Main lessons from the Integrated Field Exercise 2008

BY JOHN R. WALKER

Photo: Kirsten Haupt

Deployment of a seismometer during the Integrated Field Exercise 2008 in Kazakhstan.

In spring 1962, as the newly established Eighteen Nation Disarmament Committee started work, President John Kennedy wrote to his friend and colleague Harold Macmillan, then British Prime Minister and a staunch advocate of a Comprehensive Nuclear-Test-Ban Treaty (CTBT). One of the main problems facing the negotiators was how to deal with large numbers of uncertain seismic events that would be detected by the then envisaged monitoring system. Kennedy told Macmillan:
"No matter how we arrange to detect seismic events that might or might not be nuclear explosions, the only way we can always verify the proposition that a given event is not a nuclear explosion is by on the spot inspection."

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Forty-eight years later that statement remains as valid as it was in 1962. Although the early years of CTBT negotiations in the late 1950s and early 1960s witnessed a considerable amount of experimental work on seismological and other means of detecting nuclear explosions, nothing equivalent was done for on-site inspections. For this we had to wait until the establishment of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) in 1996, which has since conducted a large number of field exercises. These have yielded practical insights into how to plan, mount and conduct an effective on-site inspection (OSI). The Integrated Field Exercise 2008 (IFE08), carried out at the former Soviet nuclear test site at Semipalatinsk, Kazakhstan, was by far the most ambitious and largest CTBT OSI ever conducted. It involved nearly 50 tonnes of equipment and around 200 personnel and generated a vast quantity of information. This article highlights the main lessons, future priorities and action being taken by the CTBTO's OSI Division to implement them.

THE ROLE OF AN OSI

A credible OSI capability will be a key component of the CTBT's verification regime once the Treaty has entered into force, and will serve as a deterrent to cheating. We need to build up a cadre of well-trained and motivated inspectors with the right balance of experience and expertise across a diverse range of scientific and other disciplines. We need robust and reliable equipment that is fit for purpose. And finally, we need logistical support to enable inspectors to be deployed quickly, along with their equipment, to potentially remote and climatically hostile locations.

Inspectors may use several techniques, such as visual observation and gamma radiation detection for detecting residual radioactive contamination, which is needed to help inspectors narrow down the search area. Overall it is the effective and sustained integration of these techniques that is critical for a successful inspection. The IFE08 therefore sought to test how key OSI techniques could be implemented in an integrated manner. In CTBT OSIs, it is the synergy of these techniques that provide the system's strength; if they are applied disjointedly with no attempt to integrate the information gathered, then an inspection's utility is limited. In addition, its prospects of establishing whether the suspect event in question was a nuclear explosion conducted in breach of the Treaty's Article I , which bans all nuclear test explosions and any other nuclear explosion, correspondingly diminishes.

Photo: Kirsten Haupt

NOBLE GAS SAMPLING:
Testing noble gas sampling equipment during the Noble Gas Field Operation Test, Slovakia, October 2009.

TESTING NOBLE GAS DETECTION PROCEDURES
Inspectors drilling a hole to extract air from the ground to be examined for traces of the radioactive noble gas, Argon.

Photo: Kirsten Haupt

IFE08: SOME MAIN POINTS

IFE08 provided some 880 lessons covering a wide range of issues – from matters such as planning and scenarios for future exercises; radiation monitoring; the Seismic Aftershocks Monitoring System; overflights; negotiating and leadership; equipment specifications; design and operation of the Field Information Management System (FIMS) – the computer system used by inspectors to hold, process and present inspection data gathered in the field; size and composition of an inspected State Party's escort team; geophysical surveys; sampling strategies; design and operation of the radionuclide laboratory; logistical support; documentation; health and safety; and media handling. In the subsequent review and evaluation process, we found that in some areas good progress had been made, but in other areas much more is required to bring capabilities up to a higher standard. The Seismic Aftershock Monitoring System worked well and provided valuable data for the inspectors – this is one of the key techniques employed by inspectors in the early stages of an OSI. Deployment of the seismometers and the subsequent data processing all performed satisfactorily.

One of the problems in many arms control verification exercises is realistically simulating features and signatures that would be indicative of non-compliance – especially in a CTBT OSI exercise; or sufficiently anomalous to attract inspectors' attention. A key lesson from IFE08 for the design of future comparable exercises is the need to develop more plausible and technically credible "artificialities". Some of those created for IFE08, although providing a useful prop for testing some of the Treaty's inspection provisions, could have been better developed.

As the Duke of Wellington remarked later in life on his first campaign, "At least I learned what not to do, and that is always a valuable lesson." The whole point of exercises is to establish what remains to be done and where weaknesses lie so that they might be overcome. The CTBTO's OSI Division has an Action Plan in place to implement these lessons and to move forward the level of operational readiness. Pressing ahead with this Action Plan is now a key priority for the CTBTO.

OSI OPERATIONAL MANUAL

The CTBTO's OSI Operational Manual, when finalized, will contain detailed guidance for the future CTBTO, inspectors and an inspected State Party on the preparations for, planning and conduct of an inspection. One of IFE08's main objectives was to test a version of the Operational Manual specifically prepared for the exercise. This was to facilitate further elaboration of the draft OSI Operational Manual to be adopted by the first Conference of States Parties after entry into force of the Treaty. IFE08 showed that much of the Test Manual worked reasonably

Photo: Kirsten Haupt

THE FINAL STAGE OF IFE08
John Walker [right] during the discussions of the final reporting document at IFE08.

well, but that more work is required on some issues, such as definitions of what constitutes the initial overflight.

FUTURE WORK

IFE08 did not address all aspects of the OSI regime. Some techniques (multispectral imaging, radioactive xenon sampling and analysis, active seismometry, gravimetry – a technique that measures relative variations in the Earth's gravitational field – and drilling) and issues (off-site sample analysis and requesting State observer) were excluded. This was largely for financial reasons and because some capabilities have not yet been fully developed for OSI purposes. Insufficient time, too, was available for a fuller testing of the geophysical techniques such as magnetometry and resistivity (an intrinsic property of a material which resists the flow of an electrical current within the material). A priority area for further development is field radioactive xenon sampling and analysis. Identification of radioactive xenon is a strong indicator that a nuclear explosion has taken place.

Further progress was made here after the Noble Gas Field Operation Test in Slovakia in October 2009.

Work is also needed on multispectral imaging so that it might be included in the next large scale exercise. More thought is necessary on the characterization of underground nuclear explosion signatures to assist further operationalization of some OSI techniques

The International Scientific Studies conference in Vienna in June 2009 – a series of independent scientific studies and assessments to address the readiness and capability of the CTBT to detect nuclear explosions worldwide – included a large number of poster presentations on the technologies behind the OSI techniques discussed here. It is clear that there has been significant progress in recent years, which will need to be taken into account as the CTBTO completes its work on building an OSI capability.

OSI READINESS

A key step is to develop a sense of what constitutes an OSI operational capability for the future CTBTO after the Treaty's entry into force. In this context it is reasonable to note that IFE08 itself represented, for all its limitations, a sort of basic capability, albeit one where much more work is needed to improve the performance of an inspection team.

Even here we should not forget that during IFE08, a surrogate inspection team did work professionally and managed to apply many of the OSI techniques specified in the Treaty in an inspection area of 1,000 km^2 in weather and working conditions that at times were harsh.

This was a success in itself and one which bodes well for future work and future such large scale field exercises.

BIOGRAPHICAL NOTE

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