no 3

The Nuclear Landscape in 2004: Past Present and Future

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WMDC
THE WEAPONS OF MASS DESTRUCTION COMMISSION
www.wmdcommission.org

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The commissioners serve in their personal capacity. The Commission is supported by a Secretariat based in Stockholm, Sweden.

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Introduction

1. In June/July 1941 the UK Maud Committee produced two fateful reports, one on the use of uranium for a bomb, the second on its potential as a source of power. The nuclear age had begun. Fifty-nine years ago nuclear weapons were used for the first time against Hiroshima and Nagasaki. Since that point, a global taboo has been sustained on their use despite the slowly accelerating dissemination of knowledge of nuclear bomb design and its enabling technologies. This can only be regarded as a remarkable achievement, but one that was not inevitable. Neither is it guaranteed to last.

2. Its achievement appears to have been a product of two factors: the inherent structural characteristics of the nuclear landscape that evolved after 1945 and the positive attempts made by governments to prevent use occurring. Among other things these attempts involved the creation of global governance structures for nuclear energy and the use of traditional bilateral diplomatic tools and, in some cases, conventional arms transfers. For the first four decades of the nuclear-weapon age, despite decolonisation and the subsequent increase in the number of states, the global nuclear landscape was dominated by the ideological conflicts between the leaderships of the Western and Eastern blocs. It remains unclear to what degree ideological differences drove the nuclear arming that occurred or the degree to which it was fuelled by its own internal dynamics and technological logic.

3. The end of the ideological divide brought with it first a reduction, and then an extinguishing, of most of the antagonistic relationships that drove that first nuclear arms race. However, it took over ten years for this fact to be formally recognised by the Treaty of Moscow in 2002. It has left an ongoing conceptual, doctrinal, hardware and military materiel overhang, which continues to impact upon the threat perceptions and political configurations found in the current nuclear landscape, as well as intellectual thought concerning it. The degree of that impact and the extent to which it will continue to influence perceptions remains problematic.

4. While the two variables of changes in international politics and the evolution and diffusion of technology will continue to dominate the nuclear landscape for the foreseeable future, two new variables have now entered the picture. These are non-state actors/global terrorism and nuclear-weapon procurement systems operating outside the control of nation states. These new elements may take years, if not decades, to be fully assimilated into perceptions of the global political system and domestic nuclear governance mechanisms.

The Overhang of the Past

5. The political behaviours that underpinned the East-West relationship were antagonistic and, because of the existence of nuclear weapons, inherently dangerous and globally threatening. The relationships they created in the nuclear-weapons area appeared to threaten the total annihilation of mankind. Yet at the same time that threat generated a common interest among all states in controlling the development and military use of nuclear energy, both within the domains of the bloc leaders, the US and USSR, and between them. It also led many to advocate global nuclear disarmament (and some the complete prohibition of nuclear energy activities) as the only long-term and effective technical solution to the dangers generated by the existence of nuclear energy. One consequence of the threat of a mankind termination event was the creation of a web of multilateral global and regional arrangements on nuclear energy and weapons, as well as specific bilateral agreements between the two bloc leaders. These formed the foundation of efforts to preserve the nuclear-weapon use taboo, and manage threats and behaviours arising from these weapons and their associated technologies.

6. These diplomatic and military constructs were designed to handle differing aspects of nuclear-weapon threats, and of the associated problem of the control of nuclear materials. Yet unlike the case with chemical and biological weapons, there was no direct ban on the use of nuclear weapons. Indeed increasing numbers of weapons were deployed in the 1950s in Europe and at sea in battlefield, tactical or theatre roles. In part this was driven by their explosive power being able to compensate for contemporary limitations on the accuracy of delivery systems; in part by it appearing to provide a military solution to the asymmetries generated by conventional arms imbalances; and in part because they formed part of a comprehensive nuclear deterrence escalation ladder. Precision guidance technologies in time enabled their tasks to be undertaken with conventional explosives, but it was not until the end of the period of ideological confrontation in the European and Atlantic areas that the removal and dismantlement of these systems became politically possible. This was, however, an area where there were few attempts to control numbers and types of nuclear weapons, and the interaction between imbalances in conventional capabilities and such weapons remains a significant dynamic driving their acquisition, retention and deployment.

7. The second role nuclear weapons were believed to play was strategic: to deter attacks on the nuclear-weapon state's territory, its forces or territories under its protection. It was recognised at an early stage that such forces might attract pre-emptive attacks on themselves if they were unprotected, and thus policies, technologies and deployments to reduce their vulnerability and enable state

leaders to retain control over them under attack were devised, together with mathematical models to determine "how much was enough". Mutual Assured Destruction (MAD) was regarded by many as the most stable (and thus safe) configuration of strategic nuclear forces. The desire to sustain this, reduce uncertainties and remove incentives for deploying additional systems led to bilateral negotiations and agreement between the US and USSR on limiting both their offensive and defensive strategic nuclear capabilities, in order to achieve such perceived stable configurations.

8. Global efforts were also made to halt, or at least slow down and make more difficult, the development of nuclear ordnance through bans on nuclear-test explosions. Although a global "clean-air act" driving testing underground was agreed in 1963 through the Partial Test Ban Treaty (PTBT), it was not until 1996 that a Comprehensive Test Ban Treaty (CTBT) emerged. Attempts to limit fissile materials available for weapons were also sought in the 1960s through a Fissile Material Cut-Off Treaty (FMCT). Although these were revived in the 1990s, they have yet to reach fruition. Radiological, as against nuclear, weapons were considered for deployment by several states, but were rejected as too demanding to weaponise given their limited utility as area-denial devices. As a consequence little inter-state effort was put into attempts to limit or ban their deployment: the inherent limitations of the technology appeared to make international control unnecessary.

9. In parallel, limitations on nuclear materials and technology transfers between West and East were constrained by the CoCom export control arrangements. Uranium supply was managed by the Combined Development Trust (CDT) and its successor global export control arrangement, the Nuclear Suppliers Group (NSG). This covered all nuclear materials and technologies and involved states from both ideological blocs. The formation of this group was stimulated by both the 1974 Indian test and the lengthening list of power-reactor purchases following the 1973 oil crisis, which alerted some developed states to the danger of parties to the Treaty on the Non-Proliferation of Nuclear weapons (NPT) acquiring enrichment and reprocessing technologies and then using them to divert nuclear material to a weapon programme or to "break out" from the Treaty.

