# VERIFICATION RESEARCH, TRAINING AND INFORMATION CENTRE

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#### LEVERAGING OUTSIDE EXPERTS

IPNDV, Oslo, Norway, November 2015 Andreas Persbo, Executive Director

## Slide 1 ('Multilateral verification of nuclear disarmament')

Thank for that kind introduction, Kelsey. It is good to be back in Norway again, and it is fantastic to see so many good friends and familiar faces at this meeting. I have devoted a decade of my life to verification, and it is, of course, good to see that I am not the only one interested in the topic.

# Slide 2 ('VERTIC and disarmament verification')

Before I begin, I would like to say a few words about the organisation I run. Most of you would be familiar with VERTIC. We were founded in 1986, mostly to support the development of a nuclear test ban. In the early 1990s, we made headlines through our novel use of seismic data for monitoring purposes. We got into this habit of announcing tests on CNN before governments even had time to react. Back then, VERTIC could go from detection to classification, and then to announcement in less than four hours. Today, we do not need to; the CTBTO is doing it for us, and in less time too. It is indeed possible to achieve change in less than two decades.

Our files on disarmament go back almost 20 years. However, most of you will know us from our early involvement in the UK-Norway Initiative, which we left in mid-2010. You will meet my colleague David Keir, who was involved on the player side, at tomorrow's demonstrations at Kjeller. He will be able to answer any questions about the initiative, and our involvement in that.

#### Slide 3 ('Other VERTIC activities')

VERTIC is a hybrid organisation: part think tank, part implementer. This slide shows some of our other activities. Let me touch on a few things: our bespoke safeguards database—the first of its kind—was presented in Japan last week. We developed this database with the help of the Carnegie Corporation of New York. In the future, this database, which will soon go into beta testing, may be extended into nuclear safety and security as well.

Some of our products have been circulated as official documents of the UN Security Council. In the words of former 1540 expert Dana Perkins, VERTIC is the "most prolific and efficient legislative assistance provider in the world" in areas relating to resolution 1540. Warming words indeed. They are just words, however, what matters to us are the many treaty ratifications we've helped secure, and the many laws we have assisted in drafting. To date, we have assisted more than 50 states on all continents.

#### Slide 4 ('Increasing trend towards multilateral R&D)

A feeling of gloom appears to prevail in the arms control and disarmament community today. Some have been getting their hopes up that states would come together in the coming few years and ban nuclear



weapons. While hopes like this come and go like the tide, there has been a swell of preparatory activities in the last 15 years. This trend is strong and shows no sign of abating.

The trend for multilateralism too is stronger than ever before. More and more governments are coming to the realisation that they too can contribute to preparatory activities, and some may even feel that it is their obligation to do so. The research itself, both that produced by governmental initiatives centred around Norway, the UK and the US, is exciting. There are plenty of other governmental and intergovernmental initiatives too, such as the IPNDV meeting today.

A multilateral approach is nothing new. It is important, I think, to note that the first major studies on disarmament verification—and the Cloud Gap study comes to mind—also explored the possibility of non-cleared, non-nuclear weapon state, inspectors taking part in the venture. Back then, as today, there were few principal technical obstacles to involvement.

## Slide 5 ('The MVD project')

Four years ago, we came up with a new idea based on an old concept. We wanted to bring together a group of non-nuclear weapon state researchers to explore disarmament verification through a specific lens, multilateralism. We also wanted to get a firmer understanding on what level of support disarmament verification research and development would have in a multilateral organisation, such as the International Atomic Energy Agency.

The project has assumed a broad perspective on nuclear disarmament. It looks into all aspects of the disarmament challenge, ranging from the withdrawal and dismantlement of nuclear explosive devices to material disposition. It also looks at the application of safeguards in formerly armed states.

The objectives have been twofold: first, we wanted to bring in an emerging set of stakeholders into thinking about disarmament verification. Second, we wanted to focus their effort on the identification of tools, organisational structures and procedures that would enable a multilateral body to carry out verification effectively and credibly.

We structured the effort around a series of closed meetings, which we called 'conclaves' to emphasise their private nature. We also had research groups that met when necessary.

