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B R I E F

News from Open Skies

A co-operative treaty maintaining military transparency

Hartwig Spitzer

VERTIC

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Introduction[1]

When the Treaty on Open Skies was signed at the Conference on Security and Co-operation in Europe (CSCE) Summit in Helsinki, Finland, on 24 March 1992, it was seen as one of the most far-reaching and intrusive confidence-building measures ever agreed.[2] The treaty opens up the full territory of its member states, 'from Vancouver to Vladivostok', to co-operative aerial observation flights. It embodied the determination of its states parties to overcome decades of bloc-to-bloc confrontation and secrecy in military matters by enhancing transparency and openness.

Today, the treaty's 34 states parties find themselves in a fundamentally transformed security environment. Political changes and remarkable reductions in armed forces since 1990 have made a large conventional war in Europe now very unlikely. The danger of destabilization in many transition states has been nearly eliminated by their integration into the European Union (EU) and the North Atlantic Treaty Organization (NATO). However, regional wars have been fought and crisis-prone regions remain.[3] New tensions have emerged in relations between the United States and the Western alliance on the one hand and the Russian Federation on the other. These culminated, inter alia, in Russia's suspension of implementation of the Treaty on Conventional Armed Forces in Europe (CFE) on 13 December 2007.

The Open Skies Treaty, which was meant to support the transition process after the end of the Cold War, only came into effect on 1 January 2002. Hence it is appropriate to ask: how well does it work? And what is its role in the changed circumstances?

The author has observed the Treaty on Open Skies from its emergence. This paper sketches out the main provisions of the treaty and discusses the interest of the original and new states parties in the agreement. It focuses primarily, though, on events since 2005: the first Review Conference, preparations for use of additional sensor categories, the flight allocation for 2008, and the outcome of treaty implementation—that is, support for monitoring of arms control treaties and military transparency in a co-operative setting.

Figure 1
C-130 Hercules, which are used on Open Skies observation missions

Source: Federal Armed Forces Verification Centre, Germany.

1. Updated and extended version of Hartwig Spitzer, 'Open Skies: Entering full implementation at low key', *Helsinki Monitor,* no. 17, 2006, pp. 83–91, Martinus Nijhoff, Leiden/Boston.

2. Peter Jones and Márton Krasznai, 'Open Skies: Achievements and Prospects', in John B. Poole and Richard Guthrie (eds), *Verification Report 1992,* VERTIC, London, 1992, pp. 47–56; Peter Jones, 'Open Skies: A Review of Events at Ottawa and Budapest', in John B. Poole (ed), *Verification Report 1991,* VERTIC, London and Apex Press, New York, 1991, pp. 73–82; Peter Jones, 'Open Skies: Events in 1993, in John B. Poole and Richard Guthrie (eds), *Verification 1993,* VERTIC, London and Brassey`s, London, New York, 1993, pp. 145–161; Sergey Koulik and Richard Kokoski, *Conventional Arms Control – Perspectives on Verification,* Oxford University Press (for the Stockholm International Peace Research Institute), Oxford, 1994; Michael Krepon and Amy E. Smithson (eds), *Open Skies, Arms Control, and Cooperative Security,* St.Martin´s Press, New York, 1992.

3. The 2008 war in the Caucuses involved two states parties to the treaty (Georgia and the Russian Federation).

Overview

The treaty foresees co-operative observation flights at a ground resolution that allows for identification of major weaponry. Between 2002 and 2007, 430 such flights were conducted over military sites not only in Europe, but also in the vast territories of North America and Siberia, which are inaccessible to inspections under the CFE Treaty and the 1999 Vienna Document on Confidence- and Security-Building Measures. The imagery has been used to support monitoring of arms control treaties, as well as for achieving the treaty's general objective of military openness and transparency. All states parties have the right of access to images from each flight—a remarkable achievement—which puts them on an equal footing.

Since 2002, the treaty has attracted eight new members from the Nordic region, the Baltic States and the former Yugoslavia, bringing the number of states parties to 34. At the first Review Conference in February 2005, the states parties confirmed their intention to adhere to the agreement as signed and to keep it open to all states participating in the Organization for Security Co-operation in Europe (OSCE).

It is noteworthy that the Russian Federation and the US have not clashed over the Treaty on Open Skies, but rather support it. They seem to have a genuine interest in the imagery and in the demonstrative character of the agreement. In fact, among the three so-called pillars of European security—the CFE Treaty, the Open Skies Treaty, and the Vienna Document—Open Skies has proved the least contended, so far.

In spite of this generally positive picture, clouds are gathering on the horizon. A major concern is fundamental asymmetry, as NATO states have agreed not to inspect each other. The Open Skies missions of these states are solely directed towards the Russian Federation and the five remaining non-aligned states (Bosnia-Herzegovina, Croatia, Georgia, Sweden and Ukraine). Should these latter countries, in particular Ukraine, join NATO, the imbalance would become more severe, perhaps even fatal for the treaty.

One possibility to keep the Open Skies approach relevant and vital is an extension to crisis regions which are not yet covered by the treaty and to engage in outreach beyond the OSCE area.[4] Another is to operate different sensors beyond photographic cameras with black-and-white film. With some luck, 2009 will see an agreement on the use of digital aerial cameras with up to four colour channels as well as certification of the first thermal infrared imaging device onboard the Turkish Open Skies aircraft.

"All states parties have the right of access to images from each flight—a remarkable achievement—which puts them on an equal footing."

Provisions of the treaty

It is worthwhile remembering the intentions and purpose of the treaty, as stated in the Preamble: 'to improve openness and transparency, to facilitate the monitoring of compliance with existing or future arms control agreements and to strengthen the capacity for conflict prevention and crisis management in the framework of the Conference on Security and Co-operation in Europe and in other relevant international institutions'.[5] In this context, the states parties also saw the possible contribution that an aerial observation regime of this kind could make to security and stability in other areas (outside of the OSCE zone), as well as potential for its extension to other fields such as protection of the environment.