10. It had been recognised in 1945 that if the non-military explosive (or peaceful) uses of nuclear energy were to be developed, this would generate difficulties in drawing the line between military explosive and other nuclear activities. Indeed proposals for international governance of nuclear energy in the immediate post-war period included the creation of a global international nuclear organisation that would own all existing and future nuclear materials and facilities. This concept proved impractical in the emerging Cold War climate

except in the specific regional context of Western Europe, where it formed the basis for EURATOM.

11. The imminent commissioning of nuclear power reactors a decade later, linked to claims of nuclear "energy too cheap to meter" generated an urgent need for workable international control and technical assistance mechanisms. This was paralleled by the US "Atoms for Peace" programme and the resultant expansion of nuclear energy activities in an increasing number of states. As a consequence, the International Atomic Energy Agency (IAEA) was created with powers to both own nuclear materials and lease them to states, and to monitor that they were not diverted to purposes other than those that had been declared. This safeguarding activity expanded during the 1960s as the US handed over to the Agency oversight of many of its bilateral nuclear material supply arrangements generated by "Atoms for Peace".

12. These global controls on nuclear energy were reinforced in 1967 by two additional sets of arrangements: the NPT and the first Nuclear-Weapon-Free-Zone (NWFZ) treaty in a populated area. The NPT was a framework agreement to regulate nuclear weapons and nuclear energy, and put into legal form agreed norms and rules for international nuclear behaviour. Among its key elements were:

- two types of state could be parties to the NPT, those which had exploded a nuclear device before 1 January 1967 and those which had not, with differing commitments under the Treaty;
- transfers of nuclear weapons or explosive devices between states were banned, thus recognising nuclear weapons as being qualitatively different from conventional weapons;
- non-nuclear-weapon states committed themselves not to attempt to acquire nuclear-weapons;
- all nuclear materials in non-nuclear-weapon states were to be placed under a safeguards system organised by the IAEA to provide assurances against diversion;
- all parties had an inalienable, but conditional, right to nuclear energy for peaceful purposes; and
- all parties were to pursue negotiations on the cessation of the nuclear arms race at an early date, on nuclear disarmament and on a treaty on general and complete disarmament (i.e. covering conventional as well as unconventional weapons).

13. The commitments contained in regional NWFZ treaties covering populated areas were broadly similar to those in the NPT, but differed in at least two areas. One was that they banned all stationing or emplacement of nuclear weapons within the territories of states parties to the zonal treaty, and thus a

nuclear-weapon state could not base nuclear weapons there. The NPT had no such provision in order to allow the continuance of existing arrangements for the stationing of US nuclear weapons in NATO Europe. These NATO "nuclear-sharing" arrangements also provided an enhancement to existing arrangements under which both bloc leaders provided guarantees of nuclear-weapon assistance to allies if attacked by states in the other bloc. Among other things, these nuclear security guarantees were regarded as significant in reducing the incentives for allies to engage in independent nuclear-weapon programmes.

14. The second area of difference between NWFZ agreements and the NPT was that the former enabled the five nuclear-weapon states to offer their states parties unconditional negative security assurances (i.e. legal guarantees that the nuclear-weapon states would not attack them with nuclear weapons). There had been attempts to include such legal commitments from the nuclear-weapon states in the NPT while it was being negotiated, but these were unsuccessful. Although unilateral conditional commitments were made by individual states in the years that followed, and in 1995 the five NPT nuclear-weapon states consolidated their existing negative and positive security assurances in a UN Security Council resolution, the only unconditional legal commitments remain those offered through NWFZ Treaties.

15. One may draw many conclusions from this survey of the "historical overhang" that conditions the current nuclear landscape, but three interlinked points should be emphasised. One is that conceptually, policies to handle issues of nuclear-weaponry could be placed within two distinct dichotomies: vertical and horizontal proliferation and demand side and supply side constraints. The horizontal / vertical distinction was used to distinguish between expansion and modernisation of existing nuclear capabilities by the five NPT nuclear-weapon states and attempts by other states to acquire national nuclear weapons. The supply side / demand side division was applied almost exclusively to potential proliferators. The idea was that if the incentives for states to acquire nuclear weapons could be removed or reduced, horizontal proliferation would not take place. Failing this, supply side controls would buy time to create such incentives by denying to would-be proliferators non-indigenous technical routes to a bomb-making capability. However, it was always recognised that buying time was the best that could be hoped for from these policies of technical denial, and all too often little attempt was made to use the time "bought" to craft longer-term solutions.

16. Second, by the late 1960s, it had started to be accepted that the two antagonistic ideological blocs had a mutual interest in the global governance of nuclear materials, technology and weapons, and that positive attempts should be

made to create and develop appropriate structures for this. Attitudes towards nuclear weaponry were moving away from a fatalistic and "real politik" acceptance of the inevitability of the global diffusion of nuclear weapons. Instead, the possibility of taking a social engineering perspective towards the situation was gaining strength, focussing on the development of international norms, legal constraints, and rules of behaviour. The result was a multifaceted international regime based upon non-discrimination between states and cooperation for mutual benefits.

17. Finally, motives and attitudes towards national nuclear-weapon programmes were changing. Whereas the initial programmes had been driven by acute military threat perceptions and technological determinist attitudes that all states would want these "most modern weapons" as rapidly as possible, by the later 1960s security alternatives were in place through "nuclear umbrellas" provided by bloc leaders. Increased knowledge of nuclear weapons, and what they implied for national armed forces, was leading to hard analyses of the financial and other disadvantages of acquiring such weapons. The domestic political power of many national nuclear establishments in the developed, but not necessarily the developing world, was also waning. The evolving international political climate suggested that the political costs of acquisition of weapons, rather than a capability to make weapons, would be considerable, at least in the short term. Reactions to the Indian "peaceful" nuclear explosion in 1974 appeared to reinforce this.

