale plutonium program.

There has been a persistent rumor that South Korea is aiming at reprocessing. This has come to surface again recently in connection with the governmental decision of constructing a spent fuel storage site in Kulop Island. Also China which plans to construct tens of power reactors to meet with the expected power demand growth would want to have civil reprocessing plants in the near future. So far as Japan sticks to its reprocessing policy, other Asian nations will follow suit before long and this spread of reprocessing may possibly lead to proliferation and at least to regional instability caused by suspicions.

[51] Press release from the Japanese Science and Technology Agency, February 6/7, 1995.

2.2.2 Cutoff proposals and verification

This section discusses many different cutoffs. It addresses the cutoff of production as well as that covering the use of the material as well. It deals with fissile material for weapons purposes as well as with weapon-usable fissile material, including civilian material. More variations will be introduced in the course of this subsection.

Steps or levels of implementation of cutoff agreements

"Cutoff" in a narrow sense referres to a stop in production of fissile material for military purposes. The idea to cut nuclear weapons production at its source has been used to describe controls on the production of fissile material by scientists since years[52] and several related publications appeared recently.[53] The following two issues regarding the scope of a cutoff agreement are nearly completely ignored by these studies: one is the international control of the fusionable material tritium, the other a production halt for civilian fissile materials that goes beyond safeguards. Both are treated below in separate sections.

In the past related proposals dealt in general with the stop of dedicated military production of weapons-grade fissile materials. Currently the first **de-facto halts of military production** and a bilateral agreement between Russia and the USA to stop production of plutonium for military purposes are in effect. The political climate now is ready to discuss the cutoff topic in a broader sense and on the international level.

Cutoff agreements are not bound only to bannning fresh production. They may cover existing stockpiles as well and might become even *"cutback"* agreements. They may include the following steps or levels of implementation:

1. unilateral **transfers** of weapon-usable materials from military or unsafeguarded stocks to safeguarded civilian facilities

2. bi- or multilateral agreements on **military fissile material production cutoff** for weapon purposes or outside safeguards, especially shut-down and dismantlement of dedicated production reactors[54]

[52] See [Hippel/Levi (1986)], [Sutcliffe (1991)], [Thompson (1990)] and [Weinstock/Fainberg (1986)]

[53] See [Albright/Berkhout/Walker (1993)], [Berkhout et al. (1995)], [Chow/Solomon (1993)], [CISAC (1994)], [Gronlund/Wright (1994)], [IPPNW/IEER (1992)], [NAS (1994)], [Swahn (1992)], [OTA (1993)], and [Thompson (1994)] [UNIDIR (1994)]

[54] The Gore Chernomyrdin Agreement is a precedent for this kind of agreements. Its scope is limited to plutonium; HEU is not included nor is tritium altough tritium production reactors might as well be used for plutonium production. Such an agreement would be more trustworthy, if a third party would be involved in the verification. Another shortcoming is that the production reactors will not be dismantled but put under "cold stand-by".

3. world-wide **accountancy** of past production and **register** of all existing stocks of weapon–usable nuclear materials

4. **integrated production cutoff** (i.e. including the fusionable material tritium) of materials for weapon purposes and outside safeguards

5. unilateral binding declarations to **forgo the civilian production and use** of weapon–usable materials[55]

6. agreements on putting all remaining stocks of weapon–usable materials and all still necessary uranium enrichment, plutonium separation, and tritium production capacities (including shutdown facilities) under **multilateral or international physical control** unabling the access to any nation (internationalisation)

7. agreement to **demilitarize and dispose of existing stocks** (e.g. dilution and burning of HEU, immobilization and final disposal of plutonium)

8. agreement to put the technology under ban that is used to produce or qualify the weapon-usable material. Especially this might be a ban on reprocessing for any purposes including transmutation, or a ban on research in new enrichment technologies such as laser isotope separation. Such an agreement may be seen as a step towards *complete phase-out* of uranium enrichment and plutonium generation even as a byproduct, i.e. a step towards phasing-out of nuclear energy use.

9. Comprehensive Cutoff Convention (CCC) banning the acquisition, retention, spread, and any use of all weapon–usable materials (in particular, HEU, plutonium and tritium) in significant amounts. This kind of cutoff may put the possession of quantities above a certain limit under ban (**quantity cutoff**), may ban the final processing step (**qualifying cutoff**) and may require the elimination of existing stocks (**stock cutoff**).

The critical steps are the final shutdown and dismantlement of military production facilities and the submittance of *all* military stocks of weapon-usable fissile material to international control, the inclusion of de-facto nuclear weapon states in such an agreement, the ban on separation of civilian plutonium and on the high enrichment of civilian uranium, as well as the internationalisation of facilities able to handle or produce weapon-usable materials.

The Comprehensive Cutoff Convention (CCC) may be seen as the final step in a cutoff process embracing all previously taken partial bans.[56] For each level of implementation of the CCC the technical and political impact has to be assessed. The main political question is acceptability by various countries (or groups of countries) and the impact on non-proliferation.

[55] In the late 70's, the U.S. Carter Administration decided to oppose export of reprocessing facilities even under full–scope safeguards and rennounced the commercial use of plutonium in its own country.

[56] The very last step could be the *complete phase-out of nuclear energy use.*

The technical questions are related to verification and scope. Many safeguards and verification procedures relevant for a CCC have already been developed, in particular under the IAEA auspices. Routine on–site inspections can be forseen to verify the shut–down of declared facilities and challenge inspections to search for clandestine facilities similar to the inspections conducted in Iraq under the auspices of UNSCOM. Indications for clandestine activities could be discovered remotedly by infra–red measurement from satellites or comparable tools. Also citizens/societal verification could contribute to the entire verification regime.

Current state of negotiations

Bilateral negotiations between Russia and the USA on a cutoff made progress. The Gore-Chernomyrdin agreement of June 1994 on the verified cutoff of plutonium production for military purposes is a major step towards a fissile materials production cutoff. However, verification procedures were left unspecified within the agreement. Furthermore, it is severely questioned by allowing for ongoing tritium production, although plutonium could easily be produced in the tritium production reactors which are excluded from the agreement. Safeguarding of tritium production would be a way to deal with this problem, but may be difficult to agree upon.[57]

In December 1993 the UN General Assembly passed a resolution to start negotiations on a fissile material production cutoff for weapons purposes. Though the Conference of Disarmament at Geneva failed to agree on a negotiating mandate for a cutoff by the end of its 1994 negotiating session and again in early 1995, it is highly likely that an Ad Hoc Committee on a Fissile Material Cutoff will be established before the NPT 1995 Conference starts in April 1995.
It is not yet clear what the goal of such treaty negotiations will be. In particular, the question of whether the convention will cover existing stocks as well as future production of fissile material remains unsettled.

Verification[58]

This section considers the measures required to verify an agreement on a cutoff of "production of fissile materials for nuclear weapons or other explosive devices," under consideration at the Conference on Disarmament (CD) in Geneva.

This discussion assumes that the cutoff convention will be open to signature by all countries. While joining this convention would be redundant for those non- nuclear-weapon states that

[57] See [Kalinowski (1994)]
[58] This material is largely excerpted from [Gronlund/Wright (1994)]

have signed the Nuclear Non-Proliferation Treaty (NPT), their signature should be encouraged. Unlike the NPT, this agreement would apply equally to all signatories including the five nuclear powers; having more signatories would stress the universality of the constraints.

To ensure that highly enriched uranium (HEU) and separated plutonium are not produced for weapons, safeguards could be applied either narrowly or broadly. Applied narrowly, in a "minimum" verification regime, they would only be required for HEU and separated plutonium, reactor fuel made from these materials, and facilities where these materials were produced or handled. Applied more broadly in a "maximum" verification regime, safeguards would be required for all types of nuclear material, including LEU, natural uranium and spent fuel, and the facilities containing that material, as they currently are for IAEA safeguards. We discuss below in some detail the verification measures required in these two cases, but first consider several features common to both.

For both the minimum and maximum verification regimes, the safeguards applied would not be full-scope since a Production Cutoff Convention would not prohibit the use for weapons of fissile material that had already been produced. Thus, under this convention, an unspecified amount of existing fissile material would be exempted from safeguards. Regardless of the scope of safeguards applied, any material and facilities that are subject to safeguards would be formally declared by each country. It is important that provisions be made for challenge inspections of both declared and undeclared sites. The right to inspect undeclared sites is critical for finding violations involving covert sites that should have been declared but were not. Moreover, challenge inspections can be used to verify that the initial declarations are complete.

It may be necessary to conduct challenge inspections at sensitive military installations. For example, Israel's plutonium production reactor and separation facility are sited at the Dimona nuclear facility, which is highly secret. A challenge inspection could be requested to verify that no undeclared plutonium separation facility existed at Dimona. In this case, employing techniques such as "managed access"[59] could provide confidence that an undeclared facility did not exist without revealing other information that is considered sensitive.

Minimum Verification Regime – Narrow Application of Safeguards: The requirements under a minimum verification regime are less than those already in effect for the non-nuclear-weapon states that have signed the NPT, so that no additional verification measures would be needed for these countries when they join the Production Cutoff Convention. These measures would thus apply to the nuclear-weapon states and states that have

[59]Managed access is a concept developed for use under the Chemical Weapons Convention (CWC) that gives inspectors access to only a percentage of the buildings at a site or rooms in a building so they are unable to gain a complete picture of all activities there. However, the specific buildings or rooms to be inspected are chosen by the inspectors, so if no treaty violations are found they can assume that this is not because of manipulation. In addition, managed access allows computer screens to be covered and equipment that is too small to be of interest to the inspectors to be shrouded.

not signed the NPT.

Applying safeguards only to weapon-usable materials and those facilities in which they are produced or handled would require the following:

- All uranium enrichment facilities would be declared in one of two categories: facilities producing only LEU and facilities producing at least some HEU. The output of facilities in the first category would be monitored to verify that no HEU was being produced, but a quantitative accounting of the material passing through the plant would not be made, nor would the LEU be monitored after leaving the plant. For facilities producing some HEU, a quantitative accounting would be made of the amount of HEU produced and this material would be safeguarded after leaving the plant to verify that it was not used for weapons.[60]

- All plutonium separation facilities would be declared and safeguarded. The spent fuel input would be measured and the amount of plutonium determined. The separated plutonium produced would be safeguarded after leaving the facility.

- Any uranium enrichment or plutonium separation facilities no longer in operation would be declared and would be monitored to verify non-operation until they were dismantled.

- All fuel fabrication facilities handling either HEU or separated plutonium (including MOX fuel) would be declared and monitored. The amounts of HEU and separated plutonium would be monitored and all fuel made using these materials would be monitored.

- Any reactors using fuel made with HEU or separated plutonium (including MOX fuel) would be declared and the operation of these reactors would be monitored to verify that the fuel was not diverted. Monitoring of the fuel would cease once it was extracted as spent fuel.

In this verification regime, only weapon-usable materials are accounted for quantitatively. Fuel made with LEU would not be monitored, the operation of any reactors using only LEU fuel would not be monitored, and spent fuel would not be accounted for. The weaknesses of this regime are clear: the diversion of natural uranium, low-enriched uranium, or spent fuel would not be detected by safeguards in the nuclear- weapon states and states that have not signed the NPT or otherwise accepted NPT-equivalent safeguards. While these materials

[60]Under the IAEA safeguards agreement applied to NPT non-nuclear-weapon state parties, fissile material may be withdrawn from safeguards for a non-proscribed military purpose, which includes all military activities other than developing nuclear explosives. In particular, according to paragraph 14 of INFCIRC/153(corr.), HEU could be withdrawn from safeguards to fuel naval reactors [IAEA (1972)]. The cutoff convention could close this loophole for newly-produced fissile material by not including this provision.

would have to undergo either enrichment or reprocessing in order to be weapon-usable, acquiring these materials clandestinely could be the first step to building nuclear weapons or increasing arsenals.

Maximum Verification Regime – Broad Application of Safeguards: A stronger, though more expensive, verification regime would require the application of international safeguards to the production and use of all types of fissile material–the same means by which the NPT commitments of the non-nuclear-weapon states are verified. Thus, the production and use of LEU fuel, the operation of all reactors, and the storage of spent fuel would be safeguarded.

Because the United States and Russia have large existing military stockpiles of fissile material, it is unlikely that their governments would divert material from commercial power plants for weapons purposes. It may therefore appear unnecessary to safeguard commercial facilities in those countries, implying that a minimum verification regime would be adequate. However, in the future we can anticipate that these large, unsafeguarded military stockpiles will be significantly reduced, and a maximum verification regime will then be needed to provide confidence that neither country is producing HEU or separated plutonium for weapons. Such confidence, in fact, may be a prerequisite to negotiating meaningful controls placing low limits on existing stockpiles of unsafeguarded fissile material. In addition, since a maximum verification regime would require a detailed accounting of all fissile material, it would force improvements in Russia's currently inadequate national system of material accounting and provide international oversight of this system.

Moreover, an important feature of the convention is that its terms are to be universally applied. Thus, its verification measures must be adequate to ensure that countries without large existing stocks are not diverting material for weapons. It will also be politically important to apply the same verification measures to the nuclear-weapon states that the non-nuclear-weapon states have already accepted.

Under a maximum verification regime, applying safeguards to the civilian nuclear activities in the five nuclear-weapon states and all other states that are not NPT signatories (including India, Israel, and Pakistan) would increase the workload of the IAEA considerably and require an increase over the current safeguards budget (US$70 million annually) of roughly a factor of three.[61]

It would presumably also take time to train additional IAEA inspectors and otherwise prepare to fully implement such safeguards. As a result, the convention could specify that the verification provisions could be phased in over a period of a few years, beginning with those facilities where theft or diversion pose the biggest risk, i.e., those specified above for the minimum verification regime. Verifying that military plutonium production reactors were shut down could also be required in the first stage. Safeguards at civilian power plants could

[61] See [Gronlund/Wright (1994)] and [IAEA (1991)]

be implemented gradually, with the percentage of a country's total reactors that must be placed under safeguards each year and the date by which all reactors must be safeguarded specified in the convention.

Replacement of dual-purpose reactors in Russia[62]

By now 10 of the 13 Russian plutonium production graphite reactors have been shut down. In January of 1992 President Eltzin confirmed the decision, early adopted in the FSU, on the intention of Russia to cease the operation of three remaining reactors by the year 2000. These reactors are continue enlarge Russian nuclear arsenal on about 1,5 metric tons of weapon grade plutonium annually. Although recently Russia has committed not to use the plutonium produced in these reactors in nuclear weapons their earliest possible closing is very desirable. But this task involves a complex set of technical, economic, social and ecological problems.

These three reactors were put in on operation in the middle of 60-th as so-called dual-purpose reactors to produce plutonium for weapons and to produce heat and electricity for local residents. All of them have a similar design - these are a graphite moderate channel type pressurized water cooled reactor operating at about 2000 MW thermal power. Fuel is discharged with a typical burn up of 650- 800 megawatts days per metric ton and stored at pool before reprocessing. Due to corrosion of the aluminum cladding, the discharged fuel elements is storing usually no longer than six months.

All these reactors are operating now principally to supply heat to their respective cities. The Krasnoyarsk-26 reactors provides 100% of heat for Zheleznogorsk - the city with one hundred thousands population. Two Tomsk reactors supply about 30% of the available heat supply for the city with seven hundred thousand inhabitants. Under these circumstances the shut down of these reactors in near future without replacement power sources is not possible.

The following options are now under consideration to replace the heat production capacity of the dual-purpose reactors:

1. The construction of new coal fuel power units.
   At the beginning, the coal option was rejected by Tomsk's local authorities due to the lack of the required transportation infrastructure to deliver coal to the area. The pollution problems associated with the operation of the coal-fired plant were an additional argument for such a decision. But currently this option is examining again.
   The Krasnoyarsk-26 administration is considering the coal option as more reliable than other options. Construction of a new coal-fired plant has been started south of the city more than 10 years ago but was suspended later. Now the main problem for moving the construction of this plant forward is the lack of financial support. Russia agreed to review an existing feasibility study to complete the construction of this coal plant.

[62]This part is based on [Diakov (1993)]

2. The construction of a new nuclear heat supply unit.
   The construction of a new nuclear power heat supply station to replace two production reactors at Tomsk-7 has been explored as an option and was approved by the local counsel in 1993 after a long discussion inside the city's community. The critical argument for this option is the saving of jobs for people who currently are working in the production reactors and thereby to diminish the social problems associated with the conversion. But in the absence of the Western financial support this option has a minimal chance for the realization.

3. The construction of gas fired power plants.
   At present time the gas-turbine option is considered by the Tomsk regional administration as more favorable for the replacement of the two production reactors at Tomsk. Four 100-MWe gas-turbine power plants each having four 25-MWe gas turbines could replace these reactors. It is proposed to use the converted gas turbines earlier developed for military aircraft. But this option requires further analyses, mainly of the cost of this project. Up to now there is no production of gas turbines for stationary power in Russia, such production requires the conversion of a jet engine plant. In addition, it is necessary to build the new natural gas pipe-line to Tomsk. Therefore, the implementation of this option will require several years and allow to shut down Tomsk's production reactors not earlier than 2000, according to a careful forecast.

4. The conversion of dual-purpose production reactors.
   According to this not widely discussed option, a new fuel will be developed which doesn't require reprocessing. It might make most sense to examine this option with respect to safety. There is understanding among experts that these are intrinsically unsafe reactors and their further operation with the converted fuel is possible, only if the safety will be improved. More essential is that all reactors are in operation 30 years and have a rather short remaining time-frame for further operation.

Possible cutoff agreement between India and Pakistan[63]

It is supposed that Pakistan has produced about 200 kg of HEU. India is believed to have separated some 300–400 kg plutonium.
There is already a freeze in Pakistani weapons grade uranium enrichment activity. It has been in force since January 1989, but enrichment up to 5% may have continued.[64] There was a limited return to enrichment in Spring 1990, but it was short-lived. The US has never questioned the Pakistani assertions of freezing production, and seemed to be certain that

[63]This draft for this section has been written by Zia Mian.

[64]While the reasons offered for the "freeze" are varied, including the pressing need for economic aid, the global situation there is some reason to believe that technical problems may have played a role.

production had resumed briefly in 1990. The US has in effect been operating a de facto verification regime with regard to Pakistan's enrichment activity.

The only practicable proposition to make the freeze in enrichment "legal", would be for a bilateral agreement between India and Pakistan. One way is outlined below.
A third party (perhaps the International Council of Scientific Unions) would provide support for a Bilateral Surveillance of Atmospheric Radioactivity (BSAR). This would be in the form of funding, equipment and training, to allow India and Pakistan to monitor select nuclear facilities in each other's country. The facilities would be those able to produce nuclear-weapons-usable material, i.e uranium enrichment and fuel reprocessing facilities. Provisonally, only those facilities that are on the list of nuclear declared facilities, exchanged annually under the bilateral agreement not to attack declared facilities, could be so monitored.

India and Pakistan may not be prepared to accept intrusive inspections at there production facilities that could reveal information about past activities because they may wish to keep up the policy of *nuclear ambiguity*.[65] However they may be prepared to consider allowing stationary non-intrusive detectors (e.g. within the vicinity of its uranium enrichment plant at Kahuta) able to monitor the isotopic ratios of uranium that may have leaked, as uranium hexafluoride, in exchange for the stationing of monitors for Krypton-85 produced by plutonium separation at Indian reprocessing plants Trombay, Tarapur, and Kalpakkam. The proximity of the detectors to the facilities, and very long data collection times, would allow for much greater sensitivity than for long distance and global monitoring.

The obvious question that hangs over this scenario is whether and under what conditions India may be prepared to agree to a production cut-off for weapons usable material. India has stated the intention to use plutonium in fast breeder reactors. Note that since India does not yet have a fast breeder reactor, there is actually no civilian need for it to reprocess plutonium from spent fuel.

One possibility is that an international fissile material cut-off agreement could involve placing such detectors in the vicinity of all nuclear weapons-usable material production plants. Indian and Pakistani support for such a cut-off is well-publicised and they may be prepared to implement such a bilateral surveillance system as a prefigurative arrangement. If the detectors are going to be put there anyway, then it may as well be sooner rather than later, since there would be a confidence building pay-off.

The Integrated Cutoff including the fusionable material tritium[66]

In principle all tritium production reactors can easily be used for plutonium production as well.[67] Therefore, it constitutes a severe loophole with respect to verifying compliance

[65]The idea of nuclear ambiguity is described in section 2.1.3.

[66]The draft for this section has been written by Martin Kalinowski.

[67]The possibilities to exchange the raw materials lithium and uranium depend on the configuration of the core and the design of the fuel and target elements. Besides exchanging the target materials, a slight

with a cutoff agreement, if tritium is not included at least by safeguarding its production [Kalinowski (1994)]. The Gore Chernomyrdin Agreement does not even mention tritium. In its Annex a list of plutonium production reactors is given which makes no mention of the shutdown US K-reactor[68] at the Savannah River Plant and of the two still operating Russian light water reactors at Ozersk, named Lyudmila and Ruslan, which both have some 1000 MW_{th} and are used to produce tritium and special isotopes, e.g. Pu-238.

Although tritium is not essential for the production of a nuclear weapon, all five recognized nuclear weapon states (NWS) make extensive use of tritium within their weapons programmes and three de-facto NWS (India, Israel, and Pakistan) are known to have either followed this path or have attempted to do so.[69] Tritium from civilian sources is increasingly available in excess of civilian demand, thus rising questions about its non-proliferation.

The control of tritium, which used to be regulated solely by national export controls, has gradually been expanded to the international level. Most initiatives at the international level aim at tightening the export controls of tritium (CoCom; 4th NPT Review Conference; "dual-use list" of the Nuclear Suppliers Group) by denying proscribed countries the transfer of tritium and associated technology. The noticable exception being an extension of a cooperation agreement between EURATOM and Canada[70] which was finalized in 1991. It has given EURATOM the mandate to control tritium-imports for fusion research from Canada to its memberstates. In this agreement, EURATOM will act as a supervising agency authorized to establish control procedures for tritium shipments and to verify the declared end-use.

But international tritium control has only been an incoherent and insufficient approach so far, since only some areas of concern have been regulated, while most proliferation paths remain open.[71]

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re-configuration of the core might be necessary. Normally, such a procedure is easy, because target elements are separated from fuel elements. Sometimes fuel and target material are integrated in the same elements which would imply higher costs for converting a tritium breeding target to one that breeds plutonium. But there is no physical reason that impedes such a conversion.

[68] In fact, the K-reactor, which is nearly identical to the plutonium production reactors L, P, R, and C at Savannah River Plant, has been used since 1983 for several years for the production of supergrade plutonium (3% in Pu-240). See [Cochran et al. (1987a)]. The mission of this reactor was changed to tritium production, after the shutdown of the C-reactor in 1986 which was dedicated to tritium production. Co-production of plutonium and tritium has been current practise. All U.S. production reactors are shutdown since 1988. Plans to restart the K-reactor are abandoned and the construction of a new production facility will probably not be started before the year 2000. In early 1995 the US DOE has released draft Environmental Impact Statement for new tritium production facilities.

[69] The military use of tritium by these countries is described in [Kalinowski (1995)]. By turning from simple fission devices to boosted fission or thermonuclear weapons tritium is playing a key role. Tritium has strategic significance, because warheads can be built smaller and lighter while retaining the same yield. Because of its decay rate of 5.5% per year, continuous supply of tritium is necessary to maintain those nuclear arsenals which depend on tritium.

[70] See [EURATOM/Canada (1991)]

[71] See Colschen/Kalinowski/Vydra (1991)

To improve on this, the "integrated cutoff" (ICO) and the international tritium control system (ITCS) have recently been proposed.[72] The *goal* of the ICO is the non-availability of **fresh tritium supplies** for nuclear weapon programs, as a means to avoid the vertical proliferation of states that possess nuclear weapons or weapons capability and to pave the way towards complete nuclear disarmament, i.e. the denuclearization of those states. Only the recognized and de-facto nuclear weapon states are the potential member states of the ICO.

The main *advantages* of an ICO in comparison to a "fissile material cutoff" are:

- Compared to the "cutoff" proposal, the ICO would constitute a **stronger commitment** by the nuclear weapons states **towards complete nuclear disarmament** and is more suited to satisfy those demands by non-nuclear weapon states, because it would be demonstrated that there is the binding intention to continue with disarmament beyond START II.[73]

- If the START-implementation proceeds as planned, there will be no need to resume tritium production in both nuclear superpowers for more than 20 years and if disarmament goes further down tritium production may stop for good.[74]

- **Verification** of this "zero-approach" would be easier and less intrusive.

- There would also be substantial **cost-savings effects** on two levels accompanying an ICO. Firstly, there are the costs to build and maintain new tritium production reactors.[75] Secondly, there would be additional costs for safeguarding tritium production reactors necessary to verify a "cutoff" in military plutonium production, that would be absent within the ICO.

To correct the identified deficits regarding horizontal non-proliferation of tritium, an International Tritium Control System (ITCS) has been suggested.[76] It represents a comprehensive

[72] See Kalinowski/Colschen (1995)

[73] Such a disarmament scheme would in fact keep pace with the radioactive decay of tritium (5.5% per year). The possibility of nuclear disarmament by an ICO alone, i.e. using the tritium decay as a "forcing function" for reversing the vertical proliferation process or as a means to achieve a yield limit is different from this proposal. It has been rejected for good reasons and is not proposed by the authors! For the discussion of "tritium as a forcing function" see: [NCI/AAAS (1988)] and [Mark et al. (1988)]

[74] The ICO would guarantee that time is bought by definitely postponing new production activities. Tritium production will not resume before it is really required and possibly it will not be necessary to restart it ever.

[75] In case of a limited agreement and the resumption of the military tritium production after the agreement expires and is not extended, the ICO would at least have bought time for further investment decisions. See also paragraph on "Decision making procedures".

[76] See Colschen/Kalinowski (1994), Kalinowski/Colschen (1995) and Colschen (1995)

and systematic approach to dealing with the problem of curbing the horizontal proliferation of tritium, while allowing its civilian use. A precedent for controls of horizontal nonproliferation is given by an agreement between EURATOM and Canada.[77]

If a cut-off of weapon-grade fissile materials was negotiated, due consideration should be given to adding tritium to such an agreement.[78]

Comprehensive Cutoff Convention including civilian production and stockpiles[79]

Up to now, proposals to constrain the production of weapon–usable nuclear material were dealing mostly with the production for military purposes. But many technologies in the civilian sector are civil–military ambivalent since they can serve military purposes as well by producing weapon–usable material or by maintaining demand for the production and transport of it. This concerns mainly the materials highly enriched uranium (HEU), plutonium and tritium and related technologies.

As the civilian nuclear technology continues to be in use, the danger of its clandestine use to produce weapon grade material, despite all the improved and enforced international safeguard systems, will continue to loom large on the nuclear horizon. A good 17% of the world's electric energy requirement is still met through nuclear power technology, and the demand is projected to increase at a steady pace. At least 19 countries have the capability to separate plutonium from nuclear waste and more than 14 countries are able to enrich uranium even to weapon–usable HEU. The call for devising proliferation-resistant use of civilian nuclear power technology is therefore very timely.

Enrichment and reprocessing technologies are the most significant steps in the entire fuel cycle from the point of view of nuclear proliferation. They are dual-purpose technologies. Besides producing materials for weapon, they are needed for several of the existing civil and military purposes. Reprocessing is needed to extract Pu (and U-233, as in the case of India) for use in the MOX fuel for power reactors and in fast breeder reactors. Enrichment technology is needed to obtain LEU for power reactors and HEU for research reactors as well as for running nuclear submarines. And the two technologies are the most essential steps a country must pass through to obtain material for nuclear weapons.