At the core of the treaty is the right to observe any point on the territory of the observed state party, including areas designated as hazardous air space. It is completely up to the observing state to select the sites to be over-flown and photographed.[6] The legitimate interests of the observed state party with regard to avoidance of espionage are taken into account by ensuring that the ground resolution of the sensors to be used, while allowing for the reliable identification of major weapons systems, does not enable detailed analysis.

4. Unfortunately, due to the rivalry between Armenia and Azerbaijan over Nagorno-Karabakh and the flaring up of conflicts on the territory of Georgia, there is little chance that Open Skies could be extended further in the South Caucasus, although Georgia (unlike Armenia and Azerbaijan) is a party to the treaty.

5. The full text of the treaty as well as the Decisions of the Open Skies Consultative Commission (OSCC) with respect to annual quota assignments and other implementation issues can be found at www.dod.mil/acq/acic/treaties/os/index.htm. See also Rüdiger Hartmann and Wolfgang Heydrich, *Der Vertrag über den Offenen Himmel* [The Treaty on Open Skies], Nomos, Baden-Baden, 2000. The authors illuminate the negotiation process and the intentions of the negotiators.

6. Different national agencies, including the verification centres, take part in the selection process.

Box 1: Treaty provisions

- A system of flight quotas has been negotiated, which reflects to some extent the geographic size and the military 'weight' of the states parties.[7] Since 2006, for example, France, Germany, the United Kingdom and Ukraine have been entitled to carry out 12 observation flights per year (active quota) and have had to accept up to 12 over-flights (passive quota), whereas Russia (along with Belarus) and the US each have had an active quota of 42 flights and a passive quota of 42 flights.[8]
- Flights are conducted by fixed-wing unarmed aircraft with inspectors from both sides onboard. Navigators from both sides make sure that the submitted and accepted flight plan is observed. Sensor operators activate the sensors over the sites determined by the observing state. Due to the co-operative approach, flights are not escorted by aircraft of the observed party.
- The agreed sensor set comprises:
  - optical panoramic and framing cameras with a ground resolution of 30 centimetres (cm);
  - video cameras with a real-time display and a ground resolution of 30 cm;
  - thermal infrared imaging sensors with a ground resolution of 50 cm; and
  - imaging radar, Synthetic Aperture Radar (SAR), with a ground resolution of 300 cm.

  The resolution definition of the treaty as specified in Decisions of the Open Skies Consultative Commission (OSCC) deviates from the standard photogrammetric definition by a factor of two. For instance, a resolution of 30 cm under Open Skies corresponds to a ground resolved distance of 60 cm.
- Sensors and aircraft have to pass a certification procedure to ensure that the agreed resolution is not exceeded.
- The flight timeline allows for an element of surprise. The time between the announcement of the planned flight route and the beginning of the flight is typically 24–30 hours.
- Image data are shared between the observing and the observed state. Other states parties can acquire copies of the imagery at a nominal cost.
- Treaty implementation matters are decided by the OSCC in Vienna, Austria. Topics include the allocation of active and passive quotas on an annual basis within overall entitlements, the admission of new members, and the upgrading of existing sensors.

New states parties and their interests in the treaty

The Treaty on Open Skies was signed on 24 March 1992 by all of NATO's then 16 member states, and by many of the transition states and successor states of the Soviet Union (Belarus, Bulgaria, the Czech and Slovak Federal Republic, Georgia, Hungary, Kyrgyzstan, Poland, Romania, Russia and the Ukraine). All but Kyrgyzstan have ratified the treaty. The accord finally entered into force on 1 January 2002 after considerable ratification delays, mainly by Russia and Ukraine. Entry into force was preceded by a 10-year period of trial implementation, during which nearly 400 test flights were carried out to check and optimize procedures (see Box 2).[9]

Since 2002, eight more states have acceded to the treaty (Bosnia-Herzegovina, Croatia, Estonia, Finland, Latvia, Lithuania, Slovenia and Sweden). Turkey has vetoed an application by Cyprus for accession. Given the stalemate in the ratification of the Adapted CFE Treaty of 1999, which was meant to be open to all OSCE participating states, the Treaty on Open Skies has been received as a welcome alternative. New members obtain access to a multilateral framework of security co-operation that complements the Vienna Document in a flexible and future-oriented way. It allows participation in confidence-building measures through co-operative flights and in the cross checking of information on military forces that is exchanged under the Vienna Document. In particular, Open Skies flights—through their symbolic and co-operative character and their information potential—can help to reduce tensions between Russia and the Baltic States and within the former Yugoslavia.[10]

One indicator of active interest in the treaty is the acquisition of copies of film from flights undertaken by other states. In 2004, five states (Finland, Germany, Sweden, Ukraine and the US) utilized this option.[11] All parties are informed of who has bought what.

7. The passive quota of the initial signatories that later ratified the treaty was fixed in Annex A of the treaty after consideration of the 'wishes' of the parties regarding their respective quota. A change of these assignments would require another ratification process, and is therefore unlikely to happen. The quota of the parties that acceded later was agreed by the Open Skies Consultative Commission (OSCC).

8. Belarus and the Russian Federation comprise a group of state parties under Article II of the treaty. They are treated like one state party and have a joint passive and active quota.

