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Policy Brief

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Reducing nuclear weapons risks
A menu of 11 policy options

As long as nuclear weapons exist, efforts should be made to prevent them from being used – on purpose or by accident. In this publication eleven categories of policy options are identified which might be implemented by any of the nuclear weapon states to further reduce the risks of nuclear weapons being used.[1]

Since the nuclear bombings of Hiroshima and Nagasaki in 1945 the world has never been confronted with any nuclear weapon detonation (except for test explosions). Not once has any nuclear weapon explosion occurred by accident. Yet, simply assuming that what has not happened in the past will not happen in the future may be a reasoning that is too simple. Historic research has shown that there have been numerous close calls.[2] Many examples of nuclear weapon incidents have become public, and many more are supposedly not known publicly. For analytical purposes, three categories of nuclear weapons risks can be distinguished:

- Unauthorized use (someone using a nuclear weapon without official authorization);
- Unintended use (for example, by accident or due to a technical error);
- Intended use based on incorrect assumptions (authorized use which later appears to be based upon incorrect information, misunderstandings or misperceptions).

As long as nuclear weapons exist, efforts should be made to prevent them from being used. Especially during the Cold War much thought was given to measures to prevent a nuclear war – on purpose or by accident. Considering the recent increase in the status of nuclear weapons in strategic communications, military spending, and political rhetoric in many of the nine states possessing nuclear weapons (in short: nuclear weapon states), it is worth reviewing the possibilities of such risk-reduction options.

1 A 2-page summary of this publication was earlier published as: Sico van der Meer, *Reducing the risks of nuclear weapons use: 11 policy options*, Clingendael Alert, April 2018.

2 For detailed overviews of past incidents, see: Scott D. Sagan, *The limits of safety. Organizations, accidents, and nuclear weapons*, Princeton University Press, Princeton 1993; Eric Schlosser, *Command and control. Nuclear weapons, the Damascus Incident, and the illusion of safety*, Penguin Books, New York 2013; Patricia Lewis, Heather Williams, Benoît Pelopidas and Sasan Aghlani, *Too close for comfort. Cases of near nuclear use and options for policy*, Chatham House Report, April 2014.

This publication will not offer an overview of all options that have been previously proposed, yet it aims to identify some of the most practical and relevant options that might be implemented by any of the nuclear weapon states. Simply structuring the most appropriate options that are available may be helpful in shaping any dialogue or policy discussion on nuclear weapon risk reduction and may function as a starting point for more detailed explorations. Such explorations alone may already be considered as a confidence-building measure between nuclear weapon states.

The menu of choice offered here consists of 11 categories of policy options. To summarize, those options are: Training; Transparency; Communication; De-targeting; Increasing the security of launching systems; De-alerting; Increasing decision time; Raising the threshold for use; Eliminating certain types; Limiting numbers and locations; and Nuclear disarmament.

The order of this (non-exhaustive) overview of potential policy options is not static. Although the list starts with the seemingly least fundamental step and ends with the most complicated option, parallel and synchronised steps are certainly possible. Some of the options may already be (partly) implemented by various nuclear weapon states, but to what extent is often unknown. The report will finish with a brief exploration of the venues that could be used to discuss and implement any of the risk reduction policies identified here.

1. Training for nuclear emergencies

The risk reduction policy that may be the least complicated to implement is increasing attention and transparency regarding the training of personnel involved in nuclear weapons' infrastructure. A key factor in almost all known nuclear weapon incidents is the people who are involved. From technicians and operators to military and political decision-makers: at any moment they could be involved in causing or preventing such incidents. Regularly, 'sloppy practices', including safety violations and misconduct, play a role in such incidents.[3] The continuous training of all those who are involved in nuclear weapons' infrastructure, within the scientific, military and political realm, is therefore a crucial element in risk reduction, especially with regard to preventing the unintended use of nuclear weapons.[4]

Although one may argue that such training is already common in all nuclear weapon states, the many examples of dangerous incidents in the (recent) past show that one can never receive enough training. Training could include, for example, safety procedures, cyber hygiene, as well as stress testing and simulation exercises with far-fetched scenarios in which various complications need to be taken into account at the same time in nuclear weapon decision-making. Training based on past failures and incidents may be helpful and may prevent similar mishaps.

