Societal Verification: Leveraging the Information Revolution for Arms Control Verification

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"Societal Verification" refers to the concept of incorporating non-traditional stakeholders into verification and transparency regimes to increase the likelihood that violations of international commitments are detected. In the case of nuclear arms control verification - which has heavily relied on tools such as on-site inspections and satellite imagery - societal verification should be evaluated as an additional resource as it may be possible to leverage certain technologies and publicly available data to help verify a state's nuclear activities.

Future verification demands will require a wide range of tools and with the increased amount of public information about individuals and their activities, the greater connectivity of people in previously isolated areas, and improvements in data mining and filtering techniques, open source information technologies may have an important role to play in future verification regimes. Past examples, both related and unrelated to nuclear activities, provide a good frame for determining how societal verification may be leveraged to verify future arms control agreements.

Verification of arms control and disarmament has historically been a technical discipline limited to experts in the United States and Russia. Moving toward deeper reductions, potential multi-lateralization of arms control and a growing recognition that non-nuclear weapons states and publics will need reassurance on the credibility of disarmament processes leads to a need to explore whether and how non-traditional stakeholders may contribute to verification efforts.

With more than 50 percent of the global population now having access to either a cell phone (more than five billion), the internet (more than two billion), or both, the ability to communicate and exchange information globally continues to spawn new thinking on how connection and communication tools could be applied to security challenges. Such platforms are already being utilized in increasingly unique scenarios – from monitoring and reporting atrocities in

Darfur to assisting emergency response personnel who are trying to locate disaster victims to tracking and reporting disease outbreaks.[1]

Within the arms control arena, there is an increased appetite to determine how this flood of open source data can be used to supplement information gathered through traditional verification systems, including National Technical Means. As information collection, analysis and promulgation technologies continue to evolve and perform increasingly diverse functions, such tools could potentially help empower nontraditional actors to monitor and report violations, increase transparency and even assist with verifying nuclear arms control agreements, and much of this may be done without users even knowing how their information is consumed. While open source platforms like Google Earth or Twitter may have an important role to play, such systems would not aim to replace existing practices or tools but could instead serve as a supplement to enhance our overall understanding and knowledge of a state's nuclear activities.

Though the speculated role and need for new verification techniques has increased, the potential for non-traditional mechanisms to contribute to nuclear arms control transparency and oversight is largely unexplored. Social media platforms like Twitter and Facebook have proven instrumental as convening and communication tools – but the potential for these mediums to play a specific role in the security arena is not yet fully understood. Similarly, other open source technologies are opening the door to a stronger public role in monitoring and verifying information, but it is not yet clear how this information can feed into traditional intelligence and verification systems. These methods also raise moral, ethical and legal questions that must be considered in a serious examination of the potential value to verification efforts.

Within the nuclear sphere, there are several areas ripe for exploration – can such technologies aid determinations of treaty compliance? Can information serve as a red flag or precursor for impending violations? By increasing the overall level of transparency, can such sources strengthen strategic stability between states with nuclear weapons and increase confidence amongst non-nuclear weapon states that obligations are being fulfilled? As arms reductions lead to deeper cuts, each warhead becomes more marginally important, leading to a desire for more intrusive verification. The fear of this intrusiveness may create a hesitancy to move forward with the arms control process. Can societal verification help to fill the gap?

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[1] The Departments of State, Defense and USAID recently partnered with the National Geospatial Agency to declassify satellite imagery so that the public can help map refugee movements and camps in Somalia. Work that would have normally taken months if not longer to complete was rapidly completed with the help of the wider public. Within just three days the U.S. government was able to track over 1 million people and plot nine different refugee camps throughout Somalia. Earthquake victims in Haiti tweeted their location or the location of people who were stranded to emergency response personnel who were able to use the coordinates to locate and rescue the people who were trapped.

International verification needs will demand an increasingly diverse set of capabilities and tools. Creative approaches that utilize societal verification instruments and input could provide an additional layer of assurance and insight if leveraged appropriately. Significant issues must be explored before we can wholly understand and calculate the value of such tools, but opportunities for strengthening a 21st century verification regime abound if public and private resources are focused on exploiting such mediums.

