Open Skies: transparency in stormy times

The Treaty on Open Skies opens the full territory of its parties 'from Vancouver to Vladivostok' to cooperative aerial observation. In contrast to monitoring by satellite, images are shared between the observing and the observed state. Each party involved knows what the other has seen; a precondition for reducing misperceptions and for enhancing transparency. The treaty limited resolution of 30cm (Ground Sampled Distance, GSD) for optical cameras allows for identification of military vehicles such as tanks and aircraft, which are parked in the open, but does not enable more detailed images to be taken that would allow recognition of sensitive details (electronic equipment, for example).

This level of resolution also facilitates monitoring of military and civilian infrastructure, such as industrial plants, airports, roads, and railway lines. The level of current activity can be derived from indicators such as the number of vehicles observed. Thermal infrared cameras with 50cm GSD and Radar imaging devices with 3m GSD are also allowed under the treaty arrangements, but have not been used so far.

The new Russian Open Skies Tupolev-214 aircraft (Source: VEGA-M, Moscow)

In this issue

The treaty comprises all NATO states (except Albania), the Russian Federation, Belarus, Ukraine and a few other states. The agreement was signed in 1992 and entered into force on 1 January 2002. Flights are conducted within a quota system. The Russian Federation and the US, for instance, are entitled to 42 observation missions annually in other states (known as the 'active quota') and have to accept up to 42 missions in their own country annually (dubbed the 'passive quota'). France, Germany, the UK and Ukraine have an active and passive quota of twelve each. Other parties have a smaller quota. In 2014, some 110 flight missions are foreseen, many of them as shared missions between two or three parties.

Treaty implementation functioned quietly for many years (see Hartwig Spitzer, *News from Open Skies*, VERTIC Brief 8, February 2009). However, the years 2013 and 2014 brought greater attention to the treaty in countries' capitals. A long overdue modernisation of sensors was started with the introduction of digital aerial cameras by Russia. But the certification of these cameras was questioned in Washington and only approved after a long delay.

Meanwhile, the Ukraine crisis and increasing tensions between NATO states and Russia have created a difficult politico-military situation. Interestingly, implementation of the Open Skies treaty has been largely unaffected. This seems to indicate that parties value the cooperative transparency created by the treaty. However, after the repeated downing of aircraft over Eastern Ukraine, restrictions of Open Skies flights in Ukraine and near the Russian-Ukrainian border have been implemented recently.

Technical modernisation

At present ten parties operate Open Skies aircraft (Bulgaria, Canada, France, Hungary, Romania, Russia, Sweden, Ukraine, United States, and Turkey). The majority of the remaining parties either lease aircraft from one of these ten states or arrange shared missions with other parties. The aircraft of Bulgaria, Hungary, Romania, Russia, the Ukraine and the US are vintage models, having been built 30-50 years ago. Modernisation is therefore an issue.

The same holds for the cameras in use. The majority of the Open Skies black and white film cameras date back to the

1970's. That is why the Informal Working Group on Sensors (IWGS) of the Open Skies Consultative Commission (OSCC) started in 2006 to explore the technical and legal preconditions for the introduction of digital aerial cameras. In May 2010 the OSCC decided that modern commercially available digital aerial cameras with up to four colour channels (blue, green, red, near infrared) could be used. This was a decade after the introduction of digital aerial cameras for civilian remote sensing.

The long delay had two causes. First, a provision of the treaty mandated restrictions on using the full sensor set in the years 2002-2005, and second, initial reluctance from Russia to accept modern four colour aerial cameras. Russia wanted to ban multispectral capabilities, that is, pictures taken in narrow wavelength bands of a few nanometres width which would allow, for example, analysis of the chemical composition of materials.

Nevertheless, once specifications for technical upgrades had been agreed by states through the OSCC, the Russian Federation was the first party to start developing its modernisation programme with a budget of some 220 million USD. At the Treaty Review Conference of June 2010, Russia announced its intention to acquire and equip two modern long-range Russian-built aircraft: Tupolev-214s (see photo, page 1). The first aircraft had its maiden flight in spring 2011. Each aircraft has been equipped with three large format digital aerial cameras—the German-developed DMC II from ZI/Intergraph, one for a vertical view and two for oblique angles.

These cameras yield images in four colour channels plus a separate black and white channel. They cover ground strips of 8 and 16 km when flown at altitudes of 1875 m and 3830 m, respectively, at treaty-mandated resolution of 30 cm (GSD). The new Russian aircraft will also be equipped with a thermal infrared line scanner at 50cm GSD and a synthetic Radar sensor of 3m GSD. The completion of the upgrade project has been plagued by several delays, however. Consequently, certification and entry into treaty use is expected not sooner than 2016.