18. One of the drivers moving states towards global governance of nuclear energy from the mid-1950s onwards was the expectation that nuclear power for propulsion and electricity generation would expand rapidly, both in terms of its uses and geographic spread. In the period following the oil crisis in 1973 these forecasts seemed to be being turned into realities, with a rapid acceleration of orders for large power reactors. However, the capital costs of these projects; their domestic unpopularity, due in part to their association with nuclear weapons; and the need for extensive electricity grids to absorb their output when operating as base load stations meant that ordering rapidly peaked, while expected completion dates retreated. Several stations planned for the developing world were never completed, and at least one was completed but never operated.

19. Events in the early 1970s led to the United States attempting to steer the global community away from what appeared to be the more risky aspects of a surge in nuclear power activity by radical domestic and international actions. Legislation was passed banning further fast-breeder reactor and reprocessing activities in its civil sector, and attempts were made to pressure the rest of the world to do the same. Proposals were made to supplement this by developing

regional fuel cycle centres, an IAEA Committee on Assurances of Supply and a major technical assessment of fuel cycle options, the International Fuel Cycle Evaluation (INFCE). In addition, there was an invisible rule within the NSG that neither reprocessing nor enrichment technology would be supplied to states outside the group. This, and the operation of IAEA safeguards, was seen to reduce the risks of emerging nuclear power programmes becoming a source of weapons material. The effect was to move proliferant states towards dedicated parallel military programmes, particularly centrifuge uranium enrichment ones, rather than contemplating diversions from power and research programmes.

20. In the decade after the end of the ideological division in Europe and elsewhere the domestic and international mechanisms and multilateral structures and processes created over decades to ensure that these specific antagonistic behaviours would not spin out of control started to degrade. In some cases this was a natural consequence of changes in the global security environment which made them unnecessary; in others because they appeared incapable of handling the new challenges that confronted them. Indeed, some of the challenges were of a nature that would have been inconceivable prior to 1991. The remainder of this paper will therefore try to identify and analyse the contours of the new nuclear landscape which has been evolving since 1991, and which may evolve in future.

The Contemporary Nuclear Landscape

21. The period since 1991 has seen major changes in the structure of the international political system and consequently in nuclear relationships. The global bipolarity that characterised the Cold War period has given way to the military dominance of the single superpower, the United States, built upon usable, electronically-networked conventional armaments. Concerns over the outbreak of a nuclear war between East and West with catastrophic global consequences have abated, and so too has the incentive to acquire nuclear weapons among the states of the EU, as well as their need for a “nuclear umbrella”. Military forces in Europe are now focussing not on a major nuclear war in central Germany but on acting as peacekeeping and intervention forces on the eastern and southern peripheries of a new cooperative Europe.

22. The nuclear forces of the five nuclear-weapon states appear increasingly irrelevant to the security challenges they face at the start of the new century: they have arguably moved into a low salience nuclear world on the inter-state level. Yet pressures and incentives to reduce them, let alone disarm totally, appear lacking or ineffective, other than internal opportunity cost issues and budgetary pressures. Inertia rules their activities, against a background of receding risks of their arsenals being used to engage in a nuclear exchange between them, and

perceptions that a greater risk may be that non-state actors might acquire the means to mount terror attacks by thefts from some of these existing arsenals.

23. For many states, nuclear-related threat assessments are radically different in 2004 than in 1991, both in their source and above all geographical focus. There is no longer any central nuclear conflict with a global reach. Concerns of inter-state nuclear weapon use are concentrated not as in the past on Europe but in regions with persisting acute ideological or religious disputes, such as the Middle East, South Asia and the Korean Peninsula. Thus while this region of previous maximum concern as the trigger and venue for a nuclear war is now of least concern and has the lowest salience, several of those regions which previously were regarded as subordinate to the central global conflict or any West-East nuclear event have become the regions of most concern and highest salience. North American and European (including Russian) nuclear threat concerns are predominantly focussed on suicide attacks with nuclear or radiological devices implemented by non-state actors such as Al Qaeda. And in that context, Western concerns over Russian nuclear capabilities mainly focus upon the dangers of accident or accidental launch of their existing large stockpiles, and theft from them, rather than purposeful action.

24. One consequence of these changes has been to focus attention on regional, rather than global nuclear balances, and the role of external nuclear and conventional forces within those regions. It also generates questions about the relationship between areas of high and low nuclear-weapon salience and the discontinuities between them, as well as the degree to which nuclear weapons are now seen by the NPT nuclear-weapon states as deterring nuclear use against their peacekeeping or intervention forces in regions of high nuclear salience and/or instability, rather than against their own territories.

25. These developments have had several significant impacts upon the global governance approach to managing nuclear threats. First, normalisation of East-West political relationships has removed the core role previously played by arms control agreements as a channel of political discourse between them. Moreover, there is no nuclear balance to sustain, or obvious stability to be pursued, between the US and any other state: nuclear relationships between the five NPT nuclear-weapon states are no longer the main driver of their nuclear-weapon procurement activities, with the possible exception of China. As a consequence, the basis for classical arms balance agreements between them, as against arrangements to disarm down to minimum levels, no longer exists. And there appears to be reduced international political or military incentives for these reductions, given their normalised relationships. Indeed the pressing question is not whether they have a duty / commitment / obligation to disarm, but what positive or negative

incentives can be offered to persuade them it is in their interests to do so, and what role intra-state budgetary pressures and issues of opportunity cost may play in this.

26. Second, threats of nuclear use now appear to be focussed in regions outside Europe and North America, excepting the remote possibility of nuclear, as against radiological terrorism, within them. Also, the nature of the current arsenals in these regions suggests that nuclear use, while it would kill millions, would not generate the cataclysmic global consequences feared during the Cold War. Indeed one concern must be that nuclear war, if it were to occur, would be in a focussed military form. While destroying the nuclear taboo on use, the extreme traumatic impact of its expected human consequences might be missing, and thus it might not generate any significant global demands for the reinstatement of the taboo and for total nuclear disarmament. Indeed the contrary might happen.

27. Two security drivers appear to exist in relation to such use: nuclear or traditional military threats from other states in a region and advanced conventional threats from forces outside. One consequence is that the concerns about nuclear war, disarmament and proliferation appear to have ceased to be a global problem which can be resolved by global solutions, and have become a series of regional problems which will require regional solutions.

