Miniaturized, Modular, High Resolution X-ray Backscatter Imaging as a Blue Force Enhancer

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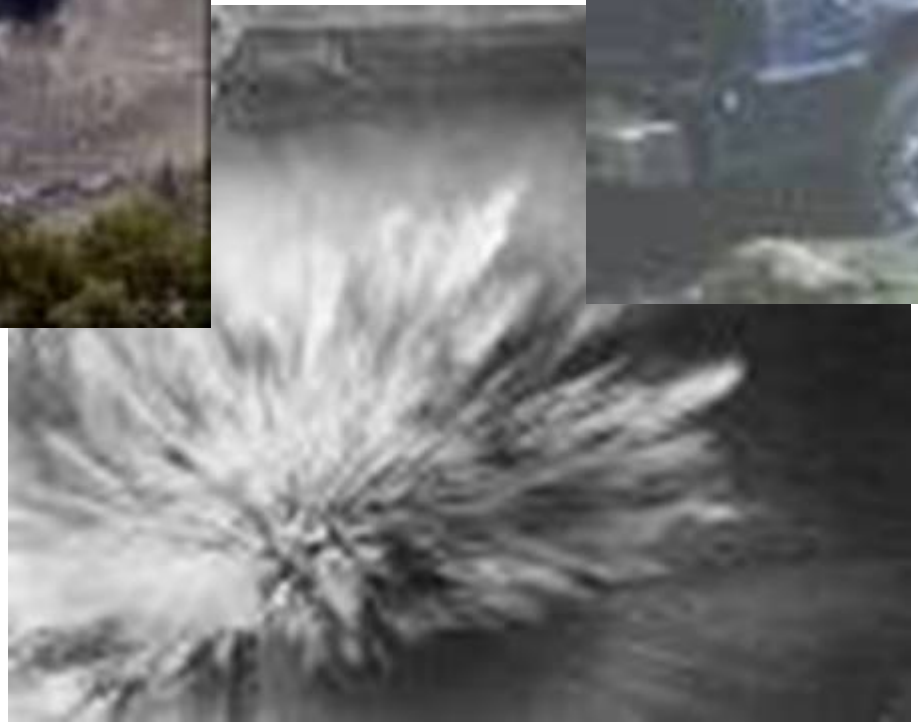
AS&E

Overview

- The Need
- X-ray Backscatter Imaging as a Disruptive Technology and Blue Force Enhancement
- Applications and Configurations
- Challenges/Observations

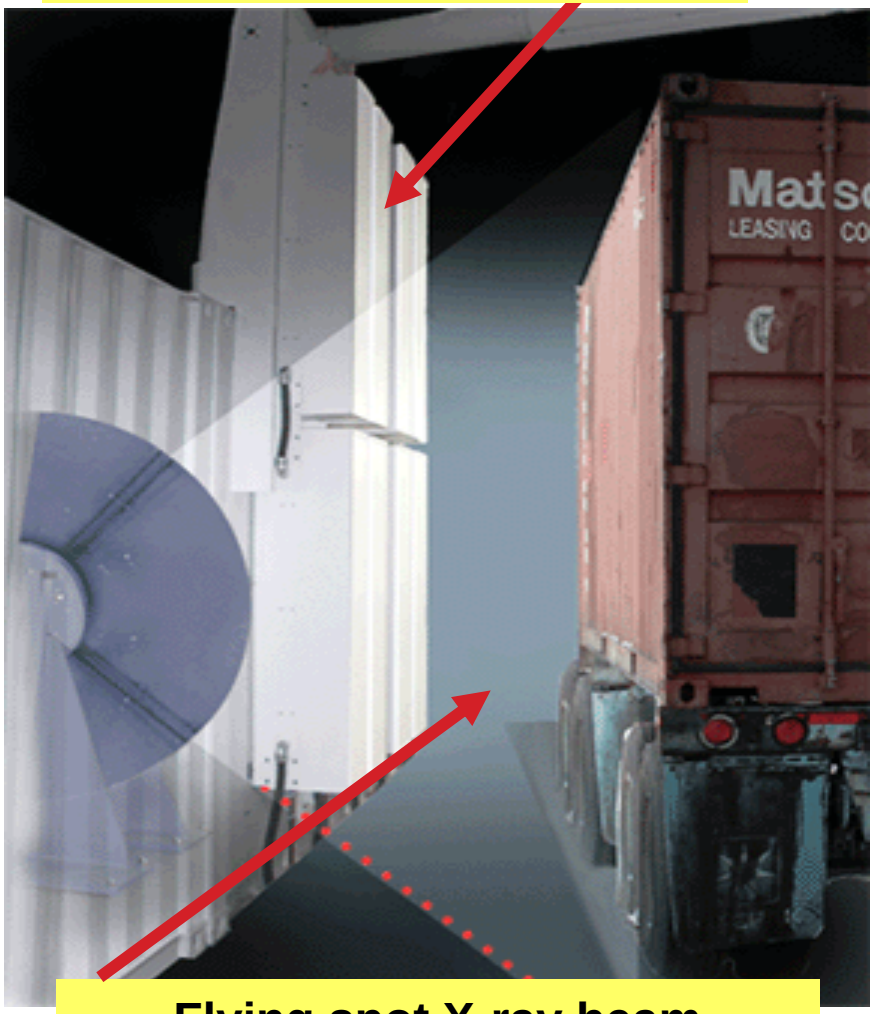
The Need: Maneuverable, Fast, High Resolution Threat Detection

