Introduction

Let me begin by making a simple observation: having nuclear weapons does not lead to prowess in football. Only non-nuclear weapon states now remain, leading to the question whether nuclear abolition leads to World Cup victories. Argentina and Brazil’s experience seem to indicate that this might be the case.

I have been invited to talk about scientific and technical challenges to nuclear arms cuts. Since I represent VERTIC, I will limit myself to verification solutions—shamelessly avoiding other areas where science and technology will play a role.

This presentation will contain few slides. I will start with two slides on the recent NPT review conference. The first will go through the review part of the document, whereas the other will look at the action plan. I suspect many of you are well aware of what the documents say already, so I beg your forgiveness.

The third slide will outline a few ideas on how the disarmament agenda can be brought forward. I will then conclude with a few words.

Review: 2005-2010

The word ‘verification’ was mentioned 13 times in the final document, mostly in connection with IAEA safeguards. It should be beyond anyone’s doubt that an effective safeguards system, to contain the spread of nuclear weapons, is of fundamental importance in achieving a nuclear weapon free world.

How to verify the nuclear disarmament was also raised in the final document. For instance, the conference noted the UN Secretary-General’s proposals for nuclear disarmament to for instance consider ‘negotiations on a nuclear weapons convention or agreement on a framework of separate mutually reinforcing instruments, backed by a strong system of verification.’ Personally, I think I agree with Garry George, who spoke in the previous session. Before the world moves into an era of multilateral nuclear arms control, it needs to ensure that all nuclear weapon states have moved into a position of parity with one another. A nuclear weapons convention is the logical end state, but pushing for it now is like leaping to step 100, when you’ve hardly taken a feeble first step.

Science and technology can, in fact will, play a role in pushing decision makers towards that final step. The NPT parties recognized this when they welcomed ‘efforts towards the development of nuclear disarmament verification capabilities that will be required to provide assurance of compliance with nuclear disarmament agreements for the achievement and maintenance of a nuclear-weapon-free world’. It was encouraging that the Conference, in that context, noted the cooperation between Norway and the UK in setting up a system for nuclear warhead dismantlement verification.

Action: 2010-2015

The conference also agreed on a comprehensive list of ambitions. They are written down as ‘actions’ but in reality, most actions are vague and peppered with words such as ‘encourage’ and ‘appropriate’. It would be
wise to read this section of the document as guidance, as a list of feasible and desirable work, rather than something that must be fulfilled without condition.

Two actions are directly relevant to the work of the International Atomic Energy Agency. Actions 16 and 17 encourages the nuclear weapons states to declare excess material to the IAEA, and then to put this material under safeguards. Verification arrangements are supposed to ‘ensure the irreversible removal of fissile material designated by each nuclear-weapon State as no longer required for military purposes’. Much work was done on this throughout the 1990s by the Trilateral Initiative comprising the IAEA, Russia and the United States. I will talk about this a bit later.

It is, however, action 19, which is most interesting, at least for us at VERTIC. Here, all States agree on the importance of supporting cooperation among Governments, the United Nations, other international and regional organizations and civil society aimed at increasing confidence, improving transparency and developing efficient verification capabilities related to nuclear disarmament. This represents a very strong mandate for future work into verification aspects of nuclear disarmament. Such work ought to be preserved and nourished in the difficult financial times before us. My conviction is that even very small investments can generate fantastic yields in this exciting field.

**Progressing the technical agenda**

As far as the technical agenda on nuclear disarmament is concerned, two immediate routes forward are clear. My recipe is based on a mixture of existing initiatives, which obviously needs to be refreshed and revitalized. Few are willing to support already existing work. For the political mind, the old is stale, often for no apparent reason. Therefore, some repackaging and rebranding is necessary to attract political will, and with it the necessary funds.

**Trilateral initiative**

First, the trilateral initiative should be revived. This is obvious, and would directly count towards a fulfilment of actions 16 and 17, while expending few resources.

1. The US and Russia should agree to publicize already covered work, and open it up for international peer review. Much work has already been done, and the remaining disagreements are not beyond a solution.
   a. The first related to the question of equipment authentication. How can the inspector be sure that the equipment he or she is using is un-tampered with? Two possible options were proposed by the Working Group. The preferred option was, as you are all aware, for the nuclear weapon states to produce many copies, for the IAEA to authenticate a sample, while the rest remain under seal.
   b. The second question was more compliance related. What happens if an anomaly is detected? What would the status of the remaining items be, and how could the anomaly be resolved? These are, as you all know, hardly scientific questions, but deeply political.
   c. Finally, the question of material shapes remained. The United States wanted Russia to submit roughly the same amount of plutonium in roughly the same forms as the US itself. But while the US decided to put the entire pit under verification, the Russians wanted to melt its pits into two kilogramme balls and pack two balls each into specialized containers (the so-called AT-400R). Since the US had no intention of converting its pits, the two sides started to fall out of sync. While technical activities still continued, the IAEA found itself increasingly having to maintain the pace of the activities.
2. The Working Group should be re-established. While many of the people who worked on the trilateral initiative are still in active duty, some are nearing retirement age. Their expertise should not be squandered, as so often happens when initiatives go unfunded. People tend to move on to greener pastures. They need to get paid.
3. It is very important, consequently, to think of a way to transfer their knowledge to a younger generation of scientists and technicians who may pick up the ball and carry it forward.