28. Associated with this re-orientated regional focus is a third development: in 2004 there were seven states that had exploded nuclear devices; two more which were widely regarded as having nuclear devices (Israel and the DPRK); and at least one other that some states suspected of having an active nuclear-weapon programme (Iran). By comparison, in 1967 only five nuclear-weapons states were identified in the NPT as being nuclear-weapon states. In addition there are a small group of states which probably have the technical capability to assemble and explode a device within a matter of months if they chose to withdraw from the NPT (sometimes referred to as the recessed or virtual proliferators). The explanations for this proliferation of nuclear-weapon states and capabilities since 1991 are many and varied. Among them is the collapse of the bloc structure, which has removed some of the bloc leaders' nuclear security guarantees that previously addressed the nuclear security concerns of states such as the DPRK. This collapse also affected the incentives and abilities of the bloc leaders to keep the nascent nuclear-weapon capabilities of their allies and client states under rigorous control, as the dangers of being drawn into escalating nuclear exchanges over which they had no direct control had been much reduced.

29. During the 1990s the decision that the NPT should have an indefinite duration served to force states which previously were content to exist in an

ambiguous nuclear-weapon position to choose between declaring their capabilities and joining the Treaty. One consequence of this is that the membership has now reached a point where there are only three states (or four if the DPRK is regarded as having legitimately withdrawn from the Treaty) that are non-parties to the NPT. All are arguably outside its legal framework, being states which have exploded nuclear weapons after its threshold date of 1 January 1967 or otherwise acquired them. The process for amending the NPT to take account of this situation, even if it was desirable, is complex and is widely regarded in practice as too risky to contemplate.

30. The existence of nuclear-weapon states outside the Treaty poses a policy dilemma for NPT parties: is the priority to avoid nuclear war and ensure effective control over the emerging arsenals by engagement with them, or is it to continue to try to close down their procurement channels, harass their weapon development activities and generally to try to isolate and penalise them. It also poses the more profound question of whether nuclear proliferation has now progressed to the point where nuclear-weapon diffusion can no longer be ignored, and by implication nuclear disarmament is no longer a realistic policy aim, or at least has to be radically rethought. One consequence may be the increasing attention now being paid to national counter-proliferation and defence, rather than non-proliferation policies.

31. Finally, the 1990s placed two difficult issues upon the international agenda, which are still being addressed: the consequences of the collapse of a nuclear-weapon state – the USSR: and the proven existence of an NPT non-nuclear-weapon state party breaching its commitments under article II of the Treaty. While one effect of the collapse of the USSR was successfully dealt with, namely preventing more than one nuclear-weapon successor state emerging from it, it did lead to great external concerns over the physical security of nuclear materials in all the successor states, and specifically of nuclear submarine fuel and weapon stocks in Russia. Although public concerns initially centred upon theft and transfers into the arc of potential proliferant states to the south of the former USSR, after 9/11 it also became their transfer to non-state entities.

32. The issue of non-compliance with the non-proliferation provisions of the Treaty arose in two contexts. One was claims of transfers of technology to non-parties to the Treaty, particularly China to Pakistan and the US to Israel. The second involved Iraq's clandestine nuclear-weapon programme. This not only made transparent the existence of a "renegade" state within the Treaty, but also opened a set of difficult issues over what constituted compliance in terms of both IAEA safeguards and the NPT, and thus what constituted proliferation in the specific terms of the Treaty.

33. The NPT non-compliance problem has three main facets. One is what constitutes non-compliance with the non-proliferation elements of the Treaty: the second what should be the response if it is proven; and the third how it relates to other aspects of the Treaty. The issue of what constitutes non-compliance arises in part from the distinction between what the IAEA safeguards system was designed to achieve and what the NPT prohibits. The IAEA system was originally designed to detect diversion of nuclear materials, though it has now been widened to detect undeclared nuclear activities. However, non-compliance with Agency safeguards agreements does not necessarily constitute non-compliance with the NPT. At its simplest, it may be only a technical breach of the agreement.

34. The existence of an undeclared fuel cycle facility may not in itself be convincing and direct proof of the existence of a nuclear-weapon programme, though it would constitute persuasive circumstantial and contextual evidence of it. Moreover, most such facilities, if declared, would be legitimate in terms of the NPT, unless it could be demonstrated that they were being built with the intent to violate articles I or II of the Treaty. This situation becomes even more complex when a non-nuclear weapon state attempts to develop a nuclear submarine or surface ship naval reactor as such activities are not banned by the NPT. No detailed IAEA safeguarding arrangements have been devised for this military non-explosive option, though they have for commercial ships.

35. In 1967 when the NPT was signed, the sole proof of the existence of a weapon programme was seen as a test explosion. However, test explosions are now regarded as necessary only for developing thermonuclear weapons, and a technically reliable arsenal of fission weapons with yields up to one megaton can be amassed without testing. Thus the standard of proof has of necessity moved to the existence of weaponisation activities (e.g. the existence of chemical explosive test activities, experimentation with potential initiator materials; the existence of blueprints for a device; and possibly suitable dedicated delivery systems). Yet although IAEA integrated safeguards now offer the possibility of searches for such activities as an adjunct to fuel cycle investigations, no verification organisation is currently tasked to search specifically for them.

36. Once a weapon programme has been uncovered, the agency will remit the issue to the Security Council. The council, however, has no standard procedures for dealing with it. Indeed the Iraq and North Korean cases demonstrated that the greater problem may not be establishing non-compliance but the inability of the Security Council to agree on how to respond when the Agency remits the issue to it for action. Three options appear to be available: to sanction a state very heavily for the non-compliance; to insist on the dismantlement of both the weapon

programme and all other nuclear activity in the state as happened in both the Iraq and Libyan cases, or to seek to manage the consequences of the proliferation as happened in the DPRK case. The core problem is thus how to return a state party to a compliant non-nuclear-weapon status without appearing to reward it for its non-compliance, and thus offer incentives for others to follow down the same path.

