Social media research and non-proliferation

Sometimes technologies come along that completely change how we can connect to each other: the printing press, the telegraph and the telephone; the newspaper, the radio and TV. Each changes how society, and all of us work, how we relate to each other, how we organise, who we think we are and how we live our lives. They are technologies that begin social revolutions.

We are living through one such revolution now. Since the mid 1990s, the Internet has increasingly crept into our daily lives. And less than a decade ago, as the Internet revolution was picking up pace, it dramatically shifted direction. Suddenly, people began to use those platforms, apps, forums and sites that allowed them not just to find and consume content, but also to create and share it. This was the birth of a new, 'social' media–and it has transformed how the Internet is used today.

The rise of social media has not just transformed how society works, but also how it can be studied. Throughout history, most human activity has naturally and normally been lost. As people have moved more and more of their lives—intellectual, professional, political and social—online, more and more of the normal concourse of daily existence is captured in digital form. Every minute Facebook users share 2.5 million pieces of content, Twitter users Tweet 300,000 times, YouTube users upload 72 hours of video, Apple users download 50,000 apps. This is the 'datafication' of social life.

The arrival of these new kinds of information about what we think, what we are doing and seeing, who we connect to and how we do it, has led to the flowering of a new kind of research discipline: social media science. It is carried out across commercial outfits, academic institutions, governments, law enforcement agencies, and third sector groups. It applies a motley collection of research techniques, from highly arcane, automated algorithms developed by computer scientists to highly textured, extremely qualitative ethnography. It has

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aims ranging from understanding networks of millions of people to deep knowledge of an individual. What these approaches have in common is the desire to leverage and harness the new data that social media produces, and turn it into some kind of meaningful or worthwhile insight.

Social media science is changing how many organizations both understand and engage with the social world. Advertisers and marketers have ripped up old business models in favour of newer, cheaper, digital ways of understanding loyalty, brand affiliation and consumer trends. 'SOCMINT'—social media intelligence—is now a recognised new intelligence area by police forces and intelligence agencies.

Could social media research genuinely influence, even transform the field of non-proliferation, as it has others? A number of powerful voices have risen to suggest that it might. In 2012, the Under Secretary of State for Arms Control and International Security, Rose Gottemoeller, gave an important 'ideas' speech in Moscow. She challenged the non-proliferation community to think 'bigger and bolder' about leveraging the new tools of the information age: 'today, any event, anywhere on the planet, could be broadcast globally in seconds. That means it is harder to hide things. When it is harder to hide things, it is easier to be caught.' In the wake of this speech, non-proliferation organizations have begun to map out the opportunities in the area. The National Threat Initiative has released 'Redefining Societal Verification', and the James Martin Centre for Non Proliferation Studies released 'New Media Solutions in Nonproliferation and Arms Control'. Both are good reads.

Social media and non-proliferation join in two different ways. Social media could be used explicitly and proactively—to ask, coordinate, or co-opt people to help support elements of the non-proliferation regime, such as those concerned with monitoring and verification, and to provide them a way of doing so. This is 'solicited' societal verification. There are currently impressive attempts using social media to make non-proliferation less a distant, mysterious international endeavour, and more an activity that makes sense to each individual, their own locale, concerns, skills, interests and hobbies. Safecast (www.blog.safecast.org) have created a crowd-sourced radiation-monitoring network. They help people to build inexpensive devices to monitor radiation where they live and where they travel, and then make that data available for anyone to see and use. Blackshore have created a game where people explore unfamiliar landscapes, and in so doing crowd-source human analysis of satellite imagery (www.cerberusgame.com). Moritz Kutt from the University of Darmstadt is arguing that more open source software, with freely available source code, should be developed to support nuclear non-proliferation (www.nuclear-freesoftware.org). This type of activity has been successful in other fields where talented coders and software designers spend significant time and effort in collaboratively developing software (in their own time) precisely because they feel invested in the process. Linux, a widely used and very effective operating system, was entirely developed, and is freely available, on this basis.

However, I am interested in 'unsolicited' social media research; on listening to the information that social media produces anyway. Nuclear non-proliferation is (sadly) unlikely to become the priority of most of the people in the world overnight. It is in the unimaginable amounts of data that society now produces anyway, as a by-product of its activities, that we might find perhaps the greatest transformative potential.
There are three ways that social media data might be researched to increase confidence in the international non-proliferation and arms control regime; for working out whether everyone is doing what they are saying they are doing, and not doing what they are saying they are not doing. They are:

- Societal verification: detecting events—'spotting a nuke driving down the road'.
- Strategic culture: shedding light on strategic decision-makers, their cultures, calculus and concerns.
- Understanding nuclear decisions: through the backdrop of social and political currents, trends and shifts.

Can analysis of social media spot a nuke driving down the road?

Could social media be used to support assurance of treaty compliance? Could it expose illicit activities if they are committed, and could it confirm that actions that are said to be undertaken, are in fact undertaken?

Illicit nuclear activities are typically committed under the darkest shroud of secrecy. However, activities—even those that are clandestine and illicit—rarely happen in isolation. They almost always have some kind of interface with the outside world. Through these interfaces, indications of such activities can be spontaneously noticed, tangentially mentioned, and accidently revealed.

The sensitivity of a particular kind of social media to offline events is now becoming well understood. These are real-time microblogs—like Twitter and Sina Weibo. One of their primary uses is as a forum for a new kind of digital 'citizen witnessing', where their users adopt the often spontaneous and temporary role of a correspondent journalist to provide first person reportage when they find themselves at the scene of an important or unusual event. The most famous example happened on May 2011, when Sohaib Athar used Twitter to provide live commentary on an operation that had been planned under the highest level of secrecy: the US SEAL raid on the home of Osama bin Laden. This was Twitter's CNN moment.

Today, Twitter is frequently used both to reveal events that are happening throughout the world, and provide first hand, almost real-time information about them. As examples amongst many, after the crash of Malaysian Airlines' MH-17, the first scenes of the crash site were revealed on Twitter; likewise the helicopter crash in Vauxhall, in London in January 2013.

