



Irreversibility in Nuclear Disarmament

Political, Societal, Legal and Military-Technical Aspects

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Credits

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Foreword

Over the last decade, the term ‘irreversibility’ has entered the lexicon of nuclear disarmament. It was introduced into the Nuclear Non-Proliferation Treaty (NPT) framework at the NPT’s 2000 Review Conference—both as a practical measure applying to nuclear material no longer needed for military purposes and as a general disarmament principle. This concept of irreversibility was ushered into the multilateral process seeking to denuclearize the Korean peninsula and found its way into diverse multilateral documents. It is steadily becoming a mainstream notion, often appearing alongside mentions of verification and transparency.

Yet, whereas the issues of verification and transparency have been the subject of numerous studies, assessments and proposals regarding implementation, the concept of irreversibility has undergone very little scrutiny and remains largely understudied. No agreed-upon definition of what it means and what it entails exists. It remains vague and may even mean different things to different people. As a result, the practical utility of this concept in supporting nuclear disarmament remains limited. Its potential seems to have been far from fully explored.

It is with these elements in mind that the Swiss Federal Department of Foreign Affairs (FDFA) set out to further the concept of irreversibility in nuclear disarmament, at both the theoretical and practical levels.

The FDFA commissioned two studies on irreversibility in nuclear disarmament. VERTIC developed a study focusing on the conceptual, technical and operational aspects of the question. SIPRI drafted a study addressing the political, societal, legal and military-technical dimensions of the issue.

The aim of these studies is to make up for some of the shortfall surrounding the concept of irreversibility. Their aim is to stimulate thought, debate and action, to challenge readers and to introduce new approaches and options. They have been drafted with several audiences in mind: disarmament practitioners, government officials and diplomats, nuclear weapons designers, policy analysts and academics, NGO representatives and the wider public.

The process that led to the publication of these two studies on irreversibility also included a workshop held in Glion, Switzerland, in February 2010. The objective of this gathering was to discuss an initial draft of the VERTIC study, as well as to further explore the issue as a whole. We are thankful to all the participants of that meeting. The wide range of government officials and representatives from the academic and non-governmental world made for thorough and productive discussions. The final version of the two irreversibility papers benefited greatly from the input of all participants.

What the discussions in Glion and the two studies commissioned by the FDFA have shown is that irreversibility is both a key concept and a vast, complex subject. It covers many areas, has received too little attention thus far and its potential remains largely untapped. The two studies provide indications as to what measures would reinforce the irreversibility of nuclear disarmament. It is hoped that they will lead to further work on this issue and spur action at many different levels.



Executive summary

While the expression 'irreversible nuclear disarmament' is widely used there is no agreed understanding of what it means. The expression entered the disarmament lexicon after it was incorporated into the 13 practical steps towards nuclear disarmament elaborated at the 2000 Nuclear Non-proliferation Treaty (NPT) Review Conference. The recollections of participants at that meeting suggest that the expression should be interpreted in a broad manner and seen as a series of measures that can, taken together, reduce the likelihood of backsliding on agreed commitments.

Practical and technical issues play a central role in discussions of irreversibility in nuclear disarmament and are the subject of a study prepared by VERTIC. However, the political, societal, cultural, legal and military-technical dimensions of the issue must also be addressed in light of the intentions of the Review Conference.

Irreversibility can be usefully thought of as a scale, rather than an absolute value. At one end would be a world in which at least some states could fairly quickly restore nuclear armaments to their national arsenals, while at the other end would be a world in which this would be a difficult and long-term undertaking.

The inter-relationships between the different dimensions can be analysed in a way that produces valuable insights by focusing on a future scenario in which the world is populated by states that are either nuclear-unarmed or nuclear-disarmed. Nuclear unarmed states would be able to create nuclear weapon arsenals more quickly, while it would take longer and cost more for nuclear disarmed states to take that step.

It is not possible to create conditions where nuclear re-armament is totally excluded, but a world in which nuclear unarmed states could quickly reverse their status through a simple political decision cannot be regarded as irreversible. The political dimensions of this problem therefore deserve further exploration and consideration. Furthermore, the legal regime that is binding on non-nuclear weapon states in the context of the NPT has raised the cost of reversing their non-nuclear status. Violating the commitments given in this legal regime, or stepping outside it, have also underlined that there are risks involved because doing so inevitably brings counter-measures.

The analysis suggests that there are four critical background elements that would create a permissive environment and open the way for irreversible nuclear disarmament. These background elements are:

- Organizing relations among major powers in ways that minimize the risk of war;
- Engaging the USA in the international system on the basis of responsible leadership within a common framework;

- Managing relations with the small group of states in which there is low confidence regarding their respect for nuclear, biological and chemical weapon-related arms control;
- Establishing a modern, rule-based framework for the legitimate use of force in the non-nuclear security environment.

In the *political domain*, the national discourse inside the states that have the potential to arm themselves with nuclear weapons would be the critical determinant of the durability of irreversible nuclear disarmament. The actions of countries that do not have this potential and do not seek it would be an important factor in shaping an international political environment that facilitates national discourse in those countries that do. The promotion of a common and cooperative security system that emphasizes peaceful resolution of disputes would be a key element in creating a permissive environment for irreversible nuclear disarmament.

In the *societal and cultural domain*, several recent influential studies and analyses have identified an emerging norm against the use of nuclear weapons in key countries, notably the United States.

How-ever, the impact of ethical bodies and religious authorities as well as the potential to strengthen understanding of nuclear weapon-related issues through dedicated education programmes could contribute to wider acceptance of this norm. Strong societal and cultural norms and a strengthened legal framework would be mutually reinforcing.

In the *legal domain*, an integrated framework needs to go beyond international public law of the kind suggested by advocates of a nuclear weapons convention. In order to strengthen the irreversibility of nuclear disarmament the legal framework should also incorporate international humanitarian law, international criminal law and national criminal law. The implications of the recent emergence of the United Nations Security Council as the focal point for managing nuclear arms control and the shift in balance away from multilateral forums also need to be taken into account.

In the *military-technical domain*, some current tendencies have been criticized because they are seen as undermining the stability of an international system based on nuclear deterrence among the major powers. The development of more effective missile defences, the availability of weapons that can deliver quick and accurate non-nuclear strikes on small nuclear capabilities as well as new types of capabilities for cyberwarfare, non-destructive anti-satellite weapons, and a better understanding of information and psychological warfare could contribute to irreversible nuclear disarmament. However, this promise probably cannot be delivered if these capabilities are owned exclusively by one dominant state.



1. Introduction

The principle of irreversibility was embedded into the disarmament lexicon when it was included as one of 13 practical steps toward nuclear disarmament elaborated at the 2000 NPT Review Conference. In the Final Document of the 2010 Review Conference the 189 States Parties to the NPT confirmed that they would ‘apply the principles of irreversibility, verifiability and transparency in relation to the implementation of their treaty obligations’. While the word is frequently used in discussions of disarmament, and the commitment to it is frequently stated, there is no generally accepted understanding of what irreversibility would mean in practice.

The Federal Department of Foreign Affairs of Switzerland convened a Seminar on the irreversibility of nuclear disarmament in Glion, Switzerland on February 17-18th, 2011 in order to discuss the question of how the term should be understood now and in the future. A study entitled *Irreversibility in Nuclear Disarmament* prepared by the Verification Research Information and training Center (VERTIC), London was discussed at that meeting.¹ The VERTIC study is a detailed examination of practical and technical measures that could, if applied together, produce a state of irreversible nuclear disarmament. While the VERTIC study deliberately does not take up the political, legal, societal or military-technical aspects of irreversibility, this paper is intended to provide a complementary assessment by explicitly focusing on them.

1.1 The scope of the principle of irreversibility: Broad or narrow?

Given that the term irreversibility is frequently used in official documents as well as in analytical studies, it is perhaps surprising that there is no shared understanding of what it means. The term has sometimes been used very narrowly to describe practical measures applied to the fissile material released when specific nuclear warheads are decommissioned—either at the end of their in-life service or under the terms of an arms control agreement. Irreversibility in this context would involve ‘chemically, isotopically and physically [altering] the special fissile material items that constituted the warhead once they have been removed’. In this way, the fissile material removed² from a specific warhead on retirement would never again enter the military nuclear fuel cycle. To give examples of this kind of irreversibility, in 1993 the United States and Russia reached an agreement commonly referred to as “megatonnes to megawatts”. After 1995 this led to the production of nuclear reactor fuel using highly enriched uranium extracted from nuclear warheads removed from the arsenal of the former Soviet Union.³ In 2005

1 David Cliff, Hassan Elbahtimy and Andreas Persbo, *Irreversibility in Nuclear Disarmament*, VERTIC, 2011.

2 James Fuller, ‘Going to Zero: Verifying Nuclear Warhead Dismantlement’, in Corey Hinderstein, ed., *Cultivating Confidence: Verification, Monitoring, and Enforcement for a World Free of Nuclear Weapons*, Nuclear Threat Initiative, Washington DC 2010, p. 137.

3 A similar approach to the disposition of plutonium has been explored, but not implemented to the same extent as for HEU. James P. Holdren, *Management and Disposition of Excess Weapons Plutonium*, National Academy of Science, National Academies Press, Washington DC, 1995.

the United States announced a somewhat similar initiative to use HEU considered surplus to nuclear weapon requirements for other purposes.⁴

Ensuring that the material extracted from specific warheads does not find its way back into the arsenal in another form has to be a vital element of any definition of irreversibility. However, disposing of fissile material removed from dismantled warheads cannot offer a comprehensive approach to irreversibility. Eliminating material in one place would be of little benefit if new stocks were being created in another location at the same time. Therefore, the scientific and industrial base on which nuclear weapon arsenals rest would also have to be taken into consideration. At a minimum, measures would have to be applied at facilities in the nuclear weapon complex and sensitive parts of the civilian fuel cycle as part of irreversible disarmament.