Eventually, the group grew to 53 participants, of which about half have committed to all meetings.

## Slide 6 ('The MVD project, continued')

The first phase of this work, which I will talk about in more detail in the following slides, focussed on consolidating the group and organise the research.

We used the conclaves to guide on-going research at VERTIC. This was necessary, as the participants had day-jobs, and so could not invest a large amount of their time into this work. Without a core group of supporting staff—in this case VERTIC—it would not have been possible to make material progress on the products.

Most of this preparatory work is now completed, on schedule. We have proposed to proceed to the next phase, which will operationalise some aspects of our work.



The project is planned to run until 2021 when it publishes its final datasets. This date is not arbitrary. It coincides with the long-term strategic plan of some multilateral organisations, and so intends to inform plans already laid.

## Slide 7 ('Facilitating capacity building and generating debate')

One element of our work was to start a dialogue with the verification community in Vienna. We, therefore, contracted the Vienna Centre for Disarmament and Non-proliferation to hold a series of meetings on nuclear arms control. This series proved to be very popular. All of these events informed our work in the conclaves.

In the meanwhile, we held a series of very well attended verification conferences at Wilton Park. These discussed top-level topics, such as general principles and methodologies. The outcomes, again, informed our work in the conclaves.

In the proposed next phase, we intend to centralise our effort to Vienna, as this city has the highest known concentration of experts on nuclear issues, and nuclear verification.

# Slide 8 ('Investigating support for multilateralism')

An important part of the research was to conduct the first ever survey of IAEA member state support for nuclear disarmament verification research and development. We surveyed the IAEA for several reasons. First, because all nuclear-armed states except one is represented at this venue. Second, because it holds much of the world's expertise on nuclear verification. Third, the work of our project could directly inform the organisation's verification planning for one country of concern.

The publication contains interesting information on where the membership would want groups such as the IPNDV to put their focus. The data should be read with care, obviously, given the small size of the surveyed population. The report is available on the NTI's site, and our own.

As this slide makes clear, there appears to be great appetite for long-term planning for nuclear disarmament verification. Many states also appear willing to contribute with expertise to ventures such as the IPNDV, the UK-Norway Initiative, or indeed VERTIC's own work.

#### Slide 9 ('Developing an equipment development and procurement strategy'

We did some thinking on equipment requirements throughout the first phase of our project. We have drawn up a set of internal working papers on this. They mostly build on already conducted work by US laboratories.

In the coming phase, aim to start work on a draft equipment development and procurement strategy. This strategy will be informed by three iterations of a technology review, which in turn is informed by the outcome of a planned series of simulations.

# Slide 10 ('Verification solutions')

Early on in the process, participants remarked that the problem with conducting research on the multilateral verification of disarmament was that every word of the term needed definition.



As you heard in the first session, it is a very large topic to study, and you can devote considerable time and attention at minute details.

We came up with the concept of simulations to set the required boundary conditions for the work. The simulation consists of a surrogate nuclear weapon state, which provides an object of study. It also consists of a scenario, which sets the frame, if you will; it sets the parameters of the study itself.

We are today releasing a major report on the topic of simulations. It is available for download on our website. It also summarises much, but by no means all, of the research done over the last three years. We will send the report to the NTI too, and hope that it will be hosted in their repository.

#### Slide 11 ('Verification solutions: model')

The model lies at the heart of the simulation. It establishes a fictitious nuclear weapon state and traces the development of its nuclear fuel cycle—both civilian and military—across its entire history.

As you may understand, creating a model takes much time and effort. It requires modelling every production facility and their material inventories and any given point in time. It requires thinking about how material flows between sites, and how metal is channelled into the nuclear explosive devices themselves. Moreover, each building on a site needs to be mapped out, in as much detail as is required to create a believable simulation environment.

Producing nuclear explosive devices require more than just material, there is also an entire explosives-related infrastructure that needs modelling: both on the development side and on the deployment side.

We have worked on two models, which we internally call Model K and Model Q.

The first model is a small-scale weapon state with few production facilities and few explosive devices. This model, based on a real country, is about three months away from completion, and we intend to use it in our proposed first simulation next year. We have come to realise that it may have value not only as a development tool for disarmament verification but potentially also for as a training tool for real world tasks ahead.

