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Verification and Monitoring of International Arms Control Agreements in the 21st Century

Research Group on Monitoring & Verification

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Abstract

Major changes and new challenges to the monitoring and verification of international arms control agreements mean that the range of actors who can play active roles in monitoring arms control agreements is broadening. Relevant players now include not only states but also non-governmental actors and international organisations. New technologies and procedures are available or are being developed that do not depend on the involvement of state parties. This allows NGOs to play an enhanced role in technical surveillance and transparency building – a trend that has also been observed in a variety of other fields. This paper describes and analyses the new opportunities for NGOs and considers their utilisation on the basis of four case studies.

1 Introduction

Today, the monitoring and verification (M&V) of arms control agreements is being carried out under rather different circumstances than was the case twenty years ago.[i] Although the activities of state parties and reliable evidence of their adherence to agreements remain key for the implementation of treaties, the potential of non-state actors to obstruct arms control objectives has grown. Similarly, the mechanisms and organisation of monitoring and verification are no longer the exclusive domain of nation states. International organisations (IOs) and (international) non-governmental organisations (NGOs) are increasingly involved in at least some areas of surveillance to determine whether the norms enshrined in arms control agreements are respected. Furthermore, they have an emerging potential for monitoring that is relevant for verification processes in several other areas, such as climate change and environmental protection.

This article aims to provide a framework to compare and assess major changes in the circumstances under which monitoring and verification take place. The framework is applied to four brief case studies (nuclear, biological, chemical and humanitarian arms control). The cases demonstrate the potential for non-state actors to monitor norm adherence, but also that the degree to which such activity occurs varies widely. The same is true of the degree of relevance such monitoring has for state-party views of treaty adherence.

It is our contention that the most important factors driving the recent qualitative changes in the framework in which the adherence to arms control treaties occurs are: the current crisis in arms control, contemporary challenges for arms control caused by changes in security perceptions, and the growing number of non-state actors in the field together with improvements in their ability to use modern technology. Furthermore, we put forward the hypothesis that there is substantial potential for expanding the role of non-state actors in monitoring and verification.

At this point our usage of the terms monitoring and verification should be clarified: There are no agreed definitions – neither in the academic literature nor in the policy world. Historically, monitoring has sometimes been regarded as a subset of verification and sometimes as a synonym for it. This indicates a confusion between formal and informal procedures used to investigate compliance with international agreements. We propose to use monitoring as the broader category, with verification limited to data analysis and interpretation regarding compliance by state parties within procedures agreed in treaties. In more detail:

> *Monitoring* refers to the collection and interpretation of data, both within and outside the legal frameworks of an agreement. Monitoring may not only include different kinds of actors – states as well as NGOs – but also a wide range of observation procedures used to generate data beyond the scope of formally agreed compliance provisions. Monitoring might even be done in areas where no basic norm or formal monitoring or verification framework is yet in place. Monitoring outside formally agreed provisions may lead to conclusions on compliance, but these do not have any legal status.
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> *Verification* covers only legally defined procedures to judge treaty compliance of parties by parties. This can include provisions for following allegations of non-compliance. Although state parties have delegated monitoring to other stakeholders, such as international organisations or sometimes non-state actors, verification remains their prerogative as state parties.

2 Context Changes for Arms Control Monitoring

We see four trends as particularly important in explaining the growing role of non-state actors in arms control and justifying our hypothesis that substantial potential exists for expanding that role.

2.1. The Crisis of Arms Control

Although *verification* of arms control obligations is not a recent phenomenon, it attained particular importance during the Cold War. A good number of agreements, especially in the area of nuclear materials and weapons, were linked to elaborate agreed verification procedures (in addition to national means of monitoring compliance). Verification systems were considered to be the best, if not perfect, means to confirm or to challenge compliance.[ii] Moreover, verification was seen as a valuable tool that contributed to trust and confidence-building between state parties.[iii] Despite the emphasis on verification as an indispensable element of arms control, a good number of treaties were concluded during the Cold War without verification procedures. Examples include the Biological and Toxin Weapons Convention (BWC) and the Outer Space Treaty. These treaties were either seen as not verifiable in principle, or simply no longer important enough to make verification worthwhile.

The short surge in arms control at the end of the Cold War was accompanied by the growth of verification systems beyond the field of nuclear materials and weapons, as exemplified by the Conventional Forces in Europe (CFE) Treaty and the Chemical Weapons Convention (CWC). In the early 1990s, there was considerable hope that verifiable multilateral treaties could be developed.[iv] The heyday of arms control and verification was followed by the great crisis of the late 1990s and the following decade. The low priority placed on arms control by the Bush administration also extended to verification. Cases in point included the Comprehensive Test Ban Treaty (CTBT), ABM and START II as well as the unverified Treaty on Strategic Offensive Reductions (SORT) and the failure of the BWC verification protocol. Despite some shortcomings regarding the implementation of the inspection mechanism, only the CWC seems to be more or less untouched by the backward steps taken in multilateralism in traditional fields of arms control – nuclear, biological, chemical and heavy conventional weapons.

As a result, the toolbox of formal verification provisions has been unchanged in all areas of arms control for years. This is remarkable in view of the context changes described here, which call for appropriate adjustments. Yet for almost ten years, no multilateral agreements have been concluded in traditional areas of arms control, and the Bush administration put the clocks back to verification by national means whenever possible. However, that does not mean that states have been inactive in all fields relevant to compliance with international norms.

At the same time, non-state organisations have taken on more active roles in many fields (as have, to a limited extent, international organisations), including both fields regulated by agreements such as the NPT and those without such regulations, such as space security. NGOs cannot replace state parties in verification. But by providing more and better information on adherence to existing, or desirable norms, they put pressure on state parties to review data and make policy adjustments. The field of biological weapons, where NGOs such as the Sunshine Project unearthed detailed information on programmes, is a case in point.[v]

Furthermore, at least some states have deliberately fostered monitoring by non-state actors, for instance by funding NGOs and IOs. In the field of humanitarian arms control, which is surveyed below, NGOs were tasked with performing activities that amounted to a kind of quasi-verification. Since the end of the Cold War, state parties have increasingly accepted that formal verification mechanisms can be supplemented by non-official monitoring. Moreover, independent monitoring has a value of its own beyond providing state parties with information. It increases the possibilities for open and transparent discussions about verification issues among the general public and in the media. It also increases the trust among states that violations of treaty obligations will be revealed.

In summary, it seems likely that the role of non-state actors will increase, particularly since the current US administration appears willing to reverse the arms control policy of the Bush years. The sceptical stance of the Bush administration towards arms control has fostered the growth of NGO activity in this area, but the more positive position taken by the Obama administration is likely to provide further stimuli to monitoring by NGOs and IOs in order to supplement governmental data gathering and verification.

2.2 New Challenges

The scepticism of the Bush administration and others towards arms control had several causes, one of which was the belief that the importance of monitoring and verification within arms control treaties was decreasing. This in turn was predominantly seen as the result of a changing threat environment marked by the growing importance of non-state actors, particularly terrorists.[vi]

Beyond the views of the Bush administration, there is general agreement that verification limited to state parties may increasingly miss important aspects of arms control. A range of state ("rogue states") and non-state actors, for instance, is now able to take part in legal or illegal proliferation of relevant technologies. Such proliferation is made easier by the acceleration of globalisation. More generally, economic globalisation is a key driver of the spread of knowledge and technology with a potential for misuse. Global trade flows have exploded since 1990, as have the number of nodes in the system – both of origin and destination. Moreover, the scope of many technologies has grown. The separation between civilian and military technologies has become less pronounced. This in turn lowers barriers to the proliferation of technologies relevant under existing or potential arms control norms. In practical terms, growing trade and expanding dual-use potential increase the burden on export control systems. Furthermore, trade of dual-use goods is harder to control because existing export control regimes have not been adapted fast enough to globalised markets.[vii]

The growing complexity of trade patterns as well as the increasing difficulty in separating technology relevant for arms control from other technology also provides openings for non-governmental actors in monitoring and providing input for verification. Economic actors such as producers and traders have access to relevant information. People working in production facilities have inside information. Furthermore, it may be easier for NGOs to collect information on non-state actors using controlled technology, such as anti-personnel mines, than for states. In summary, the changing security environment also seems to open new opportunities for non-state actors.