Verification Then and Now

Nearly 25 years ago, U.S. and Soviet inspectors conducted the first set of on-site inspections under the Intermediate-Range Nuclear Forces (INF) Treaty. When the START accord was negotiated and ratified, its verification provisions expanded to include the exchange of telemetry information and pledges of noninterference with National Technical Means. Over time, this provided clearer insight into Russia's strategic forces and instilled a sense of predictability in what was a tenuous relationship throughout the Cold War and beyond.

While U.S. and Russian inspectors have built a deep reservoir of expertise after more than 20 years of conducting onsite inspections and data exchanges, this experience is largely limited to verifying bilateral agreements. We have virtually no experience verifying multilateral agreements. In the future these types of agreements will likely require different approaches and new tools as more players are brought into such arrangements and states reduce their arsenals in pursuit of an eventual world without nuclear weapons.

Verification tools will become even more important as we move to lower numbers of nuclear weapons and states need the ability to detect and monitor smaller items and quantities of nuclear material. Non-strategic forces will also need to be accounted for and verified, a difficult challenge given that states with large non-strategic arsenals cannot even agree to a common definition as to what exactly constitutes a non-strategic weapon. Warheads held in containers in storage facilities will also need to be monitored and accounted for should all non-deployed weapons be included in a future treaty. In fact, future arms control agreements will likely require the exact number of warheads to be counted, a metric inspectors have not used in past agreements. It may even be necessary to monitor the cradle to grave lifecycle of individual warheads and materials.

The existing verification regime is unlikely to be suitable for future arms control initiatives. For example, On-site Inspections and National Technical Means may not be sufficient in all future arms control agreements and while such techniques have served the United States and Russia well in the past, there is now an opportunity to pursue new verification tools that could, among other things, reduce implementation costs and be less disruptive at operational facilities.

The Role of Technology in the Nuclear Arena

The potential for societal verification tools and technologies to play an important role in the national security arena is promising, but before determining what tools are most suitable for arms control and nonproliferation objectives, the first priority is to specify what it is we want to find, locate or track. It is useful to separate these objectives into four distinct categories:

- *Activities.* Who is doing what?
- *Locations.* Who or what is where?
- *Connections.* Who is talking to/engaged with whom?
- *Attention.* Who is paying attention to what?

Within the nuclear sphere, verification provisions have historically been utilized as a means of bolstering a state's confidence that other parties to an agreement are in compliance with their treaty obligations. The primary function has been to verify the accuracy of a state's declared data and to confirm treaty compliance – that is verify activities and locations, or confirm that a state is doing what it said it would do and deploying items where they indicated items would be deployed.

Over time, verification mechanisms have helped ensure strategic stability by enhancing transparency and creating predictability within a strategic relationship. Verification tools have also served as a red flag for observers and analysts who are monitoring a state's behavior – if a state fails to comply with its treaty obligations or is obstructing transparency and verification activities it can be an indicator of future violations or instability.

Platforms like Twitter are less useful for strictly determining treaty compliance, but such tools can enhance transparency and in some cases, serve as an indicator of what is happening inside a country. Information analysis tools are critical for targeting, extracting and compiling useful information from the stream of publicly available content. Given the sensitive nature of this particular topic, however, there is a limit to what open source and social media tools can communicate. These tools and technologies cannot replace the function of an inspector on the ground but they may be able to enhance the overall picture of a particular country at a snapshot in time.

Experts are still studying how users can be motivated to track and report certain activities and how crowd-sourcing technologies can best be leveraged. In 2009, the Defense Advanced Research Projects Agency (DARPA) sponsored the Red Balloon Challenge which challenged teams and individuals across the U.S. to utilize various crowd-sourcing techniques to correctly locate ten, 8-foot red balloons which were simultaneously released in parks across the United States. The MIT Media Lab team correctly identified all ten balloons in 8 hours and 52 minutes after it tapped into an extensive social network that helped locate and track the balloons. Before the start of the competition, the MIT Media Lab team

designed an incentive based model that allowed the team to "recruit" nearly 5,400 individuals in a time span of about 36 hours. [2]

The State Department is currently collaborating with a number of partners to determine how new and existing technologies can help verify activities and monitor locations. One potential avenue would be to equip arms control and safeguards inspectors with safeguard/verification applets for smart phones and tablet computers.[3] Some of the State Department's other examples include:

- Connecting all safeguards/verification sensors in an inspected facility wirelessly to an inspector's iPad.
- Employing the use of specially designed quick response codes to rapidly decode and track munitions, warheads or smaller items using an iPad.
- Real-time access to virtual models of a facility while it is being inspected, assuming adequate broadband connectivity.
- Adding sensors such as Geiger counters giving citizens the ability to detect radiation spikes.