It is possible that events related to non-proliferation appear on Twitter in much the same way, especially if they are unusual. For instance, in December 2013, the theft of a Cobalt-60 source in Mexico was first publicized on social media. Likewise, the unexpected movements of military materiel, appearance of unusual vehicles or convoys, and the unplanned closures and diversions have all find themselves on social media.

Importantly, these events can now be detected. They are buried within the 500 million Tweets-per-day that we call the 'Tweet stream'. It is a chaotic and diverse torrent of digital commentary, arguments, discussions, insults, jokes, pictures, quotes, links, questions and answers.

However a wide range of different kinds of events—even fairly small ones—can cause ripples in the Tweet-stream. People witnessing an event begin the ripple by posting information about it. These ripples are often amplified by 'information brokers' that collect and corroborate the information, and by highly followed 'information broadcasters' that send the information to a much wider viewership.

One of the most important coalfaces in social media research is to build technology to detect and appreciate these ripples. This is happening in academia: the EMBERS project in the Discovery Analytics Centre at Virginia Tech has a very large programme using a number of different models and algorithms to detect civil unrest. It is also happening in industry: Boeing Research and Technology are building sophisticated models along similar lines. Professional journalists are beginning to use similar technology, and I would be astonished if national security services have not also developed a capability.

There are a number of ways to detect events from Twitter. The most straightforward is to look for certain 'targeted events' by simply looking at the volume of Tweets that contain key terms and phrases that (it is hoped) indicate that event. In a published case study conducted by the Centre for the Analysis of Social Media, we could reliably detect Olympic medal wins on the basis of spikes in Tweets containing the first or last name of any Olympian competing in the Games. It also might help you detect events faster than any other method. Our analysis of the Ottawa shooting earlier in 2014 indicates a visible, detectable spike in Tweets mentioning Ottawa before the first mainstream news story broke about the incident.

It is also possible, although more difficult, to detect 'untargeted' events that you did not know were going to happen before they did. This requires the detection not of volume spikes, but of 'clustered bursts' of certain terms that suddenly appear in the Tweetstream in ways that are unusual for each term, but consistent with one another. Think 'convoy', 'nuke', 'missile' and 'military' all suddenly being used together over several minutes, when they previously were not. It is possible to statistically map 'clustered bursts' of terms from the Tweet stream in graphs that display their relationship to each other—called community structure. This can allow

you to instantly start seeing and analysing bursts of words that could indicate events related to non-proliferation. A methodology to do this is described in a recent chapter I co-authored in *Open Source Intelligence in the Twenty-First Century* (Palgrave Macmillan). Overall, it is becoming technically possible to marshal the chaos of Twitter, and to turn it into an enormous digital observatory, containing pinprick indications of events happening in real-time, all over the world.

Shed light on strategic decision-makers, their cultures, calculus and concerns

Just as nuclear-related actions interface with society, they also interface with culture. It is possible to use social media not just to detect events, but also to understand better the leaders and decision-makers that cause, prevent, or influence them. This can provide a bedrock of understanding to support the non-proliferation regime - of how and why treaties are made, the rationale used to design them and the dynamics and mechanisms that affect them. Since the 1970s, a scholarship of 'strategic culture' has emerged that has argued that different organizations and different countries react to events and threats differently. This body of work criticised the conception of states as undifferentiated value-maximisers, capable of soaring above their own history and context. In the words of Colin Gray, one of the leading advocates of this approach, from his book *Modern Strategy* 'all strategic behaviour is cultural behaviour'.

This scholarship suggests—convincingly in my view—that nations have their own collective histories and experiences; early formative experiences; and philosophical, political, cultural, and cognitive characteristics. These lead to different symbols, beliefs, attitudes, practices, habits of thought, fears, hopes, and memories. It also leads to different ideas about the use of force, responsible action, strategic preferences and possible options (see for example Alastair Ian Johnston's *Thinking about Strategic Culture, in International Security*). This can allow us to better understand or predict decisions made behind closed doors by knowing more about the people that make them.

Strategic culture has, up to now, focussed on a relatively small collection of what are known as 'culture-bearing units' produced by strategic decision makers: their writings, transcripts of debates, letters, and declassified records. Within these sources, scholars look for the assumptions, metaphors, historical references, and modes of justification that allow us to build up the moral and intellectual worlds of decision-makers.

Social media is a rich new vein of information that scholars of strategic culture could tap. The way that Governments—both officials and politicians—engage with their publics is drastically changing. They are increasingly being pulled onto digital platforms to talk directly with people, to explain their policies and justify their actions. In a small study that I conducted recently, I analysed these interactions: both a 'Tweet-chat' hosted by the Deputy British Prime Minister Nick Clegg and also routine interactions conducted by dozens of official Twitter accounts run by the British Government (*A Question of Trust*, freely downloadable from the Demos website). These are just two UK-based examples of a broader and more significant trend.

Understand social and politcal currents, trends and shifts

It is also possible to use social media as a lens on the aspects of broader political and social life that relate to, and influence, non-proliferation. These might include either sudden or incremental shifts in public attitude, bursts of nationalist sentiment, heightened national security concerns or spikes of revanchist or irredentist sentiment that leads to increased political pressure on leaders. This can take the form of pressure on leaders to take a 'hard-line' against a national adversary in crisis-situations, or even to develop nuclear weapons.

Social media—Facebook 'likes', Instagram posts, Twitter Tweets, FourSquare check-ins and Pinterest pin constitute ever-increasing proportions of cultural and intellectual activity. Taken together, social media is the largest reservoir of information about people's attitudes, hopes, fears, concerns and priorities that we have ever had: huge, naturalistic, and constantly refreshing bodies of behavioural evidence that are, in digital form, inherently amenable to collection and analysis. These bodies of data also present a formidable and largely new research challenge: they are too large to ever manually be read in their totality. They demand, in one way

or another, a basic shift in research method away from manual techniques, at least in the first instance, and onto automated technologies. A crucial technology has emerged to make this possible. It is called natural language processing (NLP). A long-established sub-field of artificial intelligence research, natural language processing combines approaches developed in the fields of computer science, applied mathematics, and linguistics. It is increasingly used as an analytical 'window' into 'big' datasets such as those produced by social media.

