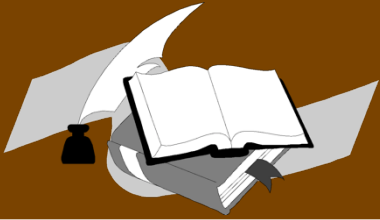




# **Transportation Terrorism**

**Dr. Rachel Ehrenfeld  
American Center for Democracy  
[www.acdemocracy.org](http://www.acdemocracy.org)**



# Keeping Terrorism in Perspective

- Terrorism and Organized Violence are **more frequent** and **more violent**
- Terrorists can be **anywhere**, defense has to be **everywhere**
- Terrorists **target the weakest** points of society
- Terrorists **exploit technological vulnerabilities**

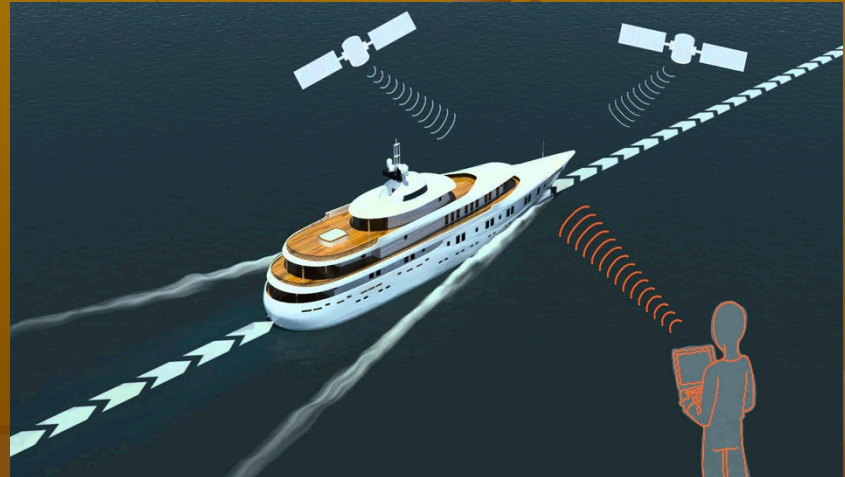
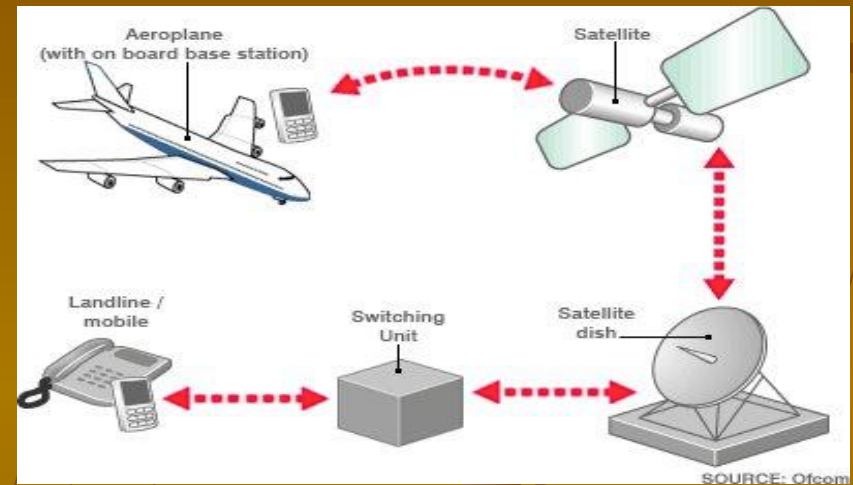
# Transportation as a Terror Weapon