Russia also initiated a modernisation programme for the cameras on its medium-range turboprop aircraft, Antonov-30,

for flights over European states. Russia ordered and acquired tailor-made cameras for Open Skies use from a small Russian high-technology company called KSI. These cameras use a multitude of lenses and detector chips to image a wide strip on the ground from a choice of three flight altitudes. Russia will use a similar camera on its one long-range Tupolev-154 aircraft for flights over the US and Canada.

Avoiding illegal manipulation of digital data

Digital image data can be manipulated. To prevent data from being illegally altered by a party, the Sensor Group agreed after 2010 on a sequence of steps, which were then adopted in decisions of the OSCC:

i. Raw image data and supplementary information such as navigation data are recorded during flights on removable storage media under the supervision of inspectors from the observing and the observed state.
ii. These storage media are sealed before being processed on the ground into the official Open Skies digital data format, again under supervision by inspectors from both sides.
iii. The final product of annotated Open Skies images data is duplicated.
iv. The identity of data duplicates is verified.
v. Storage media containing the raw data recorded during the flight are erased in a verified way.

Beyond these steps any unsanctioned copying of any information is strictly prohibited.

Certification controversy

The certification of the first Russian digital camera triggered a major controversy among two parties and a seven months blockade of the IWGS. On 2 July 2013, the Russian Federation had invited all parties of the treaty to send representatives to the certification event for the Russian digital aerial camera OSDCAM 4060 on board an Antonov-30 aircraft.

On 21 September 2013, 54 foreign delegates from 22 countries assembled in Kubinka near Moscow. Most of the certification steps were executed more or less smoothly: in-flight data-taking over a calibration target; ground inspection of the aircraft; resolution reading and determining the minimum flight altitude to enable 30 cm GSD for the four sensor con-

figurations; processing of the raw data into the final format; duplicating the final data and verifying the identity of duplicates; and erasing the raw data using a Russian device.

However, US representatives requested permission to use devices of their own which could record all software operations while the camera was being operated and during data processing into the final format. This was declined by Russia. The US team had been advised from Washington to check that non-removable storage units of the on-board computer and the ground processing station would not permit 'secret' recording of data not accessible to others. The Russian delegates pointed out that the use of such devices to record software operations had not been approved by OSCC decisions.

Although chief inspectors from 21 attending foreign states were content with the overall outcome, the US delegation was advised by Washington not to sign. Since certification requires consensus of all parties participating in the event, treaty use of the Russian camera was put on hold. Initially, it was hoped that the matter could be resolved in two weeks. Those two weeks became seven months, and on 29 October the US tabled conditions for its signature to all parties:

i. Russia should allow other parties to purchase non-removable storage media after an observation flight or alternatively;
ii. Russia should use only removable data storage media both in on-board and ground processing stations.

These demands were rejected by Russia on 13 November 2013. Condition (i) would have implied a disassembly of processing devices and loss of manufacturer warranty. Condition (ii) would have required redesign of the equipment.

What triggered the US position? It was a deep mistrust in parts of the Department of Defense and intelligence agencies about the 'integrity' of data accessible to Russia, as well as fears that Russia could extract images at better than treaty resolution.

An extended bitter interagency dispute in Washington between the State Department and the White House on one side and the Department of Defence and intelligence agencies

on the other side became public in April 2013 through press reports (see for example, William Kristol, 'A Secret Fight over Russia in the Obama Administration', *Weekly Standard*, 13 April 2014). Additional concerns were voiced about potential future Russian 'spy flights' using the Tupolev-214 aircraft equipped with Synthetic Radar at 3m GSD. (See article by Bill Gertz, *Washington Times*, 30 April 2014).

The matter was finally decided in the US National Security Council. On 21 May 2014 the United States approved certification of the Russian digital camera 'with the understanding that this certification does not establish a precedent for US certification of any sensor/aircraft combination in the future'. In the end, the White House was confronted with the choice of either quitting the Open Skies Treaty or of certifying the Russian camera, which would only be used in Europe. The largely unimpeded continuation of Open Skies flights over Russia by the US and other parties during the Ukraine crisis had underlined the relevance of the treaty.

Open Skies flights during the Ukraine crisis

The ousting of the Ukrainian president, Victor Yanukovitch, on 21 February 2014 marked the beginning of open conflict in Ukraine itself, and in Ukraine-Russia relations as well as in the relations between Russia and members of NATO and the European Union. How was the Open Skies implementation affected by this complex and serious crisis? Surprisingly little, with a few significant exceptions. In general, Russia and all other parties have continued to adhere to the treaty and carry out and allow flights as agreed.