The value of NLP is its ability to create 'classifiers'. Classifiers are algorithms that can learn how to automatically place tweets in one of a number of pre-defined categories of meaning. These algorithms are the new tools of the social media researcher— the scalpels and hammers that are needed to sort relevant data from irrelevant, to separate Tweets or posts on the bases of their meaning, intent, or significance. The Centre for the Analysis of Social Media, my research group, has just published a paper that lays out how natural language processing can be used to understand attitudes from social media, called *Vox Digitas: Listening to Digital Voices*, it is freely available on our website.

Conclusion

Speaking as a social media researcher, I think social media research is generally over-hyped. 'Big data' and 'social media' have become something of a modish cure-all for any research needs, and underneath the enormous quantities of data that are now produced and consumed by these new analytical engines, worrying gaps and frailties in basic research rigour starkly remain, including in each of the techniques I have described in this article.

Social media has vastly uneven take-up throughout the world, and in some countries these approaches will not work at all at present. Even if social media is used, authoritarian regimes can censor its content, or punish those that upload sensitive information. And even in the countries where it is used openly and freely, there are many different ways in which it does not represent society. Data produced by it can be gamed, spoofed and contorted, and is very difficult to corroborate or verify. The technologies that we now need to analyse the data are new, unfamiliar and often arcane, and are being imported into fields and disciplines that have not used them and do not know how they work. These technologies, anyway, often have not been built with the decision- or policy-maker in mind and are at root tools used in the marketing and advertising industries. Many of the current offerings on the market are 'black box' capabilities where the analyst cannot really understand how the technology works, or what it really does. This is not helped by the fact that social media research is being done in isolation, away from much older, more established, more trustworthy methodologies. All of this means that there have been seldom few cases where this area of research has managed to impact an important decision within any domain.

Rose Gottemoeller is right; big ideas are important. But now is the time to also get stuck into the detail that will make it all happen: case studies, prototypes, pilots and proofs of concept. The opportunities I have sketched out are three amongst many, and in this field, as in many others, it is not yet clear which will bear fruit. What is clear is that joining social media research with non-proliferation is a strategic prospect rather than some kind of a quick fix.

The most important step to make this a reality is for non-proliferation practitioners and funders to not look over-the-counter for ready-made, pre-packaged solutions, but instead to the tech innovators and communities that have typically had very little to do with non-proliferation work. There are strategic links here that do not exist yet, but are waiting to be forged. It is in these relationships that well-tested, well-understood, clearly-described and honestly-communicated capabilities will be created in specific, practical contexts that are useful.•

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Verification Watch

Nuclear Test-Ban Treaty Integrated Field Exercise 14

Andreas Persbo and Alberto Muti, London

In November and December 2014, the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) held its second Integrated Field Exercise (IFE). It lasted for 36 days, and involved more than 200 experts drawn from the organisation, its member states, and various invited observers. It is the largest field exercise ever undertaken by the CTBTO. The activity, budgeted at US $10.3m, was the capstone of a sustained effort within the Provisional Technical Secretariat (PTS). This involved a comprehensive training programme, three build-up exercises and some two-dozen dedicated workshops. Because of this effort, the CTBTO now maintains a roster of about 100 so-called surrogate inspectors (surrogate since the treaty is not yet in force). The organisation called up 40 to take part in Jordan.

On-site inspection activities under the Comprehensive Nuclear Test Ban Treaty (CTBT) are directed from a so-called Base of Operations (BOO). In an earlier exercise—the first full scale OSI—held in Kazakhstan in September 2008, this base was set up on a remote part of the tundra, where inspectors braved sub-zero temperatures, snow, and failing generators. In contrast, the Jordanian BOO was set up near the Dead Sea Conference Centre on the shorelines of the Dead Sea, the lowest spot on earth, 40 km southwest of the capital Amman.

The PTS has been tight-lipped about the scenario details, but some are known. In the fictional exercise, the CTBT has been in force for six months (in reality, the treaty continues its long wait for sufficient ratifications to bring it into force) when the CTBTO's International Monitoring System (IMS) detects traces of what might be an underground nuclear explosion. A state-party submits a request for an On-Site Inspection (OSI), which is approved by the Executive Council. Ten days after the alleged explosion is detected, the inspection team moves into the inspected state. They will have to operate in delicate political circumstances, and under tight time constraints.

The Dead Sea region, where the exercise was held, is of particular interest because of its peculiar geological features, such as landslides, sinkholes, and naturally occurring seismicity. Some of these—especially the sinkholes created by the collapse of underground cavities—could resemble the results of an underground nuclear explosion, making it an ideal proving ground for much of the inspection technology used in the exercise.

The progress shown through the ambition of IFE 14 is also noteworthy. Six years after the first full-scale OSI organised by the CTBTO in Kazakhstan, the exercise in Jordan shows a remarkable increase in the effort put in every level to make the exercise realistic and complex. The training programme lasted some 28 weeks (four times as much as IFE 08), while the newly introduced 'build-up exercises' simulated individual phases of the larger exercise.

The organisation also conducted field tests focusing on specific instruments and techniques. The logistical effort has also stepped up, with three times as much equipment deployed by weight—51.2 metric tonnes for IFE 08 compared to 150 tonnes for IFE 14—and better camp logistics, including heavy-duty equipment to move instruments and conduct operations.

