X-ray and γ-ray standards for aviation security

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November 9, 2010
Motivations:

At the creation of DHS, the need for national technical performance and radiation safety standards was quickly identified for x-ray and gamma-ray security screening systems that continue to be deployed on a large scale at transportation and commercial venues.

As of 2010, first versions or revisions of a complete suite of x-ray standards have been published that cover the screening of explosives and VBIED’s, PBIED’s, and LBIED’s.

Screening!

“changing national policy and practice in the area of bulk explosives detection across key DHS agencies through national x-ray standards development & international standards harmonization”
Programmatic Goals

To enhance the effective use of bulk-explosives x-ray detection technologies by:

[1] providing standard evaluation metrics, test objects, and protocols for image quality and radiation safety for x-ray & γ-ray security-screening systems

[2] enabling field testing of prototype systems, procurement guidance, & support for certification activities uniformly across DHS agencies

[3] filling well-documented gaps in transportation security, to meet the requirements for 100% screening of baggage, cargo, and airline passengers

When things get ugly at the checkpoint...
Partnerships/Customers

**Government Partners / Customers:**
Hazardous Devices School / NBSCAB

**Industrial Partners:**
Analogic, Astrophysics Corporation, ENSCO, GE Security (formerly Invision), Reveal Imaging, SureScan Corporation, Control Screening, AS&E, L-3 Communications, Rapiscan Systems, SAIC, Smiths Detection, Tek84 LLC, SecurePath, HighCom, Annistech, CSC, SRA Intl., SCA, Batelle, Varian, Underwriter’s Labs, Valley Forge Imaging
Primary Outputs

- documentary standards

- standard test objects, test methods, T&E protocols, and minimum performance requirements

- field testing (of standards & protocols)

- dosimetric protocols informed by radiation-transport calculations

- technical & guidance documents
Spiral Development of X-Ray Standards

1. Field testing/feedback
2. Customer adoption
3. T&E protocols
4. Test artifacts
5. Consensus documentary standards
6. Stakeholder input
7. Operational requirements/needs

Technical Approach
Bridging the Gap

Threat-Based / Operational Testing

Technical / Imaging Performance
# National & International X-Ray Standards for Bulk Explosives

<table>
<thead>
<tr>
<th>Venue</th>
<th>Technical Performance</th>
<th>Radiation Safety</th>
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</thead>
<tbody>
<tr>
<td>Checkpoint</td>
<td>ANSI N42.44 – 2008&lt;br&gt;ASTM F 792 – 2008</td>
<td>ASTM F 1039 (21 CFR 1020.40)</td>
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<tr>
<td>CT / EDS (checked luggage)</td>
<td>ANSI N42.45-2010</td>
<td>(21 CFR 1020.40)</td>
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<tr>
<td>Cargo / Vehicle</td>
<td>ANSI N42.46 – 2008&lt;br&gt;IEC 62523 – 2010&lt;br&gt;ANSI N42.41 – 2007</td>
<td>ANSI N43.16 – draft&lt;br&gt;IEC 62523 – 2010&lt;br&gt;ANSI N43.14 – draft</td>
</tr>
<tr>
<td>Bomb Squads (portable sources)</td>
<td>NIJ 0603.01</td>
<td>ANSI/HPS N43.3</td>
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</table>
ASTM F-792 test piece
ASTM F-792 test piece x-ray image
ANSI N42.45 test articles for CT systems

Accredited by the American National Standards Institute

Sponsored by the National Committee on Radiation Instrumentation, N42

National X-Ray Standards for Bulk Explosives Detection

x-ray backscatter image

simulated PETN explosive

image quality test objects
The United States is set to deploy 950 full body screeners by the end of 2011, and about 1,800 by the end of 2014.
Standards for portable x-ray sources used by bomb squads
### Identifying Needs:

#### ANSI-HSSP Workshop on Standards for Noninvasive Inspection Systems

- **April 2010**
- **160 participants**
- **75 organizations**

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<thead>
<tr>
<th>Requirement</th>
<th>Action/Status</th>
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<tr>
<td>Revised ANSI N42.46 (technical performance, cargo/vehicle)</td>
<td>Add materials discrimination test</td>
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<td></td>
<td>Re-size for air-cargo inspection</td>
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<td></td>
<td>Apply statistical scoring</td>
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<td></td>
<td>Safety considerations</td>
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<td></td>
<td>Compare results to IEC cargo standard</td>
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<tr>
<td>Revised ASTM F-792 (classic aviation checkpoint IQ test piece)</td>
<td>Technically outdated</td>
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<tr>
<td>ANSI N43.16 (cargo/vehicle radiation safety)</td>
<td>Needed by CBP, NBSCAB, &amp; TSIF</td>
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<tr>
<td>Revised NIJ 0603.01 (bomb squads; image quality)</td>
<td>NBSCAB 2010 requirements document</td>
</tr>
<tr>
<td>IEC standard for x-ray AIT image quality</td>
<td>NWP accepted OCT 2010</td>
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<tr>
<td>Imaging performance standard for mm-wave or technology-neutral standard</td>
<td>Currently no extant standards</td>
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<tr>
<td>Dosimetric protocol to measure high-E beams used in cargo screening</td>
<td>Under development at NIST, traceable to primary standards</td>
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<tr>
<td>Standard screener training, CONOPS, data formats, and Automated Target Recognition</td>
<td>NEMA’s DICOS standard, etc.</td>
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The Department of Homeland Security Science and Technology Directorate funded the production of the work presented in this material under IAA# HSHQDC-10-X-00405, Requisition # RSTS-1-00021.