Joint training programmes in which people from various nuclear weapon states cooperate and share experiences and 'best practices', for example on how to prevent miscommunications and misperceptions, could be worthwhile as well. Moreover, some transparency concerning training procedures may function as a confidence-building measure in which nuclear weapon states show that they take this issue seriously.[5]

2. Increased transparency

While any information related to nuclear weapons is generally highly confidential, increasing transparency concerning some

3 Lewis etc., *Too close for comfort*, 29.

4 Albert Carnesale, Joseph S. Nye Jr., and Graham T. Allison, 'An agenda for action', in: Graham T. Allison, Albert Carnesale, and Joseph S. Nye Jr. (eds.), *Hawks, doves, and owls. An agenda for avoiding nuclear war*, W.W. Norton, New York & London 1985, 237.

5 Beyza Unal and Patricia Lewis, *Cybersecurity of nuclear weapons systems. Threats, vulnerabilities and consequences*, Chatham House Research Paper, January 2018, 5-9 & 21.

issues would be helpful in reducing the risks of any (unintended) use.

First of all, increased transparency regarding nuclear capabilities, doctrines, postures and other related policies is a viable risk-reducing policy option. In this way, the predictability of the use of nuclear weapons could be increased to some extent, in turn decreasing the risk of misperceptions, misunderstandings, and miscommunications (especially in times of crisis and stress). Although some nuclear weapon states prefer a certain level of opacity to increase the deterrent effect of their nuclear weapons, changes in the balance between deterrence and risk reduction might be possible.[6]

Second, but possibly less feasible, is more transparency on past nuclear weapon incidents. Increased openness about such incidents, as well as about the prevention of actual disasters because of these incidents, could be useful in learning from and sharing lessons on what could possibly go wrong and how to prevent such incidents. Nuclear weapon states are generally not very willing to make such incidents public because they are bad publicity and could provide insights into their secret procedures. Nevertheless, venues and procedures could be explored to share the lessons learned between nuclear weapon states, preferably in the form of comprehensive accounts of such incidents and their follow-up actions without making public any technical details which could be misused by potential adversaries.[7]

Increased transparency concerning issues which are not directly related to nuclear weapons, but could influence decisions regarding their use, could also be effective in reducing the risk of (pre-emptive) nuclear attacks as a consequence of miscalculations or misperceptions. An important step in this regard could be increased information exchange on military exercises, which in the past sometimes resulted in concerns and alarm with the use of nuclear weapons being seriously considered as a consequence.[8]

3. Improving communications

One of the main risks with regard to the potential use of nuclear weapons is intended use based on miscommunications. Such miscommunications could create misperceptions among decision-makers who could then act based on incorrect assumptions. Clear, unambiguous lines of communication on several levels can prevent reliance on incorrect information, especially (but not only) in times of tension, stress and chaos. As long as there will be a shared understanding of the reality of any (crisis) situation among (potential) adversaries, the risk of the inadvertent use of nuclear weapons will decrease.[9]

6 Bruce Blair, Victor Esin, Matthew McKinzie, Valery Yarynich and Pavel Zolotarev, 'Smaller and safer. A new plan for nuclear postures', *Foreign Affairs*, Vol. 89, No. 5, September/October 2010, 9-16; John Borrie, Tim Caughley and Wilfred Wan, 'Reducing nuclear weapons risks', in: John Borrie, Tim Caughley, and Wilfred Wan (eds.), *Understanding nuclear weapons risks*, UNIDIR Resources, 2017, 101; Lewis etc., *Too close for comfort*, 29.

7 Stewart Britten, *The invisible event. An assessment of the risk of accidental or unauthorised detonation of nuclear weapons and of war by miscalculation*, Menard Press, London 1983, 43.

8 Daniel Frei and Christian Catrina, *Risks of unintentional nuclear war*, UNIDIR, Geneva 1982, 177; Lewis etc., *Too close for comfort*, 29; Nate Jones, *Able Archer 83. The secret history of the NATO exercise that almost triggered nuclear war*, The New Press, London & New York, 2016.

