

Did Iraq conduct a clandestine nuclear weapon test?

The London-based *Sunday Times* reported on 25 February 2001 that Iraq had carried out a clandestine nuclear weapon test in 1989. The story—apparently based on interviews with several Iraqi defectors and interpretation of satellite photographs of the purported test area—was detailed and contained enough technical jargon to sound credible. If confirmed, such an event would be a significant blow to proponents of the Comprehensive Nuclear Test Ban Treaty (CTBT) and would provide ammunition to those who argue that the agreement is unverifiable.

The test was reportedly conducted beneath Lake Rezazza, approximately 150 kilometres (km) southwest of central Baghdad, at 10:30 A.M. on 19 September 1989. The site was described as a 'natural cavern' under the lake, which had allegedly been enlarged and strengthened to serve as a cavity to 'decouple' or attenuate seismic signals from a blast. The nuclear device was depicted as an enriched uranium weapon that was placed on a special platform to maximise decoupling. The detonation was said to have produced a yield of 10 kilotons (kt), which would be expected to produce a seismic signal equivalent to an earthquake of about 5.2 magnitude. But the decoupling efforts allegedly reduced the seismic signal to 2.7 magnitude.

Fortunately, it is possible to assess the veracity of the story using seismology, past experience with decoupling, and geology. An examination of global earthquake catalogues—produced by the International Seismic Center and the US Geological Survey—reveal no significant seismic activity in Iraq that day. In fact, no seismicity was detected within 50 km of the reported test site between 1980 and 1999. However, the detection threshold for the global catalogues was probably in the order of magnitude 4.0 in 1989. The use of regional catalogues pushes the detection capability for this area in September 1989 down to around 2.9. Iran, Israel and Jordan all produce earthquake catalogues for the Middle East based on in-country, national networks of seismometers. None of these reported any seismic events of this size in the region around Lake Rezazza on 19 September 1989.

The regional catalogues do reveal some 'unassociated phases', weak seismic waves deriving from an event so tiny that it is difficult to determine its location accurately. Yet there is no reason to believe that these were connected to any man-made event near Lake Rezazza. In US decoupling experiments the seismic signals always showed very large primary-to-secondary (p- to s-) amplitude ratios at high frequencies, a powerful tool for discriminating between explosions and earthquakes. The phases in this case all clearly had both p- and s- wave energy and significant high-frequency s energy, which would indicate a natural earthquake source.

As for the alleged decoupling effect, the maximum decoupling factor often quoted in the scientific literature is 70, making a yield of around 700 tons, for example, appear to be 10 tons. In fact, a decoupling factor of 70 is highly unlikely and has never been observed for a

Inside this issue . . .

John Hart looks at the financial crisis facing the Organization for the Prohibition of Chemical Weapons, while Rosalie Gardiner and Clare Tenner analyse preparations for the 2002 Earth Summit. In addition, all of the usual features: Verification Watch, Science and Technology Scan, Peace Missions Monitor, Verification Quotes, Book Reviews and VERTIC News and Events.

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The Verification Research, Training
and Information Centre (VERTIC)

Baird House
15–17 St. Cross Street
London EC1N 8BW
United Kingdom

tel +44 (0)20 7440 6960
fax +44 (0)20 7242 3266
e-mail info@vertic.org
website www.vertic.org

Iraq remains uninspected . . . mostly

Iraq continues to refuse to permit the UN Monitoring, Verification and Inspection Commission (UNMOVIC) to begin on-site inspections on its territory, as demanded by the UN Security Council. UNMOVIC is exploring the potential use of overhead imagery to ‘complement’ on-site inspections, if and when they resume. At a 21–22 February meeting of its College of Commissioners, it was agreed that the Commission should further investigate the use of overhead imagery, including consultations with governments and commercial providers.

Meanwhile, the International Atomic Energy Agency (IAEA) has carried out its annual inspection of the Tuwaitha nuclear centre in Iraq. Four inspectors from Egypt, Poland, Russia and South Africa confirmed that the low-grade nuclear material held there has not been moved since the last inspection. Western intelligence agencies have again alleged that Iraq has reconstituted parts of its weapons of mass destruction programmes in the more than two years since inspectors, other than routine IAEA inspectors, were allowed into the country. British and American officials maintain that Iraq has rebuilt three factories capable of producing chemical and biological weapons. The German Federal Intelligence Agency is reported to have gathered evidence that Iraq could produce a nuclear device within three years.

Source Wael Faleh, ‘Nuclear Inspectors Praise Iraq’, *Associated Press*, 25 January 2001; Ewen MacAskill and Brian Whitaker, ‘Pressure on Iraq over “new weapons”’, *The Guardian*, 23 January 2001; Douglas Busvine, ‘Iraq nearing capability to use nuclear weapons’, *The Philadelphia Inquirer*, 25 February 2001, inq.philly.com; Fourth quarterly report of the Executive Chairman of the United Nations Monitoring, Verification and Inspection Commission, S/2001/177, 27 February 2001; www.un.org.

test with an actual yield greater than about 300 tons. The claim that the alleged 10kt explosion was muffled to the extent that it registered as a 2.7 magnitude seismic event is, therefore, implausible. A fully decoupled 10kt explosion would more likely have appeared as a 3.8–4.0 magnitude event, easily detectable by global and regional networks at that time.

Moreover, a cavity that could successfully decouple a 10kt test would have to be free-standing, in the order of 700,000 cubic metres and with a 55-metre radius. The geology around Lake Rezaiza encompasses significant areas of carbonates with the potential to produce caves as a result of permeating water. Yet the idea that a very large cave beneath the lake could support the overpressures of a 10kt nuclear explosion, and that such a cavity would be completely isolated from cracks, joints or passageways to the surface, is not credible. The collapse of a nuclear cavity under a lake would, of course, immediately produce a telltale sudden drop in the water level, if not the disappearance of the lake, a risky proposition for a country attempting a clandestine test. Nothing remotely similar to this scenario has been successfully tested in the US or the former Soviet Union.