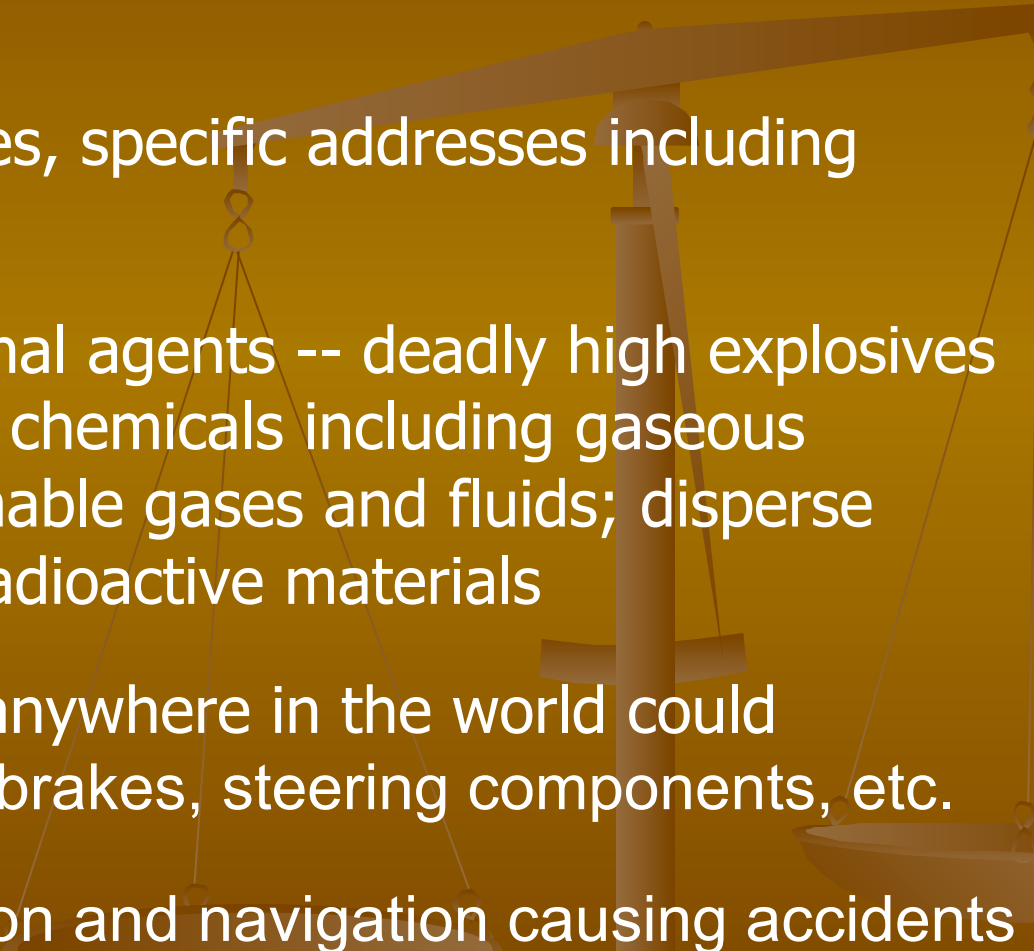
# Technological Vulnerabilities

## Cyber Hacking & GPS Jamming





# The Potential of Transportation Terrorism

- Direct, reliable means of moving threats to the targets or targets to the threats
  - Targeting specific routes, specific addresses including populated areas
  - Could carry specific lethal agents -- deadly high explosives and gases; highly toxic chemicals including gaseous materials; highly flammable gases and fluids; disperse biological agents and radioactive materials
  - **Cyber hacking** from anywhere in the world could commandeer engines, brakes, steering components, etc.
  - Jamming communication and navigation causing accidents
- 



# Car/Aircraft/Boat/Train

## *Threats - New Dimensions*



- Maximum size is about 60,000 to 100,000 pounds (trucks and airplanes) and tens of kilotons (ships)
- **Direct** and **precise** delivery
- **Maximizing destruction** of people, infrastructure, and important economic sectors
- **Mass casualties** and concurrent **media coverage** advances the agendas of the terrorists
- **Ammonium nitrate**, other explosives, and highly **toxic chemicals** and gases are transported in bulk form, **aerosolized fuel** itself is a highly effective explosive
- Detection and limited response time are problematic



A few sad reminders...





October 12, 2000 - Al Qaeda Attack on USS COLE





September 11, 2001 - *UNITED AIRLINES FLIGHT # 175* crashes into the World Trade Center South Tower



December 9, 2002 - Bali Nightclub





March 11, 2004 - Madrid Commuter Train Bombings





London subway/bus bombing, July 2005





July 11, 2006 - Mumbai India Commuter Train Attacks



2010 - New York Times Square Event



Faisal Shahzad

Fortunate failure due to technical problems with the explosive device(s).