Nuclear weapon states currently reject nuclear disarmament according to a single, integrated plan in favour of separate but related processes and initiatives that are consistent with and lead in the direction of eventual abolition.⁵ Given this emphasis on parallel but inter-related steps, it is logical that the term irreversibility has also been used in a wider context, linked to the verification of particular arms control agreements. Verification is the procedure by which parties, almost always states, determine compliance with the legal obligations undertaken by signatories to agreements.

The characteristic of timeliness is an important element of verification. A verification regime should provide appropriate assurance that significant violations are detectable early enough to permit others to respond and to make suitable adjustments in their own policies and practices. Verification is therefore a part of the irreversibility concept.

While linking irreversibility to agreements on a case-by-case basis is a perfectly respectable method, the VERTIC study argues that this context-specific approach cannot fully meet the expectations of those who originally framed the term. This remains true even if irreversibility is considered more broadly to encompass verifying multiple agreements because verification does not incorporate the measures taken in response to detected non-compliance. As pointed out by the VERTIC study, 'verification measures can play an important role in increasing confidence that 'irreversible' steps have been taken, and adhered to, but verification does not by any means ensure irreversibility. Nor is it designed to.'⁶

These fairly limited uses of the term irreversibility probably cannot fully capture the more fundamental objective that NPT states parties had in mind in 2000. According to the best recollection of representatives who participated in that Review Conference—several of whom participated in the Glion seminar—most delegates were using the term in a broad sense, to mean erecting strong barriers against backsliding from disarmament commitments related to nuclear weapons. The intention was to convey a sense of permanency in the disarmament process and in particular, in the specific context of the NPT, to hold the five permanent members of the UN Security Council to their commitments under Article VI of the Treaty. At Glion it was also emphasized that the term irreversibility expressed a collective will, and was not put forward from one region or by countries with a shared political perspective. For example, the

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4 US Dept. of Energy, National Nuclear Security Administration (NNSA), Surplus U.S. Highly Enriched Uranium (HEU) Disposition, <http://nnsa.energy.gov/aboutus/ourprograms/nonproliferation/programoffices/fissilematerialsdisposition/surplusheudispositio>.

5 For the purposes of this paper a nuclear weapon state is one of the five countries that conducted a nuclear weapon test prior to 1963, synonymous with the five permanent members of the UN Security Council. The term nuclear armed states is used to describe any country that owns nuclear weapons.

6 David Cliff, Hassan Elbahtimy and Andreas Persbo, Irreversibility in Nuclear Disarmament: Practical steps against nuclear rearmament, VERTIC, London September 2011, p. 15 (emphasis in original).

term was introduced into the discussion not only by all of the Member States of the European Union, but also by the countries participating in the New Agenda Coalition.

This use of the term irreversibility is consistent with the emphasis placed on developing operational measures in the framework of the NPT that do not have a technical dimension (in that they are not verified) but can, over time, change the political climate. A good example is the gradual acceptance that it is a duty for nuclear weapons states to report on steps taken towards disarmament. By formalizing the principle that nuclear weapons states are accountable to the wider community a mix of incentives and pressures has been created that has already increased transparency and might gradually reveal evidence of disarmament.

1.2 The background security environment

Brief consideration needs to be given to the particular background conditions in which the Review Conference was being held. The year 2000 came at the end of a decade in which many very real achievements in the field of arms control could be listed. The 1991 Strategic Arms Reduction Treaty (START) had entered into force in 1994 and Russia and the United States were working together closely to implement it, including through the measures financed using the Cooperative Threat Reduction (CTR) legislation sponsored by Senators Sam Nunn and Richard Lugar. In 1996 the UN General Assembly adopted the Comprehensive Test Ban Treaty (CTBT). In 1997 the IAEA Board of Governors approved the Protocol Additional to Safeguards Agreements, granting the Agency complementary inspection authority in countries that adopt it.

In the non-nuclear field, in 1990 the Treaty on Conventional Armed Forces in Europe (CFE Treaty) was signed and during the 1990s hundreds of thousands of heavy weapons were being destroyed in Europe in a process under full transparency and intrusive verification. In 1992 the UN General Assembly adopted the Chemical Weapons Convention, which entered into force in 1993 and created the conditions for the destruction of roughly seventy thousand tonnes of chemical weapons. This destruction process was overseen by a dedicated body, the Organisation for the Prohibition of Chemical Weapons, ensuring full transparency and intrusive verification.

In spite of these successes, the period leading up to the 2000 Review Conference was also one in which some of the key political and strategic factors that underpinned progress in arms control were under severe strain. The relationship in the security field between Russia and the United States was deteriorating, not least because of changing domestic political conditions in both countries. The domestic reaction to agreements reached between President Bill Clinton and President Boris Yeltsin in 1997 intended to create the conditions for further arms reductions illustrated how brittle the relationship had become over matters that are still unresolved—the appropriate size of the US military footprint in Europe and the role of anti-ballistic missile defences.

Outside the most important bilateral relationship, seen from the perspective of arms control, there were other events that contributed to the feeling that arms control may have proved its worth in the immediate transition from the Cold War but had more limited scope in other areas. In 1998 North Korea tested a medium-range ballistic missile by firing it over the territory of Japan without warning or consultation and India and Pakistan both conducted nuclear weapon tests, bringing their latent nuclear weapon arsenals into the open. For many members of the international community these events underlined that further measures were badly needed to shore up arms control gains. However, for

others they were signals that arms control could not be trusted as a central plank in national security policy.

Against that backdrop there are convincing reasons to accept the statements of diplomats that in highlighting the principle of irreversibility, states parties to the NPT had something wider in mind than eliminating specific warheads, or even verifying individual agreements. Rather, they were making explicit a widespread uncertainty about the long-term durability of disarmament measures and expressing their concern that past achievements might be rolled back.

If this line of argument is accepted as convincing, then the conclusion is that the term 'irreversibility in disarmament' emerged out of fundamentally political concerns, rather than reflecting a more technical assessment. In particular, the term reflected the need to chart a political course that reduced the emphasis on military instruments in managing international affairs. This is not to say that technical measures would not be key elements of providing political reassurance. However, it is widely accepted that the knowledge needed to rebuild nuclear weapons will never be forgotten, and by extension there is no exclusively technical guarantee against nuclear re-armament.⁷

The experiences gained in the period leading up to the 2000 Review Conference are perhaps particularly relevant in current circumstances, where there is once again increased political attention being paid to arms control at the highest levels of government. The decision of the current US Administration to invest political capital in a new attempt to achieve significant arms reductions and reduce nuclear threats has not only created a new momentum in bilateral talks with Russia, but also led to a new interest in exploring the feasibility of a world without nuclear weapons.

The successful completion of the New START was a signal that the two countries that hold the lion's share of nuclear weapons felt comfortable reducing the number of deployed weapons in their arsenals. The agreement was also seen by the responsible officials in both countries from the outset as a transition measure that would lead to follow-on negotiations intended to further reduce stockpiles. However, accomplishing what would (seen from the perspective of today) be an impressive catalogue of follow-on measures—such as an agreement reducing US and Russian nuclear warhead stockpiles to roughly 1000 per side, the entry into force of the Comprehensive Test Ban Treaty and the successful negotiation of a treaty outlawing the production of fissile material for nuclear weapons—would still fall far short of nuclear disarmament.

As a result, we are in essentially the same situation as delegates to the Review Conference faced in 2000—though it could be argued that the political environment today is even less permissive because a trust deficit has grown larger both along the axis of P5 relations with non-nuclear weapon states and along the axis of relations among the major powers. It is difficult to interpret the steps being taken by nuclear weapon states and by states acquiring sensitive parts of the civilian nuclear fuel cycle in relation to disarmament and non-proliferation obligations. Steps towards the abolition of nuclear weapons are indistinguishable from steps that would preserve nuclear weapons as a central feature of the international security environment—albeit with fewer numbers and in an altered configuration. Similarly, programmes to build an advanced nuclear fuel cycle under national control are hard to distinguish from the steps that would be needed to create a key element in a nuclear weapon capability.

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7 The difficulty of bridging this concern was reinforced in the years following the 2000 Review Conference as nuclear weapon states appeared to embed reversibility into national policies. See, for example, Jacqueline Cabasso, Executive Director, Western States Legal Foundation, Irreversibility and Verification, Presentation to the NPT Review Conference Preparatory Committee, April 2002.

1.3 The lack of an irreversibility “yardstick”

In another similarity, or perhaps continuity, there is no obvious technical answer to the question of how to differentiate measures being taken to preserve or create strategic stability based on nuclear deterrence from measures that could be called “real” disarmament. Moreover, we are no closer to having any yardstick against which to judge actions taken, or even a way of thinking about this question.

One way to approach understanding and assessing the significance of current developments in relation to disarmament objectives is to extrapolate from them in a forward projection or concept map of the path to disarmament. There have been recent (and very interesting) attempts to do that by governments, notably the United Kingdom, and by non-governmental analysts.⁸

SIPRI attempted a somewhat similar exercise in the period immediately after the end of the Cold War, when fundamental and all encompassing changes in Europe seemed to offer an opportunity to investigate security without nuclear weapons.⁹ The thinking behind the SIPRI study was that three important changes that accompanied the end of the Cold War had the potential to transform the debate on nuclear disarmament.