The crisis paradoxically strengthened support for and the visibility of the treaty in capitals, because it was proved to work in a particularly difficult political situation. Transparency regimes like Open Skies work best within a limited zone of relations between former and potential future adverseries. A mix of residual fears and suspicion, on the one hand, and a sufficient willingness to cooperate, on the other, motivate parties to hold on to the regime (see for example. D. Lindley, 'Cooperative Airborne Monitoring', in *Contemporary Security Policy*, Vol. 27, No. 2, August 2006, pp. 325-343). This holds true for Open Skies, so far.

Initially, after the regime change in Kiev, Open Skies flights

increased. Parties exploited a provision in Annex L of the Treaty: 'States parties may agree on a bilateral and voluntary basis to conduct observation flights over the territory of each other following the procedures regarding the conduct of observation flights'. Two such flights were conducted, by Sweden and the US, Western and Central Ukraine on 12 and 14 March 2014 at Ukraine's invitation.

Another flight by the US on 21 May 2014 covered the full territory of Ukraine, including regions close to the Russian border and the border of Moldova/Transdniestria. In addition Ukraine asked the Russian Federation for agreement to a Ukrainian flight over the western border region of Russia on a bilateral voluntary basis. The flight was conducted on 21-23 March 2014. Ukraine requested another such flight for the period 26-30 May 2014. This time Russia said no; an indication of the increasing tensions between Russia and Ukraine.

In total, foreign parties performed 22 quota flights over Russia from 1 March to 15 August 2014. Initially, most of them covered areas in South Western Russia close to the Ukrainian border. The aforementioned significant exceptions to the unimpeded implementation of the treaty were threefold:

1. No flights were made by NATO states over Crimea after its annexation by the Russian Federation. Until March 2014, Open Skies flights by NATO states regularly covered the Crimean peninsula as part of missions in the Ukraine. It was a welcome opportunity to take a look at the port and ships of the Russian Black Sea fleet in Sevastopol.

Naval forces are excluded from major arms control treaties but are included in the Global Exchange of Military Information, which was agreed by the Conference on Security and Cooperation in Europe (CSCE) in Budapest on 28 November 1994. On 12 May 2014, Russia invited flights over Crimea as part of missions over Russia. But Westerns states decided not to accept this offer since it would imply a recognition of the annexation.

2. A deferral of Open Skies flights over Ukraine for the time being due to air space safety concerns after the downing of several Ukrainian military aircraft and the Malaysian airliner MH17 over Eastern Ukraine; and

3. A recommendation by Russia to other parties in June 2014 to avoid flying closer than 45 km to the Ukrainian border because air space safety could not be guaranteed in that area.

Open Skies aircraft shot down
On 6 June 2014 one of the two Ukrainian An-30 Open Skies aircraft was shot down near Slaviansk in Eastern Ukraine. The plane was allegedly hit by a MANPAD fired by separatist forces at an altitude of 4050 metres. Ukrainian experts claimed that one of the two engines was hit by a modern Werba-type missile, which was introduced in Russian forces in May 2014.

Three of the eight crew members escaped by parachute, five were killed (see http://fakty.ua/182976, in Russian). The plane was on a national surveillance mission, outside the framework of the Open Skies Treaty, at the time. Still, this illustrates the limits of the Open Skies-type approaches in asymmetric conflicts. The Open Skies regime requires the cooperation of two states that can provide a safe airspace. It is unsuited for conflicts involving irregular non-cooperative forces. As a consequence, after June 2014 parties put their scheduled flights over Ukraine on hold due to airspace safety concerns.

In conclusion, it seems remarkable that Russia has adhered to the treaty by accepting an intensification of flights in a region of alleged troop concentrations. Unfortunately the results from those flights shed little light on the debates within the Organisation for Security and Cooperation in Europe (OSCE) on troop concentrations. The analysis of the pictures is classified and restricted to the national level. The political debate would profit from faster, integrated analysis and from sharing of findings and conclusions between parties. The transition to digital sensors would support such an approach.

Future challenges
The future implementation of Open Skies faces technical and political challenges. The transition to digital cameras has been started in Russia. Canada, Norway, Sweden Turkey and the United States are also planning to replace the film camera(s) on their aircraft with digital aerial cameras in 2016 and beyond. Digital imagery will provide enhanced information from the colour channels and reduced processing and analysis times. The Antonov aircraft of Bulgaria, Hungary, Roma-

nia, Russia and Ukraine are reaching the end of their service lifetime in the next few years. Investment in new aircraft and lifetime extensions are needed in order to maintain treaty implementation at a healthy level.