Any attempt to control the potential use of weapon–usable material for weapon purposes has to include both military and civilian weapon–usable material activities. The most restrictive measure would be the ban on any acquisition, retention or spread of fissile material covering even the production as by-product and the ban on all production technologies and capacities, i.e. the ban on using nuclear power. Since that seems not achievable within a short period of time, those technologies should be the prime focus for the "*comprehensive cutoff* convention"

[77] See [EURATOM/Canada (1991)]

[78] See Kalinowski/Colschen (1995), Colschen (1995), and Kalinowski/Colschen/Leventhal (1992)

[79] This section is mainly based on [Liebert/Kalinowski (1994)]

(CCC) which are required to refine precursor materials to become readily weapon-usable. Examples are further enrichment of low enriched uranium, separation of plutonium from spent fuel, or extraction of tritium from heavy water. Efforts should be directed to curbing these technologies as far as possible.

At least a ban on the separation of plutonium from spent fuel should be included in a (CCC) as well as a ban on the enrichment of uranium beyond 20%. This would be a *refinement cutoff*, i.e. the final processing steps that refines them to be readily accesible for nuclear weapons would be stopped. A cutoff agreement will be the more proliferation-resistant the more technology is banned, i.e. the more difficult it is with the nuclear technology remaining after implementation of the agreement to regain plutonium in a form readily usable for nuclear weapons.

A cutoff agreement will be the more comprehensive the more existing material is banned. Any use of these materials in amounts larger than a significant quantity would be banned as well (*quantity cutoff*). Existing stocks would have to be eliminated on an agreed time schedule (*stock cutoff*).
Such a radical approach has rarely been proposed as the immediate next step. Most authors who include a control of civilian materials into their considerations typically see this as the eventual goal. As a major step towards that goal an internationalization of existing stocks it is often envisioned as well as measures which make it more unattractive to use and transfer weapon-usable fissile material without explicitely banning it. In this approach outlined here, internationalization is seen as a necessary compromise on the way to the global abondonement of weapon-usable materials.

The main reasons for this comprehensive approach are:

1. There is no way to separate the military potential from weapon–usable materials such as HEU (enriched to more than 20%), plutonium in all isotopic compositions (with the only exception of a Pu–238 content of more than 80%) and tritium.

2. As long as reprocessing and enrichment technologies are nationally operated, the possessor has the means to channel them in the direction of weapon-grade material production, making the future task of verification of a production cut-off all the more difficult. Suspicions that they are being used for clandestine production of material for weapons will continue to vitiate international environment.

3. Existing IAEA safeguards are inadequate for nuclear bulk–handling facilities. For example, the minimum detectable amount of diverted plutonium in a large commercial reprocessing plant exceeds several significant quantities (up to 30 significant quantities) per year.

4. Civilian stocks of weapon–usable plutonium will exceed military stockpiling around the turn of the century (see first part of this section 2.2).

5. The more dangerous problem is break-out. The existent production technology as well as the storage and use of large quantities of weapon–usable nuclear materials will keep alive temptation and opportunities for users or owners to rapidly break out of any control system and produce nuclear weapons. This latent proliferation threatens regional and global security.

6. Only world–wide self–restrictions in production[80] and use of weapon–usable material could overcome the practice of technological denial against so–called rogue states. Otherwise some states might use the production or accumulation of weapon–usable material by others as an excuse to justify their own similiar activities.

7. A sustainable solution for dealing with weapon–usable nuclear material within the framework of a nuclear–weapon–free world (or an irreversible transformation process aiming at this goal) could hardly avoid its total ban of production and use in order to include all prerequisits for eventual reproduction of nuclear weapons into the ban. Especially, these preventive measures have to include all weapon–usable nuclear materials.

As has been demonstrated in the first part of this section 2.2, a comprehensive cutoff for all production of weapon–usable nuclear materials would not hurt energy and research rationals for the forseeable future (several decades to 50 years) in a drastic way. Such a cutoff could be first put in force for a limited period of time, say 50 years, leaving it free to be extended afterwards. It could also allow for further use of insignificant amounts (which has to be quantified) of related materials for industrial or research applications.

A HEU production ban would have an impact on military naval reactors, civilian research and test reactors only in the very far future since existing HEU surplus is tremendous. Therefore, a comprehensive regime could forsee that, for a limited time period, naval reactors could be fueled with HEU already produced today. Similiarily, the phasing out of HEU use for research reactors could be organized. Only for a fixed period of time, for example one or two decades, one could allow fuel existing research reactors with HEU already produced if no conversion to LEU use seems feasible. Within a given time frame all other research reactors have to be converted or, in the case of high–flux neutron sources, they have to be replaced by alternative technologies or by new LEU consuming reactors.

In constraining Article IV of the NPT and in tackling the ambivalence problem of nuclear technology, a comprehensive cutoff would strengthen the existing non–proliferation regime and provide important progress towards the aim of a nuclear–weapon–free world.

[80]Note: In case of plutonium from power reactor operation it is usual to consider the stage of separation to be the "production". It is suggested here to call this the "refinement" step.

A comprehensive cutoff would require the following provisions:

- reconstruction and documentation of all produced weapon-usable material in the past
- registration of all existing stocks of weapon-usable material
- inventroy verification of all existing stocks
- accountancy of all existing stocks on a regular basis by international safeguards
- destroying excess stocks of weapon-usable materials
- submitting remaining stocks to international physical control
- ensuring the long-term inaccessibility of non-destroyable materials
- phasing out, as far as economically and political feasible, civilian and military facilities able to handle or produce weapon-usable material; monitoring their shutdown and dismantlement
- inclusion of all remaining civilian and military facilities able to handle or produce weapon-usable materials under a safeguard regime or under international physical control

The international monitoring effort could be carried out by the IAEA (if its financial resources are enlarged and its tasks are reshaped appropriately). Enforcement of the provisions of the comprehensive cutoff could be guaranteed by a (reformed) UN Security Council.

The main question is the scope, i.e. what exactly can be banned in a technical feasible and political acceptable way. After defining this ultimate goal of a Comprehensive Cutoff Convention (CCC), a step by step process can be developed how to achieve this goal and how to fulfill the requirements listed above.

2.2.3 Towards disposal

Taking nuclear weapons off deployment and putting them into national repositories[81]

The aim is to take existing deployed nuclear weapons and begin the process of turning them back into fissile material. This has already begun in a bilateral way between the US and the USSR as part of the START Treaty. But it can be turned into an international

[81]The draft for this section has been written by Zia Mian. His work flows from an original idea written down in [Makhijani/Yih (1992)].

disarmament measure which is aimed specifically at storing and disassembling numbers of warheads incrementally in such a way that all nuclear states first become threshold states and then gradually non-nuclear states. The first stage is to remove nuclear warheads from their places of deployment and put them into secure storage within the national territory of the state to which they belong. This repository, while within national control, will be internationally monitored. It will publicly "count-in" nuclear warheads, tag them, and be the site where they can be maintained, for an indefinite period. It will also have the facility to "count them out", after a public declaration by the state concerned that for "national security reasons" it needs to re-deploy any, or all, of them.

This combination of publicly counting nuclear weapons into designated sites, monitored storage in them, and counting them out in "emergencies", has three obvious benefits. Firstly, a state will have to give notification that it intends to withdraw some or all of its weapons from its repository. The second benefit is that it will create a certain amount of parity between nuclear weapon states and threshold states - which have a nuclear weapons capability but have not deployed weapons. This would bring Israel, India and Pakistan into the disarmament process. Thirdly, it is more likely that an agreement to incrementally turn these stored warheads into disassembled devices, and then into separately stored accumulations of fissile material and associated components, can be negotiated. This counting-in, storage and build down would begin with the state having most nuclear weapons and as each nuclear weapons state arsenal came within say a factor of 2 of the remaining warheads of the largest nuclear state, it would begin the process also.
The critical point in the whole process will be to establish that all warheads are delivered to the repositories. This will require that the whole process is transparent, from the removal of warheads at the deployment sites, to their transport to and storage in the designated repository. This will require multilateral inspectors at all stages to watch the process and to apply seals and tags to warheads and containers.

The warheads will have to be removed from the ICBMs based in silos or in submarines, and from the bombs at airfields. Ideally, the warheads should be disabled before they are removed from their launchers. This reduces the likelihood of accidental detonation. The arming, fusing, and firing mechanisms would have to be disengaged or removed. If the weapons are boosted, then the tritium store would also need to be removed.
But as far as removing the warhead goes, this is easy, since the machinery to remove them is the same as the machinery from putting them in place. All that is needed[82] is a crane or a specialised transporter, erector, extractor (TEE). These are already there for routine maintenance of warheads. Tagging can begin at this stage.[83] Warheads could be bar-coded, like tins of beans, using secure visual tags.

Unlike strategic weapons, tactical weapons are apparently kept separate from their launchers, usually intermediate range and battlefield missiles, even when they are deployed. These

[82]See [Carter/Cote (1993)]
[83]See e.g. [Garwin (1988)]

warheads are usually stored in national storage sites, and in sites close to bases for nuclear forces. Warheads in the these forward based sites could be disabled and kept in the national storage sites. These national storage sites would need to be publicly identified as storage sites, and modified to be able to count in the warheads, and tag them.

The national repository will require facilities to unload the weapons-containers from the trains or vans bringing them in. The tagged containers can be visually counted in and accounted for. Perimeter portal monitoring using germanium gamma spectrometers may be adequate to verify that there is a warhead in the container, without revealing design information, other than the presence of U-235 and/or Pu 239.[84] Once a warhead is in storage it cannot leave without passing through a portal monitor, and a visual check.

The design of the storage sites within the repository and the securing and monitoring of the perimeter could be uniform. The nuclear weapons states could undertake to build these sites for the threshold states in preparation for when they could store their undeclared nuclear weapons, whether they are assembled, disassembled, or just pits and components that have, as yet, never been assembled.

Dismantlement of nuclear weapons[85]

Although the commitments on tactical warheads and in START-II do not require Russia and the U.S. actually to dismantle the warheads from the eliminated weapons, both countries intend to dismantle a substantial fraction. As a result, Russia and the U.S. could dismantle over the next ten years or so a combined total of over 45,000 tactical and strategic nuclear warheads, about two-thirds of these Russian. The dismantlement process has already begun, with the Russians reportedly having dismantled 13,000 warheads over the past six years.

Modern nuclear warheads consist of a fission "primary" containing a plutonium "pit" or weapons-grade uranium surrounded by high explosives and a "secondary" containing thermonuclear fuel and sometimes highly-enriched uranium. Warheads are disabled by removal of the chemical explosives and of key parts of the electronic triggering mechanism. The warheads are then placed in sealed containers for transport to central military storage facilities.

U.S. nuclear warheads are currently dismanded at the Department of Energy's (DoE) Pantex facility near Armarillo, Texas at a rate of 1000-2000 warheads annually. The secondaries are taken for further dismantlement to the DoE's Y-12 plant in Oak Ridge, Tennessee where they were originally produced. At present, the recovered highly-enriched uranium is stored at the Y-12 facility. Prior to 1989, the pits from warheads dismantled at Pantex were taken to the DoE's Rocky Flats plant near Denver, Colorado where plutonium was recovered and purified for recyle into new pits. However, environmental and safety problems shut down the Rocky Flats plant in 1989. Eventually, it will probably be replaced by a new facility with a

[84] See e.g. [Cochran (1989)]

[85] This part is based on [Feiveson (1994)].

much smaller capacity. In the meantime, however, all pits from newly dismantled warheads are being stored intact in sealed canisters in heavily protected bunkers called "igloos" at the Pantex site. There are a total of 60 igloos at the Pantex facility that could be converted to store up to about 400 pits each for a total capacity more than sufficient to accomodate all the pits from the U.S. warheads scheduled for dismantlement.

In Russia, warheads are reportedly being dismantled at four sites at the same total rate as in the U.S. – about 1000- 2000 a year. This rate could be increased to 7,000 warheads a year if the dismantlement plants operated on three shifts and 24 hours per day and if secure storage for the recovered components could be assured. The Russian Ministry of Atomic Energy has asked for U.S. assistance to construct a secure central storage for 40,000 component containers near the Siberian city of Tomsk, one of Russia's three plutonium-production centers. However, in response to local opposition and in the aftermath of an explosion in the Tomsk-7 reprocessing plant in April 1993, Russia has for now officially "deferred" the proposed storage facility.

Up to now, the dismantlement process has proceeded without any outside monitoring. While Russia has indicated that it would be willing to accept bilateral and international safeguards, if these were applied reciprocally to the U.S., the Bush Administration opposed reciprocal monitoring and through the Summer of 1993, the Clinton Administration has not accepted any verification arrangements to oversee the dismantlement process. Eventually it seems likely that Russia and the U.S. will arrange at least bilateral verification of the dismantlement process. The imposition of international safeguards would also be valuable, although this might take longer to arrange.

For the moment, the U.S. and Russia appear content simply to store at least the plutonium pits of the dismantled warheads, without further processing. But in the long-run, this approach seems unsatisfactory, because the recovered fissile materials could still be reused to produce new weapons. As long as the materials remain in forms easily converted back to weapons uses, they will erode confidence in the irreversibility of the disarmament process and raise dangers of diversion to non-nuclear states and to terrorist groups, an especially worrisome prospect today in Russia. For this reason, it is useful to consider ways to convert weapons uranium and plutonium into forms which make weapons reuse much more difficult.

Demilitarization of separated plutonium without the use of reactors[86]

Final disposal of high-level radioactive waste in general and of plutonium in particular is still an unsolved technical and social problem and will probably remain one for the next decades. Technologies for elimination by burning the plutonium in speciallized reactors are not technologically ripe as well. Therefore, a "demilitarization" method has to be developed which makes the plutonium as unaccessible as possible for military purposes during the time

[86]The draft for this section has been written by Ed Lyman.

of its intermediate storage. Some suggestions for the chemical and physical form in which separated plutonium might be transformed are discussed in the following paragraphs.

Final disposal and elimination are not discussed in this document. They might become two alternative options leading to the termination of intermediate storage instead of turning it into indefinite storage.
A dedicated study undertaken by the U.S. National Academy of Sciences recommended two disposition methods for plutonium from dismantled nuclear weapons.[87] One is to put the material in MOX fuel elements and burn them in LWRs or CANDU type heavy water reactors. The other is the immobilization of plutonium by vitrification with high-level radioactive waste. Please note that once through cycles of MOX fuel elements do not reduce the total amount of plutonium and therefore do not establish a method for the elimination of plutonium but rather for the demilitarization of separated plutonium. This method is not further discussed here for reasons outlined in the first part of this section. The NAS study does not fully explore other immobilization alternatives which are discussed in the following paragraphs in more detail.

Separated plutonium can be effectively demilitarized by diluting it to a low concentration with non-fissile materials and solidifying the mixture, resulting in a product which is less vulnerable to theft, diversion and rapid return to weapons. This approach is an attractive alternative to conversion of plutonium to spent fuel in nuclear reactors, since it is capable of achieving similar results at a faster rate, involves fewer facilities and employs only chemical and mechanical processing. In addition, it is an explicit acknowledgement that plutonium has no commercial value at present and should be regarded as waste.

A number of candidate processes have been suggested for this task. These include the immobilization of plutonium in matrices made of glass[88], ceramic[89] or metal[90]. Diversion resistance is provided by the addition of "spikants," gamma-emitting fission products which render contact-handling of the material impossible, or "spoilers", elements chemically similar to plutonium that enhance the difficulty of extracting a purified plutonium product. A useful benchmark for diversion resistance is the "spent fuel standard" (SFS) endorsed by the National Academy of Sciences (NAS).[91] As will be discussed below, some argue that relaxation of this standard may be appropriate in certain circumstances.[92]

Some have argued that only glass technology is sufficiently well-developed to be recruited for plutonium immobilization without causing unacceptable delays.[93] However, judging from the slow pace of negotiations on such relatively simple issues as a bilateral U.S.-Russian

[87] See [CISAC (1994)]
[88] See [Berkhout et al. (1993)]
[89] See [Simonson and Chodak (1993)] and Lyman (1994)]
[90] See [DeVolpi (1994)]
[91] See [CISAC (1994)]
[92] See [Feiveson (1993)] and [Makhijani/Makhijani (1995)]
[93] See [Makhijani/Makhijani (1995)]

monitoring regime for plutonium storage, it is apparent that there is little point in sacrificing quality for haste in choosing the best demilitarization and disposition strategy.

The choice of the appropriate process for a particular nation depends on the optimization of a number of factors, such as the degree of diversion resistance it confers, the rapidity with which it can be carried out, the economic and environmental costs and the availability of diluent materials. Another important consideration is the suitability of the product either as a waste form for direct geologic disposal or, for nations which regard plutonium as a potentially valuable commodity, as a source for eventual recovery of the material for commercial fuel, should it ever become economic to do so.

In the United States, the non-reactor option which has received the greatest amount of attention is the incorporation of plutonium into the feedstock of the Defense Waste Processing Facility (DWPF) at the Savannah River Site, a plant constructed to vitrify (glassify) high-level radioactive wastes (HLW) generated during past plutonium production. The 1.7-tonne HLW glass blocks to be produced at the DWPF will emit intense penetrating radiation fields and will meet the SFS.

The chief advantage of this proposal is that it would obviate the need for construction of a new facility for plutonium immobilization. However, due to the numerous delays and problems being experienced at the DWPF, the prospects for modifying the plant to include plutonium in a timely way appear remote.[94] Consequently, it is likely that a dedicated production line will have to be built if this option is to be viable in the U.S. A dedicated facility would permit consideration of immobilization processes designed specifically for the goal of plutonium disposition. For example, preliminary studies suggest that the inclusion of plutonium at concentrations of up to several weight-percent may be facilitated by adjustments in the glass composition.[95]

Although a dedicated facility would increase the costs of immobilization, it is not clear that this would be a decisive disadvantage compared to the MOX route, which will require construction of a MOX fuel fabrication plant, and possibly dedicated reactors as well. The trend in current MOX plants, such as MELOX in France, is toward full automation of the process, with remote handling and maintenance employed wherever possible. On a conceptual level, a plant of this type would be quite similar to one designed to produce fully radioactive plutonium-doped glass, although the level of required shielding would be substantially greater in the latter.

To date, the Russian Ministry of Atomic Energy (Minatom) has expressed no interest in vitrifying or otherwise immobilizing its surplus plutonium, which it regards as a valuable resource.[96] It has repeatedly stated its intention to fabricate MOX from the material, preferably for use in a future generation of fast breeder reactors. Nevertheless, it is unlikely that

[94] See [Carter (1994)]
[95] See [Lyman (1993)]
[96] See [Hibbs (1995)]

there will be much demand for the material in the domestic energy generation sector in the forseeable future, with the result that a large stockpile of separated plutonium will continue to remain in storage in Russia indefinitely.
Grounds for compromise may be found in the development of immobilization technologies which would reduce the near-term theft and diversion risks of the material, yet permit to reserve the option of eventually using it to generate power. This compromise may be used to strengthen arguments in favour of an immediate stop of reprocessing, especially if it is combined with some incentive, such as the financial guarantee for the re-extraction of plutonium from the matrix.[97] One strategy would be to dilute plutonium in glass blocks without fission products, and perhaps poisoned with chemical spoilers.[98] A rare earth may be used for this purpose and gamma-emitting fission products such as cesium-137 can be added to the canister that will hold the glass log. It is claimed that this would not only complicate the recovery of weapons-usable material by sub-national groups and proliferating countries, but that this might be technically realized much quicker.[99] On the other hand, these blocks may not satisfy the SFS; thus the plutonium would be more accessible to national authorities than the plutonium in spent fuel. This might be more acceptable than vitrification with HLW to Russians and any country opposing giving away the opportunity to use plutonium as fuel.

However, there are a number of reasons why such an approach may not be desirable. First, plutonium immobilization should be not only a deterrent to theft by sub- national groups, but also a convincing demonstration to the international community that the nuclear weapons states are effectively demilitarizing their plutonium stockpiles. Schemes that fall short of meeting the SFS by design, to explicitly permit easy recovery of the material by NWS, would be hard to explain and justify.
Second, the level of diversion resistance provided by chemical spoilers alone, without any radiological barriers, is highly uncertain. If no fission products are present, all chemical operations, including analytical chemistry, can be carried out manually in gloveboxes. Moreover, industrial-scale chemical processes that can readily separate plutonium from candidate spoiler elements (such as uranium, thorium and members of the lanthanide series) can be easily found in the open literature.[100]

The use of ceramic matrices would introduce an additional chemical barrier to reprocessing. Although this would undoubtedly be a nuisance for sub-national proliferants, it is not clear that it would be an adequate deterrent to theft. None of these barriers appear to be as compelling as the radiation barrier surrounding spent fuel.

An alternative strategy would be to immobilize plutonium in ceramic matrices which meet the SFS and would be suitable for direct disposal, yet could also be used in power reactors

[97] See [Makhijani/Makhijani (1995)]
[98] See [von Hippel et al. (1993)]
[99] See [Makhijani/Makhijani (1995)]
[100] See [e.g. Benedict et al. (1981)]

without requiring substantial additional processing. In particular, separation of the plutonium from the bulk of the diluent would not be necessary.[101]

If no other suitable highly radioactive diluent is available, it could be prepared from spent oxide fuel via a dry process known as AIROX.[102] This process effects only a partial separation of plutonium from fission products by liberating the gaseous species (most of which could be captured using well-established technology), yet retaining most of the cesium and other semi-volatiles; no separation of uranium from plutonium occurs. The powder obtained in this way can then be blended with plutonium dioxide and compacted. This results in a highly self-protecting ceramic slug that meets the SFS. The encapsulation of 50 tonnes of plutonium at a concentration of 5.5% (necessary for recycle in light-water reactors) would require the AIROX processing of 1250 tonnes of spent fuel. To recycle these blocks in power reactors, it would not be necessary to reprocess them.

[101] See [Lyman (1994)]

[102] Atomics International Reduction-OXidation, see [Jahshan and McGeehan (1994)]

2.2.4 References

[Albright/Berkhout/Walker (1993)] Albright, D.; F. Berkhout; W. Walker: *World Inventory of Plutonium and Highly Enriched Uranium, 1992.* New York 1993.

[Benedict et al. (1981)] Benedict, M.; T. Pigford; H. Levi: *Nuclear Chemical Engineering, 2nd ed.* McGraw Hill, New York 1981.

[Berkhout, et al. (1993)] Berkhout, F.; et al.: *Disposition of Separated Plutonium.* Science and Global Security 3 (1993) p. 161.

[Berkhout et al. (1994/95)] Berkhout, F.; et al.: *A Cutoff in the Production of Fissile Material.* International Security 19, No. 3 (1994/95) 167-202.

[Böning (1993)] Böning, K.: *Statement at the Hearing "Erneuerung der Hochfluáneutronenquelle der Technischen Hochschule München in Garching."* Bayrischer Landtag, Munich, April 29, 1993.

[Carter/Cote (1993)] Carter, A.B.; O. Cote: *Transport, Storage and Dismantlement of Nuclear Weapons.* In: Cooperative Denuclearisation - From Pledges to Deeds, 1993.

[Carter (1994)] Carter, L.: *Let's Use it.* Bulletin of the Atomic Scientists, April/May 1994, p. 42.

[Chow/Solomon (1993)] Chow, B.G.; K.A. Solomon: *Limiting the Spread of Weapon-Usable Fissile Materials.* RAND, 1993.

[CISAC (1994)] Commission on International Security and Arms Control (CISAC): *Management and Disposition of Excess Weapons Plutonium.* National Academy of Sciences, Washington 1994.

[Cochran et al. (1987)] Cochran, T.B.; et al.: *Nuclear Weapons Data Book. Volume 3: U.S. Nuclear Warhead Facility Profiles.* Cambridge 1987.

[Cochran (1989)] Cochran, T.B.: *Black Sea Experiment: Only A Start.* The Bulletin of Atomic Scientists, Nov. 1989.

[Colschen (1995)] Colschen, L.: *Die Internationalisierung der Tritiumkontrolle als Baustein des Nichtweiterverbreitungsregimes für Kernwaffen. Bedingungen, Möglichkeiten und Chancen.* PhD thesis to be submitted to Free University Berlin 1995.

[Colschen/Kalinowski (1994)] Colschen, L.; M. Kalinowski: *Can International Safeguards be Expanded to Cover Tritium?* Paper IAEA-SM-333/27, Proc. IAEA Symposium on International Safeguards, Vienna, 14-18 March 1994, pages 493-503.

[Colschen/Kalinowski/Vydra (1991)] Colschen, Lars; M. Kalinowski; J. Vydra: *Comparative Documentation. National Regulations of Accounting for and Control of Tritium.* IANUS-2/1991, Darmstadt 1991.

[DeVolpi (1994)] DeVolpi, A.: *Managing Excess Weapons Plutonium.* Arms Control Today 24 (1994) p. 22.

[Diakov (1994)] Diakov, A.: *The cessation of production of weapons-grade plutonium in Russia: progress and problems.* INESAP Information Bulletin No. 3/1994, p14-16.

[Dircks (1992)] Dircks, W.J.: *Nuclear Fuel Recycling -The IAEA Perspective.* Presentation at the 1992 Annual Meeting of the Japan Atomic Industrial Forum.

[EURATOM/Canada (1991)] EURATOM and Canada: *Exchange of letters between the European Atomic Energy Community (Euratom) and the Government of Canada amending the Agreement between the European Atomic Energy Community and the Government of Canada for cooperation in the peaceful uses of atomic energy of 6 October 1959.* EL/CEEA/CDN/GER. May 1991. Reproduced in Official Journal of the European Communities No C 215/5, dated 17 August 1991.

[Feiveson (1993)] Feiveson, H.: *The Disposition of Plutonium.* International Workshop on Nuclear Disarmament and Non-Proliferation, Tokai University, Japan, March 1993.

[Feiveson (1994)] Feiveson, H.: *Nuclear warhead dismantlement.* In: Liebert, W.; J. Scheffran (Eds.): *Against Proliferation - Towards General Disarmament.* Proceedings of the First INESAP Conference at Mülheim in August 1993, Agenda Verlag, Münster 1994.

[FMRT (1994)] Federal Ministry for Research and Technology, Answer to a question from H. Kubatschka, Member of Parliament, April 27th 1994.

[Garwin (1988)] Garwin, R.L.: *Tags and Seals for verification.* The Bulletin of the Council for Arms Control, 40, Oct. 1988.

[Gronlund/Wright (1994)] Gronlund, L.; D. Wright: *Beyond Safeguards - A Program for More Comprehensive Control of Weapon-Usable Fissile Material.* Union of Concerned Scientists, Cambridge Mass., May 1994.

[Hahn/Sailer (1988)] Hahn, L.; M. Sailer: *Tragweite und Grenzen der internationalen Safeguard-Kontrollen - Untersuchungen zur technischen Wirksamkeit der Spaltmaterialkontrollen.* ko-Institut, Darmstadt 1988

[Hensing/Schulz (1995)] Hensing, I.; W. Schulz: *Simulation der Entsorgungskosten aus deutscher Sicht.* Atomwirtschaft 40 (1995) 97-101.

[Hibbs (1995)] Hibbs, M.: *NGO Anti-MOX Front in Retreat; Critics Advancing Pu Fuels Use.* Nuclear Fuel, Jan. 30, 1995, 5.

[von Hippel, et al. (1993)] von Hippel, F. ; et al.: *Eliminating Nuclear Weapons.* Scientific American, August 1993, 44.

[von Hippel/Levi (1986)] Hippel, F.v.; B.G. Levi: *Controlling Nuclear Weapons at the Source: Verification of a Cutoff in the Production of Plutonium and Highly Enriched Uranium for Nuclear Weapons.* In: Tsipis, C.; D. Hafemeister; Janeway (eds.): *Arms Control Verification: The Technologies the Make it Possible.* 1986.

[IAEA (no date)] IAEA: *Survey of Experience with Dry Storage.* IAEA Safety Series, Technical Document 290, no date.

[IAEA (1972)] IAEA: *The Structure and Content of Agreements Between The Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons.* June 1972, Document INFCIRC/153(corr.).

[IAEA (1991)] IAEA: Document GOV/INF/613, 1991.