2.3 The Role of IOs and NGOs in Monitoring

A further factor that has favoured the growth in importance of non-state actors in arms control monitoring has been the increase in the scope and political importance of civil society functions more generally. This still includes, but goes far beyond the classical concepts of societal verification and whistle-blowing.[viii] In international policy fields such as trade, human rights and the environment, the participation of NGOs and IOs in policy making and treaty monitoring has been institutionalised for some time.[ix] The list of NGOs that are active in human rights, development and environmental monitoring is enormous. Some examples follow: The International Union for Conservation of Nature (IUCN) is entrusted with monitoring the international convention on wetlands; Greenpeace is not only active in monitoring compliance with the International Convention for the Regulation of Whaling, but also attempts to enforce the treaty provisions; and the Environmental Investigation Agency (EIA) is contributing to the monitoring of both the Convention on International Trade in Endangered Species and the Montreal Protocol on Substances that Deplete the Ozone Layer. EIA is associated with UNEP, which is the IO assigned with monitoring the latter. Both NGOs and IOs sometimes have recourse to unofficial data for monitoring, a practice which is not limited to environmental issues, as will be shown in the case studies.

Some NGOs and IOs focus their work on monitoring obligations, but most are more interested in broader information gathering. Their objectives are transparency and awareness raising in the fields of their concern rather than building trust between state parties.[x] The motives of non-state actors are, in fact, quite multifaceted: They may try to fill the gap where legal verification mechanisms are lacking or to “verify the verifier”. Another motive may be found in the widespread assumption that official mechanisms are failing to ensure credible and transparent monitoring. This is, for example, one of the lessons learned from the issues of the “evidence” produced in the run up to the 2003 invasion of Iraq.

The trend towards an enhanced role for NGOs in monitoring arms control agreements has been reflected in a number of studies on M&V regimes. All VERTIC Verification Yearbooks since 2000 contain articles that at least mention the role of civil society actors in monitoring international agreements. The publications of the Canadian Centre for Treaty Compliance, founded in 2005, highlight civil society

engagement in monitoring international arms control norms.[xi] A report by former UNIDIR director Patricia Lewis alluded to the significant role that NGOs play in monitoring.[xii] In a general overview of the state of monitoring and verification, Meier (2008) also reflected on the increasing role of non-state actors.

Under certain circumstances, IOs are also able to foster activities beyond the formally defined scope of agreements. In settings that Haas has called *bureaucratic alliances,* international organisations such as the Preparatory Commission (PrepCom) for the Comprehensive Nuclear-Test-Ban Treaty Organisation (CTBTO) have cooperated with civil society actors such as academics or have contracted civil society organisations to benefit from their expertise.[xiii] In the field of monitoring, multilateral organisations have cooperated with NGOs by setting up more or less formal agreements to advance the implementation of shared norms. This has usually encompassed a broad range of activities, including the development and use of technologies within and beyond the defined scope of relevant agreements.[xiv]

IOs are employed in monitoring because they are better suited to provide independent information for monitoring purposes than are states.[xv] Mandating or establishing IOs to perform monitoring, however, is rare. Currently the OPCW, created especially to monitor the CWC, and the International Atomic Energy Agency (IAEA), mandated to monitor the Nonproliferation Treaty (NPT), are the only IOs involved in the monitoring of arms control agreements. IOs, however, are generally not regarded as autonomous monitoring actors. Rather, they are considered to be dependent creatures of the state parties.[xvi] In this view, they are seen as the technical support staff tasked with performing monitoring duties, but they are not allowed to provide their own interpretations of information or go beyond their mandates in any other regard. Most IOs, with the exception of the IAEA, are mandated to use only information produced and submitted by those under observation: the state parties themselves.

While the role of NGOs and IOs in arms control verification has clearly grown, it has done so less than in other policy fields, such as climate change and environmental protection. One possible reason for this may be the relative difficulty of obtaining information in many areas of arms control – partly for technical reasons but also because of the secrecy applied by many actors, due to the sensitive nature of information linked to national security.

2.4 New Technologies and Procedures

On occasion, especially when performed by non-state actors, monitoring can be a matter of applying relatively simple methods, such as exploiting freedom of information provisions in national legislation, eye-witnessing or photography. In humanitarian arms control monitoring, interviews by civil society actors currently play a central role.[xvii]

However, in the majority of cases, relevant data cannot be collected by simply using the naked eye. Often only the application of sensor technology and the use of data mining from larger collections allow the monitoring of treaty provisions. Non-state monitoring has already benefited from technological innovations. Not all technologies, techniques or methods used for monitoring are entirely new, but some are now being used in innovative ways or in new or changed contexts. Furthermore, rapid technological progress has the potential to widen the scope of action for non-state actors in monitoring even further. For instance, rapid increases in the resolution of satellite-based optical sensors (cameras) make monitoring and verification easier.[xviii] Camera resolution in satellite reconnaissance has increased from 100 m to about 10 cm since the 1960s. Improvements in radar technologies, seismic sensors, and technologies for on-site and air sampling of various substances are further examples of the substantial progress that has been made in recent decades.[xix] Another case in point are the greatly enhanced capabilities now available for the evaluation and exchange of large amounts of data. The innovation with the deepest impact on all fields is the internet. It allows wider access to and dissemination and exchange of data. Although most of these developments have not been promoted specifically for this purpose, what they all have in common is that they can be used for monitoring activities by different kinds of actors.

3 Case Studies

In the following, current patterns of monitoring in four different areas of arms control are described. A special focus is placed on technologies that have only recently been leveraged for monitoring purposes and on overall changes in the monitoring framework and the potentials they hold for new actors. The case studies will outline the changes that have taken place with regard to threat perceptions, actors and technologies and will describe monitoring procedures that have been set up either in

support of or supplementary to official monitoring and verification regimes. The case studies address in detail whether and how civil society actors and international organisations are using and developing new procedural methods and technologies for monitoring purposes. They briefly discuss what non-state actors are already doing – or not doing – in terms of monitoring, but also, where relevant, what they could do if they used existing or emerging technology. The cases are structured in terms of four questions:

- whether there has been an overall decline in the importance of verification,
- whether the challenges for verification have opened new space for activities by non-state actors,
- whether there has been a marked growth in the number, scope and variety of NGOs active in relevant areas,
- whether non-state actors are aware of the potential of new technologies and procedures and whether they are in fact using them (e.g. in gathering data or awareness raising).

3.1 Nuclear Arms Control

3.1.1 Context Changes

The Crisis of Arms Control

Following the failure of the International Atomic Energy Agency (IAEA) to detect the unreported nuclear programmes being run by Iraq, Libya, and Iran, as well as Syria's alleged programme, trust in NPT verification eroded and national intelligence services attained a critical influence on international security politics, although they often turned out to be incorrect or even fraudulent. At the same time, however, it should be recalled that the IAEA is not permitted to make use of national intelligence information. Furthermore, the individual states play almost no role in nuclear safeguards – neither in the collection of data nor in its analysis and interpretation for treaty compliance. All information is kept strictly confidential within the team of inspectors who are responsible for the inspected country. As a result, neither national nor IAEA verification is sufficient, yet they have not been integrated to produce as true a picture as possible.

In addition to the verification issues, the crisis of the NPT is driven by an increasing pattern of discrimination against non-nuclear-weapons states, while the nuclear-weapons states are perceived as severely neglecting their commitments. Their modernisation programmes and the use of laboratory experiments to replace underground testing indicate a lack of good faith in the area of nuclear disarmament negotiations.