37. The issue of what constitutes non-compliance under article II also applies to other articles of the NPT, in particular Article VI under which the five nuclear weapon states have agreed to conduct negotiations in good faith on nuclear disarmament. The ICJ offered an advisory opinion in July 1996 that this implies not only negotiating but concluding agreements. Yet Article VI remains opaque as to what negotiations are to be undertaken and how nuclear disarmament relates to conventional disarmament (i.e. General and Complete Disarmament). The NPT Review Conferences of 1995 and 2000 attempted to clarify this situation by arriving at consensus interpretations of how this article should be interpreted, but some of the nuclear-weapon states appear to wish to backtrack from this agreement, parts of which have been overturned since 2000 by US actions and policies over the ABMT and CTBT.

38. Although 9/11 and the events that followed had the positive effect of moving the Russian Federation and the US from the increasingly antagonistic positions they were taking over their own nuclear weapons, leading indirectly to the Moscow Treaty of 2002, it also opened up entirely new concerns over issues of global nuclear energy management. In particular, the discovery in Afghanistan of evidence that Al Qaeda operatives had been engaged in researching nuclear and radiological devices, even if no evidence existed of the acquisition of the materials to make them, led to a major reorientation of US nuclear policies. Increasing attention became focussed on preventing terrorist acquisition of the materials necessary to manufacture and use such weapons at the expense of trying to limit and reverse state nuclear proliferation, particularly that of Pakistan.

39. These developments moved to centre stage issues of physical protection of nuclear facilities and materials against theft and attack; international arrangements to account for and safeguard radioactive sources; the replacement and repatriation of HEU in research and other reactors with LEU; and the installation of sensors to detect clandestine movements of radioactive materials between states. Although this involved using and amending existing international arrangements, new ones also seemed to be required, and few of these activities appeared to fall directly within the ambit of the NPT, as against the IAEA. The IAEA therefore started to become a more significant international actor as greater emphasis was placed by

developed states on more comprehensive and rigorous controls over nuclear and radiological materials.

40. Events in 2003-4 have served to reinforce this trend, particularly the consequences of Libya's decision to abandon its clandestine nuclear-weapon programme and accept its verified dismantlement. This made transparent the existence of non-state nuclear procurement networks that had previously only been known to a limited number of state officials and intelligence organisations. It also revealed two specific new developments that previously had not been visible. The first was that blueprints and manufacturing instructions for first-generation nuclear-weapon designs were being commercially traded across state boundaries and acquired by potential proliferators.

41. The second was that states were being provided with turnkey industrial capabilities to manufacture HEU, including provision of feed materials, components for centrifuges and ongoing technical assistance and advice. All of this was taking place on a commercial basis. It used networks and component manufacturers that had previously been involved in the clandestine nuclear-weapon programme of Pakistan, a non-NPT and self-declared nuclear weapon state. The extent to which some of the states and enterprises involved in this trade were aware of the end-use of their products is unclear. Moreover the key Pakistani individual involved was not regarded as a national traitor and dealt with harshly, as had previously been the case with individuals from other state nuclear programmes in similar circumstances, but was given a Presidential pardon. It also indicated that the nuclear arms trade had started to become conventionalised, given that some of the middlemen involved were known conventional arms traders.

42. The implications of these revelations for the future nuclear landscape are still unclear. Among other things, however:

- it has reversed previous assumptions about national nuclear programmes, namely that technical information and materials embedded in them would remain highly secret and protected;
- it has suggested that commercial networks exist and will continue to exist, that could enable states without significant nuclear energy programmes to acquire nuclear weapons on relatively short timescales;
- it has demonstrated that the mechanical engineering technology for centrifuge enrichment of uranium and the conventional explosive and electronic technology for reliable bomb designs are now freely available via global commercial networks. These may involve manufacturing activities in both nuclear and non-nuclear weapon states which are nominally dual-use / non-nuclear in their nature;

- it has raised questions about the degree to which Pakistan's own nuclear-weapon programme remains dependent on this commercial network, and thus whether rolling up the A.Q. Khan network will curtail it, or whether it can now sustain its arsenal independent of it;
- it has shifted the emphasis in nuclear non-proliferation efforts towards ensuring that individual states implement effective domestic manufacturing and export controls;
- how much of the A.Q Khan network remains unseen, such as its uranium sources and all its suppliers of centrifuge components, is currently unknown. So too is how many states were approached by A.Q. Khan and his associates, and whether other states besides Libya and Iran were in receipt of assistance from them (and whether Iran was supplied with the same assistance as Libya, including a nuclear weapon design, as would appear logical); and
- whether this clandestine network had links with Al Quaeda operatives and networks or similar non-state entities, and if so what was supplied to them and might be supplied in future.

43. The case of Iran has also generated new nuclear non-proliferation concerns in at least two areas. One is that submarine fuel may be leaking out of Russia, and its 20% enrichment level offer the basis for the rapid acquisition of HEU via a small centrifuge enrichment cascade. This development, if proven, suggest that denial of materials to potential proliferators is becoming more difficult. Secondly, concerns are emerging over the use by potential proliferators of a specific proliferation path. This involves the acquisition of a centrifuge enrichment plant or heavy water reactor and reprocessing plant, both of which are perfectly legitimate actions under the terms of the NPT. When they are functioning, the requisite three months notice is then given for the state's withdrawal from the Treaty, after which there will be no more restrictions on the use of such facilities in a military programme. The state is then in a position to rapidly break-out from its non-nuclear weapon status.

44. One consequence of these developments is to highlight the central significance of intelligence to future non-proliferation strategies, but equally to make this activity more complex as it will move it heavily into areas normally labelled industrial espionage. Moreover, the saga of international inspection and disarmament activities in Iraq, and the apparently mistaken belief that weapons of mass destruction were present prior to the Spring of 2003, demonstrates the limitations of national intelligence gathering activities, but more particularly of their structures for analysing such materials. This makes even more problematic the linking together the products of national intelligence organisations and the inspection activities of international organisations, which cannot create their own

versions of intelligence organisations, though they can engage in analyses of open source materials.