Don’t let these events happen



X-ray Backscatter Today

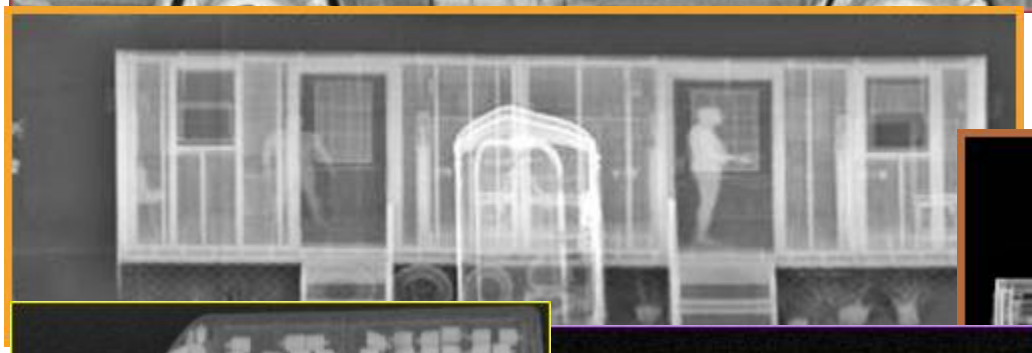
Large Area Detectors



Flying spot X-ray beam

- One-sided Inspection
  - VBIEDs
  - Drugs
  - Weapons
  - Other contraband
- Discriminates Lo Z and Hi Z
- Fast
- User Friendly
- Adaptable and Transportable

Backscatter Images Reveal A Variety of Contraband



Smaller, Lighter, Higher Resolution, Modular Systems Provide Additional Blue Force Enhancement

- **Current systems fill a valuable need**
- **Tomorrow's systems will provide additional capabilities for our forces**
  - **TSWG/NIJ: Trailer-mounted robot borne system**
  - **Army/RDECOM/I2WD: Miniaturized Imager**
  - **DHS/S&T: Modularized Backscatter**
- **Goals: Expand the flexibility, performance and application base for single-sided imaging**

Miniaturized Backscatter System – An Expandable, Adaptable Concept

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- Large system
- Objects at a distance

TSWG/NIJ Program

- Small system
- Objects up close
- Adaptable for standoff

Control Electronics

Data Collection

Heat Exchanger

Detectors

X-ray source
• X-ray tube

HVPS

Shielding

Control/Display
• Laptop

Main Power
• Wallplug
• Battery

Beam Forming Subsystem

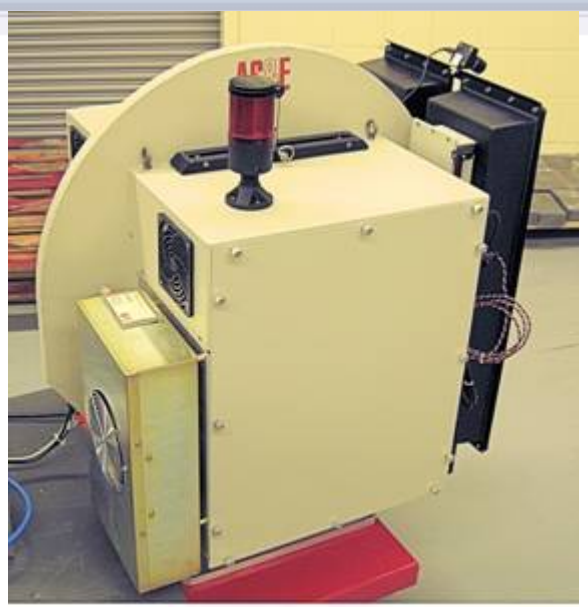
Vertical Scan Mechanism
• Collimation Wheel

Horizontal Scan Mechanism
• Rotating Turret

Transport/Platform

Single-Sided Imaging Module
• Single Unit
or
• Modular Assembly

The First Prototype



Prototype:

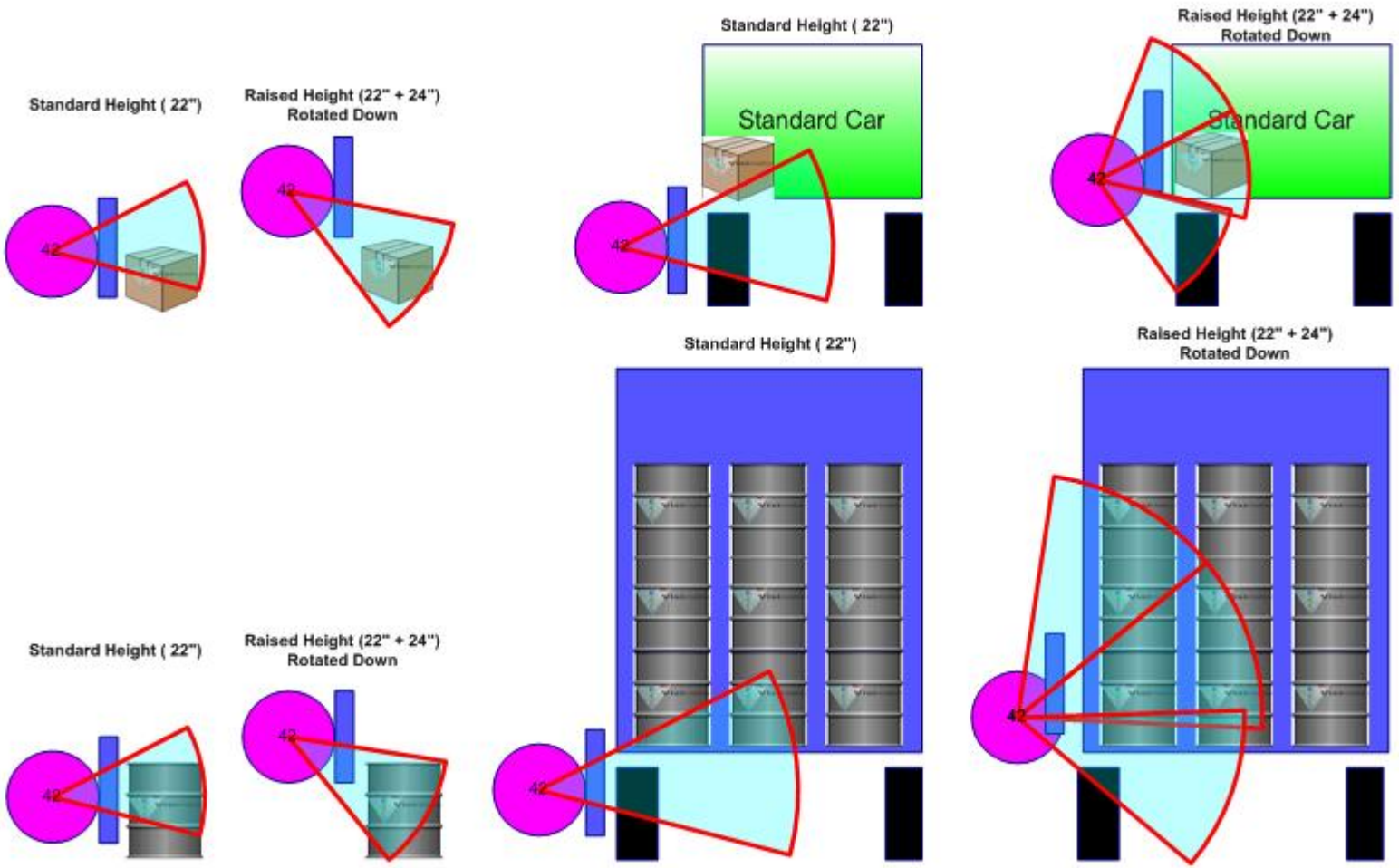
Imager Weight	**320 Pounds**
Imager Size	**Width: 27.0”**
	Depth: 31.5”
	Height: 31.5”

Second Unit to be smaller and lighter

~ 250 pounds, 19.5” x 24.5” x 30”

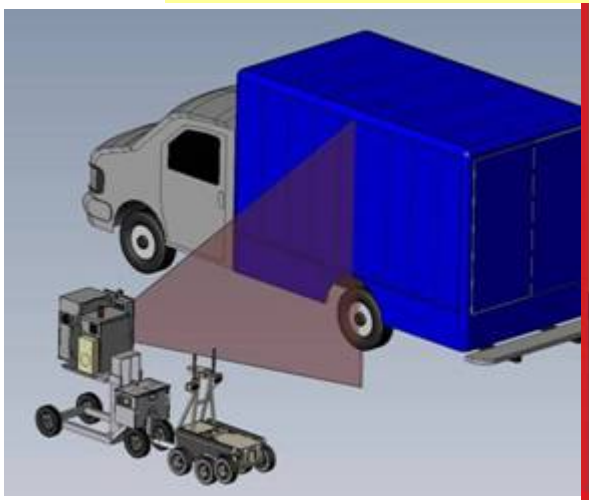
Variable Positioning Provides Flexibility