[INFCE (1980)] International Nuclear Fuel Cycle Evaluation (INFCE): *Advanced Fuel Cycle and Reactor Concepts.* Report of Working Group 8, INFCE/PC/2/8, Wien 1980

[IPPNW/IEER (1992)] International Physicians for the Prevention of Nuclear War (IPPNW) and The Institute for Energy and Environmental Research (IEER): *Plutonium Deadly Gold of the Nuclear Age.* Cambridge 1992.

[JAEC (1994)] Japanese Atomic Energy Commission: Atomic Energy White Paper 1994.

[Kalinowski (1994)] Kalinowski, M.: *Verification of a production cutoff for fissile materials under different options for tritium production.* INESAP-Workshop "Beyond the NPT", Mülheim, 22.-24. Nov. 1994.

[Kalinowski (1995)] Kalinowski, M.: *International Control for Non-Proliferation of Tritium A Technical Assessment.* PhD thesis to be submitted to Technical University Darmstadt 1995.

[Kalinowski/Colschen (1995)] Kalinowski, M.; L. Colschen: *International Control of Tritium to Prevent its Horizontal Proliferation and to Foster Nuclear Disarmament.* Science and Global Security 5 (1994/95) issue number 2.

[Kalinowski/Colschen/Leventhal (1992)] Kalinowski, M.; L. Colschen; P. Leventhal: *Why and How Tritium Should be Considered Under a Verified Cutoff of Fissile Materials Production.* Proc. of the 42nd Pugwash Conference on Science and World Affairs in Berlin, September 11-17, 1992, Volume I, p. 473-480, Singapore et al. 1994.

[Kankeleit/Küppers/Imkeller (1989/1993)] Kankeleit, E.; C. Küppers; U. Imkeller: *Report on the Usability of Reactor-Plutonium in Weapons.* UCRL-TT-112792, Livermore, 21 January 1993. (Translation of the German original: *Bericht zur Waffentauglichkeit von Reaktorplutonium.* Working Paper IANUS-1/1989, Darmstadt 1989)

[Küppers/Sailer (1994)] Küppers, C., M. Sailer: *The MOX Industry of The Civilian Use of Plutonium.* Report from the German and Belgian Sections of The International Physicians for the Prevention of Nuclear War (IPPNW), Berlin/Brussels 1994

[Liebert/Kalinowski (1993)] Liebert, W.; M. Kalinowski: *Present problems of nuclear non-proliferation (and nuclear disarmament) from natural scientists point of view. List of thesis, problems, and proposals.* 43rd Pugwash Conference on Science and World Affairs, Hasseludden, Sweden, 9-15 June 1993. In IANUS-5/1993.

[Liebert/Kalinowski (1994)] Liebert, W.; M. Kalinowski: *Comprehensive Cutoff Convention.* INESAP Information Bulletin No. 4/1994, p11-14.

[Lyman (1993)] Lyman, E.: *The Solubility of Plutonium in Glass.* PU/CEES Report No. 275 , Center for Energy and Environmental Studies, Princeton University, 1993.

[Lyman (1994)] Lyman, E.: *Interim Storage Matrices for Excess Plutonium: Approaching the 'Spent Fuel Standard' Without the Use of Reactors.* PU/CEES Report No. 286, Center for Energy and Environmental Studies, Princeton University, 1994.

[Makhijani/Yih (1992)] Makhijani, A.; K. Yih: *What to do at Doomsday's End.* The Washington Post, Sunday March 29, 1992.

[Makhijani/Makhijani (1995)] Makhijani, A.; A. Makhijani: *Fissile Materials in a Glass, Darkly: Technical and Policy Aspects of the Disposition of Plutonium and Highly Enriched Uranium.* Institute for Energy and Environmental Research Press, Takoma Park, Maryland, 1995.

[Mark et al. (1988)] Mark, J.C.; et al.: *The Tritium Factor as a Forcing Function in Nuclear Arms Reduction Talks.* Science 241 (1988), p. 1166.

[Mark (1993)] Mark, J.Carson: *Explosive Properties of Reactor Grade Plutonium.* Science & Global Security, Vol.4, p.1, Gordon and Breach Science Publishers, 1993.

[NAS (1994)] National Academy of Sciences (NAS): *Management and Disposition of Excess Weapons Plutonium.* Washington 1994.

[NCI/AAAS (1988)] Nuclear Control Institute (NCI); American Academy of Arts and Sciences (AAAS): *The Tritium Factor.* Washington/Cambridge 1988.

[OTA (1993)] Office of Technology Assessment (OTA): *Dismantling the Bomb and Managing the Nuclear Materials.* OTA-O-572, Washington 1993.

[Simonson and Chodak (1993)] Simonson, S.; P. Chodak: *A Program Studying Waste Forms for Plutonium Immobilization.* Plutonium Immobilization Workshop, Department of Nuclear Engineering, Massachusetts Institute of Technology, 1993.

[Swahn (1992)] Swahn, J.: *The Long-term Nuclear Explosives Predicament: The Final Disposal of Militarily Usable Fissile Material in Nuclear Waste from Nuclear Power and from the Elimination of Nuclear Weapons.* PhD thesis, Chalmers University of Technology, Göteborg 1992.

[Thompson (1990)] Thompson, G.: *Verification of a Cut-Off in the Production of Fissile Material.* In: Barnaby, F. (ed.): *A Handbook of Verification Procedures.* New York 1990.

[Thompson (1994)] Thompson, G.: *Opportunities for International Control of Weapons-Usable Fissile Material.* IPPNW, ENWE paper No.1, Cambridge 1994.

[Tsushin (1994)] Denryoku Jiji Tsushin (Electric Power Newsletter) No.4177 Jan. 24,1994 (in Japanese).

[Sutcliffe (1991)] Sutcliffe, W.G. (ed.): *Fissile Materials from Nuclear Arms Reductions: A Question of Disposition.* Proc. for Session 35T-2 of the Annual Meeting of the American Association for the Advancement of Science at Washington, February 18 -1991. Livermore 1991.

[UNIDIR (1994)] UNIDIR: *Halting the Production of Fissile Materials for Nuclear Weapons.* UNIDIR Research Paper No. 31 including contributions by Therese Delpech, Lewis A. Dunn, David Fischer and Rakesh Sood, New York and Geneva 1994.

[US DOE (1994)] US Department of Energy, Press Release, June 26, 1994

[Weinstock/Fainberg (1986)] Weinstock, E.; A. Fainberg: *Verifying a Fissile Material Production Freeze in Declared Facilities with Special Emphasis on Remote Monitoring.* In: Tsipis, C.; D. Hafemeister; Janeway (eds.): *Arms Control Verification: The Technologies the Make it Possible.* 1986.

2.3 Beyond the MTCR: Non-proliferation and disarmament of nuclear capable delivery systems

Coordinators: George Lewis, Jürgen Scheffran
Contributors:[103] *Li Bin, George Lewis, Lora Lumpe, Eugene Miasnikov, Götz Neuneck, John Pike, Jürgen Scheffran, Maxim Tarasenko*

2.3.1 Relations between weapons of mass destruction and delivery systems[104]

The proliferation of weapons of mass destruction (WMD) is widely seen as a main challenge for future arms control and disarmament efforts. Western governments in particular have given priority to curbing the proliferation of nuclear, biological and chemical (NBC) weapons and their delivery systems. In general, "conventional weapons" (e.g. bomb attacks against cities, cluster bombs or land mines) which can produce large damage and many casualties are not categorized as WMD. As the Office of Technology Assessment (OTA) has stressed: "Not only are weapons of mass destruction and their delivery systems spreading, but so are advanced conventional weapons, along with equipment needed to build a command, control, communication, and intelligence infrastructure."[105]

Many reasons can be found for acquiring WMD and related delivery systems, from nuclear and conventional deterrence to national prestige or terrorist purposes. The possession or indigenous production of WMD, especially nuclear weapons, are mostly justified by pointing to the nuclear systems of other countries (i.e. India to China) or to the conventional superiority of the other side (Pakistan to India), demonstrating the strong interconnection between nuclear forces and conventional balances.[106]

Many countries have agreed to eliminate biological and chemical weapons in the Biological Weapons Convention (BWC) and the Chemical Weapons Convention (CWC); in the Non-Proliferation Treaty (NPT) they also pledged to forgo or eliminate nuclear weapons. The proliferation of delivery systems is one of the critically important issues related to the overall nuclear non-proliferation (NNP) agenda, but as of today there is no multinational treaty prohibiting the development and use of delivery systems. Although the NPT preamble emphasizes "the elimination from national arsenals of nuclear weapons and the means of their delivery pursuant to a Treaty on general and complete disarmament under strict

[103]Not all contributors are signing all parts of this section. Where appropriate the authors who have drafted major parts are indicated in a footnote.
[104]The main contributor to this section is Götz Neuneck.
[105]See [OTA (1994)], p.2.
[106]See [Steinberg (1994)].

and effective international control", the NPT does not further specify how this ultimate goal could be achieved for delivery systems.

Restricting the "vectors" for carrying WMD and conventional weapons is important in reducing the threat posed by such weapons. Most attention has been focused on missiles which are very fast, do not need a pilot and can carry different payloads over a long distance. A number of missile types exist, including surface-surface missiles, unmanned aerial vehicles (UAVs) and antiship- or anti-aircraft missiles which are today widely available on the international arms market. While many Third World countries possess missiles with ranges up to 300 km which could be used to threaten neighbouring countries with WMD, the indigenous development of long-range missiles is a complex, time-consuming and costly venture.

For some observers the missile threat is exaggerated. A Stanford study found "that modern aircraft are, indeed, very capable and cost-effective alternatives for ground-missions."[107] Modern combat aircraft are high-tech systems which are now in the hands of the military all over the world.

Beside missiles and aircraft, a wide range of "low-technology" delivery systems exists – such as civilian cars, ships or even suitcases – which can transport nuclear or other payloads. However, missiles and combat aircraft are designed to fulfill "military missions" more rapidly, more controllably and perhaps more reliably than civilian means.

To deliver WMD to their targets, it is not necessary to rely on so-called high technology. The German V2 and even the Soviet Scud are based on technologies of the 1940s and 1950s. Much of the information necessary to design and construct short-range missiles is publicly available.

The example set by the overwhelming military arsenals of West and East, local tensions and latent conflicts, and by the symbolic value of missile forces give some Third World countries strong incentives to buy existing "low-tech" missiles (Frog, Scud), to improve or modify them (Al Hussein, Iraq) or to produce and sell them to other Third World countries (North-Korean Scud production). But there is also a clear superiority in numbers, categories and capabilities in the missile arsenals of the West compared with those from the Third World. These western missile forces provide an excuse for many militarized regional competitors to justify their own missile programs.

An action-reaction cycle could develop, if states feel obliged to counter proliferation by more rigid diplomatic and punitive military measures such as:

- economic sanctions and diplomatic isolation
- preparation for missile defense and protection measures
- preemptive attacks by conventional forces and cruise missiles

[107] See [Stanford (1991)], p.2.

Such approaches, albeit with differing priorities, are ingredients of the US Defense Counterproliferation Initiative. Careful analysis is needed to understand the implications and consequences of a policy depending heavily on coercion for its effectiveness.

In the longer run, the only way to prevent the possession of WMD and related delivery systems will be to convince states, including the nuclear weapon states, to give up the option of having WMD. For this purpose international norms have to be implemented. Depending on the actor, its motive and instruments, there are different peaceful strategies for inhibiting the proliferation of weapon systems and production technologies, both on the demand and on the supply side. These include:

- global and regional disarmament, including arms control and conflict resolution measures;
- barriers such as export controls;
- cooperation and incentives to give up NBC possession.

On the supply side, there are three origins of proliferation: the traditional arms trade, which is dominated by the West, indigenous industries and the black market. States should contemplate stricter export regulations at the international level.

The current approach to curbing missile proliferation, the Missile Technology Control Regime (MTCR), has scored some successes – at least, if compared with the situation prior to the existence of the MTCR. Initiated in 1987 with seven members, MTCR membership has grown to 25 countries, with Argentina and Hungary as the most recent members, and additional countries - including Russia, China and Israel - have pledged to abide by the MTCR.[108] Although the MTCR has been effective in creating an international norm against missile exports and has delayed some missile programs, more significant accomplishments are impeded by several problems:

- Although they can slow-down the military technology flow, supply-side controls are incapable of stopping the spread of missile technology in the long run.
- The MTCR has no specific verification and enforcement mechanisms.
- Rigid export control of dual-use goods impedes civil technology cooperation and the economic interests of suppliers and recipients.
- The MTCR does not address the already existing ballistic missile arsenals of the great military powers and their allies nor the numerous shorter-range missiles already deployed in developing countries.

[108] See [Ozga (1994)].

- The asymmetry between "haves" and "have nots" is seen as discriminatory by regional powers in the developing world, fuelling their drive for indigenous missile development.

Since the existing regime does not deal with motivations, which lead some states to seek rocket technology and other states to supply it, supply-side controls against missile proliferation need to be complemented or replaced by more cooperative, demand-side oriented solutions that go beyond the MTCR.

The 1993 UN Register of Conventional Weapons is a first step towards global transparency of arms sales in at least some weapon categories. It should be extended to cover domestic inventories, production figures and other items. An international secretariat with the mandate to monitor the transfer of production technologies could be established. Its functions could include establishing lists of dual-use technologies, comparing national export regulations and adopting the principles and procedures of the NPT, the CWC, the BWC and MTCR within an agreed international framework.

Regional security arrangements are flexible in applying safeguards, disengagement zones and confidence building measures (CBMs). The traditional concept of arms control, born in the framework of the Cold War, should be extended, and multilateral arms control approaches should be developed in the future including: architectural measures (e.g. security zones), structural measures (restructuring forces for purely defense purposes), operational measures (limiting the size, structure and frequency of military activities), declaratory measures (restricting military R&D or defense budgets) and test bans.

Cooperative activities, based on equal rights and duties for all countries, are also required for missile controls. Regional solutions for arms control are important, including for example:

- CBMs like launch notification and exchanges of information, including establishment of data centers;
- conversion programs;
- common seminars on military forces and strategy;
- a regional missile test ban, including an adequate verification regime (e.g. on-site inspections);
- a freeze of R&D on missile technologies for military purposes.

The development of a cooperative security policy could begin with informal discussion forums involving politicians, scientists and the military from industrialized and developing countries, leading to a more formal diplomatic process, as exemplified by the CSCE. A cooperative security policy in the fields of missile development and nuclear weapons has become a successful political process in the relations between Argentina and Brazil. A process of

confidence building has been started in the Indian-Pakistani relations mainly concerning border disputes. Confidence-building agreements are the first steps towards more binding engagements such as treaties for disarmament, agreements on changes of force structure and military doctrine and agreements on industrial and economic cooperation. The disarmament process in Europe has shown that a change of structure of the conventional forces, eliminating the capacity for large scale invasion, has been linked to nuclear disarmament. The same link could be valid in other regions (i.e. South Asia). Thus an investigation of the possibilities for cooperation in civilian fields of advanced technology between industrialized countries and developing countries, as a strategy of security policy, should be initiated.

2.3.2 Measures to control nuclear-capable delivery systems

Ballistic missile elimination[109]

Ballistic missiles allow states to strike distant targets quickly, with little warning, and with a high probability of penetration. Ballistic missiles played a destabilizing role and wasted enormous resources during the Cold War. Now, grave concerns are raised about the spread of ballistic missile systems and technologies, in particular to the Middle East, South Asia and the Korean Peninsula. The extensive use of ballistic missiles as weapons of terror in the two Gulf Wars highlighted the political significance of ballistic missiles in regional conflicts, even if their military utility is negligible. The emerging ballistic missile threat is increasingly used as an argument to develop ballistic missile defenses.

The control of ballistic missiles needs to be discussed in the context of other relevant delivery systems for WMD. Closing the window on ballistic missiles as a delivery option would set an important precedent for controlling all delivery categories and would facilitate achievement of a Nuclear Weapons Free World.

To remove the ballistic missile threat and prevent destabilizing military reactions to missile proliferation, comprehensive disarmament measures - going beyond the MTCR - are required. As a long-term vision, a Ballistic Missile Convention (BMC) would aim for a global ban and the elimination of ballistic missiles, in conjunction with a Nuclear Weapons Convention (NWC). The process towards a BMC would:

- delegitimize missiles as symbols of military, technical, economic, and political prestige;
- enhance global security and stability by increasing decision-making time and removing the threat of accidental ballistic missile launch;
- prevent more states from generating ballistic missile threats and avoid the financial and security costs of an arms race between ballistic missiles and defenses against them;

[109]The main contributors to this section are Lora Lumpe and Jürgen Scheffran.

- be cheaper, more effective and less destabilizing than anti-missile systems;
- not obstruct legitimate civilian space efforts;
- have a political appeal because it aims at the elimination of a complete class of weapons and as a non-discriminatory agreement would balance the interests between industrialized and developing countries.

One possible model for the elimination of offensive ballistic missiles is the ZBM (Zero Ballistic Missile) regime which has been developed and discussed by the Federation of American Scientists (FAS).[110] A ZBM regime could be implemented in four stages:

- *Stage I:* The U.S. and Russia would agree to make substantial and accelerated cuts beyond those negotiated in START II in the number of deployed missiles; ballistic missile-free zones would be negotiated in certain regions.
- *Stage II:* An international Missile Conference would be held to discuss critical issues; the implementation of the regional ballistic missile-free zones and reductions announced in Stage I would be negotiated.
- *Stage III:* The ZBM regime would be designed; an International Agency for Ballistic Missile Disarmament (IABMD) would be created to supervise the ZBM process and to provide technical and diplomatic assistance to states.
- *Stage IV:* All states would move on varying schedules to a zero ballistic missile capability no later than an agreed period of years.

Very important is the combination of global ballistic missile reductions and regional ballistic missile free zones. The elimination schedules should be adapted to the specific regional security concerns. During this process, critical issues of verifiability, cost, stability and security need to be resolved, both in a regional and global context. For example, low missile numbers would raise questions of stability against small variations and uncertainties. Missile defenses would complicate a stable transition down to zero missiles.

A ballistic missile flight test ban

A Flight Test Ban (FTB) for ballistic misssiles would be an important tool for curbing missile proliferation and a precondition for a BMC. The United States and the Soviet Union considered limitations on testing ballistic missiles throughout most of the history of the Cold War.[111] Some restrictions were eventually adopted in the SALT II, INF, and START treaties. The ABM Treaty restricts testing of missiles for strategic defense.

[110] See [FAS(1992)], [Frye (1992)] and [Lumpe (1993)].
[111] See [Hussain (1981)], [Schelb (1988)].

A testing prohibition would be effective because: a) flight testing is essential to achieve any degree of confidence that a ballistic missile system under development will work as intended; and b) such a ban would be more readily verified than many other arms control agreements. Developing and testing new ballistic missiles requires an expensive testing infrastructure, unaffordable for many developing countries. However, the vast majority of ballistic missiles in developing countries were imported and deployed with little or no additional testing; using short-range ballistic missiles as deterrents, or as counter-city weapons of terror does not require extensive testing. But the third world missile development or upgrade programs of greatest concern – those aimed at achieving accurate inertial guidance, solid fuel and multi-staging – must flight test.

Agreeing to a comprehensive military missile flight test ban in the near term would be one demonstration of the commitment to nuclear arms reduction which the superpowers pledged in the NPT. The entire world would benefit by decreasing the chance of accidental or intentional nuclear war through continued development of strategic missiles. Assuming non-transfer of further missiles, a testing ban would halt costly, destabilizing and deadly regional missile races.

Certain developing countries would also be relieved of anxiety about the United States and Russia re-targeting ICBMs or SLBMs on them. Such fears would likely motivate some developing countries to pursue their own long range missile development as a deterrent. In addition, the development of the ultra-high accuracies needed for conventional SLBMs - a plan under discussion in the US Navy - could destabilize the US-Russian nuclear relationship and re-energize the qualitative nuclear arms race. A flight test ban would preclude these developments and would also preclude China from developing new ICBMs and SLBMs with improved guidance and a MIRV (multiple independently targeted reentry vehicle) capability.

Undoubtedly, flight testing restrictions would hamper and could even make impossible the spread of long range missile capability. The main question relevant to the feasibility of a global flight test ban regime is whether the United States and the other strategic missile states are truly concerned enough about ballistic missile proliferation to rein in their own military activities.

Verification

Verification of both BMC and FTB regimes is a crucial issue. Effective implementation of a BMC would require comprehensive safeguards and a verification system, whose task seems to be less demanding than that of the Chemical Weapons Convention. Most important would be measures to prevent the transformation of space launch technology into ballistic missiles.[112] Despite their inherent similarity, differences in basing modes, testing procedures, payloads, flight trajectories, guidance systems and reentry characteristics could be used as indicators to distinguish between the two. During testing, production and deployment, national technical means of verification (sensors, intelligence) would focus on observable rocket characteris-

[112]See [Scheffran (1993),(1994)]

tics (number, size, range, payload, deployment mode, launch preparations, flight trajectory) which provide indications of rocket type and performance. The missile testing infrastructure, which includes production and destruction facilities, development programs and test ranges, tracking and communication facilities, missile containers and missile-carrying vehicles is also highly visible.

A comprehensive flight test ban would be far easier to verify than existing arms control undertakings. As then CIA Director William Webster acknowledged in May 1989, "The status of missile development programs is less difficult to track than nuclear weapons development. New missile systems must be tested thoroughly and in the open...."[113] U.S. Defense Support Program (DSP) early warning satellites reportedly detected all of the Scud launches during the 1991 Gulf War. In addition, airborne reconnaissance aircraft and the E-8A Joint Surveillance Target Attack Radar System (JSTARS) detected missile activity during the war. The US Air Force is now creating a data base on radar measurements of the exhaust plume of various missiles, and Los Alamos National Lab is developing a transportable light detection and ranging (LIDAR) system which can rapidly and accurately identify missile exhaust plumes.

During flight tests and space launches, missiles transmit a stream of electronic data on the missile's performance to monitors on the ground. Interception of this telemetry could expose military-related upgrades on ostensible space launcher flights, in particular, if non-encryption of transmitted data is agreed upon. Violation of the non-encryption principle might provide early indication of intention to break out of a missile FTB.

In order to build the strongest possible wall between ballistic missile tests and space flights, Robert Sherman and others have suggested verification measures that could be applied at each stage of flight.[114]

- A test ban regime could prohibit high-speed reentry, terminal maneuvers and the use of radar-emitting reentry vehicles. Legally permissible re-entry angles could be defined to distinguish between re-entering spacecraft and weapons payload re-entry vehicles.
- The release of objects sharing the weight and velocity change of catalogued missile reentry vehicles could be banned.
- Since all US ICBMs and the more modern of the Soviet ICBMs use solid-fuel rocket engines, new space launch vehicles could be required to utilize non-storable liquid fuel engines.
- Internal inspection of missiles and space vehicles may be required to ensure that guidance systems being tested on a space shuttle or space launch vehicle are not intended for an ICBM.

[113] See [Webster (1989)].
[114] See [Sherman (1987)], [Zimmerman (1993)], [Wilkes etal. 1991], [Thomas (1988)], [Howes (1993)].

- Restrictions on static testing of rockets could also be used as a verifiable measure of compliance with a pledge to forgo missile development.

To limit the risk of space launchers being used for ballistic missile development, technical means of verification need to be accompanied by cooperative verification and confidence building measures. These include information exchanges on relevant missile characteristics and facilities, including information on ballistic missile tests and space launches, non-encryption of telemetry and the establishment of data centers. Reconnaissance overflights, as agreed on in the Open Skies Treaty, could provide an alternative to satellite monitoring for many countries. Most important would be inspections to detect reliably evidence of non-compliance and to help provide assurance that no military ballistic missiles are being developed under a civilian space program. Several types of on-site inspections could be applied:[115]

- Observation of ballistic missile tests and space launches
- Routine and challenge inspections of missile and space launch facilities
- Pre-launch inspections
- On-site monitoring of production and destruction facilities

Since countries and companies that launch space rockets don't like to open up their payloads for inspection, non-intrusive devices and techniques could be used for determining the basic payload type without disclosing proprietory information. Scanning and radiographic devices, for instance, could discover reentry vehicles on top of a rocket.

Under a safeguards system for space launchers some of the "most critical" items identified in the MTCR could be placed under an IAEA-like supervision. A separate organization, like the IABMD proposed in the ZBM concept, could oversee the complete elimination of ballistic missiles for military purposes, monitor space launch activities on a global scale, permit conversion of decommissioned ICBMs to space launchers, and might also perform safeguards measures and pre-launch inspections needed to control dual-use items and to investigate suspect declarations. International cooperation and technology transfer in civilian space programs would be also important in containing misapplications of space technology for missile development (see the following subsection).

[115] See [Altmann (1993)]

Controlling land-attack cruise missile proliferation[116]

Should we be concerned about cruise missile proliferation?

Although naval ship-attack cruise missiles are now widely distributed, the more difficult problems involved in flying to, locating, and attacking land targets have so far limited the spread of land-attack cruise missiles. Only the United States and Russia (and possibly a few of the other Soviet successor states) are known to have such weapons, although countries such as France and Britain may soon deploy them. However, the deployment of the United States' Global Positioning System (GPS) navigation satellites has eliminated or reduced many of the most difficult problems involved in producing land-attack cruise missiles, potentially opening the door to widespread proliferation of land-attack cruise missiles.

Cruise missile proliferation has so far received relatively little attention from arms control and international security analysts.[117] The proliferation of land-attack cruise missiles, if it occurs at all, is still in its very early stages, and it is difficult to predict its future course or consequences. An argument can be made that cruise missiles may not be attractive to proliferators because they may be highly vulnerable to defenses and would be dependent on systems (such as GPS) that are not under their national control, or that such proliferation would not pose a very serious additional threat since many countries already possess attack aircraft.

However, there are a number of reasons for believing that the proliferation of land-attack cruise missiles could become an important international security problem:

- Cruise missiles are likely to be much easier to build than advanced attack aircraft or ballistic missiles.
- Unlike attack aircraft, cruise missiles do not require highly trained pilots nor do they place pilots at risk. If designed to be launched using small rocket boosters, they may also be much less vulnerable than airplanes to preemptive or suppressive attacks.
- Cruise missiles are potentially very inexpensive compared to both ballistic missiles and attack aircraft. Thus they could be deployed and used in large numbers. It also means that they can tolerate a much higher attrition rate than airplanes and so may be effective even against an adversary with a superior air force.
- Using GPS guidance information, cruise missiles are potentially highly accurate (roughly 50 meters). As conventional terror weapons, such accuracy would provide significantly higher lethality than current ballistic missiles. Moreover such an accuracy would provide some capability against certain types of military/industrial targets. Thus cruise missiles could be viewed as legitimate military weapons (and cannot easily be

[116]The main contributor to this section is George Lewis.
[117]One book on the subject is [Carus (1992)]. See also [Arnett (1992)].

stigmatized as just "terror" weapons as it is currently the case with ballistic missiles). Post-Gulf War U.S. use of cruise missiles to send "messages" to Iraq set a particularly bad precedent in this respect.

- Cruise missiles are well suited for delivery of submunitions or chemicals.
- Proliferation of cruise missiles could drive proliferation of advanced (and expensive) air defenses and warning systems.

What is the nature of the threat posed by cruise missile proliferation?

The characteristics and capabilities of future cruise missiles are highly uncertain. It would be a mistake to assume that they will be very similar to the cruise missiles used by the United States during the Gulf War. Future cruise missiles of proliferation concern could range from converted military or civil aircraft to jet or propeller driven purpose-built missiles. They could be launched from the ground, from airplanes, or from ships. They could employ a wide range of guidance techniques, particularly at shorter ranges, but at longer ranges the US GPS satellite system or the similar Russian GLONASS system will almost certainly be the key navigation method. Although purpose-built cruise missiles are likely to have at least moderately low radar cross sections, if they are to be used against opponents with modern air defenses, low altitude flight will be required, and this is likely to be one of the most difficult challenges facing a cruise missile designer. Missile ranges will likely be comparable to those of ballistic missiles of current proliferation concern: a few hundred up to perhaps a thousand kilometers, although longer ranges are possible with larger missiles.

