Characterization of events through On-Site Inspection (OSI)

Theme: Events and nuclear test sites - **T2.2-O3**

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An acceptable assumption?

Considered the relative ease of detecting possible nuclear tests both in open air (atmosphere) and the ocean bottom, it is rational to **ASSUME** that any possible violations would be taken place in the subsurface. Further, there are natural causes in the subsurface that resembles to an Underground Nuclear Explosion (UNE). Hence, OSI inspection tools were developed with a high focus to the subsurface.

However, no guarantee that things will happen as anticipated

OSI OBJECTIVE and Existing scenarios
Verification of an event (suspicious) via OSI Inspection even in a concealed environment
(via assessing and evaluating characters)

OSI Limitations *(OSI technologies)*
ISP Advancement *(concealment tactics)*

Way Forard

What we know about possible characters of an event → Conventional observables: disperse energy, site - leftovers

Challenges in an un-friendly geographical environments → Diverse environments produce challengers for OSI technologies

Natural events that resembles a (*clandestine*) nuclear explosion → Screening-out process, natural vs. man-made explosions

What sort of concealment a possible violator may impose → Concealment of energy disperse patterns, no leftovers resemble as natural-cause(s)

TREATY and PROTOCOL fixed technologies except NTM → Partially outdated TREATY fixed technology and heavy dependence on NTM (third party)

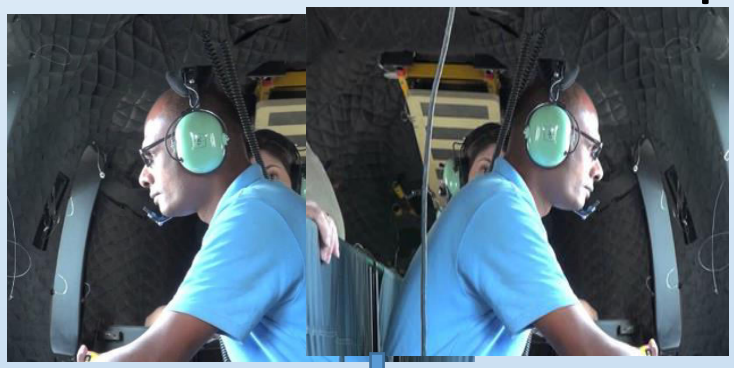
Thorough assessment of non-concealing signatures → More FREEDOM for upgraded and advanced in-house (OSI) technologies

Well trained versatile OSI inspectorate → **OSI OBJECTIVE (satisfactorily fulfilled)**

Conventional observables

No any ample efforts to conceal characters of a nuclear explosion *(prior to PTBT, 1963, in open environments and in the post PTBT era at underground nuclear test-sites)*

Looking into different environments to find observables via TREATY accepted technologies



VOB: Visual Observations
SAMS : Seismic Aftershock Monitoring System
RN Measurements: Radionuclide measurements
NTM: National Technical Means**?** (Third Party info.)
CPT : relevant exploration geophysical applications
How the signatures may differ in differing environments?

In general it is accepted that screening of UNE vs. earthquake is a standard practice, yet?

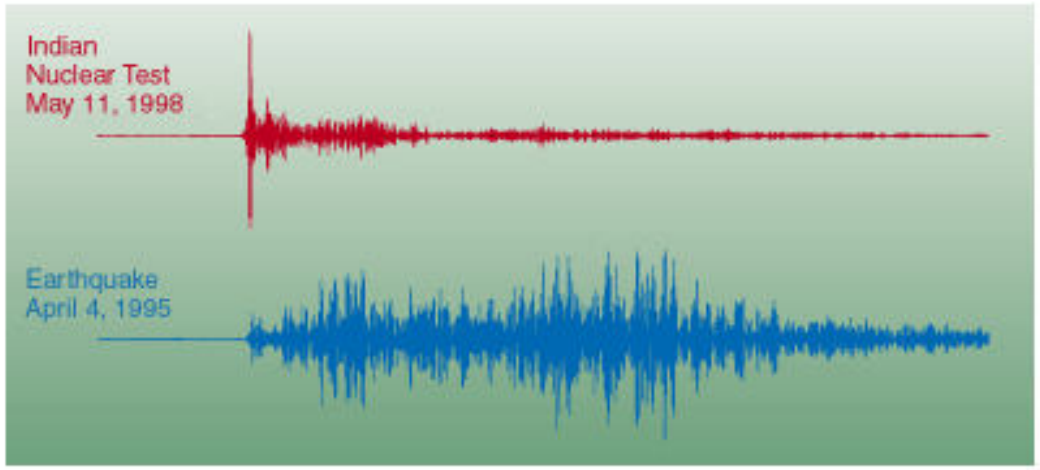


Figure 2. Seismograms of the Indian nuclear test (top) and a representative nearby earthquake (bottom) recorded at the seismic station at Nilore, Pakistan. These seismic signatures for an explosion and earthquake are typical and clearly distinguish one from the other.

