Ensuring international border security standards

Developed:

Distributed and Manufactured:

ICAO - WCO Joint Conference
Kuala Lumpur 2016
The Worlds Most Comprehensive Test Equipment for Medium to Large Sized Scanners: **XTE**

- Developed by ANSTO (Australian Nuclear Science and Technology Organization),
- **Only** commercially available non-invasive system to provide comprehensive range of 9 tests, consistent with the ASTM standards,
- Evaluates performance of X-Ray scanners within minutes,
- Easy to use software and reporting,
- Environmentally friendly - completely no waste emission.

**Easy to use software for image analysis**

Patented in Australia, Singapore
Pending Patent in Europe, USA & China
Developed by The Australian Nuclear Science and Technology Organisation (ANSTO) in collaboration with:

Endorsed by:

Australia

USA

Under WCO Guidelines and according to the ASTM Standards:
Types of X-Ray, Gamma Ray Scanners

Medium-Sized: Tunnel Size > 1m x 1m; 140keV to 450keV; Use for Air Cargo

Large-Size Scanners: 2.5MeV to 9MeV; Use mainly for Sea/Land Cargo

Small-Size Scanners: Tunnel Size < 1m x 1m; Use mainly in Airports or Border Crossings Checkpoints
As part of the qualification process, X-ray machines are required to meet minimum image quality criteria. TSA currently uses a device built to the American National Standards Institute (ANSI) N42.46-2008 standard, as well as the American Society for Testing and Materials (ASTM), International’s F792-08 X-ray Test Object for measuring conformance to these criteria. However, ASTM does not recognize the use of the latter test object for assessing systems with tunnel apertures larger than 1 meter x 1 meter [1].

The Australian Nuclear Science and Technology Organisation (ANSTO), with funding from the Australian Government, developed two test objects that can “effectively evaluate the performance of most [X-ray] scanners (from 140 kilovolt [kV] and above) within minutes” [2].
Potential Threats Waiting To Happen if Scanners are Not Maintained Properly

**Terrorism...**

- Air India 182 Explosion
- Metro Jet Flight 9268 Disaster

**Bomb Threats...**

- Explosives loaded on Kingfisher Flight KF4731, Bangalore

**Contraband...**

- Singapore Airlines Flight SQ 1 from SFO

**Wildlife Protection...**

- 4.8 tonnes of cigarettes from Lebanon into Australia, 2009
- 229kg Heroin 2013, Taiwan
- Animals smuggled through Bangkok Subarnabhumi Airport, 2011
- 1000 elephant task seized in Hong Kong, 2013
HOW IS XTE USED? – Maritime & Land Ports

Maritime Ports & Customs
• Large Size X-Ray / Gamma Scanners (1MeV to 9MeV)
• Dimensions
  • L – 1.10m, B – 1.10m, H – 0.95m
• Estimated Weight (XTE 1 & XTE 2 combined)
  • ~ 500kg
HOW IS XTE USED? - Air Cargo Sector

**Air Cargo Sector**
- Medium Size X-Ray Scanners (140keV to 450keV)
- XTE Dimension (Two Models)
  - L 1.10m, B 1.10m, H 0.95m
  - L -1.10m, B -0.95m, H -0.95m
- Estimated Weight (XTE 1 & XTE 2 Combined) - ~ 250kg to 350kg
PROCESS OF TEST IN PALLET CARGO ENVIRONMENT

RESULTS OF TEST
(Evaluation Reports / Audits)

Medium Size Pallet X-Ray Scanners

Software Scoring & Evaluation by Certified Personal

XTE Loaded on Scanner by Forklift

Captured Test Image
Common Problems (Penetration)

XTE 1

Penetration = Fail (causes CS to fail)

Penetration = Pass

- Main Causes: Failure in maintenance and inadequate testing.
Common Problems (Material Discrimination)

- Main Causes: Failure in maintenance and inadequate testing.
XTE Border Protection Users

Australia

Australia Custom and Border Protection Services

USA

US Naval Base

US CBP

Singapore

ICA

Singapore Customs

Thailand

Airport of Thailand

Republic of Korea

Advertised on Korean Newspaper

Awaiting DEMO
BENEFITS OF USING XTE

• Prevent revenue loss. Eg: Terrorism.
• Operational Efficiency – Eg. Long-term economic benefits from reduced dwelling time to increased revenue for customs collections (i.e, customs revenue collection and goods tax collections).
• Asset Protection - Audit record for service and performance of equipment.
• Compliance with WCO Guidelines
• Branding of Customer’s ports or airports – Example: Safest Ports in Asean/Europe/Americas
Excerpt from WCO Guidelines for Procurement of Scanners