As is the case with ballistic missiles, for the foreseeable future, cruise missile proliferation will be primarily a regional threat. Countries with no or weak air surveillance/defense capabilities will be most vulnerable, but few countries have a comprehensive air surveillance/defense capability, and thus most countries would be vulnerable to at least some extent.

Civilian targets are certainly vulnerable to cruise missile terror attacks, since cruise missiles would be expected to have accuracies much better than the Iraqi Scuds used during the Gulf War. However, the ability of cruise missiles to pose a significant military threat is much more problematic and will depend on the specific scenario. For example, U.S. forces intervening in a regional conflict could be attacked by cruise missiles, but are likely to be well defended against such attacks, since defenses against cruise missiles are essentially the same as defenses against low-flying aircraft.

The overall reliability (including their vulnerability to defenses) of cruise missiles may be relatively low, since low-flying cruise missiles may have a high crash probability while higher flying missiles will be more vulnerable to air defenses. This may make cruise missiles unattractive as nuclear delivery systems. However, the attractiveness of cruise missiles as nuclear delivery systems will depend to some degree on the success of efforts to limit ballistic missile proliferation and on the effectiveness of future ballistic missile defense systems.

What can be done about cruise missile proliferation?

As with ballistic missiles, supplier control regimes can buy some time, but cannot by themselves prevent proliferation. Supplier control regimes may to some extent limit the capabilities of cruise missiles that do get deployed by preventing the optimization of characteristics such as radar cross section and minimum flight altitude, and could also help limit the size of the missile forces that are deployed. Most of the important components and technologies for producing effective cruise missiles such as (lightweight and fuel efficient) jet engines, highly precise gyroscopes and accelerometers, flight control systems, radar altimeters, etc., are already controlled by the Missile Technology Control Regime (MTCR). However, in many cases, alternate or less precise technologies that are not controlled could be used, and in general, the technological barriers to building cruise missiles appear to be much lower than those for building ballistic missiles. Many countries already possess much or all of the technology base required to build cruise missiles.

Arms control agreements could be used to limit or ban cruise missiles. Such agreements could be coordinated with agreements on ballistic missiles. For example, all missiles exceeding the MTCR guidelines could be banned. It might be necessary to include naval anti-ship cruise missiles, as these could potentially easily be modified for land-attack use. Verification of limits on cruise missiles is much more difficult than for ballistic missiles, but as the INF Treaty demonstrates, this is not an insurmountable problem. It probably makes the most sense to start with regional approaches (such as the 1991 Bush Middle East initiative), although it might be desirable to obtain pledges by outside countries not to use missiles against countries that forego obtaining them.

Air defenses and other countermeasures could reduce the threat posed by cruise missile proliferation (and might also be able to deter, to some extent, countries from seeking to acquire them). Air defense missile manufacturers are already arguing that defenses are the only viable response to cruise missile proliferation. Currently, most countries would not even be able to detect, much less shoot down, more than a small fraction of low-flying cruise missiles. Warning systems are certainly possible and need not be extremely expensive. Modern missile-based air defenses are largely untested against low-flying targets, but a country willing and able to spend enough money can probably obtain a substantial degree of protection. Other countermeasures, such as jamming GPS signals, are technically feasible, but as with defenses, their effectiveness and consequences need to be assessed in specific regional scenarios. However, it is far from clear that most countries facing a cruise missile proliferation threat would be willing or able to spend the money required to establish such defenses (or even that doing so would be a good idea).

In general, cruise missiles share characteristics of both ballistic missiles and attack aircraft. Like ballistic missiles, they can be used essentially only for offensive purposes, and thus would seem to be very deserving of efforts to control their proliferation. However, it may be much more difficult to limit the proliferation of cruise missiles because essentially all of the technologies required to produce them have wide civilian applications. In many other

important respects, cruise missiles more closely resemble attack aircraft. In particular, the technology base required to produce cruise missiles is essentially identical to that required to produce airplanes, cruise missiles are vulnerable to the same types of defenses as airplanes, and the military utility of cruise missiles is closer to that of attack aircraft than to that of ballistic missiles (and cruise missiles are increasingly seen as being able to substitute for aircraft in at least some roles). These considerations suggest that while it is certainly desirable to continue efforts to limit the proliferation of cruise missiles through the MTCR and other missile-oriented approaches, it may also be desirable and even necessary to adopt arms control approaches that treat cruise missiles and attack aircraft as closely related aspects of the same arms control problem.

An international control regime for combat aircraft[118]

In marked contrast to ballistic missiles, combat aircraft with equivalent capabilities are widely distributed across the globe. There are only a few hundred, certainly fewer than 1000, ballistic missiles with ranges beyond the 300 kilometer MTCR limit in the hands of Third World states. But the MTCR standard of a 300 kilometer range with a 500 kilogram payload covers the entire range of military combat aircraft, down to the smallest jet trainers. Of the over 40,000 military aircraft operational in the world today with range and payload capabilities in excess of those of the MTCR threshold, over 8,000 of these are deployed in Third World countries. And most of these aircraft can carry warloads significantly greater than 500 kg over ranges greatly in excess of 300 km.

The presumed ascendancy of stealth aircraft and ballistic missiles is predicated on extreme estimates of the effectiveness of air defenses. But combat experience suggests that per-sortie attrition rate may be rather low, typically on the order of only a few percent. The probability of a combat aircraft not reaching its target due to air defenses is of the same order as the probability of a missile not reaching its target due to mechanical failure, since at least 10% of missiles launched fail in flight.

Missiles do not seem to offer significant advantages for surprise attack or delivery of weapons of mass destruction relative to aircraft. For the delivery of conventional munitions, aircraft can offer distinct advantages. And for newly emergent nuclear powers, combat aircraft are the delivery systems of choice. The offensive potential of counter-airfield operations by combat aircraft may pose greater threats of crisis instability than missiles. And dual-role combat aircraft certainly offer greater operational flexibility than single-mission missiles. But the military potential of combat aircraft is much more highly dependent on the number and quality of support personnel and pilots.

Aircraft add to crisis instability because of their inherent capabilities, namely speed, firepower, and range. Especially in regional theaters, aircraft lend themselves well to surprise

[118]The main contributor to this section is John Pike.

combat. Combat aircraft can be compared to MIRVed (multiple, independently targeted reentry vehicle) missiles. One aircraft can destroy several, or ground several, if an airfield is destroyed. Therefore, a strong pre-emptive motive exists to initiate counter air operations. In a crisis, there is a compelling incentive to "use 'em or lose 'em."

This broad range of capabilities is matched by equally diverse means of acquiring combat aircraft. A growing number of countries have indigenous design and production capabilities. A range of first-rate aircraft are for sale in the international market-place. A secondary market exists for used or refurbished aircraft, and some entrepreneurs are offering their skills for hire.

The technical complexity of combat aircraft provides a unique opportunity for control of the diffusion of this capability through supplier restraint. The full suite of airframe, engine and avionics technologies required for the development and production of competent combat aircraft remains a challenge that has been mastered by only a few – Russia, Europe and the United States of America. The development and production efforts of all other countries have been aided in whole or in part by these suppliers. The technical barriers to domestic development and effective integration of the complex combination of technologies required for combat aircraft have only been exceeded by the willingness of suppliers to offer such systems on the international market. In contrast to weapons of mass destruction, or ballistic missiles, which have been subject to various constraints on international transfers, global sales of combat aircraft are currently accepted as a legitimate form of international commerce. Indeed, the governments of supplier countries actively encourage such sales in this highly competitive market place.

The policies of the American government toward proliferation of combat aircraft have varied greatly over time. Through the 1960's American policy was generally to discourage acquisition of advanced aircraft, since such expenditures were held to detract from economic and counterinsurgency priorities. Efforts in the early 1970s by the Nixon Administration to increase sales to oil-producing countries were tempered by Carter Administration policies intended to discourage sales of sophisticated weapons, which were in turn quickly abandoned when the Reagan Administration took office.

Multilateral restrictions on combat aircraft sales have had even less success than U.S. unilateral efforts. The Carter Administration held Conventional Arms Transfer (CAT) Talks with the Soviet Union during 1977 and 1978, which had not led to significant results when they were terminated in December 1978. One of the aims of these negotiations was bi-lateral restrictions on the export of offensive delivery systems, including ballistic missiles and aircraft.

While the Carter Administration's CAT initiative eventually led to the Reagan Administration's Missile Technology Control Regime, combat aircraft remained uncontrolled. In response to this gap, in February 1989, Rep. Howard Berman (D-CA) introduced a proposed Missile Technology Control Act that also applied to other delivery systems for weapons of mass destruction, including combat aircraft, but the Congress has not acted on these provisions.

The continuing military utility of combat aircraft, coupled with their widespread availability, suggest the difficulties of limiting their further spread. The overwhelming success of airpower in Operation Desert Storm further wheted the international appetite for increasingly sophisticated combat aircraft. Because of the effectiveness, destabilizing nature, and geometric spread of combat aircraft, however, this craving must be denied, and developing and developed countries alike must go on an combat aircraft diet.

Perhaps the most forceful argument for acting now to limit the spread of combat aircraft is that their spread has taken on geometric proportions. Not only is the number of aircraft increasing at an alarming rate, but the number of combat aircraft producers is increasing as well. Between 1981 and 1988, the United States, the Soviet Union and actors, such as India, Brazil, Argentina, Israel, and others began to transfer combat aircraft on just a fraction of this scale.

Controlling the proliferation of combat aircraft clearly represents a high priority challenge to policy makers. To address this growing international security threat, there are four broad avenues from which to choose. First, understanding that proliferation is indeed a problem, policy makers could choose to continue present policies, deeming them an adequate response. Second, a multilateral supplier control regime, similar to that currently in place for nuclear weapons or ballistic missiles could be emplaced. But as with the nuclear non-proliferation regime, this would probably require restraining aircraft deployments by supplier countries as well. Third, air defense systems could be deployed to counter combat aircraft threats.[119] Finally, states could focus on building regional arms control regimes to resolve the problems associated with proliferation.

Current policies of "peace through superior firepower" could lose ground, if transfers of current generation aircraft continue and if the latest generation of combat aircraft, such as the F-22, Eurofighter 2000 and MRI fighters, conceived during the Cold War, prove unaffordable in the post-Cold War environment.

A second path to stem the tide of combat aircraft would be to coordinate a multilateral control regime, similar to the MTCR, among supplier countries. There are several potential variations of this option. The CACR (Combat Aircraft Control Regime) could control aircraft transfers, or focus on supporting technology; such as spare parts, for example. Controlling the export of avionics and engines, the most difficult components for a nascent aircraft industry to develop, would be another option. The CACR members could attempt to control the spread of all types of aircraft, or limit the spread of "offensive" aircraft while even encouraging the transfer of "defensive" platforms. The success of this regime would depend on symmetrical constraints on the activities of supplier states, as the Nuclear Non-Proliferation Treaty shows. This would consist of a global ban on new types of combat aircraft.

A complementary approach to controlling aircraft proliferation would be to foster regional arms control agreements and confidence and security building measures (CSBMs). By nego-

[119]This option will not be further discussed here.

tiating reductions in aircraft arsenals, or at least freezes, one would reduce the demand for the commodity, which is more effective than reducing the supply

Restricting submarines[120]

Compared to other nuclear capable delivery platforms, submarines can operate covertly, so that it is very difficult to monitor their location continuously. Due to their stealth, long range (more than 10,000 miles), and ability to operate submerged for extended periods, submarines are potentially able to launch strategic or tactical nuclear weapons from close to the territory of an adversary. As a result, they pose a difficult to eliminate surprise attack threat.

Deployment of strategic weapons on nuclear submarines is widely recognized to be the best option for strategic deterrence. The sea-based component is the key element of the US, British and French strategic forces. These countries have deployed nearly half of their strategic arsenals at sea. By the year 2003, this list will likely include Russia, which could be required to dismantle its land based MIRV-ed missiles in accordance with the START II Treaty.

During the Cold War, nuclear weapons were widely deployed on nuclear powered submarines. Non-nuclear weapon states and "threshold" states do not possess such nuclear-powered submarines, nor are they likely to acquire them in significant numbers in the near future. However, because of the end of the confrontation between the superpowers and the increased number of regional conflicts all over the world, it is possible that modern conventional-powered submarines, which in some respects are as capable as nuclear-powered ones, could play a decisive role in military conflicts.

The first sea-based ballistic missiles were deployed on conventional diesel submarines. Because of the technical complexity involved, it is unlikely that non-nuclear states will deploy submarine launched ballistic missiles in the foreseeable future. However, currently some threshold states are considering deploying strategic sea-launched cruise missiles (SLCMs).[121] Modern "Tomahawk" type SLCMs, which can be used against ships and land targets, are compact enough to fit in standard torpedo tubes of submarines. Although threshold states are unlikely to be able to obtain cruise missiles as advanced as the Tomahawk, less capable cruise missiles could still create a serious threat. One cannot exclude the possibility of creating nuclear capable "Harpoon" or "Exocet" type missiles and mines, although this may be difficult for threshold states. Compact and stealthy conventional-powered mini-subs may represent the best platforms for delivering small saboteur groups and nuclear devices.

It should be noted that littorals and shallow waters, which are typical in potential conflict regions (such as the Persian Gulf, Mediterranean Sea, Indian Ocean, East-China Sea etc.) represent the ideal environment for a submarine. Submarines can easily hide in reefs, and

[120] The main contributor to this section is Eugene Miasnikov.

[121] On November 16, 1994, REUTER reported with a reference to a publication in "Jane's Defence Weekly" that Israel is considering such an option.

even lie on the bottom in shallow waters. Antisubmarine warfare (ASW) operations are very difficult to carry out effectively in shallow waters.

Modern submerged conventional submarines are more covert than nuclear ones. However, they have to surface periodically to charge their batteries. Therefore, the strategy of ASW operations against conventional-powered submarines consists of searching for surfaced or snorkeling submarines, which are detectable at distances of a few dozens of kilometers. At the end of World War II, on average submarines had to surface once every 24 hours. Diesel submarines of the 1970s to 1980s (Type 209, Kilo class)[122] can run submerged up to 72 hours and cover distances of up to 400 miles. The new generation of conventional-powered submarines developed in Sweden, Germany, France and Russia, has a combined propulsion system, which does not need air as an oxidizer. Therefore, the underwater endurance of such submarines can be increased by several times. Thus there is a danger of proliferation of conventional submarines which could be at least as difficult to detect as current nuclear submarines.[123]

Currently only highly developed countries are able to deploy effective anti-submarine warfare (ASW) systems. The Falklands War provides a good example of the kind of danger that these platforms can pose.[124]

Several specific measures must be taken in order to prevent the deployment of nuclear weapons on submarines by threshold states.

1. Sales of submarines and submarine deliverable weapons should be forbidden to the countries which have not signed the NPT Treaty.

2. Restrictions should be established on access to technologies which are critical for the production of stealthy, highly capable submarines and submarine weapons. Preferably, this would be carried out via the creation of an international regime, similar to the MTCR.

3. It may be desirable to create joint naval task groups under the framework of the UN, which could establish international control over the operation of diesel submarines in "hot spots." During a "period of danger," these joint task groups could monitor and trail diesel submarines of conflicting countries, and under proper circumstances prevent them from using their weapons.

[122]Currently, navies of 11 countries including India and Israel operate Type 209 submarines which were initially produced in Germany. Russian Kilo-class submarines have been purchased by Iran and India.

[123]For example, Pakistan has already signed a contract with France for the purchase of 3 "Agosta" class submarines, which can operate for almost 2 weeks without surfacing [Navy News (1994)].

[124]The Argentinean diesel submarine "San Luis" sailed 800 miles from its base and returned back successfully in spite of the fact that it faced 2 aircraft carriers, 15 escorts, dozens of ASW helicopters as well as nuclear attack submarines of the Royal Navy. See [Lionis (1994)].

2.3.3 Ballistic missile defenses and the ABM Treaty[125]

Ballistic missile defenses after the Cold War

In the late 1950s and early 1960s, the United States and the Soviet Union each began to develop nuclear-armed Anti-Ballistic Missile (ABM) systems. An arms race in ballistic missile defense (BMD) systems, which could have led to an even greater strategic nuclear offensive build up than actually occurred, was prevented by the ABM Treaty, which was concluded in 1972. The Treaty and its protocols, intended to prevent deployment of nation-wide ABM systems, specifically ban the development of any missile defense system with a capability against strategic targets and the testing of any missile defense system or its components against strategic targets. Only a single, limited ballistic missile defense system was allowed for each country.

Following the ratification of the ABM Treaty, BMD research continued at a relatively low level in both the United States and the Soviet Union. This situation changed when the Strategic Defense Initiative (SDI) was announced by President Reagan in 1983. SDI was intended to defend the United States against a large-scale Soviet nuclear missile attack by deploying a multi-layered defense system. Many proposed SDI systems would clearly have violated the ABM Treaty, and in order to be legally able to develop these systems, the Reagan Administration developed the so called "broad interpretation" of the ABM Treaty, which argued that the Treaty's limitations did not apply to systems based on physical principles other than those used in traditional ABM systems. The interpretation was never widely accepted and has been rejected by the Clinton Administration.

As the Cold War came to an end and the perceived Soviet missile threat declined, U.S. emphasis began to shift away from strategic defenses towards defense against shorter range tactical and theater missiles. This trend was accelerated by the Iraqi Scud missile attacks during the 1991 Gulf War which spurred renewed interest, particularly in the United States, in developing missile defenses. The Clinton Administration renamed the SDI program (calling it the Ballistic Missile Defense Organization), and heavily shifted its funding to theater missile defense systems. The election of a Republican Congress in 1994, will likely increase the pressure not only to expand theater missile defense (TMD) activities, but also to deploy a nationwide strategic defense.

Currently, missile defenses have been developed or are under development by at least the United States, Russia, Israel and Western Europe. In addition the United States has sold its Patriot missile defense system to a number of additional countries, and Russia appears to be willing to sell its S-300 system. Israel is now cooperating with the U.S. in developing its Arrow TMD system, and also appears to be very interested in developing boost phase defenses. A consortium of Western European countries are also developing a new TMD system.

The U.S. missile defense program is clearly by far the most active and advanced. The core

[125]The main contributors to this section are George Lewis and Li Bin.

package of the U.S. TMD program consists of the THAAD system, the Patriot Advanced Capability 3 (PAC-3) system – which will use the ERINT missile – and the Navy lower-tier defense system. A sea-based Navy upper-tier defense system, the U.S. Army's Corps Surface to Air Missile (Corps SAM) system, and an air-based boost phase interceptor system are all under consideration for future development.

It is not yet clear whether TMD systems can be built that will be effective enough to allow them to play an important role in responding to ballistic missile proliferation. The primary problem is that TMD systems are potentially highly vulnerable to countermeasures. This problem is well illustrated by the experience of the Patriot missile defense system during the Gulf War. Although the Patriot reportedly had a perfect test record, it was unable to deal with the maneuvers resulting from the apparently inadvertent instabilities and breakups of the Iraqi Scud missiles and was able to destroy few if any Scud warheads.

In addition, missile defenses have certain other drawbacks. They are likely to be highly expensive and thus be beyond the means of many countries. Even those countries that can afford them must spend money that could otherwise have been used for other military or social programs. Moreover, the acquisition of TMD systems by one country might simply spur its competitors to deploy more ballistic missiles or to equip their missiles with countermeasures – leading to the same kind of offense-defense competition that the ABM Treaty helped to prevent in the U.S.-USSR context. Any assessment of the value of missile defenses must weigh the potential benefits of such defenses against their drawbacks. Moreover, theater missile defenses are only one possible response to the threat posed by the proliferation of ballistic missiles; other approaches include arms control efforts to prevent proliferation or civil defense measures aimed at reducing the effects of missile attacks.

Theater missile defenses and the ABM Treaty

Perhaps the single most immediate and important issue raised by current TMD development efforts is their impact on the future of the ABM Treaty. This Treaty is one of the most important arms control agreements, and still appears to have a vital role to play in enabling further reductions in deployed nuclear weapons and in helping to stem nuclear proliferation.

The ABM Treaty was not intended to limit air defenses or theater or tactical missile defenses. However, to prevent strategic defenses from being developed while disguised as theater systems, the Treaty limits theater missile defenses in two ways. First, it prohibits giving TMD systems (or any other non-strategic defense system) a "capability" to counter strategic missiles, regardless of whether or not the system had demonstrated this capability in tests. Second, it prohibits testing TMD components or systems in an "ABM mode" – that is, testing them against targets with the characteristic of strategic missiles – regardless of whether or not the system was actually capable of successfully intercepting a strategic target.

However, the ABM Treaty neither defines the difference between theater and strategic missiles nor provides a definition of what it means to have a capability to counter strategic missiles. The United States and Russia have never reached a common understanding on how

to draw a line between theater and strategic defenses. However, the United States is now developing advanced theater missile defenses, such as THAAD and the Navy upper-tier system, for which the question of how to distinguish between theater and strategic defenses is a crucial issue. These systems are being designed to counter missiles with ranges of 3,000-3,500 kilometers, which have a reentry speed of about 5 kilometers per second.

It is clear, as the U.S. Administration has acknowledged, that the testing of THAAD, scheduled to begin in early 1995, would violate the ABM Treaty as currently written and interpreted. In order to be able to proceed with the testing and deployment of THAAD and other TMD systems, the U.S. Administration has proposed to Russia that the Treaty be modified to establish a dividing line between theater and strategic missile defenses. The proposed dividing line would permit the development, testing and deployment not only of THAAD, but also of even more capable missile defenses. However, in January 1995, the United States announced that it might proceed with THAAD testing even in the absence of an agreement with Russia.

In order to be able legally to develop and deploy some of its planned TMD systems, the United States has proposed modifying the ABM Treaty. Under the proposed changes, a missile defense will not be considered to be a strategic defense system unless it is tested against a target with a maximum speed greater than 5 kilometers per second. Moreover, the Treaty's prohibition against giving non-strategic defenses a "capability" against strategic missiles would be eliminated. Thus if the U.S. proposal is put into effect, any system that has not been tested against a target having a maximum speed greater than 5 kilometers per second would be considered to be a theater missile defense system, and thus not limited by the ABM Treaty, regardless of its actual capabilities to counter strategic missiles. Thus the U.S. proposal, which the Clinton Administration claims is only a minor "clarification" of the terms of the Treaty, in fact significantly alters the Treaty, and, as discussed below, undermines the fundamental objectives of the Treaty.

The U.S. Administration has argued that since strategic ballistic missiles, with a range of about 10,000 kilometers, reenter at a higher speed than theater missiles – about 7 kilometers/second – systems limited to tests against 5 kilometers/second targets would not have a significant capability against strategic missiles. However, the Administration has not published any analysis in support of this claim. In fact, the only detailed, publicly-available analysis shows that if TMD systems capable of countering 5 km/sec reentry vehicles can be built, these systems would have significant capabilities against strategic targets.[126]

The U.S. proposal is currently under discussion in the Standing Consultative Commission (SCC). In these discussions, Russia has reportedly proposed that an additional limit be added to the U.S. proposal – that interceptors be limited to a maximum speed of 3 kilometers per second. While this proposal would not prevent the deployment of THAAD or other TMD systems with significant strategic defense capabilities, it would prevent the deployment of

[126]See [Gronlund et al. (1994)].

some planned, more capable U.S. TMD systems, such as the Navy Upper Tier system, and the U.S. has reportedly rejected the Russian proposal. At present the negotiations remain deadlocked.

If implemented, the U.S. proposal would allow the development and deployment of ballistic missile defenses capable of countering strategic missiles, but exempt from any numerical or other limitations. In particular, these systems could be mobile and they could use space-based sensors for cueing and targeting. All these factors combined would make it possible to deploy such TMD systems to provide defense of a large part of a country's territory. The current U.S. proposal would thus effectively eliminate the ABM treaty as a mechanism for preventing the deployment of strategic defenses.

The implications of the proposed ABM Treaty modifications

The proposed changes to the Treaty, which are now under negotiation with Russia, have potentially serious and adverse implications for a wide range of international arms control and non-proliferation efforts.

There are at least four ways how the crippling of the Treaty could adversely affect international nuclear arms control and non-proliferation efforts: (1) by preventing further reductions in U.S. and Russian nuclear forces; (2) by preventing the three other declared nuclear nations – Britain, France, and China – from joining in nuclear arms reductions; (3) by interfering with efforts to bring the undeclared nuclear nations – Israel, India, and Pakistan – into nuclear arms control agreements; and (4) by undermining the nuclear Non-Proliferation Treaty (NPT).

(1) As the Clinton Administration has repeatedly emphasized, the ABM Treaty is indispensable to the START I and START II reductions and to longer-term reduction opportunities. The most obvious effect of the proposed Treaty modifications is that they would almost certainly impede future U.S. and Russian efforts to reduce their nuclear arsenals below the START II levels. In addition, it is entirely possible that currently planned START I and START II strategic nuclear reductions would not go forward due to uncertainties created by the prospect of large-scale deployments of strategic-capable defenses.

(2) The proposed changes to the ABM Treaty could not be ignored by the three smaller declared nuclear nations. Although Britain, France, and China are not parties to the Treaty, they all rely on the Treaty in their nuclear force planning. If the proposed Treaty changes were made, all three countries would face a situation in which the United States and Russia would both retain substantial nuclear forces and obtain the freedom to deploy strategic-capable defenses. Many of the key strategic missile systems of these countries are relatively short-ranged and would actually be considered theater systems if deployed by either the United States or Russia.

The threat of a vast expansion of strategic-capable U.S. and Russian defenses would certainly not be ignored by these countries, and it could lead them to expand their nuclear forces or to develop new and modernized nuclear weapons and delivery systems. At a minimum, in the

absence of a strong ABM Treaty, they must be expected to preserve an option to increase their nuclear forces in order to be able to overwhelm any defenses that might be built. Thus the proposed changes to the ABM Treaty would also likely undermine U.S. efforts to get these countries, China and France in particular, to join two key accords being sought as a means of stemming global nuclear proliferation – a comprehensive test ban (CTB) and a multilateral convention to ban the production of fissile material for weapons or outside of safeguards. The latter initiative was announced as the centerpiece of the U.S. nonproliferation program by President Clinton last fall at the United Nations.

(3) The developments discussed above could also have serious implications for the nuclear postures of the undeclared nuclear weapons states. In addition to capping the fissile material stockpiles of the nuclear weapons states, the fissile material production ban is also seen as a lever that could be used to bring the undeclared nuclear states – Israel, India, and Pakistan – into the international non-proliferation regime. If these countries, none of which are signatories to the NPT, could be persuaded to join this convention, it would be the first time that an international agreement has placed constraints on their nuclear weapons programs. However, without China's participation, getting India and Pakistan to join the convention would be essentially impossible.

Moreover, if China actually started to expand its nuclear arsenal, this could lead to a reciprocal build-up in India, which could in turn cause Pakistan to similarly build up. Moreover, the U.S. Administration's proposed changes to the ABM Treaty would make it legal for both the United States and Russia to sell or otherwise transfer advanced missile defense systems to any country. Such a threat could cause India and Pakistan to back away from a test ban or production cutoff so they could maintain options to counter defenses with buildups of their nuclear and missile forces. It could also have a similar effect on the Israeli nuclear program.

(4) The effects of the developments discussed above could well undermine the cornerstone of international efforts to prevent the spread of nuclear weapons – the Nuclear Non-proliferation Treaty (NPT). The NPT is explicitly conditioned on the pursuit of nuclear disarmament by the nuclear weapons states. By preventing further nuclear reductions, and possibly leading to backsliding on nuclear disarmament by both the declared and undeclared nuclear states, the ABM Treaty changes could seriously weaken the NPT regardless of the outcome of the NPT extension conference.