Novaya Zemlya Event, August 16, 1997

"If the CTBT is to succeed, incidents such as the August event in Novaya Zemlya must be prevented. This study demonstrates that the August 16 suspected seismic event was detected by the IMS, and could be identified as an earthquake"

Richard M Allen, Dept. Geosciences, Princeton University, January 1998

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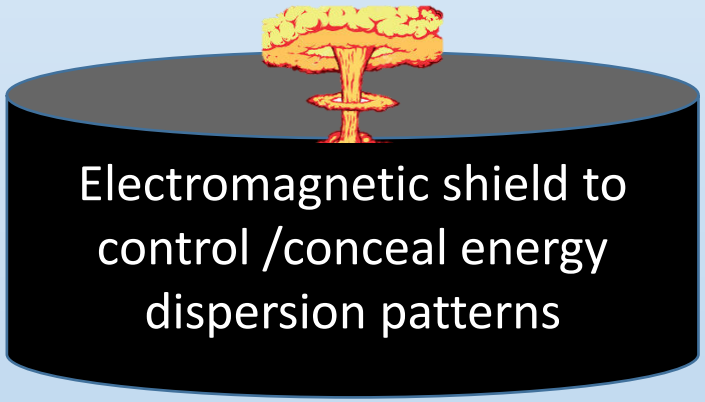
OSI OBJECTIVE (satisfactorily fulfilled)

ISP ADVANCEMENT *(concealment tactics)* and **OSI LIMITATIONS** *(OSI technologies)*



TREATY and PROTOCOL approved technologies
VOB + SAMS + RN + CPT

NTM?

Attempts to portray UNE as a natural phenomenon

Proto-type digitally enhanced nuclear tests (below the treaty specified yield)

Event characterization (OSI perspectives) in changing scenarios as contender(s) develop their strategies freely and continuously

National Technical Means (NTM) – The Riddle

As Treaty and Protocol specified OSI technologies (*if not upgraded*) would be outdated soon, the NTM remain as the only developing entity possibly in-par with ISP capacity.

However heavy dependence on a third party (*though Member States to the Treaty*) and under-developed / ambiguous procedures in utilizing NTM is not for the best interest of the IT (OSI).

ISP advantages

1. **A possible violator (ISP) has a thorough understanding what the IT is looking for, including the technical capacity and limitations of the same.**

1. **In a possible clandestine UNE, ISP is having a head-start over the IT and the catching-up time is very limited as of the Treaty and its Protocol**

IT advantages

1. **Pre-prepared facility is required to conduct an UNE**

2. **GSN is quite capable almost to (*as of the recent UNEs*) pin-point the event location with a great assistance to the IT (OSI).**

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OSI OBJECTIVE (satisfactorily fulfilled)

Identifying the end members and events in-between, *(that a request may trigger)*

Natural event that resembles of an UNE

Fully cooperative ISP

Radiological-spill / Radiation accident /damage to national facilities via an earthquake – where a degree of concealment is required due to possible political backlash (national or international)

Partially cooperative ISP

UNE (clandestine nuclear explosion, underground)

Fully uncooperative ISP

Thorough assessment of non-concealing signatures

Many of the conventional observables that are common to a test site would disappear in a clandestine UNE. Hence through assessment is required signatures that are difficult either to mask, remove or conceal.

Such discipline(s) shall be developed for different conditions (Environment, climatic and geological)

Agreeing for necessary tolerance of technologies (and technological development) to address the above*

**Though the TREATY is an agreed and sealed document, with an agreement of State Parties, technological barriers shall be lifted, towards developing in-house effective OSI process.*

Conclusion:

Identifying the possible scenarios that a request may trigger, recognizing probable challenges pose by extreme climatic conditions and with a proper assessment of the limitations of OSI technologies, the strategies for OSI inspections needs to be developed. As focused observables of a conventional UNE site would not exist, in a clandestine effort, and with potential concealment the OSI event characterization truly become a challenge.

Widening technological gap between ISP (would be) and IT needs to be bridged via proper structural adjustments and in-house OSI development, rather than relying on NTMs.

References:

- CTBTO home page

- https://www.google.lk/search?q=Cracks+after+underground+nuclear+explosion&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjo-JW75KLTAhUCFZQKHYnHABAQ_AUIBigB&biw=1366&bih=659