July 16, 2010, Ciudad Juarez, Mexico – drug cartel car bomb attack on police patrol trucks, killing two officers and wounded nine people





September 5, 2013 - a car bomb rocked Cairo's eastern Nasr City district. Officials said that the blast was targeting Egypt's Interior Minister Mohammed Ibrahim.



October 2014, Montreal CA  
The vehicle used to hit two Canadian soldier





Jerusalem, November 5, 2014 – Hamas terrorist rammed a van into a crowd of people; kills 1 person and injures many others





Ongoing explosive vehicles in Iraq and Afghanistan

# “Shoe Bomber” Richard Reid



Richard C. Reid



Ibrahim al-Asiri

December 22, 2001 - Richard C. Reid failed to ignite a shoe bomb fabricated by Ibrahim al-Asiri on American Airlines Flight 63 flying from Charles De Gaulle International Airport in Paris, France, to Miami International Airport in Miami, Florida



# “Underwear Bomber”

- Umar Farouk Abdulmutallab removed his shoes, but... the **PETN bomb** in his **underwear** was **not detected**



Christmas Day 2009



# Composite Systems Failures

## Systems failed to identify terrorists

- **One way tickets** were purchased with cash
- Purchased **shortly** before the flights
- **No checked bags**

### Shoe Bomber

- **Reid**, a US citizen, was not on the US terrorist watch list
- Explosives in shoes were undetected

### Underwear Bomber

- **Abdulmutallab**, a Nigerian citizen, on the **UK "security watch list"** but **NOT** on other watch lists
- The **PETN bomb** in his **underwear** was **not detected**







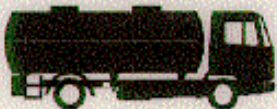

Still potential targets...







# VEHICLE BOMB THREAT DISTANCES

	VEHICLE DESCRIPTION	MAXIMUM EXPLOSIVES CAPACITY	LETHAL AIR BLAST RANGE	MINIMUM EVACUATION DISTANCE	FALLING GLASS HAZARD
	COMPACT SEDAN	500 Pounds 227 Kilos <i>(In Trunk)</i>	100 Feet 30 Meters	1,500 Feet 457 Meters	1,250 Feet 381 Meters
	FULL SIZE SEDAN	1,000 Pounds 455 Kilos <i>(In Trunk)</i>	125 Feet 38 Meters	1,750 Feet 534 Meters	1,750 Feet 534 Meters
	PASSENGER VAN OR CARGO VAN	4,000 Pounds 1,818 Kilos	200 Feet 61 Meters	2,750 Feet 838 Meters	2,750 Feet 838 Meters
	SMALL BOX VAN <i>(14 FT BOX)</i>	10,000 Pounds 4,545 Kilos	300 Feet 91 Meters	3,750 Feet 1,143 Meters	3,750 Feet 1,143 Meters
	BOX VAN OR WATER/FUEL TRUCK	30,000 Pounds 13,636 Kilos	450 Feet 137 Meters	6,500 Feet 1,982 Meters	6,500 Feet 1,982 Meters
	SEMI-TRAILER	60,000 Pounds 27,273 Kilos	600 Feet 183 Meters	7,000 Feet 2,134 Meters	7,000 Feet 2,134 Meters





The “**Run over Organization**” - “**Hit the gas at 199 [km/h] for Al-Aqsa**”  
Urging Palestinians to use their cars to kill Jews.

The “**Run over Organization**”, or **Da'es in Arabic**, is play on words for the Arabic acronym of ISIS - **Da'esh** [Facebook, "Fatah - The Main Page" Nov. 6, 2014]"





## FIFTY KILOTONS OF LPG

Kilaton quantities of LPG/LNG are transported via special refrigerated ships. Megatons of LPG/LNG are stored at port facilities. Terrorist attacks on LPG/LNG tankers or port facilities could cause major injuries and significant structural damage. Risks from such attacks can be significantly reduced with appropriate security, planning, prevention, and mitigation.



# Containerized Freight





# Containerized Freight



# Tanker Trucks





# Our Response

There has to be a better way...



# There has to be a better way...





# Prevention

The art of war teaches us to rely not on the likelihood of the enemy's not coming, but on our own readiness to receive him; not on the chance of his not attacking, but rather on the fact that we have made our position unassailable.

