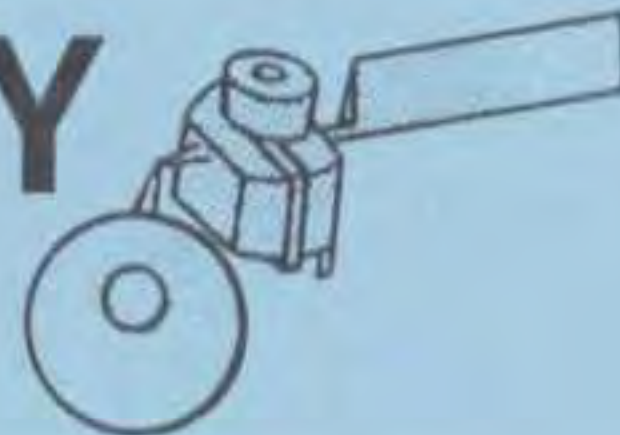




# TRUST AND VERIFY



THE BULLETIN OF THE  
VERIFICATION TECHNOLOGY  
INFORMATION CENTRE

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## What is "Trust and Verify" ?

*Verification has become one of the key issues in arms control negotiations. Having worked in the field of verification research for more than three years, VERTIC has come to realise that there is a need for a regular bulletin dealing solely with verification. In particular there is a need for an up to date analysis of current developments in arms control and the related verification issues.*

We intend that "Trust and Verify" will bring together, on a monthly basis, the latest information on verification technology, methods and applications, and act as a regular report on VERTIC's activities.

## What is VERTIC?

The Verification Technology Information Centre was founded in 1986. The fundamental aim of the organisation is to research and provide information on the role of verification technology and methods in present and future arms control agreements and to assist wherever possible in the generation of informed debate. Material is sent to the media, Members of Parliament, non-governmental organisations and to others who request information.

VERTIC also organises seminars by overseas experts and jointly arranges a regular Short Course on Verification at Imperial College, London. VERTIC has collaborated with a number of other institutions in the organisation of conferences such as the Specialist Workshop On Verification at St. Bart's Hospital, London, and Ways Out Of The Arms Race at Imperial College.

Of fundamental importance to VERTIC's work is the coordination of six working groups: Remote Sensing, Nuclear Materials, Seismology and Nuclear Testing, Space Weapons, Conventional Forces and Arms Control. Each of these working groups is comprised of scientists and other academics based at several UK universities. Each working group also has at least one overseas advisor. In total 21 UK consultants and 11 overseas advisors contribute to VERTIC's working groups. VERTIC is administered and co-ordinated from an office in central London.

As the only organisation in Britain dealing exclusively with the verification of arms control agreements, VERTIC has become the major source of information on that subject for scientists, policy makers and the press. VERTIC is funded primarily by grants from foundations and trusts and its independence is monitored by an Oversight and Advisory Committee.

## Progress On Comprehensive Test Ban

As a depository state of the 1963 Partial Test Ban Treaty (PTBT), the UK recently announced that sufficient requests have been received from among the treaty's

signatories, that is at least one third, for an amendment conference to take place.

More than the requisite 39 nations, including GDR, India, Iran, Romania and Yugoslavia have requested the convening of such a conference to propose the conversion of the PTBT into a Comprehensive Test Ban Treaty (CTBT).

In August 1988 six nations brought together by Parliamentarians Global Action (PGA), an international network of legislators from 37 countries, proposed an amendment to the PTBT preventing tests underground and emphasising the need for more wide-ranging agreements on verification as a fundamental part of such a treaty. Ten months later vigorous campaigning on the part of PGA and others has ensured the requisite number of signatories supporting the proposed amendment, thus requiring the three depository nations, the UK, USA and USSR, to call a conference to discuss the proposal.

The conference is likely to be seen as the most significant step towards a CTBT since the unilateral moratorium of testing by the USSR 3 years ago.

The final declaration of the third review conference of the NPT called upon the US, USSR and UK to reconvene trilateral negotiations on a CTB. Up to now this has not happened but the US and USSR have begun "step-by-step" negotiations on nuclear testing which led to the Joint Verification Experiments (JVEs) of 1988. Some observers have suggested that the arrangements for a PTBT amendment conference could interfere with the Non-Proliferation Treaty (NPT) review conference planned for next year.