2.3.4 International space cooperation and conversion of the aerospace complex[127]

Increasing the effectiveness of efforts to curb the proliferation of delivery systems requires dealing with all the interrelated aspects of the problem, including the dual-use nature of aerospace technologies, the internal desire of established powers to employ their available

[127]The main contributors to this section are Maxim Tarasenko, John Pike and Jürgen Scheffran.

aerospace capabilities, and other countries' demands for related technology. This section considers international space cooperation and aerospace conversion as a means to discourage proliferation of delivery systems and to prevent the use of a principal delivery means of today - long-range ballistic missiles (LRBMs).

Rationale for space cooperation and aerospace conversion

In several ways, international space cooperation and aerospace conversion would facilitate as well as benefit from a transition to a nuclear weapon free world (NWFW):

- A non-discriminatory approach to the non-proliferation of nuclear weapons and delivery systems would increasingly replace tight export controls of sensitive aerospace goods, which is contrary to the interests of both suppliers and recipients in the aerospace business.
- Aerospace cooperation with developing countries could undermine their interest in building their own national aerospace capabilities, which could serve as a basis for delivery systems.
- International space cooperation and aerospace conversion in the states of the former Soviet Union would serve their economic interests and could make the best use of their enormous aerospace capabilities.
- Aerospace cooperation could serve as a means of confidence building and would improve the conditions for verifying the non-proliferation and disarmament of missiles and aircraft.
- The conversion of both the nuclear and the aerospace complex would free resources which could be used to finance nuclear disarmament or the application of aerospace capabilities to the solution of global problems.
- The conversion of the nuclear and the aerospace complex would make the transition to a NWFW more controllable and irreversible.
- The process towards elimination of the nuclear threat would substantially improve the international climate, creating better conditions for international trade and economic cooperation in civil aviation and spaceflight.

In the past conversion has largely focused on military industrial facilities. To be effective, long-term conversion strategies need to include conversion of the large R&D complex which forms the basis for the early stages of a weapons life-cycle, particularly in the aerospace field.[128] To make conversion irreversible, preventive arms control measures are needed to

[128]Some ideas concerning aerospace conversion can be found in [UN (1993)].

restrict destabilizing technical developments that might occur or begin in the R&D phase.[129]

Factors determining demand and supply of rocket technology

LRBMs became a nuclear weapons delivery mean in the 1950's, when it first became possible to squeeze a nuclear weapon into a missile warhead and to deliver it to the territory of an adversary. The invulnerability of missiles relative to bombers especially motivated ICBM development, particularly, for the Soviet Union, which believed they were necessary to counter superior U.S. nuclear capabilities. The same motivation is clearly observable in the efforts of some Third World countries to acquire or develop ballistic missiles, despite the fact that nuclear-capable aircraft suitable for their regional military needs are relatively more readily available.

On the other hand, rocket technology is also a mean of accessing outer space. This has a dual importance. Spaceflight is a way of gaining international prestige since it is a visible demonstration of technological capabilities. In addition, space launch vehicles enable the use of space systems for national needs, both civil and military.

The history of the major powers demonstrates that the space capabilities of the USSR, the US, France and China appeared as an outgrowth of their missile developments, with international prestige and security concerns as primary reasons behind them.

Cold War demands resulted in the major nuclear powers developing extensive ICBM forces and the industrial capabilities for missile and space programs. For example, the Soviet Union possessed a branch of industry dedicated to missile and space, which at its height employed about 1 million people and was capable of producing several hundred ICBMs annually.

With the drastic reduction of "internal" demand for ICBMs resulting from strategic arms reduction, a desire to somehow employ now-idle capabilities complements an "external" demand for a rocket technology from "new rocket powers".

Thus a simple strengthening of the MTCR cannot be effective. Moreover, after the recent expansion of the MTCR adherence list to include some ex-Soviet states, the differences between current situations of national missile-related industries have grown. This increases the internal pressure on MTCR adherents to circumvent regulations, particularly, in the cases of Ukraine and Russia, whose industries are in relatively poor condition compared to those of the Western powers.

To achieve a more effective non-proliferation and disarmament regime it is imperative to pursue a two-sided approach, which would both inhibit the desire of additional countries to acquire indigenous rocket capabilities and consume excess capabilities of the established rocket powers.

Strengthening international space cooperation

The development of international cooperative space programs is one way of partially com-

[129]For deeper discussion see [Altmann et al. (1995)].

pensating for the decrease of internal national demand for rocket-related technology caused by the loss of Cold War-driven national missile and space programs. Such cooperation is considered to be especially important by Russia and Ukraine (although the US rocket industry seems to be less enthusiastic about international space cooperation). At the same time, this solution is not a universal one, especially in the short run, since increased support to sectors specifically involved in space programs does not necessarily provide support to the whole branch of industry. Again, this is particularly true for ex-Soviet states, because of highly monopolized nature of the Soviet economy and the remarkably low diversification of defense industries.

An important milestone in developing a new agenda for international space cooperation was reached in 1993 when Russia was included as a full partner in the International Space Station (ISS) program. That agreement played an important role in Russia renegotiating the former Soviet agreement with India on cryogenic engine technology – which formally violated MTCR regulations. More recent indications that China would also like to join the ISS program suggests that this approach can be further expanded.

The need to inhibit the desire to acquire rocket technology, and detach the motivations associated with military intentions from the needs for space exploration, suggests that the MTCR be developed towards a new regime which would provide new space-faring nations with access to space through the capabilities of established space powers, in exchange for the non-acquisition of missile-related capabilities by those new nations.

The ultimate purpose of this development could be a "Rockets for Peace" regime, in which rocket launch vehicles would be used only for space programs. No matter how unrealistic that ultimate goal might seem, nor how long might it take to reach, there are several interim stages along the way, and every such stage is capable of increasing the efficiency of non-proliferation efforts.

In the first phase, ("Missile Swords to Space Ploughshares"), converted or surplus ICBMs would be employed to assist new space-faring nations in orbiting payloads with "humanitarian" missions. This could be performed under a formal jurisdiction of a to-be-established World Space Development Organization (Fund), which would cooperate with the existing MTCR framework to verify compliance of applicants with missile technology non-proliferation, and regulate the availability of "space access aid" to developing space powers (depending on their compliance).[130]

Problems associated with implementation of the first phase include the likelihood that commercial space launch vehicle (SLV) manufacturers will strongly object to this approach. However, there are few potential commercial customers for established SLV suppliers in the countries of interest. In addition, ex-Soviet SLV possessors/manufactures may well have difficulty in providing free services, since they may not have even the small amount of money

[130] A World Space Organization was discussed during the 1980s in the East-West context. See for example [Piradov (1988)].

necessary to minimally refurbish surplus ICBMs for using them as space launchers. To address both these concerns, it might prove more appropriate to establish a "Fund" rather than an "Organization." The Fund could provide some financial support for launch services, perhaps with funding provided by existing international institutions for promoting development in underdeveloped countries. For the new space-faring states this phase appears more like a "carrots-only" phase. Hence established rocket powers will obviously be concerned as to whether new space-faring countries would use the offered aid just as a springboard for further development of their national launchers. However, no technology would actually be transferred in this phase, and the established space powers do not lose anything, but do gain additional jobs for their idle industrial capacities.

The second phase would envision assured space launch services provided by established space powers for implementation of national or international space programs by new space-faring nations – in exchange for the later's complete and verifiable renunciation of indigenous rocket development. This phase would demand a controlling body resembling the IAEA. Given the IAEA experience, it remains doubtful whether the task of space cooperation should be merged with the task of missile control in one organization. Similar to the current nuclear non-proliferation regime, the advent of this phase would not have to be preceded by full implementation of a "Rockets for Peace" regime. However, as with the nuclear non-proliferation regime, the attitude of the "non-missile" countries toward the new regime would heavily depend on willingness of the "missile powers" to accept a "Rockets for Peace" concept, including the elimination of their own missile arsenals, as an eventual goal. At present there are no signs that the governments of the established rocket powers are ready to abandon the military use of LRBMs in the foreseeable future. However, in this respect their attitude is in no way worse than their attitude toward the idea of a nuclear weapons-free world.

An advanced phase of a new regime might be effective only, if it provides equal access to the benefits of space launch technology to all participants. This would pose a significant challenge as soon as the issue of the military use of outer space is reached. The leading space powers, particularly, the U.S. and Russia, would have to accept the free use of space by any country for every kind of activity which is compliant with international law. Therefore, space weapons would have to be outlawed, while other kinds of space applications would be allowed on an equal basis. Appropriate measures to deal with the inherent dual-use capabilities of satellites for remote sensing, communication or navigation would need to be taken. Their military relevance could be reduced by the international operation of these satellites and by sharing of data.

The approach discussed here will provide the most effective tool for curbing the ICBM threat in a middle and long run. From the perspective of the established rocket powers this should be a more effective approach than the "conventional wisdom," which is focused on the development of sophisticated ballistic missile defenses.

2.3.5 References

[Altmann (1993)] Altmann, J.:*Ballistic Missile Limitations and Their Verification.* in: G. Neuneck, O. Ischebeck (Eds.):*Missile Proliferation, Missile Defense and Arms Control.* Baden-Baden: Nomos, 1993, pp. 91-100.

[Altmann et al. (1995)] Altmann, J.; W. Liebert; G. Neuneck; J. Scheffran: *Preventive Arms Control as a Prerequisite for Conversion of Military R&D.* to be published in: J.Reppy, V.Avduyevsky, J.Holdren, J.Rotblat (eds.):*Conversion of Military R&D.* 1995.

[Arnett (1992)] Arnett, E.H.:*The Most Serious Threat of the 1990s? Cruise Missiles in the Developing World.* in: W.T. Wander and E.H. Arnett (eds.): *The Proliferation of Advanced Weaponry: Technology, Motivations, and Responses.* Washington, D.C.: American Association for the Advancement of Science, 1992.

[Carus (1992)] Carus, W.S.: *Cruise Missile Proliferation in the 1990s.* Westport, Connecticut: Praeger, 1992.

[FAS (1992)] *Revisiting Zero Ballistic Missiles - Reagan's Forgotten Dream.* in: F.A.S. Public Interest Report, May/June 1992.

[Frye (1992)] Frye, A.: *Zero Ballistic Missiles.* Foreign Policy, No. 88, Fall 1992, pp. 12-17.

[Gronlund et al. (1994)] Gronlund, L.; G. Lewis; T. Postol; D. Wright: *Highly Capable Theater Missile Defenses and the ABM Treaty.* Arms Control Today, April 1994, pp. 3-8.

[Howes (1993)] Howes, R.: *Monitoring the Capabilities of Third World Ballistic Missiles.* in: G. Neuneck, O. Ischebeck (Eds.): *Missile Proliferation, Missile Defense and Arms Control.* Baden-Baden: Nomos, 1993, pp. 101-113.

[Hussain (1981)] Hussain, F.: *The Future of Arms Control: Part IV—The Impact of Test Restrictions.* Adelphi Papers, No. 165 (1981).

[Lionis (1994)] Lionis, A.d.: *Anti-Submarine Review in the Third World.* Jane's Intelligence Review, April 1, 1994, p.188, v. 4, no. 4.

[Lumpe (1993)] Lumpe, L.: *Zero Ballistic Missiles and the Third World.* Arms Control, Vol. 14 (1), April 1993, pp. 218-223.

[Navy News (1994)] *Pakistan to get Mesma AIP before France.* Navy News & Undersea Technology, October 24, 1994.

[OTA (1994)] U.S. Congress, Office of Technology Assessment: *Proliferation of Weapons of Mass Destruction: Assessing the Risks.* OTA-ISC-559, Washington D.C. 1993.

[Ozga (1994)] Ozga, D.: *A Chronology of the Missile Technology Control Regime.* The Nonproliferation Review, Winter 1994, pp. 66-93.

[Piradov (1988)] Piradov, A.S.: *Creating a World Space Organization.* Space Policy, May 1988, pp. 112-114.

[Schelb (1988)] Schelb, U.: *Raketenzielgenauigkeit und Raketenteststopp (Missile Accuracy and Missile Test Ban).* Marburg, 1988.

[Scheffran(1993)] Scheffran, J.: *Dual-Use of Missile and Space Technologies.* in: G. Neuneck, O. Ischebeck (eds.): *Missile Proliferation, Missile Defense and Arms Control.* Baden-Baden: Nomos, 1993, pp. 69-78.

[Scheffran (1994)] Scheffran, J.: *Verification of Missile Bans and Monitoring of Space Launches.* in: W.Liebert, J.Scheffran (eds.): *Against Proliferation – Towards General Disarmament, Proceedings of the First INESAP Conference.* Münster: agenda, 1995, pp. 156-164.

[Sherman (1987)] Sherman, R.: *Deterrence Through a Ballistic Missile Flight Test Ban.* Arms Control Today, December 1987, p. 8.

[Stanford (1991)] Center for International Security and Arms Control: *Assessing Ballistic Missile Proliferation and its Control.* Stanford University, November 1991

[Steinberg (1993)] Steinberg, G.M.: *Time for Regional Approaches?* in: Orbis, Vol. 38 (3) 1993, pp. 409-424

[Thomas (1988)] Thomas, V. *Monitoring Solid-Fueled Missile Production for Arms Control.* Physics and Society, Vol. 17 No. 1 (January 1988), pp. 8-10

[UN (1993)] *Report of the UN Conference on Conversion of the Aerospace Complex.* Moscow, 12-17 October 1992, New York: United Nations, 1993

[Webster (1989)] *Prepared testimony of William Webster before the Senate.* Governmental Affairs Committee, 18 May 1989.

[Wilkes et al. (1991)] Wilkes, O.; et al.: *Chasing Gravity's Rainbow: Kwajalein and US Ballistic Missile Testing.* Canberra, Australian National University, 1991

[Zimmerman (1993)] Zimmerman, P.: *Verification of Ballistic Missile Activities: Problems and Possible Solutions.* Working Paper 18, Berkeley, CA: Nautilus Pacific, September 1993

2.4 Regional approaches towards a Nuclear-Weapon-Free World

Coordinators: Fernando Barros, Mike Casper

2.4.1 Worldwide "regional" Nuclear-Weapon-Free Zone negotiations: A key to creating a non-discrimanatory non-proliferation regime and a promising approach to a Nuclear-Weapon-Free World

Barry M. Casper, Wade T. Crow and Aaron J. Spitzer

The non-proliferation regime established by the Non-Proliferation Treaty has turned out to have two glaring defects. First, it is discriminatory, in effect sanctioning a special nuclear weapons "have" status for the five NPT nuclear weapons states (NWS's) and relegating the rest of the world to a permanent "have-not" status. This is a source of strong resentment among many non-aligned nations that threatens the long-term viability of the treaty. Second, the NPT non-proliferation regime does not include key non-proliferation players as several "threshold states" have chosen not to sign. In significant part, this is based on the discriminatory character of the treaty; in some cases, it is also based on national security concerns vis a vis neighboring states. The purpose of this paper is to propose an international process aimed at addressing these defects. It would be based around worldwide parallel regional Nuclear Weapons Free Zone (NWFZ) negotiations, whose progress would be monitored and supported by periodic international conferences. One "region" would be a geographically non-contiguous one, consisting of the five nuclear weapons states, the U.S., Russia, U.K., France and China. The others would be contiguous; for example, Latin America (perhaps with the addition of Canada, as suggested in Marco Martinez's paper, chapter 2.4.3), the South Pacific, Africa, the Middle East, South Asia, East Asia, Southeast Asia and Europe.

Such a process would set the international community on a course aimed directly at achieving a non-discriminatory non-proliferation regime. It would build on successful regional models of non-discriminatory non-proliferation regimes – the NWFZ's negotiated in Latin America and in the South Pacific. It also has the virtue of reaching out to include those nations who have thus far refused to sign the NPT. Precisely because the NPT system does not count several important non-proliferation players among its ranks and because the NPT treaty itself is for all practical purposes unamendable, the process will necessarily involve negotiations in forums outside the NPT.

In many ways, this is a particularly appropriate framework for dealing with the both the de facto discrimination and regional security issues. When the NPT first went into effect in

1970, it was explicitly not aimed at permanently dividing the world into nuclear weapons "have" and "have-not" states. Rather, while Article II of the treaty committed the non-nuclear-weapons signatories to forswear permanently the acquisition of nuclear weapons, Article VI obligated the five nuclear-weapons states 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..." Taken literally, the treaty is a blueprint for sending the "haves" and "have-nots" down two different paths to the same future goal – nuclear-weapons-free status.

So far that promise has not been fulfilled. By and large the non-nuclear weapons states have proceeded along their assigned course, although the clandestine acquisition programs discovered in Iraq and North Korea give cause for serious concern. The nuclear weapons states, however, have clearly not upheld their end of the NPT bargain. Despite impressive progress in the START and INF negotiations in reducing the nuclear arsenals of the United States and Russia, one could not mistake those negotiations for a process aimed directly at nuclear-weapons-free status or likely to achieve that end. Many non-aligned nations have made it clear that they want a commitment from the nuclear weapons states that explicitly fulfills their Article VI obligation. The NWS negotiation would directly address the non-aligned and non-signatory states' desire for Article VI compliance in the most straightforward way one can imagine.

The other regional negotiations would bring together both NPT signatories and non-signatories in a process condusive to devising confidence-building measures and mutual security arrangements that fit the particular circumstances of the regions. Of course, in some regions like the Middle East, this will be extremely difficult, due to long histories of antagonism and distrust. And in other regions, like South Asia, the participation of states like India and Pakistan in a Nuclear Weapons Free Zone will likely depend on the actions of states not party to the regional negotiation, presumably China and, as suggested in the Monteiro/Wadia paper (chapter 2.4.2), the United States as well.

This points up an important positive feature of simultaneous parallel negotiations. That framework would make possible linkages between the negotiations, such as reciprocal actions by parties in different regions. Having periodic international conferences of all states at, say, five year intervals would facilitate such linkages and reciprocal actions.

An example of a possible linkage involves plans in the United States and France to circumvent what most nations see as the primary intent of a comprehensive test ban treaty – to stop the acquisition of nuclear weapons. Both the U.S. and France are pursuing non-nuclear explosive means of testing nuclear weapons, such as the U.S. AGEX (Above Ground Experiments.) At this point, it would make sense for each regional negotiation to proceed in two phases. The first phase would focus on establishing a Non-Acquisition Regime, involving commitments by all parties to a comprehensive test ban, a weapons-grade fissile material production cutoff and a Non-Acquisition Pledge. The latter would be aimed at outlawing AGEX-type programs and the purchase or sale of complete nuclear weapons or their major component materials or parts. This package would directly address what a comprehensive test ban alone would

only symbolize, stopping the acquisition by all nations of any more nuclear weapons.

In the second phase, each region would focus on establishing a NWFZ. We view this as a way the non-nuclear weapons states can begin to seize the initiative in the non-proliferation arena by declaring their regions off-limits to nuclear weapons deployment, use, or threat of use. As such off-limits regions spread around the globe, one could imagine pressure building within this process on the nuclear weapons states to reciprocate fully. For example, in his paper Marco Martinez[131] proposes a NWFZ for the whole American continent; in this conception, the first step has already been taken by Latin American nations and the next step would be to invite Canada to join the Tlatelolco Treaty; once that happens, an invitation would be issued to the one country left to complete the American NWFZ.

How could such a process of worldwide parallel NWFZ negotiations come about? Ideally, the 1995 NPT Extension Conference, recognizing this approach as the most straightforward way to deal with the two major defects in the NPT's non-proliferation regime, would endorse such regional negotiations, the nuclear weapons states would promise a good faith effort in accordance with their Article VI obligation, and NPT signatories and non-signatories alike would be invited to the first worldwide conference to review progress in the negotiations, at the United Nations in the year 2000. Failing that, such a process is still the key to the long-term viability of the NPT and the best hope for pursuit of a nuclear-weapon-free world. It may well be up to non-nuclear weapons states to seize the initiative and take the lead in this most important quest.

2.4.2 South Asia

Regional approaches in the context of global nuclear disarmament

Zia Mian, Abdul Nayyar, Praful Bidwai

The nuclear facts of life in South Asia are that both India and Pakistan possess a nuclear weapons capability sufficient to be able to produce nuclear weapons that can be deployed at short notice. Both countries have few incentives to begin the process of rolling back their capabilities. However, both countries have also in the past indicated that they would observe some degree of restraint in developing their capabilities and would even support a universal fissile material production cut-off and a comprehensive nuclear test ban treaty. For domestic political reasons neither state would find it easy to sign bilateral or regional agreements on these issues in the absence of a change in the postures of the nuclear weapons states.

Over the past decade both countries have rejected a series of disarmement proposals. Most notable is the 5+2+2 formula, involving talks between the 5 nuclear weapons states, Japan

[131] See chapter 2.4.3

and Germany, and India and Pakistan. There has also been a proposed regional treaty forswearing the development of nuclear weapons, the idea of a nuclear weapons-free zone, and any verification (mutual or third-party) of nuclear facilities. A tangible process of delegitimising nuclear arms as a currency of power is, therefore, a necessary precondition of any regional approach towards a nuclear weapons free world.

Substantial progress at the global level towards disarmament on an equitable and non-discriminatory basis would reopen the possibility of a regional initiative leading to the establishment of a nuclear weapons-free zone in South Asia, and offers the best means for attempting to defuse the nuclear rivalry between India and Pakistan.

Global agreements such as the CTBT, and a fissile material production cut-off are obvious preconditions for such an initiative, but they are not enough. Deep cuts in the strategic arsenals of the nuclear weapons states, a universalisation of the Intermediate Nuclear Forces agreement, and elimination of battlefield (tactical) nuclear weapons are needed.

What is crucial however is the relation between the nuclear weapons states and the region. India has traditionally been the more unreasonable and unyielding of the two nuclear threshold states in South Asia, tending to turn down all proposals without any counter-proposals. In part this stems from an Indian perception that its nuclear weapons capability is not just a response to regional security concerns. As far as India is concerned even the US cannot be excluded as a potential adversary. A number of situations are possible, such as US involvement in the Kashmir issue, and sanctions arising out of trade disputes (as now mark relations between the US and China) in which a military confrontation is, it has been suggested, could occur.

US military policy thus become a direct factor in prospects for regional denuclearisation. In particular there is the US posture of being prepared to threaten to use nuclear weapons first, through for example the declaration of a nuclear alert, the moving of nuclear weapons into a zone of potential conflict during a crisis. Then there is its stated policy of actually being prepared to initiate the use of nuclear weapons during a conventional conflict. These need to be addressed directly.

The first step is thus a move away from traditional deterrence postures, through a treaty not to initiate in any way the use, or threat of use, of nuclear weapons. Such a treaty would forbid, explicitly, the use, or threat of use, of nuclear weapons against non-nuclear weapons states. How to give the treaty a clear strategic content becomes an important question. There are three immediate steps that can be identified. First, all nuclear weapons would be deployed within the territorial limits of the respective nuclear weapons states. This would require nuclear armed submarines, ships carrying nuclear cruise missiles, and aircraft carriers transporting nuclear armed fighters to return to port. The ability of a nuclear weapons state to project power through its deployment of nuclear weapons in a zone of crisis would be eliminated. Second, all intermediate range and intercontinental ballistic nuclear missiles would have their warheads removed. This would eliminate the ability of a nuclear

weapons state to threaten any other state with a nuclear attack. Thirdly, a global moratorium on further production and development of nuclear weapons. This would ensure that any verification regime entered into during this treaty could not be circumvented by adding to the number of nuclear weapons available to any given nuclear weapons state. If all nuclear warheads belonging to the nuclear weapons states were taken off deployment and placed in national repositories, then there would be an effective parity between the current threshold nuclear weapons states, especially India and Pakistan, and the current nuclear weapons states in terms of strategic readiness. In this scenario India and Pakistan would find it impossible to resist concerted moves towards nuclear disarmament.

A brief note on non-proliferation of nuclear weapons: need to re-define agenda

Vivek Monteiro, Spenta Wadia[132]

The NPT is coming up for renewal in 1995. The focus of debate at this conjecture will undoubtedly be the refusal of some nations to sign the treaty, and ways and means to persuade them to do so this time around.

India is one of the nations which has not acquiesced to the NPT. It is also a nation which has demonstrated its capability to conduct a test nuclear explosion. Its weapons capability is unspecified, but it may be presumed that India is very close to achieving that capability.

Its policy of eschewing nuclear weapons, while retaining capability in all categories: production of weapons grade fissile material, developing short and long range systems which can be used for delivery etc. has been widely criticised as hypocritical. What we will argue here is that this policy of retaining capability while refraining from full scale armament development and deployment is the minimal option open to its defence establishment.

There is a great deal of ambiguity in the discussion on nuclear matters in the media. Some of the ambiguity appears to be quite deliberate. To begin with therefore, it is necessary to introduce some clarity and specificity into the terms of discourse.

Firstly, the term 'nuclear deterrence'. The same term is used to describe the deterrence policies of all the nuclear or potentially nuclear nations, as if the policies of all these nations were identical. In fact there is an important, in fact crucial, difference in nuclear deterrence policies which needs to be highlighted.

Let us term as a policy of '*non-initiatist nuclear deterrence*' a policy of non-use of nuclear weapons except as a response to the first use of *nuclear weapons* by an adversary. This is to be distinguished from '*initiatist nuclear deterrence*', a policy which permits the use of nuclear weapons as a response to conventional attack with conventional, non nuclear weapons. These

[132]The views presented here are the individual viewpoints of the authors

are two completely conceptually different deterrence postures. Of the NW possessing nations (NWPN), China and the USSR had adopted non-initiatist nuclear deterrence postures, while the USA, Britain and France have consistently refused to commit themselves to a non-initiatist deterrence posture. This difference has understandably been underplayed by a mass media dominated by NWPN media transnationals. However it is too important a difference to be ignored by those serious about non-proliferation and disarmament.

The second point which needs to be clarified is the term 'use of nuclear weapons'. As was pointed out by Daniel Ellsberg, nuclear weapons can be used in two ways. First, they can be actually detonated over a target as happened at Hiroshima and Nagasaki. The other kind of use, is like when a gun is used to point at somebody in order to give a threat. In the second sense, nuclear weapons have been used more than two dozen times after Hiroshima and Nagasaki. The declaration of a 'nuclear alert' by a nuclear power, the moving into a zone of nuclear weapons in a time of crises — these are all ways in which nuclear weapons have been used in the second sense. 'Non first use' sometimes is taken to connote non-use in the first sense. Actually, 'Non use of NW' requires a more strict interpretation in excluding the second kind of use also.

The third point that we must be clear about is that there is no conventional defence against nuclear weapons. Faced with an adversary possessing NW, a nation has essentially three choices: accept the military hegemony of the adversary; develop a deterrent of its own, which is necessarily a nuclear deterrent; accept the nuclear umbrella of another nuclear power. It is argued that as far as India is concerned, its main adversary is Pakistan, and that the security needs of both countries will be better served if both eschew nuclear weapons. Therefore, it is further argued, if India is averse to signing the NPT because of its discriminatory provisions, both countries can enter into a regional agreement to exclude nuclear weapons. De facto, the end result will be the same — the closing of the nuclear option for both countries.

India is unlikely to accept such an arrangement, because Pakistan is not its only adversary. Even if China is for the sake of argument excluded (China having given a guarantee of non first use), it is evident that the USA cannot be excluded as a potential adversary, as far as India is concerned.

Why? Briefly, because of the defence posture of the USA. The 'Initiatist Nuclear Deterrence' posture of the USA envisages the use of nuclear weapons as a continuation and permissible escalation of a conventional engagement. In fact recent research in the USA has been directed towards reducing the 'gap' between conventional explosives and the nuclear weapons of the lowest power, ostensibly in order to enhance the 'credibility of the US nuclear deterrent'. Nuclear weapons have also been used against India by the USA in the second sense. As has been revealed by Richard Nixon in his memoirs, there was a threat of U.S. nuclear intervention during the 1971 India-Pakistan war over Bangladesh. India's 1974 nuclear explosion was presumably a direct outcome of that episode.

