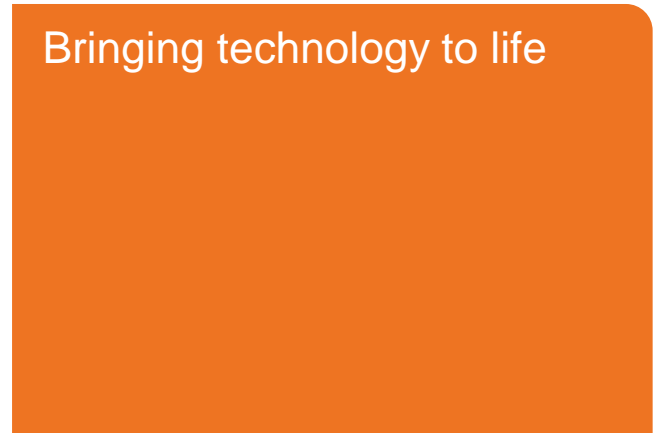


Cargo Screening: Challenges and Solutions

May 2014

smiths detection
bringing technology to life

Dr. Martin Hartick



Conclusions

- From a vendor perspective new screening systems may be successful only if they meet regulator and freight forwarder/airline demands
- Regulators and freight forwarders/airline have to be involved in the development of new systems
- Systems providing automatic Detection at high throughput for small Cargo (boxes, parcels) are available - Detection based on density and Z_{eff}
- Palletized Cargo and Container screening is based on imaging: Evaluation by an Operator; next step should be to provide better Operator support
- Automatic Detection for palletized Cargo and Containers is very challenging taking regulators and freight forwarder demands into account.

US Air Cargo Screening Regulator Requirements

US Cargo Screening Background

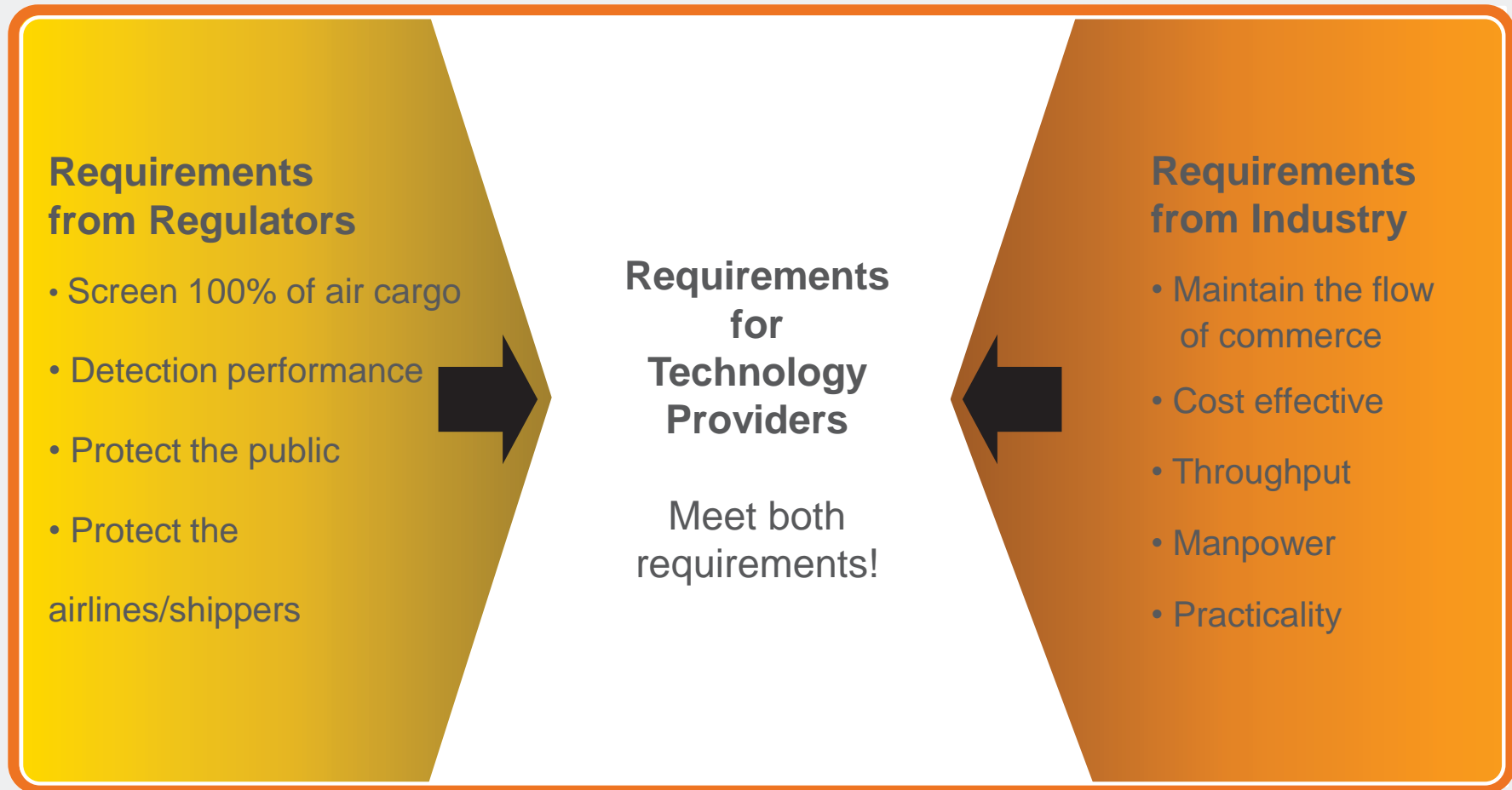
- “Cargo” means boxes, pallets, and ULD (unit load device) containers
- 100% screening of cargo is the mandate
- Air Cargo must be screened in a manner consistent with checked luggage
- “EDS Certified” systems can be used with ATR
- “Accepted” systems from other programs can be used in imaging mode