9 Frei & Catrina, *Risks of unintentional nuclear war*, 198-199; David Krieger, *Preventing accidental nuclear war*, Nuclear Age Peace Foundation, Santa Barbara 1984, 12; Zafar Nawaz Jaspal, *Nuclear risk reduction measures and restraint regime in South Asia*, Regional Centre for Strategic Studies, Colombo, 2004, 85; Tughral Yamin, 'Nuclear Risk Reduction (NRR) in South Asia', *Journal of Contemporary Studies*, Vol. 1, No. 2, Winter 2012, 87; Borrie etc., 'Reducing nuclear weapons risks', 96; John Gower, *The dangerous illogic of twenty-first-century deterrence through planning for nuclear warfighting*, Carnegie Endowment for International Peace, 6 March 2018, 3-4.

More than ever before, technical possibilities nowadays exist to manipulate communications, for example using cyber tools to disturb communication channels or creating and spreading fake information on several decision-making levels – also making use of media or social media to influence public and political opinions. Methods that could affect decision-making processes regarding the launching of nuclear weapons could include data manipulation, the cyber jamming of communication channels, or even cyber spoofing (changing information in digital systems). Such technological possibilities make reliable, direct communication lines even more important.[10]

The establishment of swift and reliable direct communication links between nuclear weapon states could also be beneficial in the case of (probable) errors in warning systems signalling incoming missiles, or in the ultimate case of any accidental launch of a nuclear missile. Both incidents could be misinterpreted as the start of nuclear warfare; quick communications to clarify the actual situation may at least prevent an escalation into a fully-fledged nuclear war.

Various, but not all, nuclear weapon states have already established special communication channels between their leaderships (often called 'hot lines'). Increasing the number of such communication links could be encouraged. Additionally, agreements not to manipulate or interfere with such communication mechanisms are conceivable as well.

Next to improved (emergency) communication possibilities between nuclear weapon states, increased threat and intelligence sharing regarding the risks of nuclear weapons may be helpful – for example, sharing information on non-state actors trying to interfere with digital infrastructure related to nuclear weapons command and control systems. A possibility would be to establish a framework, such as a technical working group in which as many nuclear weapon states as possible participate, particularly focussing on this kind of information sharing. More far-fetched, but not impossible, is establishing joint early warning centres in which potential (nuclear) missile launches are monitored globally. With staff from several nuclear weapon states cooperating in the same centre, communication lines would be short if unexpected events were to occur.[11]

4. De-targeting

Little public knowledge is available about the potential predefined targeting of nuclear weapons in the nine nuclear weapon states. If a nuclear missile is accidentally launched, will it automatically hit its predefined target, which may well be a densely populated area? After the end of the Cold War two of the nuclear weapon states, Russia and the United States, mutually agreed to change the default targeting of their nuclear weapons to open-ocean targets. This was done as a confidence-building measure, and is not being verified, yet it is an important signal that predefined targets cannot be too easily destroyed by accident.[12] The other nuclear weapon states could implement a similar policy – or make it public if it has already been implemented. Such a policy will particularly limit the consequences of any unintended use.

De-targeting will also increase the decision time for using nuclear weapons; although one may assume that retargeting to another target will take only a few minutes, any additional minute during which decision-makers can weigh all the information that they have can be crucial in preventing the use of nuclear weapons because of miscommunications, misperceptions or misunderstandings (see also Category 7 on increasing decision time). In this way, de-targeting may also limit the risk of intended use because of incorrect assumptions.

10 Unal & Lewis, *Cybersecurity of nuclear weapons systems*, 3-4; Gower, *The dangerous illogic*, 4-6.

11 Bruce Blair etc., 'Smaller and safer', 16.

12 Lewis etc., *Too close for comfort*, 28.

5. Increasing the security of launching systems

Launching systems for nuclear weapons are generally complex and consist of various sub-systems. Simplified, they involve tightly coupled warning, communications, and command and control systems. These complex systems can be susceptible to technical errors, human errors and manipulation.