# Countering Car/Aircraft/Boat Bombs

## Prevention

- Airport/On-board security
- Active defeat measures
- Traffic management
- Denaturing high explosives & fuels
- Safe havens (hardened cockpits)
- Firing component defeat
- Rapid identification of individuals
- Betterment principle

## Detection

- Unintended emissions
- Nitrogen detection
- Solvent/volatile species detection
- Flash x-ray, genetic algorithms

## Protection

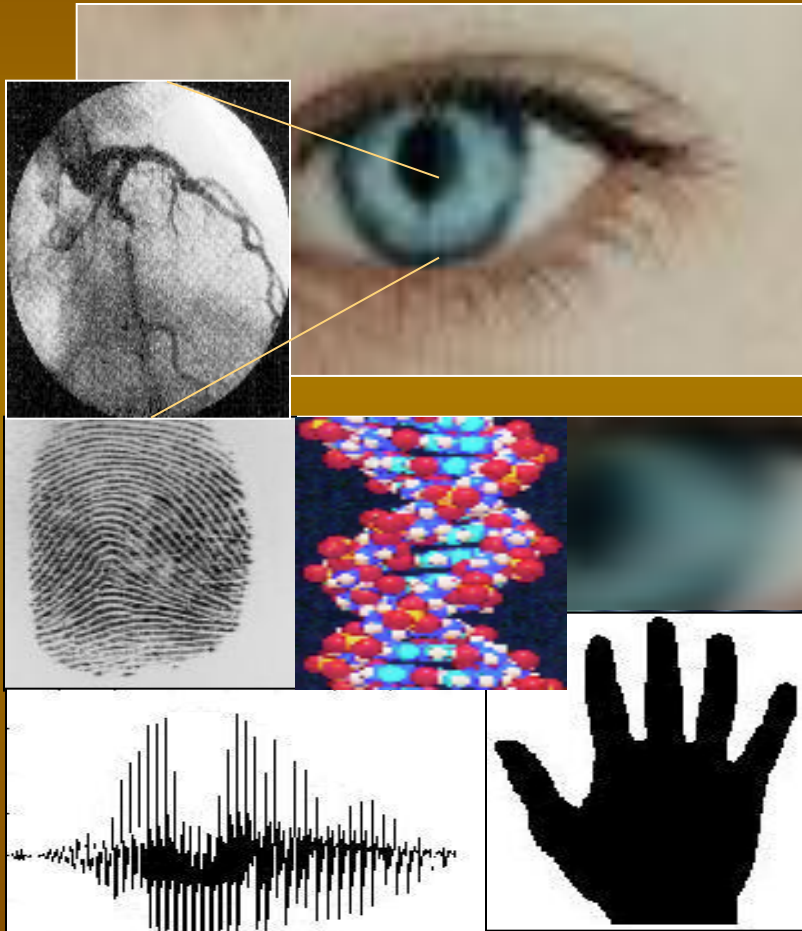
- Blast mitigators & deflectors
- Containment systems
- Shrapnel reduction/shielding
- Structural mechanics
- Controlled preinitiation

## Response

- Robotic disablement
- Remote control and operation
- Victim location and removal
- Remote victim life support
- Active measures
- Resource management
- Forensics and attribution