Assuming that the reported magnitude 2.7, rather than the reported kilotonnage, was a correct estimate, and using a more realistic decoupling factor of 50, the maximum credible yield of the alleged Iraqi test would have been around 900 tons or about 1kt. This would indicate a failed test. A state attempting to conduct a nuclear test for the first time is unlikely to be able to design successfully a device with such a small yield. A larger, cruder device has been the norm for all initial nuclear experiments (the first US highly enriched uranium bomb, detonated over Hiroshima, was 13kt).

Such analyses strongly indicate that Iraq did not conduct a nuclear test in September 1989. The worst-case scenario is an explosion of 1kt or less. Although it is far easier to prove something did happen than to prove that it did not, there is no reason to believe that the *Sunday Times* story is anything but a hoax. It is notable that seismic monitoring and detection capabilities in the Middle East have improved considerably since 1989. At least 30 additional high quality seismic stations are now operating in continuous recording mode, some quite close to the Iraqi border. The detection threshold for nuclear tests in the region has thus been considerably improved, making the conduct of an illicit nuclear test a much greater technical challenge for a potential proliferator than ever before.

erratum

In the last issue of *Trust & Verify*, Australia’s greenhouse gas emissions target under the Kyoto protocol was said to be -8. In fact it is +8. VERTIC apologises for the error.

Professor Terry Wallace

Department of Geosciences, University of Arizona, US
(Former Commissioner, Independent Commission on the Verifiability of the CTBT)

CWC verification in question

The Organization for the Prohibition of Chemical Weapons (OPCW) is experiencing unprecedented financial uncertainty, which threatens its ability to verify the 1993 Chemical Weapons Convention (CWC). The twenty-third session of the Executive Council, in late February, was dominated by the impending financial crisis. The Secretariat currently lacks funds to fulfil its verification responsibilities for 2001. Inspections of the chemical industry have been reduced to a minimum and may be postponed; the status of inspections of military-related facilities is similar, except perhaps in cases where they are subject to continuous remote monitoring. International co-operation and assistance activities under the CWC have also been curtailed or deferred, and the recruitment of new staff has been suspended.

The crisis is mainly due to lower than projected reimbursements to the OPCW for certain 'direct costs of verification', which inspected states parties are obligated to pay. Chemical weapon (CW) possessor states are supposed to meet inspector salaries during the course of an inspection. It had been assumed that up to 10 percent of the annual budget would be met in this way. However, inspectors' salaries must still be paid even if an inspection does not take place. The current budgetary predicament is the cumulative effect (unanticipated by many observers) of non-payment of reimbursements from previous years. Cost increases have also contributed to the emergency, resulting from salary rises for Secretariat employees, which began in mid-2000, the seven-year tenure policy for OPCW staff (producing more frequent recruitment and additional training costs), and the fact that additional CW destruction facilities are scheduled to come online over the next two to three years, which will lead to an increase in verification activities.

The 2001 budget amounts to 60 million euros (around US\$56m). In nominal terms, this is the same as for 1999 and 2000, but it is a reduction in real terms. States parties' reluc-

tance to adequately fund the Organization is illustrated by the fact that consideration of hundreds of individual implementation issues has been heavily influenced by the desire to limit costs. For instance, there is lack of agreement at the working level on the intrusiveness of non-challenge inspections and the frequency of inspection at various types of facilities. Some states parties also believe that OPCW staff levels are too high—there are currently almost 500 people working for the OPCW, of which some 200 are inspectors.

A further matter with financial consequences is the possible revival of the 1990 US–Russia Bilateral Destruction Agreement (BDA). The CWC allows the Executive Council to 'limit verification to measures complementary' to those undertaken under bilateral or other multilateral agreements. One of the original planning assumptions was that there would be a BDA in effect when the CWC entered into force in April 1997. Since Russia and the US have by far the largest declared stockpiles of CW—India and South Korea being the only other declared CW possessors—the size of the OPCW inspectorate would probably be at least halved if a BDA were in force. However, the US–Russia BDA has never been fully implemented.

The reputation and effectiveness of the OPCW is being adversely affected by these unresolved budgetary and implementation issues. The Secretariat may well shrink over the course of the year, which appears to be the deliberate intention of some states. The danger is that the Secretariat will lose irreplaceable expertise and the regime will move away from verifying compliance towards becoming more of a confidence-building regime. This could have dangerous and unpredictable consequences for the entire arms control and disarmament enterprise.

John Hart
On-site inspection researcher, VERTIC

stop press

US President George W. Bush appears to have ended hopes of any early resolution of the disputes that have held up agreement on verification and other details pertaining to the Kyoto Protocol. Bush 'opposes' the Protocol on the grounds that it exempts 80% of the world, including China and India, from compliance, would allegedly cause 'serious harm' to the US economy, and because the causes of climate change are still unproven. Contrary to a campaign pledge, the Bush administration will, therefore, not impose mandatory emissions reductions on US power plants. Meanwhile, Romania has become the first country in Europe, and the first with emission reduction targets, to ratify the Kyoto Protocol.

Source 'Text of March 13 2001 Letter from the President to Senators Hagel, Helms, Craig, and Roberts', White House, Washington, DC, 14 March 2001; Douglas Jehl and Andrew C. Revkin, 'President cancels clean-air vow', *International Herald Tribune*, 15 March 2001, pp. 1 and 3; Statement by Ion Iliescu, President of Romania, Bucharest, 21 February 2001.

Preparing for Earth Summit 2002

Governments, inter-governmental organisations (IGOs) and non-governmental organisations (NGOs) have started to tackle a huge verification task: reviewing implementation of the environmental and development agreements adopted at the 1992 UN Conference on Environment and Development (UNCED)—the ‘Earth Summit’—in Rio de Janeiro, Brazil. The Summit produced three main documents: the Rio Declaration, Agenda 21 and the Forest Principles. Two new conventions were opened for signature, the UN Framework Convention on Climate Change and the Convention on Biological Diversity. The Summit also marked the start of negotiations on desertification, leading to the 1994 UN Convention to Combat Desertification, and created the Commission on Sustainable Development (CSD) to review (among other things) progress in the implementation of Agenda 21 and additional instruments.