The Verification Technology Information Centre has agreed to work with Parliamentarians Global Action in order to produce a set of protocols on verification, for presentation to the proposed amendment conference. It is hoped that the support of governments will be gained for these protocols so that they may be formally proposed at the amendment conference. VERTIC will work on the scientific and technical aspects whilst Parliamentarians Global Action will have final responsibility for the project as a whole. The scientific work will be carried out by VERTIC's seismology and remote sensing experts with the advice of scientists from the USA, USSR, and non-nuclear weapon states.

The degree of support likely to be obtained for the amendment proposals from scientists and politicians in the US and Britain is uncertain as many have spoken strongly in favour of a low threshold ban as opposed to a comprehensive ban. VERTIC has always been in favour of a comprehensive ban, saying that it is, in fact, easier to verify than a low threshold ban.

One of the most important features of the INF Treaty was that in eliminating an entire class of weapons, evidence of making, flight testing or deploying just one such weapon constitutes a violation. If one follows the same principle, using all available means of verification, not just seismology, a test ban treaty banning all tests can be

made easier to verify than a treaty which allows the conduct of some small tests.

In order to gain any real advantage from circumventing the INF Treaty, many missiles would have to be produced. With a CTB, a series of clandestine tests would have to be carried out and such a course of action would be extremely unlikely given a comprehensive verification regime. It would take many years to translate a clandestine testing programme into a strategic advantage in the nuclear stockpile. During this time, confidence building measures which are already available could be used to reassure a verifier state that an opponent state was not violating the treaty.

Clearly the crux of a comprehensive ban on nuclear testing is to prevent tests taking place underground. Seismology, the measurement of vibrations in the ground, allows discrimination of nuclear explosions from earthquakes down to levels of somewhere between 1 to 10 kilotons. Even at those levels, evasion would mean detonating a bomb in a huge cavern deep underground.

Such an agreement would limit testing to such an extent that all but the very smallest of explosions could be detected and attempts to avoid such a treaty would involve running a considerable gauntlet of detection. A major engineering programme to hide a test would itself have to be hidden for months from a vast range of sophisticated surveillance methods.

Confidence could be built in a CTB through a comprehensive system of verification using already available technological means. These include seismic techniques, satellite photography and on-site inspection (OSI).

There are in essence three aspects of the "evasion gauntlet". First, the preparations for any testing, such as in an underground cavern, would have to be hidden from photoreconnaissance satellites, bearing in mind that the areas where such caverns might be built are already broadly known.

Second, the purpose of the cavern and preparations for the test would have to be hidden from signals intelligence. If, as is proposed, an array of seismic stations were set up within the USSR's territory, such a concealment would be virtually impossible, especially if challenge on-site inspections are included as part of the arrangements. It is likely that the USSR would agree to consider an in-country seismic network. They accepted the idea of a seismic monitoring network during the 1977-1980 CTB talks. Indeed, they have already allowed the establishment of a number of non-governmental seismic stations around the USSR.

Third, the aftermath of the test would present uncertainties. Any leak or collapse of the cavern would be monitored by radiation monitors at potential testing sites. Add to this further confidence building measures and the result is a treaty that would be very hard to circumvent and be certain of non-detection; exactly the requirements of an effective verification regime.

The reason cited so often by Britain and the US at the UN and at the Third Review Conference of the NPT for not reconsidering the question of a CTB has been that verification of such a treaty is not possible. Clearly they remain to be convinced even if a thorough set of verification protocols is presented to an amendment conference, but as far as technical means are concerned, there are no longer insurmountable barriers to such a treaty. Nevertheless at this stage, international commitment to verification research is not sufficient and it is partly for that reason that both the PGA and VERTIC

have placed so much emphasis on it with regard to the PTBT amendment proposals.

VERTIC also places a great deal of importance on confidence building measures as a prelude to further limitations on nuclear testing. The US and the USSR agreed in principle to such limitations prior to the Washington Summit. The Joint Verification Experiments which took place in Nevada and Kazhakstan in August 1988 were an example of just such confidence building measures, despite their limited scientific value.