The first was the collapse of the logic of deterrence with the end of the Cold War—or at least the logic of that version of deterrence with which nuclear weapons became so intimately entwined. The huge nuclear arsenals amassed during the Cold War stemmed from war plans based on the assured destruction of specified enemy targets under all conditions (including after absorbing a nuclear first strike). This approach was threat-based in that the targets to be destroyed were specifically identified. With the end of the Cold War the threat assessment on which deterrence was based became redundant. If the problem nuclear deterrence was designed to solve had gone away, would the weapons themselves fade into irrelevance?

More than 20 years after the Cold War ended we now know that the answer to this question is a qualified “no” even though there have been significant reductions in nuclear stockpiles. Even if they are no longer on the minds of senior political leaders on a daily basis, nuclear weapons still hold a very important place in the national security policies of the states whose adversarial relationship was at the heart of the Cold War. As long as nuclear weapons are seen to underwrite deterrence they will, in the minds of some, be seen as a security asset rather than a liability.

The second important change was in the calculation of risks associated with nuclear weapons brought about by the problem (widely seen at that time as a crisis) of “loose nukes” in the former Soviet Union. If one huge danger (a military conflagration between nuclear armed superpowers) was averted, it quickly became clear that the post-Cold War world was not risk-free, and the presence and disposition of nuclear weapons could multiply and compound risks in parts of the world where political control was fragmenting and discipline was breaking down. In this environment the mutual self-interest in cooperation to prevent unauthorised access to nuclear warheads weighed more heavily than concerns about secrecy or the risk that foreigners could get access to information about the location and condition of nuclear stockpiles.

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8 UK Cabinet Office, *The Road to 2010 - Addressing the Nuclear Question in the Twenty First Century*, London, 16 July 2010; Michael Quinlan, *Thinking About Nuclear Weapons: Principles, Problems, Prospects*, Oxford University Press 2009.

9 Regina Cowen Karp ed., *Security Without Nuclear Weapons? Different Perspectives on Non-nuclear Security*, (Oxford University Press: Oxford 1992).

Again, with the benefit of hindsight it appears that the shared concern to recover state control over warhead stockpiles did not lead sequentially to their elimination (let alone irreversible elimination). Moreover, the joint programmes in this field that were previously seen as important symbols of a new spirit of cooperation have arguably become a negative, rather than a positive, political factor. After Russia became convinced that the problem of secure custody of nuclear warheads was solved, continued efforts to engage on this issue by Washington were increasingly interpreted as evidence of less honourable US motives.

The third important potential change was an end to the Cold War tendency for attitudes towards nuclear weapons to be seen as a litmus test of group solidarity. During the Cold War statements about nuclear weapons were frequently used to measure loyalty to a tightly knit community. Deviation on nuclear policy was interpreted as abandoning solidarity in defence and security cooperation. For example, after the government of Prime Minister David Lange in New Zealand barred nuclear-powered or nuclear-armed ships from using New Zealand ports or entering New Zealand territory (including territorial waters) the United States suspended its Alliance obligations to New Zealand. In light of the changes in the security environment, it was thought that sustaining this symbolic role for nuclear weapons might no longer be necessary to Alliance solidarity, which could instead be built on positive cooperation to build a common security system.

In fact, events suggest that in the minds of many decision makers there is still strong support for sustaining some (albeit reduced) role for nuclear weapons, including as symbols of the joint commitment to collective defence within NATO. Recent debates over nuclear policy in Europe and Asia underline the tenacity with which at least some Allies of the United States cling to extended nuclear deterrence—though it should be acknowledged that there are also Allies that emphasize the need to reduce the role of nuclear weapons in extended deterrence.

The results of previous forward-looking conceptual mapping exercises suggest that they are a limited instrument when it comes to understanding the dynamics of nuclear disarmament. Looking back at the past 15 years, even if the end of the Cold War has not led to a world without nuclear weapons, there have been very large reductions in total nuclear stockpiles. It is possible to analyze why expectations were only partly realized, to identify the points where the expected path was not taken and suggest reasons why. However, even if though such an analysis would produce valuable insights, it is unlikely that it would be a platform for looking forward. Past experience suggests that the number of variables that need to be taken into account and the ways in which they combine will quickly produce a level of complexity that defeats both extrapolations of recent history and predictive models.

1.4 A different way of thinking about irreversibility

The VERTIC study offers a different way of thinking about irreversibility and also offers a way of thinking about how to give complete assurances that it has been accomplished. The approach taken is unconventional in that the study takes a world in which there are no nuclear weapons—an imagined world—as its starting point.

Whereas the previous SIPRI study as well as others referenced above were mainly concerned with the process by which nuclear disarmament could be reached, VERTIC assumes the end-state and works backwards to identify technical measures that would increase the cost and difficulty of rearmament. As the study expresses it, in thinking about irreversibility ‘the question is not whether disarmament can be reversed, but how costly—and, by the same token, how difficult—would it be to do so?’¹⁰

Linked to this, the study suggests a way of thinking about irreversibility in terms of a scale on which ‘at the lower end reside readily reversible measures, for instance those that only address the nuclear explosive devices themselves. At the other end lies complete denuclearisation, i.e. the most costly and difficult (and time-consuming) to undo.’¹¹

This approach has its critics, and some participants in the Glion seminar noted that pro-nuclear advocates might use exercises of this kind to block discussion. If the conditions in which disarmament could be contemplated could never, in reality, be mapped out then an exercise that assumes disarmament could be labelled as wishful thinking and of no practical value, since such a world cannot be considered real.

At the Glion seminar, however, participants recognized the VERTIC methodology as an innovative and useful way of thinking about irreversibility, offering an approach that can help in assessing whether or not the anticipated end game of nuclear disarmament is robust and contributing to a better understanding of which factors determine whether particular steps are likely to feed a virtuous cycle or a vicious cycle. In that case the potential political impact of such a study would be positive rather than negative because many people who agree that the world would be safer if there were no nuclear weapons condition their agreement on a high level of confidence that this nuclear free condition really exists.

The European example perhaps illustrates this dynamic. One reason why events in Europe did not unfold as nuclear disarmament optimists hoped was the speed with which decision makers came to see nuclear weapons as what Michael MccGwire called an ‘all purpose security blanket’ in conditions of uncertainty.¹²

After the end of the Cold War it was widely believed that progress towards denuclearization would be one component of the building of a common and cooperative security system in and for Europe. As people across Europe lost confidence that the inter-connected set of laws, institutions and technical means associated with a common and cooperative system would really deliver what was

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10 David Cliff, Hassan Elbahtimy and Andreas Persbo, Irreversibility in Nuclear Disarmament: Practical steps against nuclear rearmament, VERTIC, London September 2011, p. 13.

11 David Cliff, Hassan Elbahtimy and Andreas Persbo, Irreversibility in Nuclear Disarmament: Practical steps against nuclear rearmament, VERTIC, London September 2011, p. 13.

12 Michael MccGwire, ‘Is there a future for nuclear weapons?’, International Affairs, Vol. 70 no. 2 1994, p. 213.

promised, they withdrew their consent from the process of creating it. As the process of common and cooperative security building lost momentum, stalled and finally broke down in Europe so the prospects for denuclearization also diminished.

However, in the discussion at Glion many participants pointed out that although technical barriers were essential and close to the heart of irreversibility, the notion of an irreversibility scale must also capture other aspects, such as legal, political, societal, cultural, doctrinal and military-technical developments. In any of these spheres the cost of reversing a decision to disarm could be higher or lower for a former possessor of nuclear weapons depending on how specific instruments and factors are configured and arranged. Using the logic of a scale the aggregation of these factors would present a more comprehensive picture of the irreversibility of disarmament.

Given the constraints of space and the limitations of the author it is not possible for this paper to address each of these spheres in any detail. The intention is to lay out the issues in a way that might fruitfully be further developed in future research and analysis. To try and complement the VERTIC study this paper will use certain terms and ideas that are briefly described in the next section. After that, subsequent sections will address political and societal, legal, doctrinal and military-technical issues from the perspective of whether and how they might enhance irreversibility.



2. Analytical overview

In order to maintain the highest degree of compatibility, this paper tries to retain certain key analytical features of the VERTIC study. It is not possible to apply the methodology, which was designed to focus on technical issues, precisely or in its entirety. However, the following aspects have been retained:

1. The differentiation between a state of being unarmed and a state of being disarmed.
2. The consideration of how specified sets of variables apply in generic countries that have characteristics derived from, but not identical to, real world cases.
3. An assessment of what combination of the variables in each generic state would be consistent with either an unarmed or a disarmed state.

2.1 An irreversibility scale

To take the first element in the methodology, the VERTIC study uses the notion of an unarmed state and a disarmed state to identify the two end points on an irreversibility scale. In an unarmed state a nuclear weapon could be brought into being rather quickly. In a disarmed state a nuclear weapon could only be brought into being with difficulty and after an extended period. It should be emphasized that this distinction is used in the paper as an analytical device, it is not being suggested that the differentiation should be codified into any legal framework or introduced in any institutional arrangement.