The UN General Assembly decided in December 2000 to hold a World Summit on Sustainable Development in Johannesburg, South Africa, in 2002, which will, in part, conduct a 10-year review of the Rio outcomes. Consultation, analysis and strategic dialogue will take place over the next one and a half years at the national, regional and international levels in order to identify areas of progress, the main obstacles to implementation and priority issues for the Summit.

Work has already started at the national level, with governments producing reports reviewing national and local progress. From September–December 2001, these reports will be reviewed region by region under the auspices of the UN Regional Economic Commissions. The UN Department of Economic and Social Affairs has elaborated a proposed framework for the national and regional reviews to facilitate consistency.

In January and March 2002, two Global Preparatory Committee meetings, under the auspices of the CSD, will bring a global perspective to the reviews. The UN Secretary-General will produce reports on global, regional and national progress for the January meeting, ensuring that the substantive review takes place at that time. A report will be finalised at the March meeting. The results will be used at a final ministerial-level Preparatory Committee meeting to identify priority areas for debate in Johannesburg. The CSD is also organising regional roundtable discussions and multi-stakeholder dialogues to contribute to the process.

Despite its complexities, this comprehensive consultation process, which is being undertaken well in advance of the meeting in Johannesburg, should permit the Summit itself to focus on future action, namely global, regional and national commit-

ments for the next five to 10 years. The European Commission, meanwhile, has called for one of the strategic objectives of the Summit to be ‘stronger international monitoring’. A further important activity will be to review global environmental governance to enhance coordination between the various multi-lateral environmental agreements and institutions.

Rosalie Gardiner, Policy Coordinator, UN Environment and Development Forum, London, and Clare Tenner, Environment Researcher, VERTIC

UNEP considers improvements to environmental governance

The Governing Council of the United Nations Environment Programme (UNEP) ended its latest biannual meeting in Nairobi, Kenya, on 9 February with agreement to strengthen the agency, possibly with a view to transforming it into a global environmental governance body. Such a body could have oversight over the implementation of all multilateral environmental agreements, which could, in turn, lead to greater attention to monitoring and verification of compliance. Delegates decided to establish a group of ‘ministers or their representatives’ to examine how to strengthen UNEP and its funding base. The group will feed its proposals into the World Summit on Sustainable Development in 2002.

UNEP has already started looking at ways to make multilateral agreements on wildlife protection work more effectively. One key outcome could be improved verification. A joint project has been launched by the UNEP World Conservation Monitoring Centre in Cambridge, UK, and UNEP’s Division of Environmental Conventions in Nairobi, Kenya, to evaluate how best to harmonise national reporting of five international conventions to protect wildlife: the Conventions on Biological Diversity (CBD), Migratory Species (CMS), International Trade in Endangered Species of Wild Fauna and Flora (CITES), Wetlands (Ramsar) and World Heritage. The results of this project will also be reported to the World Summit.

Source ‘Streamlining biological conventions could save millions of dollars for conserving world’s wildlife’, *UNEP Press Release*, www.unep.org, 15 February 2001; ‘UNEP Aims for Stronger Global Role’, *Environment News Service*, www.ens-news.com, 9 February 2001; ‘Summary of the 21st session of the UNEP Governing Council and Second Global Ministerial Environment Forum’, *Earth Negotiations Bulletin*, vol. 16, no. 16, 12 February 2001.



Verification Watch

Verifying climate change itself

While multilateral talks on finalising the Kyoto Protocol, including its verification arrangements, flounder, and monitoring of the implementation of the Climate Change Convention itself remains fraught with difficulties, the Intergovernmental Panel on Climate Change (IPCC) has been doing some verification of its own. It recently adopted three reports outlining the current scientific consensus on the status of climate change, its future impact and possibilities for mitigation. The reports will be synthesised into the IPCC Third Assessment Report later this year.

Working Group I's report, adopted on 22 January in Shanghai, China, concludes that there is 'new and stronger evidence that most of the observed warming over the last 50 years is attributable to human activities'. The report increases projected temperature rises between 1990 and 2100 to 1.4–5.8 degrees centigrade, compared with 1–3.5 degrees in the 1995 Second Assessment Report, and states that this is 'very likely without precedent during at least the last 10,000 years'.

Working Group II's report, adopted on 17 February in Geneva, Switzerland, concludes that more people are likely to be harmed by, than to benefit from, climate change, even for global mean temperature increases of less than a few degrees centigrade. Potential adverse effects include a widespread increase in flooding, reductions in crop yields in tropical and subtropical regions, decreased water availability in water-scarce regions, greater mortality rates due to heat stress, and higher exposure to vector- and water-borne diseases.

Working Group III's report was the most politically contentious. After much wrangling, it was adopted on 3 March in Accra, Ghana. It states that new technologies which can help restrain the growth of greenhouse gas emissions, such as wind power, have been developed faster than anticipated since the Second Assessment Report. By 2020, furthermore, half of the potential emission reductions:

'may be achieved . . . with direct benefits (energy saved) exceeding direct costs (net capital, operating and maintenance costs)'.

The report also stresses the advantages of carbon removal and storage, and the use of economic mechanisms, such as carbon trading.

Source 'Global climate change warning confirmed', *ENDS Daily*, 22 January 2001; 'Global impacts of climate change assessed', *ENDS Daily*, 19 February 2001; 'Global climate change can be conquered', *ENDS Daily*, 5 March 2001. Also see www.ipcc.ch.

CTBT news

The CTBT Preparatory Commission's Working Group B (WGB) on verification met from 5–16 February in Vienna. CTBT Executive Chairman Wolfgang Hoffmann reported that, by the end of 2000, the first 11 of the 321 International Monitoring System (IMS) stations had been certified as meeting technical specifications, 98 were complete or substantially met requirements and 90% of site surveys had been finalised.