9. The following publications contain descriptions of the trial implementation phase, as well as critical evaluations of the treaty: Pál Dunay, Márton Krasznai, Hartwig Spitzer, Rafael Wiemker and William Wynne, *Open Skies: A Cooperative Approach to Military Transparency and Confidence Building,* United Nations Institute for Disarmament Research (UNIDIR), Geneva, 2004; Klaus Arnhold, *Der Vertrag über den Offenen Himmel: Ein Konzept zur Aktualisierung des Vertrags* [The Treaty on Open Skies: A Proposal for Modernization], Stiftung Wissenschaft und Politik, Berlin, June 2002; Ernst Britting and Hartwig Spitzer, 'The Open Skies Treaty', in Trevor Findlay and Oliver Meier (eds), *Verification Yearbook 2002,* VERTIC, London, 2002, pp. 223–238; Pál Dunay, 'The Treaty on Open Skies in Force: European Security Unaffected', in Institute for Peace Research and Security Policy at the University of Hamburg, *OSCE Yearbook 2002,* Nomos, Baden-Baden, 2003, pp. 289–310; Hartwig Spitzer, 'The Treaty on Open Skies – Status Quo and Prospects', in Institute for Peace Research and Security Policy at the University of Hamburg, *OSCE Yearbook 2004,* Nomos, Baden-Baden, 2005, pp. 369–380.

10. Serbia demonstrated some interest in Open Skies by arranging three test flights over its territory in 2005–07 with technical support from Germany, Hungary and Romania. However, it has not yet applied for accession.

11. Russia usually gets enough information from its own flights. It has bought copies of film only once: a joint flight by Canada, France and Italy over Georgia in early April 2008 during the build-up of Georgian forces for the 2008 war in the Caucasus.

Box 2: Open Skies milestones

12 May 1989
US President George H.W. Bush proposes a multilateral Open Skies regime that would include the US, the Soviet Union and the allies of both sides.

14–15 December 1989
NATO Council approves 'Open Skies Basic Elements'.

12–28 February 1990
First Open Skies conference in Ottawa, Canada, including all member states of the Warsaw Treaty Organization and of NATO.

23 April–10 May 1990
Second Open Skies conference in Budapest, Hungary.

11 May 1991
Signature of a Hungary–Romania bilateral Open Skies agreement.

9 September 1991
Resumption of the multilateral Open Skies negotiations in Vienna.

31 December 1991
Dissolution of the Soviet Union. The Russian delegation replaces the former Soviet delegation. Belarus and Ukraine also participate in the negotiations.

24 March 1992
Signature of the Treaty on Open Skies by 26 states in Helsinki.

April 1992–December 2001
Trial phase involving nearly 400 trial and test flights.

26 May 2001
Ratification of the treaty by the Russian Duma—the last ratification needed before entry into force.

1 January 2002
Entry into force of the treaty.

April–July 2002
First round of certification of Open Skies aircraft (15 states parties).

1 August 2002
Start of quota flights under treaty rules. This initial implementation phase included a restriction on the use of quota entitlements (no more than 75 per cent of flight quotas could be utilized) and on the use of two sensor categories (infared and radar sensors).

August 2002–December 2004
Accession of eight more states parties.

14–15 October 2004
OSCC seminar in Vienna on ecological use of the Open Skies regime.

14–16 February 2005
First Review Conference in Vienna.

1 January 2006
Start of full implementation phase, allowing for all (five) sensor categories and for exploitation of full quota entitlements.

23–24 May 2007
Open Skies seminar on digital sensors in Berlin, Germany, hosted by the Federal Foreign Office.

17 September 2007
The OSCC adopts a decision on the certification rules for thermal infrared sensors.

20 August 2008
The 500th Open Skies flight, conducted by the Benelux countries (Belgium, Netherlands and Luxembourg) over Bosnia-Herzegovina.

13–14 November 2008
Seminar on enhanced implementation of the Open Skies Treaty with modern observation aircraft in Berlin, Germany, hosted by the Federal Foreign Office.

Note: for further details see footnote 9 in Pál Dunay, Márton Krasznai, Hartwig Spitzer, Rafael Wiemker and William Wynne, Open Skies: A Cooperative Approach to Military Transparency and Confidence Building, UNIDIR, Geneva, 2004.

"A key issue currently under discussion in the IWGS [Informal Working Group on Sensors] is the introduction of digital aerial cameras with several spectral (colour) channels."

Open Skies aircraft and sensors

Eight states operate aircraft that are used under the Open Skies regime (Bulgaria, Hungary, Romania, Russia, Sweden, Turkey, Ukraine and the US) while a further 10 in the so-called Pod Group share one sensor pod that can be attached under the wing of one of their C-130 Hercules transport aircraft (see Figure 2).[12] Most of the remaining states rent aircraft from the countries which operate Open Skies aircraft in order to make use of their active flight quota. Flights are co-operative, with operators and inspectors from the observing and the observed party onboard. Hence aircraft require a capacity to seat approximately 20 people. So far, only photographic framing cameras and panoramic cameras with panchromatic (black-and-white) film have been used, partially supplemented by video sensors.[13]

Figure 2
Sensor pod as operated by the Pod Group

Notes: the sensor pod is attached to the wing of a C-130 aircraft. A video camera is mounted in the nose of the pod. Behind this, on the underside of the pod, are windows for the KS-116 panoramic camera and the nadir-pointing KS-87B camera, followed by two windows for the two KS-87B cameras pointing obliquely to the left and the right.

Source: Canadian Forces.

Preparing for additional sensor categories

In addition to photographic cameras, the treaty also permits the use of thermal infrared line scanners and synthetic aperture radar sensors. Thermal images can be taken at day and night through cloud-free skies (see Figure 3). Radar sensors work even in the presence of clouds at day and night. The full sensor set will thus ensure an all-weather, day-and-night observation capability. However, even after the introduction of thermal and radar sensors, optical cameras will remain the lead sensors, providing the largest amount of information. But they have to be used in daytime.[14]

The OSCC has established an Informal Working Group on Sensors (IWGS) that is tasked with elaborating the complicated certification procedures, which the OSCC will then adopt as Decisions to the treaty. This working group first met from 1992–97. It was re-established in 2005 under the chairmanship of Scott Simmons (US), a former Open Skies Mission Commander. Its major focus from 2005–07 has been elaboration and testing of certification procedures for thermal infrared line scanners (see Box 3).