New Challenges

The 9/11 terrorist attacks directed attention to the possibility of terrorists constructing an improvised nuclear explosive or a radiological dispersion device. The A.Q. Khan network was able to provide nuclear technology to Iran, Libya and North Korea at least. Verification that is limited to nationally reported activities is not a viable approach against either of these two threats that arise from non-state actors.

More generally, nuclear dual-use technologies continue to be of high concern with regard to both nuclear safeguards and in addressing the new threat developments described above. Commercial nuclear activities drive the establishment of yet greater discrimination in the non-proliferation regime, with the nuclear deal between the USA and India being a prime example.

The Role of NGOs in Monitoring

Civil society has been deeply involved in revealing information about nuclear weapons activities. A highlight of societal verification is the testimony on Israel's nuclear weapons material production at Dimona given by the former technician Mordechai Vanunu and published with a selection of his photos by the Sunday Times in 1986. Another example is the public exposure of Iran's clandestine uranium enrichment activities by members of the National Council of Resistance of Iran (NCRI) opposition group. In August 2002, they held a press conference in Washington to report for the first time publicly on the construction of the heavy water plant at Arak and an underground facility at Natanz. The IAEA had apparently been unaware of these facilities and subsequently initiated regular inspections.

In recent years, reports prepared by the IAEA for distribution only to member states have often been handed without permission to non-state actors, who immediately post them on the internet.

New Technologies and Procedures

Technology plays a crucial role in nuclear safeguards, and new or improved sensors offer new opportunities for nuclear verification and monitoring by civil society. These address the two main stages of nuclear proliferation: nuclear material production and nuclear testing.

- Satellite data and environmental sampling can be used to detect facilities for the production of nuclear weapons-usable materials;
- Seismic and radioactivity measurements, together with satellite data, can support the detection and location of nuclear tests and their preparations.

In the following, examples of both these stages are described. The response to the failure to detect Iraq's unreported nuclear activities was to negotiate the Additional Protocol of 1997. Ten years later, its implementation also appeared insufficient and the Novel Technologies Program was initiated by the IAEA with the goal of enhancing the technical capabilities of the inspectorate.[xx] New and novel technologies are under investigation for stand-off and remote detection of unreported nuclear weapons material activities.

Eye-witnessing is best supported with photos or videos. But satellite data makes it possible to inspect any place in the world from the sky without travelling.[xxi] The commercial availability of high resolution images has a deterrent effect on those countries that fear being detected. Several NGOs frequently post their analysis of satellite images online. Just a month after the NCRI had announced their suspicions about the underground construction at Natanz, David Albright of the Institute for Science and International Security (ISIS) published an annotated satellite image of the Natanz site and sent a copy to CNN. However, by that time the IAEA had already conducted its own satellite image analysis and Iran had invited Mohammad Elbaradei to visit the site in December 2002. The resulting media outcry most likely caused a delay of the first IAEA inspection, which eventually took place in February 2003.

In the following years, developments at Natanz and the situation at several other sites with unreported activities were analysed by ISIS and other NGOs. Similar satellite image analyses followed for installations in North Korea, Pakistan and Syria. Though the extent to which these findings support or may even alert the IAEA is unclear, the definite achievement of civil society is to provide the public and those

states that do not have own access to satellite data analysis with some transparency into sensitive nuclear programmes.

Plutonium production can be detected at great distances. Assessment of large quantities is possible on a global scale. In 1985, a group of US physicists followed the example set by Operation Bluenose.[xxii] The detection of small production capacities can be carried out at distances of up to a few hundred kilometres. Inspired by the promising case study of atmospheric observations of krypton-85 at various distances from the pilot reprocessing facility in Karlsruhe, the independent Group of Scientific Experts (iGSE) was formed to assist the IAEA Novel Technologies Programme in identifying novel methodologies and technologies to detect unreported production of fissile materials.[xxiii] The detection of nuclear weapons material requires close proximity but can be achieved even if no direct access is possible. In 1989, a remarkable experiment was conducted by NGOs from the Soviet Union and the USA in the Black Sea to demonstrate that a nuclear weapon can be detected with radiation sensors from a distance.[xxiv]

Remote detection has been most efficient with regard to nuclear testing. Since the 1960s, many radiation laboratories in the world have analysed atmospheric samples in combination with atmospheric transport simulations to retrieve information about nuclear tests. In 1976, the Group of Scientific Experts (GSE) was established at the Conference on Disarmament (CD) in Geneva in order to develop and demonstrate seismic verification. During the two decades of their work, the GSE and the radiation laboratories paved the way for the CTBT negotiations by demonstrating a crucial element of the verification with three successive Technical Tests (GSETT). The International Data Centre of the CTBTO Preparatory Commission provides data gathered by the International Monitoring System (IMS) and presents its analysis only to the member states, but not to the public. However, using publicly available seismic data, e.g. from the United States Geological Survey (USGS), one academic analyst was able to file an online report on the location and estimated nuclear yield of the North Korean nuclear explosion in May 2009 on the very day it happened.[xxv]

3.1.2 Conclusion

New technological developments represent opportunities to increase the prospects of successful verification and monitoring with regard to the described threats. New and

innovative technologies are under investigation for stand-off and remote detection of unreported nuclear weapons material activities.

3.2 Biological Arms Control

3.2.1 Context Changes

The Crisis of Arms Control

It was not until the third Review Conference, held after the breakup of the Soviet Union in 1991, that state parties decided to establish a working group to work towards the creation of a verification protocol (VEREX and later Ad Hoc Group). These endeavours failed in 2001 because of the last minute withdrawal of the USA from the process. The first Confidence Building Measures (CBMs) had already been established at the second Review Conference in 1986, and they were improved in 1991. The CBMs are the closest thing to a monitoring and verification system in the BTWC framework. They are designed to be similar to a declarations system, but were never used as or even considered to be a verification tool. However, today they are the only information-exchange mechanism in the field and can be defined as a de facto (state-centric) monitoring instrument, although participation and data quality is rather low and another update is overdue.[xxvi] Such an overhaul is currently being discussed and could strengthen the resemblance to a verification system. A critical role in this might be played by the Implementation Support Unit (ISU), which was established in 2007 and today also undertakes basic analysis of technical developments in addition to its original mandate of merely administering the CBM system. Although the word “verification” is avoided by most diplomats, compliance is an important element in many discussions. At the meeting of state parties in 2009, however, a statement by the USA made it clear that there would be no verification mechanism in the future either. Like many other arms control treaties, the BTWC also includes provisions that compete with each other. Prohibitions (here: of an entire class of weapons) clash with requirements for international technology transfer. In the area of biological weapons, where the dual-use problem is and always was “total”, complying with these two competing requirements will continue to be a special challenge.[xxvii]

New Challenges

In the period since the end of the Cold War, no states and few experts consider state BW programmes to constitute the greatest threat in the BW field. In the 1990s, asymmetric warfare scenarios, which saw BW as "the nuclear bomb of the developing countries" dominated global security discourse. But while such scenarios are still debated, most discussion nowadays focuses on threats that are expected to stem from terrorist organisations.[xxviii] But despite the seriousness of the threat scenario, there have been relatively few cases of bio-terrorism to date, and there is no indication that international terrorist groups had developed any capacity in biological weapons up to 2009.[xxix]

At this point of time, it is unlikely that BW will be developed as a weapon of *mass destruction* in either state or non-state context, but it remains essential for the preventive function of the BW ban to keep an eye on the activities of all kinds of actors. The possible threat posed by large and well equipped state-based BW programmes, in particular, is unlikely to re-enter the political agenda in the BTWC context in the near future. Greater attention should also be paid to uncontrolled proliferation, classified state-based research on so called "non-lethal" BW, and advanced biotechnology.