Various technical options are available to prevent unintended use because of failing (components of) launching systems. An important risk reduction measure is including redundancies in these systems. Redundancy measures ensure that if any component fails, the system would continue to function through back-up components. This means that launching will always be possible, but halting a launching procedure that has already commenced will also be possible. An important redundancy measure is the inclusion of a combination of digital and analogue command and control mechanisms, so that problems in the cyber domain can be circumvented via the analogue option.[13]

Launching systems should always include human decision factors next to automated systems as well. Even though it is regularly claimed that automated systems make fewer errors than humans, past nuclear weapons incidents show that human judgment is vital in decision-making. Only humans can incorporate ethics, doubt as to the accuracy of certain information, and disregard inappropriate orders from hierarchical superiors.[14]

Increased attention being given to the cyber security of launching systems is also required. Technological developments in the cyber domain are very rapid and the often-heard argument that the infrastructure related to nuclear weapons is not connected to any external networks can no longer be sufficient; even the most 'air-gapped' facilities have proven to be vulnerable to cyber-attacks – think of the Stuxnet virus damaging the highly securitized uranium enrichment programme of Iran.[15] In this context, nuclear weapon states may also consider implementing guarantees, as a confidence-building measure, that they will not try to execute cyber-attacks against the nuclear missile launching systems of their adversaries.

Another risk reduction measure regarding launching systems is the inclusion of mechanisms to destroy accidently launched nuclear missiles before they hit their target.[16] As far as is known, none of the nuclear weapon states has implemented such a mechanism, probably because they fear that such mechanisms may be vulnerable to (cyber) manipulation by adversaries, which could ultimately make (the deterrent effect of) their nuclear weapons useless. Yet, with sufficient security measures having been implemented, such tools could be able to limit the eventual consequences of a nuclear missile that has been accidentally launched.

Last but not least, increased transparency concerning security measures related to nuclear missile launching systems can be thought of. It may be the case that many of these options have already been implemented by nuclear weapon states, but in most of these states the lack of transparency (often because of security concerns) prevents any public knowledge about such measures. For both nuclear and non-nuclear weapon states it is currently only possible to merely hope that all launching systems in the nuclear weapon states are safe, while a little more transparency – within the limits of military

13 Unal & Lewis, *Cybersecurity of nuclear weapons systems*, 21.

14 Alan Borning, 'Computer System Reliability and Nuclear War', *Communications of the Association for Computing Machinery*, Vol. 30 No. 2, February 1987, 112-131; Unal & Lewis, *Cybersecurity of nuclear weapons systems*, 5-9.

15 Kim Zetter, *Countdown to Zero Day. Stuxnet and the launch of the world's first digital weapon*, Crown Publishers, New York 2014; Borrie etc., 'Reducing nuclear weapons risks', 99; Unal & Lewis, *Cybersecurity of nuclear weapons systems*.

16 Sagan, *The limits of safety*, 276-277.

confidentiality – could provide them with a higher level of assurance in this regard.

6. De-alerting

Some nuclear weapon states are presumed to keep some of their nuclear weapons on high alert, ready to be launched within a few minutes. This high-alert status – often called 'hair-trigger alert' or 'launch on warning' status – is considered to allow nuclear missiles to be launched very quickly after receiving a warning of an incoming nuclear attack, and before the attacking missiles will hit their targets.[17] The decision time in the case of a warning of incoming missiles is so short that misperceptions because of technical failures, human errors, miscommunication, etc., may occur more easily and there is less time to check information and to adjust any misperceptions. Moreover, the (cyber) manipulation of automated warning systems coupled to the launching systems of these high-alert weapons may create more serious problems compared to those of nuclear weapons which are not on high alert.

To reduce the risk of the unintended use of nuclear weapons, or of intended use based upon incorrect information, any state with nuclear weapons on high alert could adjust this status, if deemed necessary through a phased approach. Adjusting the alert status is meant to increase the time in which decision-makers have to digest incoming information on which they have to base a decision to launch or not to launch any nuclear weapon (see also Category 7). Although the alert status of nuclear weapons will be almost impossible to verify, adjusting it will be at least a confidence-building measure.

More transparency by all nuclear weapon states concerning their alert status and the accessory risk mitigation measures is important as well, because information regarding this topic is currently scarce and generally lacks any official confirmation.[18]

7. Increasing decision time

As was stated above, the more time decision-makers have to ensure any perceived need to launch nuclear weapons in times of stress and (potential) emergency, the less risk there is of decisions being based on misinformation, miscommunication and misperceptions.