Moves for talks on a test ban were given a further boost when Mikhail Gorbachev and US Secretary of State Baker announced that talks between their two countries on limiting the size of nuclear tests would resume on 26 June.

Meanwhile testing continues. There have been three US tests so far this year at the Nevada test site and three by the USSR. The Nevada tests were all greeted with public protest by anti-nuclear activists. Also, after a brief hiatus, France has resumed its testing programme in the South Pacific.

## Verification of an SNF Treaty

(The information below is taken from an unpublished paper by VERTIC's Dr Patricia Lewis and Bradford University's Owen Greene, an advisory member of VERTIC's Nuclear Materials Working Group).

Short-range Nuclear Forces (SNF), commonly called battlefield nuclear weapons, are classified as those having a range of between 50 and 500km. They are ground-launched and include the Lance, SS21, Scud and Frog missiles, as well as nuclear artillery shells. The Warsaw Pact and several NATO countries, notably West Germany on whose soil such weapons would most likely be used, believe that SNF forces should, like INF forces, be reduced to zero.

A logical reason for negotiating an SNF reduction is the inextricable link between battlefield nuclear weapons and conventional systems in Europe. In a number of cases battlefield nuclear weapons share facilities and delivery systems with conventional weapons and in the case of artillery, the same guns. The recent NATO Summit agreed to start negotiations to partially reduce SNF, once implementation of a conventional agreement is underway. I

Politics aside, the reduction of INF would pose difficult, but not insurmountable, problems for verification. In many ways the verification procedures for a treaty banning short-range nuclear weapons would be very similar to the procedure outlined in the INF Treaty. If, however, future negotiations end up reducing, rather than eliminating, battlefield nuclear weapons, the verification problems would be much larger than those which would have been encountered under the proposed 100-100 INF deal. Before July 1987 the USSR and USA negotiators were settling for an INF Treaty which allowed 100 intermediate nuclear warheads on each side to be deployed outside Europe. Once it was agreed to eliminate all INF inside and outside Europe, the USA relaxed its verification demands because it is always easier to monitor total absence than partial absence. This is even more true for SNF. SNF are smaller, more mobile and easier to hide than the INF and they are dual capable which poses, as in the case of Sea Launched Cruise Missiles (SLCMs), a whole host of problems. On the other hand, they are only useful if close to the field of battle. There would, therefore, be a smaller area to monitor than in the case of INF, despite their mobility.

From the verification point of view therefore, it is highly desirable that SNF are eliminated rather than reduced. A

third zero option which eliminates both conventional and nuclear versions of the weapons is the most effectively verified form of treaty. However a limit on SNF could be verified at a lower degree of confidence.

How would verification procedures for a third zero option work in practice? In the first place there would be data exchange on the numbers and positions of each type of weapon to be eliminated, as in the INF Treaty. One of the most important steps is to verify this data and, because SNF are dual capable, battlefield nuclear weapons are interwoven with battlefield conventional weapons making this step very tricky. Experience from the INF data exchange showed that US intelligence predictions for the numbers of long-range INF were good, but for the short-range INF they were less certain. For the smaller, more mobile SNF the intelligence predictions will be even less sure and so it is important to be careful in verifying the initial data supplied by both sides. Proper verification would therefore require challenge access to all storage and deployment areas which would mean long-term access to practically all of the NATO or Warsaw Pact military facilities in Central Europe. Because the conventional forces at these sites would be operational, the likelihood of the US or USSR military agreeing to such intrusion is very low. The monitoring of the absence of SNF would also require long-term access to Central European military installations.