Biotechnology was never a technology that allowed for an easy distinction between civilian and military use. Hence, much of the equipment and knowledge needed for a BW programme has always been available – spread among laboratories and scientists worldwide. The decisive factor is the intention behind the use of equipment and techniques. This has to be subject to preventive monitoring.[xxx] In recent decades, in particular, not only has a broader understanding of microbiological mechanisms developed, but the relevant laboratory equipment has become easier to use, cheaper and more widespread. New sub-disciplines as synthetic biology and biopharming with their own potential for misuse have emerged; we have a much better understanding of the immune system and deeper insights into neurobiology. Developments in biotechnology and the growth of global markets are deeply interrelated. In this regard, economic globalisation is a key force behind the spread of knowledge and technology with potential for misuse. There is no doubt that, in the future, ambitious BW programmes, whoever is running them, will be able to make

use of a broader range of automated, smaller, and cheaper technology operated by qualified scientists in a wider range of locations worldwide than ever before.

A further challenge is represented by several long-running defence research projects. Various publications point to the fact that these projects might have the potential to cause the very threats they are supposed to protect against.[xxxi] However, growing, weaponising, and distributing the agent effectively still requires both the expertise and the requisite equipment. It may be necessary not only to develop more exact detection devices, but also to rethink general strategies of monitoring in the field. The strategies that are implemented must allow the drawing of unambiguous conclusions regarding the intentions of those who use biotechnology.

The Role of NGOs in Monitoring

Historically, BTWC member states have been the sole actors in the execution of international biological arms control. The only exceptions to that rule were the United Nations Special Commission (UNSCOM) and its successor organisation, the United Nations Monitoring Verification and Inspection Commission (UNMOVIC), which were employed to monitor Iraq's disarmament from 1991 until 2007 and which developed and operated a number of monitoring technologies.[xxxii] The failure of the verification protocol in 2001 and the fact that bioterrorism and biosecurity became hot topics increased NGO interest in monitoring. The globalisation of civil society allows the (gradual and not always straightforward) development of international civilian monitoring capabilities. A broad spectrum of NGOs – more from the academic than the activist side of that sector – entered the field and tried to compensate for absent state activities. Nevertheless, most are active in policy advice, while only few seek a role in the monitoring itself. In 2003 some NGOs created the network organisation *BioWeapons Prevention Project (BWPP)*, which was intended by some members to become the equivalent of the International Campaign to Ban Landmines (ICBL).[xxxiii] However, in biological arms control a number of complexities, including differences in how participating organisations saw themselves and their role, impeded similar success. Although some monitoring technologies are available, the kinds of off-site monitoring seen in other areas are unlikely to become viable. Moreover, the widespread civilian use of many relevant technologies complicates things. Apart from the problems of NGOs in determining the way they can participate in monitoring, NGOs struggle with the acquisition of funds, since neither states nor foundations

consider biological arms control to be a hot topic any longer. Hence, the number of NGOs active in BW monitoring is shrinking again after the rise that began in 2001. However, assuming that states do not establish a verification system, if biological arms control has a future then it will have to be non-governmental (either inside or outside a coordinating network).

Individual whistle-blowers played a central role in uncovering several BW programmes, including Russia's, but this can hardly be institutionalised. In addition, the future role of profit-oriented non-state actors remains unclear. In the recent past, biotechnology corporations and lobbies that had previously been seen as standing in the way of better monitoring have started on occasion to come up with their own initiatives for voluntary commitments.[xxxiv] Nevertheless, the current status and effects of such commitments are questionable.

New Technologies and Procedures

If the technology and the knowledge needed for the abuse of biotechnology are available to a broad range of actors, this is just as true of the technology that can be used for monitoring. The concept of monitoring technology for this area was first proposed by SIPRI (1972), which specified possible detection approaches at the same time as the BTWC was signed. Many of these approaches are now widespread, but the analysis of life-science capabilities is still the principle requirement for compliance assessment of the BTWC.[xxxv] Hence, in 2009 more than ever, the continued absence of a verification system for the BTWC can no longer legitimately be attributed to a lack of effective BW verification technologies (Woodward, 2008).

Since the dual-use problem is more virulent in biotechnology than in other fields, monitoring the BW ban requires capturing a particularly broad overview of the field in order to draw conclusions on the intentions of technology users. In this respect, monitoring should include approaches such as the evaluation of "soft-data". Such data can be generated by non-technological means, such as surveying the purposes of single projects and of production and research capabilities in general. NGOs (most prominently the *Sunshine Project*) have also made extensive use of the US Freedom of Information Act to collate information on relevant research programmes in the USA. Other methodological procedures or technologies that are used today or could potentially be applied by NGOs in BW monitoring are the assessment of publications

and industrial production, the tracking of scientists with relevant knowledge, risk assessment with regard to potential acts of bioterrorism, and the analysis of aggregated information such as trade data. NGOs are also involved in campaigning for codes of conduct for scientists and industry .[xxxvi]

3.2.2 Conclusion

In the absence of a verification mechanism for the BTWC, treaty relevant information can only be acquired via monitoring activities, accomplished either as NTMs or by NGOs. The rapid development and dissemination of technology that is being accelerated by economic globalisation are challenges that impede monitoring activities. However, both high-tech and “non-tech” proposals on how to monitor BW relevant activities exist, and both could be applied by non-state actors. Nevertheless, the NGO monitoring community in the field is shrinking and much of its potential is not being used. Since there is no prospect of the establishment of an international organisation in this area, broader NGO activities are the only conceivable means of independent and critical monitoring alongside NTMs.[xxxvii]

3.3 Chemical Arms Control

3.3.1 Context Changes

The Crisis of Arms Control

In 1993, the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (CWC) was opened for signature in Paris. By and large the regime for the prohibition of chemical weapons seems to be, at least in comparison with other international arms control mechanisms, in good shape. The CWC has so far been signed by 188 states. At first glance, this would suggest broad adoption of this set of international norms. However, among the non-members are a number of states that are suspected of having chemical weapons (CW) programmes or possessing CW. Often mentioned in this regard are North Korea, Egypt, and Syria.[xxxviii] The effectiveness of the treaty is also in question because two signatories – Israel and Myanmar – are suspected of holding undeclared CW stocks. Furthermore, major problems already emerged in the three years between the opening for signature and the entry into force of the Convention, and these have continued to plague its proper implementation.

Firstly, in Article VII, the state parties undertook to prohibit all activities prohibited by the Convention by national legislation, including penal legislation. However, as of October 2009, only 86 of the state parties had enacted comprehensive implementation legislation.[xxxix]

Secondly, verification has to be carried out independently if it is to fulfil its purpose. The history of OPCW operations, however, raises doubts about the Technical Secretariat's (TS) independence. In 2002, the contract of the first Director General of the TS was terminated abruptly, primarily because of pressure from the US government. The Administrative Tribunal of the International Labour Organisation (ILO), which acts as a kind of labour court for international organisations, called this an "unlawful dismissal" and warned that this disregarding of independence was "inconsistent with the proper functioning of an international organisation."[xl] A tenure policy adopted in 2003 limits the contracts of TS civil servants to a maximum period of seven years. This is contrary to the idea of a professional, independent staff.