The OSI simulation itself is more complete: The CTBTO deployed nine inspection techniques in 2008, of which only four were fully used. By contrast, the organisation deployed 15 different inspection techniques in Jordan, of which 13 were fully available. Besides visual observation, the exercise now allowed for the filming of the inspected sites and multi-spectral imaging. It also introduced radiation monitoring, environmental sampling, and detection of noble gases argon-37 and radio-xenon. The exercise also tested techniques such as ground electrical conductivity measuring, gravitational and magnetic field mapping, and ground-penetrating radar, designed to identify underground cavities and underground metallic structures.

During the exercise, participants had to adapt to the constraints posed by the scenario. When faced with a limitation on their rights to inspect an area that the Inspected State Party (ISP) had designated as a 'Restricted Access Site', sur-

rogate inspectors decided to analyse samples from tyres of vehicles they had used to drive around the site perimeter. The scenario also presented the participant with unexpected challenges: for example, during the late stages of the exercise some of the equipment housed at the Inspector Team's BOO showed signs of having been tampered with overnight. Since the ISP provided the security services to the BOO, some inspectors suspected foul play. In an IFE 14 video blog, one inspector wondered aloud whether the same people that provided the camp's security had an interest in not finding the answers.

IFE 14 has given the CTBTO yet another opportunity to showcase its readiness for a live on-site inspection. Readiness was already high when the team deployed in Kazakhstan, and it is evident that the organisation has applied lessons learned there successfully. Only two major techniques remain to be tested, namely resonance seismometry and drilling, the latter being underdeveloped in the CTBTO's OSI Operational Manual as well as being very costly to set up.

The CTBTO will identify and discuss lessons learned from running the exercise at workshops in Ramat-Gan, Israel, on 12-16 April 2015 and Vienna, Austria on 17-19 June 2015. •

First conviction under UK's BWC Act

Russell Moul and Yasemin Balci, London

On 7 November 2014, Ms Kuntal Patel, a graphic designer from east London, was jailed for three years having been convicted of acquiring the toxin abrin. This marked the first occasion in which a person had been convicted under the UK's Biological Weapons Act 1974, which implements the provisions of the 1972 Biological Weapons Convention (BWC) in this country.

Under Article IV of the Convention, all states that are party to the treaty are required to adopt national measures to prohibit and prevent activities involving biological agents and toxins as weapons. The UK became a party to the BWC on 26 March 1975, the day the BWC entered into force. The UK is also a Depositary of the Convention, together with Russia and the United States.

According to Section 1(1)(a) of the UK's Biological Weapons Act, the acquisition of biological agents and toxins, like abrin, is forbidden if there is no 'justification for prophylactic, protective or other peaceful purposes'. Southwark Crown Court established that Ms Patel had purchased the toxin with the intent of primarily using it to poison her mother, or alternatively, to commit suicide after a period of prolonged conflict between the two of them. Consequently, she was convicted for acquiring the toxin without a peaceful purpose. The court heard that Ms Patel had originally purchased the toxin in December 2013, after making contact with a dealer from the United States operating an illicit website on the 'dark web'—an area of the internet that is not indexed by standard search engines. While making the purchase, Ms Patel created encrypted accounts that would, she hoped, conceal her activities.

However, upon obtaining the phial of abrin, which was hidden in a fragrance candle in a glass jar, Ms Patel noticed the jar had broken and threw it away in a panic. The discarded abrin posed a risk to third parties handling the package, but it has never been recovered. Ms Petal attempted to acquire the toxin a second time in late December 2013 and early January 2014. However, her contact in the United States had since been arrested by the US authorities, who posed as him for a few days before contacting Scotland Yard's Counter Terrorism Command to investigate her case.

Pursuant to Section 1(3) of the Biological Weapons Act, the maximum penalty for the offences relating to biological weapons in Section 1(1)(a) is life imprisonment. In Ms Patel's case, there were aggravating circumstances such as her persistence in obtaining the toxin and the risk she created for third parties. However, there were also mitigating circumstances including her previous good standing and the severe stress she had endured due to physical and mental abuse by her mother. The court weighed these considerations, and Ms Patel was sentenced to three years imprisonment. She was acquitted of the charge of attempted murder.

The toxin in question, abrin, is a potent toxic plant protein derived from the seeds of the Abrus precatorius plant, otherwise known as the rosary pea. These seeds are commonly

used as beads in rosaries and other jewellery, in toys or percussion instruments (see picture below). The plant is native to Southeast Asia and grows in tropical and subtropical areas of the world where it has been introduced. It is also found in many parts of the United States such as Alabama, Arkansas, Florida, Georgia, Hawaii, Puerto Rico and the Virgin Islands.

An abrin bead bracelet.

Every part of the Abrus precatorius plant is toxic, but the seeds contain the highest concentration. Like ricin, a similar plant toxin, abrin causes toxicity by inhibiting the formation of proteins in the cells of the exposed individual. The toxin can be absorbed into the body through ingestion, inhalation, or contact with the eyes; even exposure to small amounts of abrin can be fatal and there is no antidote available.

As well as being prohibited under the UK's Biological Weapons Act when used for non-peaceful purposes, abrin is also classified as a 'dangerous substance' in the United Kingdom under the Anti-Terrorism, Crime and Security Act 2001. Before abrin is kept or used at a premise, its occupier is under an obligation to notify the Secretary of State. This is in line with the BWC, which requires states to not only adopt criminal legislation prohibiting the misuse of biological agents and toxins, but also to adopt control measures to prevent such misuse. •

Verifying the Arms Trade Treaty

Hugh Chalmers, London

Last year, Christmas came a day early for supporters of conventional arms control. The UN Arms Trade Treaty (ATT)—which requires its adherents to tackle illicit and irresponsible arms exports—entered into force on 24 December, with sixty ratifying states and a further seventy signatory states. Coming only twenty-one months since the treaty first opened for signature, this swift entry into force is testament to the value of setting binding standards on a $110 billion industry, whose poor control has exacerbated conflict and slowed development in much of the developing world.

From now on, adherents to the ATT will have to forgo the transfer of arms if such a transfer would violate UN Security Council Resolutions or any other international agreement, or if the adherent has knowledge that such a transfer would be used for genocide, crimes against humanity, 'grave breaches' of the 1949 Geneva Conventions, or attacks against civilians.