At one end of the scale, an unarmed state have a very low irreversibility score, while at the other end of the scale, a disarmed state would have a very high irreversibility score. To calibrate this irreversibility scale more precisely, the VERTIC study identifies five levels of measures that would move countries up or down the irreversibility scale. Level 1 measures would correspond with an unarmed state that would be easily reversible, while level 5 measures would correspond to a disarmed state that could be reversed, but only over a considerable time and with high cost.

To adapt the logic of a scale for the purposes of this paper, in an unarmed state the question of irreversibility would mainly focus on barriers to using a nuclear weapon. In a disarmed state, on the other hand, irreversibility would describe the conditions and measures that could change the decision calculus of the state when leaders were considering whether to bring a weapon into being.

The VERTIC study considers how these five levels might be applied in three generic types of states with different characteristics—Country A, Country B and Country C.

Country A was a nuclear weapon state as defined in the context of the NPT. Country A therefore has an advanced fuel cycle, large stocks of fissile material and detailed knowledge of how to develop, build and deploy nuclear weapons. Country A is a party to the NPT as a recognised nuclear-weapon state and a member of the IAEA.

Country B was a nuclear armed state, with a relatively advanced nuclear fuel cycle focused on those elements that provide the basis for a weapons programme. Country B is not a party to the NPT but is a member of the IAEA.

Country C had a small nuclear arsenal developed in secret, in dedicated national facilities, while the country was a non-nuclear weapon state party to the NPT. The country has a civilian nuclear fuel cycle that is still under development.

In this paper these categories are retained, but a fourth category—countries that never had nuclear weapons—is added, given the importance of the non-proliferation dimension. It is important that the states which have already given up their right to nuclear weapons in perpetuity continue to demonstrate their commitment to non-nuclear status.

The steps that provide reassurance about the continued commitment of states to non-nuclear weapon status are well known, and include adopting the most advanced safeguard standards in cooperation with the International Atomic Energy Agency (IAEA)—including an Additional Protocol to the legal agreement with the Agency. However, beyond this general statement the category of non-nuclear weapon state cannot be applied either directly or generically in this paper because the very diverse context (both historical and contemporary) has such a heavy bearing on political, societal and legal dimensions of attitudes towards nuclear weapon.

In addition, the technical measures identified in the five levels identified in the VERTIC study build naturally on one another in sequence. This is not necessarily the case in regard to non-technical measures, where the dynamic is more likely to be simultaneous development across different issue areas that interact with one another in ways more akin to a web than a hierarchy.¹³

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13 In the SIPRI study referred to above, Julie Dahlitz drew attention to and examined the interactions between the triangle of international law, politics and the use of force, Jule Dahlitz, 'Legal issues concerning the feasibility of nuclear weapon elimination' in Regina Cowen Karp ed., *Security Without Nuclear Weapons? Different Perspectives on Non-nuclear Security*, (Oxford University Press: Oxford 1992).



3. Political and societal factors

At the seminar in Glion to discuss the VERTIC report the critical importance of political factors was one consistent strand in the discussion. A number of the speakers emphasized that political factors would be the central determinant of the willingness of States to undertake irreversible measures. Moreover, it was pointed out that in a world of unarmed or disarmed states the decision to begin unraveling nuclear disarmament achievements would after all begin with a political decision.¹⁴

Richard Butler, a participant at the seminar, has pointed out that through intensive work as part of past processes (not least in the framework of the NPT in 1995 and 2000) a great deal is already known about what needs to be done to bring about nuclear disarmament and what steps and measures will be effective. A lot is also known about how to do what needs to be done—materially and physically—in order to move to the disarmament end of the irreversibility scale. However, a fundamental requirement for the implementation of the the identified measures is a political decision by the responsible leaders. Moreover, political momentum can perhaps also be seen as a scale on the basis that every instance of success will breed further confidence in the process while setbacks will instead trigger negative political reactions. According to this logic, creating a climate of political confidence is an equally essential requirement, in parallel with the implementation of technical measures, for moving to progressively higher levels of irreversibility.¹⁵

3.1 Irreversibility and integration

Recent experience suggests that when making their political calculations political leaders take into account a wider set of factors than the military-technical benefits (real or imagined) that accrue from possessing nuclear weapons. For example, virtually all cases of de-nuclearization have involved states pulling back from nuclear weapons while taking big steps forward in their regional relationships and on the wider global scene: towards guaranteed independence in the case of the post-Soviet states, or legitimate black majority rule in South Africa, or advances in democracy and regional stabilization in the case of the Latin American countries. The decision to disarm was unilateral—and this is the most effective and sustainable approach because it reflects the judgement of the country itself using its own methodology and metrics. However, in every case the states concerned shifted the emphasis of their

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14 Harald Müller, 'Relative Irreversibility: Physical, Temporal, Institutional, Legal, Political, Cultural, Social, Economic Stumbling Blocks on the Way Back To The Bomb', unpublished paper, Feb. 2011.

15 This paragraph draws on Richard Butler, Chairman Middle Powers Initiative, 'Irreversibility of Nuclear Disarmament: Notes for remarks on the Politics of the Irreversibility of Nuclear Disarmament', 17 Feb. 2011.

national policy to seek the political and economic benefits of participation and integration into wider international processes.¹⁶ In several cases some kind of security assurance from the great powers came into the picture.

We know, therefore, that one part of the formula for irreversibility needs to be shaping a permissive national, regional and international political context. Defining an agreed pattern of behaviour to which countries aspire would underline that states are working together in a non-zero sum process—in contrast to the more hierarchical approach of regarding the current practices of any one country or group of countries as a benchmark. This non-hierarchical approach also facilitates the creation of a structured path to integration that is criteria-based, rather than depending on adopting any particular political affiliation. Backsliding on nuclear disarmament commitments, on the other hand, would lead to exclusion from participation in wider integration processes.

The building blocks for a permissive political context should be emphasized at national, regional and then international level. Not only should decision makers arrive at the conclusion by themselves that the benefits that accrue from the decision to abstain from nuclear weapons will be substantial, they also need to be convinced that the political and economic cost of reversibility would be very high.

The discussion of political factors underlined the “top down” responsibilities of political leaders to ensure that their own citizens are properly informed about the costs and dangers of nuclear weapons. This responsibility extends to providing the information to support public debate. The almost complete secrecy about nuclear weapon-related issues that was a characteristic of the Cold War has gradually given way to greater transparency in some of the countries armed with nuclear weapons. However, this process has still not gone very far and would have to go much further, until ideally the public release of extensive information about military capabilities and planning has become a normal and accepted practice in all countries.

Transparency within countries could contribute to irreversibility by promoting societal verification, which has been defined by the International Panel on Fissile Materials as ‘the reporting of possible violations of international agreements both by ordinary citizens and those such as nuclear scientists with direct knowledge of such violations.’¹⁷ Disclosure would also be a precondition for the mobilization of public opposition to any decision to reverse disarmament.¹⁸

The United States and Russia, as the countries that have produced the lion’s share of the nuclear weapons in the world, would continue to have a special responsibility to lead the political debate in a world of unarmed or disarmed states. The United States, as the only country with both global military ‘reach’ and a truly global foreign and security policy, would have a special responsibility in a world of unarmed or disarmed states. Building on and anchoring the normative shift in the approach to nuclear weapons in the US is particularly important for this reason. This point is discussed further below.

Agreeing the proper role of the military leadership would also be an important aspect both inside government and in the wider dialogue with society. While offering their best professional advice is an

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16 Alyson J.K. Bailes, Ian Anthony, *Atoms for Peace or War: SIPRI and the Challenges of Nuclear Disarmament and Non-Proliferation*, IMEMO, Moscow 26 May 2006.
17 *Global Fissile Material Report 2009: A Path to Nuclear Disarmament*, Fourth Annual Report of the International Panel on Fissile Materials, p. 114.
18 Harald Müller has proposed that in at least some societies the process could be formalized through the creation of a Disarmament Supervision Agency that is given the task of producing regular assessments of national compliance with disarmament obligations based on a duty of government to provide access to sufficient information. Communication with the author, 5 September 2011.

important responsibility, senior military leaders should not lobby for preferred technical outcomes in a self-serving manner. Political and military leaders would have to work together to underline for the public that nuclear weapons are unnecessary elements in defence policy. By extension, nuclear technology and the most sensitive parts of the nuclear fuel-cycle should not be under military custody or control, including in the field of research and development. An active and open public policy along these lines would in turn be important in building international confidence and raise the cost to a government of backsliding on its disarmament commitment.

Domestic political factors would also contribute to the credibility of undertakings provided in a nuclear unarmed or disarmed world. States that took a balanced approach to national security, in which military security is no longer the central (or almost exclusive) focus would have a higher credibility in this regard. The tendency towards a public and transparent (in the sense that there is no classified or secret version of the public statement) statement of declaratory policy, such as a national security strategy document, is positive in this regard.

A durable record of civilian, as opposed to a military, government could also be seen as reassuring, but the importance of constitutional arrangements and governance—and in particular the relationship between democratization and denuclearization—appear somewhat ambiguous. While a number of countries that gave up nuclear weapon programmes were on a path to democracy, this has not always been the case—Libya being an obvious exception. It can also be noted that the great majority of countries that still depend on nuclear weapons (either by possessing them or by participating in a nuclear-armed Alliance) are democracies. On the other hand, it does appear that in recent times there is a tendency for proliferation-prone countries to be those with authoritarian forms of government.