Thirdly, while the CWC authorizes the Executive Council (EC) to take decisions by a two-thirds majority vote of its members,[xli] shortly after the Convention entered into force, the EC took the decision to work by consensus only. This reduces the scope of the OPCW's work, since it allows every member of the EC to veto decisions, including those concerning challenge inspections under Article IX. In practice, this procedural feature could allow states to breach the CWC without triggering OPCW activities.[xlii]

New Challenges

Not a new challenge to the regime, but rather an ongoing and unsolvable one is that the number of synthesized chemicals keeps growing at an explosive rate. Today the three CWC schedules of listed chemicals, which cover almost 20,000 compounds have to be considered too small and outdated. Furthermore, it is hardly possible to describe novichoks or toxalbumins such as Curcin, as well as compounds containing such substances, in openly accessible information systems. Although research in chemistry and related sciences is very dynamic, the CWC contains provisions to cope with the development of new substances and processes, most of which have never been used.[xliii]

A particularly pressing problem concerns so-called non-lethal chemical weapons. This issue became the subject of broader discussion when an opoid (a Fentanyl derivate) was weaponized as an incapacitant (ibid.). The use of such weapons would, according to Coupland,"increase, not decrease, the lethality of the modern battlefield by increasing the vulnerability of troops to lethal fire."[xliv] Contrary to the spirit of the General Purpose Criterion, the OPCW has limited its activities to listed substances and processes, even though there is compelling evidence that "both Russia and the USA began research and development of new, effective 'non-lethal' chemical weapons for armed conflicts, prohibited by Art. I, §1 CWC."[xlv]

As is also true with regard to other arms control regimes, the possibility of terrorist organisations seeking chemical weapons capabilities is considered to pose a particular problem for the CWC. No later than 1994 and 1995, when the Japanese Aum Shinrikyo sect committed attacks with Sarin gas and killed 19 people, it became obvious that the threat is no longer merely hypothetical. It is, however, unclear whether international arms control regimes are the proper means of stopping terrorism, or whether monitoring and verification mechanisms – state or non-state – can effectively detect small-scale terrorist weapons programmes.

The Role of NGOs in Monitoring

While NGOs could potentially play a major role in monitoring the provisions of the CWC, their role has been limited in the past. This was partly due to the lack of openness on the part of CWC bodies. Furthermore, NGOs with relevant information on progress in chemical technologies have little influence on the OPCW. Even the Scientific Advisory Board (SAB), a group of external experts working on behalf of the OPCW, was not able to establish a direct dialogue with the EC.

There is no mechanism to provide the OPCW with relevant information from civil society representatives, such as medical doctors, chemists, ecologists, and lawyers, who may possess primary data concerning human and animal deaths, injuries and environmental contamination caused by the use of chemicals prohibited by the CWC. (The newly formed CWC Coalition, see below, may become a forum in which such information can be shared among the NGO community.) However, the International Union for Pure and Applied Chemistry (a commercial lobby group) has had some impact on the proceedings of the OPCW. It organized several workshops, the first in 2002, to assess the impact of new science and technology on the Convention and

informed the OPCW of its findings in the run-up to the First CWC Review Conference in 2003. As a consequence, the OPCW purchased several new gas chromatography-mass spectrometers for on-site analysis at the end of 2008/2009 and hired several analytical chemists as inspectors.

At present, the number of NGOs making regular contributions to the CWC regime is small and their resources for research and advocacy activities aimed at expanding collaborative action are very limited. To date, the observation of the CW destruction programmes in the USA and the Russian Federation by the international peace and environmental organisation Global Green USA/Green Cross International is the sole significant non-state monitoring activity regarding the provisions of the CWC at the international level.

As one step towards addressing these problems, the formation of an “International Coalition for a World Free of Chemical Weapons” was discussed in December 2009 by 39 NGOs. One of the activities planned is the production of an independent coalition analysis of the existing inspection and verification regime for industry.

New Technologies and Procedures

The number of technologies that could be used in non-state CWC monitoring is vast. NGOs – in reviewing public documents – could check their plausibility by comparing them with other public data. In monitoring environmental problems, NGOs can detect illegitimate trafficking of hazardous chemicals for weapons purposes at border crossings and strategic points (ports, containers, along supply chains). By using new developments in spectroscopy, NGOs could engage in the detection of clandestine chemical-weapons production. These technologies offer an opportunity to detect vapours and gases from orbit at lower detection limits, so that comparing resulting mappings through enhanced optical techniques could enhance the potential of detecting undeclared chemical facilities and production equipment not only by their morphology. It might also prove possible for NGOs to include the matching of disclosed export data from different publicly available databases within the scope of their activities.[xlvi]

3.3.2 Conclusion

The number of NGOs making regular contributions to the CWC regime is currently very small, partly because of a lack of transparency and openness on the part of

CWC bodies and partly because of limited resources for research and advocacy activities aimed at expanding collaborative action. There is, however, scope for NGOs to play a considerably larger role. First and foremost, this would be furnished by much better public access to the data collected by nation states and the OPCW's verification system

Since almost all relevant NGOs are located in Europe and North America, there is a lack of capabilities and resources in other regions that will need to be overcome. To raise awareness, NGOs will have to bring these issues to the attention of parliaments, courts, political parties, and the general public. The CWC Coalition may be a promising beginning of a coordinated non-state approach.

3.4 Humanitarian arms control

3.4.1 Context Changes

The Crisis of Arms Control

In contrast to most other forms of arms control, humanitarian arms control has been experiencing a historical boom since the mid-1990s, as can be seen by the number of new agreements made both within the CCW framework and elsewhere.[xlvii] The main drivers of new agreements have been NGOs, including INGOs such as the International Committee of the Red Cross (ICRC), and governments particularly interested in humanitarian arms control. Major powers, however, have been reluctant to go along the path towards more effective humanitarian arms control. They have not been willing to accept many new obligations in the CCW track, and those they have accepted have been minor. Nor have they agreed to the more far-reaching Ottawa and Oslo treaties, which came about because of frustration with the CCW track. Very little progress was achieved in negotiation forums where consensus, or near consensus is the rule, as in the case of the UN. In particular, attempts by NGOs and like-minded states to conclude legally binding agreements on small arms and light weapons (SALW) have so far failed.

Beyond the CCW track of negotiations, stand-alone agreements have been reached in the *Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction*, (Ottawa Treaty, 1997) and the

Convention on Cluster Munitions, or Oslo Convention, of 2008. None of the agreements mentioned contains verification provisions.

New Challenges

The push for humanitarian arms control after the end of the Cold War had much to do with the general shift of international attention towards local or regional wars in various parts of the world, particularly in Africa. Most of these were "civil wars" – armed confrontations between rebels (a kind of "non-state actor") and governments. They were characterised by the absence of clearly defined front lines, widespread violence against civilians and, frequently, the existence of a plethora of non-state armed groups with various, sometimes hard to gauge objectives.[xlviii]

The weapons primarily used in these wars, such as small arms and light weapons (SALW) and small calibre artillery, became more easily available with globalization, particularly after the end of the Cold War. Arms manufacturers were desperate for customers and armed forces were shedding surplus equipment. Less control of international trade, particularly from former communi[xlix]st countries in Eastern European, also made it easier to transfer weapons to crisis areas all over the world. The supply of such weapons became almost unlimited with the end of the Cold War because of overcapacities in arms production and the existence of surplus stocks of weapons all over the world.

The political profile of humanitarian arms control was raised by two factors: Human suffering in these wars, and particularly the plight of civilians; but also the greater involvement of the international community, including through the deployment of peacekeeping troops. This was supported by a general broadening of concepts of security in the post-Cold War world. One powerful idea, promoted by NGOs and a number of governments, and closely linked to humanitarian arms control, is that of human security.[l]

The Role of NGOs in Monitoring

All recent agreements in the field of humanitarian arms control have come about through a combination of pressure by NGOs and support from like-minded states. The most prominent examples are the Ottawa and Oslo Conventions, but the same can be said, with some reservations, about the CCW. Even the less successful small arms negotiations have largely been driven by NGOs.

A few of the NGOs active in humanitarian arms control have a long history of involvement in such matters. The most prominent example is the ICRC, which has had a crucial role in lobbying governments for new instruments. However, large new coalitions of NGOs emerged in the 1990s. Possibly the most important change was the growth in interest of humanitarian, human rights and development NGOs that was precipitated by the perception of changes in the nature of warfare. Key NGOs in these fields, such as Oxfam, Human Rights Watch and Amnesty International, gave much support to specialized NGOs in terms of resources, media attention and particularly access to broader public audiences.