Furthermore, any arms transfer that an adherent assesses might undermine peace, security, or human rights will have to be abandoned unless suitable confidence-building measures can mitigate this risk. Bringing the ATT into force has, in the words of UN Secretary General Ban-Ki Moon, opened 'a new chapter' in collective efforts to bring 'responsibility, accountability and transparency to the global arms trade'. It is now up to the treaty's parties to determine exactly how this chapter will be written. Many policy-making and monitoring mechanisms outlined in the treaty need to be fleshed-out.

The form, function, and funding of the ATT's Secretariat has to be decided; the agenda and procedure for the ATT's policy-making Conference of States Parties (CSP) has to be determined; as do states' reporting requirements outlined in the treaty. The coordination and implementation of the ATT's provisions for international cooperation and assistance will also be of concern to those small states that struggle to develop the national implementation measures required on ratification.

Thankfully, parties have not been resting on their laurels. Before the treaty even entered into force, meetings were held in Mexico (September 2014) and Berlin (November 2014) to begin tackling these issues. Mexico will host a provisional secretariat, which will be responsible for arranging the first CSP—now expected in August or September of 2015. More preparatory meetings will be held in Trinidad and Tobago (February 2015), Austria (April 2015), and Switzerland (June 2015).

Managing the pace of these preparations will be very important. Moving too slowly to put flesh on the bones of the treaty may jeopardise the strong momentum built behind the ATT to date. Moving too fast to finalise knotty issues—such as the form, function, and financing of the ATT's secretariat—may break the spirit of collaboration which characterised the treaty's development, and alienate important states that remain outside the treaty.

Neither China nor Russia have signed the treaty, and whilst the US has signed (but not ratified) the treaty, it refused to attend the second preparatory meeting on procedural grounds. According to a Stimson Center report on the meeting, the US clashed with the organising governments over whether those yet to sign the treaty, and non-governmental organisations opposed to the treaty, could attend.

At a meeting of the EU Non-Proliferation Consortium last September both Angela Kane, UN High Representative for Disarmament Affairs, and Jessica Hand of the UK Foreign and Commonwealth Office warned against biting off more than can be chewed, and it is unlikely that the first CSP will be the final word on the design of the ATT.

That being said, some clarification as to the reporting and verification mechanisms in the treaty will unavoidably be required in the coming year. Article 13 of the treaty requires states parties to provide an initial report to the as-yet unformed secretariat on the measures taken to implement the treaty within a year after its entry into force. These reports will subsequently be distributed among parties. They will have to demonstrate that the required national implementation measures outlined in Article 5 of the treaty have been carried out, and present these measures in a way that facilitates the identification and sharing of implementation best-practices.

The ATT Baseline Assessment Survey—carried out by the Stimson Centre and Coventry University—has gained support from a number of parties as a template for these reports. This survey has already generated a useful database of national approaches to ATT implementation, which is freely available to the public online. Adjusting this online platform for formal use within the ATT structure will involve tackling some difficult questions regarding the amount of information that is required, and the level of detail states would be prepared to share on such an open platform.

Similar concerns are likely to arise when parties consider their other reporting requirements, namely their annual reports of authorised or actual exports and imports of conventional arms listed under the treaty.

While the treaty itself states that these reports can exclude commercially sensitive or national security information, it gives little insight into how this judgement should be made. Neither does it give precise details about what information should be included, beyond the suggestion that these reports can contain the same information for arms transfers submitted to the United Nations Register of Conventional Arms (UNROC). UNROC reports do not include information on all conventional arms covered by the ATT and, being voluntary, are not necessarily familiar to ATT states.

Furthermore, the wording of the treaty is such that it is still ambiguous whether the first of these reports will be required on 31 May 2015, or the following year. The latter option would be the most pragmatic, and was supported by Argentina, Switzerland, France, Austria, Costa Rica, and Norway at the most recent meeting of states parties in Berlin. This would also reflect the initial report deadlines within the UNROC, adopted in 1991.

Perhaps most importantly, it is not clear exactly what role these reports are meant to play in verifying states' commitments under the ATT. Verifying that these reports do not contain any indication of violation, or that such indications have been omitted from these records, will go a long way

towards demonstrating the strength of the treaty, exposing any violations, and therefore deterring such violations in the first place.

Verifying treaty adherence involves a difficult trade-off between specificity and generality. Specific prohibitions are limited in scope, but make the identification of violations relatively easy. Whilst the ATT has some specific prohibitions—such as the transfer of arms despite UN Security Council Resolutions or other international agreements—most are broader in scope. Identifying an arms transfer that has not considered the potential for undermining peace or human rights 'in an objective and non-discriminatory manner' is far more complicated than identifying one directed towards an internationally-sanctioned state.

Nevertheless, a 2007 report on states' views on a prospective arms trade treaty by the United Nations Institute for Disarmament Research (UNIDIR) demonstrates that surveyed states felt that 'monitoring, information-sharing and enforcement' measures were extremely important. In a previous article for this publication, Ambassador Jo Adamson—former chief ATT negotiator for the UK—suggested that parties themselves will examine annual reports distributed by the secretariat, with the CSP eventually emerging as the primary forum in which questions of compliance may be aired.

This approach seems to take inspiration from the Chemical Weapons Convention (CWC); where parties discuss potential violations with each other through the convention's technical secretariat; only escalating to major policy-making organs when such discussions fail to reach a satisfactory conclusion.

Alternative approaches to compliance verification could place a greater responsibility on the ATT's Secretariat who, much like the International Atomic Energy Agency (IAEA) does for nuclear activities, would examine annual reports and raise any issues with the state concerned directly—turning only to other parties if any issues cannot be resolved.

Such an approach would place the responsibility for verification within a technical (and theoretically apolitical) body, but would commit parties to a strict and potentially expensive verification regime.