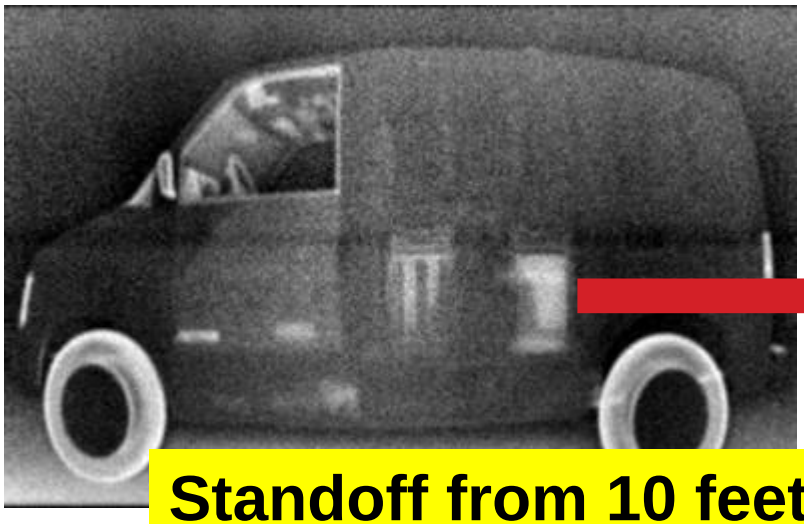
- **Scanning Wheel X-Ray Angle Changes +/- 30 Degrees**
- **Detector Set Raises and Lowers as needed from 22 - 25” Nominal Scanning height**



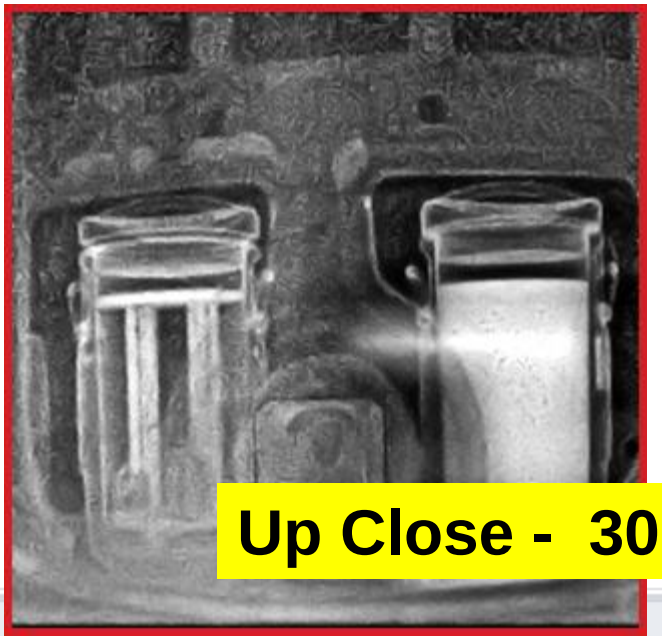
Robot-borne Miniaturized Backscatter Imager in Action