In order to cultivate new information, the State Department is also exploring how states might issue "public verification challenges" as a mechanism for proving that the state issuing the challenge is complying with its treaty obligations.

Nongovernmental organizations, independent scientists and other nonstate actors also have a role to play. As satellite access expands for instance, nontraditional actors can provide additional insight and expertise by using this imagery to give the public a better understanding of what is happening in certain countries. For example, the Institute for Science and International Security (ISIS) utilizes satellite imagery to analyze nuclear sites and facilities in Iran, Syria, Israel, Pakistan, India and North Korea.

Tamara Patton, a graduate student at the Center for Nonproliferation Studies, has used 3D geovisualization techniques to explore nuclear weapons infrastructure and force developments in Pakistan and North Korea. Using only open source information, Patton employed Google Earth and Google SketchUp to estimate fissile material production rates, verify design information for certain facilities and monitor technology developments.[4] As Patton has noted, "It's

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[2] *DARPA Network Challenge Project Report*. Feb 16, 2010, <http://www.eecs.harvard.edu/cs286r/archived/fall10/papers/ProjectReport.pdf>

[3] The Department of State, Bureau of Arms Control, Verification and Compliance (AVC) through the Key Verification Assets Fund (V Fund) has released its first ever unclassified needs document for verification technologies research. For more on these and other examples, see BAA-2012-DOS-AVC-VTRDN.

[4] Tamara Patton, "3D Geovisualization for Nuclear Force Development Analysis," FAS Conference on Using Satellite Imagery to Monitor Nuclear Forces and Proliferators, Washington, DC, 7 June 2012.

important to recognize the vast potential of freely available software tools like Google Earth and Google SketchUp to identify and analyze nuclear proliferation challenges. Such tools not only allow us to create an immense 'neighborhood watch' effect, but they also allow students and professionals in nonproliferation to perform their own analysis rather than relying on a few confined sources."[5]

The Satellite Sentinel Project also utilizes satellite imagery as a tool for monitoring and reporting atrocities in Africa. "DigitalGlobe satellites passing over Sudan and South Sudan capture imagery of possible threats to civilians, detect bombed and razed villages, or note other evidence of pending mass violence." The Harvard Humanitarian Initiative then analyzes and produces reports on the imagery and passes that analysis to the Enough Project, which utilizes social media platforms like Twitter and Facebook to alert the public to possible atrocities.[6]

Data gathered through non-traditional, commercial sources has a contribution to make for verification and monitoring of arms control and disarmament as well. For example, information collected by companies about attempted procurements may give one a glimpse into the activities of potential violators. Currently, in most cases, this information is not used by governments to learn about the activities of illicit procurement networks or their customers, nor is it shared within industry to better enable companies to make responsible export decisions. This is an important body of information to leverage for nonproliferation efforts, but may also prove valuable for arms control verification.

Challenges

There are several challenges that need to be studied before we can understand the role that broad use of non-traditional information can play in a verification regime. The first task in defining a verification system is to define the detection goals. In the case of a significant expansion of the verification "universe" that might accompany deep, multilateral reductions or disarmament, the goal for societal verification efforts will need to complement traditional tools (such as reporting, OSI, tags, seals, etc.) in specifically designed ways. This may include any or all of the following, but the broader the mandate the greater the challenges:

- Defining **patterns** (e.g. of behavior, activities, movements of people and things)
- Looking for **shifts** (e.g. changes of behavior, activities, movements either from the norm or from the expected)

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[5] Tamara Patton, "Monterey Institute Student's Innovative Geospatial Analysis Work Cited by Assistant Secretary of State Rose Gottemoeller," October 28, 2011, CNS, http://cns.miis.edu/activities/111028_gottemoeller_patton.htm

[6] See Satellite Sentinel Project, "Our Story," http://satsentinel.org/our-story

- Identifying **outliers** (a single activity, person or pursuit that doesn't match the expected or predicted)
- Filling in **blind spots** (e.g. where are there gaps in knowledge from traditional verification systems)
- Detecting **signals** (e.g. something which may indicate something else but which is not itself a proscribed activity)

Several related challenges need to be explored in greater depth:

Volume and quality. Given the sheer volume of information, one of the central challenges for utilizing information and communication technologies is how to sift through the vast amounts of raw data. As communication barriers drop and more information is released, the quality of the information typically declines as well. More work needs to be done on how information can be filtered to avoid information overload. Data analysis tools can help manage this problem, but in order to process such information users need to have a very specific idea of what it is they're looking for. In the arms control arena, this may be harder to identify upfront, particularly if the goal is to uncover unknown or undisclosed activities. In many cases language may be a barrier to effectively integrating this information as well.