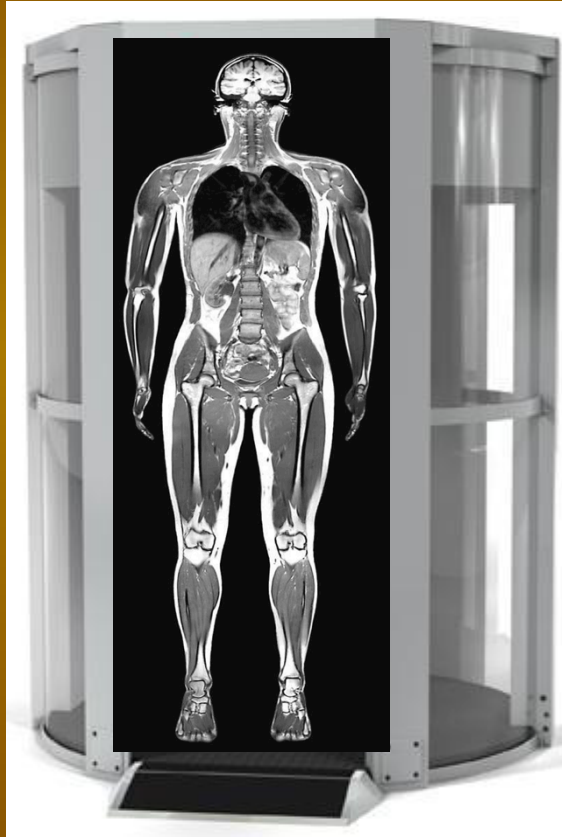


# Biometric Identification

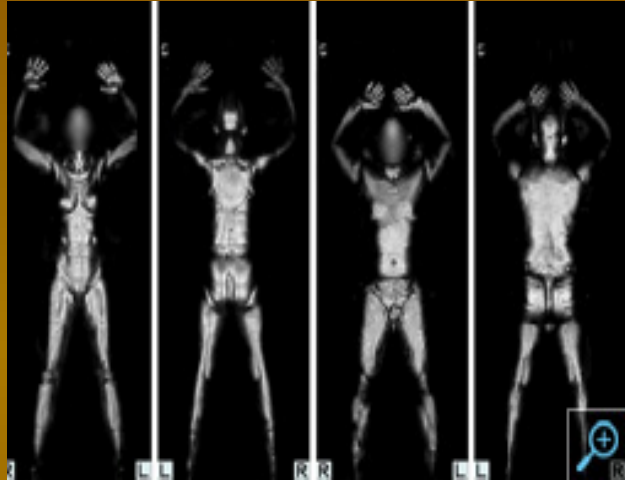


Biometrics involve the precise measurement of unique human features such as iris and retina patterns, fingerprints, voice prints, hand geometries and DNA.