The pronounced role of NGOs in the emergence of new instruments of humanitarian arms control has carried over into a central role for non-state organisations in the monitoring and verification of these instruments, particularly the far-reaching Oslo and Ottawa conventions.

In practice, the prime instrument for gathering information and pressuring for compliance with the Ottawa Convention has been the Landmine Monitor run by the International Coalition to Ban Landmines (ICBL) rather than the procedures described in the Convention itself.[li] By the time of the Convention's signing, the ICBL had already created a very good information network on all aspects of the production, transfer, use and stockpiling of landmines. This was consolidated, after the signing of the Ottawa Convention, in the form of the Landmine Monitor, an annual publication researched by numerous local experts.[lii] The Landmine Monitor is also the prime source of information on violations of the CCW protocol on mines.

NGOs received this crucial role because of the unwillingness of government negotiators to establish powerful, and possibly expensive institutions, including institutions needed for verification. Both conventions have similar, limited verification procedures. These focus on the declaration of certain information and the clarification of conflicting information through the good offices of the United Nations Secretariat, as well as vaguely described means of settling disputes over compliance involving the meeting of state parties and the International Court of Justice (ICJ). The procedures for monitoring and verification mentioned in the treaties have not received as much attention as relevant activities by NGOs. This is partly because, despite NGO allegations of violations by state parties, no challenge by a state party

to another state's declaration and no treaty-based investigation of allegations on the ground has so far occurred.

The role of NGOs in compliance is even more pronounced in the case of non-state armed groups, who have made commitments under the Geneva Call.[liii] Geneva Call and associated NGOs have visited areas under the control of more than 20 signatories and even conducted two "challenge" inspections, in Mindanao in 2002 and in July-August 2007 in northeast Somalia/Puntland.[liv] The monitoring of their activities has been an important means of putting pressure on some of these organisations to renounce the use of mines.

This section would be incomplete without a caveat about the "N" in NGO. While the relevant organisations are all legally outside of governments, funding by governments of these NGOs is crucial. This is not only true for "quasi-NGOs" such as the Geneva International Center for Humanitarian Demining (GICHD) and the Small Arms Survey, which have strong government representation on their supervisory boards, but also for the Landmine Monitor, whose supporters include quasi-NGOs, the ICRC and citizen groups without government affiliation. Much of the research that goes into the Landmine Monitor is funded by governments from Europe, as well as Australia, Canada, and New Zealand, the European Union, and the UNDP and UNICEF.[lv]

New Technologies and Procedures

While no detection technologies for the violation of agreements on humanitarian arms control exist worth mentioning, the monitoring of humanitarian arms control has benefited from improvements in information and communication technology. These have given NGOs campaigning for humanitarian arms control access to a wider set of sources, enabled them to store information more easily and to operate more effectively in international networks (Kaldor, 2003). These technologies have also made it easier for journalists to report from crisis areas, and for NGOs to use what has proven to be the most effective means of mobilising public support: visual images.

3.4.2 Conclusion

Humanitarian arms control provides a counterexample to the general tendency of arms control to be in crisis – but it needs to be recognized that crucial actors,

particularly the major powers, have resisted or even tried to stop this development. Furthermore, success was partly precipitated by the framing of humanitarian arms control within a new concept of security: human security. This occurred in response to a changing perception of the character and consequences of contemporary wars. The focus on victims in the discourse on the usage of arms opened up considerable new space for media and lobbying campaigns by NGOs. It also made it more difficult for governments to argue that arms control would endanger national security. The opportunities for a wider role for NGOs, and to a lesser extent IOs, in humanitarian arms control were not only taken up, non-state actors further expanded the field by pushing for new negotiating forums. They also obtained crucial roles in monitoring obligations and possible violations. They did so in conjunction and close collaboration with a number of governments that were similarly concerned to achieveprogress in arms control. Today, NGOs are vital for verification in humanitarian arms control. New information technology, and particularly the internet, are crucial to the efforts of NGOs. New monitoring techniques, however, did not play a role.

4 Conclusions: Monitoring Arms Control Agreements in a Changing World

The case studies confirm in general the early finding of Chayes and Chayes that NGOs can be successful players in monitoring. The context changes described above allow and require more civil society engagement in the monitoring of arms control agreements. In sum, civil society groups now have a far greater potential to make a difference than in the early years of treaty monitoring.

More systematically, the case studies contained in this paper identify the following possible contributions by non-state actors to checking the compliance with arms control treaties:

- Supplementing the verification efforts of states and IOs, and thereby increasing transparency and raising awareness, particularly among the public
- Stepping into the gaps where states and IOs have limited abilities to carry out verification activities
- Facilitating confidence building among states and between states, IOs and the public

- Increasing deterrence against non-compliance by raising the risk of being detected.

Table 1: Change Factors and Implications for the Monitoring of International Agreements

Change factors	**Implications for the monitoring of arms control agreements**
General framework changes creating additional challenges for monitoring	**End of the Cold War:** • Multiplicity of actors at the level of states • Trend towards multilateral arms control ended mid-1990s replaced by more unilateral frames for the regulation of international agreements **New perceptions of threats and security:** • Expanded definition of security • New types of proliferation/transnational terrorism • Diffusion of weapons-relevant technologies fuelled by globalisation **New challenges for M&V:** • Fast developing technologies in all fields and greater number of dual-use technologies. Monitoring focus widened to more states, wider range of actors and technologies
New procedures and technological developments supporting monitoring	**Networking and better access to data:** • Greater access of civil society to policy forums • Collaboration between NGOs and IOs. • Better opportunities to develop and use enhanced and independent monitoring technology and to produce data independently from states • Global information revolution breaks states' unchallenged monopoly on information relevant for M&V and enables network activities of non-state actors

According to the case studies, the states' long-held and unchallenged monopoly of the technical means of monitoring is about to be broken, and independent actors such as NGOs have entered the field or at least have the potential to do so. In view of the fact that, since the mid 1990s, the states have often been unable to agree on M&V regimes in multilateral agreements, the activities of NGOs (and to a certain degree also IOs, who in some cases are starting to behave more independently of

their creator states) have led to a significant increase in transparency in the technical assessment of compliance. Non-state actors have collected and published interpretations of the collated data. As long as the produced information is of good quality and reliability, states can hardly ignore findings on cases of non-compliance.

Actors from civil society are supported by the development of new procedures and technologies that can be used for monitoring. These days, their ability to perform monitoring activities without the need for whistle-blowing insiders are greatly enhanced. NGOs can now also act globally. Whereas it used to be the case that only well funded NGOs had the capacity to perform work on a global scale, the digital revolution has allowed the emergence of an global civil society network of like-minded actors. This network has already brought about substantial changes in the patterns of governance of international politics in general, and particularly in the governance of monitoring.

NGOs can today access technology that was the unchallenged domain of a limited number of privileged states for decades. One example is high-quality satellite images, which are widely available today (either several months old and free, or up-to-date on request and for a fee). Key sources of information in the future, however, will be open-source, such as collections of information in online databases, documents, electronic newspaper archives and scientific journals – and, to an increasing extent, the use of monitoring technology developed by NGOs themselves.[lvi]

The cases presented in the previous chapter have demonstrated that civil society engagement differs significantly from regime to regime:

- In humanitarian arms control, civil society was not only important for the establishment of the monitoring regime, but has also acquired a quasi-official role in monitoring the Ottawa treaty. In humanitarian arms control (but to a lesser degree also in nuclear and biological arms control), NGOs are supported strongly by like-minded states.

- Regarding nuclear arms control, NGOs traditionally complement the monitoring activities carried out by states. They have alerted and supported the IAEA and provided a degree of public transparency into sensitive nuclear

programmes. Moreover, expert groups have demonstrated the feasibility and usability of certain new or unconventional means of verification.