Ambassador Arend Meerburg of the Netherlands has been appointed to the new position of Task Leader for an Operational Manual for on-site inspections. Based on a consolidated draft rolling text, development of the Manual is expected to begin in earnest at the next WGB meeting in June. To facilitate access to more than 1,000 pages of text, the Provisional Technical Secretariat (PTS) is producing a CD-ROM version.

Little progress has been made on the question of the release of IMS data to third parties. China is reportedly still blocking agreement on a phased release to humanitarian relief and scientific organisations. As a modest first step, procedures for access to IMS data and International Data Centre (IDC) products by external contractors working for the PTS were agreed.

Laslo Evers and Hein Haak of the Royal Netherlands Meteorological Research Institute have discovered that infrasound and other CTBT verification technologies can detect and identify meteor collisions with earth. Their report in *Geophysical Research Letters* led to incorrect speculation in the German media that meteorites could produce 'false nuclear alarms' because they might be mistaken for atmospheric nuclear explosions.

There are reports that the US intelligence community is divided over whether Russia is violating the CTBT at its test site at Novaya Zemlya. Some analysts reportedly argue that Russia might have been conducting either nuclear test explosions or so-called hydronuclear experiments, both of which are banned by the treaty. Russia has refused a US offer to enhance bilateral transparency measures. If and when the US ratifies the treaty and it enters into force, such controversy can be dealt with by a request for an on-site inspection.

The second 'Article XIV Conference on Facilitating Entry into Force of the Treaty' is scheduled to take place from 25–27 September 2001 in New York, while the UN General Assembly is in session. On 23 February the Philippines and Ukraine deposited their instruments of ratification with the UN Secretary-General, bringing the number of ratifications to 71, including 31 of the 44 states whose ratification is required for the treaty to enter into force. The CTBT has been signed by 160 states.

Source Press Releases of the PrepCom of the CTBTO, Vienna, 1 March 2001; Laslo G. Evers and Hein. W. Haak, 'Listening to sounds from an exploding meteor and oceanic waves', *Geophysical Research Letters*, vol. 28, no.1, 1 January 2001, pp. 41–44; 'Falscher Atom-Alarm durch Meteoriten', *Süddeutsche Zeitung*, 9 January 2001, www.sueddeutsche.de; William J. Broad and Patrick E. Tyler, 'Dispute Over Russian Testing Divides U.S. Nuclear Experts', *New York Times*, 4 March 2001; 'Report of Working Group B to the Fourteenth Session of the Preparatory Commission for the CTBT', CTBT/WGB-14/I, Vienna, 22 February 2001.

INF inspections end, but Kalinigrad inspections sought

On 11 December 2000, Belarus, Kazakhstan, Russia, Ukraine and the US signed agreements to end the 24-hour monitoring of missile manufacturing plants, which has successfully verified implementation of the 1987 Intermediate-range Nuclear Forces

(INF) treaty. The agreement, signed originally by the US and the Soviet Union, eliminated a whole class of nuclear systems: 2,600 nuclear-armed land-based missiles and cruise missiles with 500–5,500 km ranges. The INF verification system was revolutionary, creating the first ever on-site inspection regime for nuclear missiles. While the INF treaty is permanently binding, the verification inspection regime and related infrastructure will be disassembled by 31 May 2001. US officials have confirmed that 'other types of monitoring', presumably by satellite and other 'national technical means', will continue for intermediate-range missiles.

Meanwhile, in response to a *Washington Times* report of 10 January 2001 that Russia has positioned tactical nuclear weapons in its Baltic Sea enclave of Kaliningrad, Poland and Lithuania have demanded that inspections be carried out to verify the claim. Poland's Defence Minister, Bronislav Komorowski, said:

Earth Summit 2002: A New Deal, Edited by Felix Dodds
Earthscan Publications, London, 2000, £18.50, paperback

review

Evoking US President Franklin D. Roosevelt's New Deal of the 1930s, this work reflects the hopes that most of its readers will have that the 2002 Earth Summit will reinvigorate the sustainable development agenda known as Agenda 21. By bringing together contributions from all relevant sectors, including governments, IGOs and NGOs, this timely book probes the subjects that the Summit should address and the preparatory action needed. Contributors also present the concerns of different regions—North, South and 'economies in transition'—making *A New Deal* a truly global analysis. Yet the downside of having such a variety of contributions is a certain degree of repetition.

The first part of the book focuses on the challenges to implementation of Agenda 21 from the point of view of the UN, NGOs, central and local government, trade unions and women. The key message is that the major goals of sustainable development have so far proved elusive. Explanations vary depending on specific stakeholder concerns, but there is a convergence of opinion on a lack of resources and capacity, political will on the part of governments and adequate communication. As to the solutions, there is agreement that, at this stage, only fundamental changes will do. Since Part I is the only section that deals directly with implementation, one might have expected a chapter on the important subject of verification. This is unfortunately not the case, despite the fact that almost all of the other chapters flag compliance, monitoring and verification as vital tools for ensuring the success of Agenda 21.

Of particular interest from the verification point of view are the chapters in Part III on forests and finances, which both acknowledge the importance of verification for sustainable development and recommend its creation or enhancement. Rob Lake notes civil society's important role in establishing transparency and information disclosure mechanisms to verify companies' compliance with sustainable development standards.

Emerging issues are analysed in the fourth part of the book. Margaret Brusasco-Mackenzie describes existing global environmental monitoring systems and the support needed to ensure their effective operation, while Jagjit Kaur Plahe and Pieter van der Graag examine the potential of verification and monitoring in their chapter on the accountability and responsibility of transnational corporations. While voluntary codes of conduct are the main tool proposed by transnationals to guarantee their compliance with the Rio Principles, the authors note that their credibility and effectiveness will depend on independent monitoring and evaluation.