Politically, the use of Open Skies assets in crisis situations should be further developed, both among treaty parties and in cooperation with international security organisations like the OSCE and the United Nations. Annex L of the treaty foresees the option that the Open Skies Consultative Commission facilitates the organisation and conduct of extraordinary observation flights over the territory of a state party with its consent upon request of bodies of the OSCE and other relevant international organisations.

In summary, the Open Skies treaty and its implementation have withstood two harsh tests: a certification controversy and the Ukraine crisis. Two major powers, the Russian Federation and the United States are adhering to the treaty, so far, and they use it *inter alia* for verification of their nuclear forces in the framework of the New START Treaty.

The Russian investment in modernisation of its Open Skies assets outpaces all other modernisation programmes. Because of the present crisis in NATO-Russia relations, Europe needs frameworks of cooperative security. Open Skies is one relevant element of such a framework. It would therefore seem wise for European and North American decision-makers to support the treaty and enhance their cooperation under it. ●

Hartwig Spitzer
University of Hamburg

Verification Watch

After MH17: BA chief calls for missile treaty

Rebecca Hirschfeld and David Cliff, London

The downing of Malaysia Airlines Flight MH17 over eastern Ukraine on 17 July 2014 by a surface-to-air missile, widely believed to have been fired by pro-Russian separatists, brought concerns about commercial flight paths over areas of conflict around the world to the fore.

In early August, in light of the crash, Willie Walsh—head of British Airways' parent company, IAG—made a public call for a global treaty to track surface-to-air missiles (SAMs), and who is responsible for them. He suggested that the International Civil Aviation Organisation lobby the UN to bring about such a treaty and bring it into force. As a 'minimum', said Walsh, there should be a 'complete inventory' of all these weapons, clearly identifying which government had responsibility for managing them, and a system for tracking their whereabouts.

Such a treaty would not be easy to implement. A central problem with monitoring and verifying such a treaty on SAMs is the variety of these weapon systems and in many cases their potential to be quickly moved around. Shoulder-launched SAMs are the most portable, though typically lack the range to strike civilian aircraft at cruising altitudes. Other SAM systems, such as the 9K37 BUK launcher that is thought to have been used to bring down MH17, are vehicle based—so inherently mobile.

Air crashes caused, or thought to have been caused, by SAMs being operated in areas of conflict is not a new phenomena. SAM systems were for instance linked to the downing of Lionair flight LN602 in Sri Lanka in 1998 and a TransAVIAexport cargo plane downed in Mogadishu in 2003.

Concerns regarding SAM systems have been addressed to some extent in the past, including, notably, as part of the 2003 G8 'Action Plan'. This initiative, however, focused only on one class of surface-to-air system: Man-Portable Air Defence Systems or MANPADS (shoulder-launched weap-ons). The G8 agreed to implement tighter export controls and provide assistance in the collection, storage and destruction of MANPADS deemed surplus to national security requirements. More recently, the global Arms Trade Treaty (ATT) includes missiles and missile launchers in its list of items to which the treaty applies.

The ATT, which is set to come into force later this year having now received a sufficient number of ratifications, requires member states to set up national systems for regulating the export of conventional arms—with a view to preventing their misappropriation and misuse. This latest development is welcome, given the fact that such weapons continue to circulate on the black market where they can be picked up by insurgent groups.

Mr Walsh's ambitious proposal would necessarily require participating states to report where all such systems were in territories under their jurisdiction. Herein lies other difficulties. SAMs exist in huge numbers around the world and determining a credible baseline would require intensive effort, on the part of both states and the UN. Some states, however, may not wish to participate in such reporting out of concerns that the disclosure of the location of military hardware might impact their own national security.

In other cases—for example where states are experiencing ongoing insurgency movements and may not have full control over their territory—governments may not be able to accurately say where any SAM systems are. Nor might they be able to confirm how many and what kind any non-state actors operating in their country might have in their possession.

As the investigation into the downing of MH17 continues, so this debate is likely to persist. There is, though, little in the way of evident pressure being brought by airline companies at large for a SAM treaty (or, as an alternative, for onboard protective systems). For now, airlines deal with the threat from ground-based weapons by stopping or temporarily diverting flights over conflict areas, as they have done

recently with flights over Iraq, Syria, and into Tel Aviv airport after, in that case, a Hamas-fired rocket landed on the airport grounds.