Cargo Carrier Requirements

Customer (freight forwarders, shipping companies, airlines) requirements

- SPEED (high throughput)
- Cost (unit and personnel)
- CONOPS (Don't disrupt operational flow)
- Automation (Detection and Reporting)
- Footprint in their warehouse or business
- Non-intrusive (don't touch or open my box!)
- Detection Capability

The GOALS



Technical Challenges

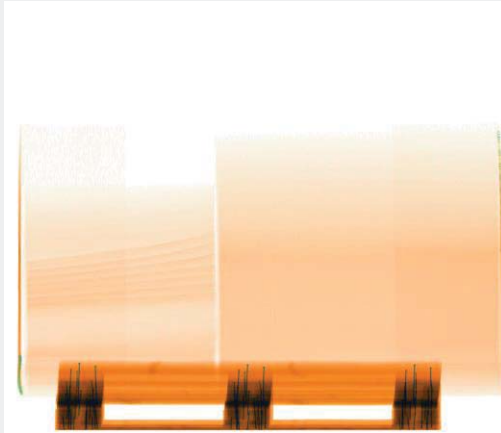
Challenges:

- Multiple commodity types
 - Food
 - Clothing
 - Electronics
 - Machinery
- Variation in object size (from small to large)
 - Small
 - Large

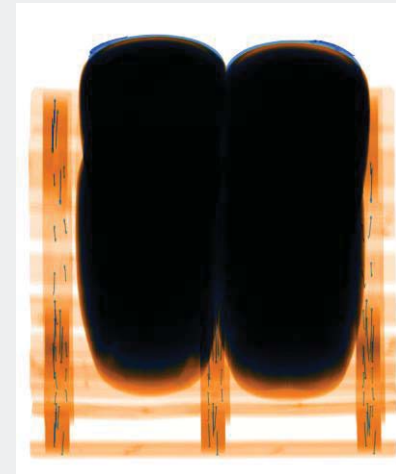
Technical Challenges

Challenges:

- Variation in object absorption is very high



Filter Pads



Barrels

- Exposure to harsh operating conditions
 - Extreme temperature swings
 - Aircraft and vehicular exhaust fumes and soot
 - Vibration

Smiths Detection Technologies

Solutions:



Parcel Capable Systems



Pallet Capable Systems



Explosive Detection Systems



Trace

Bar code reader &
data base Capabilities

Automated Explosive Detection X-ray Systems: Example Systems

140 keV



Break Bulk (Large)

Break Bulk (Complex)



Break Bulk (Small)