A more radical approach might distribute the responsibility for verification amongst states parties and civil society. Doing so would free up the ATT's as-yet unformed secretariat to tackle other matters, but would rely on the political desire of the former and the capabilities and clout of the latter to ensure the treaty is properly enforced. A collection of non-governmental organisations known as the Landmine and Cluster Munition Monitor currently serves the unofficial yet de facto verification body for both the Mine Ban Treaty and the Convention on Cluster Munitions.

The Control Arms Coalition has been developing a similar civil society monitoring group that may serve a similar role for the ATT. After an initial conference towards such a monitor in January 2014, the Coalition hopes to present its thoughts on the matter to the first CSP. In her report for VERTIC, Ambassador Adamson suggested that whilst non-governmental organisations might play a role in advocating for compliance with the treaty, they may not play a role in verifying it.

Monitoring procedures for the ATT will naturally evolve over time and are unlikely to be set in stone at the first CSP next year. However, the reports submitted over the coming year will set a precedent that may have long term impacts. States should begin to explore means of augmenting, and not replicating, the reports that can be submitted to UNROC to ensure they cover all pertinent transfers and can be usefully compared to each other. States may also wish to consider how export reports link to their national implementation reports, and whether either of these reports should be made publically available. The treaty 'to-do list' looks quite heavy over the coming year, but clarification on these matters should not wait too long. •

Science & Technology Scan

Automated Enrichment Monitors and IAEA Safeguards

Hugh Chalmers, London

The International Atomic Energy Agency's (IAEA) system of safeguards—which aims to detect and deter any attempts to misuse peaceful nuclear technology—faces several challenges over the coming decade. The number of nuclear facilities and materials under IAEA safeguards has increased by over ten per cent in the last five years alone. This trend is unlikely to change any time soon, as is the zero real-term growth restriction on the agency's budget. To do more with the same limited resources, the agency will have to take full advantage of modern technologies to implement safeguards more efficiently.

One such technology may be automated monitors of uranium enrichment processes, which can provide the agency with continuous remote monitoring of gas centrifuge cascades and, crucially, the enrichment level of the uranium gas that flows through them. Gas Centrifuge Enrichment Plants (GCEPs) can enrich natural uranium in its fissile isotope Uranium-235 with far less effort and far less space than other technologies such as gaseous diffusion or electromagnetic separation, and have emerged as the technology of choice for nuclear fuel and nuclear weapon producers alike.

The current approach to safeguarding GCEPs was first developed through the Hexapartite Safeguards Project (HSP) between 1980 and 1983. The project aimed to develop and implement an 'effective and efficient safeguards system' at specific GCEPs, and to create an adequate technical knowledge-base to evaluate the safeguards system. The HSP approach monitored the potential diversion of declared nuclear material by sending inspectors to scan, weigh, tag, and seal cylinders of uranium gas fed into and out of GCEPs on a semi-regular basis.

The system also aimed to detect the production of undeclared highly-enriched uranium through 'low frequency' unannounced inspections within the GCEPs cascade hall, involving visual inspections, environmental sampling, seals and radiation measurements.

This system may not be efficient enough to cover global enrichment capacity, which the World Nuclear Association expects to expand by some 70 percent between 2013 and 2020. The majority of this expansion will come from existing plants, which can already churn out tens of tonnes of highly-enriched uranium per year. Simply increasing the frequency of HSP inspections may not be a financially-sustainable solution.

While the agency's daily presence at Iran's GCEPs at Natanz and Fordow is very reassuring to those who question the peaceful nature of the country's nuclear programme, it is also extremely expensive. The agency's Director-General told the IAEA Board of Governors that extending the agency's expanded inspection activities in Iran up to July 2015 will cost it another €5.5 million on top of its regular safeguards activities, and Iran's enrichment capacity is dwarfed by that of other states.

This is where automated enrichment monitors could come in. By monitoring the characteristic radiation signatures (either spontaneous or induced) of various uranium isotopes in gas flowing into or out of centrifuge cascades, these systems can automatically detect the enrichment level being produced, and then notify the Agency remotely if these levels are higher than they should be. Three systems have been developed to date: the Canberra Continuous Enrichment Monitor (or CEMO), Los Alamos' Advanced Enrichment Monitor (AEM) and On-Line Enrichment Monitor (OLEM).

All have undergone field trials within large-scale GCEPs owned and operated by URENCO, and the most recent tests of OLEM have proven so successful that URENCO is investigating its use for operational, not just safeguards, purposes. According to a presentation given at the 2014

IAEA Symposium on International Safeguards the China Institute of Atomic Energy has also developed their own continuous and automated monitoring technology, which has been successfully operating within a Chinese GCEP for several years now.

While this technology is relatively mature (both the CEMO and OLEM systems are formally authorised for use in safeguards systems), none are currently used by the IAEA. Unfortunately, integrating new technologies into the existing safeguards systems is not easy. The safeguards approach to each individual facility within a state is described in detail within 'facility attachments' to the subsidiary arrangements to IAEA safeguards agreements with each state, and introducing new techniques to these attachments requires the agreement of both the agency and its hosts.

Negotiating the exact implementation of online enrichment monitors for safeguards purposes will be particularly difficult. GCEP operators are extremely wary of releasing classified or proprietary operational information to the agency, and whilst field trials suggest that automated systems could reduce the safeguards burden placed on operators this is likely to be small comfort if their trade secrets are leaked in the process. Both the CEMO and OLEM operate an 'information barrier' that delivers only a warning that enrichment levels are not as they should be. However, they still rely upon continuous and highly detailed measurements of uranium flows and enrichment levels. Whilst the agency would try to reassure states that it will not gain access to such sensitive information, its hosts may not be so comfortable allowing such powerful tools into their cascade halls.

Furthermore, the introduction of unattended monitoring systems into safeguards has political ramifications for the agency as well. Although a remote enrichment monitor may provide a more cost-effective means of monitoring Iran's controversial enrichment programme, it will never offer the same political confidence as boots on the ground, even if the agency is satisfied that the monitoring equipment works well and cannot be tampered with. And for those that already resent the safeguards burden placed upon them by the agency, it may be easier to accept the devil they know than the devil they don't.