While a treaty addressing SAM systems would, if properly implemented, be of great value to commercial airline security, the difficulties of designing and implementing a treaty of this nature look hard to overcome in the near future without, it appears, even greater incentives for the international community than the aircraft attack incidents to date have presented. •

INF dispute highlights treaty compliance monitoring

Alberto Muti, London

In July 2014, the United States accused Russia of violating the Intermediate-Range Nuclear Forces (INF) Treaty. The announcement came in the annual US Department of State report on compliance with arms control, nonproliferation and disarmament agreements for 2013.

The INF treaty is a landmark bilateral agreement between the United States and Russia that pioneered several verification techniques. Entering into force on 1 June 1988, the treaty obliged each party to dismantle all nuclear and conventional cruise and ballistic missiles with a range between 500 and 5500 kilometers within three years of that date. It also prohibited construction and testing of missiles of this kind. While the INF treaty has indefinite duration, the verification protocol attached to it expired in 2001, leaving verification of the agreement solely to each party's national technical means. The current dispute between the two parties underscores the importance of verification in ensuring that an international agreement is not only implemented at its onset, but also respected in the future.

The US first raised concerns on Russian compliance with the treaty in 2013, and briefed NATO on the issue in January 2014. The July 2014 report, however, does not speak of 'concerns': rather, it explicitly states that Russia is violating the agreement by producing a ground-launched cruise missile, the R-500. While early testing of the R-500 in 2007 and 2008 was limited to approximately 200 kilometers (allowed under the INF), further tests allegedly extended to

ranges prohibited under the agreement. A second Russian system, the RS-26 ballistic missile, raised concerns, but its status under the agreement is unclear, as, in some payload configurations, it exceeds the 5500 kilometers range and can be counted as an ICBM. The RS-26 was not mentioned in the compliance report.

Russia replied to the accusation by raising concerns on some US activities. Russian officials have claimed that the converted missiles used by the US as targets in ballistic missile defence tests might fall under INF definitions, and that the launchers used to fire the interceptor missiles may also fire intermediate-range missiles against ground targets. Furthermore, the US production of unmanned drones has come under scrutiny, as Russian officials have equated drones to ground-launched cruise missiles. The two parties met earlier this month (on 11 September 2014) to discuss the issue, but came to no conclusion.

The INF treaty broke new ground in arms control. While all previous agreements had put ceilings on the number of weapons, the INF treaty was the first to mandate an elimination of a certain class of nuclear weapons. By the treaty-mandated date of May 1991, the Soviet Union had dismantled 1,846 banned systems, and the US 846; including missiles, launchers and support equipment. Furthermore, the treaty introduced the most stringent verification regime to be applied to an arms control agreement at that time.

Both parties to the agreement could perform on-site inspections to verify baseline declarations submitted under the treaty, as well as the elimination of weapons and decommissioning of facilities. The treaty also allowed for short-notice inspections. In addition, both parties could resort to continuous portal monitoring of former INF missiles assembly facilities, to confirm that the production of banned items had ceased.

The current dispute comes as a stark contrast to the treaty's initial success. Regardless of how the situation will be solved, it can offer lessons that may be relevant in the future. The INF treaty established a comprehensive and stringent verification regime with a limited duration of 13 years. While this was enough to verify the process of disarmament, it left

a gap in the state parties ability to ensure compliance in the future. Maintaining inspections and monitoring of relevant facilities may have allowed for a more timely discovery of non-compliance, and more prompt action. In such a scenario, convincing a country to abandon a weapons project in its early stages of development might be easier than convincing it to renounce a new weapon already on the verge of deployment, as the R-500 reportedly is.

Making disarmament irreversible and preventing the re-emergence of banned weapons has long been a key issue in arms control, and verification measures can play a central role in ensuring compliance to these types of prohibition. In the case of the INF treaty, reintroducing a set of verification measures might be necessary to overcome the stalemate and restore confidence between the two parties, even though the current political climate would likely make it difficult to agree on a solution. ●

Chemical weapons in the Levant

Andreas Persbo, London

The recent military onslaught by the Islamic State and its July capture of a former chemical weapons facility in Iraq has brought on fears that the self-styled caliphate may get hold of and use weapons of mass destruction. This gives rise to questions regarding the completeness of Syria's declaration of its chemical weapons stockpile, and also puts the legacy of Iraq's former weapons programme into renewed focus. On the latter issue, there is little to worry about. On the former, the situation remains unclear.