The OSCC adopted the Decision on procedures for certification of aircraft with thermal infrared sensors on 17 September 2007. Turkey is the first state to have installed a thermal infrared line scanner on its CASA CN-235 Open Skies aircraft. The certification process is envisaged for summer 2009. Russia has built a two-channel infrared line scanner, with one thermal channel and one channel in the visible/near infrared wavelength range (0.5–0.9 micrometers). Russia is also preparing a radar sensor for installation on a future Open Skies aircraft (Tupolev Tu-214).

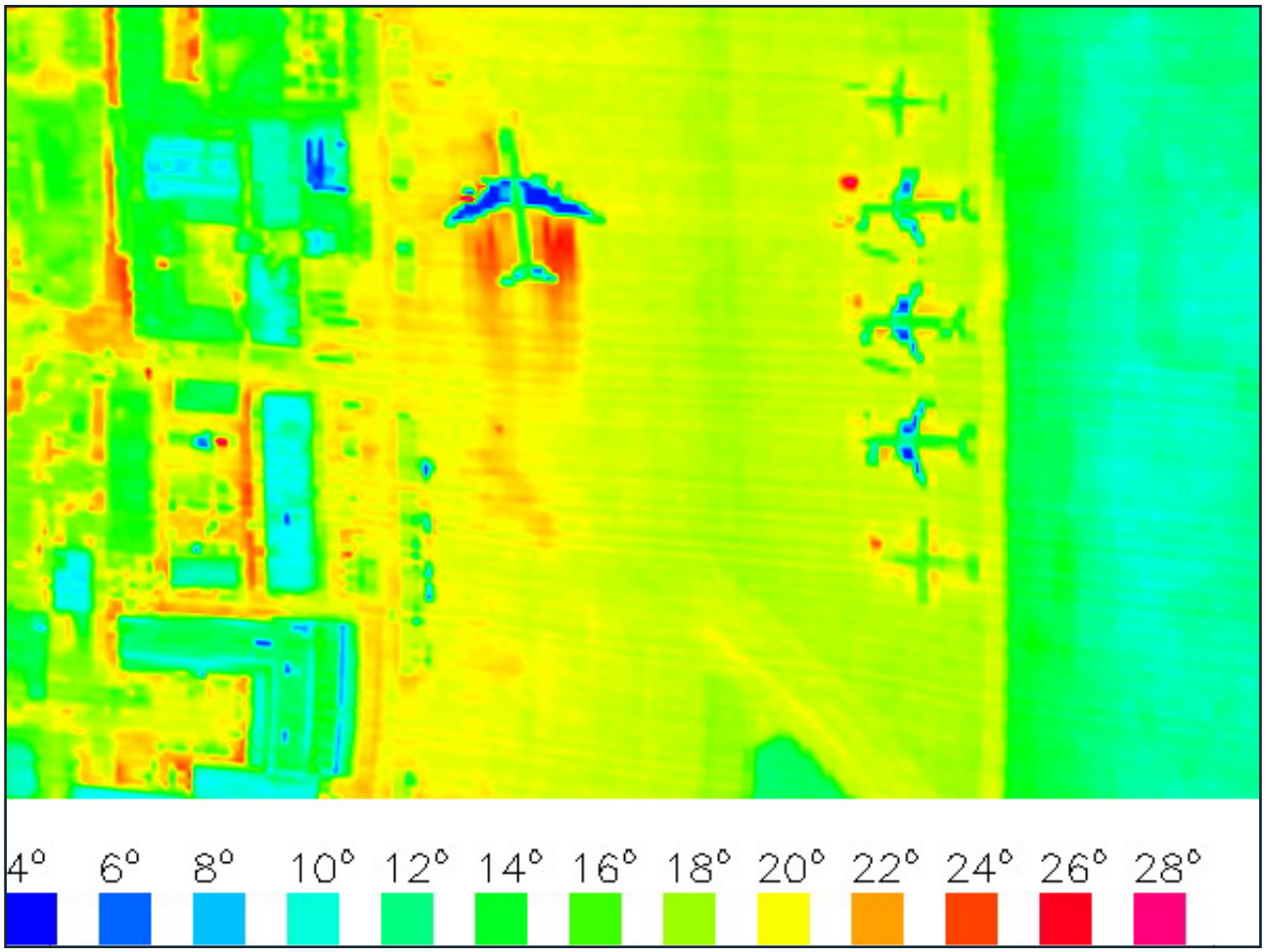
A key issue currently under discussion in the IWGS is the introduction of digital aerial cameras with several spectral (colour) channels. The treaty mandates that Open Skies sensors must be commercially available. The civilian commercial aerial surveying market has been transformed over the past seven years by the nearly complete

12. The UK decommissioned its Open Skies aircraft on 1 April 2008 for budgetary reasons. The Czech Republic did likewise in 2002. Germany lost its only Open Skies aircraft in 1997 in a mid-air collision and has not replaced it.

13. Gordon Petrie and Hartwig Spitzer, 'Open Skies – Aerial observation to help prevent conflicts between countries', *GeoInformatics*, July–August 2007, pp. 24–29. See also the 'Open Skies' section at http://censis.informatik.uni-hamburg.de.

14. The detection potential of radar sensors at a resolution of three metres is quite limited. They are essentially restricted to large infrastructure and naval vehicles, such as bridges, buildings and ships.

Figure 3
Thermal image of Nuremberg Airport taken with a Daedalus 1268 sensor at a three-metre nominal resolution, 05:30, 26 August 1997



Notes: Open Skies thermal images will have a superior resolution of 50 cm. The image illustrates the potential for detecting the operational state of vehicles or plants at day and night. The fuel tanks in the wings of the large aircraft in the upper centre of the picture have just been refilled and thus appear cool (blue) while the exhaust plumes of the running engines are hot (red).

Source: German Aerospace Center and Hartwig Spitzer, University of Hamburg, Germany.