45. The focus of nuclear governance activities is therefore moving towards nuclear materials and the IAEA, as well as illuminating the need for global cooperation in ensuring effective national control over potential nuclear-related activities and materials. This has transformed the emphasis of contemporary non-proliferation efforts away from multilateral cooperative activities to prevent inter-state proliferation and towards actions taken unilaterally and through coalitions of the willing. Part of this move has been a result of the perceived inability of multinational organisations and fora to deal rapidly with proliferation emergencies. In some quarters it has also been a result of perceptions that those treaties and organisations have assisted, rather than prevented, proliferation by providing a cover for their proliferation activities, a development has been labelled "dysfunctional multilateralism". This movement away from global multilateralism can be seen in the use of the G-8 to address the problems arising from the overhang of weapon materials and radiological sources in Russia and other parts of the former USSR, and the development of the Proliferation Security Initiative (PSI) to intercept transfers of material and technology between supplier and proliferant entities.

46. These actions have also placed the future of the diplomatic nuclear disarmament process in increasing doubt. Although Russia and the US have some distance to go in dismantling their retired weapons and those they are committed by Treaty to remove from service, it seems probable that the momentum to run down stocks of nuclear material and stockpiled weapons for budgetary and opportunity cost reasons must start to fade as the technical floors are reached on the force levels regarded as necessary if an effective operational force is to be maintained. What this level might be will differ between states, but the numbers, configuration and drivers for the current UK stockpile may offer a good indication of how such calculations may be made. Also, the impact upon arsenals of a continued moratorium on nuclear testing remains uncertain, as is the need and utility of new nuclear warheads and physics packages, as against delivery systems. US unwillingness to ratify the CTBT and rumours of the need for new weapon designs and discussions of specific military uses for such weapons can only add to these current uncertainties, as does the continued paralysis of the Conference on Disarmament.

New Non-Proliferation Policy Initiatives

47. The evolving nuclear security landscape after 9/11 has generated a surge of new initiatives and suggestions for changing international nuclear non-

proliferation arrangements. These have been stimulated in part by the security threats pereceived to be posed by terrorists and commercial proliferation networks. 9/11 has also led to active counter-proliferation measures supplanting diplomatic non-proliferation activities as the focus for state action. Initiatives have come from a range of sources, including several governments and the Director-General of the IAEA. The genesis of some of these ideas can be traced to the second half of the 1970s during the period of the Carter administration in the US, when they were discussed but never implemented as they lacked the necessary international support. Some are new, and reflect the very different circumstances of the 21st Century.

Demand Side Initiatives

48. The evidence from the past suggests that the most effective demand-side non-proliferation mechanisms are those which resolve inter-state conflicts. Concerns in the 1980s over the nuclear programmes in Argentina, Brazil and South Africa were all removed by political change between or within them. The solution to the problem of nuclear weapons in the Middle-East is seen by most of the states involved as necessitating a political settlement. The same appears to apply to other regional conflict situations, such as the Korean peninsula and South Asia. The long term solution to security threats is almost always a political one: attempts at arms limitation, arms management and creating deterrence structures can prevent conflicts slipping into hostilities, including nuclear ones, but they cannot resolve them. At best they can suspend a conflict until a more propitious time emerges for its solution, as happened in the East-West context. Thus it is to the UN, its Security Council and the attempts to reform the UN conflict resolution machinery, as well as more effective inclusive regional organisations, that one may have to look to find meaningful initiatives to resolve regional proliferation problems.

49. Global nuclear security assurances, either attached to the NPT or independent of it, were seen in 1967 by many non-aligned states as an interim solution to nuclear-related security problems, while nuclear-security guarantees from bloc leaders performed the same role within the Cold War blocs. The non-aligned movement still appears to regard such assurances as a significant way of enhancing their security and reducing pressures to acquire nuclear weapons, and wants these assurances to be expressed in legal treaty language rather than through a Security Council resolution. Some of the nuclear-weapon states, however, take the view that since over 100 states already have the potential for such assurances through NWFZ treaties, the issue is both not a high-priority one and might be an example of "dysfunctional multilateralism" if it hindered deterrence of other forms of WMD proliferation. Indeed one initiative proposed in

this area is to offer nuclear security assurances only to states which have ratified all three WMD Treaties. It is also the case that the states of Africa are not in receipt of such assurances currently as a result of their own inaction as they have yet to gather sufficient ratifications to bring their NWFZ treaty into force. Initiatives to do this would extend the scope of current legally binding security assurances, though this development might also have the effect of weakening the case for global ones.

50. Two forms of security assurances have been sought from nuclear weapon states: negative and positive ones. Negative ones are commitments not to use nuclear weapons against NPT non-nuclear-weapon or NWFZ states parties: positive ones are commitments to go to the aid of such parties threatened with nuclear weapons. Since 1995 the question of nuclear security assurances has been complicated by the existence of nuclear-weapon states outside the NPT. This has generated a greater focus on possible global or regional initiatives to strengthen positive assurances, as against providing nuclear guarantees to deter attacks. Measures to provide such positive assurances have included the development of missile defence capabilities and their deployment into areas under potential regional nuclear threat, such as US movement of missile defence ships into the sea area between Japan and the Korean Peninsula, as well as being able to respond rapidly to the consequences of nuclear and radiological attacks.

51. Attention has continued to be paid to providing nuclear security guarantees to potential proliferators. This has been a long standing item on the agenda of those attempting to address both the Middle East and South Asian situations, as well as being part of the solution to ensuring the withdrawal of nuclear weapons from Byelorussia, Kazakhstan and the Ukraine. They remain on the agenda in the North Korean situation as they are part of the price demanded for its nuclear disarmament. However, these demands pose a major problem for the NPT parties. Acceding to them when similar guarantees are denied to NPT parties appears to reward and encourage nuclear proliferant or non-compliant international behaviour, and leads them to question the benefits (or lack of them) enjoyed by remaining parties to the Treaty, and thus to undermine it.

Supply Side Initiatives

52. After almost sixty years during which radiological weapons have not been high on the international agenda, the prospect of radiological terrorism has demanded a major international effort to account for radiological sources, ensure their physical security, prevent their diversion from their intended uses, and safely and securely dispose of them. This is an issue which is being dealt with via the

IAEA rather than NPT, and involves efforts to draft a Convention on Radiological Sources setting out standards for global governance of these materials and initiatives to amend the existing Convention on Physical Protection of Nuclear Material to cover materials in all situations, not just in transit. It also involves accounting for, and in some cases repatriating, HEU provided under technical assistance programmes for fuelling research reactors and other purposes. In addition, efforts are being made through the IAEA to document attempts to smuggle nuclear materials across state boundaries, and advise states on methods to prevent this. It should be noted, however, that these developments in nuclear material governance are mainly focussed on standard setting and require national legislation and implementation to be effective.