Lewis and Grøene propose that an initial, once only check on the exchanged data be made on all the deployment, storage, and maintenance facilities after ratification of an SNF Treaty. After this check, all the SNF scheduled for destruction should be taken to a number of designated sites at which challenge inspections should be allowed for some ten years. The moving of SNF to designated sites can be witnessed and the missiles recounted on arrival to check that they tally with the previous account. Couple this procedure with production facility monitoring and witnessing missile destruction and the verification of an SNF Treaty would be as good as that for the INF Treaty. If a third zero option is negotiated, we are left with the possibility of modernisation leading to covert production, SNF being somewhat easier to hide. One way to prevent this would be total non-encryption of all missile tests and a requirement to fully notify each other of all missile launchers with specified ranges and altitudes. This would be an extension of provisions in SALT 2 and would inhibit attempts at using modernisation to produce new prohibited SNF. This could be seen as a general principle as a confidence building measure between the superpowers.

## Chemical Verification

According to the Government Defence White Paper released in early May, Britain remains strongly committed to the negotiation of a "a comprehensive and verifiable global ban" on chemical weapons. The White Paper mentions the recent opening of Porton Down Chemical Defence Establishment to Soviet observers. It claims this as evidence of British willingness to establish satisfactory verification measures for chemical weapons. The ability to carry out on-site inspections at any time is essential to the proper verification of chemical weapons. However, the White Paper described the return visit by British observers to Shikani in the USSR as "disappointing" claiming access was denied to certain parts of the complex visited.

Unlike 1988, the White Paper did not treat separately the question of verification measures for all kinds of arms control agreements.

UK Defence Secretary George Younger recently stated that "100% verification" of a chemical weapons treaty "was not possible", as most countries have the ability to produce

civil chemicals which can be used for chemical weapons, but the UK would insist on "adequate verification".

Negotiations at the Conference on Disarmament (CD) for a global ban on chemical weapons will reconvene on 13 June.

## SLCMs A Stumbling Block for START?

The negotiations on the reduction of strategic arms (START) will be reconvened in Geneva on 12 June. The end of the six month hiatus in negotiations was announced after the meeting in Moscow between US Secretary of State James Baker and his Soviet counterpart Eduard Shevardnadze. The talks will last for six weeks and have the aim of cutting deeply into stocks of strategic stockpiles, resulting in as much as a 50% reduction on both sides.

Although it is likely that some agreement will have to be reached on SDI development and the ABM treaty before a START agreement is reached, the limitation of Sea Launched Cruise Missiles (SLCMs) remains the major potential stumbling block. For seven years the US has avoided meeting the challenge of SLCMs head on. Since that time the US has claimed an agreement on SLCMs is not verifiable because of the difficulty in distinguishing between the two types of US SLCM. Some SLCMs are armed with nuclear warheads and others with conventional warheads, but both have the same external appearance so distinguishing between them is clearly a verification problem. The US agreed in principle in 1987 to a ceiling on nuclear armed SLCMs that would not be counted against a 6000 ceiling on strategic warheads but stuck to the general position that SLCM restrictions were non-verifiable and should therefore be avoided.

However the Soviet insistence on including SLCMs in a START agreement is unlikely to change. Indeed the argument that any START treaty would be seriously undermined if no agreement were reached on SLCMs is a strong one, not so much for the relatively small numbers (compared with the 25000 strategic warheads in the superpower arsenals) that exist at the moment, as for the future deployments of more capable and more numerous systems that could and most likely would be deployed if an agreement on SLCMs is not reached. Furthermore, if the current strategic arsenals are reduced to 6000 accountable warheads on each side as is expected, the number of SLCMs would become proportionally far more important.

As has been proved in the past, loopholes in treaties are always exploited. It is therefore particularly important that the SLCM verification problem is tackled to the satisfaction of both parties.

Clearly a key problem is the continuing policy of "neither confirm nor deny" (NCND) followed by the US Navy. If the US Navy continues to adhere to this policy it would preclude the on-site inspections necessary to verify SLCM warheads on ships. NCND is a contradiction to genuine efforts to seek a verifiable SLCM agreement. It could block an agreement on SLCMs and therefore cripple a START treaty.

Nevertheless, the INF model for OSIs and Confidence and Security Building Measures (CSBMs) has proved the possibility of developing monitoring methods acceptable to both sides. National Technical Means (NTMs) would not be sufficient to distinguish between nuclear and conventionally armed SLCMs or to verify range or numerical limits if the missile system were reduced rather

than banned. However verification of range differentiation was not a problem that prevented agreement on the Tomahawk Ground Launched Cruise Missile (GLCM) in the INF treaty. It is also worth noting that under the INF treaty, both nuclear and conventional GLCMs were included, largely for reasons of ease of verification.