Whilst on-line enrichment monitors show a lot of promise, this promise will be squandered if they cannot ultimately be integrated into IAEA safeguards operations. Understanding how modern technology can streamline agency safeguards is one challenge. Understanding how these technologies can be integrated into technically complex and politically sensitive safeguards agreements adds a significant further hurdle. •

Programme News

Verification and Monitoring Programme

This quarter, the VM team carried out legal analysis under the project on the universalisation of the Additional Protocol, and continued researching nuclear verification solutions for its project on Multilateral Disarmament Verification. In October, VERTIC's report 'Cybersapce: an Assessment of Current Threats, Real Consequences and Potential Solutions', was published as part of the Network of Social Change's Remote Control Project. It was written by Researcher Alberto Muti, Research Assistant/Administrator Katherine Tajer and Senior Researcher Larry MacFaul. Katherine Tajer also presented on the report at a panel organised by the Remote Control Project. The panel discussed the first phase of the project looking at how technology has impacted modern warfare.

Also in October, VERTIC took part in the International Atomic Energy Agency's quadrennial Symposium on International Safeguards. There, Alberto Muti presented on the database of national approaches to the implementation of IAEA Safeguards developed by VERTIC, while Researcher Russell Moul presented on the use of simulated environments to develop and test multilateral verification solutions.

In addition, VERTIC Researcher David Cliff and Verification Monitoring Programme Director David Keir led a group of UK-based specialists to Beijing, to initiate a new track-II UK-China technical dialogue on a range of issues, including nuclear, biological and chemical weapons security and threat reduction.

Alberto Muti speaking at the IAEA's Symposium on International Safeguards in Vienna, Austria.

November saw the first meeting of the Working Group dedicated to the launch of the British International Nuclear Disarmament Institute (BRINDI). VERTIC's David Keir attended and agreed to lead the BRINDI operational matters subgroup, with Paul Schulte, in the launch phase of the organisation.

VERTIC Executive Director Andreas Persbo attended the London GCC Nuclear Workshop in November, which was hosted by BASIC in cooperation with the Center of Information and Arabian-Russian Studies (CIARS). Mr. Persbo took part in the International Law Association conference on Verification of Nuclear Non-Proliferation Obligations in Cologne, Germany, and gave a presentation on the evolution of verification technologies over time.

In December, VERTIC's David Keir and Senior Researcher Larry MacFaul attended the Foreign and Commonwealth Office's Dialogue on Non-Proliferation. David Cliff attended the Vienna Conference on the Humanitarian Impact of Nuclear Weapons, and Researcher Hugh Chalmers attended the Next Generation Safeguards Professional Network Meeting at Idaho National Laboratory. The meeting included a shortened version of the INL Pre-Inspector Training course for upcoming IAEA Inspectors.

Andreas Persbo attended the Vienna Center for Disarmament and Non-Proliferation for a workshop titled 'New Technologies for Information Analysis to Support Non-Proliferation and Disarmament Verification', and took part in a panel on information security and accountancy mechanisms, talking about the use of modelling and simulation software for historical accountancy of fissile material.

Finally, David Cliff attended a conference on Nuclear non-proliferation: preparing for the 2015 NPT Review Conference at Wilton Park. •

National Implementation Programme

This quarter, the NIM team published a Chinese version of the 'National Legislation Implementation Kit on Nuclear Security', a legislative tool for states to draft nuclear security legislation. In addition, representatives of the Governments of Canada and the United Kingdom briefed the UN Security Council's 1540 Committee on VERTIC's 'Legislative Guide to National Implementation of UN Security Council Resolution 1540 (2004)' on 3 November.

Also, two chapters written by Scott Spence—one on efforts by the OPCW to promote universality and one on Articles XVIII to XXI—have been included in the second edition of 'The Chemical Weapons Convention: A Commentary'. The Commentary was edited by Walter Krutzsch, Eric Myjer, and Ralf Trapp and published by Oxford University Press.

Sonia Drobysz contributed an article on 'A new legal tool for States: the National Legislation Implementation Kit on Nuclear Security,' in Nuclear law in progress—Derecho nuclear en evolucion, XXI AIDN/INLA Congress—Buenos Aires 2014, edited by Mariano R. Manóvil and published by Legis Argentina.

From 1 to 3 October, Yasemin Balci and Sonia Drobysz worked with Mongolian officials on a draft bill to implement the Biological Weapons Convention (BWC) and the biological weapons-related requirements of UN Security Council Resolution 1540 (UNSCR 1540) in Ulanbator, Mongolia. This legislative drafting workshop was organized by the UN Office for Disarmament Affairs (UNODA) through the BWC Action.

Yasemin Balci, Sonia Drobysz and Mongolian officials in Ulanbator, Mongolia.

Sonia Drobysz was part of a panel on nuclear security and non-proliferation during the Inter Jura of the International Nuclear Law Association, held from 20 to 24 October in Buenos Aires, Argentina. Sonia spoke on the international legal framework regarding nuclear security and the 'National Legislation Implementation Kit on Nuclear Security'.

From 27 to 28 October, Yasemin Balci presented at the 'Biothreats and Biorisk: Bridging Science and Security' seminar in Penang, Malaysia. On 5 November, Yasemin spoke on the state of implementation of UNSCR 1540 at an event at Chatham House. On 6 November, Scott Spence attended an event organized by King's College London Project Alpha titled 'Preventing Proliferation Through Intangible Technology Transfer And Balancing Academic Freedom and Non-proliferation.'

Hugh Chalmers presented on implementation and verification of the Chemical Weapons Convention (CWC) on behalf of the NIM team during a roundtable organized by the Chemical Weapons Convention Coalition in Israel from 10 to 11 November. From 10 to 21 November, the NIM team conducted its third technical assistance visit to Cambodia, Laos, Malaysia and the Philippines with partners BAFA (the German export control agency) and the UN Office on Drugs and Crime, as part of a project under the EU CBRN Centres of Excellence.