Felix Dodd closes the book with a chapter on the reform of international institutions, outlining some of the options, including the creation of a World Environment Organisation to provide an environmental counterweight to the pro-trade stance of the World Trade Organization. He supports a 'new realistic deal' between developed and developing countries on the environment, one that also involves other newly acknowledged stakeholders, such as civil society. *Earth Summit 2002: A New Deal* offers comprehensive and stimulating analysis not only for policymakers, but also for anyone interested in the advancement of sustainable development.

Alexandra González-Calatayud, Intern, Legal Affairs Division, World Trade Organization, Geneva

Verification Quotes

A report by the Independent Commission on the Verifiability of the CTBT concludes that when all the resources are put into place, they will be able to detect, locate and identify all relevant events. Monitoring and verification will involve a complex and constantly evolving network, which any potential violator will have to confront. A treaty evader would need to muffle the seismic signal, ensure that no signature particles or gas escape the cavity, as well as avoid the creation of surface evidence, such as a crater. And, all test preparations, such as making a cavity or buying materials, would have to be done without causing suspicion. Only the United States and the former Soviet Union have ever been able to carry off such a test. How likely could an emerging nuclear weapon state do so? Some have argued that advancing technology would make hiding such a test easier, but that assumes all monitoring and detection technology will stand still. New technologies and the expansion of a global monitoring regime will make it more difficult to conceal such tests.

Senator Daniel Akaka, 'The CTBT and a National Non-Proliferation Policy', US Senate, Congressional Record, p. S1457, 15 February 2001.

There's a lot of respect for our role there. The reason it's successful is it has been sorted out between the parties and the stakeholders. If we'd gone in with anything bigger the locals would have lost ownership and lost interest.

Australian Foreign Affairs official Simon Merrifield, commenting on the success of the tiny peace monitoring team in the Solomon Islands. Quoted in The Age (Melbourne), 17 February 2001, p. 4.

Any treaty on defense issues is a compromise—you lose something and you gain something. At a time when NATO could continue its eastward expansion, when there's the possibility of new kinds of weapons being deployed and new ABM systems created, the Open Skies Treaty gives Russia the chance to monitor the military activities of European countries and the United States.

Colonel Fyodor Syemkin, representative of the National Center for Reduction of Nuclear Danger, commenting on the possible ratification of the Open Skies Treaty by the Russian Duma. Quoted in Vladimir Mukhin, 'Easing tensions or revealing secrets', The Russia Journal, 25 November 2000.

. . . discussions will move on and at some stage there will be a solution which leads to a renewed inspection.

Hans Blix, Executive Chairman, UN Monitoring, Verification and Inspection Commission, cited in 'Blix sees U.N. weapons inspectors in Iraq in 2001', Cable News Network, 6 December 2000, www.cnn.com.

'Poland needs to monitor the situation in Kaliningrad on a day-to-day basis . . . verification will include pushing for international inspection, which is the normal thing'.

Under an informal agreement between the US and Russia in 1992, Moscow undertook to remove all tactical nuclear weapons from forward-deployed areas and to place them in 'centralised storage'. But no verification of these unilateral undertakings has ever occurred and the location of the storage areas has not been identified.

Russia has repeatedly denied that there are any nuclear weapons in Kaliningrad and refuses to countenance inspections. The Russian Defence Ministry stated that the *Washington Times* report 'does not conform with reality, as Russia's tactical nuclear warheads are at their permanent storage sites and have not been transferred anywhere'. An unconfirmed report in the *Washington Times* claims that US spy satellites have located the exact positions of Russian tactical nuclear weapons since their suspected arrival on 6 June 2000.

Source 'Russia transfers nuclear arms to Baltics', www.washtimes.com; 'Poland angered as Russia deploys missiles', *The Times*, 5 January 2001; Bill Gertz, 'Poland wants inspections in Kaliningrad', *Washington Times*, 5 January 2001;

Bill Gertz, 'Satellites pinpoint Russian nuclear arms in Baltics', *Washington Times*, 15 February 2001.

Uranium shipment from Russia to India

The US has described Russia's supply of fuel to India's water-cooled reactor at the Tarapur Atomic Power Station (TAPS) as a 'violation of Russia's nonproliferation commitments'. Most members of the Nuclear Suppliers Group, of which Russia is a member, reportedly opposed the move. India argues that the deal is legal. Foreign Ministry spokesman Raminder Singh Jassal stated that, 'All import of fuel for Tarapur atomic power station has always been under IAEA . . . safeguards'. While TAPS is under IAEA safeguards, however, other Indian nuclear facilities are not. China has also supplied nuclear fuel for the Tarapur reactors.

Source 'Statement by Philip T. Reeker, Deputy Spokesman', US Department of State, Office of the Spokesman, Washington, DC, 16 February 2001; 'India Defends Importing Nuclear Fuel from Russia', *Reuters*, 20 February 2001; David Albright, Frans Berkhout and William Walker, *Plutonium and Highly Enriched Uranium 1996: World Inventories, Capabilities and Policies*, SIPRI, Oxford University Press, Oxford, 1997, p. 182.



Filling the verification voids?

A new method of detecting underground structures or voids—gravity gradiometry—has been successfully tested: an underground missile launch facility at Vandenberg Air Force Base in California was positively identified. Where tunnels or bunkers are constructed, the mass of the earth that is removed results in a weaker gravity signal. The gravity gradiometer detects the rate of change of gravity, rather than gravity itself (as previous models did), and is, therefore, much more sensitive. The device, developed by the US Air Force Research Laboratory in Massachusetts, has been designed to be portable and to be used in the field by a two-person team operating under a normal working environment. A more sensitive model could be built for use on an airborne platform.

The external detection and verification of underground facilities has always been difficult, but this new technique when used in conjunction with existing methods, such as satellite image analysis, audio magnetotelluric and geophysical exploration, could help to provide conclusive data on sites likely to hide underground facilities. Planned uses for the technology include detecting underground bunkers in Iraq and checking for tunnels under the Korean demilitarised zone. Because this new system is extremely good at pinpointing the signatures of very large underground voids, it could be ideal for locating the sites of suspected underground nuclear tests.