3.2 Irreversibility and conflict

The approach taken by different countries towards military security issues could be expected to have a significant impact on the durability of their commitment to an unarmed or disarmed nuclear weapon status. The Hague Centre for Strategic Studies (HCSS) recently published a study on the future of conflict based on extensive surveys of expert opinion in key countries. The study underlined that most influential writers in Arabic, Chinese, English and Russian language groups believe that in the future there will be a significant number of political leaders who see more to be gained from conflict than from cooperation.¹⁹ However, the study also revealed some significant differences between different strategic cultures when thinking about what conflict would look like—who would be fighting, how and about what.

The HCSS study reveals that many of the people who study and analyse conflict expect a continuation of current tendencies towards greater diversity in the types of actor and in the forms that conflict will take. The analysts anticipate conflicts arising between blocs of states and between pairs of states. They also see conflicts in which coalitions of state and non-state actors will form as well as conflicts between non-state actors. However, the pattern also reveals differences in the language groups about the number and significance of conflicts in each of these groups. For example, in the Russian language literature conflict among blocs and between states is both seen as more probable and given a higher salience than is the case in English language literature.

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19 Stephan de Spiegelare, Tim Sweijts and Tong Zhao, *Contours of Conflict in the 21st Century*, Hague Centre for Strategic Studies, March 2011.

While the study reveals a diverse set of expected motives underneath future conflicts, relatively few analysts expect to see the re-emergence of wars of national survival, with most expecting limited conflicts that destroy some or all of the military capacity of an adversary, that in some way support the separation of territory from a state and that hold down the political and economic capacity of a state seen as a near-term competitor. Although such conflicts would obviously be extremely serious, they would not rise to the level of existential conflict that has sometimes been seen as the most likely trigger for nuclear weapons use.

If (as the HCSS study suggests) the future strategic conditions make the use of nuclear weapons implausible, it is at least as likely that the way is open for states to tailor their national and collective capabilities using more plausible (non-nuclear) options to address identified needs. However, some recent studies have concluded that the future security environment will reinforce the need for nuclear weapons in the minds of political leaders, mainly because of a fear of uncertainty and the perceived need for a hedge against it, and may see nuclear rivalries intensify rather than diminish.²⁰

In contrast to political and economic analyses, which emphasize the increasingly dense web of international connections, future conflict scenarios tend to underline a strong regional dynamic. This is perhaps natural given the general absence of points that might form the basis for a *casus belli* among states. There is no reason why the United Kingdom and China to take one example or, for that matter, Russia and North Korea need to have a “strategic relationship” in world of unarmed or disarmed states. On the other hand, when it comes to military potential, India and Pakistan or China and Russia will probably always take an interest in one another regardless of the presence or absence of nuclear weapons. Therefore, shaping regional security environments in ways that promote cooperation in pursuit of shared goals among the critical actors would need to be at least equal in priority with seeking accommodation at global level.

3.3 Normative aspects of irreversibility

It could be argued as a counterpoint that the combination of the NPT and the 1996 advisory opinion of the International Court of Justice on the legality of the threat or use of nuclear weapons create a norm (albeit a weak one) against the possession of nuclear weapons.²¹ However, it is clear that in a nuclear unarmed or disarmed world a significant normative shift would have had to have taken place compared to today.

Even though virtually all states are opposed to the retention of the weapons in perpetuity in their declaratory policy, as of today there is no international norm against the possession of nuclear weapons. It is rare for a country that possesses nuclear weapons to be ostracized or marginalized in international society. A significant group of states also seek indirect benefits from the nuclear weapons owned by the United States through Alliances in which nuclear deterrence plays a role. There is also little evidence of significant domestic political opposition to these policies in the countries that depend on them. On the other hand, there is some evidence that nuclear weapons are popular with the public in the countries that own them and in countries that depend, to a greater or lesser extent, on extended deterrence.

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20 For example, Henry Sokolski, *The Next Arms Race: A short dash among equals?*, Non-proliferation Policy Education Center, Washington DC 2008; Bruno Tertrais, *The Illogic of Zero*, *The Washington Quarterly*, April 2010; Sokolski.

21 International Court of Justice, *Legality of the Threat or Use of Nuclear Weapons*, Advisory Opinion of 8 July 1996, Report of Judgments, Advisory Opinions and Orders 1996, p. 226.

In discussing the normative and societal aspects of an unarmed or disarmed world a number of participants at the Glion seminar drew parallels between the historical precedents of building norms against a range of different kinds of behaviour—such as piracy, slavery and torture. Even though these norms are in place, it is not disputed that they are regularly violated—and therefore a normative basis would provide few safeguards against backsliding from nuclear weapon-related commitments on its own. Nevertheless, some participants in Glion considered that norms against anti-social behaviour can be useful even where there are deviant acts. After a norm has been established few if any governments would either condone or admit to deviant practices. Therefore, the norm provides leverage in helping to change anti-social behaviour and reverse deviancy.

In each of the cases used as examples in Glion the behaviour covered by the relevant norms is also illegal. It could well be that respect for accepted legal conventions (which is itself a strong international norm) is at least as powerful in conditioning behaviour. In reality normative pressure and compliance with legal obligations are not separate from one another and there is likely to be a close inter-relationship between actions in the political and legal spheres. It is probable that legal and non-legal norms would reinforce one another.

Legal issues are considered separately below, and at this point it is sufficient to note that although a political norm against reversing nuclear disarmament would be useful, it would not provide sufficient reassurance in the absence of a supporting legal framework. In a world of nuclear unarmed states a normative framework by itself would be seen as a particularly weak platform for national security policy.

While there is no normative barrier to possessing nuclear weapons, several authors have suggested that there is already an emerging norm against the use of nuclear weapons in one country—the United States. According to these studies it is increasingly doubtful whether a US President of any political persuasion would authorize the use of nuclear weapons in any circumstances—and this is an important factor behind the support for global nuclear disarmament by the US government.

If it is true, then this might lead to the conclusion that even in a world of unarmed states creating a norm against the use of nuclear weapons would not necessarily be impossible—though it would undoubtedly be much easier in a world of disarmed states.

Harald Müller has proposed that strong political and societal norms against the possession and use of nuclear weapons could be based on six pillars.

- The support of the world religions could be enlisted based on their teachings against mass killing. If senior religious leaders of all world religions emphasized the objections to nuclear weapons in joint sermons this could make it more difficult for governments to generate public support for backsliding on disarmament commitments.
- A secular moral campaign led by senior political and cultural leaders could also emphasize the humanitarian consequences of nuclear weapon use.
- Disarmament commitments should be embedded in domestic law, an aspect that is discussed further in section 4 below.
- The potential for non-proliferation and disarmament education (something that was identified a decade ago in decisions of the UN General Assembly) could be realized in different age groups and at different levels, beginning in high schools. In key professional communities, notably the military and relevant technical professions such as nuclear physics and engineering, tailored education would reinforce the non-nuclear norm.

- The different measures taken to preserve and strengthen the non-nuclear norm could be compiled by the United Nations and reviewed with a view to promoting best practices through outreach.
- Collective symbolic rituals, such as public holidays, could be used to maintain the focus of attention on the non-nuclear norm.

In many cases one would expect the measures and activities undertaken in the fields connected to these pillars to be mutually reinforcing.



4. Legal factors

As noted in the previous sections, legal prohibitions would necessarily have to support the normative and political framework in which states were prepared to accept unarmed or disarmed nuclear status. Moreover, the legal basis to regulate relations among unarmed or disarmed states would be different from the system of treaties and laws put in place during the process of disarmament—though it would build on many of the elements already agreed in those documents. While interim agreements are needed to manage the process of disarmament, they would not be sufficient to provide confidence in irreversibility.

A very large majority of states agree (and have made it clear in, for example, NPT Review Conference documents) that it will not be possible to sustain nuclear disarmament as long as the possession of nuclear weapons is legal under certain conditions and while the legality of the threat to use nuclear weapons occupies a legal grey zone. These matters would have to be clarified in laws that supercede current legislation. The elimination of existing weapons would therefore have to be supplemented by a complete ban on the development, production or ownership of any new ones.

If the need for a comprehensive legal framework is widely recognized, how to achieve it is contested. There are advocates in favour of an integrated document (often referred to as a nuclear weapons convention) and also those who favour what the 2010 NPT Review Conference referred to as a framework of separate mutually reinforcing instruments, backed by a strong system of verification.

This report does not attempt to predict which of these approaches will be preferred, and in reality they may be compatible with one another. Elements of the framework of separate instruments are either already negotiated (such as the comprehensive ban on nuclear testing) or long-awaited. For example, there is a major effort underway to make progress towards a treaty banning the production of fissile material for use in nuclear weapons. The universal adoption of strengthened nuclear safeguards also remains an objective that many states are working to achieve, and the number of such agreements in place has steadily increased. The creation of nuclear weapon free zones has developed a certain momentum and succeeded in a significant number of different regions and territories. It must be acknowledged that progress on some of these fronts is slow, while in other cases there seems to be an impasse. However, if and when a comprehensive catalogue of separate agreements on different aspects of nuclear disarmament have been agreed it is conceivable that they could be amalgamated in a legal drafting exercise that produces a single, comprehensive document that all states would subscribe to.

The emphasis within the field of law would be slightly different depending on whether a nuclear free world consisted of unarmed states or disarmed states. To prevent backsliding in a world of unarmed states laws would have to have a primary focus on outlawing the use of nuclear weapons. A state that took advantage of the short lead time for producing a nuclear weapon would in any case pay a high penalty in terms of its reputation as a law-abiding state, but time would not permit the application of some of the other constraints that could be brought to bear in a world of disarmed states.