From 1 to 5 December, Sonia Drobysz took part in work sessions and a national round table on the implementation of UNSCR 1540 in Kingston, Jamaica, which was organised by Jamaica, UNODA and its regional office UNLirec.

In the same week, Yasemin Balci attended the BWC Meeting of States Parties in Geneva, Switzerland and the CWC Conference of States Parties in The Hague, the Netherlands, while Scott Spence presented on the BWC and CWC during the Non-Proliferation Dialogue between Myanmar, the United Kingdom and the United States in Yangon, Myanmar which was organized by the Pacific Forum CSIS. From 15 to 18 December, Scott participated in the conference 'Nuclear non-proliferation: Preparing for the 2015 NPT Review Conference' organised by Wilton Park. •

Publications news

Cyberspace: An Assessment of Current Threats, Real Consequences and Potential Solutions

On 3 November 2014, VERTIC's cyber report 'Cyberspace: An Assessment of Current Threats, Real Consequences and Potential Solutions' was published by The Network for Social Change as part of its Remote Control Project. The Remote Control Project is supported by the Network for Social Change, and considers the impact of new military trends. The report addresses the role of cyber attacks in remote control warfare and considers the potential consequences of cyber attacks on civilian populations and on future international stability.

To promote the report, VERTIC's Katherine Tajer participated in a round-table discussion on Wednesday, October 15th at UCL. Alberto Muti also discussed the report's implications on Austria National Radio's 'Reality Check' on 3 November. •

Chinese version of nuclear security Kit now available

A Chinese version of the 'National Legislation Implementation Kit on Nuclear Security' is now available on the VERTIC website. The Kit was developed by VERTIC at the request of the Indonesian government, and presented by the vice president to the third Nuclear Security Summit, which took place in The Hague on 24-25 March 2014. •

1540 committee briefed on VERTIC guide

On 3 November 2014, representatives of the governments of Canada and the United Kingdom briefed the UN Security Council's 1540 Committee, at its 62nd formal meeting, on VERTIC's 'Legislative Guide to National Implementation of UN Security Council Resolution 1540'.

The publication is designed to be used as guidance for states when they are engaged in the process of implementing UNSCR 1540. It identifies and organises in one document the model laws, implementation kits and handbooks that have already been developed by the IAEA, OPCW, VERTIC and other legislative assistance providers to assist states in implementing the international legal instruments to prohibit and prevent the proliferation of nuclear, chemical and biological weapons and related materials. It is available on the VERTIC website in Arabic, Chinese, English, French, Portuguese, Russian and Spanish. •

News Flash

OPCW-UN mission on Syria completed

The OPCW-UN Joint Mission on the elimination of Syrian chemical weapons drew to a close on 30 September on completion of its mandate. The OPCW will continue to operate in the Syrian Arab Republic and has signed an agreement with the UN Office for Project Services (UNOPS), who will supply safety, security and logistical support. The OPCW will now undertake the remaining tasks in implementation of UN Security Council Resolution 2118, such as the verification of the ongoing destruction of chemicals outside Syria, the destruction of chemical weapons production facilities and the clarification of the declared weapons stockpile. •

Verification Quotes

'A declaratory ban, or a timetable not underpinned by the necessary trust, confidence and verification measures, would jeopardize strategic stability. Ambassador Susan le Jeune d'Allegeershecque, UK Ambassador to Austria, speaking at the Humanitarian Consequences of Nuclear Weapons conference in Vienna, in November 2014.

Appropriate verification remains a central element of an effective BTWC disarmament and non-proliferation regime. Verification measures have the objective to build further confidence among States parties in the continued adherence to their obligations under the Convention. European Union Statement by Mr Andras Kos, Minister Counsellor, Permanent Delegation of the European Union to the United Nations Biological and Toxin Weapons Convention (BTWC) Annual Meeting of States Parties, Geneva, 2 December 2014

We can all acknowledge that verification will become increasingly complex at lower numbers of nuclear weapons, while requirements for accurately determining compliance will dramatically increase….With that idea in mind, I am announcing today a new initiative: the International Partnership for Nuclear Disarmament Verification. The United States proposes to work with both nuclear weapon states and non-nuclear weapons states to better understand the technical problems of verifying nuclear disarmament, and to develop solutions. The United Kingdom and Norway have already pioneered this type of work. This new initiative will build on the spirit of that experiment to create a non-traditional partnership that draws on the expertise of talented individuals around the world, in both the public and private sectors. The Nuclear Threat Initiative will be a prime partner, providing intellectual energy and resources to the project. We are excited to work with them. Rose Gottemoeller, Under Secretary for Arms Control and International Security, delivering her 'Vision of Prague Endures' speech in Prague, Czech Republic, 4 December 2014.

Grants and administration

This autumn we were pleased to host Roberta Daveri as an intern to the Verification and Monitoring programme. During her three months at VERTIC, Ms Daveri assisted with our project on the Additional Protocol. We would like to thank her for her contribution and we wish her well in her future endeavours.

The VERTIC London office has sadly said goodbye to Sonia Drobysz. While Sonia will continue her work as a legal officer with VERTIC, she will do so from her home in Paris.

VERTIC is delighted to announce a new addition to the Verification and Monitoring team. Mr Hugh Chalmers, formerly with the Royal United Services Institute (RUSI), joined the team as a Researcher in September. Prior to his work with RUSI, Hugh interned for the programme and we are very pleased to see him return to VERTIC. •

building trust through verification

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VERTIC is an independent, not-for-profit non-governmental organization. Our mission is to support the development, implementation and effectiveness of international agreements and related regional and national initiatives, with particular attention to issues of monitoring, review, legislation and verification. We conduct research, analysis and provide expert advice and information to governments and other stakeholders. We also provide support through capacity building, training, legislative assistance and cooperation.

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