53. In addition, many of the ideas generated in the late 1970s to deal with some of the inherent weaknesses in the nuclear non-proliferation system are now being revisited. They include the lack of any way of distinguishing in advance between explosive and peaceful uses of enrichment and reprocessing technologies, and the lack of measures to address the increasing attractiveness of centrifuge enrichment technologies to potential proliferators. The solution implemented at the time was an understanding among suppliers not to transfer such technologies to states which lacked them. This has now been outflanked by theft and indigenous development of what is basically a mechanical engineering, not an inherently nuclear, technology; by illicit transfers of the technology from Western Europe to Pakistan and then to other regions; and the existence of globalised supply networks to purchase, manufacture and deliver the components for centrifuges to proliferators.

54. Despite these adverse developments, it continues to be regarded as necessary to sustain current arrangements to control transfers of the relevant technologies (if only to fulfil commitments under Articles I and II of the NPT), and attempts are now being made to expand the membership of the NSG (China is among the latest states to join) and to make overt the ban on transfers of enrichment and reprocessing technologies. In addition, proposals have been made to deny formally these technologies to all states (and non-state actors) that do not currently possess them, thus making any form of acquisition illegal and constituting evidence of an intention to acquire nuclear weapons. Counterbalancing this would be arrangements to guarantee the supply of fuel for existing and new power and propulsion reactors at agreed prices, probably through a new IAEA supply mechanism and/or regional fuel cycle centres owned and operated by consortiums of governments or commercial concerns. Variants of this are to have reactor constructors lease fuel to the operator of a plant and repatriate it after use; to build seaborne reactors which can be towed to a coastal city and supply electricity to it, with the plant and any fuel involved remaining

under the ownership and control of its nuclear-weapon state supplier; and in the longer term the creation of automated proliferation resistant reactor and reprocessing systems able to recycle used fuel into new fuel without external access to the process.

55. These are all methods aimed at providing the benefits of nuclear power without exposing the global community to additional proliferation risks. However, agreement to this through the NPT process will be difficult to obtain, if only because they all contain inherent elements of discrimination between classes of states and will be perceived by some as attempts by the current technology holders to retain indefinitely their commercial and security benefits. This is likely to be exacerbated by proposals to change IAEA and NPT rules of procedure in order to exclude non-compliant states from decisions on their cases and to penalise them for their non-compliance.

56. Innovations have also been proposed to the NPT review process to make it more reactive to the changing nuclear landscape. These include annual meetings with plenipotentiary powers; an NPT secretariat and/or executive body; and an ability to convene emergency meetings of the parties. However, the core problem with the NPT process is that it is now regarded by many parties and observers, as well as the US State Department in a working paper to the 2004 NPT PrepCom, as unable to address the key non-proliferation issues of the day in an effective way. It appears to be accepted that it remains useful for standard and norm setting in the nuclear area and in creating the conceptual and legal basis for non-proliferation activities, but it is not capable of taking action decisions, nor is it regarded by some as possible or desirable to amend it.

57. If the NPT process is incapable of acting effectively against proliferators, the weight of doing so will fall inevitably on the UN Security Council. Several suggestions have been made for strengthening the links between the NPT and the Council, and for using the Treaty to assist the Council to prevent proliferation. Some of these proposals focus upon making it more difficult for states to withdraw from the Treaty by deeming withdrawal to be legally impossible. Others favour the Council setting out the detailed conditions to be met if withdrawal was to be accepted and/or setting out mandatory penalties and /or restrictions to be implemented if it were to occur. What has yet to be demonstrated, however, is how the Security Council could be effectively reformed so as to ensure consensus on action against proliferators: indeed its expansion might make it more difficult.

58. What the Security Council has done, however, is to place the issue of WMD proliferation, particularly to non-state entities, high on its agenda through the passing of Resolution 1540 on Non-Proliferation. Among other things this

elevates terrorism and illicit trafficking in WMD materials to a comparable status to more traditional concerns. It also emphasises the need for states to have effective legislation against domestic manufacture of WMD by non-state actors and to enforce effective controls over WMD materials within their jurisdiction, including effective physical protection and accounting measures. Finally it creates a Committee of the Security Council to monitor the implementation of the resolution, with a life of at least two years. What the consequences for global nuclear governance are to be of this consensus decision by the Council remain to be seen.

59. One consequence is that decisions on action are increasingly bypassing the global community, and being taken by the type of coalitions of the willing that created, for example, the Landmines Treaty. In the nuclear case two such coalitions are now in existence. One is the G8, the other the PSI. The first is concentrating on ensuring that the weapons, materials and technology from existing nuclear weapons programmes, and particularly that of the former USSR, do not migrate to other countries before they are disabled, dismantled and made unusable for use in weapons. However, thoughts clearly exist that it might be expanded into other areas where action appears necessary to counter proliferation, not least national intelligence cooperation to track and intercept commercial and other proliferation procurement networks. This activity is also at the heart of the second initiative, the PSI, of which Russia recently became a core member. The PSI mechanism is seeking to exploit to the full existing international law and domestic authority to enable materials being shipped between states to be intercepted before they arrive at their destination. Specific proposals have been made to amend elements of international maritime law to facilitate this. The Libyan case offers at least one example of this activity. It also highlights the centrality of national intelligence cooperation to the combating of proliferation in the increasingly globalised world of today.

60. Supply side controls have for the last four decades operated in the context of declining enthusiasm and interest for nuclear energy in North America and Europe, with the exception of Russia and France, but gradually developing interest in other regions and in Asia particularly. The balance of power in the peaceful uses area has therefore been moving away from the major actors of the 1960s and 1970s, such as the US. At the same time, market prices of other types of energy, especially oil, have remained stable if not declined in relative terms. Current indications suggest, however, that this situation will not last indefinitely, especially with the sharply increasing demands for power in China, which among other things are likely to generate increased greenhouse gas emissions. Nor is it clear if an oil crisis similar to that of 1973 can be avoided in the near future. Thus developments that may generate a new round of nuclear power construction

outside of North America and Europe cannot now be ruled out, leading to panic ordering of new nuclear power stations, and complicating the existing nuclear non-proliferation picture.