Iraq's chemical weapons programme was comprehensive, but almost all of it was destroyed in several rounds of United Nations Special Commission (UNSCOM) and United Nations Monitoring, Verification and Inspection Commission (UNMOVIC) missions. Remaining chemical weapons were stored in two buildings at a mostly derelict site formerly operated by the Muthanna State Establishment, some 80 kilometres northwest of Baghdad. These two reinforced structures, known as bunkers 13 and 41, have for the last 20 years been sealed up with a metre and half layer of brick, concrete and tar.

Iraq joined the Chemical Weapons Convention (CWC) on 12 February 2009. This obliged the country to destroy chemical weapons it owns or possesses under Organisation for the Prohibition of Chemical Weapons (OPCW) monitoring. How to deal with the materials in bunkers 13 and 41 has been discussed since then. According to an OPCW paper issued in 2012, the remaining chemicals in the two structures would be destroyed through opening up bunker 41 but 'encapsulating in concrete the remnants of chemical weapons in bunker 13 by filling the bunker with self-consolidating ("liquid") concrete (referred to as "encapsulation")'.

This is not without cause. Bunker 13 contains 2,500 122mm chemical rockets formerly filled with the nerve agent sarin, about 180 tonnes of sodium cyanide, about 200 tonnes of cyanides, 75 kg of arsenic trichloride and 170 one-tonne containers previously used for tabun storage. Some of these materials may have degraded over time, making them less potent; others might retain their lethality. Since the integrity of their containers likely can not be ascertained, and may have deteriorated, the bunker would be a very dangerous environment to enter.

UNMOVIC inspections in Iraq during 2002 and 2003 were comprehensive. Trevor Findlay notes in Verification Yearbook 2004 that 'in its 111 days in Iraq UNMOVIC conducted 731 inspections at 411 sites—of which 88 had not been previously inspected—while the [International Atomic Energy Agency] carried out 237 nuclear inspections at 148 sites, including 27 new ones, with over 1,600, buildings.' This extensive inspection effort uncovered nothing of significance, a finding that has remained true to this day.

Syria has been a party to the CWC since 14 October 2013. It quickly thereafter declared a large stockpile of chemical weapons, about 1,310 metric tonnes, of which 96.7% had been destroyed as of 8 September 2014. However, the recent use of chlorine in barrel bombs and the reported declaration of three additional sites associated with Syria's chemical weapons programme has prompted concerns that not all weapons have been declared. The OPCW's investigation, complicated by the country's brutal civil war, is bound to continue for yet some time to come. ●

Science & Technology Scan

Ebola: tools for detecting an outbreak

Russell Moul, London

The current Ebola outbreak in West Africa is the largest ever documented since the virus was first identified in 1976. The outbreak, deadly and distressing in itself, presents another clear example of the need for countries to properly implement international mechanisms designed to strengthen global health security, especially those that will help detect future outbreaks.

In 2005, the World Health Organisation (WHO) developed the International Health Regulations (IHR), a legally binding international law instrument that is aimed at improving the global response to public health emergencies. Under the IHR, member states of the WHO are required to 'strengthen and maintain' the capacity to detect outbreaks of infectious diseases in their countries, as they occur, as well as the capability to assess, notify and report to the wider international community on such incidents as quickly as possible.

There is currently no known cure or licensed vaccination available for Ebola (although several vaccines are currently being tested). Consequently, there is a particularly urgent need to improve the diagnostic techniques available to response teams and states affected by the virus, in particular those in Africa since all known outbreaks have started in that region and health care providers there often face severe resource constraints. Having appropriate diagnostic procedures available greatly strengthens chances of effective detection, containment, treatment, and timely and precise notification.

In the case of Ebola, the WHO has recommended that laboratory confirmation be sought for all suspected cases. Ebola can be diagnosed definitively through several types of tests that are also employed to detect other viral infections. The two most common techniques are the reverse transcriptase polymerase chain reaction (RT-PCR) assay, which is used to amplify the tiny amounts of genetic material retrieved in samples, and the 'ELISA' technique, which is used to identify the virus based on the reaction of a selection of antigens, see box below.

RT-PCR

The Ebola virus belongs to the family Filoviridae (filovirus), which are single strand RNA (ribonucleic acid) viruses. RNA is a complex organic compound found in living cells that conveys instructions from DNA for creating new proteins. In some viruses like the Ebola virus the RNA is also the virus's genetic material, which is fundamental to its replication. The RT-PCR is used to single out, amplify and thus detect this RNA.