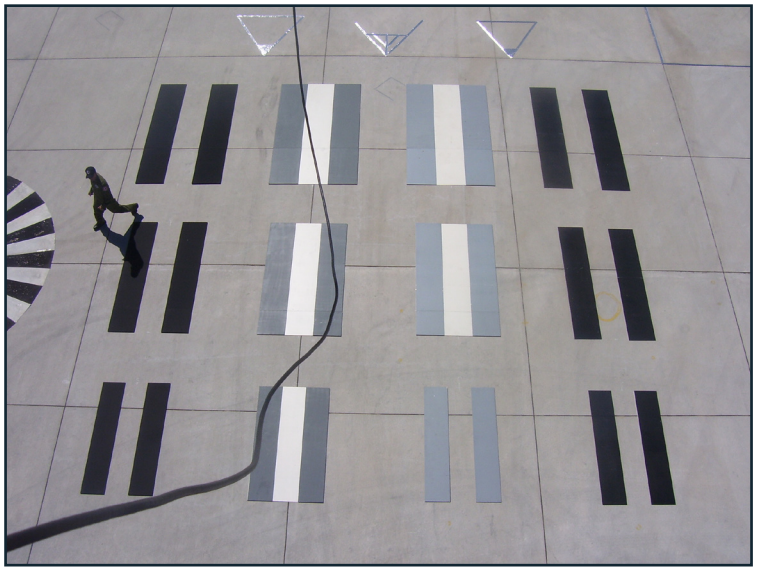
Box 3: Determining the resolution of thermal sensors

The basic requirement of the treaty in this regard is a minimum flight altitude that corresponds to a ground resolution of 50 cm. More precisely, resolution is determined by flight tests over calibration targets consisting of two bars on a contrasting background. For optical sensors, targets consisting of black bars painted on a white background are being used. For thermal imagers, suitable targets with a thermal contrast had to be built and tested. Germany was particularly active in this respect. Tests of *active* targets (involving electric heating of every other bar) yielded unsatisfactory results.

Ultimately a robust design for passive targets was chosen. The bars consist of five-millimetre (mm) thick aluminium sheets, which are painted with special non-glittery paint in different tones of grey (between pure white and black). Two bars of one colour are placed on a contrasting background (usually concrete) at a distance that corresponds to their width. Sets with different widths of 40, 50, and 60 cm are being used (see Figure 4). Under solar irradiation, grey and black bars absorb more heat than concrete throughout most of the day, thus providing thermal contrast.

After three test campaigns in Turkey and on the island of Sardinia, the working group selected the 'hot target method'. For this method the contrast between the aluminium bars and the background must be at least three degrees Centigrade. At such temperature differences, the sensor tested—an AAD-5 Honeywell line scanner—produced a nearly flat response—that is, the geometrical resolution would not change much for different thermal contrast values above five degrees Centigrade.

Figure 4
Passive thermal targets for geometric resolution determination of Open Skies infrared sensors during a test data gathering at Eskisehir, Turkey, September 2006



Notes: five of the grey bar groups in the centre have a central bar painted white that serves as a contrasting background. The dark line is a cable in front of the camera.

Source: Dawn Wick, Wright Patterson Air Force Base, Dayton, OH, US.

replacement of photographic film cameras by digital cameras (when it comes to new acquisitions). For instance, Intergraph (formerly Zeiss) has stopped manufacturing its famous RMK-TOP metric camera series. In addition, some brands of aerial film are no longer being supplied. Similar transitions have occurred or are happening in the military reconnaissance sphere. Many of the commercial aerial cameras have either three or four spectral channels (red, green, blue and near infrared) plus panchromatic capabilities.

The IWGS has been addressing the issue since 2006. Discussions were stimulated by a seminar hosted by the German Federal Foreign Office in Berlin on 23–24 May 2007). Consensus is emerging—after initial hesitation by Russia—to propose to the OSCC the introduction of digital aerial cameras with up to four spectral channels in the visible or near infrared wavelength range (below 1.1 micrometers), which would also generate panchromatic images. Again, Turkey might be the first state party to go digital. Turkey is considering either equipping its KS-87 framing cameras with a digital readout or installing a modern large format digital aerial camera on a future second Open Skies aircraft.

The Open Skies Review Conference: A rare example of Euro-Atlantic-Russian accord

Representatives of 32 states parties met in Vienna from 14–16 February 2005 for the first Review Conference of the Treaty on Open Skies. The main objective was to evaluate and discuss past and future implementation of the agreement. It soon became obvious that all states parties continue to support fully the intentions of the agreement as a confidence-building measure, a rare case of Euro-Atlantic-Russian consensus.

The *distribution of flight quota* remains one of the more sensitive issues. As mentioned above, an inter-alliance understanding prevents NATO countries from inspecting each other. This arrangement has been observed strictly so far. Hungary and Romania even had to terminate their bilateral Open Skies agreement of 1991 after becoming NATO members. Consequently, NATO states concentrate their flights on Bosnia-Herzegovina, Croatia, Georgia, Russia and Ukraine. While Russia along with Belarus is subject to 42 flight missions per year, none of the NATO states has been subjected to more than four inspection missions per year. At the conference, some states parties objected to any attempt to question the quota assignment scheme. Hence the original framework continues to hold. No provision was made for the case of more states parties joining NATO. Still, the issue of asymmetry in treaty implementation does not endanger the agreement for the time being, but it might do so in the more distant future, particularly if Ukraine were to join NATO.

It was only on the last day of the conference that a controversial debate ensued. France, Germany and Sweden proposed to apply the Open Skies regime to two additional fields mentioned in the preamble to the treaty: *protection of the environment;* and *conflict prevention and crisis management* within the framework of the OSCE and other relevant international organizations. The majority of delegations that spoke up rejected the idea of giving enhanced responsibility to the OSCC in these respects.