Some policy options that could increase decision time were already identified above: de-targeting and de-alerting have such an effect to some extent. Yet, increasing decision time for nuclear weapon use could be considered more broadly. Nuclear weapon states could ensure that there is enough time for consideration in their launching procedures in general – and be transparent on this point.

An option to build in more time is, for example, to remove warheads from missiles and to store them separately, and/or to store nuclear payloads in isolation from detonation devices. Along the same lines are measures like de-activating mechanisms that automatically open missile silo covers or adding safety switches on missile silos. Also possible is a policy measure to move submarines with nuclear weapons far enough away from any adversaries' coasts to increase the amount of time between any launch of these missiles and the moment they would arrive at their targets, so there is

17 Hans M. Kristensen and Matthew McKinzie, 'De-alerting nuclear forces', *Bulletin of the Atomic Scientists*, 19 June 2013; Lewis etc., *Too close for comfort*, 28; Union of Concerned Scientists, *Reducing the Risk of Nuclear War. Taking Nuclear Weapons Off High Alert*, UCS Report, 2016, 1-3.

18 Pavel Podvig, *Reducing the risk of accidental launch. Time for a new approach?*, PONARS Policy Memo, No. 328, February 2005; Anthony M. Barrett, Seth D. Baum and Kelly Hostetler, 'Analyzing and reducing the risks of inadvertent nuclear war between the United States and Russia', *Science & Global Security*, Vol. 21, 2013, 127; Lewis etc., *Too close for comfort*, 28; Union of Concerned Scientists, *Reducing the Risk of Nuclear War*, 1-3.

plenty of time to communicate in the case of unintended launches.[19]

All these policy options are intended to add more activities to the actual launching procedures of nuclear missiles, and thus to add more decision moments and more time for decision-makers to demonstrate prudent judgment, to resolve potential misperceptions and to receive all vital pieces of information relating to the perceived need to launch missiles. Although one could question the credibility of such policies, since verification seems to be almost impossible, considering them at least as confidence-building measures is already a useful step.

8. Raising the threshold for use

An important risk reduction measure is keeping the threshold for the intended use of nuclear weapons as high as possible. Especially since some nuclear weapon states currently seem to be moving in the direction of accepting so-called 'limited nuclear warfighting' as a realistic military option and are planning to (re)introduce sub-strategic nuclear weapon capabilities, the threshold actually appears to be lowering. The lower the (perceived) threshold, the more likely it is that the use of nuclear weapons will be seriously considered.[20]

To raise the threshold for use, nuclear weapon states could limit the circumstances in which nuclear weapons may be used in their doctrines and postures. The doctrinal line between nuclear and conventional warfighting should be very clear. In this regard, one could also think of 'No First Use' policies and negative security assurances, posturing that nuclear weapons will not be used against non-nuclear weapon states and/or as a response to non-nuclear attacks. Currently, only two of the nine nuclear weapon states (China and India) have publicly declared that they have a 'No First Use' policy. Of course, the transparency of doctrines and postures is important in this respect as well.[21] Next to unilateral No-First-Use declarations, one could even think of establishing a multilateral No-First-Use Treaty.[22]

Raising the nuclear threshold in doctrines and postures may to some extent be perceived as a symbolic measure, because it cannot be verified whether decision-makers will actually behave like their (published) policy documents postulate. Nevertheless, it can again be considered as an important confidence-building measure.

9. Eliminating certain types

Closely related to raising the nuclear threshold is the elimination of nuclear weapon types which by their nature lower the threshold for use and could create confusion between conventional and nuclear weapons during crisis situations. Examples of such weapon types are cruise missiles with nuclear warheads, short-range and/or intermediate-range missiles with nuclear warheads in general, and/or tactical nuclear weapons all together.

Those types of nuclear weapons have two characteristics that may increase the risk that they are actually used. First, they could be

19 Ashton B. Carter, 'Sources of error and uncertainty', in: Ashton B. Carter, John D. Steinbruner and Charles A. Zraket (eds), *Managing nuclear operations*, Brookings Institution, Washington DC 1987, 638-639; Sagan, *The limits of safety*, 276-277; Podvig, *Reducing the risk of accidental launch*; Barrett etc., 'Analyzing and reducing the risks of inadvertent nuclear war', 127; Lewis etc., *Too close for comfort*, 28; Borrie etc., 'Reducing nuclear weapons risks', 94-95.