Source ‘Scanner will spot military bunkers’, *The Times*, 29 January 2001, p. 9; ‘A comparison of gravimetric techniques for measuring subsurface void signals’, *Journal of Physics D: Applied Physics*, vol. 34, no. 3, 7 February 2001, pp. 433–443, www.iop.org.

Verification clothing

Continuing research into ‘smart clothing’ could yield useful results for those conducting on-site inspections. ‘I-wear’ garments being developed by Starlab, a private research group in Brussels, Belgium, contain cameras and microphones, house small batteries or solar cells and generate small amounts of electricity from human movement. The clothes can also link the wearer’s position to a satellite, providing information on their location and what the body is doing. The data collected can also be transmitted to a memory chip for future use. While the prototypes are rather crude, I-wear could provide the ideal self-contained garment for carrying out future on-site inspections.

Source ‘Geek Chic’, *New Scientist*, 24 February 2001, pp. 30–33.

Robots turn on a dime, park on a nickel

Scientists at the US Department of Energy’s Sandia National Laboratories have created what may be the world’s smallest mini robot at a quarter of a cubic inch and weighing less than one ounce. The new mini robot has an 8K ROM processor, temperature sensor, and two motors powering two tracks, allowing it to travel at some 20 inches a minute. Plans for further development include a miniature camera, microphone, two-way communication device and chemical micro-sensor. These robots may eventually be able to work like swarms of insects, in communication with each other and a ground station, performing verification tasks, such as locating landmines or detecting chemical and biological weapons.

Sandia National Laboratories have also developed a super miniaturised version of a traditional preconcentrator that is used to collect gas samples for analysis. With an active area of only two millimetres by two millimetres it is highly portable. It could be used to verify the presence of chemical weapons without the need to send samples to a laboratory.

Source ‘Can turn on a dime and park on a nickel’, Sandia National Laboratories Press Release, 31 January 2001; ‘Tiny sampling device promises big results for detection and analysis of chemicals’, Sandia National Laboratories Press Release, 28 August 2000 (see www.sandia.gov).

Verifying the paper chain

The University of Sydney and the Queensland Police Service in Brisbane, Australia, have developed a means of distinguishing between different batches of white paper. This could provide a powerful verification tool for checking the authenticity of documents like nuclear accounting records. The team tested for 23 chemical elements in samples of 17 different papers from around the world. They found that they could reliably measure nine of these elements and that they only required two, strontium and manganese, to identify each paper type. It is hoped that, with the ability to identify all nine elements, it will be possible to distinguish between hundreds of different types of paper.

Source ‘Paper Chase’, *New Scientist*, 22 July 2000, p. 10.

Canadian portable radar

Canadian defence researchers are developing a portable high-frequency radar to detect cruise and theatre ballistic missiles and to monitor the country’s Arctic territories. The system, which uses high-frequency surface-wave radar, can track objects

at much greater distances than conventional, line-of-sight microwave radar. The radar transmits high-frequency waves and uses the ocean as a conducting surface to increase its range. It is able to detect and track targets hundreds of kilometres over the horizon. A fixed-site version for coastal operations is expected to have a range of 500 km for large objects, such as icebergs, and 200 km for other targets, like small aircraft. The Canadian forces have identified it as a potential part of a ballistic and cruise missile defence system.

Source 'Canadian radar to detect missiles over Arctic', *Defense News*, 22 January 2001, pp. 3–4.

Getting under your skin: GPS implants

Applied Digital Solutions of Florida has licensed the technology for Ground Positioning System (GPS) implants. The device, the size of a small coin, is designed to be inserted under the skin. The miniature GPS system has a receiver that uses satellites to calculate its location. The device can then broadcast this information to a local receiver. It is powered by a piezoelectric device that converts energy from the body's movement into electricity that is stored in a small battery. Such a system could be used for tracking on-site inspectors.

Source 'They can find you', *New Scientist*, 12 August 2000, p. 7.

Peace Missions Monitor

Solomon Islands monitoring mission partially succeeds

A 50-strong Australian and New Zealand team has been monitoring and facilitating implementation of a peace agreement signed in Townsville, Australia, in October 2000 aimed at ending the conflict between rival militias in the Solomon Islands. The international team is answerable to an indigenous peace monitoring council. Militias from the islands of Malaita and Guadalcanal handed over their weapons in December to the international team in return for amnesties for criminal acts committed during the conflict that began in 1999. This process has gone well, although an estimated 500 weapons are still unaccounted for. The head of the mission, Australian Foreign Affairs official Simon Merrifield, reported that not a single member of the team had been threatened or confronted while carrying out their mandate, despite having to approach armed men in the streets and gently suggest they surrender their arms.

Source *The Age* (Melbourne), 17 February 2001, p. 4.

New role for Congo monitors

At a 21 February meeting at UN headquarters in New York between six warring countries and three main rebel groups involved in the war in the Democratic Republic of the Congo (DRC), agreement was reached on the start of troop disengagement. A deadline of 15 March was set for a 15-km withdrawal and 15 May for a complete pullout. As of 28 February, both Rwanda and Uganda had begun to withdraw their troops from the frontline. UN Secretary-General Kofi Annan said that he hoped these developments would inspire all sides to set a date for total disengagement and allow full deployment of the UN Organisation Mission in the Congo (MONUC).

MONUC was established in November 1999 to monitor the 10 July 1999 Lusaka ceasefire agreement. Due to continued fighting, though, the mission was only partially deployed and found it impossible to fulfil its mandate. From 1 January 2001, there were reported to be 183 military observers, 24 troops and 216 international and 142 local civilian personnel involved in MONUC. This is supposed to be increased to 5,500 this year, just above the original authorised deployment level. While recent developments are encouraging, it is only the beginning of what will undoubtedly be a long process of restoring peace in the region.