- In the field of chemical weapons control, an important part of civil society engagement was the disclosure of the Soviet/Russian BW programme by a whistle-blower, but in total there have not been many monitoring activities by organised civil society groups – and the access to relevant data is still problematic. The newly founded CCWC will lead to greater and more coordinated civil-society activism in monitoring the field in the future.

- In biological arms control, the specific characteristics of compliance-relevant information have not yet been adequately developed. Hence, neither states nor NGOs have established criteria and procedures necessary to reach conclusions on compliance behaviour; in particular there is no official verification system in place. Similar to the field of chemical weapons, monitoring activities would first of all imply the development of appropriate technologies and, in many cases even more importantly, procedures.

One reason for the differences in the engagement of civil society across these various fields is possibly that the range of their activities is limited by specific restrictions on access to sources. Official declarations or notifications, classified surveillance data, or on-site closed circuit television (CCTV) images will seldom find way to these external actors. In chemical weapons control, for example, the OPCW keenly restricts access to any information that states provide, and relations between NGOs and the OCPW tend to be competitive.

The obvious disadvantages of non-state monitoring are that these activities tend to be discriminatory and incomplete, in part because NGOs are motivated by their own specific scientific curiosity and also because their limited resources need to be directed to the most suspicious or easiest-to-monitor areas. (On the other hand, curiosity might be one of the main driving factors for non-state monitoring, which in most cases is carried out by organisations with a background in academia.) Further, there is danger that results may be manipulated by interested parties who may pass information that reflects only their interests to NGOs (there is however also no guarantee that state-produced information is of better quality – verifiability is the watchword in any case).

The most important finding of the case studies is that NGOs have generally not yet made use of their full *potential*. What remains to be explained is *why* the new potential for independent monitoring is used to different extents in the various fields of arms control. A number of factors might play a role, including the existence of qualified and interested NGOs in a given field, factors arising from the broader context, such as the availability of information, the existence of an official verification system, and the openness of relevant M&V regimes to the contributions of NGOs. Opportunities for NGOs to make use of available opportunities for monitoring and to enhance them further might influence the degree to which they participate in the monitoring of international arms control treaties. These questions show the great potential and the urgent need for ongoing research in an area that lies between two sub-fields of political science, namely International Relations and Global Social Movements.

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[i] UNIDIR and VERTIC, *Coming to Terms with Security: A Handbook on Verification and Compliance,* http://www.unidir.ch/pdf/ouvrages/pdf-1-92-9045-149-1-en.pdf (2008).

[ii] The famous question of Alan Krass (1985): '*Verification: How much is enough?'* mirrors the insight that 100% complete knowledge of all compliance relevant activities - especially of what a party is *not* doing - is not possible.

[iii] Michael Krepon, and Mary Umberger eds. *Verification and Compliance,* (Basingstoke, Palgrave Macmillan, 1988).

[iv] Abram Chayes and Antonia Handler Chayes, *The New Sovereignty: Compliance with International Regulatory Frameworks*, (Cambridge (MA), Harvard University Press, 1995).

[v] Daniel Feakes: "Global Civil Society and Biological and Chemical Weapons", Mary Kaldor with Helmut Anheier and Marlies Glasius, eds., *Global Civil Society 2003*, (Harvard, Oxford University Press, 2003).

[vi] The synonymous use of the terms threat, danger and risk neglects that the differences between the terms are more than just semantic. While *threat* describes a concrete danger, *risk* is a statistical figure. According to Beck (1986, 2007) the production of risks is immanent to the industrialised (and now globalising) society.

[vii] Gunnar Jeremias and Jan van Aken, "Harnessing Global Trade Data for Biological Arms Control", The Nonproliferation Review, Volume 13 (July 2006), Number 2, pp. 189-219.

[viii] Dieter Deiseroth, "Societal Verification: Wave of the Future?", *Verification Yearbook 2000*, (London, VERTIC, 2000), pp 265-280.

[ix] Bas Arts with Math Noortmann and Bob Reinalda, eds., *Non-State Actors in International Relations*, (Farnham, Ashgate, 2001) and Ann M. Florini ed., *The Third Force: The Rise of Transnational Civil Society* (Carnegie Endowment for International Peace, Washington DC, 2000).

[x] Richard Bruneau, "Unofficial monitoring of compliance with arms control treaties: a survey", *Compliance Chronicles* 2 (Carleton, Canadian Centre for Treaty Compliance, July 2006).

[xi] Ibid. and Jez Littlewood, "Confidence-building measures and the Biological Weapons Convention: where to from here?", *Compliance Chronicles* 6 (Carleton, Canadian Centre for Treaty Compliance, 2008).

[xii] Patricia Lewis, *The role of NGOs in disarmament and conflict prevention,* United Nations Disarmament Yearbook, 27, 2002, pp. 21 ff.

[xiii] Abram Chayes and Antonia Handler Chayes, *The New Sovereignty: Compliance with International Regulatory Frameworks*, (Cambridge (MA), Harvard University Press, 1995), pp 271 ff.

[xiv] Mandating a UN sub-organisation would theoretically be an alternative to the use of intergovernmental organisations, but this kind of 'third party verification' has never really become a popular tool (Report of the UN Secretary General: Verification in all its aspects, 1995). UN bodies are or have been active in the M&V of resolutions of the UNGA and the UNSC, but although bodies like UNSCOM/UNMOVIC together with the IAEA have successfully executed the most comprehensive and intrusive M&V system in history (Jeremias and van Aken, 2006), and political actors such as the EU were pushing a standing UN monitoring body *((so??))*, these initiatives failed (EU strategy against Proliferation of Weapons of Mass Destruction, 2003). With this, the discussion on UN involvement in M&V, which has run since the mid-1960s, fizzled out once again (Wainhouse, 1965). The DDA operates the UN Register of Conventional Arms (based on UNGA resolution 46/36 L), which is a kind of monitoring of an arms control relevant issue, but there is no arms control/disarmament norm to be enforced.

[xv] Oliver Meier, "Verification Regimes", *Encyclopedia of Violence, Peace and Conflict*, (Oxford, Academic Press, 2008), pp. 2251-2261.

[xvi] [xvi] Abram Chayes and Antonia Handler Chayes, *The New Sovereignty: Compliance with International Regulatory Frameworks*, (Cambridge (MA), Harvard University Press, 1995), pp 271 ff.

[xvii] Angela Woodward , *Banning Biologial Weapons: National legislation in Africa*, African Security Review, 14 No 1, 2005.

[xviii] Bhupendra Jasani and Gotthard Stein, *Commercial Satellite Imagery: A Tactic in Nuclear Deterrence*, (Berlin, Springer, 2002) and . Frank Pabian, "Commercial Satellite Imagery: Another Tool in the Nonproliferation Verification and Monitoring Toolkit".

[xix] Angela Woodward, "Evolution in Verification Technologies", *DDA Occasional Papers*, No. 10, 2005, pp. 29-46.

[xx] Julian Whichello with Davide Parise and Nikolai Khlebnikov, "IAEA Project on Novel Techniques", *INESAP Information Bulletin 27*, November 2006.

[xxi] Bhupendra Jasani B with I.Niemeyer, S. Nussbaum, Richter, B Stein and G.Stein eds., *International Safeguards and Satellite Imagery. Key Features of the Nuclear Fuel Cycle and Computer-Based Analysis,* (Berlin, Springer, 2009) and Frank Pabian, "Commercial Satellite Imagery: Another Tool in the Nonproliferation Verification and Monitoring Toolkit", James E. Doyle, Nuclear Safeguards, Security and Nonproliferation, (Burlington and Oxford, Butterworth-Heinemann, 2008), pp. 221-251.