The second state is a mid-range state, with a fuller history, a range of production facilities, and a couple of hundred explosive devices. This model has been much more complex to put together, and still require some work before it is ready to be deployed.

We intend to use these models as sandpits: the basis for a range of simulations, ranging from negotiation exercises to implementation trials.

We used a range of software solutions to build a model of the required complexity. I refer you to chapter 6 of the research compendium we released today if you are interested in learning more about this.

Through a sub-contractor, we also developed a pre-alpha version (that is computer code that yet has to undergo software testing), which visualises a dismantlement facility for nuclear explosive devices. We have demoed it with Oculus Rift, a virtual reality headset that enables three-dimensional stereoscopic views.



#### Slide 12 ('Verification solutions: scenario')

Disarmament scenarios portray a specific, discrete instance of disarmament, which can be based on existing or hypothetical countries and agreements. These scenarios provide the political and legal context for the disarmament activities. They include both a comprehensive overview of the country's history, international relations, and approach to nuclear weapons and technology, as well as highly detailed information of the commitments and requirements for disarmament and verification.

The scenario is critically important for the simulation. A study conducted under this methodology will yield results that are only as good as the premises and assumptions they are built on. The three main requirements are detail and comprehensiveness, logical consistency, and realism.

The detail is necessary to consider the practical aspects of the problem at hand. This is especially true for research that looks at disarmament verification on a wide scale, covering many weapons of different types and many facilities at all stages of the nuclear fuel cycle. Moreover, having clear definitions of what items are accounted for under a treaty, and in what ways, is crucial for verification purposes.

It is crucial that scenarios be internally consistent. A scenario that contradicts itself may be useless for the purpose of researching verification solutions, or even worse, it may produce results that are not applicable to real life.

As a final requirement, scenarios need to be credible and realistic for the results to be relevant and applicable to possible real-life cases in the future. Verification solutions based on a scenario that would likely never take place in real life would add little value to the debate on nuclear disarmament verification.

#### Slide 13 ('Verification solutions: simulation')

When you run a scenario against a model, you get a simulation (or an exercise, if you prefer to call it that). Participants in the simulation will add the required detail, and produce the desired outputs.

What are these outputs? At the moment, we are proposing to start with a relatively easy exercise on the K-model; the small-sized state. What we want to get out of it is general verification practices contained in a verification agreement. The participants will not go into this simulation empty-handed, of course. We have already produced a draft text that we think will tease out most pertinent lessons in this first phase.

As we progress, we intend to increase the level of ambition and move towards detailed verification practices applied to the K-model.

We will aspire to set in place a framework for facility and activity specific procedures. However, this involves creating a vast amount of highly detailed data on sometimes very sensitive processes. We will, therefore, develop these aspects of the simulation framework in close collaboration with our project partners. Given the size of the task, we may not be able to fully construct this framework over the coming years, but we're confident it will be close to completion.

Slide 14 ('Verification solutions: example output')



This slide lists example outputs in a bit more detail. We are certainly hoping to develop and publish an outline verification agreement before the end of 2018. We are also aiming to produce more detailed versions, based on the outcome of the three proposed simulations.

As I indicated earlier, we would want to at least explore the application of selected monitoring equipment in each simulation. We will do this by deploying some experts to the simulation whose job it will be to think only of what equipment may be deployable and, if they find no suitable piece of kit, what equipment would need to be developed.

We will start by looking at already certified safeguards equipment, to get a feel for which already fielded gear can be given broader application.

Finally, and this is probably the most important part of the simulation framework. It will give participants the opportunity to deploy their knowledge—perhaps acquired through experience in a neighbouring field, such as safeguards—into a structured analytical framework. This will obviously lead to an increased knowledge base amongst other participants, and so fulfil a clear capacity building and training need.

# Slide 15 ('Further reading on disarmament verification')

This final slide lists a few publications that we think may inform the work of the IPNDV. We hope that most of these will be available on the NTI website too, for your later review.

I thank you for your attention, and again thank the organisers for inviting me to this very important meeting. I hope my presentation has been of use for your coming deliberations.