Given current equations between the USA and India, Indian government spokesmen are unlikely to explicitly enunciate or highlight the above realities. But no serious analysis can

ignore these realities. It is also clear to anyone familiar with the political scenario in South Asia, that there are a number of possible situations in which a military confrontation between the USA and India could occur in future. This could occur over Kashmir, or over sanctions arising out of differences on economic policy/USA investments if present policies are changed, to name just a couple. US defence policy formulations vis-a-vis the 'third-world', which envisage a nuclear response to conventional engagement, is yet another reason. In short, the USA has to be included in the list of NWPN potential adversary in any Indian defence assessment.

Since of three options available to nations facing nuclear adversaries, two are politically unacceptable, the only politically acceptable option is to maintain a minimalist nuclear deterrent of one's own. It should be clear that unless there is a change in the US nuclear deterrence posture, there is no possibility of India closing its nuclear option. In fact, its present policy of 'nuclear ambiguity' (a more accurate term would be nuclear abstinence) appears to be the minimal nuclear posture consistent with the adversarial scenarios facing Indian defence planners.

No effort at non-proliferation can succeed only on the wishes and good intentions of its proponents. Any serious effort must take into consideration political realities, defence needs and public perceptions of these needs. Does this mean that non-proliferation is not possible today? No. It does mean that *non-proliferation will only be possible when the NWPN are all persuaded or pressurised to adopt minimal 'Non-initiatist Nuclear Deterrence Postures*'. An important corollary of the above analysis is that the condition precedent for a non-proliferation treaty is a preliminary treaty of a different kind: a 'Nuclear Non-initiation Treaty' (NNIT). In such a treaty, each signatory agrees not to initiate in any way, the use, or the threat of use, of nuclear weapons.

Such a treaty would forbid the use, or threat of use of NW against non-nuclear nations. It must also be noted that immediately after such a treaty, all nuclear weapons of first use, including the so-called 'tactical nuclear weapons' would become redundant, and would have to be eliminated. These are precisely the most destabilising weapons which have so far been excluded from agreements between the USA and USSR/Russia.

It is necessary to mobilise public opinion, especially opinion in the NWPN and potentially nuclear nations in favour of this enabling treaty. International pressure of the peace movement, of scientists, etc. must be directed towards making a NNIT as point number one on the international non-proliferation agenda, including the agenda of this conference/workshop.

2.4.3 Latin America

Towards a Tlatelolco Treaty for the whole American continent

Marco Martinez

The Tlatelolco Treaty (TT) is but the first very important step towards a Nuclear Weapons Free Zone (NWFZ) covering the whole of the American continent. Nuclear weapons are not needed any longer in this ample region because:

- the Cold War is over;
- all the countries of the area, with an obvious exception, have expressed their straightforward decision not to develop such armaments and
- the United States is a party of the Non Proliferation Treaty (NPT) which, according Article VI, means it isviobligated to get rid of its nuclear arsenal.

It could be argued that nuclear weapons are required for conducting a safeguarding or a disarmament process on the American continent (or even in the world), with those weapons in the hands of the U.S. or the United Nations Security Council. But not much could be expected of such a process when one country is playing the role of a (potentially violent) "policeman", even if it professes only "good" intentions. The asymmetric role played by that special nation works to undermine the goal nuclear disarmament. In other words, a symmetric NWFZ cannot be achieved with asymmetric nuclear measures of any kind. Both the TT and the Argentina/Brazil treaty show that the non-nuclear-weapon states (NNWS) alone can legally and peacefully reject nuclear weapons without the intervention of other nations.

Of course, the weapons denuclearization of the U.S. could only make sense when the othcr nuclear weapon states (NWS's) also denuclearize. But this process could only succeed when all country agree concerted actions towards that goal. Compliance by all NPT parties with their NPT obligations is absolutely necessary, as in the inclusion of the reaining non-NPT parties.

A TT covering the whole of the American continent would required and is requires by the universal application of the NPT. We therefore discuss in what follows some specific aspects of the TT connected with NPT and try to identify possible actions leading to its continental expansion.

The TT is a symmetrical treaty within the region in which it is conceived. But it is not symmetrical with respect to the American continent or to the rest of the world, due to the existence of the NWS. Complete symmetry can only be achieved in a Nuclear-Weapon-Free World (NWFW). This we declare as our supreme objective (see Casper et. al. in this study).

The TT does have some drawbacks, such as allowing peaceful nuclear explosions (PNE) by member states (Art. 18, 1). And the assumption that the right to develop the so-called "civilian nuclear energy technology" is necessary for economic and social development (Art. 17). While there is no doubt about the connection of PNE to nuclear armaments, the direct connections between civilian nuclear energy technology and the capacity of nations to develop nuclear weapons is also becoming widely recognized.

The safeguards and verification provisions of the TT are appropriate in principle, the additional strenght of such measures as part of bilateral agreements is not contemplated by the TT. The recent bilateral nuclear agreement between Argentina and Brazil shows the impressive potential extent of these kind of treaties for building confidence in and otherwise strengthening regional NWFZ's, providing a practical framework for TT implemmentation[133].

The present world geoplitical situation, especially on the American continent, renders the United States' 1968 "interpretative declaration" about the TT both negative and obsolete. It says in essence that the U.S. can transport nuclear weapons anywhere it chooses in the TT region. In fact this proposition has been inappropriate from the beginning, because the TT parties agreed not to create the conditions that could make such a nuclear weapons "patrolling" necessary (Art. 1.1.).

The case of Canada looks much simpler than the United States with regard to establishing an American continent NWFZ. All Canada needs to do is add its territory to the TT provisions. The technical means of doing this are not difficult to imagine. This action would be very important because it would add substantially to the moral and political pressure on the United States to denuclearize. It would also help to promote the creation of other NWFZ in the world.

The NNWS's of the American continent have thus far complied with the NPT Article II Obligations. So ahve non-NPT signatories Argentina, Brazil and Cuba. The next move is up to the United States. It must comply to its Art. VI obligations. To create conditions for that to happen will depend on a broad spectrum of worlwide actions, including some beyond the NPT and the TT ass discussed in other contributionsto this study.

ABACC Model for regional inspection

Fernando Barros[134]

"Each sovereign nation must decide what nuclear activities it will encourage and establish a national system to ensure that such activities will be conducted safely, contribute to the

[133]See [Barros and Zamora Collina]

[134]Extracts from [Zamora Collina/Barros (1995)]

general welfare, and be consistent with any agreements with other nations...Verifying that the materials account are accurate and unbiased requires intensive and unfettered access by the inspectors, which the IAEA is not designed to perform...Unless a bilateral or multilateral agency is provided with the authority and resources to satisfy the public and the congress in a state, the state should perform this function and establish a central nuclear materials data system. " (William A. Higinbotham, BNL-49240-SSN-93-09)

Once the nations decide to forgo nuclear explosives, the establishment of a national-regional inspection system plays an important bridging role on the way to full-scope IAEA inspections. On the other hand, a state no longer interested in nuclear weapons may still object to the NPT as discriminatory, and IAEA inspections carry political baggage in states that are sensitive to infrigements on their sovereignty. These political drawbacks might tip the balance against formalizing nonproliferarion commitments. Argentina and Brazil's commitment to open up their secret programs was preceded by years of high-level bilateral visits to each other's sensitive facilities and joint declarations by their presidents. These joint activities were crucial to reducing regional nuclear suspicion and confrontation. This confidence-building process created the foundation for the bilateral inspection regime. The inspection they set up allows for NPT-equivalent safeguards on all of their nuclear facilities, including their previously unsafeguarded uranium enrichment plants. And while the IAEA conducts independent inspections, Brazilian and Argentines carry out their own, reducing domestic opposition to the inspections as external meddling. This gives these nations more timely and credible assurance that all materials are accounted for, or that a diversion would be detected. It is also more politically acceptable than IAEA inspections alone.

The case of Latin America shows that regional solutions to proliferation problems can avoid many of the pitfalls inherent in international approaches. This new path from potential proliferator to non-proliferation example was not imposed by the north, but developed by the region for the region. As such it is an attactive alternative for other "NPT-resistant"regions in the developing world where initiatives by the United States and other western powers are politically unacceptable. In all regions, bilateral or regional inspections can play a crucial confidence-building role, and can supplement other measures already underway. But to convince the world of a nations' peaceful intentions, they are not enough. They must eventually be followed by interaction with the IAEA to ensure uniform inspections. Otherwise, resistance to the IAEA could be used as an excuse to establish alternative inspection regimes that are less intrusive. The bilateral inspection regime in Argentina and Brazil meets these requirements. Using this approach, these states were able to convince the world that their nuclear programs are for peaceful purposes.

The Argentine-Brazil Agency (ABACC) is an important step for the implementation of a regioanal safeguards system in Latin America. The fact there there now exists a common system between Argentina and Brazil for accounting and control of nuclear materials is of vital importance for placing unsafeguarded nuclear facilities in military installations under civilian surveillance. On December 21st, 1991, the Quadripartite Agreement was signed by

Argentina, Brazil, ABACC, and the IAEA. This accord establishes the IAEA's independent role in the inspection process. The Quadripartite Agreement is in practice equivalent to verification under the NPT, providing for full-scope safeguards and following the procedures of INFCIRC/153. The value of bilateral safeguards in Latin America could also be realized in other regions. First, regional approaches are well suited to supplementing IAEA safeguards. ABACC, for example, creates an additional layer of safeguards and thus a more robust verification regime. Its inspections can add confidence in regions where the failure of safeguards could have serious consequences, and where the IAEA is not fully trusted. Public confidence in inspections can increase simply by a nation using its own inspectors, insted of a foreigner. But more than that, ABACC allows each government direct access to inspection information that is otherwise indirect or confidential. The IAEA publicizes its inspections methods and techniques. But anything the IAEA learns at a particular facility -including accounting inconsistencies- is considered confidential. Bilateral inspections give these governments - and possibly their press and their citizens - direct access to information that they might otherwise not have, and can thus provide for more timely and possibly more credible assurance that materials are accounted for or that there may be a problem. For countries that are suspicious of each other, this access could open up their nuclear programs and build mutual trust. Second, as in Latin America, regional agreements may be more politically acceptable than IAEA safeguards alone, since problem regions tend to see the IAEA as overly intrusive and the NPT as discriminatory. Moreover, "inspections" and "verification"are seen as western intrusions on sovereignty. Indigenous agreements could use their own terms and need not be tainted as being imposed by the west. ABACC also provides political cover for full-scope IAEA safeguards by enhancing domestic involvement in the inspection process. Third, bilateral or regional agreements would build confidence between participating nations, reducing overall tensions. By conducting the inspections themselves and gaining direct access to safeguards information, greater understanding and communication would result. Regional rivalry could be reduced as states learn more about each other through the inspection process. Bilateral inspections are also a way for nations to gain experience with inspections procedures without western involvement. Forth, regional agreements can demonstrate to the local actors that they can start solving their own problems, without having solutions imposed from outside. And fifth, regional agreements can go beyond AIEA safeguards. They can reach areas unaccessible to the IAEA, like chemical weapons plants in the Middle East, and they can go beyond NPT requirements, such as banning enrichment and reprocessing, as envisioned in the unimplemented North-South Korean bilateral agreement. They can be tailored to fit the regional needs. But regional inspection agreements have their limitations as well. They cannot help in a region where one or more nations are intent on maintaining nuclear ambiguity. A commitment to openness must precede bilateral or multilateral inspections. Other confidence-building measures, such as reciprocal visits, can lay the ground work for inspections. Nor are regional agreements sufficient in themeselves to ensure non-nuclear-weapon status. Regional inspections alone could lead to nations teaming up to develop the bomb, or to a breakdown of the regime when relations sour. Moreover,

individual states might not be able to maintain a high level of confidence in their inspections if they do not have safeguards experience.

The most important benefits of regional inspection agreements are that they can build mutual trust and provide a path for nations to move away from nuclear ambiguity. By using an indigenous inspectorate along with the IAEA, the implementation of full-scope safeguards can become a political possibility.

2.4.4 Middle East

Israel and the NPT - the nuclear catch

Reuven Pedatzur

Progress in the Middle East peace process has brought the sides involved closer to the time when they will have to reach agreement on nuclear issues as well. Early signs of this began to appear in the last several months of 1994. As the time for the convening of the NPT conference in New York in April 1995 draws nearer, these signs are manifested in pressure by Egypt and Syria on Israel to join the NPT. It is Egypt's intention, preparatory to the Conference, to focus international attention on Israel's nuclear hegemony in the Middle East.

While Egypt did bring this issue up already during the Camp David talks in 1978, after both the United States and Israel rejected this proposal, President Anwar Sadat agreed to delete the nuclear issue from the peace agreement between Israel and Egypt.[135]

The Egyptians want the issue of Israel's nuclear superiority to head the agenda of the disarmament talks in the framework of the multilateral working group on Arms Control and Regional Security (ACRS). Israel's nuclear hegemony is a source of concern for its Arab neighbors, lending further impetus to their efforts to pressure Israel into joining NPT. This trend is also evident in the words of Syria's Deputy Foreign Minister, Nassar Kadur: "It is not a secret that Israel has nuclear weapons, and it wants the Arabs to disarm, in order to become the only superpower which dominates the region."[136]

During his visit to Israel in September 1994, Egyptian Foreign Minister, Amre Moussa, declared that "Israel's refusal to place its nuclear facilities under international supervision is an obstacle in the path of a comprehensive peace. Mousa demanded that Israel join the NPT with no further delay.[137]

"Repeatedly, Egyptian spokesmen emphasized that Egypt would not be able to accept Israel's possession of nuclear weapons as an indefinite proposition. They also emphasized that Egypt

[135]See [Cohen (1994)].
[136]See [Al-Itihad (1992)]
[137]See [Pedatzur (1994)].

could not voice its opposition effectively against the nuclear ambitions of Iran and Iraq while Israel's nuclear program was ignored ".[138]

In an address before the United Nations General Assembly on 3 October 1994, Syrian Foreign Minister, Farouk AI-Shara, said that the NPT extension conference will "provide a rare opportunity for all states in the region to reveal their peaceful intentions. The accession of all states in the Middle East to the NPT constitutes a vital step towards transforming the Middle East to a region free of all mass-destruction weapons. . . (Syria) calls upon Israel to accede to the NPT and to put its nuclear installations under the inspection of the International Atomic Energy Agency (IAEA) so that the states of the region will be able to agree to extending the treaty. Achieving this will constitute an important step to create a climate of confidence that contributes to building peace and security in the Middle East."[139]

Official Israeli spokesmen reject this Egyptian-Syrian pressure, and in the words of Israeli Foreign Minister, Shimon Peres, in his response to Mouss's statement regarding the NPT, "It would be a serious mistake to deal now with the subject of nuclear disarmament before comprehensive peace agreements have been reached in the region"".[140]

Israel's policy on the nuclear issue is based mainly on the following five principles:

1. **Comprehensiveness:** The nuclear issue should be dealt with in the full context of the Peace Process, as well as all the security problems, conventional and non-conventional.

   Israel will continue to insist on linking progress on the nuclear issue with substantial political progress on the peace front, as well as on linking the nuclear issue to visible progress in other areas of arms control, both conventional and non-conventional.[141]

2. **Regional framework:** Nuclear non-proliferation will be achieved and ascertained only by establishing a mutually verifiable Nuclear Weapon Free Zone (NWFZ) in the Middle East.

3. **Regional and not global approach:** Problems of regional security can be settled only among the states of the region. The regional concept is the back-bone of Israel's approach to matters of Regional Security and Arms Control.

4. **Step-by-Step approach:** Practicality dictates beginning the process with confidence and security building measures, establishing peace relations and, in due course, complementing the process by dealing with conventional and non-conventional arms control, where priorities are assigned to systems that experiences have proven to be destructive and destabilizing.

[138] See [Feldman (1994)]
[139] See [Disarmament Times (1994)]
[140] See [Pedatzur (1994)]
[141] See [Cohen (1994)]

5. **The primacy of the Peace Process:** Negotiation on all issues concerning the security of the region has to take place in a free and direct way, as they are, in fact, conducted in the bilateral and multilateral talks, within the framework of the Peace Process.[142]

Israel, which has refused to sign the the NPT, emphasized in its NWFZ resolution (from 1980) the difference between the regional and the global approaches to nonproliferation. The Israeli proposal called "upon all states in the Middle East and non-nuclear weapons states adjacent to the region ... to convene at the earliest possible date a conference with a view to negotiate a multilateral treaty establishing a NWFZ in the Middle East." For Israel a NWFZ was a substitute to the NPT/IAEA mechanism which Israel considered as deficient.[143]

All the states in the region as a condition

Some of the most relevant states in this regard (negotiations on NWFZ or other mechanisms) are missing from the new regional forum that was established after the Madrid peace conference. Neither Iraq nor Iran is a party to the ACRS (Arms Control and Regional Security). Syria, while negotiating peace and security with Israel at the bilateral level, decided not to participate in the multilateral channel until it saw significant progress in the bilateral talks.

Israel's approach also implies that sensitive issues involving the various parties' central strategic systems should be implemented only after these parties had developed a minimum measure of self confidence and mutual trust.[144]

Rabin made it clear, in his conversation with Moussa, that Israel would be ready to negotiate any regional arms control agreement only after all the countries in the region which are threatening Israel such as Iraq, Iran, and Libya, joined the multilateral talks on arms control."[145]

The basic Israeli position toward the NPT

Israel did not regard the NPT as a significant barrier to nuclear proliferation; the dimensions of the nuclear programs developed by NPT signatories such as Iraq and North Korea illustrated Israel's concerns. The weaknesses of the global NPT approach are most evident in the Middle East.[146]

Prime Minister Yitzhak Rabin, was very clear and blunt when he wrote that "the NPT was proven to be a failure in the Iraqi case. The IAEA mechanism failed and was also proven to

[142]See [Yativ (1994)]
[143]See [Cohen (1994)]
[144]See [Feldman (1994)]
[145]See [Haaretz (9/1994)]
[146]See [Steinberg (1994)]

be worthless. We cannot count on them. " Therefore, "I think that Israel should continue in its declaratory policy: willingness to a WMD free zone through agreements between Israel and every country in the region. ... I believe more in agreements between countries than in international means like the UN, that failed."[147]

Until Israel feels secure in the new Middle East, it will continue to regard its unacknowledged nuclear deterrence as an essential ingredient for its national security.

Israel wants to keep the nuclear bargaining card in play at least until the peace-making process is complete, insisting that the establishment of a NWFZ ought to be the last stage of the arms control negotiations, linked to other issues of regional security and arms control. Israel has a clear edge and will want as many gains in the peace and security as possible before it makes concession on its nuclear option.[148]

"Given the volatile nature of the Middle East, Israel advocated and continues to advocate the establishment of a NWFZ, freely and directly negotiated, including mutual verification and encompassing all states in the region."[149]

The US approach

Since 1970, the USA and Israel reached tacit understandings on the NPT. Israel rejected the NPT and the United States had to accept it.[150]

The United States tacitly agrees with Israel that an attempt to deal with the nuclear issue now would serve no useful purpose but only cause further tensions and disagreements. According to senior officials in Washington, the United States will not apply pressure on Israel to join the NPT. "It is not realistic to ask Israel to take additional risks now, in the middle of the peace process".[151]

A study released in October 1993 by the US Congress' Office of Technology Assessment cautioned against pressing Israel "to give up its nuclear weapons," arguing that such pressure might "endanger Israel's survival".[152].

[147]See [Rabin (1992)]
[148]See [Cohen (1994)]
[149]See [Yativ (1994)]
[150]See [Cohen (1994)]
[151]See [Haaretz (11/1994)]
[152]See [Feldman (1994)]

Regional approaches towards a Nuclear-Weapon-Free World - the Middle East

Bahig Nassar

The objectives of Nuclear Weapons Free Zones (NWFZ's) include

- nuclear non-proliferation and
- nuclear disarmament.

Creation of a NWFZ in the Middle East would promote both these objectives. At this point, one can readily envision two nuclear weapons futures for the region. Unless nuclear weapons are effectively banned from the Middle East, we could see fairly soon a vast array of these weapons, tactical and strategic, carried by the armed forces of several states that already have the capability to project their military power in the region. The 1991 Gulf War can be viewed as a daunting preview of what could happen, with vastly greater dangers if nuclear weapons were available. A much more attractive alternative vision is a Middle Eastern NWFZ. Through negotiation of arrangements that insure the security of all states in the region, a NWFZ would prevent the spread of nuclear weapons to many nations and create conditions whereby the one country in the region that has nuclear weapons, Israel[153], would feel it could safely give them up. To put it another way, the Middle East poses the twin challenges that confront those who seek a nuclear weapons free world–non-proliferation and nuclear disarmament–and this paper considers a regional approach to addressing those challenges[154],in a particularly difficult region.

One special feature of the Middle East (hereafter ME) from the point of view of creating a NWFZ is the fact that one party (Israel), among all parties involved in ME conflicts, possesses nuclear weapons. In this sense, the ME differs from the two regions of the world where NWFZ's have been established, Latin America and the South Pacific, where no nation had nuclear arms. And other potential NWFZ regions are characterized by actual or possible mutual nuclear deterrence, which will tend to induce all the parties concerned to negotiate so as to try to ward off the deadly dangers of these weapons. Given that nuclear deterrence in the ME is now available to only one party, the other parties must ask themselves what leverage they have to induce Israel to join negotiations in good faith for a ME free from nuclear weapons. In particular, must they also mount the ladder of mutual deterrence to oblige Israel to negotiate?

Another special characteristic of the ME is the interconnection between the elimination and non-proliferation of nuclear weapons in the ME and the peace process now underway.

[153]See [The Sunday Times (19987)]

[154]The NPT explicitly endorsed regional approaches, such as NWFZ's. Treaty on the Non-Proliferation of Nuclear-Weapons, Article VII, see [Arms Control (1980)]

The current ME peace negotiations and the process of negotiating nuclear weapons non-proliferation and disarmament are inextricably linked. It is unthinkable that a durable and just peace for all peoples and countries of the region could be established under the umbrella of nuclear weapons possessed by one party (Israel) to deter and threaten the other (Arab) countries.

These contradictory positions and sources of tension have engendered certain developments in the ME. For instance, during the past 25 years progress has been made in nuclear weapons reductions the world over. The INF, SALT I, SALT II and the conclusion of a teaty on the reduction of conventional weapons in Europe are among the positive steps. At the same time, however, more weapons, conventional and nuclear, have been produced and deployed in the ME.

In 1964 (before the 1967 war), Egypt fully supported a resolution on the establishment of a zone free from nuclear weapons in Africa, adopted by the Summit Meeting of the Organizations of African Unity. Since 1974 (after the 1973 war), the UN General Assembly has annually adopted a resolution in support of a NWFZ in the ME, at the request of Egypt. In 1981, after the conclusion of the Camp David peace agreements between Egypt and Israel, Egypt ratified the nuclear non-proliferation treaty, hoping that Israel would follow suit. Before the Gulf War, when information about the production of chemical weapons by some ME states became public, Egypt called in 1990 for a treaty on the elimination of all weapons of mass destruction in the region.

When Egypt urged a ME free from nuclear weapons, Israel insisted on negotiations involving all the Arab states. For example, when the Camp David peace agreements were being negotiated between Egypt and Israel, Israel refused to include the NWFZ question because the other Arab states were absent. When all ME parties began negotiations after the Madrid Conference, Israel's position was that ME peace should be attained and tested before it would negotiate to establish a NWFZ. Now the dilemma is that there will be no peace to be tested in the region so long as Israel maintains its nuclear option. Consequently, both the Arab countries and Israel will continue to assume the images of the enemy, regardless of any agreements they conclude.

Is there a way to solve this problem? Only if the issues of special concern to Israel and to Arab countries which engendered the present situation are equally, simultaneously and constructively addressed.

Three main Israeli concerns must be dealt with: First, the Holocaust, the horrible experience visited on the Jews in Europe, has a special role in defining the concept of Israeli security. Second, the Israeli geographic and demographic predicament as a tiny state. And third, the possible narrowing of the gap between Israeli and Arab capabilities in conventional weapons does not favour Israeli security. Because of these concerns, Israel insists on maintaining its nuclear weapons option.

There are also three main Arab concerns that must be addressed: First, the fact that Israel

possesses nuclear weapons poses direct threats to the security of Arab countries and even to the very existence of their people. Second, preparations for the possible use use of Israeli weapons in limited war and offensive operations are being developed. Among them are the production of varieties of nuclear weapons to be used in different military theaters, the production of the Arrow Missile with U.S. financial and technological assistance to neutralize and kill Arab missiles, the construction of Israeli early warning systems and intelligence satellites and the production of delivery systems to hit targets from Tunis to Iran. Third, nuclear weapons are now being used as a deterrent in current Israeli policy in order to limit political options available to Arab countries. An Israeli pistol is being continuously aimed at the heads of the Arabs.

If such concerns and clashes of interests continue to develop, all settlements concluded are just new arrangements for new conflicts.

An Israeli perception of problems of "Peace and Denuclearization" was recently published in the UN periodical "Disarmament". The Israeli author stressed that developing countries "failed, perhaps knowingly, to understand that balance in international relations is balance of power, which has nothing to do with the concept of equality and mutual obligations."[155] Consequently, Israeli perception of security affairs is based on the principle that "arms controle in the ME will, in the meantime, have to concentrate on confidence-building measures which can be sustained by continuing means of deterrence."[156]

Concepts similar to "balance of power" and "nuclear deterrence" to insure sustainable arms control and the rejection of the principles of "equality" and "mutual obligations" in regional and international relations are the result of very narrow nationalistic approaches to the question of security. They will give rise to mutual deterrence and arms races in weapons of mass destruction.

A regional approach to security issues in the ME is now the only promising alternative. This approach can equally and constructively seek to address the concerns of all parties in order to support common and balanced interests, without jeopardizing the legitimate interests of any party.

Th UN study on "The Establishment of a NWFZ in the Region of the Middle East" aptly states, "the problem is how to create the conditions in which a zone becomes a realistic development. How does one get from here to there? In general the answer is obvious: the fears of the various parties must be understood and dealt with. All assert that they have no aggressive intentions; all fear that they will themselves be the victims of aggression. Confidence must be built on all sides."[157] Such a comprehensive approach in this spirit must be the goal of a ME regional NWFZ negotiation.

To ensure a successful regional approach to ME security, certain issues should enjoy a com-

[155]See [Becker (1993)]
[156]See [Disarmament (1993)]
[157]See [UN study (1990)]

mon understanding among all parties. First, the NWFZ should be geographically defined according to security perceptions of all parties. Since the main conflicts which could lead to nuclear weapons threats are the Arab-Israeli conflicts and conflicts over oil in the Gulf area, the NWFZ must include the countries involved in them all. This means all Arab countries, along with Iran and Israel. This is almost identical with the IAEA's definition of the ME zone[158]. Involving countries from other regions would impede the NWFZ effort.

Second, security and confidence-building measures must address the fears of all sides. With this in mind,

- the measures must include all weapons of mass destruction, nuclear, chemical and biological. The Egyptian proposal to free the ME from all weapons of mass destruction would serve that end.

- There are a variety of restrictive measure that could be implemented to meet the security concerns of all sides, including the establishment of a special safeguards regime in the ME. A UN study on confidence- building measures stresses that they "should take place in an equitable and balanced manner that ensures the right of each state to undiminished security and also ensures that no individual state or group of states obtains advantages over others at any stage."[159]

- Groundbreaking steps have to be taken concurrently, including establishing a ME agency for the promotion of economical, non-nuclear energy sources; encouraging multinational projects for the peaceful use of nuclear energy, with the ultimate aim of a joint regionwide project; ensuring the transparancy of all aspects of armament and military operations in the region; and promoting a mutual exchange of views among military personnel on military doctrines condusive to common regional security interests.