They stated that they would rather leave extended applications to the initiative of individual states.

The conference was almost invisible to the general public: there was virtually no media coverage, and no observers were invited from international organizations, scientific institutes or NGOs. Only observers from OSCE Asian and Mediterranean partner countries were invited; some attended (Israel, Japan, Jordan, Morocco, South Korea and Tunisia). It appears that states parties prefer to see the Treaty on Open Skies functioning quietly.

A dispute on the accession of Cyprus caused further discord. Turkey objected to a statement in the Final Document that the application of Cyprus was still pending. As a result, states parties could not reach the required consensus on the Final Document. Instead the final draft was read by the chair as a chairman's statement. The Cyprus case demonstrates how a single issue can undermine consensus. However, there was a strong feeling that this episode would not affect the intention of all states parties to adhere to the treaty in future.

Flight allocation for 2008

The annual flight allocation is an interesting process, indicating how states parties want to exploit their quota entitlements. Usually the OSCC decides on the allocation in the autumn of the preceding year. Each state initially declares how it wishes to use its active quota. A moderator (at present the representative of Germany) mediates and makes suggestions for sharing flight quota, if needed. Ultimately the OSCC adopts the quota assignment.

In general, there is a strong demand for flights over Russia. Twenty-one states planned to perform a total of 41 observation flights over Belarus and Russia in 2008. The US demonstrated the greatest interest (14 flights), followed by Germany (6) and France (4). Russia (along with Belarus), meanwhile, intended to fly over virtually all NATO countries, some of them several times—for example, US (4), Germany (3), France (3) and the UK (3), thereby exploiting its full active quota of 42. This illustrates Russia's substantial interest in the treaty. Among the remaining states, the US, Ukraine, Germany, France and Turkey are most active with a total of 15, 12, 10, 10 and 8 flights, respectively. The US leaves much of its active quota of 42 unexploited, because it is primarily interested in flights over Russia. Bosnia-Herzegovina, Denmark and Estonia receive flights but do not conduct them. The appendix contains a complete list of flights scheduled for 2008.

Remarkably, Ukraine performs its 12 observation flights over many of its western and southern neighbours, although none over Belarus and the Russian Federation. Similarly, Russia does not fly over Ukraine. Note that due to high demand for flights over some states parties that do not belong to NATO and for cost-saving reasons, some countries have agreed to perform joint flights using a shared quota. In total, 118 flights were planned for 2008, 30 of which are shared flights, from an overall entitlement of 296 flights. The overall entitlement was fixed by the treaty in 1992, with some additions for states that acceded later. Underutilization of the available quota reflects three key changes since 1992:

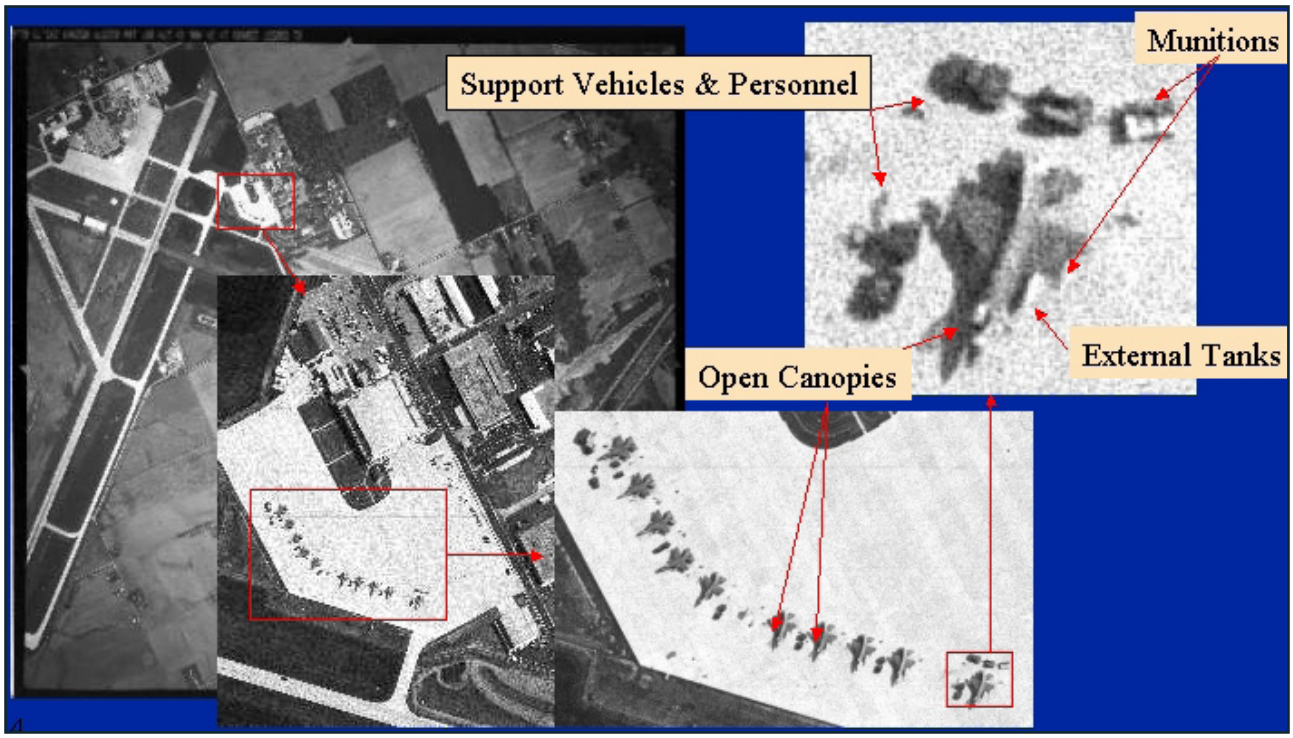
- NATO accession by the Baltic States, Bulgaria, the Czech Republic, Hungary, Romania, Slovakia and Slovenia;
- reduced security concerns among several states parties because of the changed security environment; and
- increased transparency due to upgrades to the Vienna Document since 1992.