In establishing performance standards for NII scanners used by the Australian Customs and Border Protection Service, advice was sought from other Australian government agencies including the Australian Nuclear Science and Technology Organisation; the Department of Infrastructure and Transport; and the Defence Science and Technology Organisation. Advice was also sought from independent scientific advisers contracted by the Customs and Border Protection Service, and from other Customs administrations.

1.2.3 Fees/charges on using scanners

The Australian Customs and Border Protection Service purchases NII scanners under a capital funding process, which sets out the installment payments be made at the time of contract signing, delivery/installation and acceptance testing. A separate maintenance contract is in place with each x-ray supplier that covers preventative maintenance and fault response. The cost of maintenance is generally about 10% per annum of the capital cost of the machine.

XTE to be use for: 1. acquisitions, 2. pre and post scheduled maintenance from OEMs and 3. Periodic (bi-monthly/monthly) maintenance for yearly audits of equipment.
Thank you…

谢谢 Terima Kasih Dank U Gracias
Obrigado Merci
ありがとう Danke

 nya rup bo rá
Σας ευχαριστούμε
Grazie

ขอบคุณครับ

Setting the standard for international border security
Nine Tests
As described in the Internationally recognised ASTM F792-01-e2 standard

TEST 1: RESOLUTION TEST
To determine and quantify the basic image resolution capability of the scanner source. This is a very basic test of any imaging system. Clarity through number of data pixels and the (IQI) are determined by the systems ability to image thin copper wires in air and behind steel concealment of various thickness.

TEST 2 and 3: MATERIAL DISCRIMINATION in AIR
To determine organic (explosive and contraband surrogates) thickness with special attention to material discrimination and limits of detection of the organic materials.

TEST 4: CONTRAST SENSITIVITY (CS)
To determine CS or capability of the system to detect objects through steel concealment. Essentially it is a quantitative measure of system’s ability to penetrate and see thinnest objects. CS% = thickness of steel plate / thickness of blocking plates * 100. And the smaller the CS% number the better contrast sensitivity.

TEST 5: MATERIALS DISCRIMINATION (MD) behind CONCEALMENT
To determine the system’s capability discriminate between materials and determine presence of contraband and explosives behind steel concealment. This is a hard test and will reveal the true capability of the MD claims by the makers of the scanner.

TEST 6: SPATIAL RESOLUTION
Spatial Resolution in low density matrix to evaluate the scanner capability of determining small objects in closely packed cargo. This test incorporates resolution and scan speed and the system ability to resolve small spatially separated objects.

TEST 7: MATERIAL DISCRIMINATION
To determine the systems ability to colour code the objects present in the cargo and to conform to accepted colour coding conventions. The test requires to produce colour variations according to average composition (atomic) and not vary according to object thickness. All known contrabands falls within this Zeff range.

TEST 8: SPATIAL RESOLUTION behind CONCEALMENT
Spatial Resolution through Steel Wedge to determine if the system is capable of resolving closely spaced objects behind concealment. Same as Test 6, but behind concealment.

TEST 9: PENETRATION THROUGH STEEL
To determine the penetration performance of the source. This is also the very basic function of the imaging system.
# Comparison Of Global Non-Intrusive Image Testing Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Publication date</th>
<th>&lt; 1m wide tunnel</th>
<th>&gt; Or equal 1m tunnel</th>
<th>Material Discrimination</th>
<th>Contrast Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>XTE</td>
<td>First used 2006, patent 2008**</td>
<td>Yes, 950mm base version</td>
<td>Yes, 1100mm base version</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>ANSI N42.46</td>
<td>2008</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>ASTM-F792</td>
<td>2001</td>
<td>Yes</td>
<td>No</td>
<td>Too small to use on medium &amp; large scanners</td>
<td>Too small to use on medium &amp; large scanners</td>
</tr>
</tbody>
</table>

** Patented Commercially Worldwide, including: US, EU, Australia, Singapore, China.