ELISA

ELISA is a biochemical technique used mainly in immunology to detect the presence of an antibody or an antigen in a sample. Antigens are proteins that are present on the surface of all infectious organisms, including viruses. The antigen is recognised as a foreign invader by the host's immune system, which triggers the formation of antibodies to destroy or control them. ELISA mimics this in the lab. Like other antigen and antibody tests, it operates on the principle that for every antigen there is a corresponding antibody–the two operate like a lock and key. The presence of one will indicate and identify the presence of the other. ELISA involves fixing an unknown amount of the sampled antigen to an array of sample tiles and then a specific antibody is introduced to each of these so that it can react by binding to the relevant antigen. Each antibody is linked to an enzyme, and in the final step a substance is added that produces a detectable signal, most commonly a colour-change.

RT-PCR and ELISA are two examples of the types of diagnostic techniques that are available to responders dealing with outbreaks like the Ebola. They are accurate and efficient tools but they are not readily available in many states. Unfortunately, the current Ebola outbreak has been a tragic illustration that an outbreak anywhere can be a health risk everywhere, and that more states need to implement the principles for preventing, detecting and responding to infectious disease outbreaks that are enshrined in the IHRs in order to prevent future outbreaks. •

Programme News

National Implementation Measures Programme

This quarter, the NIM team completed two legislation surveys on the national implementation of the Biological and Toxin Weapons Convention (BWC). The NIM Programme also released the Portuguese version of the 'National Legislation Implementation Kit on Nuclear Security' this September.

On 1 July, Sonia Drobysz and Scott Spence attended a meeting of the Nuclear and Radiological Security Sub-Working Group of the Global Partnership in London. From 4 to 8 August, Yasemin Balci and Scott Spence attended the Meeting of Experts of the BWC in Geneva. Yasemin delivered VERTIC's statement stressing the importance of reviewing and improving national implementation measures for the BWC.

The following month, Yasemin Balci and Sonia Drobysz were invited to speak during the "Next Generation Workshop" preceding the third EU Non-Proliferation and Disarmament Conference, held in Brussels, Belgium from 4 to 5 September. Yasemin spoke on the legal lessons learned from the destruction of Syria's chemical weapons, while Sonia discussed strengthening international and national legal regimes for nuclear security. From 10 to 12 September, Yasemin Balci and Sonia Drobysz worked with Colombian officials on the drafting of a bill to implement the BWC and biological weapons-related provisions of UNSCR 1540. The workshop was held in Bogota, Colombia in cooperation with UNODA through the EU BWC Action. Later that month, Sonia Drobysz and Scott Spence attended the IAEA General Conference held in Vienna, Austria from 22 to 26 September. Scott presented on the 'National Legislation Implementation Kit on Nuclear Security' during VERTIC's side event held at the Vienna Centre for Disarmament and Non-Proliferation.

Legal Officer Bilqees Esmail had her last day with VERTIC this quarter. We wish her the best of luck at her new position with the UK government. •

Verification and Monitoring Programme

In July this year, VERTIC's executive director, Andreas Persbo, travelled to Mexico City to give a lecture on nuclear case studies to the Summer School on Nuclear Disarmament and Non-Proliferation, held at the Diplomatic Academy of Mexico. July also saw then-VERTIC senior researcher Hassan Elbahtimy attend the annual meeting of the Institute of Nuclear Materials Management in Atlanta, USA. During July, Dr Elbahtimy also travelled to Oslo, Norway, to participate in a nuclear warhead dismantlement simulation exercise in collaboration with King's College London. In August, Andreas Persbo and VERTIC researcher David Cliff travelled to Vienna, Austria, to attend a seminar VERTIC organised in collaboration with the Vienna Center for Disarmament and Non-Proliferation (VCDNP) on US-UK joint research on nuclear disarmament verification. This seminar formed the latest in a series of events that VERTIC and the VCDNP have organised over the past 12 months to address aspects of multilateral disarmament verification. Larry MacFaul attended an NNSA workshop on the Additional Protocol at Argonne National Laboratory in the US.

NNSA Additional Protocol workshop, USA, August 2014.