4.1 Enforcement of irreversibility

A legal commitment never to be the first to use nuclear weapons would be part of the legal framework. However, where the commitment to remaining unarmed had been violated, a state would already have sacrificed its reputation as a law abiding member of the international society. Therefore a statement that the no-first use commitment would be respected would have little credibility.

There could be a clear legal basis for sanctions against a state that took advantage of the opportunity for rapid nuclear rearmament. There could also be clear and unambiguous advance authorization for collective military action to disarm that state before it produced and fielded a significant number of weapons.

In this future scenario the fact that the authority to use coercive tools legally was in place does not necessarily mean that it would be used. It is rather a recognition that in a world of unarmed states the time would be too short to create that legal framework if it did not already exist.

It could be argued that the legal authorities already in place today could be sufficient in this scenario. This is why the differentiation between categories of countries made in the VERTIC technical study was retained in this paper. If the unarmed country that was revitalizing its nuclear arsenal was Country A then it would also be sitting on the UN Security Council, which would effectively paralyse any opportunity for dealing with this issue in that body. In recent years the relative weight of the Security Council has increased *vis-à-vis* multilateral forums in regard to nuclear weapon related issues. Apart from the interventions of the Security Council on matters related to specific cases of real or suspected nuclear proliferation, the five permanent members are already developing a regular, perhaps permanent, procedure for considering nuclear disarmament. However, if the Security Council was unable to rule on whether one of its own members was backsliding on its commitment to maintain an unarmed or disarmed status, the legal basis for collective action against the state in question might be called into question.²⁵

In a case where an unarmed country that revived its nuclear weapons programme had the characteristics of Country B or Country C as defined in the VERTIC study, on the other hand, the issue would be a matter for the UN Security Council to deliberate. Similarly, the Security Council would be in a position to deliberate on whether a non-nuclear weapon-state was in breach of non-proliferation commitments. In recent times the Security Council has begun to use its authority and the instruments at its disposal to put in place various restrictive and coercive measures in order to achieve disarmament and non-proliferation objectives.

Even if the record of success for this new role is mixed, it is a sign that legal action under the umbrella of the United Nations to support irreversibility is already becoming a relevant consideration. However, in future the work of the Security Council in this field would have to be embedded into a legal framework that elevated unarmed or disarmed status to an absolute legal requirement. This would be the only way to ensure that a country backsliding on its commitments could not seek the protection of a Security Council sponsor to protect itself from the consequences of its actions.

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25 A number of analyses have questioned whether the Security Council, at least in its present form, could ever overcome a series of handicaps that have so far acted as barriers to effective enforcement. Harald Müller, 'Enforcement of the Rules in a Nuclear Weapon Free World', in Corey Hinderstein ed. *Cultivating Confidence: Verification, Monitoring, and Enforcement for a World Free of Nuclear Weapons*, (Nuclear Threat Initiative: Washington DC 2010, pp. 33–66.

There is further support for the proposition that collective action under the United Nations can successfully disarm a state that has clandestine and illegal weapons programmes. In Iraq the UN Special Commission (UNSCOM) worked with the IAEA and with Member States to implement a complex disarmament process. We now know, even if the international community lost faith in it 10 years later, that the disarmament of Iraq in the 1990s was accomplished successfully. This disarmament was also “irreversible” in the sense that, whereas all of the relevant treaties have withdrawal clauses, UNSCOM did not allow for any deviation from the path of disarmament.

In parallel with irreversible nuclear disarmament it would be extremely important to ensure the continued viability of the comprehensive prohibition of biological warfare and the international norm against it. All opportunities to demonstrate, enhance and strengthen compliance with the ban on biological weapons should be used to underline that this is not a viable option for states seeking strategic reassurance.

4.2 Irreversibility and criminal law

In addition to international public law, there is also a need to examine the role of international criminal law. The leaders who decided to activate a nuclear weapons programme in a world of disarmed states should be aware that they may face a criminal liability for that decision. They should not only be *persona non grata* in international political discussions, but subject to arrest and action through the courts. The same may not always be true where an unarmed state takes actions to reverse its status as there may be cases where this is an error stemming from a misjudgement or incorrect information about the actions of an adversary. In certain conditions where the time taken to reactivate a weapons programme is short, the decision might be based on the perceived need to take prudent measures in self-defence rather than less honourable motives. The question of whether or not the intentions behind a decision to rearm should be taken into account would have to be resolved during the process of legal drafting.

Apart from international measures, there could also be an important role for national public law, including criminal law, as part of a comprehensive set of legal barriers to backsliding from disarmament commitments. Individual states could create legal, as well as public policy, barriers to engagement with nuclear weapons. A legal prohibition would potentially be more durable than a public policy commitment since it would be more difficult to overturn following a change of leadership or change of government.²⁶

As a result of the requirements laid down in the relevant conventions and under the provisions of UN Security Council Resolution 1540 states should already have criminalized participation of any kind by their citizens in an illegal nuclear weapon programme. These provisions do not extend to participation in the nuclear weapons programmes of the nuclear weapon states as defined in the NPT. Government officers and authorized non-governmental actors may legally participate in these programmes.

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26 Canada is currently debating a national law that would criminalize possession, manufacturing, testing, storing, transporting or deploying a nuclear weapon, as well as dumping or disposing of weapons-grade nuclear material, in the Canadian Arctic by either state or non-state actors. Any person guilty of an indictable offence would face a fine of up to \$500,000, or imprisonment for a term not exceeding 10 years, or both. While any state guilty of an indictable offence would face a fine of up to \$10,000,000.

In a nuclear weapon free world it would be logical to withdraw these immunities and make it an offence in national criminal law for any citizen to participate in any nuclear weapon programme. If any government was determined to reactivate a national programme under these conditions the national laws probably could not prevent it. However, such laws could provide the basis for legal action at a later date if the government changed and the policy was reversed. This might in itself create a pause for thought in the minds of both officials and non-governmental participants in the programme.

4.3 Irreversibility and the security dilemma

The measures sketched above are consistent with the logic of a nuclear weapon free world. Such a world assumes a decision among states that there are no justifications for possession of nuclear weapons, including extreme national emergency. Returning to the differentiation between country categories provided by VERTIC, Countries B and C could well have acquired their nuclear weapons in a clandestine way in the belief that they faced an existential threat to their existence.

Where a country believes it faces an extreme national emergency it is unlikely to be dissuaded from a nuclear weapons programme by legal measures. Therefore the legal framework also has to take into account measures that can address the perceived threats faced by an aspiring nuclear weapon state.

The rules that apply to the use of force have not been modernized to take account of changes in the global political and security environment, and this can be argued to be one of the barriers to reaching a nuclear weapon free world. Therefore, this situation will have to be addressed as an important component of blocking backsliding from a nuclear weapon free world.

During the Cold War the logic of nuclear deterrence was connected to the general desire to avoid conflict in a world where nuclear weapons exist. One of the most important roles normally ascribed to nuclear arsenals was to induce caution in the actions of key decision makers. Because of the risk that general war between nuclear weapon states would lead to a global holocaust, mutual assured destruction automatically restricted the use of force by the major powers.

After the end of the Cold War this cautious approach no longer applies. Far from taking a restrictive view, the major powers believe that the use of force can lead to positive results and increase security in certain circumstances. However, these powers are very far from agreeing what those circumstances are. The rules laid down by the United Nations—that the use of force is legitimate in self-defence or to implement decisions of the Security Council—are already inadequate in current conditions and certainly would not be sufficient in a nuclear weapon free world.

Ascribing a positive role to the use of force has already had an impact on political decision making related to nuclear weapons in countries that have some of the characteristics of Country A, Country B and Country C in the VERTIC study. In 1999 the decision of NATO countries to use force against Serbia without the authorization of the UN Security Council (and over the explicit objections of Russia) over the issue of whether or not Kosovo could become a separate state left a deep impression in Moscow. The crisis over Kosovo led to specific decisions by the Russian leadership that preserved and reinforced the role of nuclear weapons—including the development of new nuclear-armed tactical missiles. Even permanent membership of the UN Security Council was seen to offer weak assurances about whether Russian views on the use of force would carry much weight, and the consequences of that can be traced in the language about nuclear weapons in the version of Russia's military nuclear doctrine published in 2002. In a mirror-image,

the decision by Russia to use force in support of groups seeking political separation from Georgia in 2008 was one factor that was considered by NATO Allies when they formulated the text on nuclear weapons in their new strategic concept in 2010. As a general observation it can be said that the role of the UN Security Council has progressively declined in relation to responding to conflicts between states. In contrast, the Security Council has been far more actively engaged in responding to conflicts within states—which have both been more numerous than inter-state conflicts in recent years and more devastating in their human consequences. However, the legal status of military actions to counter nuclear proliferation has become somewhat ambiguous, in particular in its relationship to the right to use force in self-defence.

This observation can be supported by considering the response to the Israeli attack on a site in Syria where it was suspected that an undeclared nuclear facility had been constructed. While Syria drew the attention of the UN to the fact that an attack had taken place in a letter circulated to the countries sitting on the Security Council, there was no subsequent discussion of the matter. In general there was a muted response to the Israeli attack—though Mohammed ElBaradei, the Director General of the IAEA did condemn Tel Aviv for taking this action. This could be interpreted as granting Israel impunity for a preventive attack launched to disarm a neighbour suspected of undeclared nuclear weapon-related activities, and it is perhaps not surprising that the one country that did make a very strong condemnation was the Democratic People's Republic of Korea (DPRK).