Outcome: supporting treaty monitoring and military transparency

Between 1 August 2002 and the end of 2007, 430 flight missions were carried out. Black-and-white imagery was obtained

"The annual flight allocation is an interesting process, indicating how states parties want to exploit their quota entitlements."

Figure 5
Open Skies image of a military airfield with magnified details



Note: the image was taken at the nominal resolution of 30 cm.

Source: US Defense Threat Reduction Agency, Washington, DC (Briefing to 2000 Forum Innovations and Technology Transfer, 11 May 1999).

using photographic cameras. What can be learned from such imagery at a 30 cm ground resolution? Photographic black-and-white images at the treaty-approved resolution allow for the *detection and general identification* of artillery, land vehicles and rockets, as well as for the *detection and precise identification* of aircraft, airfield facilities, missile sites, surface ships, troop units, and infrastructure such as roads and headquarters (see Figure 5).[15] This holds true of course only under fair-weather conditions. Cloud, haze and other meteorological conditions can reduce identification potential. Apart from the monitoring of military sites, test missions have demonstrated an excellent capacity to observe the effects of environmental disasters, including floods and hurricanes.[16]

For most states, with the exception of the US, Open Skies flights provide images with a somewhat better resolution than is available from commercial satellites or from their own reconnaissance satellites (France, Germany and Russia). Open Skies flights offer much more flexibility and the opportunity to cover many sites or long ground strips in one go. Cost wise they are competitive in relation to satellite imaging.

Open Skies images have been used successfully to support the monitoring of several arms control agreements and exchanges of security-relevant information. Once the full sensor set is operative, its potential to make such a contribution will be enhanced. Several treaties and security agreements are illustrative:

- **The CFE Treaty.** During the negotiation of this accord it was anticipated that it would be accompanied by an aerial verification regime, but discussions were not concluded in time. The Treaty on Open Skies has assumed the task of aerial monitoring.[17] In addition, it allowed monitoring of excess heavy conventional weapons which were relocated beyond the Urals and to North America as part of CFE force reductions in Europe.[18]

  In general, Open Skies flights can be used both for the preparation of on-site inspections and as a monitoring instru-

15. See, for example, McDonnell Douglas Corporation, *Reconnaissance Handbook*, 1982, p. 125, as quoted in Ann M. Florini, 'The Opening Skies: Third Party Imaging Satellites and US Security', *International Security*, vol. 13, no. 2, 1998, p. 98.

16. See, for instance, Pál Dunay, Márton Krasznai, Hartwig Spitzer, Rafael Wiemker and William Wynne, *Open Skies: A Cooperative Approach to Military Transparency and Confidence Building*, UNIDIR, Geneva, 2004, chapter 6 and section 7.3.2.

17. Although the Adapted CFE Treaty of 1999 does not mention aerial verification among its mechanisms, information from Open Skies flights can nevertheless be used to support monitoring in a similar manner to data from national technical means, which is explicitly allowed under the CFE treaty.

18. Following the suspension by Russia of CFE implementation (data exchange and inspections) in December 2007, Open Skies flights have assumed increased importance.

ment. One single Open Skies flight can monitor more sites than the total annual passive CFE inspection quota of Germany (39, including those for stationed forces) or even Russia (50). Flights and ground inspections are complementary. Flights can be used to detect and monitor non-declared facilities and equipment parked in the open, whereas CFE inspections provide detailed accounts of weapon systems under cover at declared sites—that is, the number of Treaty Limited Items (TLE). Still, Open Skies images can give some indication of TLE holdings since an estimated 20–40 per cent of TLE is parked in the open. In addition, Open Skies images can be used to measure the dimensions of storage buildings.

- **Vienna Document.** Fifty-six states participating in the OSCE have agreed to an extensive exchange of data on their military organization and command structure, on major weapon systems and their deployment sites and on the number of military personnel. The number of agreed on-site inspections is rather small. Open Skies flights provide complementary information and conduct checks inside Europe (restricted to Open Skies states parties). For instance, Germany monitored weapon systems on a Russian airfield to check whether a notification under the Vienna Document was required.
- **Global Exchange of Military Information.** The CSCE, the predecessor of the OSCE, agreed to this data exchange initiative in Budapest on 28 November 1994. It covers all kinds of weapon systems, including naval vessels and aircraft belonging to all states participating in the CSCE/OSCE, regardless of their deployment site, worldwide. Since the exchange is not being monitored by on-site inspections, Open Skies flights have been used to cross check notifications of forces, particularly of naval forces.
- **The 1993 Chemical Weapons Convention (CWC).** This treaty did not foresee the use of aerial inspections. However, images of chemical weapon sites obtained through Open Skies flights can be used by Open Skies states parties nationally. The value of Open Skies imagery will be enhanced once thermal infrared sensors allow for monitoring of the operational status of suspect chemical weapon plants.
- **The 1991 START Treaty.** Open Skies flights have been employed to monitor the deployment and destruction sites for strategic nuclear arms to cross-check agreed limitations. The flights thus supplement on-site inspections.
- **The 1992 Cooperative Threat Reduction Initiative.** This Russia–US programme for protecting Russian nuclear fabrication and storage sites has been supported by Open Skies site photographs. They have served as a planning tool for improving perimeter fencing.

Beyond supporting treaty monitoring, Open Skies flights enhance military transparency of capabilities and infrastructure that are not covered by arms control treaties. It can be assumed that a wide range of countries such as Germany, Russia, Turkey, Ukraine and the US, but also countries with smaller quotas like Finland, the Netherlands, Norway and Sweden are making use of this option. However, it is reported that some smaller countries do not analyze the images of their flights and instead see the co-operative flights themselves as the real outcome of Open Skies as a confidence-building measure. In addition, institutional barriers and a lack of cross-departmental communication can prevent optimum usage of Open Skies images. For many observers and officials, Open Skies is seen as operating in a niche.