Source www.un.org; 'New hopes for peace in DRC as sides enter talks', *Jane's Defence Weekly*, 28 February 2000; 'Rwanda, Ugandan forces pull back from DRC', *Jane's Defence Weekly*, 7 March 2001; 'Security Council urges warring parties in DRC to begin to disengage by 15 March 2000', UN News Service, New York, 22 February 2000; 'Congo pull-back plan welcomed', BBC News, 23 February 2001, bbc.co.uk.

IRA talks to decommissioners

The Irish Republican Army (IRA) has held its first meeting since February 2000 with the Independent International Commission on Decommissioning, which is meant to oversee decommissioning of paramilitary weapons under the 1998 Good Friday Agreement. The IRA said the meeting had taken place to 'set out the basis for discussions'. Despite previous undertakings, the IRA has failed to engage in any meaningful dialogue with the Commission, much less move to verified decommissioning. Ulster Unionist Leader David Trimble, meanwhile, has revealed that the UK and Irish governments were pressuring the IRA to begin decommissioning.

Source *The Times*, 19 January 2001, p. 2; *The Times*, 15 March 2001, p. 14.

VERTIC hosts on-site inspection workshop

On 8–9 March VERTIC hosted a workshop in London on ‘On-site inspections in arms control and disarmament regimes: theory and practice’. It was attended by 13 experts with significant and varied experience in the planning and implementation of on-site inspections (OSIS). Participants discussed OSIS conducted under the Chemical Weapons Convention (CWC), the Comprehensive Nuclear Test Ban Treaty (CTBT), the Conventional Armed Forces in Europe (CFE) Treaty, the conventional arms control arrangements of the 1998 Dayton Agreement, which ended the war in the former Yugoslavia, and the 1999 Vienna Documents on Confidence- and Security-Building Measures. Inspections carried out by the International Atomic Energy Agency (IAEA) and the now defunct UN Special Commission on Iraq (UNSCOM) were also discussed.

The workshop was organised partly to inform a VERTIC Research Report on OSIS, scheduled for publication in mid-2001. Although OSIS have generally been considered within the context of specific regimes, current VERTIC research will highlight similarities and differences between them across regimes. The workshop helped to shed light on the practical problems and benefits of OSIS. In general, they can and do play a useful role, especially when they are well integrated with other verification measures. On-site inspections are also a useful gauge for determining the seriousness and effectiveness of member states’ political commitments to a particular regime. For further details of the workshop and its participants see the VERTIC website at www.vertic.org.

Promotion of Commission's Final Report

From 3–8 February, Trevor Findlay, as former Chairman of the Independent Commission on the Verifiability of the CTBT, and Oliver Meier, as former Commission Secretary, visited the US to present the Commission’s findings to various audiences. The Commission was established by VERTIC in August 2000 and released its report in November. On 5 February, Trevor presented the report at a seminar at the UN, co-sponsored by the Department for Disarmament Affairs. Under Secretary-General Jayantha Dhanapala chaired the event, which was attended by about 80 participants from national missions, NGOs and the media.

In Washington, DC, the Coalition to Reduce Nuclear Dangers hosted a seminar, attended by about 70 people, at the Carnegie Endowment for International Peace. Trevor Findlay shared the panel with Ambassador Jim Goodby, a member of

the Presidential Task Force on the CTBT, and presented the Commission’s report. He and Oliver Meier also presented the findings of the report to officials of the Departments of Energy and State and to Senate staff members responsible for CTBT-related issues. Finally, in a meeting hosted by the Australian Embassy, they briefed a select group of diplomatic representatives on their discussions in Washington. On returning to London, Dr Findlay and Dr Meier reported on their trip to a meeting of the Programme for Promoting Nuclear Non-Proliferation/Mountbatten Centre for International Studies/Foreign and Commonwealth Office (PPNN/MCIS/FCO) Non-proliferation Study Group at the FCO on 9 February. As a direct result of the trip the Commission’s report was mentioned on the floor of the US Senate (see *Verification Quotes* opposite).

Staff news

TREVOR FINDLAY, in addition to his presentations on the Independent Commission’s report in New York and Washington, DC, met with UN officials to discuss the Brahimi Report on peacekeeping reform, with Hilary Palmer to discuss US foundation funding developments and with George Perkovich of the W. Alton Jones Foundation to discuss funding. On 14 March he met with Richard Lloyd of Landmine Action. He reviewed a chapter for the 2001 *SIPRI Yearbook* on conflict prevention, management and resolution.

KELLY GROLL assisted with office duties and has been researching the monitoring missions in the Democratic Republic of the Congo and on the Ethiopia/Eritrea border.

JOHN HART organised and chaired VERTIC’s on-site inspection workshop in London on 8–9 March. On 16 February he attended a presentation, sponsored by the Sussex Policy Research Unit, by Dr David Kelly of the UK Ministry of Defence and former UNSCOM biological weapons (BW) inspector on UNSCOM’s BW assessments and its relation to a future Biological and Toxin Weapons Convention protocol. John continued work on several papers for publication, including a VERTIC *Research Report* on on-site inspections under the CWC and one on on-site inspections across several arms control and disarmament regimes.

OLIVER MEIER together with Clare Tenner and Trevor Findlay attended a panel on 22 January at Chatham House on ‘The

end of Foreign Policy?’—the guest speaker was UK Secretary of State for Foreign and Commonwealth Affairs Peter Hain. On 1 February he and Clare attended a study group meeting at the British Institute of International and Comparative Law on the use of earth observation data in the legal sector. On 30 January the German daily, *die tageszeitung*, published an op-ed by Oliver on the new US administration’s CTBT policy.

On 15 February Oliver attended a seminar on German defence policy at the International Institute for Strategic Studies (IISS) with Theodor Sommer, former editor of the German weekly, *Die Zeit*. On 21 February, together with Angela Woodward and John Hart, he attended a public speaking seminar at the Directory of Social Change. From 23–25 February he attended the annual meeting of the German Peace Research Association in Iserlohn. He gave a presentation with Iris Hunger on ‘The use of open sources in arms control: democratising arms control?’, which will be published in the conference proceedings. Oliver also wrote ‘CTBT Inspections Remain Contentious’ for *BASIC Reports*, no. 77, 10 March 2001.