Putting this into the context of this paper, one conclusion could be that if force is going to be used fairly frequently, which appears to be the tendency, then an updated and agreed set of rules describing the conditions on which force is (a) legitimate and (b) likely will be needed.

States will be most likely to close their nuclear weapons option irreversibly if they are confident that they understand the conditions under which they might be vulnerable to an external threat of the use of force and if they feel that they have an effective non-nuclear response.



5. Military-technical factors

The preceding sections have emphasized that the political conditions that would provide the most likely framework for irreversibility would build on a common and cooperative security system. However, under certain conditions a compellence mechanism would be one of a range of procedures available where violations of the agreed set of rules represent a threat to the common system. Backsliding on commitments to irreversible disarmament by a deviant state could be one such scenario. Therefore, a world made up of unarmed or disarmed states would not be one where the use of military force had been abandoned and the durability of irreversible nuclear disarmament would depend on military-technical factors to a certain extent.

Military-technical factors would also have a bearing on the durability of irreversible nuclear disarmament in another sense. Historically, there have been many examples of classes of weapons that have been eliminated from use and possession when their utility has been undermined. The development of new weapons has taken place in parallel with technological progress—in fact investments in military research have, in the past, been an important factor in this broader process of technology development.

5.1 Irreversibility and missile defences

The obsolescence of categories or classes of weapons has sometimes been the result of counter-measures that render them ineffective. In other cases new technical options have allowed the capability or effect achieved by using the weapons to be achieved more efficiently in some other way.

When speaking of nuclear weapons, it is the characteristic of assured destruction that is most relevant to the discussion of deterrence (and therefore the utility of the weapons). Assured destruction has two key characteristics. First, a nuclear explosion would destroy assets that the party being deterred holds dear in a manner that is largely irreparable. Second, at present there is no effective way to defend against nuclear weapons, partly because of their combination with a highly efficient means of delivery—ballistic or cruise missiles. An important subsidiary aspect of this offensive advantage is that, because of the highly destructive nature of nuclear weapons, any defence would have to be more or less “foolproof” in order to provide adequate reassurance. Even a defence that eliminated all but one or two incoming weapons might be considered ineffective because the degree of damage caused by the weapons that had penetrated the shield would be so high.

If research and development was to produce systems that either took away or substituted for these characteristics then the utility of nuclear weapons could be called into question. In regard to taking away the key characteristic of nuclear weapons (and their most common forms of delivery) the most likely military-technical route to would be a combination of effective defence against delivery systems (missiles and manned aircraft) and a non-nuclear means of destroying nuclear weapons prior to launch.

It is for exactly this reason that countries such as Russia and China have objected vigorously to the recent pattern of military investments by the United States, which has been developing missile defences and investigating the feasibility of so-called ‘prompt global strike’ weapons at the same time. In combination, critics argue, these capabilities can challenge the paradigm of deterrence based on mutual assured destruction by taking away the effects of offensive nuclear arsenals.

Many technical studies have underlined how difficult the task of developing “perfect” defences would be in a world with many nuclear weapons delivered by long-range ballistic missiles.²⁷ The very high speed at which inter-continental ballistic missile delivery systems fly, combined with the various measures that can help defeat defences (such as depressed trajectories, decoys, maneuverable warheads, salvo launches or swarming attacks) have normally been considered to exclude perfect defence as a feasible option.

At the same time, a number of countries have sustained a steady investment in developing missile defences and the enabling technologies associated with them. Moreover, the list of countries making a significant investment in missile defence has not only continued to expand, but is virtually identical with the group of countries that are nuclear armed or—in cases like the European states that are members of NATO, Japan, South Korea—depend on nuclear weapons for some element of their military security. Efforts to restrict or ban anti-ballistic missile defences have not achieved any significant traction, in spite of repeated efforts by Russia in particular to restore some of the legal restrictions contained in the former ABM Treaty—from which the United States withdrew in 2002.

Over time, key enabling technologies have developed, such as ever faster computer processing speeds that permit the rapid cueing of interceptor missiles and lightweight composite materials that, together with more efficient rocket motors, make interceptor missiles fast enough to catch ballistic missiles in flight. Therefore, while the offensive systems still clearly have the upper hand today and will do so for a long time to come, it is not certain that this will always be the case.

5.2 Irreversibility and non-nuclear strike weapons

In recent documents the United States has articulated the need for a capability to destroy or damage meaningful targets promptly and accurately using non-nuclear means. This capability is increasingly referred to by the label of prompt, global strike. In the literature a prompt strike is usually defined as the capacity to deliver a weapon on to a target with in sixty minutes of receiving the authorisation from political leadership (in all probability the President of the United States). The capability is one that would be under full US control—in other words it would be independent of forward basing options for tactical aircraft (fast jets), cruise missiles or armed, unmanned air vehicles (UAVs) that represent alternative options for carrying out such attacks. Research into the military applications of some technologies that could be applied for prompt, global strike weapons appears to have slowed—such as directed energy weapons. However, there are indications that the feasibility of five or six of the other specific systems

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27 An example of such a report is Andrew M. Sessler, John M. Cornwall, Bob Dietz, Steve Fetter, Sherman Frankel, Richard L. Garwin, Kurt Gottfried, Lisbeth Gronlund, George N. Lewis, Theodore A. Postol, David C. Wright, Countermeasures: A Technical Evaluation of the Operational Effectiveness of the Planned US National Missile Defense System, Union of Concerned Scientists, MIT Security Studies Program, Cambridge MA., April 2000.

that are usually named in studies of prompt, global strike capabilities is still being evaluated seriously in the United States. These alternative systems include:

- An existing, long-range ballistic missile that was designed for nuclear weapon delivery but converted to carry a conventional warhead;
- Reactivating and adapting a previously decommissioned long-range missile with a conventional warhead;
- A new land-based ballistic missile specifically designed to carry a conventional warhead;
- A new submarine-launched ballistic or cruise missile designed to carry a conventional warhead;
- A very fast (hypersonic) medium range cruise missile launched from a long-range aircraft.

There are two “gaps” that this capability is normally said to fill. The first is the ability to respond in a scenario where a very high value target has been identified but it is known or strongly suspected that the target will move within a short space of time. An example of such a scenario would be identifying the whereabouts of a senior terrorist leader known to change location frequently. The second gap is an ability to respond with non-nuclear means in a scenario where the nuclear weapon delivery system of an adversary state is being prepared for launch.

In the United States the responsible authorities have stressed that there would be no need to acquire large numbers of such weapons because the number of potential targets is small and there is no possibility for protracted exchanges—a missile strike that failed probably either could not or would not be followed up by multiple, repeat strikes. Therefore, according to the United States, this prompt global strike capability would not threaten the effectiveness of the fairly large arsenals held by most nuclear armed states. The capability would (and is specifically intended to) undermine the capability of a so-called nuclear-armed “rogue” state by giving the US President the option of destroying one or a small number of missiles prior to launch without having to use a nuclear weapon in a pre-emptive strike.

5.3 Irreversibility and strategic stability

In a nuclear-armed world a number of countries (and in particular representatives of China and Russia) have expressed their concern that these technologies will have a negative impact by increasing the probability of conflict between major powers by undermining the basis for mutual deterrence. In contrast with the lack of caution about the use of force between great powers that was the cause of catastrophic conflicts prior to the invention of nuclear weapons, nuclear deterrence is said to have made the political leaders of great powers highly risk-averse in regard to using force against their peers.

Paradoxically, the capabilities that are considered problematic in an international system based on nuclear deterrence might reinforce stability in a world of unarmed or disarmed states. For the reasons noted above, missile defences could not, seen from the perspective of today, resist the scale of offensive force available to the nuclear weapon states. However, it is becoming plausible to argue that missile defences might in future offer an effective barrier to a small number of ballistic missile delivery systems. This could reduce the incentive for states to break-out of their unarmed or disarmed state since a small number of weapons would not necessarily confer military advantage. The balance of advantage might be tipped further against an effort to break-out if it was known that the capability to destroy a single weapon or a small arsenal quickly and accurately prior to launch was available to custodians of the disarmed world.

It should be remembered that given the current pattern of military technology development the capabilities noted above, advanced missile defences and the capability for a prompt, global strike with non-nuclear weapons, are only available to the United States. Given what was said in a previous section about the potential for a strong political norm against nuclear weapons to develop in the United States it might be that the US Administration could act as the custodian of a world of unarmed or disarmed states. Alternatively, the United States might agree to share the relevant technologies on an equitable basis or other centres of military technology development might invest the necessary resources to create their own independent capabilities.

Apart from taking away the effectiveness of nuclear weapons, a second factor that could in theory lead to their elimination as a class of weapons would be to find a substitute for their destructive effects. Certain characteristics of nuclear weapons clearly should not be reproduced—for example, the deployment of certain types of biological weapons that could mirror the terror effect of nuclear weapons in the minds of a civilian population. Simply substituting nuclear weapons with biological weapons while remaining within the paradigm of deterrence through assured destruction would not represent progress over the current conditions. Moreover, this would be illegal under the terms of the 1972 Biological and Toxin Weapons Convention, and overturning that Treaty would not enhance the atmosphere of trust or strengthen the integrated legal framework that were both noted above as key elements of a nuclear free world.