61. Supply side controls are thus moving the balance against greater participation in non-proliferation decision-making and towards the ability to act rapidly against proliferant activities. This in turn is opening up a major schism between the developed and developing world over non-proliferation policies and nuclear governance systems, which is being resolved by unilateral actions in what is seen as the absence of effective multilateral decision making systems. Above all, it places in doubt the future of the NPT review process unless agreement can be reached to distinguish what it can do effectively from what it cannot, and to concentrate attention on the former. This however leaves open the questions of if, how and where consensus action decisions are to be taken, and where nuclear disarmament fits into this picture.

62. Nuclear disarmament was an integral part of the conceptual and normative underpinnings of the NPT. Above all it justified seeking to prevent all other states acquiring nuclear weapons other than the existing five. Yet its status within the nuclear global governance system is now unclear. Much of the human emotional force behind nuclear disarmament has degraded with the end of the Cold War. Nobody wants nuclear weapons to be used against cities, yet if the threat is from terrorists, what relevance is state nuclear disarmament to that threat, compared to active counter-proliferation policies? And if technology control is to be increasingly less effective in preventing proliferation, what is to replace it? The current debate in the NPT context centres upon the incremental disarmament process agreed in 2000, but some would now regard implementing this process as increasingly irrelevant to contemporary core non-proliferation threats.

63. The new nuclear landscape is one where there are seven unambiguous nuclear weapon states and one (or more) undeclared ones. Those that have appeared since 1967 will have to be persuaded that it is in their interests to disarm, as well as the original five. What is now required is new thinking on how to generate effective incentives to move all nuclear-weapon states forward towards nuclear disarmament, not additional rhetorical demands for this to happen. The landscape is also one where advanced conventional weapons are seen by many states to pose as dangerous a threat to some state regimes as nuclear ones, opening up the need to address once more ideas of general and complete disarmament.

64. Yet discussing nuclear disarmament in an NPT forum which soon may have only a minority of the nuclear weapon states within it may not be a very productive exercise. Equally, for states to decide to leave the NPT because

disarmament is not moving forward is to ignore these realities in the new nuclear landscape, and accelerate some of the more threatening aspects of it. The tragedy would be if the NPT suffered major withdrawals of states over the disarmament issue leading to yet further proliferation, in a situation where its own processes (or any others such as the CD for that matter) were inherently incapable of delivering this end-state. What therefore needs to be addressed urgently is how and where to discuss nuclear disarmament in the context of the proliferation threats and networks operating within the environment of 2004 and the nuclear weapon states currently in existence. The NPT may not be the appropriate forum for this debate – but what would be?

Alternative Nuclear Futures: Competing Strands

65. A number of alternative nuclear futures may emerge from the existing nuclear landscape, some benign and some less so. One basic question is "will more nuclear-weapon states be better?" Common sense suggests not, yet technology, globalisation and energy demand may be pushing the world in that direction. This demands that national and international nuclear governance mechanisms must evolve to stop nuclear proliferation taking place outside of state or inter-state control. It also suggests a need for those mechanisms to mediate the burgeoning conflict between state wanting access to global nuclear technology and participation in nuclear decision making, and those seeking incisive and rapid actions to prevent proliferation. What appears to be needed is some type of package deal to be developed between the NPT five and those additional states who have already proliferated, if disarmament down to virtual or recessed nuclear arsenals (the best we can probably hope for technologically) is to be achieved.

66. There are of course, also a range of much less benign futures. The one that appears most difficult to control would be one where nuclear or radiological terrorism was used against financial, commercial or governmental targets, and governments appeared unable to control it despite major expenditures on defensive measures. Further regional proliferation would open the door to what has been described as the "conventionalisation" of the use of nuclear weaponry, as well as its procurement. Equally, if nuclear weaponry is perceived as the only defence against the advanced conventional weaponry of external intervention forces, the consequence might be dangerous asymmetric arms races. The current relatively benign relationships between the P5 could also deteriorate, and the situation for the EU and states such as South Korea and Japan would then become very difficult.

67. What is clear from this survey is that we cannot go back to the past, even though its consequences still weigh heavily upon the nuclear landscape. Equally,

there are many non-benign nuclear futures that could emerge unless the global community can navigate around or eliminate them. What is now needed is incisive analysis of the proliferation and non-proliferation situations that confront the global community, and a willingness to manoeuvre in the gap between technological determinism and diplomatic possibilities. The objective should be to develop political agreements and understandings which can prevent nuclear war and manage nuclear energy. This task will be extremely difficult, but it is not impossible if it is confronted honestly, directly and with energy.

List of published studies and papers
All papers and studies are available as pdf-files at the Commission's website: www.wmdcommission.org

No 1 "Review of Recent Literature on WMD Arms Control, Disarmament and Non-Proliferation" by Stockholm International Peace Research Institute

No 2 "Improvised Nuclear Devices and Nuclear Terrorism" by Charles D. Ferguson and William C. Potter

No 3 "The Nuclear Landscape in 2004: Past Present and Future" by John Simpson

No 4 "Reviving the Non-Proliferation Regime" by Jonathan Dean

No 5 "Article IV of the NPT: Background, Problems, Some Prospects" by Lawrence Scheinman

No 6 "Nuclear-Weapon-Free Zones: Still a Useful Disarmament and Non-Proliferation Tool?" by Scott Parrish and Jean du Preez

No 7 "Making the Non-Proliferation Regime Universal" by Sverre Lodgaard

No 8 "Practical Measures to Reduce the Risks Presented By Non-Strategic Nuclear Weapons" by William C. Potter and Nikolai Sokov

No 9 "The Future of a Treaty Banning Fissile Material for Weapons Purposes: Is It Still Relevant?" by Jean du Preez

No 10 "A Global Assessment of Nuclear Proliferation Threats" by Joseph Cirincione

No 11 "Assessing Proposals on the International Nuclear Fuel Cycle" by Jon B. Wolfsthal

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