User gets two useful capabilities



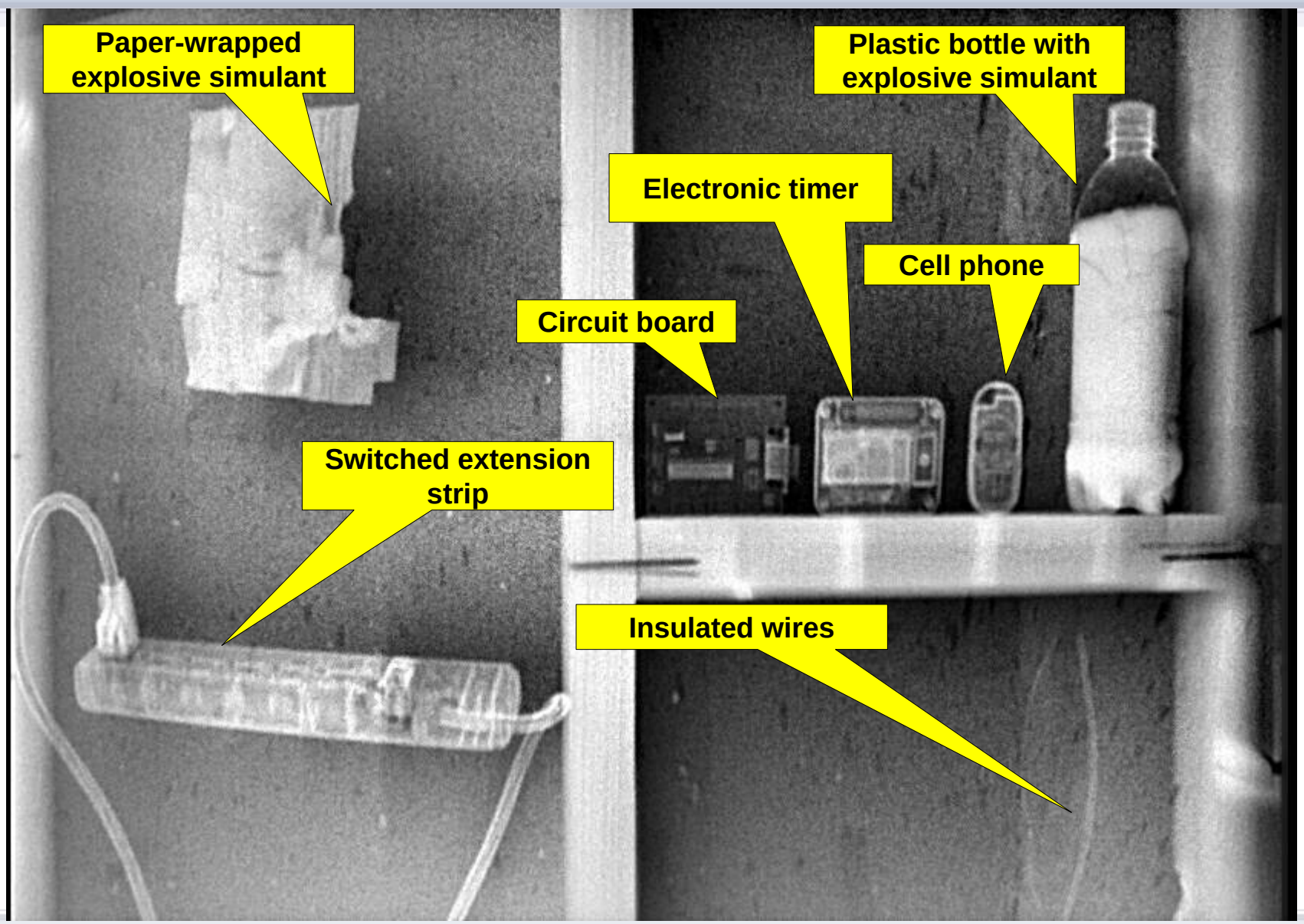


Standoff from 10 feet



Up Close - 30 in.