20 Borrie etc., 'Reducing nuclear weapons risks', 94; Gower, *The dangerous illogic*, 2; Dick Zandee and Sico van der Meer, *Trump's Nuclear Posture Review. A new rift between Europe and the US?*, Clingendael Policy Brief, February 2018.

21 Frei & Catrina, *Risks of unintentional nuclear war*, 226-227; Lewis etc., *Too close for comfort*, 28-29; Borrie etc., 'Reducing nuclear weapons risks', 95.

22 Ken Berry, 'Draft Treaty of Non-First-Use of Nuclear Weapons', Research Paper, International Commission on Nuclear Non-proliferation and Disarmament, June 2009; Gulshan Luthra, 'India suggests global No First Use of Nuclear Weapons', *India Strategic*, April 2014.

perceived as more 'usable' in actual warfare; their lower yield may facilitate a political acceptance of their real use in operations, including in scenarios that are often described as 'limited nuclear war'. Yet, it is easy to envision how a 'limited' nuclear weapons exchange could spiral out of control, resulting in a rapid escalation of the conflict to higher-yield nuclear weapons and having true devastation as a consequence.

Second, dual-capable weapon systems may cause misunderstanding and miscalculation resulting in nuclear warfare. The difficulty of recognizing whether an incoming missile is nuclear armed or conventional before the moment of impact may result in responses to conventional missile launches as if they were nuclear first-strike attempts.

Eliminating such types of nuclear weapons – multilaterally, bilaterally, or unilaterally – could contribute to raising the nuclear threshold as well as to reducing the risk of the use of nuclear weapons because of misunderstandings and misperceptions.[23]

10. Limiting numbers and locations

Currently there are some 15,000 nuclear weapons in the world.[24] Each one entails a risk of being used – on purpose or by accident. Not surprisingly, limiting the number of (deployed) nuclear weapons and/or the number of locations in which they are stored is one of the most effective measures to reduce the risk of them being used.[25]

In this regard, bilateral arms control agreements between the world's biggest nuclear weapon possessors, the United States and Russia, have proven to be very effective in the past (treaties such as SALT, START, and New START). These agreements, limiting the maximum number of deployed nuclear warheads, caused the global total of nuclear weapons to drop from almost 70,000 in the 1980s to some 15,000 nowadays.[26]

Apart from reducing the number of (deployed) nuclear weapons, limiting the number of locations in which they are stored may be helpful as well. Fewer locations will decrease the risks of complications regarding, for example, communication and command problems, misperceptions about other activities at such locations, and harmful activities by outsiders.

Removing nuclear weapons deployed in border regions between (potential) adversaries may also contribute to risk reduction. Particularly in the case of relatively low-yield tactical nuclear weapons in (tense) border regions, one may speculate that the threshold for their use could be considered somewhat lower compared to strategic nuclear weapons or tactical nuclear weapons deployed further away from borders. The risk of use, unauthorized use (for example, if local military commanders themselves are allowed to decide to use these weapons in crisis situations), or unintended use may be higher. Specific border areas where (as far as is known) currently tactical nuclear weapons are deployed are the border regions between India and Pakistan and between Russian and NATO territory (including forward deployed US nuclear weapons in European states).

11. Nuclear Disarmament

The ultimate risk reduction option is, without doubt, complete nuclear disarmament. The nuclear weapon states should seriously cooperate in working towards this goal, including issues such as the reliable verification of disarmament. Even though nuclear disarmament may be a long-term process, the nuclear weapon states could at least show their willingness to move

23 Sico van der Meer and Christine Parthemore, 'Revive arms control and start with nuclear-armed cruise missiles', *War on the Rocks*, 8 June 2016; Gower, *The dangerous illogic*, 5.