160 keV



Cargo Imaging Systems: Example Systems

160 keV



Parcel / Pallet

300 keV



LD 3

2.5 - 6 MeV



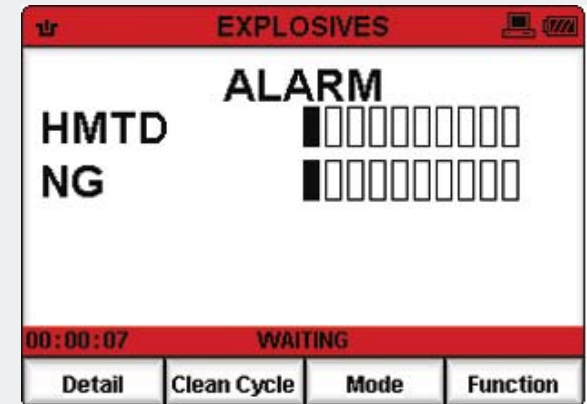
Large / Specialty

Explosive Trace Detection Capability

Handheld



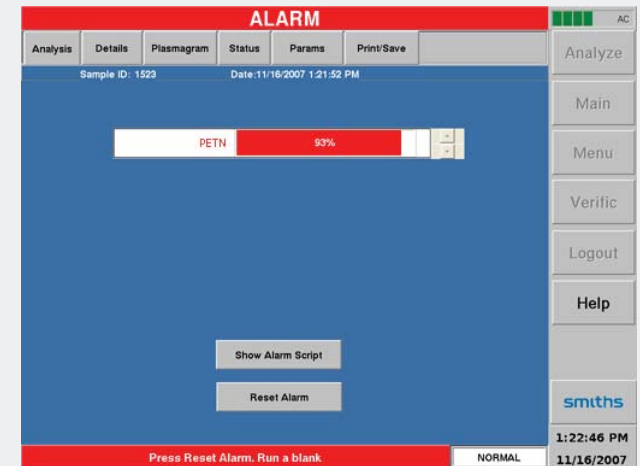
- Primary or Secondary Screening Use
- Vapor or Particle
- Carry to cargo / vehicle
- Contact or air sample
- Cost Efficient
- Proven (in use)



Desktop/Cart



- Primary or Secondary Screening Use
- Batch Sampling (10)
- Mobile through facility
- Cost Efficient
- Proven (in use)



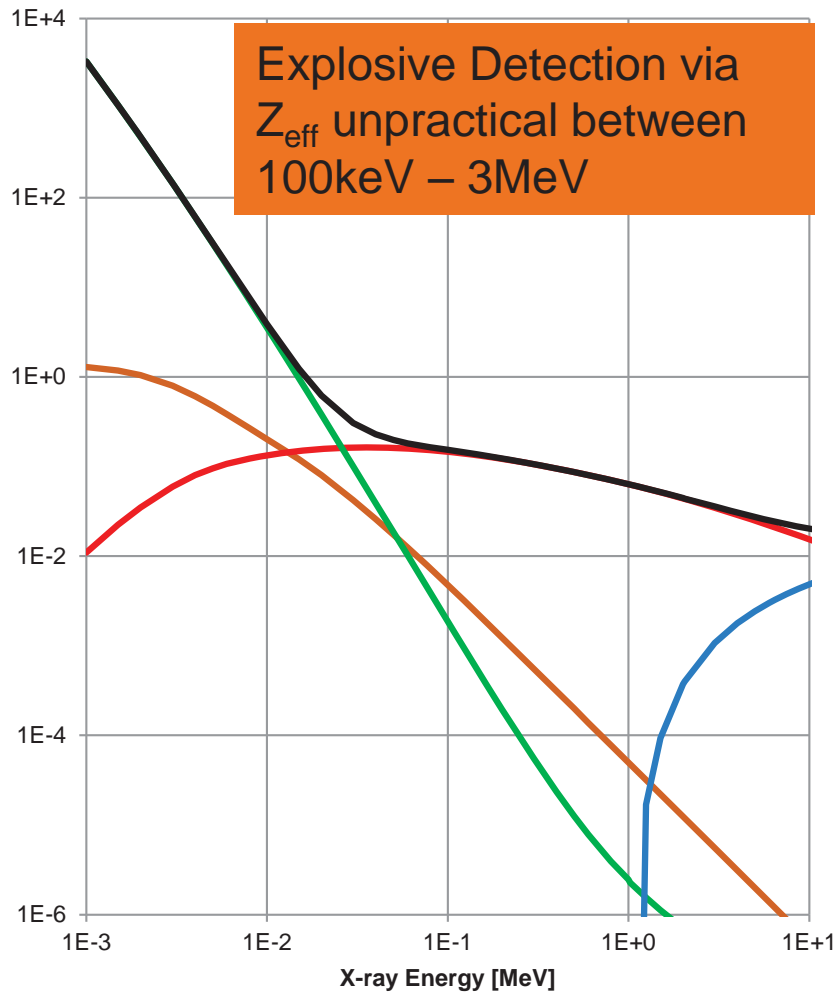
Technology Needs

Material ID Technology:

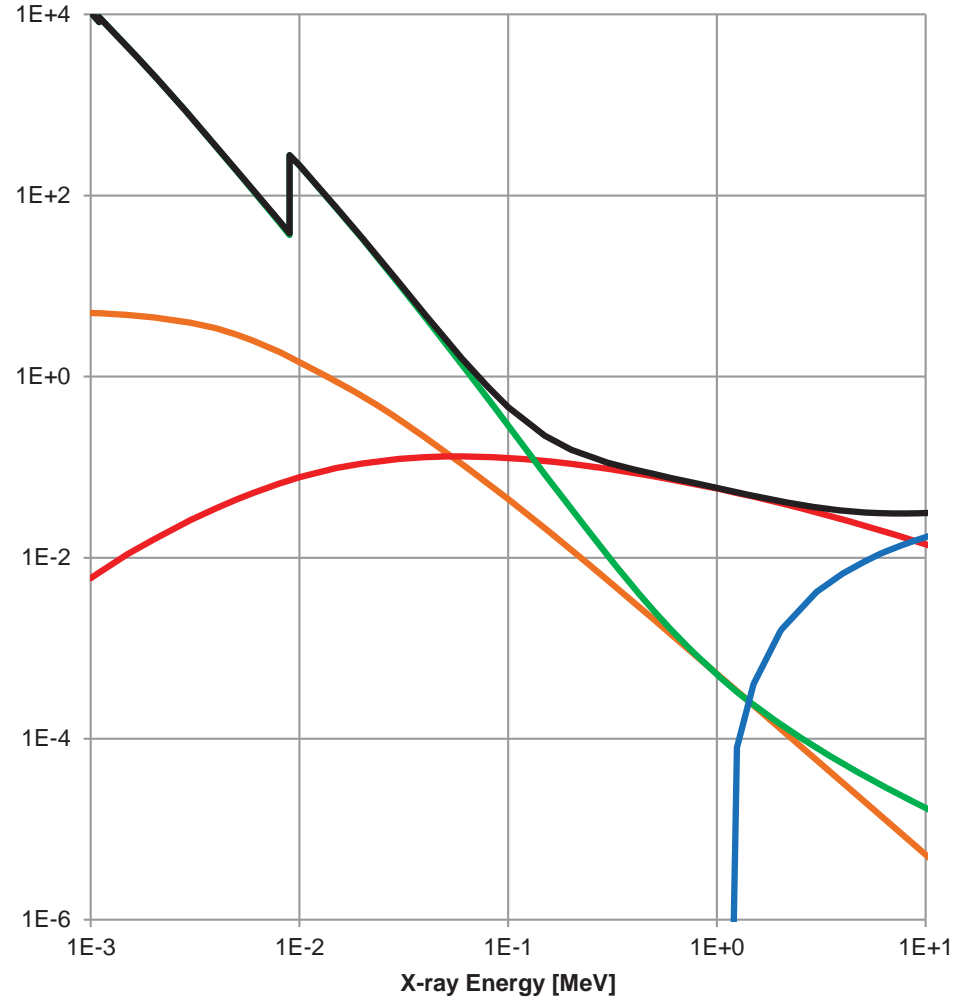
- Automatic Threat Recognition for imaging system for $E > 200$ keV
- Highlight suspicious areas in the image
- Determine material properties of scanned objects:
 - Z_{eff}
 - Density
- Adaptive Methodologies
 - Address large object density variability
 - Adapt screening parameters to object under investigation
- High throughput
 - Number of scans per hour > 1000
 - Minimize need to perform secondary check

Material ID Challenges

N X-ray Absorption



Cu X-ray Absorption



— Coherent Scatter — Incoherent Scatter — Photoelectric Abs.
— Pair Production — Total Absorption

— coh. Scatter — incoh. Scatter — Photoelectric Abs.
— Pair Production — Total Absorption

New Technologies/Ideas

New Technology

- 3D Imaging



Rotating Gantry CT



Laminography

New Technologies/Ideas

Other Technologies

Nuclear techniques:

- Neutron transmission
- Pulsed fast Neutron Analysis
- Thermal Neutron Analysis
- Nuclear Resonance Absorption

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