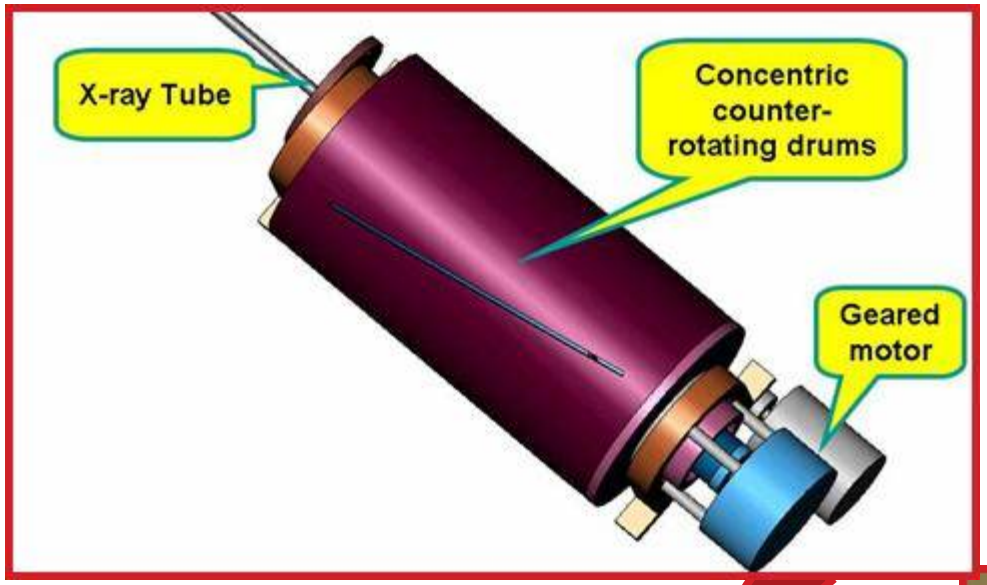
Image Into a Wall

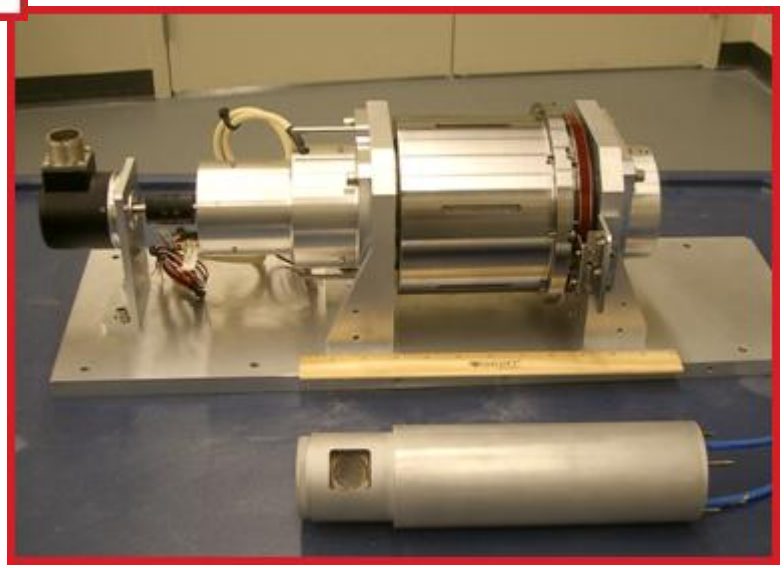


Dual Drum Imaging Concept

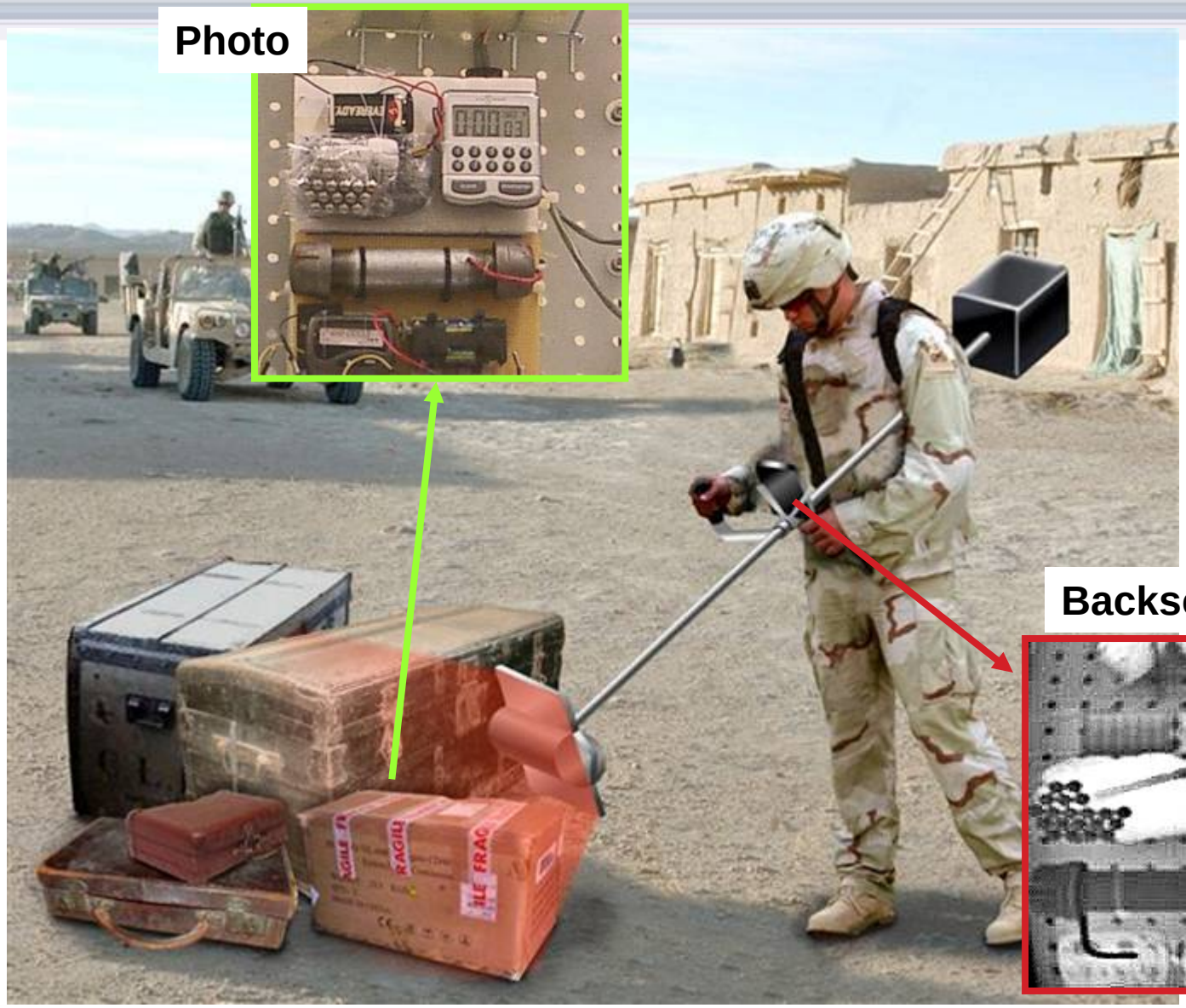
- **Army/RDECOM/I2WD funded project**
- **No “external” motion required**
  - **Counter-rotating scanner drums create two dimensional image**
- **Imaging area and resolution determined by system size and distance from object scanned**
- **Image gets better the longer you scan**
  - **Improved photon statistics**
  - **Allows for fast scans as well as more detailed interrogations**
- **Mounting/Transport scheme adaptable**
  - **Tripod mount**
  - **Robot/platform mount**
  - **Potential for man-portable system**
- **Trade-off analyses in progress**