However, in an amendment to the INF ratification, the US stated that the same would not apply to future agreements on air or sea launched systems. Clearly this is a political problem that must be faced if a satisfactory verification regime is to be developed.

Of course, the type of verification developed will on exactly what agreement is reached on SLCMs.

The following problems remain for SLCM verification

**1. Range Verification:**

This is easy for USSR SLCMs because there are different casings for long and short range missiles. However, it is much harder for US SLCMs as the same casing is used for both long and short range and both nuclear and conventional SLCMs

**2. Warhead differentiation:**

Currently USSR SLCMs are said to be readily recognisable as either nuclear or conventional. However, NTMs are not sufficient to differentiate between nuclear or conventionally armed US SLCMs. On site inspections would be necessary. These could take place more easily in port or at the point of production.

**3. SLCMs are small and easy to move or hide.**

**4. Conversion from conventional to nuclear warheads is relatively simple.**

**5. SLCM production facilities have no distinctive characteristics.**

Possible solutions are as follows:

**1. Introduce more open and regular data exchange on current deployments.**

**2. Existing NTMs are probably capable of working out whether a site is producing Cruise Missiles from signs other than appearance of buildings, such as signals intelligence.**

**3. Perimeter monitoring of agreed production facilities.**

**4. It should be possible to partially avoid the NCND problem by verifying at the point of production or at port.**

**5. Use of tags and seals on weapons checked at the point of production or at port.**

**6. As usual, a total ban would be easier to verify than a partial one.**

**7. Restriction on launchers may well be the key. SLCMs are useless without launchers so it would be pointless to**

produce weapons. Certain types of launcher are also easier to detect.

**8. Insistence on less convertible SLCM designs.**

**9. Nuclear SLCMs could be banned without any limit or ban on conventional SLCMs if use were made of the special handling facilities for nuclear-armed missiles at port. Nuclear detection techniques could also be employed before loading.**

## Atomic Energy

In mid-May, leaders of the nuclear industry from around the world met in Moscow to sign an agreement on the pooling of all technical information and the allowing of on-site inspection of nuclear installations.

The moves to form a World Association of Nuclear Operators grew out of the Chernobyl disaster. The scope of the agreement will not include military installations or low temperature tube reactors used in the USSR for military reprocessing. Neither will it cover Chinese reactors producing weapons grade materials.

The aim of the agreement is to link nuclear power stations via a computerised information network to give advance warning of technical problems. The four monitoring centres for the network will be Atlanta, Moscow, Paris and Tokyo. Reciprocal rights of inspection will be allowed for all plants covered by the agreement.

## VERTIC News

### Projects

VERTIC's Director, Dr Patricia Lewis is working on a joint research project with the Council for Arms Control for the Foreign Office on the subject of CFE (Conventional Forces in Europe) verification, which should be completed by the summer.

VERTIC is working on the scientific aspects of verification of a comprehensive test ban for presentation to the forthcoming amendment conference of the Partial Test Ban Treaty.

### Activities

Dr Lewis has attended a meeting organised by SIPRI on CFE verification, undertaken a speaking tour of Italy and a tour of Washington DC and Albuquerque and is taking part in a UN study of the role of the UN in verification. Dr Jeremy Leggett left Imperial College to become Director of Science at Greenpeace UK. Jeremy recently attended an expert's workshop on Nuclear Test Ban Verification in Japan.

### Fundraising

VERTIC has secured another three years' funding from the Joseph Rowntree Charitable Trust. A years' funding for Dr Lewis has been received from Ploughshares. A new fundraising drive is now underway.

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**Voluntary Subscriptions:** This copy of "Trust and Verify" is sent to you free of charge. The production of this bulletin entails considerable cost to VERTIC so if you would like to pay a voluntary subscription of 12 pounds for a year's issues, your contribution would be gratefully received. Anyone wishing to contribute information for inclusion in "Trust and Verify" should send it to the VERTIC office.

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