Getting used to these substantial changes from the traditional narrow chauvinistic practices obviously will take time. Implementing a NWFZ will necessarily be a gradual process that allows all parties to gain confidence that their security interests are not being jeopardized. An immediate halt to the production of all weapons of mass destruction, together with a commitment to a fixed period for the gradual implementation of all security measures wiil respond positively to Arab concerns, while the complete elimination of the existing Israel nuclear weapons at the final stage of the fixed period will meet the main demand of Israel.

These steps will lead to a durable and just peace in the Middle East and represent a major contribution to progress toward a world free from nuclear weapons.

[158]See [IAEA report (1990)]
[159]See [UN study (1982)]

2.4.5 North-East Asia and Pacific Region

Regional non-proliferation in Northeast Asia – a building block for a non-nuclear world[160]

Dana Fisher, Peter Hayes, Janice Heppell, Stephen Noerper

1. Introduction

Northeast Asia is a highly proliferated region by any index. Although exactly what nations constitute Northeast Asia region varies by issue area, in relation to nuclear weapons, the region includes at least six states, namely, Russia, China, Japan, the two Koreas, the United States. Other players less centrally involved but nonetheless relevant by virtue of geography, proliferation propensity, or alliance relationship are Mongolia, Canada, Taipei, and US allies with strategic interests in the region (and troops still in UN Command in Korea) such as Australia, New Zealand, etc.

Of these six core regional states, three are great powers committed to maintaining their nuclear arsenals for the foreseeable future (United States, Russia, and China); one is a "virtual" nuclear state due to its extensive nuclear capabilities; and one is an ambivalent proliferator (North Korea). Only Japan and South Korea are committed non-nuclear states at the level of intention. But South Korea could become a temporary nuclear state should it inherit whatever nuclear weapons that the North develops in the course of its nuclear confrontation followed by collapse due to the weight of its internal contradictions. In short, the NPT regime is either powerless to disarm three committed proliferators already loaded with nuclear weapons, or under pressure from a hard core proliferating state (North Korea) that threatens the status of the remaining committed non nuclear states (South Korea and Japan).

Relatedly, all states in the region have or are developing rocket capabilities with intermediate and long range missile delivery capabilities or potential, either directly, or via space programs. Commitment to the MTCR in the core regional states lacking ICBMs is weak (South Korea) or renegade (North Korea). US and Japanese support for the MTCR is strong, but has not evoked similar commitment from other states within the region.

The proliferation of nuclear weapons of mass destruction in the region is matched by a conventional arms buildup as states exploit firesales of excess weapons from the former Soviet Union or market competition between western exporters; and as they modernize their conventional forces. The national security elites in the region remain wedded to doctrines of

[160]This section is sustantially longer than others. Because of technical and time problems (the paper was provided very close to the final deadline) it was not possible to cut it in size. Because of its substance and relevance, the editors decided to leave the text as it is.

offensive defense and orthodox security concepts that accord with national identities built on mutual distrust and long standing antagonisms grounded in centuries of conflict, colonialism, imperialism, and war.

Unfortunately, Northeast Asia lacks the very institutions that would constitute a regional community and promulgate common norms and behavioral codes to blunt these sharp edged dynamics. There are no regional dialogues and no regional fora in which to nurture common orientations toward critical security issues such as the division of Korea and China, territorial conflicts, etc.

This institutional vacuum has two important results:

1. the non nuclear states in the region have no collective means to pressure the nuclear armed great powers to respond to regional fears and desires with regard to nuclear weapons, but are forced to resort instead to bilateral relationships (whether cooperative or confrontational) or global levels to achieve non proliferation and disarmament objectives; and

2. the non nuclear states in the region have not developed regional institutions such as monitoring and verification systems or diplomatic negotiations that would enhance transparency and reduce mutual fears and suspicions.

Thus, realizing non proliferation in Northeast Asia is linked intimately to the task at the global (primarily between the great powers) and regional levels of community building and cooperative engagement between states.

In this essay, we review briefly the vertical and horizontal dynamics of nuclear proliferation in the Northeast Asia region. We conclude by analyzing the importance of confidence building in this part of the world.

2. Horizontal proliferation in Northeast Asia

"Horizontal" proliferation refers to the possibility that the two Koreas, Japan, and Taipei may develop, test, or deploy nuclear weapons. Whatever the status of their NPT membership, all of these currently non-nuclear states have advanced "latent" nuclear weapons capabilities by virtue of their nuclear fuel cycles and delivery systems (whether ballistic or powered by airbreathing engines).

Capabilities: Two shorthand indicators for these overall capabilities are

1. the quantity of plutonium available over a five year period (that is, by 2000) which might be needed for a relatively developed country to develop a small, diverse nuclear arsenal; and

2. the availability of a suitable delivery system for a nuclear warhead.

Table 2.2: Indicators of Nuclear Weapons Capability, Northeast Asia

Country/Capability	Japan	North Korea	South Korea	Taipei
Plutonium, 1991-2000*	83 tonnes	0-0.837 tonnes**	23.1 tonnes	11.3 tonnes
Delivery systems?	Space rockets, Fighters, Bombers	IRBM, Land emplacement	Short range BMs, Fighter, Bombers, Land emplacement	Short range BMs, Fighter, Bombers
Reprocessing (++) or reprocessing - capable (+)	++	++	+	+
* from LWR spent fuel except for DPRK ** low estimate of zero assumes DPRK complies with US-DPRK Agreed Framework, maintains freeze, and reenters NPT; high estimate of 0.837 tonnes assumes DPRK starts up 255 MWe of graphite moderated, gas cooled reactors and operates them from 1996; and starts with 37 kg of plutonium produced in the late eighties/early nineties. Key: IRBM = intermediate range ballistic missile; BM = ballistic missile				

In Table 2.2[161] we show some estimates for both indices for these four non-nuclear states in Northeast Asia. Japan and South Korea are the most capable in the short and medium term respectively; followed by Taipei and the DPRK. But all states have a credible, latent capacity to produce, test, and deploy nuclear weapons in the medium-term. All these states can afford the cost of a five year nuclear weapons program (estimated at $200-300 million/year). Although all four non nuclear states are formal NPT members, North Korea challenged the non-proliferation regime after 1994 by threatening to withdraw altogether from the NPT and by restricting IAEA inspections under its safeguards agreement with the Agency.

Proliferation Propensity: Thus, intentions and motivating conditions which drive proliferation propensity in states are the critical factor, not merely technological capabilities. The strategic calculus of each of the non nuclear states varies considerably with respect to future demand for nuclear weapons. As is well known, Japan and South Korea live under the US nuclear umbrella as well as with the generic guarantees provided to them as NPT members against nuclear attacks. Taipei is no longer formally linked to the US security system,

[161]See [Albright/Berkhout/Walker (1992)], authors' calculations and US State Department for the ROK and DPRK respectively.

but the ambiguity as to how far the US nuclear umbrella casts its shadow may provide it with some residual nuclear extended deterrence against putative nuclear threats from China (conventional threats are another matter).

Of the four, North Korea is the state most susceptible to external nuclear threats, having today neither a credible external security partner willing to extend nuclear deterrence to it (arguably, North Korea has never had such, but this situation may have been perceived differently in Pyongyang and Washington), nor a deployed nuclear arsenal of its own. It has faced explicit US nuclear threats to its national existence for four decades, including deployments of nuclear weapons in and around the Korean Peninsula. Thus, North Korea's threats to withdraw and implicitly, to proliferate with nuclear weapons, combined with the prima facie case that it has lied about the quantities of plutonium extracted from spent fuel in the past, and continuing signals that it may withdraw from the NPT, all indicate that its proliferation threat is credible.

US-DPRK Agreed Framework: This dire situation led to the United States and the DPRK to sign the Agreed Framework on October 21, 1995. This document is a landmark in both US-DPRK relations, and in the non proliferation regime as a whole. It not only elevated US-DPRK dialogue to a high level on each side whereby national prestige and leadership was put on the line; it also is the first case that cooperative engagement has been put to the test in the non-proliferation regime. Over the previous two years, the United States and its security partners had discovered that the threat of sanctions and use of coercive force was insufficient to the task (and potentially disproportionately expensive) of compelling North Korea to comply with the NPT. The United States turned, therefore, to engagement and the use of positive power to reassure and persuade North Korea to cooperate rather than militant containment and the use of negative power – sanctions and military force to achieve deterrence and/or compellance. These two approaches are not exclusive, although they sit uneasily with each other because some policy currents in Washington are more comfortable with traditional, force-based means of dealing with an intransigent small power than with cooperative engagement based primarily on political and economic instruments.

It remains to be seen if the Agreed Framework will bring North Korea back into the NPT fold. The deal is complex and stretches over a decade. In many respects, it is ambiguous, and subject to continuous reinterpreration and dispute at every step. From the US perspective, however, it is not hard to see why the Agreed Framework was attractive. Not only did it freeze the construction program for indigenous "power" reactors that would have boosted the DPRK's plutonium production rate to upwards of 160 kg/year, according to US officials; but it also requires the North to dismantle its reprocessing plant in accordance with its December 1991 commitment to the DPRK-ROK Denuclearization Declaration – an action that surpasses that required by the NPT for non-nuclear states.

In Figure 2.1, we show the North Korea's accumulation of plutonium based on "going it alone" outside of the NPT ("NK" in the legend) versus the future promised by the Agreed

Framework wherein the DPRK obtains light water reactors ("LWR" in the legend). In the former, North Korea starts with an estimated 37 kg of plutonium, and accumulates 0.837 tonne by 2000 (rising to 1.797 tonnes by the time the first LWR might come on line as envisaged under the Agreed Framework).

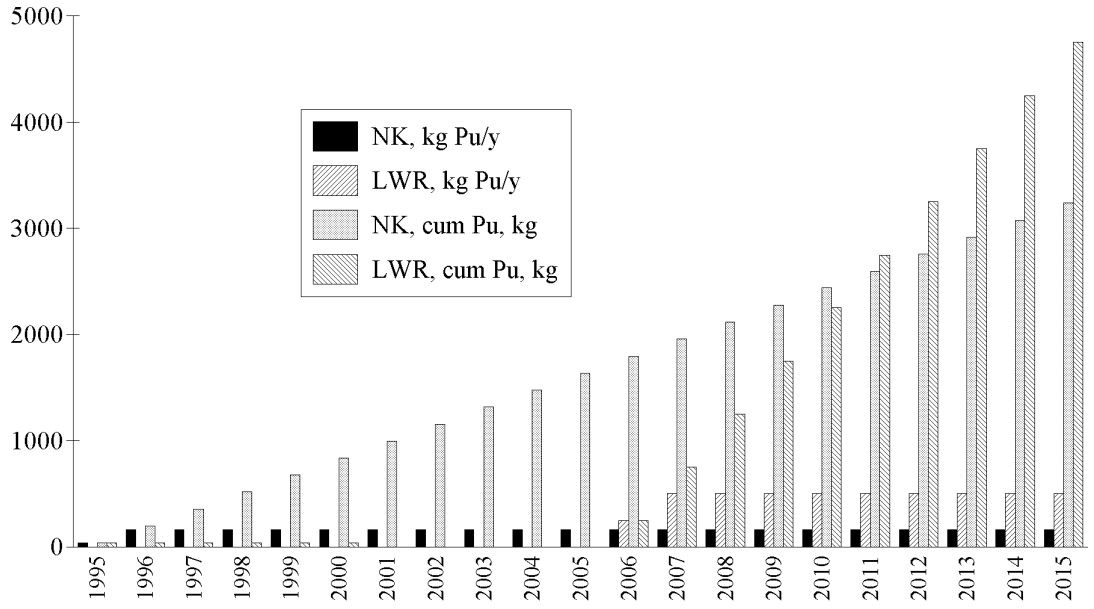

Fig. 2.1: Comparison, DPRK Annual and Cumulative Pu, NK vs LWRs

In contrast, under the Agreed Framework, an estimated maximum of 37 kg of undeclared plutonium extracted in the past will have to be removed or put under safeguards (or otherwise explained and resolved); then the DPRK has zero plutonium until about 2006; and thereafter accumulates it at the rate of 500 kg/year (once the second LWR comes on line). Not until 2008 would the DPRK accumulate as much plutonium from LWRs as it would by the year 2000 using its own technology. Correctly or not, many US analysts believe that the DPRK may not exist long after the year 2000 (due to the weight of its internal contradictions). To them, the Agreed Framework looks rather attractive in the short and medium-term relative to the North "going it alone." This deal is doubly attractive to the United States because most of the $4 billion cost of implementing the Agreed Framework will be picked up primarily by South Korea, Japan, and other security partners. Additionally, United States avoids increased costs of military readiness and even war should the DPRK proliferate its own nuclear weapons.

Some have criticized the Agreed Framework for "giving away" the shop while allowing the North to pick and choose what and when the IAEA can do in North Korea. In some respects this criticism is valid. Special inspections demanded by the IAEA on the disputed waste

storage sites will be delayed for five or more years until the nuclear components of the LWR are transferred (circa 2000). Also, an ambivalent proliferator will have been "rewarded" for non-compliance with the NPT.

Conversely, the IAEA is now conducting stringent inspections on the DPRK, and is sealing off and monitoring facilities in ways not envisaged under the original safeguards agreement. And the principle of special inspections and the authority of the IAEA have been preserved formally as the main inducements are not to be delivered until the Agency signs off that the DPRK is in full compliance with its safeguards obligations.

From the North Korean perspective, the "lavish" rewards are actually relatively small. The LWR transfer is a loan, not a grant, which will add to the DPRK's already large (and unrescheduled) foreign debt. We estimate the loan to be worth about $360 million/year. The 500,000 tonnes of oil to be provided each year is worth about $60 million, or about the value (at $0.1/kWhe) of the electricity foregone from the partly constructed reactors that the DPRK is obligated to junk under the Agreed Framework–that is, the DPRK's net gain on this score is approximately zero from an economic perspective.

Other elements that may enter the DPRK's calculus–its ability to substitute nuclear deterrence for expensive conventional troops, the reduction in tensions and thereby the ability to reduce conventional forces associated with giving up definitively its nuclear weapons option, the political costs of admitting that it lied about past reprocessing (if indeed it did), the foregone prestige and influence associated with nuclear weapons – these and other costs and benefits of nuclear proliferation are subjective and cannot be quantified easily or precisely. But overall, these factors may cancel each other out, making the DPRK's net gain from fully complying with the NPT via the Agreed Framework versus continuing to defy in its ambiguous status more or less the same – so long as sanctions are avoided. Should the situation shift back into confrontation, the cost of sanctions and the risk of war may be very large to all parties – thus, the extraordinary efforts to achieve and implement the Agreed Framework. But until the DPRK achieves its overarching objective – using the nuclear battering ram to beat open the US closed door policy on trade, technology transfer, finance, and investment – it will not reap substantial gains at a rate that will make a major difference to the regime's ability to survive.

Perhaps the critical determining factor in past local decisions to proliferate or not in this region has been the reassurance provided and discipline imposed by the United States, the senior security patron of Japan and South Korea, and formerly of Taipei. The United States reversed proliferation decisions by Seoul and Taipei by a combination of arm-twisting and assurance (including massive conventional arms transfers buttressed by forward deployments of nuclear-armed and/or capable US troops, depending on local circumstances). Japan's proliferation propensity has been contained firmly since the inception of the US-Japan alliance by the US nuclear umbrella. Consequently, the risks of increased vulnerability (and ignominy) combined with domestic political considerations during the phase of initial proliferation have precluded serious consideration of a nuclear weapons option in Tokyo.

For all these reasons, the main determinant of the medium- term proliferation propensity of the four non-nuclear states in the region is the outcome of the DPRK case. If it is resolved cooperatively and via engagement, the US-DPRK Agreed Framework has the potential to become the seed of a regional multilateral security framework. It would be ironic if a spoiler, anti-status quo proves to be the motivating factor impelling the United States to build a multilateral security architecture in the region.

If, on the other hand, the impasse reemerges and spirals again toward sanctions and threats or acts of force, then the old, bilateral system of US military alliances based on US military dominance and nuclear hegemony will be the dominant factor in offsetting nuclear proliferation by North Korea. In any case, the likely modality of a highly improbable event – Japanese or South Korean nuclear proliferation in the medium- term – would be nuclear sharing on the NATO model, not an independent nuclear force.

3. Vertical Proliferation in Northeast Asia

In the late eighties, it was still conceivable that nuclear war could erupt in Europe or the Middle East, but be fought primarily between the United States and the former Soviet Union in the East Asia/Pacific "theater." Or, that war could start in the region (in Korea, for example) and escalate to a regional nuclear war. In such wars, the number of targets within the region determined the total number of warheads that might have rained down on the region. Arguably, the United States might have allocated 1,500 strategic and theater nuclear warheads to then-Soviet forces east of the Urals and forward-deployed across the region; the Russians might have had 2,500 warheads aimed at US forward-deployed nuclear-capable forces and bases – excluding the US mainland; and China had some 200 odd nuclear weapons, mostly with a range to hit only targets within the region.

Today, the situation is changed totally. US and Russian intermediate range nuclear missiles have been dismantled, along with their tactical nuclear weapons. Both nuclear superpowers are dismantling a large fraction of their strategic nuclear forces and have home-based their residual naval and air-delivered theater nuclear weapons; China's "minimal" nuclear forces are increasing slowly in size and capability. "Theater" nuclear wars and "horizontal escalation" scenarios have disappeared. Superpower missiles are targeted on whales, not cities. So is there no reason to be concerned with great power nuclear arsenals on a regional basis? And what of the linkage between the residual nuclear forces and horizontal nuclear proliferation?

One estimate of the existing nuclear forces is shown in Table 2.3[162]. In brief, it is evident that the United States will deploy mainly SLBMs and slow moving bomber and bomber-launched nuclear missiles. The Russian Federation will rely heavily on a much diminished but still enormous land-based missile arsenal, supplemented by a large force of SLBMs and

[162]See [Lockwood (1994] revised by author ; Chinese data from Robert Norris, Natural Resources Defense Council

bombers. And China's primary nuclear forces remain its intermediate range missiles and bombers, reinforced rather minimally by a small number of long range rockets and SLBMs.

	Number of Nuclear Weapons and Warheads		
Category of Nuclear Weapon*	**United States**	**Russian Fed eration**	**China**
ICBMs (5,500 km range or greater)	530 Minutemen with 3 RVs each; 50 MX with 10 RVs each *Total CONUS land -based ICBM warheads, US: 2090*	30 SS-13 with 1 RV each; 25 SS-17 with 4 RVs each; 188 SS-18s with 10 RVs each; 170 SS-19s with 6 RVs each; 10 silo-based SS-24s with 10 RVs each; 36 rail-based SS-24s with 10 RVs each; 297 SS-25s with 1 RV each; *Total Russian land-based ICBM warheads 3,787##*	4 DF-5As (CSS-4)* with 1 RV each *Total land-based ICBM warheads: 4*
Land-based IRBMs (1,000-5,500 km range)	*Total US Land-Based IRBM warheads: 0*	*Total Russian Land-Based IRBM warheads: 0*	50 DF-3A (CSS-2) with 1 RV each; 20 DF-4 (CSS-3) with 1 RV each; 36 DF-21 (CSS-6) with 1 RC each; *Total Chinese Land-Based warheads: 106*
SSBNs in the Pacific	8 Ohio-class each carrying 24 Trident J (C-4) SLBMs with 8 RVs each *Total Pacific-based warheads: 1,536*	6 Delta-Is carrying 12 SS-N-8-SLBMs each carrying 1 RV each; 9 Delta IIIs carrying 16 SS-N-18 with 3 RVs each; 1 Yankee I carrying 16 SS-N-6 SLBMs with 1 RV each *Total Pacific-based warheads: 520*	1 operational Xia-class SSBN carrying 12 JL-1 (CSS-N-3) SLBM with 1 RV each *Total Pacific-based warheads: 12*
Bombers	94 B-52H with 20 Air Launch Cruise Missiles (ALCMs)/Advanced Cruise Missiles (ACMs) with 1 RV each; 95 B-1B with 16 bombs; 5 B-2 with 16 bombs *Total CONUS-based air deliverable warheads: 3,480*	35 Bear G with 2 bombs each; 36 Bear H with 16 ALCMs each; 27 Bear H with 6 ALCMs each; 5 Blackjack with 12 ALCMs each;** *Total airdeliverable warheads, Russia only: 868*	30 H-5 (B-5);120 H-6 (B-6); 30 Q-5 (A-5); there are approximately 150 nuclear gravity bombs available *Total China-based airdeliverable warheads: 150*
Total***	7,106	5,175	272

(Notes on next page)

* The parentheses indicate the NATO designation of the weapon # US Atlantic-based SLBMs are 7 Ohios armed with 1,344 Trident warheads; Russian Atlantic-based SLBMs armed with 2,024 warheads. ## Not included here are those weapons located in newly independent states as follows: Ukraine, 90 SS-19s with 6 RVs each; Belarus, 36 SS-25s with 1 RV each; Kazakhstan, 60 SS-18s with 10 RVs each. Some of these nuclear weapons have been transferred to Russia and have been incorporated in the table; all three of these states are parties to START I and the NPT. **Not included here are those weapons located in Ukraine, that is, 19 Blackjack with 12 ALCMs each; 21 BearH with 16 ALCMs each; 1 BearA with 1 bomb; 1 Bear B with 1 bomb. *** If Atlantic-based SLBM warheads, and non-Russian FSU warheads (see notes above) are included, then the US total rises to 8,450 and the Russian/FSU total reaches 8,941 nuclear warheads. *Notes:* All these numbers are "moving targets." The table includes only nuclear weapons that are counted per the START I and INF Treaties. It does not include categories of what were called tactical nuclear weapons during the Cold War such as gravity bombs, antisubmarine depth charges, artillery and short range missiles, and land mines. Russia and the United States are committed to withdrawing and dismantling tactical nuclear weapons. Russia is committed to dismantling one third of its 6-13,000 tactical nuclear weapons. For its part, the United States declared in September 1994 that it will never deploy nuclear weapons on surface warships. Current plans are to retain about 1,000 operational "tacnukes" composed of about 3-500 B61 gravity bombs based in Europe and the United States, and about 350 W-80 nuclear warheads stored in the United States for Tomahawk SLCMs for deployment on attack submarines (which would not be so armed routinely); the number of Russian nuclear SLCMs in unknown. However, in 1992, the United States and Russia removed all nuclear-armed SLCMs from their ships and submarines. China is not believed to have any nuclear SLCMs. Many US tactical nuclear weapons such as ASW depth bombs, artillery shells, mines, etc. have not been not only withdrawn but dismantled. China may have some tactical nuclear weapons. Finally, a substantial portion of Russian nuclear weapon systems at all levels are inoperable or non-deliverable, due to lack of funds, maintenance, fuel, etc.

Table 2.3: Global and Asia-Pacific Nuclear Forces (as of December 1994)

What fraction of the nuclear forces in the US and Russian arsenals with a true global reach are based in or might be targeted in the future against the "Asia Pacific region?" Assuming that 25 percent of the Russian ICBMs, all the Pacific- based SLBMs, 25 percent of Russian and US bomber forces, and all Chinese forces are salient to the Asia-Pacific region by virtue of either basing or targeting contingencies, then the region either contains or could be targeted by more than 4,000 nuclear weapons. In short, available arsenals exceed enormously the requirements of minimum deterrence. So far, all the great powers have managed to do is to return approximately to the force levels associated with the early 1970s which at the time were merely absurd, as against the later clinically insane.

As we noted earlier, it is difficult to postulate meaningful scenarios of nuclear war between the great powers today. Nuclear weapons are justified solely in terms of "insurance" against future, unspecified threat scenarios in which the great powers revert to past bad habits of coercive nuclear diplomacy. Thus, there is no sound basis for developing great power force levels except vague notions of future confrontations. The major determinant of force levels over the next five years appears to be bureaucratic momentum, modernization programs, and the difficulty of implementing existing strategic arms control and disarmament agreements.

In terms of lesser nuclear threats from small states – whether conventional or via weapons of mass destruction – the United States and Russia appear to have both more and less options than were available to them in the past. On the one hand, they have dismantled most of their intermediate range missiles and home-based theater and tactical nuclear weapons that used to be forward deployed regularly aboard bombers and warships. But they are also less constrained by the other in terms of using strategic nuclear missile, dual capable bomber, or cruise missile forces formerly held in reserve for use in deterring and/or fighting the primary adversary at the global level. Thus, in a strictly military sense, nuclear threats against states with small nuclear arsenals (or engaged in a conventional war against US forces or its allies) have increased credibility in the post Cold War era.

Certainly potential proliferators such as North Korea surely have studied carefully three historical lessons: the NATO doctrine of deterring superior conventional forces with nuclear weapons; the Israeli posture of nuclear armament shrouded in studied ambiguity; and what happened to a "slow" proliferator (Iraq) when confronted by great powers. All these lessons are apt to the strategic circumstances of small states confronted with either American or Russian power, including the continued threat of nuclear attack under extreme circumstances.

It is obvious, therefore, that Northeast Asia is not about to become a non nuclear nirvana in the near future. Nonetheless, great power nuclear inventories in this region can and must be reduced. Four recent studies identified the following steps which can and should be taken at the regional level to supplement and speed up this process:

- Reinforce the international nuclear non-proliferation regime as a whole;
- Strengthen the NPT regime (which requires serious progress on the Comprehensive Test Ban Treaty;
- Prevent further proliferation of nuclear weapons in the region so as to reduce tensions and to facilitate on-going reduction of great power nuclear forces;
- Buttress longstanding negative security assurances by pledging not to use or threaten to use nuclear weapons against any non- nuclear weapons state, regardless of its alliance;
- Stop nuclear testing and negotiate, sign and ratify the Comprehensive Test Ban Treaty;
- Stop the production of fissile material for weapons;
- Cease all reprocessing of plutonium, including reprocessing for civilian purposes;
- Declare the number of nuclear weapons in their stockpiles (including non-deployed strategic and all tactical warheads) and their fissile material inventories and arrange for measures to verify these declarations, thereby creating a register of nuclear arms in the region;

- Allow international monitoring of warhead dismantlement;
- Commit to dismantling all naval nuclear warheads carried on attack submarines, surface ships, and aircraft;
- Commit to dismantling all ground-launched tactical nuclear warheads;
- Establish and institutionalize a multilateral forum, including the US, Russia, China, Japan, and South and North Korea, to discuss nuclear security issues in NEA;
- More responsible action on the part of the "haves" might also help encourage more "have-nots" to sign up for an unlimited extension of the NPT;
- Commit in principle to a Start III (and getting Start II 'to fruition');
- Bring China into the START III dialogue to build consensus among the nuclear states;
- Continue and accelerate reduction of Russian and US nuclear stockpiles under START I;
- Help Russia to dismantle their weapons systems and warheads on the START II schedule;
- Bring medium nuclear powers (like China) into nuclear arms control talks aimed at reducing and restructuring their arsenals to rely less on land-based systems and more on SLBMs;
- Initiate a regional dialogue on a regional nuclear free zone building on the Korean bilateral Denuclearization Declaration;
- Develop multilateral security relationships in the region;
- Increase security-related transparency to build confidence in the region such as a conventional arms register and extending the Open Skies to the region.

In short, the great powers do not lack policy options to contribute to the process of nuclear non-proliferation at the regional level in Northeast Asia. What is lacking is the political will to tackle these imperatives.

4. Confidence Building and the NPT in Northeast Asia

As noted above, the Geneva Agreed Framework between the United States and the DPRK is the most important confidence building measure to date in Northeast Asia. The success or failure of the Agreed Framework has enormous implications for the NPT regime at a global level, and for non-proliferation dynamics at a regional level. As an exercise in cooperation

to induce compliance, the emerging US-DPRK relationship has the potential to become the foundation for an inclusive Northeast Asian community. Overall, confidence building in this region is at an early stage and is badly needed due to residual conflicts combined with the total lack of institutionalized community structures. Successful confidence building can make the difference between war and peace in Northeast Asia, and is highly relevant to the NPT regime. Nowhere is this more apparent than in the Korean Peninsula.