AS&E Dual Drum Scanning Technique

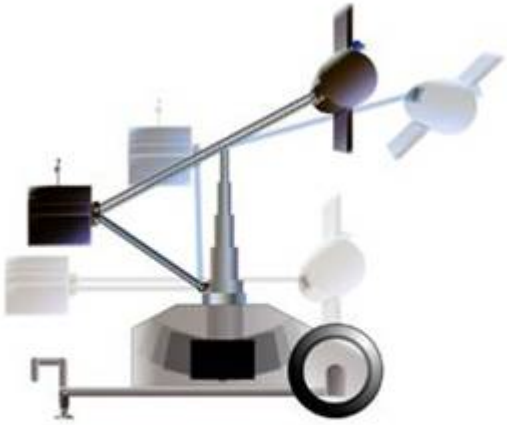




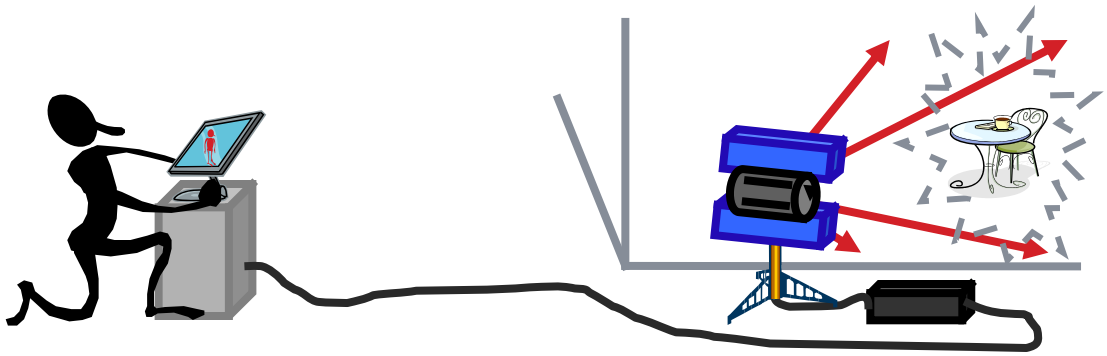
One Potential Application



Alternative Mounts and Applications



Trailer-mount

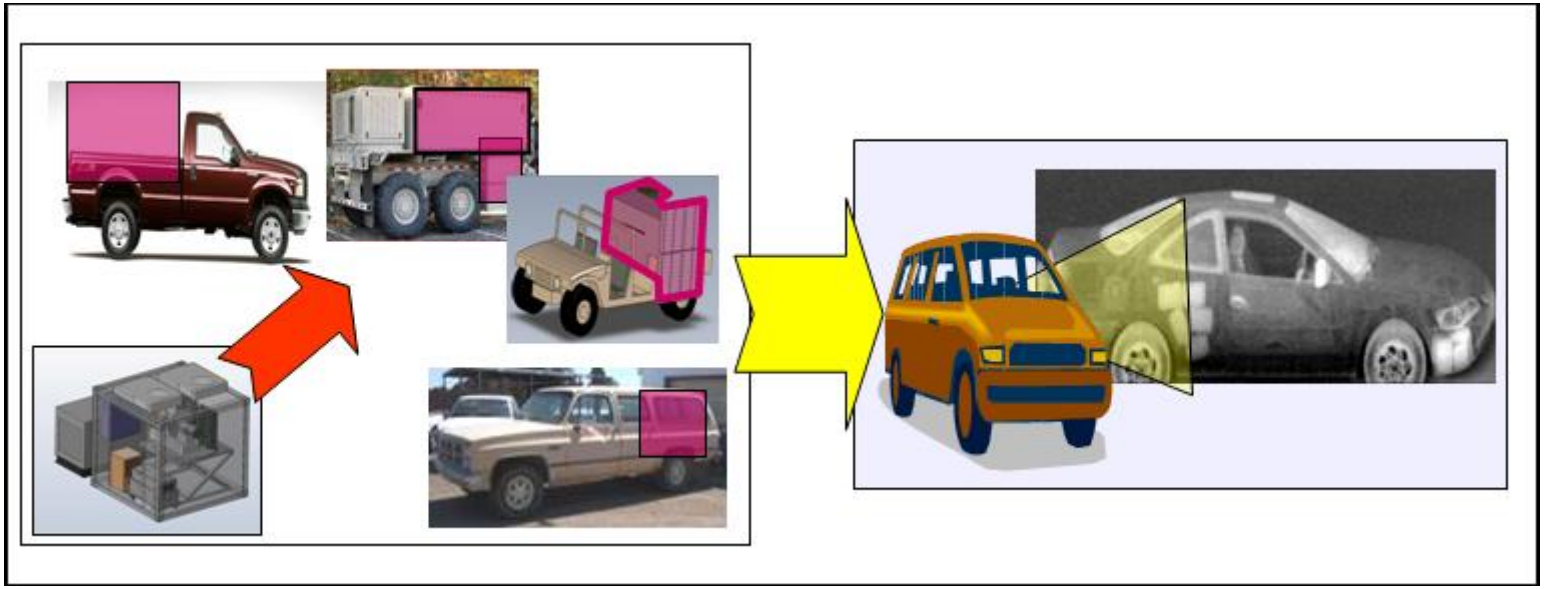


Thru-Wall Imaging

Robot-mount

Modular Backscatter

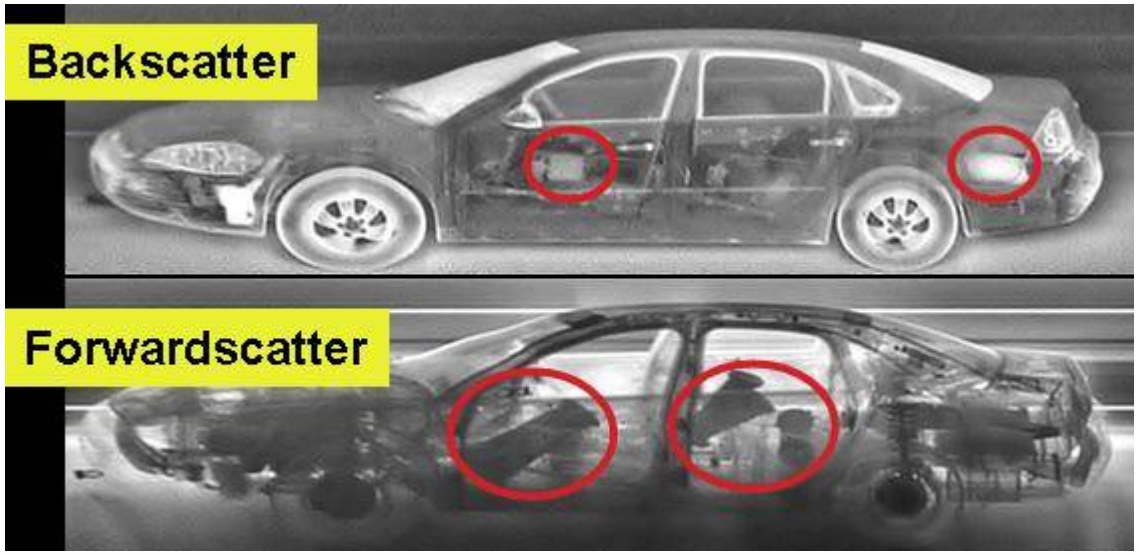
- Program sponsored by DHS S&T
- Explores system requirements trades and configuration/mounting alternatives to increase application base
- Selects and prototypes a modular system for evaluation



Trades and Requirements Definition in Progress

Supplemental Detectors Permit Additional Capabilities

- Better/Quicker Backscatter images
  - Increased scatter capture area improves S/N
- Potential for “stereoscopic” images
  - Allows offset detectors and independent channel processing
- Permits “Forwardscatter” imaging
  - Improved detection of high density materials in clutter



Where To Go From Here

- Operator Assist
  - Image processing/manipulation
  - Filters
  - Historical Comparison
  - Threat Identification
- Interface with others
  - Data sharing
  - Networking

More Information?

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