Existing bi- and multilateral research
Implementing Action 19 will prove more challenging. It is easy to support multilateral cooperation in developing verification mechanisms in a conference paper but it is exceptionally difficult to make it happen in practice. It is difficult to raise the funds needed to carry the work forward; it is difficult to coordinate the international actors so to ensure that everyone is happy; it is indeed even difficult to ensure effective domestic coordination. Once all those hurdles have been cleared, however, the results can be remarkable. The UK-Norway Initiative conducted rudimentary research compared to other initiatives, but its unique multi-disciplinary and multi-national character made it stand apart from anything else ever attempted. VERTIC is presently preparing a report on this. The first draft will undergo external review in late July, and a second, revised, draft will undergo a second external review a few weeks thereafter. We’re on schedule for our September release date.

1. In my mind, building on the past is easier than to start anew. Therefore, it is essential that the UK and Norwegian governments continue to support the UK-Norway Initiative as a core activity. The first three years only scraped the surface of activities that could be undertaken. I realize that some argue that it will have to reshape itself to survive: become more proactive, engage more actors, and engage in more stimulating research. While I agree with all of that, I know how difficult it was to build the core team that are now working the problems. This core should be maintained, even if it might include even less actors in the future.
2. The key is not so much to look at the UK-Norway Initiative as the only activity out there. Rather, it should be seen as a blueprint for similar activities elsewhere. Looking into disarmament verification research ought to involve the nuclear weapon states, and the non-nuclear weapon states, but as equal partners. Having other nuclear-non-nuclear weapons state initiatives springing up would be good. But one should not discount the research potential of having exclusively non-nuclear weapon states collaborating on some of the verification issues. It can most definitely be done. Work to construct 90-95 per cent of the verification regime will not require unique insight into nuclear weapons, or an advanced degree in physics.
3. But how do you get more states involved? Frankly speaking, the UK-Norway initiative was a lucky coincidence. Other attempts to get cooperation going have failed. There are several reasons for this. One being the difficulty of gaining traction in cooperation across several time zones. While e-mail, and perhaps teleconferencing, can alleviate some of the strain, regular meetings are necessary, sometimes even key. It seems to me that involving the International Atomic Energy Agency in some capacity is part of the solution. All states with significant nuclear activities, and corresponding expertise, are represented in Vienna. It therefore makes it an ideal base for outreach and cooperation.

Overcoming preconceptions
My final points are more philosophical. The bane of multidisciplinary research is the tendency of a select and privileged few to try to ring-fence their research area by claiming that only they are capable to conduct the
work. This is, of course, something that I think permeates the entire academic world. However, if one desires for the nuclear disarmament agenda to take strides forward, the most important obstacle to overcome is that of the mind. Yes, physics brought the bomb into existence. But no, physics alone is not the panacea.

1. In order to break ground, new initiatives need to counteract tendencies of ‘disciplinary ownership’. One thing I found fascinating with the UK-Norway Initiative was the interaction of several academic backgrounds, and the application of all that training and experience on a single problem: how to verify the dismantlement of a single warhead. Human factors matter. After all, effective verification aims to build trust in the human mind, not among the elements of the periodic system. There is a vast expanse of issues to explore here. An expanse that I hope that those interested in verification start to cross soon.

2. All science, indeed all research, over the ages has relied on the review to check the quality of the work. Nuclear disarmament verification work has often been devoid of this type of work. More ‘peer-review’ of already conducted work ought therefore to be encouraged. The UK-Norway Initiative started in this way. It is a remarkably effective method to not only raise the level of your own thinking, but also that of the one that you’re reviewing. I would encourage States to have a critical look at the Initiative Working Paper to the Review Conference, and then to publish and communicate their findings.

3. By breaking ‘disciplinary ownerships’ and by subjecting research to stringent and honest review, the playing field for multidisciplinary research should open up. Monitoring and inspection; verification; these are all human endeavours. Yet, studies tend to be focussing on technological fixes. Such studies need to be supplemented in a comprehensive fashion. Human beings have a tremendous ability to observe, deduce and imagine from limited data-sets. Yet, most verification exercises almost see the human inspector as a pawn to be moved around on a facility chess-board. There could be scope for more psychologically oriented studies into disarmament verification. How is confidence in a process generated, and how is it eroded, and how quickly?

Conclusion: standing on the edge of a vast expanse?
So, are we standing on the edge of a vast expanse, simply surveying the road ahead of us?

I would say absolutely not. As our forthcoming report on the UK-Norway Initiative will show, the wealth of knowledge already produced by generations past puts us well along on our journey. We believe based on the many studies of the past, that there is nothing to suggest that the verification of warhead dismantlement is not technically feasible. There is also nothing to suggest that dismantlement verification cannot be kept within acceptable levels of tolerance: both in terms of intrusiveness and in terms of reliability. And this is more than a start.

It is true that much work remains to be done, but the art of verifying nuclear warhead dismantlement has progressed far beyond the starting line. Let’s advance it further.

Thank you for your attention.