"Beyond supporting treaty monitoring, Open Skies flights enhance military transparency of capabilities and infrastructure that are not covered by arms control treaties."

Conclusion

The broad and differentiated design of the Open Skies regime makes it a flexible tool of contemporary security policy. By opening the full air space of its parties to co-operative aerial observation it provides more flexibility in monitoring new situations than traditional arms control treaties.

Practical implementation of the treaty has in general gone smoothly. Notably, flight missions have become routine operations, involving flight notification, entry procedures, pre-flight inspections of aircraft and sensors, mutual agreement of the mission plan, flight execution, and film processing. This illustrates how intelligent selection of basic structural principles—in this case, co-operation and openness—can shape the conduct of the participants. A culture of co-operative openness that overcomes political differences has been established among the military personnel involved in implementation activities—a new experience for many. Open Skies is thus built on the basis of mutual familiarity. This can work even in times of political tension, as demonstrated by a Russian flight over US airbases in Germany during the build-up of US forces for the 1999 war in Kosovo. But it would not work in an open military conflict.

The Treaty on Open Skies continues to serve its purpose. It remains a pillar of multilateral arms control by contributing to security in Europe through maintaining military transparency on a high level, in combination with the Vienna Document and the disputed CFE Treaty. Its long-term fate will be endangered, though, if politico-military relations between major NATO states and the Russian Federation continue to deteriorate.

Appendix

Open Skies flight missions planned for 2008

Observing state(s)	Observed state(s)	Number of flights
Russia/Belarus	Germany	3
Russia/Belarus	US	3
Russia/Belarus, Sweden	US	1
Russia/Belarus	Benelux	1
Russia/Belarus	Bulgaria	1
Russia/Belarus	Canada	1
Russia/Belarus, Italy	Croatia	1
Russia/Belarus	Denmark with Greenland	2
Russia/Belarus	Spain	2
Russia/Belarus	Estonia	1
Russia/Belarus, France	Finland	1
Russia/Belarus	France	3
Russia/Belarus, UK	Georgia	1
Russia/Belarus	UK	3
Russia/Belarus	Greece	2
Russia/Belarus	Hungary	1
Russia/Belarus	Italy	2
Russia/Belarus	Latvia	1
Russia/Belarus	Lithuania	1
Russia/Belarus	Norway	2
Russia/Belarus	Poland	1
Russia/Belarus	Portugal	1
Russia/Belarus	Romania	1
Russia/Belarus	Slovakia	1
Russia/Belarus	Slovenia	1
Russia/Belarus	Sweden	1
Russia/Belarus	Czech Republic	1
Russia/Belarus	Turkey	2
US	Russia/Belarus	9
US, Germany	Russia/Belarus	1
US, France	Russia/Belarus	1
US, Czech Republic	Russia/Belarus	1
US, Bulgaria	Russia/Belarus	1
US, Italy	Russia/Belarus	1
US, Canada	Ukraine	1
Germany	Russia/Belarus	1
Germany, France	Russia/Belarus	1

Germany, Latvia	Russia/Belarus	1
Germany, Greece, Italy	Russia/Belarus	1
Germany, Finland	Russia/Belarus	1
Germany, France	Ukraine	1
Germany, Turkey	Georgia	1
Germany, Hungary, Italy	Bosnia-Herzegovina	1
Germany, Bulgaria, France	Croatia	1
Ukraine	Bulgaria	2
Ukraine	Germany	1
Ukraine	France	1
Ukraine	UK	1
Ukraine	Hungary	1
Ukraine	Italy	1
Ukraine	Poland	1
Ukraine	Romania	1
Ukraine	Slovakia	1
Ukraine	Czech Republic	1
Ukraine	Turkey	1
Turkey	Russia/Belarus	4
Turkey	Ukraine	1
Turkey, Spain, Bulgaria	Bosnia-Herzegovina	1
Turkey, France, Italy	Ukraine	1
Benelux	Russia/Belarus	1
Benelux	Bosnia-Herzegovina	1
Benelux, Greece, Spain	Georgia	1
Bulgaria, Croatia	Ukraine	1
Canada	Russia/Belarus	2
Canada, Norway	Russia/Belarus	1
Canada, Hungary	Croatia	1
Croatia, Sweden	Bosnia-Herzegovina	1
Finland, Norway	Russia/Belarus	1
France	Russia/Belarus	2
France, Canada, Italy	Georgia	1
France	Sweden	1
Georgia	Russia/Belarus	1
Hungary	Ukraine	1
Italy	Russia/Belarus	1
Latvia, Sweden	Ukraine	1
Lithuania	Russia/Belarus	1

Norway	Russia/Belarus	1
Poland	Russia/Belarus	2
Poland	Ukraine	1
Romania	Russia/Belarus	1
Romania	Ukraine	1
Slovakia	Ukraine	1
Spain	Russia/Belarus	1
Spain, Czech Republic	Ukraine	1
Sweden	Russia/Belarus	1
UK	Russia/Belarus	2
UK, Slovenia	Russia/Belarus	1
UK	Ukraine	1

Notes: some flights might not be realized due to unforeseen circumstances. Shared flights are listed only once. Belgium, the Netherlands and Luxembourg form a so-called combined party, designated as Benelux. The three states parties are considered to be a single party for the purpose of specified treaty articles and annexes, including the flight quota. In all other respects they are considered as individual states parties.

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About this paper

This paper outlines the main provisions of the Treaty on Open Skies and discusses the interest of the original and new states parties in the agreement. It focuses primarily, though, on events since 2005: the first Review Conference, preparations for use of additional sensor categories, the flight allocation for 2008, and the outcome of treaty implementation—that is, support for monitoring of arms control treaties and military transparency in a co-operative setting.

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