Timeliness. A related challenge to volume and quantity is the timeliness of the collection and analysis of information that might contain indications of treaty violations or breakout. In order for a system to have deterrent value – a core principle of verification approaches is that detection of proscribed activities never 100% assured – the violation must be assuredly detected with enough time to allow for response through political, diplomatic or other means. It is academically interesting, but not policy relevant, to ask what we should have seen through the lens of social media and other open source information after the resulting activity is exposed. It is more important to be able to identify in near-real time the indicator of proscribed activity. Without this capability, these tools may help build a case for action and response but may not allow for the prevention of such activities.

Validation and quantification. Another central challenge is how the validity of such information can be confirmed and how high degrees of confidence can be established and maintained. As information is collected and analyzed, there will inevitably be "false positives" or even disinformation campaigns that will also need to be identified and assessed. It is important to ask whether and how the contribution of these non-tradition verification tools can be quantified and factored into the calculation of confidence in verification systems. If it is not possible to quantify, then these approaches may be of marginal benefit but not fully integrated into systems, and, in the worst case, may prove more harmful than beneficial.

Interference. Efforts aimed at undermining the free flow of information will also need to be managed. During the protests in Tahrir Square in Egypt, the

government attempted to shut down internet connections and block the use of social media tools. More recently in China, party officials announced that Sina Weibo users would have to register their accounts so that Chinese officials can implement a "point system" that is aimed at controlling the spread of "untrue information." Sina Weibo is a popular microblogging site in China and the introduction of a point system has spurred some concerns that it is a method of state censorship. Users who spread information that is deemed "untrue" are docked points and restricted from using certain functions if enough points are lost. [7] Some states may discourage or actively interfere with citizens' efforts to publicize certain information, particularly in the nuclear arena.

Classification and information security issues. The arms control and nonproliferation field has historically been shrouded in secrecy, and often with good reason. It is not yet clear how publicly derived information can provide added visibility into systems and processes that have typically been closed to the public. For the arms control arena in particular, this interface presents several challenges. It is not yet clear how such information should be integrated into more formal verification processes or whether such data should be incorporated with traditional forms of intelligence. Open source (or "all source) analysis already is practiced in many intelligence efforts, and duplication of effort should be avoided where possible. However, intelligence analysis and verification do not share the same goal and these efforts are helpfully deconflicted for political and technical reasons.

Ethics and rules of engagement. Domestic and international legal systems are not well equipped to deal with broader issues such as legal protection for intentional or unintentional whistleblowers. As has already happened, these technologies have not always been used intentionally. For example, an unknowing observer live-tweeted the raid in Abbottabad when U.S. SEALS stormed bin Laden's compound. If such information can be identified at an earlier stage, what protection or rights should be afforded to civilians who unknowingly publicize sensitive information? Civil liberty issues will also need to be addressed in cases where these tools are used to track or monitor certain individuals. Overall, this may argue for the development of a "values system" in support of individuals providing information, and abstaining from involvement in activities prohibited by international law.

Even with such challenges, societal verification approaches are promising. Leveraged effectively and responsibly, these tools can help ensure a safer, more secure world where citizens are more informed and more active in helping to reduce nuclear dangers.

[7] Keith Wagstaff, "Weibo Credit: Chinese Microblogging Site Tests Points-Based Censorship," Time Techland, June 4, 2012, http://techland.time.com/2012/06/04/weibo-credit-chinese-microblogging-site-tests-points-based-censorship/

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Prior to joining NTI, Hinderstein was deputy director and senior analyst at the Institute for Science and International Security (ISIS). There, she managed projects designed to integrate technical, scientific and policy research, in order to build a foundation for addressing emerging proliferation challenges.

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