24 Shannon N. Kile and Hans M. Kristensen, *Trends in world nuclear forces, 2017*, SIPRI Fact Sheet, July 2017.

25 Jaspal, *Nuclear risk reduction measures*, 84; Blair etc., 'Smaller and safer', 9-16.

26 Kile & Kristensen, *Trends in world nuclear forces*.

forward by smaller steps in this regard. A few examples of policy options within this category of small steps towards actual disarmament are banning the production of fissile materials or a moratorium on nuclear weapons modernisation.[27]

Also feasible is a (joint) exploration of alternative means to deter adversaries which do not entail the global catastrophic risks involved with nuclear weapons. A search for bold, creative approaches to alternatives to nuclear deterrence in the longer term could be stimulated. In addition, as was already stated in the 1980s by respected academics like Joseph S. Nye and Graham T. Allison: "In particular, the community of defense and foreign policy specialists must resist cynicism toward non-traditional concepts, misplaced confidence that all of the important ideas have been examined, and condescension to newcomers from other fields."[28]

Which venues?

Risk reduction measures relating to nuclear weapons can be implemented in many ways: unilaterally, bilaterally, trilaterally, or multilaterally. Yet, an important consideration while discussing the various options is that they can only be implemented by nuclear weapon states themselves. Non-nuclear weapon states could play a role as initiators or brokers in working towards the implementation of such policies, but in general their influence concerning this issue is very limited.

There are various multilateral options to discuss nuclear weapon risk reduction measures. First of all, the various existing forums and institutions can be thought of. The five permanent members of the United Nations Security Council (the P5), which are also the five acknowledged nuclear weapon states within the Non-Proliferation Treaty, could serve as a forum for deliberating such measures. The so-called P5 Plus Group, in which India and Pakistan also participate, might be an even better forum as it includes seven of the nine nuclear weapon states in the discussion.

The Conference on Disarmament may be an appropriate forum for promoting dialogue and fostering informative debates, yet it is not the most promising forum for generating action since it has not been able to come to any important decision for decades. Various forums within the United Nations context could also be useful to generate ideas and openly share questions and concerns. The same applies to some extent to regional security organisations such as the Organisation for Cooperation and Security in Europe (OSCE) and the North Atlantic Treaty Organisation (NATO). In any case, an exploratory phase within such venues could later be followed by concrete measures or agreements by (any number of) nuclear weapon states.

If none of these multilateral venues are deemed ideal, or if they start robust international discussions that subsequently need to be built upon in a less restrictive environment, a group of interested countries could create an ad hoc forum (some sort of 'coalition of the willing') that focuses on the single issue of nuclear weapons risk reduction measures.

One could also think of bilateral, trilateral, or multilateral agreements between nuclear weapon states. Examples of how these could look like are the 'Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War', concluded between the United States and the Soviet Union in 1971, and the 'Agreement on the Prevention of Nuclear War' between the same two states dating from 1973.[29] These two bilateral agreements were merely confidence-building measures in which both parties promised to implement some organizational and technical measures to diminish the risk of nuclear weapons being used.

27 Sico van der Meer, *Accelerating global nuclear disarmament. A menu of 16 policy options*, Clingendael Policy Brief, February 2016.

28 Carnesale etc., 'An agenda for action'.

29 Frei & Catrina, *Risks of unintentional nuclear war*, 199-200 & 210-211.

Last but not least, most of the risk reduction measures identified here can be implemented unilaterally as well. Any nuclear weapon state could announce and implement one or more of those policies on its own. Even though verification would often be problematic, the announcement and the signalling of the intention behind it may already function as a valuable confidence-building measure towards other nuclear weapon states as well as towards non-nuclear weapon states.

Conclusion

Any policies that could realistically contribute to limiting the risk of nuclear weapons being used – on purpose or by accident – can only be encouraged. Above, eleven categories of policy options have been identified which nuclear weapon states could implement to reduce this risk.

Some of the options will be difficult to accomplish in the short term considering the various security dilemmas that are involved. Yet many options, especially the first ones listed in the 'menu of choice', are relatively less complicated to implement. Many of them could be considered as confidence-building measures, and transparency is a returning feature as well. Such options often do not require complicated and sensitive verification mechanisms.

Risk reduction policy measures can be implemented via various venues. The more nuclear weapon states implement any of these policies, the better. They will not only limit the risks of nuclear incidents for themselves; it is also a gesture towards the rest of the world, which itself has no options to directly reduce the global risks of a category of weapons owned by only a few states.

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