In brief, we argue below that confidence building is critical to expanding and reinforcing the NPT regime because such activity increases information, stimulates dialogue and evokes negotiation; can be wide-ranging and not only related to military issues; and start small and quickly in incremental steps to get the process of dialogue underway.

Why is confidence building important now in Northeast Asia? Northeast Asian relationships are characterized by an intricate blend of political/diplomatic, economic, environmental and military relations which have become more complex in the Post-Cold War era. Some of the thirty bilateral relationships (excluding the United States and Canada) are already inherently cooperative and "friendly" while others are profoundly conflictual. Thus what one pair of countries can agree upon may not be possible with others.

It is critical to forge agreements when "windows of opportunity" exist rather than waiting for a complete consensus among disparate players. Nations need to develop a practical menu of "la carte" measures to improve relations and address issues of mutual concern with neighbors. They must start small and build upon each successfully negotiated and implemented measure at their own pace. Overambition or impatience can result in rejection or broken agreements, which subsequently become confidence destroying measures.

Rather than concentrating on the 'defensive' elements of security, confidence building focuses primarily on the principle of cooperative, reciprocal or mutual security. The essence of confidence building is not the adoption of specific measures but the relationship between the negotiation and the implementation of these measures, which establishes a procedural relationship and mutual understanding. Disassociated from the larger political process, confidence building activities lose much of their value. In fact, without the necessary transformation in perceptions, increasing the information available for evaluation may actually undermine confidence rather than enhance it.

What are the functions of confidence building? The functions of confidence building are wide-ranging and include the following:

1. reducing uncertainty, misperception and suspicion by providing verifiable information on defence budgets, force structures, defence postures, and military equipment acquisitions;

2. reducing the risk of accidental war through notification of military movements so that a training exercise is not mistaken for the mobilization of forces prior to an attack;

3. humanizing the adversary by providing opportunities for dialogue and consultation;

4. establishing channels for consultation in potential crises, and

5. laying the basis for transnational coalition building supportive of increased interdependence in many dimensions, and may serve also as tacit geopolitical collaboration.

Confidence building relates not only to military security: The concept of confidence building is closely associated with the Conference on Security and Cooperation in Europe (CSCE). Although CSCE confidence building measures or CBMs were all military in nature, in hindsight, "non-traditional" cultural confidence building laid the foundation from which the other "traditional" CBMs were built.

Today, the concept of comprehensive and cooperative security incorporates wide ranging measures to address multiple Post-Cold War security concerns, many of which are rooted in economic, political and environmental concerns, yet manifest themselves in military terms. Thus, this broad concept of national security must be accompanied by an equally broad concept of confidence building in the Northeast Asia region. Especially in the early phase of community building, successful confidence building requires high quality, timely, and independent information, desperately lacking in Northeast Asia. Thus, non governmental agencies that can move quickly and with agility across national boundaries to circumvent traditional enmities and bureaucratic obstacles to change are of critical importance.

US-DPRK Engagement: The Realpolitik of non-proliferation in Northeast Asia
Perhaps the most important aspect of realpolitik that will affect the realization of the NPT regime in the region is the relationship between the United States and North Korea. The US-DPRK agreed framework (AF hereafter) requires that each party normalize relations with the other, but does not specify precisely how to achieve this goal. Some in Washington believe that normalization can be achieved without replacing the Armistice. But living at peace in a state of war is an oxymoron. In reality, full diplomatic recognition between the two states is impossible without replacing the Armistice.

To date, the United States has not broached the Armistice issue with the DPRK in the AF dialogue. Assuming that the AF is implemented as scheduled, what constraints will affect the normalization process? And what concerns must be addressed to normalize fully US-DPRK relations and replace the Armistice?

The initiative to implement the AF rests fully with the Administration. Nonetheless, the Republican-dominated Congress may limit the rate and scope of normalization "as progress

is made," states the AF text, "on issues of concern to each side." Congress controls appropriations necessary to improve and normalize relations. In short, Congressional support is critical to implementation of the AF and rapprochement.

The United States also knows that the ROK can veto the transfer of light-water reactors to the DPRK in accordance with the AF. Close ties between ROK and US opponents of rapprochement may retard implementation of the AF and, accordingly, the pace and scope of normalization. Conversely, Seoul is in a strong position to ward off ill-informed and partisan attacks on the US-DPRK agreement.

Given this potential friction, the slowest element of normalization is likely to be replacing the 1953 armistice with a peace treaty. The US Government holds that only the Korean people can resolve the Korean conflict – as the two Koreas asserted in their 1991 non aggression pact. Consequently, the United States will not commence serious discussions of the Armistice until the DPRK recognizes the legitimacy of the ROK government, in turn, in time to permit the transfer of light-water reactors under the AF. The earliest therefore that the United States could discuss what the DPRK now calls "interim arrangements" to ending the Armistice is the end of 1995.

Further complicating the Armistice issue is the need to negotiate a new relationship between US and ROK forces wherein a US commander of the Combined Forces Command would implement provisions of a peace treaty pertaining to ROK forces. The two allies would have to amend existing Status of Forces and other agreements that define US operational command of ROK forces.

Moreover, regional actors must identify ways to ensure that both Koreas feel secure before the Armistice is replaced. To this end, the United States may propose trilateral talks between the two Koreas and itself to draft a settlement for acceptance by the UN Security Council and by allies of UN Command.

A supplementary approach might be for China and South Korea, on the one hand, and the United States and the DPRK on the other, to strike non-aggression pacts. "Traditional" formula such as the "4+2" equations proposed in the eighties by Russia and others appear less realistic today, not least because the DPRK seeks to dilute the power of its big neighbors in larger security fora, such as the ASEAN Regional Forum. Also, its primary goal is to strengthen relations with the United States and to avoid what it perceives to be sub-regional traps set by the South.

Another critical issue inherent in a peace treaty is that of nuclear deterrence extended to the ROK by US nuclear forces. It may be possible to keep the nuclear "umbrella" over the ROK at the outset of negotiations with the DPRK on normalization. But such an option is less feasible as the two Koreas normalize relations. It might even undermine inter-Korean reconciliation, despite the US negative security assurance mentioned in the AF.

In keeping with Section III of the AF, the United States will have to abandon nuclear threat rhetoric against the DPRK. By the time a peace treaty is on the table, the DPRK will have:

returned fully to the NPT fold; reduced its offensive and destabilizing conventional force deployments and levels; and stopped missile exports. Before the moving too far down this path, the United States must ensure that the ROK is comfortable with its own ability to deter DPRK forces without putative US nuclear backing or nuclear weapons of its own.

Thus, a US-DPRK peace treaty requires major progress in the DPRK-ROK dialogue and full implementation of the 1991 ROK-DPRK Denuclearization Declaration. Cooperation on economic, energy, and environmental fronts may stimulate inter-Korean reconciliation. But only a resumption of official north-south dialogue and substantial reduction in tensions will permit a formal peace treaty to be negotiated. There is no short cut to replace the Armistice.

With the Korean War ended and the North Korean threat to proliferate over, the region would be in a good position to start authentic community building. The bilateral inspectorate envisaged under the North-South 1991 Denuclearization Declaration contains the seeds of a regional verification system that could encompass Japan and cover aspects of great power nuclear weapons in the region. Such a system could be tailored to the specific security circumstances of the region, as proved to be important in Europe and Latin America which provide important precedents for Northeast Asia.

Securing a Nuclear-Weapon-Free Korean Peninsula[163]

(Dingli Shen)[164]

The Agreed Framework Document between the U.S. and the Democratic People's Republic of Korea (DPRK), signed in last October, has well de escalated the nuclear tension on the Korean Peninsula. It has offered new windows of opportunity that, through carrying out the agreement step-by-step, mutual trust and confidence can be hopefully developed between Washington and Pyongyang.

This progress has further highlighted the prospects of a nuclear-weapon-free Korean Peninsula. In fact, as early as in December 1991, Pyongyang and Seoul reached the "Joint Declaration for a Non-Nuclear Korean Peninsula". They pledged, among other things,

- not to test, produce, receive, possess, store, deploy, or use nuclear weapons;
- not to possess facilities for nuclear reprocessing and uranium enrichment; and,
- to use nuclear energy solely for peaceful purposes.

[163]Based on an earlier version published in "INESAP Information Bulletin", Issue No. 3, October 1994, pp.8-10.

[164]The opinions expressed in this writing does not represent that of the author's affiliations, and that of the Government of China.

An envisioned Korean Peninsular NWFZ has to address two major issues. One is the verification of non-nuclear-weapon status of the two Koreas. The other is an international recognition to honor the non-nuclear zone.

First, on verification. Both Pyongyang and Seoul have expressed intention not to retain uranium enrichment and plutonium reprocessing. To ensure the true commitment of denuclearization, an effective verification is deemed necessary. As long as the countries concerned are members of the NPT, they are obliged to accept international inspections. Special inspections would be helpful to clarify cases where suspicion with sufficient evidence is raised.

Verification of the Korean nuclear-weapon-free zone can be conducted by IAEA, or a joint team of the two Koreas, or simultaneously by both. Of particular value to build trust through verification is an arrangement of mutual inspection between the North and South. A nuclear-weapon-free zone approach provides an additional means in which intrusive but symmetrical safeguards can be equally applied to both Koreas.

On the Korean Peninsula, one has to make sure that any facilities of plutonium reprocessing concern are to be banned. For the North, this will eliminate the possibility to extract new plutonium of high grade from spent fuel. On the South, one has to be aware of the argument of "fuel-cycle sovereignty", which calls for the retention of reprocessing for non-military purpose. In the meantime, one should verify that no uranium enrichment would take place on the Korean Peninsula. As gas-graphite reactors in the region are to be phased out by light water reactors, the international community will gain a new leverage by supplying enriched uranium fuel to the light water reactors. One might also consider removing all spent fuel from light water reactors to outside the Korean Peninsula.

Second, on international recognition of the Korean Peninsula as a nuclear-weapon-free zone. This concerns obligation of the nuclear weapons states not to introduce nuclear weapons into the region, not to deploy or test nuclear weapons there, not to use or threaten to use nuclear weapons against this region.

The U.S. has declared that it has withdrawn nuclear weapons from this region. An appropriate verification to this effect will be welcome. The other responsibility of nuclear weapons states is security assurance toward the Korean Peninsula. So long as the non-nuclear-weapon status of the Peninsula is effectively maintained, nuclear weapons states should pledge not to use or threaten to use nuclear weapons against the region.

China has long advocated a no-use policy toward all non-nuclear-weapon states. This policy undoubtedly applies to Korean Peninsula, as long as the region is nuclear weapon free. Although Russia has changed its nuclear doctrine, it is inconceivable that Russia will use nuclear weapons against the Peninsula. Britain and France are far away from the Far East. There is no justification that their interests would be involved in this area to the extent that they have to resort to nuclear weapons against the Koreas.

The U.S. has recently repeated its pledge not to use nuclear weapons against DPRK. In addition, the U.S. has provided positive security assurance to South Korea. Given all these

facts, there should be no serious difficulty for all the declared nuclear weapons states to ensure the immunity of the Korean Peninsula from nuclear attack from them.

As a Korean nuclear-weapon-free zone is reachable in one-decade time frame, one would consider expanding the Korean NWFZ into a larger area. There have been proposals to establish an all Northeast Asian nuclear-weapon-free zone. Due to political feasibility and usefulness, such consideration is unlikely to be realized. In the foreseeable future, a realistic approach to establishing a nuclear-weapon-free zone in Northeast Asia may simply cover the Korean Peninsula proper.

2.4.6 Europe

Ulrich Albrecht

The concept of nuclear weapons-free zones has its deepest historical roots in Europe. It emerged in the mid-1950's, when the U.S. deployed large numbers of tactical nuclear weapons on the territories of some NATO allies and when the USSR responded by deploying nuclear weapons on the territories of Warsaw Pact member states. Domestic political opposition to nuclear armament resulted in the adoption of non-nuclear status by the traditional European Neutrals, and in 1957 two NATO member states, Denmark and Norway, decided not to accept nuclear weapons on their territories in peacetime[165]. This dissent was mainly a consequence of the horrors of Hiroshima and Nagasaki. In Germany, the protesters were also motivated by an awareness of the fact that the first atomic weapons were developed in the U.S. to counter Hitler's atrocious Third Reich.

The dispute over possessing nuclear weapons has always carried enormous political consequences in Europe, with repercussions far beyond the question of their military utility. The internal debate over nuclear weapons on German soil brought about a major political crisis which shook the Adenauer government in 1957/58. Germany's neighbors considered a nuclear weapons-free zone as a crucial instrument for denying this weapon of mass destruction to the power which had twice launched world wars in this century and which might at some future time initiate a war of revanche. This was certainly the central motivation behind repeated Polish proposals.

The nuclear weapons-free zone idea was frequently suggested by members of the Warsaw Pact as they cautiously tried to free themselves to some extent from Soviet dominance. The thought was that if a socialist state were entitled to participate in a European nuclear weapons-free zone, it could define its national security in terms separate and different from the way the Soviet Union, a nuclear super-power, defined its national security. The hope was that this might lead to a reassertion of some sort of European identity that would help them resist the pressures of Sovietization. This was the other important political rationale behind the series of four Rapacki-Plans proposed by the then Polish Minister of Foreign

[165]See [Keesing (1957)]

Affairs, beginning in 1957. In the Hungarian uprising in 1956 and the "Prague Spring" of 1968, nuclear weapons-free status was one of the stated political goals of an independent socialist country. Never would the intimate relationship between nuclear weapons stationed on a country's soil and that country's political domination be more apparent than it was in the case of those two political catastrophes.

A persistent theme in Western political thinking about de-escalating the East-West confrontation was the establishment of a nuclear weapons-free corridor between the two alliances, running from Scandanavia southwards to neutral Austria and Yugoslavia. At the Geneva summit of July 1955, British Prime Minister Anthony Eden offered a plan to unite Germany, with the reunited state eventually having the option of allying itself with the Eastern or Western blocs or chosing political neutrality[166]. In any case, Germany would not have had nuclear weapons on her soil. Permanent denial of these weapons to Germany was at least a secondary intent of the Eden plan, which in general would have established "a demilitarized area between East and West." The opposition leader, Hugh Gaitskell, later campaigned for this idea during the mid-1950's.[167] He added the notion that the Soviets should pay a price for the elimination of West Germany from NATO – releasing Poland, Hungary and Czechoslovakia from their custody. The Labour defence spokesman, later defence minister, Dennis Healey was also attracted by the idea and developed it further[168]. He proposed "the creation of a neutral belt comprising the Federal Republic on the Western and East Germany, Poland, Czechoslovakia and Hungary on the Soviet side...The countries in the neutral zone should not dispose of atomic weapons."

The first to develop the notion of a European nuclear weapons-free zone into a full-fledged political concept was an American, George F. Kennan, a principal author of American Cold War strategies. His "Mr. X" articles in the journal "Foreign Affairs," were the first to advocate "containment" of the USSR [although, he later complained, he had in mind political rather than military means for accomplishing it]. In a November 1957 BBC program, Kennan addressed himself to the idea of "nuclear disengagement" in Europe, a concept meant to dampen the sharp divide between the two military blocs by a limited pull-back of nuclear forces on both sides. Thus Kennan coined a Leitmotiv for future discussions about a reduction of tensions in the East-West conflict by reducing the nuclear dimension. It is interesting to note that this is the only nuclear weapons-free zone proposal the United States has advanced in the fifty years since the development of the atomic bomb.

Proponents of the Kennan idea hoped that negotiations about a nuclear weapons-free corridor running through Europe could set in motion a dynamic that would de-escalate the Cold War arms race. Subsequently, the international peace movement sought to promote a central European nuclear weapons-free zone. The military and political utility of such a zone, running North to South through Central Europe met with increasing support by the public, but not

[166]See [Eden (1955)]
[167]See [Gaitskell (1957)]
[168]See [Healey (1958)]

by the ruling elites. British Trade Union Congresses, the Social Democrats and the Liberal Party in Germany and other groupings filed numerous resolutions towards this goal.

The Cuban missile crisis of 1962, when the world found itself on the brink of nuclear war, brought new momentum to the campaign for a nuclear weapons-free zone in Europe. In the wake of that crisis, Finnish President Kekkonen proposed in 1963 that the nuclear have-nots sign regional accords to abstain from going nuclear[169] . The campaign may have been handicapped, however, by the fact that the concept of a central European nuclear weapons-free zone was made a top Soviet foreign policy priority in the Breshnev era, which caused uninformed observers to assume that it was an "Eastern" project[170].

The new peace movement of the early 1980's brought new momentum to the idea not only of a nuclear weapons-free corridor, but also to the grander vision of a nuclear weapons-free Europe. The 1980 END-Appeal, "European Nuclear Disarmament," opened the way to fresh political ideas which culminated in the recommendations of the Palme Commission. The appeal demanded "that the whole territory of Europe, from Poland to Portugal, be freed of atomic weapons."[171] The 1982 report by the Palme Commission on "Common Security" was instrumental in stimulating the "new thinking" of the early Gorbachev era about a radically different course in defence matters. It paved the road to major arms control accords in the second half of the 1980's, especially on the Soviet side. Actually, the Commission's proposal was modest: it suggested the creation of a nuclear battlefield weapons-free zone in Europe.[172] Egon Bahr, in a famed addendum, demanded that "all atomic weapons be removed from states in Europe which do not possess them."[173]

The peace movement was successful in popularizing the idea of denuclearization generally and it promoted a number of specific initiatives. Many municipalities and other regional entities proclaimed their nuclear weapons-free status,[174] and peace activists, supported by the growing Green movement, searched by unorthodox means for neighbouring nuclear weapons storage sites.[175] The dissidents who overthrew the communist governments in Central and Eastern Europe in the late 1980's made these aspirations a reality. Today there are no nuclear weapons in the new democracies in that part of Europe, including the territory of the former GDR, and the significance of nuclear weapons for the Western Alliance has been greatly reduced. On the Western side in Europe, there are only about 1,000 nuclear bombs deployed on aircraft. The nuclear arms of Russia are being reduced, but the precise number of weapons remaining is difficult to assess. Even if there has been no formally established nuclear weapons-free zone in Europe, the enormous change in world politics following 1989/90

[169]See [Kekkonen (1963)]
[170]The various proposals of all sides are documented in [Albrecht (1986)]
[171]See [END (1980)]
[172]See [Palme (1982)]
[173]See Ibid, p. 188
[174]See *The decree of the Bremen City Councillors about the ABC weapons-free zone Bremen* in [Albrecht (1986)]
[175]See [Albrecht (1982)]

has in fact produced what has been urged for decades to ease the danger of nuclear war on the continent.

2.4.7 References

[Albrecht (1982)] Albrecht, U.: *Wie man sein lokales Kernwaffenlager findet.* (How to find one's local nuclear weapons site), in Bundesvorstand der Gruenen (ed.): *Entruestet Euch.* (the German word "entruesten" means both "disarm" and "protest") Bonn (1982), pp. 146-149.

[Albrecht (1986)] Albrecht, U. (ed.):*Europa atomwaffenfrei. Vorschlge, Plne, Perspektiven (Europe free of nuclear weapons. Proposals, concepts, perspectives).* Cologne, 1986.

[Albright/Berkhout/Walker (1992)] Albright, D. ; F. Berkhout ; W. Walker: *World Inventory of Plutonium and Highly Enriched Uranium.* 1992, Oxford University Press, 1993, p. 80.

[Al-Itihad (1992)] AI-Itihad, Abu-Dabbi, February 12,1992.

[Arms Control (1980)] U.S. Arms Control and Disarmament Agency: *Arms Control and Disarmament Agreements.* 1980 edition, p. 92.

[Barros/Zamora Collina (1995)] arros, F.; Zamora Collina, T.: Report published in ISIS report, volume II, number 2, February 1995

[Becker (1993)] Becker, Avi: *Peace and Denuclearization: An Israeli Perspective.* in UN periodical: *Disarmament.* No. 2, 1993, pp. 137-138.

[Cohen (1994)] Cohen, Avner: *Rethinking the Nuclear Equation in the Middle East.* Nonproliferation Review,1994, (forthcoming).

[Disarmament Times (1994)] Disarmament Times, October 24,1994, p 3.

[Eden (1955)] Opening speech by Prime Minister Sir Anthony Eden at the Geneva Summit, 18 July, 1955, Press release by the delegation of the United Kingdon (Europa-Archiv, 20 August, 1955, pp. 8104-8105).

[END (1980)] Leaflet by the END, London, April, 1980.

[Feldman (1994)] Feldman, Shai: *Progress Toward Middle East Arms Control.* in: Shlomo, Gazit (ed.): *The Middle East Military Balance,1993-1994.* Jaffee Center for Strategic Studies, Tel Aviv University,1994, pp.182-215.

[Gaitskell (1957)] Gaitskell, Hugh: *The Challenge of Co-Existence.* London (Methuen) 1957, a compilation of various presentations of the "Gaitskell Plan".

[Haaretz, September (1994)] Haaretz, September 1,1994, p. 4.

[Haaretz, November (1994)] Haaretz, November 15,1994, p. l.

[Healey (1958)] Healey, Denis: *A neutral belt in Europe?* London (Fabian International Bureau, Tract 311) 1958.

[IAEA (1990)] IAEA report on *Technical Study on Different Modalities of Applications of Safeguards in the Middle East.* quoted by UN report on the *Establishment of a NWFZ in the Region of the Middle East.* p. 20.

[Keesing (1957)] Keesings Contemporary Archives, 19 December, 1957, p.5802

[Kekkonen (1963)] Statement by the President of the Republic of Finland Urho Kekkonen at the Meeting of the Paasikivi Society, Helsinki, 28 May, 1963.

[Lockwood (1994)] Lockwood, D.: *The Status of US, Russian and Chinese Nuclear Forces in Northeast Asia.* Working Paper, Northeast Asia Peace and Security Network, Nautilus Institute, July 1994.

[Palme (1982)] Der Palme-Bericht:*Bericht der Unabhaengigen Kommission fuer Abruestung und Sicherheit 'Common Security'.* German edition Berlin 1982, section 1.5.

[Pedatzur (1994)] Pedatzur, Reuven: *'Yad Vashem' and the Nuclear Option.* Haaretz, September 12,1994, p. 2.

[Rabin (1992)] Rabin, Yitzhak:*Nitzul Pessek Hazman (Exploiting the Time-Out"').* Politika, no. 44,1992 (Hebrew).

[Steinberg (1994)] Steinberg, Gerald M.: *Non-Proliferation: Time for Regional Approaches?* Orbis, Vol. 38, No. 3, September 1994, pp. 409-423.

[The Sunday Times (1987)] The Sunday Times (London) revealed the Secret of Israel's Nuclear Arsenal, October 5, 1987.

[UN study (1982)] UN Comprehensive Study on Confidence-building Measures, 1982, A/36/474, p. 22.

[UN study (1990)] UN study on the *Establishment of a NWFZ in the Region of the Middle East.* 1990. A/45/435, pp. 30-31.

[Yativ (1994)] Ambassador Yehiel Yativ: Statement on Israel policy, First Committee, United Nations Assembly, Forty-Ninth Session, New York, 21 October 1994.

About the contributors

Albrecht, Ulrich	Institute for International Relations, Free University of Berlin, Germany
Bidwai, Praful	Senoit fellow; Nehern Memorial Museum and Library, Teen Murti House, India
Bin, Li	Defense and Arms Control Studies Program, Massachusetts Institute of Technology, USA
Blackaby, Frank	Former president of Stochkolm International Peace Research Institute (SIPRI)
Burnie, Shaun	Greenpeace International, Amsterdam, The Netherlands
Casper, Barry M.	Carleton College Non-Proliferation Project, USA; member of the INESAP Coordinating Committee
Crow, Wade T.	Carleton College Non-Proliferation Project, USA
Diakov, Anatoli	Director of Center for Arms Control, Energy and Env. Studies, Moscow Institute of Physics and Technology, Russia; member of the INESAP Coordinating Committee
Epstein, William	UN Institute for Training and Research, New York, USA; editorof Disarmament Times
Falk, Richard	Harvard University
Feiveson, Harold	Center for enviromental and energy studies, Princeton University, USA
Fisher, Dana	Nautilus Institute for Security and Sustainable Development, USA

Glorieux, Eloi	Greenpeace, Belgium
Gronlund, Lisbeth	Union of Concerned Scientists, Cambridge, USA
Hayes, Peter	Nautilus Institute for Security and Sustainable Development, USA
Heppell, Janice	Nautilus Institute for Security and Sustainable Development, USA
Huaqiu, Liu	Program director, China Defense Science & Technology Information Center, Beijing, China
Kalinowski, Martin	Research associate at IANUS (Interdisciplinary Research Group in Science, Technology and Security of the Technical University of Darmstadt/Germany)
Küppers, Christian	ko Institut Darmstadt, Germany
Lewis, George	Defense and Arms Control Studies Program, Massachusetts Institute of Technology, USA
Liebert, Wolfgang	Research associate at IANUS (Interdisciplinary Research Group in Science, Technology and Security of the Technical University of Darmstadt/Germany) ; Member of the INESAP Coordinating Committee
Lumpe, Lora	Director of the Arms Sales Monitoring Project at the Federation of American Scientists, USA
Lyman, Ed	Center for enviromental and energy studies, Princeton University, USA
Martinez, Marco	Departamento de Fisicia, Facultad de Ciencias ; Universidad Nacional Autonoma de Mexico
Masperi, Luis	Professor of physics at Instituto Balseiro ; Member of the Committee of Nuclear Affairs of Asociation Fisica Argentina
Matsuzaki, Sanae Y.	Nationale Institute of Materials and Chemical Research, Ibaraki, Japan

Mian, Zia	Research fellow at the Sustainable Development Policy Institute, Islamabad, Pakistan
Miasnikov, Eugene	Director of Center for Arms Control, Energy and Env. Studies, Moscow Institute of Physics and Technology, Russia
Milne, Tom	Pugwash Office, London, UK
Monteiro, Vivek	Tata Institute for Fundamental Research, Bombay, India
Nassar, Bahig	Coordinator of the International Campaign for Nuclear Disarmament and Non-Proliferation initiated in Cairo; Coordinator of the Coordianting Centre among Arab Peace Organizations by 14 NGOs and Research Centres, Egypt
Nayyar, Abdul	Associate Professor at the Department of Physics, Quaid-e-Azam University, Islamabad, Pakistan
Neuneck, Götz	Institut für Friedens- und Sicherheitspolitik, Hamburg, Germany
Noerper, Stephen	Nautilus Institute for Security and Sustainable Development, USA
Pedatzur, Reuven	Defense & Arms Control Studies, USA
Pike, John	Director of the Space Project of the Federation of American Scientists
Rotblat, Joseph	President of the Pugwash Conference of Science and World Affairs, London, UK
Sailer, Michael	ko Institut Darmstadt, Germany
Scheffran, Jürgen	Research associate at IANUS (Interdisciplinary Research Group in Science, Technology and Security of the Technical University of Darmstadt/Germany) ; Member of the INESAP Coordinating Committee
Schneider, Mycle	World Information Service on Energy (WISE), Paris, France
Shen, Dingli	Center for American Studies; Fudan University, China

de Souza-Barros, Fernando	Professor of physics at Universidade Federal do Rio de Janeiro, Brazil; member of the Committee of Nuclear Affairs of Sociedade Brasileira de Fisica; member of the INESAP Coordinating Committee
Spitzer, Aaron J.	Carleton College Non-Proliferation Project
Tagaki, Jinzaburo	Executive Director of the Citizens Nuclear Information Center, Tokyo, Japan
Tarasenko, Maxim	Director of Center for Arms Control, Energy and Env. Studies, Moscow Institute of Physics and Technology, Russia
Wadia, Spenta	Tata Institute for Fundamental Research, Bombay, India
Wright, David	Union of Concerned Scientists, Cambridge, USA