# Current advanced passenger screening - no privacy



MRI Imaging of Body Cavities



Millimeter Wave Image



X-Ray Backscatter Image



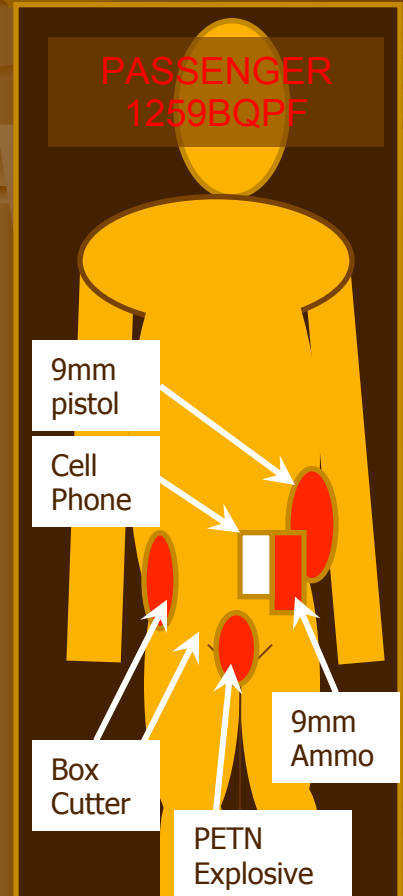


# Advanced screening to protect privacy



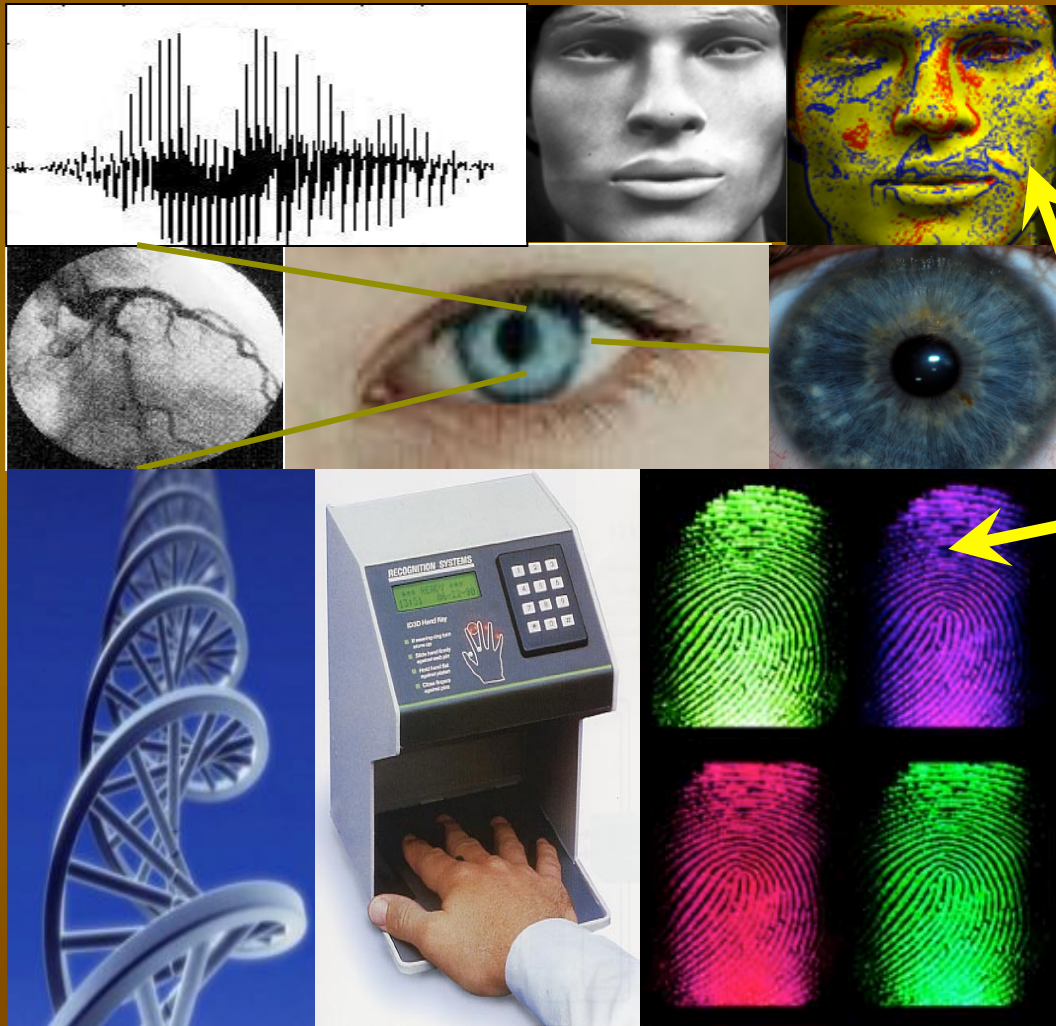
The GENIE\* image processing algorithm learner can be used quickly and on large volumes of imagery, without presuming a particular type of imagery or involving human determination

\*The GENIE was developed in LANL



*Back-scatter X-ray image produced by AS&E's "Body Search"*

# Networked identification & verification of travelers....



Biometrics involve the precise measurement of unique human features such as **epidermal features**, retina and iris patterns, **fingerprint chemistry**,\* voice prints, hand geometry, and/or DNA.

\*Over thirty detectable natural chemical components, variable from person to person.



# Biometrics continued...

- **Fingerprints minutiae** - 30 to 40 landmarks where ridges come together or end
- **Odors** - 30 distinct detectable natural chemical components, unique to each person, that does not include the fragrances and food essences we add to that list daily
- **Hand-touch** - scan of blood vessels in the hand, vein patterns change after death

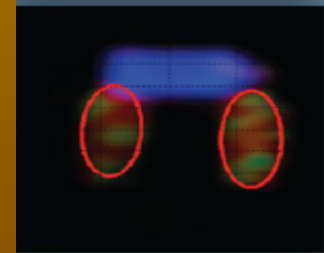
# Advanced material identification

Complementing x-ray's ability to detect guns and knives, MagViz detects harmful materials inside sealed containers. Questionable liquids are found without opening the container.

MagViz uses recent advances in ultra-low field magnetic resonance imaging (MRI) to classify materials into safe, unknown and dangerous categories.

MagViz works by manipulating and detecting hydrogen atoms with small magnetic fields. Pattern-matching software compares the detected signature with a database of dangerous materials.