As societies become increasingly complex, weapons that disrupt or destroy critical infrastructure might be a substitute for nuclear weapons. For example, a combination of cyber attacks together with attacks against critical infrastructure nodes such as communications systems and electricity distribution grids—which might be accomplished using lethal or non-lethal weapons—might disable a modern society quickly and effectively. In future the use of non-destructive anti-satellite weapons to deny an adversary the use of outer space for civilian and/or military purposes might also have a powerful impact on modern and complex societies. Through coordinated attacks of this kind a state might impose a degree of economic and social disruption approaching that which could be inflicted using nuclear weapons. However, unlike the case in which nuclear weapons are used, the effects might be reversible and both the human casualties and physical damage might be limited.

A further evolution in military capability is the use of a range of different techniques to control the flow of information to the political leaders of adversaries and manipulate their perception of events in the outside world. It has been true for a long time, perhaps always, that if a “virtual reality” can be created for leaders of an adversary through a combination of media control, information dominance and propaganda then the political outcome of actions can be determined independently from military actions on the ground. However, the importance of combining different assets in a coherent way for purposes of strategic deception has grown with the development of an integrated global communications and broadcasting system. The capabilities for these kinds of operations may be developed much further as more is understood about brain sciences and as the production of neuro- and psychochemicals with targeted outcomes comes closer to the realm of reality.²⁸

This prospect would be consistent with the findings of the HCSS study cited earlier in that most analysts consulted in that work expect future conflicts to be fought using one of three means: military capabilities that inflict physical damage; electronic and cyber weapons; and through information and psychological warfare.

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28 Steven P. Rose, *Prospects and Perils of the New Brain Sciences: A twenty year timescale*, Royal Society Science Policy Lab, 20 October 2009.



6. Conclusions

The concept of irreversibility in nuclear disarmament remains a vaguely defined concept. It has been introduced within the NPT framework but its practical implications have never been thought through. Assessing whether this principle has been applied is therefore a difficult task. This notion requires further elaboration if it is to be operationalised and contribute effectively to nuclear disarmament. This study seeks to contribute to this objective even if further work will be required.

Differentiating between unarmed and disarmed states and using the linked idea of an irreversibility scale is helpful when thinking about the political, societal, legal and military-technical dimensions of irreversible disarmament. The application of this approach is not limited to a technical analysis.

In a world of unarmed states the question of irreversibility will mainly revolve around the question of how to prevent nuclear weapons use. In a world of disarmed states the question of irreversibility will mainly revolve around how to prevent decision-makers from reactivating the scientific and industrial assets needed to produce a weapon. In keeping with the idea of a scale, in a world of unarmed states ways and means of continuing along the scale towards disarmament would continue.

The approach does not require or necessarily lead to either a predictive model of the future, or a prescriptive set of recommendations about how specific actors need to proceed in the near term. Rather, it can help to produce a framework that explains the elements needed to create a permissive environment at the different points on the irreversibility scale and the instruments which would have to be combined within that framework to achieve different degrees of irreversibility.

The framework for irreversibility is a common and cooperative security system embedded at the national, regional and international levels. Defining this as an agreed pattern to which countries aspire would underline that states are working together in a non-zero sum process—in contrast to the more hierarchical approach of regarding the current practices of any one country or group of countries as a benchmark.

This non-hierarchical approach also facilitates the creation of a structured path to integration with international and global processes that is criteria-based, rather than depending on adopting any particular political affiliation. Furthermore, this approach relies on the large amount of work that has already been done to define and promote common and cooperative security. This body of work provides the criteria against which states can judge each other and against which citizens can judge their governments. This would begin to bring the security domain into line with other sectors—such as economics, finance, environment or health—where states have begun to examine more modern governance structures that are better tuned to increasingly globalized and inter-dependent international conditions.

Backsliding on nuclear disarmament commitments would be such a serious breach of trust that it would inevitably lead to exclusion from participation in wider integration processes and the loss of political and economic benefits derived from them.

The nature of the relationships between the major powers will be a decisive element in determining where we are along the scale of irreversibility. Expert surveys of that an absence of conflict cannot be assumed or taken for granted. If major powers are concerned that a peer may see force as a legitimate instrument that can be used to address disagreements, they are likely to maintain an unarmed status at best. In those conditions nuclear weapons could quickly be re-introduced and the degree of irreversibility would therefore be limited and brittle.

Organizing the relations between major powers in ways that minimize the risk of war is therefore the first critical element of irreversibility.

There is widespread agreement on the normative framework in place related to nuclear, biological and chemical weapons today, and the vast majority of states comply with their obligations voluntarily and in full. In a world of unarmed or disarmed states the levels of voluntary compliance would be even higher and choosing to stand outside this framework would be seen even more clearly as deviant behaviour.

A handful of states have decided not to participate in the existing framework, but according to their declaratory policies these states have no objection in principle to irreversible disarmament providing it is robust and comprehensive. There do not appear to be any states that would stand outside a nuclear weapon free world because they have an ideological or irrational attachment to nuclear weapons.

A second category of deviant states are more problematic in that there are cases of deliberate and systematic violation of legal undertakings given in apparent good faith. This represents the greatest threat to irreversible disarmament because such activities undermine the cooperation between states in compliance for mutual reassurance.

Managing relations with the small group of states in which there is low confidence regarding their respect for nuclear, biological and chemical weapon-related arms control is the second critical element of irreversibility.

Experience suggests that the most effective international response to such cases has been the continuous and direct engagement of the UN Security Council using all the instruments and authority at its disposal. In contrast, more indirect engagement of the Security Council, in effect delegating authority and encouraging Member States to find solutions to the problem, have been less successful. The successful disarmament of Iraq in the 1990s through direct action under a UN umbrella and the failure (so far) to disarm North Korea through a more indirect method are the clearest examples of the two approaches.

One country, the United States, has been central to efforts to address regional security problems globally. The US is the only country that has the combination of aspiration, authority, resources, power and reach to implement a truly global foreign and security policy. While the role of the United States is critical, the US is clearly entering a period of reflection and evaluation as the implications of two decades of global leadership are assessed. In a period of reflection the temptation to seek a temporary disengagement from external matters is likely to grow. The voices of those who are ambivalent about the degree to which the United States should embrace multilateralism are likely to make themselves heard.

It is critical for the international community to emphasize to the United States the mutual advantages of its continued leadership. However, it is not just the United States but all of the main centres of power

that are reflecting on the efficiency of current systems of national, regional and international governance in light of the scale and nature of the security problems facing their citizens. This is the time for joint reflection, not disengagement, and time for open-minded discussion regarding the best solutions to identified problems.

In the specific field of nuclear disarmament, the United States is not only the inventor of nuclear weapons and one of the main possessor states, it is also the place where most of the research and development of other, more novel, military technologies currently takes place. The scale of investment in the military sector by the United States and its broad scope differentiates it from other states and is inevitably a key factor taken into account by other countries. However, this investment also provides some of the military-technical tools that would be needed by custodians of irreversible nuclear disarmament.

Engaging the USA in the international system on the basis of responsible leadership within a common framework is therefore a critical element of irreversibility in nuclear disarmament.

Uncertainty is increased by the growing body of evidence that the current system of rules governing the legitimate application of force is no longer adequate to contemporary conditions. In the absence of understandable and widely accepted guidelines, the cases where force is used come to be seen as ad hoc, unpredictable and politically driven. As long as states are uncertain about which actions will trigger a military response and which will not they are likely to seek not only reassurance but also insurance against contingencies where they may find themselves subject to pressure or coercion. This clearly has the potential to undermine irreversibility in nuclear disarmament.

Establishing a modern, rule-based framework for the legitimate use of force in the non-nuclear security environment is a critical element of the framework for irreversibility.

Within the framework provided by a common and cooperative security system, actions would be needed in each of the political, societal, legal and military-technical domains to achieve irreversible nuclear disarmament.

In the *political domain*, the national discourse inside the states that have the potential to arm themselves with nuclear weapons would be the single most critical determinant of the durability of irreversible nuclear disarmament. The actions of countries that do not have this potential and do not seek it would be an important factor in shaping an international political environment that facilitates national discourse in those countries that do. The promotion of the principles and norms underpinning a common and cooperative security system that emphasizes peaceful resolution of disputes would be a key element in creating a permissive environment for irreversible nuclear disarmament.

In the *societal domain*, several recent influential studies and analyses have identified an emerging norm against the use of nuclear weapons in key countries, notably the United States. However, the impact of ethical bodies and religious authorities as well as the potential to strengthen understanding of nuclear weapon-related issues through dedicated education programmes could contribute to wider acceptance of this norm.

In the *legal domain*, an integrated framework needs to go beyond international public law of the kind suggested by advocates of a nuclear weapons convention. In order to strengthen the irreversibility of nuclear disarmament the legal framework should also incorporate international humanitarian law, international criminal law and national criminal law. The implications of the recent emergence of the United Nations Security Council as the focal point for managing nuclear arms control and the shift in balance away from multilateral forums also need to be taken into account. Also, the notion of irreversibility needs to be more effectively integrated and articulated within existing multilateral processes.

In the *military-technical domain*, some current tendencies have been criticized because they are seen as undermining the stability of an international system based on nuclear deterrence among the major powers. The development of more effective missile defences, the availability of weapons that can deliver quick and accurate non-nuclear strikes on small nuclear capabilities as well as new types of capabilities for cyberwarfare, non-destructive anti-satellite weapons, and a better understanding of information and psychological warfare could contribute to irreversible nuclear disarmament. However, it is unclear whether this promise can be delivered if these capabilities are owned exclusively by one dominant state.

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