[xxii] In 1951, the USA launched the Operation Bluenose to determine the Soviet nuclear arsenal from the atmospheric content of the fission product krypton-85: Frank von Hippel with Barbara G. Levi and David H. Albright, "Stopping the Production of Fissile Materials for the Weapons*", Scientific American 253* (September 1985), No. 3.

[xxiii] Martin B. Kalinowski with Hartmut Sartorius, Stefan Uhl, and Wolfgang Weiss, "Conclusions on Plutonium Separation from Atmospheric Krypton-85 Measured at Various Distances from the Karlsruhe Reprocessing Plant", *Journal of Environmental Radioactivity 73/2* (2004), pp. 203-222.

[xxiv] Steve Fetter and Frank von Hippel, *The Hazard from Plutonium Dispersal by Nuclear-warhead Accidents*, Science and Global Security 2, No. 1 (1990), pp. 21–4.

[xxv] Martin B. Kalinowski, Second nuclear test conducted by North Korea on 25 May 2009. Factsheet, www.znf.uni-hamburg.de/Factsheet_NK.pdf.

[xxvi] Nicolas Isla "Strengthening the BTWC's Confidence Building Measures Regime: A Catalogue of Recommendations", *Research Group for Biological Arms Control, Occasional Paper No. 3*, (2007).

[xxvii] Kathryn Nixdorff, "Biological Weapons Convention" Rudolf Avenhaus with Nicholas Kyriakopoulos, Michel Richard and Gottard Stein, eds., *Verifying Treaty Compliance. Limiting Weapons of Mass Destruction and Monitoring Kyoto Protocoll Provisions*, (Berlin, Springer, 2006), pp. 107-134.

[xxviii] EU Security Strategy (2003) and UN Secretary general: "Uniting against Terrorism" (2006)

[xxix] In 1984 followers of Bhagwan Shree Rajneesh contaminated Oregonian salad-bars with salmonella, hoping to gain a higher percentage of votes for their party at local elections; in the mid-1990's the Japanese Aum Shinrikyo sect released anthrax after a development programme of several years, but they did not use a strain that was a human pathogen. In 2001 letters with anthrax were sent to politicians and news media offices in the USA. 22 people became infected, five of whom died. What all these cases have in common is that they were committed by individuals or groups from within the attacked society.

[xxx] Furthermore, in ex-post monitoring it can be hard to distinguish between natural and deliberate outbreaks of infectious disease. Responsibility for ex-post monitoring lies officially with national and international public health authorities. But knowledge and capacities will also be embodied by civil society actors. In many cases, the close cooperation of authorities with (mostly private) hospitals and laboratories will be indispensable.

[xxxi] See for example http://www.sunshine-project.org/biodefense/

[xxxii] Gunnar Jeremias and Jan van Aken, "Harnessing Global Trade Data for Biological Arms Control", The Nonproliferation Review, Volume 13 (July 2006), Number 2, pp. 189-219.

[xxxiii] The list of BWPP members is available at http://www.bwpp.org/partners.html. The number of NGOs that are currently active in monitoring in the area of BW is, however, limited.

[xxxiv] For example the *Industry Association Synthetic Biology*: "IASB develops Security Measures for Use of Synthetic Biology" http://www.ia-sb.eu/go/synthetic-biology/activities/press-area/press-releases/press-release-on-workshop-for-biosecurity-english/

[xxxv] SIPRI, *The Problem of Chemical and Biological Weapons, Volume IV*: *Technical Aspects of Early Warning and Verification*, (Stockholm, SIPRI, 1975) and Nixdorff, 2006 (see endnote xxvii).

[xxxvi] Projects on the evaluation of capabilities and the monitoring of global trade of relevant items are conducted at the Hamburg Research Group for Biological Arms Control (www.biological-arms-control.de).

[xxxvii] At the sixth BTWC review conference in 2006, the state parties established the Implementation Support Unit, but beyond its work on the CBMs, no further competences and capabilities were allocated to that office.

[xxxviii] See for example Joseph Cirincione with Jon B. Wolfsthal and Miriam Rajkumar, *Deadly Arsenals*Nuclear, Biological and Chemical Threats, Carnegie Endowment for International Peace.

[xxxix] See: Report to the Conference of the States Parties at its fourteenth session on the Status of implementation of article VIOI of the chemical weapons convention as at 19 August 2009, The Hague, 21 October 2009, opcw.org/C-14/DG.9

[xl] See ILO Administrative Tribunal: Judgment No.2327 (2004), available at www.ilo.org./dyn/triblex.

[xli] See: Paragraph 29 and subparagraph 21 (k) of Article VIII.

[xlii] Kathleen Lawand, "The Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personal Mines and on their Destruction (Ottawa Convention, and Lisa Tabassi, "The Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction"Geir Ulfstein with Thilo Marauhn and Andreas Zimmermann eds., *Making Treaties Work*, (Cambridge University Press, New York, 2007), pp. 324-347

[xliii] Julian P. Robinson, "The Chemical Weapons Convention in a changing political context", Paul Fogelberg ed., "Changing Threats to Global Security: Peace or Turmoil. Proceedings of the XV International", (XV International Amaldi Conference, Helsinki, 2003), pp. 211-25.

[xliv] Robin M. Coupland, "Modelling armed violence: a tool for humanitarian dialogue in disarmament and arms control", John Borrie and Vanessa Martin Randin, eds**.,** *Alternative Approaches in Multilateral Decision Making: Disarmament as Humanitarian Action,* UNIDIR, May 2005, pp. 39-49.

[xlv] Jorma Miettinen, "Changing Threats to Global Security", XV International Amaldi Conference, Helsinki, 2003.

[xlvi] Unpublished results from ongoing activities of V. Vill and I. Schwier, Hamburg University.

[xlvii] The most important set of prohibitions were agreed in the *Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects* (CCW) of 1980. The CCW currently has five protocols, which limit or prohibit the use of fragmentation weapons (adopted 1983), certain types of landmines (adopted 1983, amended 1996), incendiary weapons (1983) and blinding lasers (1998). The most recent protocol is concerned with obligations related to explosive remnants of wars (2003).

[xlviii] Mary Kaldor, *New and Old Wars: Organized Violence in a Global Era*, (Cambridge, Cambridge University Press, 1999).

[xlix] Richard Price, “Reversing the Gun Sights: Transnational Civil Society Targets Land Mines”, *International Organization* 52 (1998), pp. 613-644.

[l] Human Security Centre, *Human Security Report 2006*, (Vancouver, University of British Columbia)

[li] Another indicator of the importance of non-state parties in the implementation of the Ottawa Convention is the role played by the Geneva International Center for Humanitarian Demining (GICHD) since 2001. GICHD, a “quasi non-governmental international” organisation funded by the Swiss and other governments, provides the secretariat of the Ottawa Convention. The 3rd meeting of States Parties in 2001 endorsed the establishment of an Implementation Support Unit (ISU) at GICHD and agreed to provide the GICHD with a mandate to establish the ISU to perform the key functions to support the operation of the Convention. See: http://www.apminebanconvention.org/implementation-support-unit/overview/.

[lii] http://www.icbl.org/lm/

[liii] Beginning in 2000, the NGO “Geneva Call”, which is supported by the Swiss government, has sought to convince non state-armed groups to sign a “deed of commitment” very similar to the obligations under the Ottawa Treaty. By late 2008, more than 30 non-state armed groups had signed such documents.

[liv] The Geneva Call Progress Report 2000-2007, Geneva 2007, http://www.genevacall.org/resources/testi-publications/gc-progress-report-07.pdf, p. 27.

[lv] http://www.icbl.org/lm/

[lvi] Avenhaus et al. (2007, 503ff) have edited a volume on technological advances in monitoring that can be used by civilian organisations: passive and active acoustic, seismic and magnetic sensors, antineutrino detectors or sensors and data storage/transmission on a digital basis.