Comparable in size to an ordinary baggage x-ray machine, MagViz may render unnecessary the rules limiting the amount of liquid transported in carry-on luggage. MagViz promises to speed airport security lines while increasing passenger safety.



MagViz® MRI image of liquid-filled containers, identifies explosive peroxide gels are circled in **red**



# Monitoring Transportation Systems

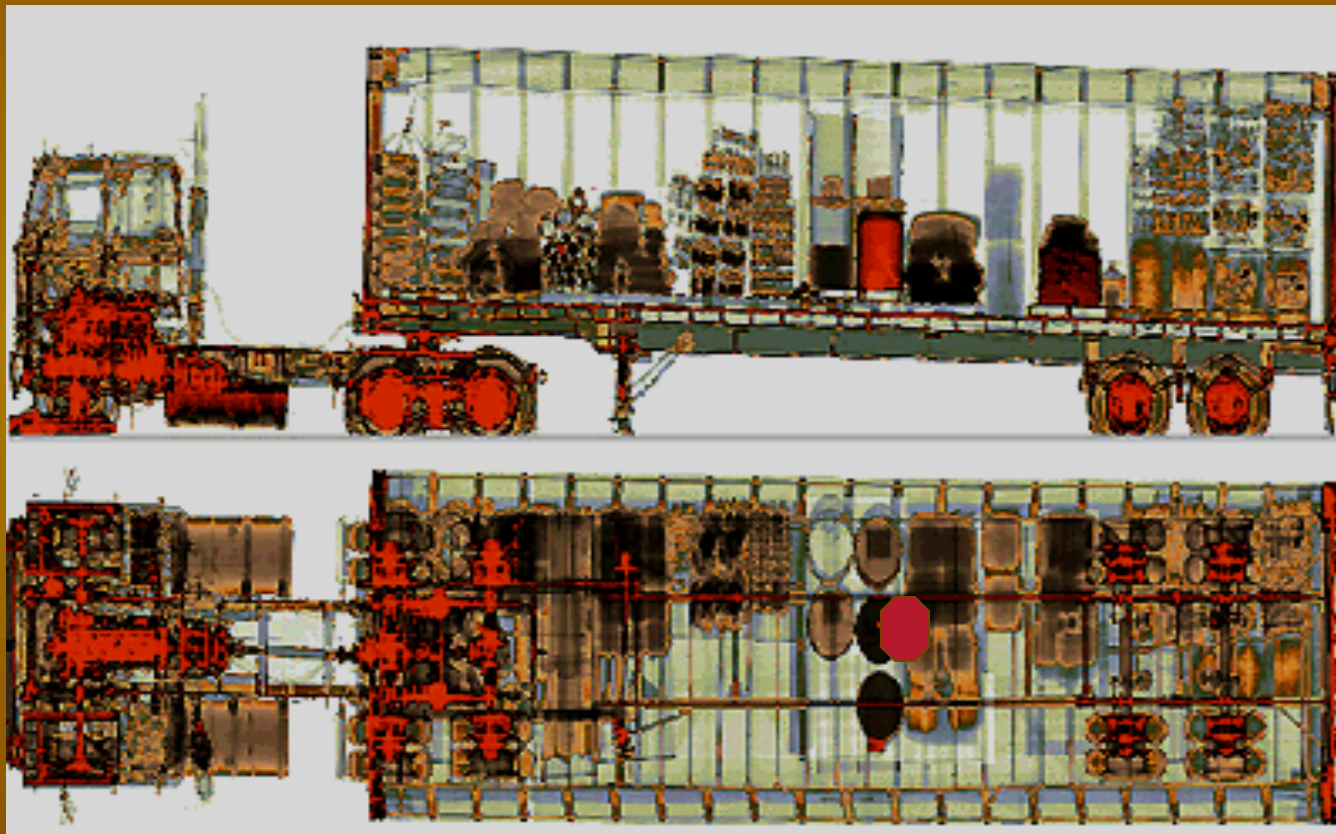


Train portal monitor at the Astrakhan Seaport on the Caspian Sea.

Monitors for nuclear materials developed could be modified and applied to all forms of transportation.