In September VERTIC organised a working-group meeting under its Norwegian-funded project on multilateral disarmament verification to consider 'verification solutions' for a number of technical modelling scenarios that VERTIC has developed over the course of this year. September also saw VERTIC senior researcher Larry MacFaul and research assistants Russell Moul and Alberto Muti travel to Addis

Ababa, Ethiopia, to carry out a technical assistance visit under VERTIC's project on universalisation of the IAEA Additional Protocol. Meanwhile, VERTIC Programme Director David Keir and David Cliff travelled to Beijing, China, for a series of meetings to finalise arrangements for a UK-China expert dialogue on arms control that VERTIC is organising in the city in October in collaboration with the China Arms Control and Disarmament Association. Towards the end of the month, a VERTIC delegation of six travelled to Vienna to attend the annual IAEA General Conference. Over the past three months, under the Additional Protocol project and in addition to the visit to Ethiopia, staff in London have completed a further three surveys of countries' nuclear safeguards related legislation. Also, during this quarter, Alberto Muti and Katherine Tajer, along with Larry MacFaul, completed a report examining the role of cyber attacks in Remote Control Warfare. The paper considers the potential impact of cyber attack issues in the field of international security and stability. This paper will be summarised in the 'Remote Control Project Digest', to be launched on 15 October 2014. ●

Recent events

Nuclear security side-event at VCDNP

VERTIC organised a side-event at the Vienna Center for Disarmament and Non-Proliferation on Thursday 25 September. Scott Spence, VERTIC Programme Director for National Implementation Measures, presented on 'A new tool for States: the National Legislation Implementation Kit on Nuclear Security'. The kit was launched on 25 March 2014 by Vice-President Boediono of the Republic of Indonesia as a gift basket to the third Nuclear Security Summit held in The Hague, the Netherlands. The aim of the kit, which includes a model law, is to 'help States develop more comprehensive national legislation on nuclear security in accordance with their own respective internal legal processes.' The heads of state of 29 nations attending the summit, as well as the United Nations, supported the Joint Statement on the Kit, and paragraph 11 of The Hague Communiqué welcomed 'efforts aimed at developing model legislation on nuclear security, which could provide states with building

blocks to develop comprehensive national legislation in accordance with their own legal systems and internal legal processes.' VERTIC's side-event, held on the margins of the 58th IAEA General Conference and attended by around 30 participants, was designed to elaborate on the background, purpose and contents of the kit and explain how it can be of benefit to states. ●

VERTIC reception held in Vienna

On Thursday 25 September, VERTIC hosted a reception during the IAEA General Conference at the IAEA's headquarters in Vienna. The reception is becoming a regular event at the General Conference and, as in past years, was well-attended by diplomatic and IAEA staff alike. VERTIC wishes to thank all our friends of the organisation that joined us on the night and we hope everyone there enjoyed the occasion. ●

Verification Quotes

More...needs to be done to bolster implementation of the [Chemical Weapons] Convention at the national level. Seventeen years since the Convention's entry into force, many state parties have still not established mechanisms for meeting their obligations or, in some cases, even adopted implementing legislation. This is a serious shortcoming, since we can ultimately can only be as strong as our weakest link—OPCW Director-General Ahmet Üzümcü, speaking at the 3rd EU non-proliferation and disarmament conference, Brussels, 4 September.

This important piece of legislation ensures Congress the opportunity to disapprove any nuclear agreement with Iran that does not contain airtight inspection and verification mechanisms—US Senator James Risch, 23 July, defending the Republican-sponsored Iran Nuclear Negotiations Act of 2014.

I prefer not to say conclusion but assessment. We are making our best efforts to clarify the outstanding issues. This is not an endless process—IAEA Director General Yukiya Amano, 15 September, speaking to journalists about whether the agency will ever be able to provide a conclusive verdict on possible military dimensions to Iran's nuclear programme.

Grants and administration

This quarter has seen several changes at VERTIC. Sadly, we have had to say goodbye to two staff members, Bilqees Esmail, and Hassan Elbahtimy. Ms Esmail has begun work at the UK Department of Justice, and Dr Elbahtimy has left for a position at King's College, London. We thank them for their service to VERTIC and wish them all the best in their new positions. We have welcomed one addition to the Verification and Monitoring programme: Hugh Chalmers, who joins the team as a Researcher. Mr Chalmers has spent the last few years at the Royal United Services Institute (RUSI) and prior to that worked at VERTIC as an intern. We are very pleased to announce his arrival and look forward to his work with the programme.

Over the summer, VERTIC hosted one intern, Ms Rebecca Hirschfeld, on the Verification and Monitoring programme. Ms Hirschfeld assisted with work on the Additional Protocol project from June to September. She is now continuing her Master's studies at the Hertie School of Governance, in Berlin. This month, Ms Roberta Daveri has joined the Verification and Monitoring programme as an intern. Ms Daveri's previous experience includes interning at the Italian Ministry of Foreign Affairs and the Permanent Mission of Italy to the United Nations in New York.

VERTIC can also announce new funding this quarter from the Carnegie Corporation of New York. The grant supports research and the development of an implementation experience-sharing tool for states on IAEA Safeguards and the Additional Protocol. ●