ELLEN PEACOCK completed the drafting of VERTIC’s 2001 *Verification Organisations Directory*, which will be published later in the year. She also added project descriptions and staff biographies to the website and completed the reorganisation of the library. Ellen has left VERTIC to return to the International Institute for Strategic Studies. VERTIC is grateful for her contribution and wishes her well in her new job.

JOHN RUSSELL was promoted from VERTIC intern to Arms Control and Disarmament Research Assistant on 5 March. He began researching a VERTIC *Research Report* on the verification of the Intermediate-range Nuclear Forces Treaty and helped to organise the VERTIC on-site inspection workshop. John also started work as a research assistant for Jane Boulden on the *Handbook on Verification and Compliance* that is to be published jointly by VERTIC and the UN Institute for Disarmament Research. His research began with the verification system of the Conventional Armed Forces in Europe Treaty.

Tightening the Reins: Towards a Strengthened International Nuclear Safeguards System

Edited by Gotthard Stein & Erwin Häckel, Springer, Berlin/Heidelberg, 2000, euros 69.95, hardcover

review

In May 1997 the Board of Governors of the International Atomic Energy Agency (IAEA) agreed on a Model Additional Protocol to existing nuclear safeguards agreements as a primary component of efforts to reform Nuclear Non-Proliferation Treaty (NPT) safeguards. Germany is a key player in this process. *Tightening the Reins*, the result of a project conducted by the Research Centre, Jülich, and the German Society for Foreign Affairs in 1997–99, contains articles from 17 academics, practitioners and officials on the past, present and future of the so-called Strengthened Safeguards System. While the volume is one of the most comprehensive analyses of safeguards reform, it is, as the authors laudably acknowledge, mostly from the perspective of Germany, a non-nuclear weapon state with a large nuclear energy industry.

In Part One, Reinhard Loosch, who represented Germany in the negotiations on the Additional Protocol, gives a detailed account of the motivations of the main players and how these affected the outcome. Part Two addresses some of the important implications of the Strengthened Safeguards System for industry, politics and international security. The book’s German focus is most apparent in the discussion of industry’s view on the future of safeguards, as well as the broader context of safeguards reform. The integration of traditional and new safeguards—which is of particular interest to Germany, as it stands to lessen its safeguards burden significantly—thus figures prominently.

In Part Three, researchers and practitioners tackle the uncomfortable question of how safeguards can be implemented effectively and efficiently, while adhering to the principle that all states in multilateral agreements are equal. Among others, Erwin Häckel asks how safeguards can be implemented in weak and failed states and Annette Schaper addresses the application of safeguards in ‘states under suspicion’. Harald Müller describes the ‘uses and limits of international safeguards in nuclear weapon states’.

The one issue not covered in depth in the book is the ramifications of safeguards reform for the IAEA itself. The Agency is a key actor in the reform process, yet its interests and policies are mentioned only in passing. This weakness, however, in no way undermines the important contribution that the book makes to the safeguards reform debate. To the knowledge of this reviewer, it is the most comprehensive, thorough and readable account of such reform efforts. The book also contains many creative ideas on how to advance the process without dodging difficult political questions. *Tightening the Reins* provides a useful roadmap for the journey ahead.

Oliver Meier, Arms Control and Disarmament Researcher, VERTIC

CLARE TENNER has been working on two chapters for VERTIC's *Verification Yearbook 2001*. She also wrote a proposal for additional funds for the climate change project and a report to the W. Alton Jones Foundation outlining the achievements of the Climate Change Project over the past two years. On 12–13 February she attended a strategy meeting of Climate Action Network Europe. From 28 February–2 March Clare represented the global Climate Action Network at a formal workshop arranged by the Climate Change Convention Secretariat on reporting of third national communications under the Convention. On 6 March Clare met with Rosalie Gardiner of the UN Environment and Development Forum to discuss links between VERTIC's work and progress towards the Earth Summit on Sustainable Development in 2002.

ANGELA WOODWARD managed the organisation's administration and continued her research work on monitoring compliance with the Landmine Convention. Angela participated in the Landmine Monitor Researchers meeting in Washington, DC, on 8–9 March and attended the Landmine Action UK meeting in London on 15 March and the PPNN/MCIS/FCO meeting on 9 February. On 28 February, Angela and Oliver Meier attended a meeting of the All Party Group on Global Security and Nonproliferation at the House of Commons on the subject of US National Missile Defence. Angela also participated in the Women in International Security's (British Chapter) meeting at King's College London on 21 February with guest speaker Dianna Melrose, Head of Policy Planning Staff at the FCO.



VERTIC is the Verification Research, Training and Information Centre, an independent, non-profit making, non-governmental organisation. Its mission is to promote effective and efficient verification as a means of ensuring confidence in the implementation of international agreements and intra-national agreements with international involvement. VERTIC aims to achieve its mission through research, training, dissemination of information, and interaction with the relevant political, diplomatic, technical, scientific and non-governmental communities.

Baird House
15–17 St. Cross Street
London EC1N 8UW
United Kingdom

tel +44 (0)20 7440 6960
fax +44 (0)20 7242 3266
e-mail info@vertic.org
website www.vertic.org

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PERSONNEL Dr Trevor Findlay, *Executive Director*; John Hart BA (Hons), MA, *On-Site Inspection Researcher*; Dr Oliver Meier, *Arms Control & Disarmament Researcher*; Ellen Peacock BA (Hons) *Networker & Information Officer*; John Russell, MA, *Arms Control & Disarmament Research Assistant*; Clare Tenner BSc (Hons), MRes, *Environment Researcher*; Angela Woodward BA (Hons), LL.B., *Administrator & Legal Researcher*; Kelly Groll, *Intern*.

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