The monitor was developed by LANL

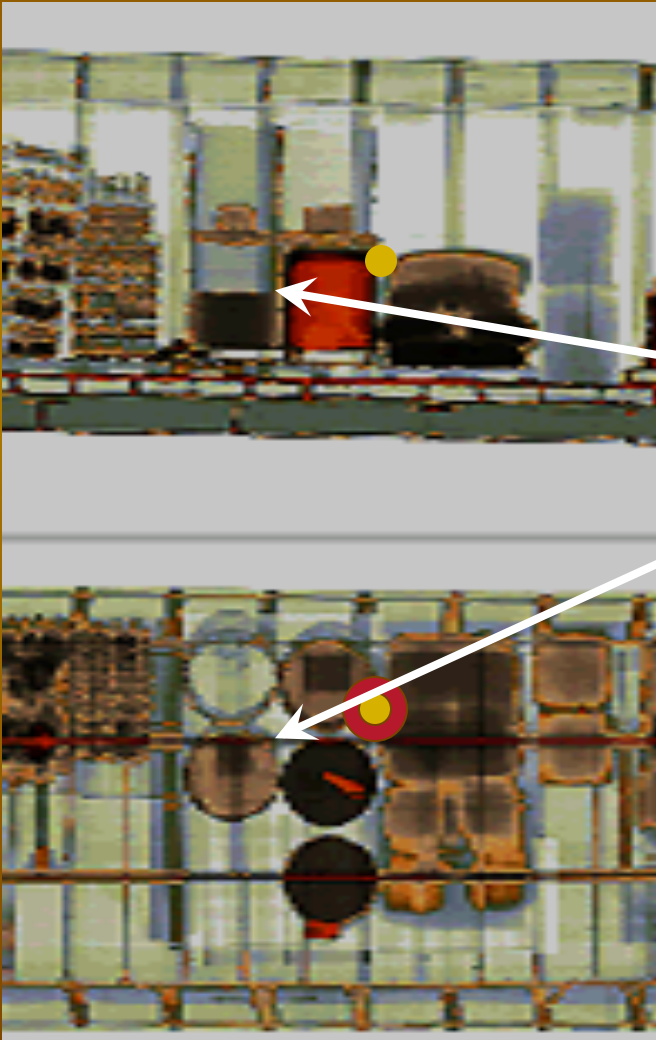
# X-ray imaging of cargo...



Heimann Container Inspection System HCV



# Identifying Radioactive Substances



A combined x-ray scan and a gamma and neutron scan allows accurate characterization and localization of radioactive substances.

# Using naturally occurring muon radiation to identify dense metals



Each minute, about 10,000 muons rain down on every square meter of Earth. These charged subatomic particles, produced when cosmic rays strike air molecules in the upper atmosphere, are being used by LANL's researchers to image dense metals.



# Lightweight Protective Armor



Appliqués of lightweight armor consisting of composites of ceramics such as alumina or silicon or boron carbide and shock-mitigating elastomers can be applied to crew compartments and cargo bins.

# Denaturing High Explosives and Fuels and Developing Alternate Materials



- A combination of calcium and ammonium nitrate produces a fertilizer of equal quality to and cost of ammonium nitrate while being less effective as an explosive.
- Insensitive high explosives significantly reduce the possibility of an accidental detonations.

# Shatter-proof Glass



Plastic film applied to the inner surface of window glass significantly reduces injuries caused by glass shards propelled by shock waves from explosives.



# Future Transportation Threats

- Increase of vehicle bombs containing biological and chemical agents, or nuclear materials (WMD & WME)
- Weaponized Transportation combined with cyber-terrorism severely damaging or destroying critical national infrastructures, impacting large number of people and industries

# Limits on Science and Technology in Countering Transportation Terrorism:

- Scientists cannot deliver solutions proscribed by the laws of the physical world. Neither can engineers
- Solutions should not bankrupt vital economic sectors and businesses.
- Science and technology should not destroy the tenets of our free society in the pursuit of security
- Science and technology cannot rewrite history and should not be focused on preventing terrorist acts that have already happened (Orwellian solutions)
- “What if” scenarios cannot be allowed to escalate costs beyond reason or to move us in wrong directions
- Technologies can present senior decision makers with difficult dilemmas
- No technology or combination of technologies can be absolutely infallible