

# Science and Security in an Age of Terrorism

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- Outline:
1. What is the problem?
  2. How can technology help?
  3. Some examples of developing technologies.
  4. Are they worth it?
  5. What does it all mean?

## Assessing the Threat

- How does the weapon hurt me?



- Can an opponent obtain and deliver it?



- How can I respond to the threat?

- prevention
- mitigation (*i.e.* cleanup, cures, *etc.*)
- retaliation



# Weapons of Mass Destruction (WMD) 101

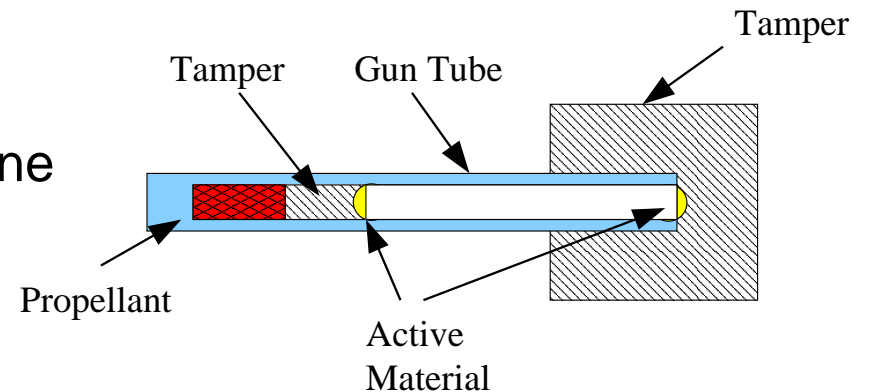
## Nuclear Bombs

- How does it hurt me?
  - Massive release of energy (blast, light) that can cause hundreds of thousands of deaths, long-term increase in cancer rates.



- Can an opponent obtain and deliver it?

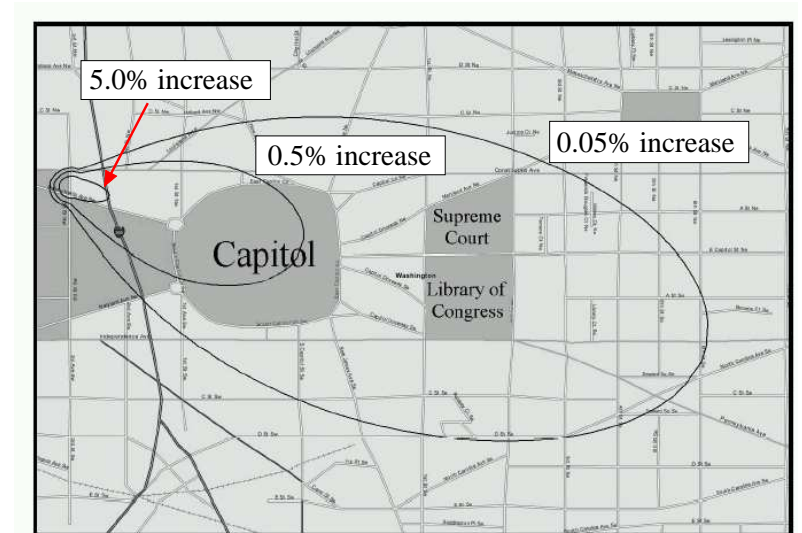
- Building one from scratch can be done by nation-states, but not terrorists.
- Building a bomb with stolen material is still difficult for terrorists.
- It's easy to smuggle things into the US. In 2000, about 700 tons of cocaine was brought illegally into this country according to the National Drug Intelligence Center.



# WMD 101

## Radiological Bombs

- Conventional explosive with radioactive material mixed in.
- How does it hurt me?
  - Immediate damage is from blast. Casualties are far fewer than caused by a nuclear bomb.
  - Increases in long-term cancer rates.
  - Clean-up could be costly.
- Can an opponent obtain and deliver it?
  - Many non-weapons-grade nuclear materials are vulnerable.
  - The technology is not much different from conventional explosives.
  - It's easy to smuggle things into the US, but some targets will be protected by radiation monitors.



# WMD 101

## Biological Weapons

- Release of a biological agent (anthrax, smallpox, salmonella) to cause widespread illness.
- How does it hurt me?
  - The natural spread of the disease and the indiscriminate nature of that spread amplifies the impact of the disease.
  - Some weaponized forms could cause large number of casualties.
  - The poor-man's atom bomb.
- Can an opponent obtain and deliver it?
  - Non-weaponized forms can/have been obtained via mail-order, dirt or stolen from labs.
  - Delivery is still difficult for causing large numbers of casualties.



# WMD 101

## Chemical Weapons

- Release of a chemical agent or toxin (botulinum, sarin, mustard gas) to cause widespread injury.
- How does it hurt me?
  - Different agents have different effects (*i.e.*, incapacitation, blistering).
  - Some forms could cause large numbers of casualties, but most are limited. No amplification of the effect occurs as in the biological case.
- Can an opponent obtain and deliver it?
  - Many chemical agents require standard industrial laboratory equipment that is widely available.
  - Delivery is difficult for causing mass casualties.



## WMD 101

### WMD versus WMD

- Nuclear bombs are true weapons of mass destruction. They cause huge numbers of casualties and damage.
- Some biological weapons can cause mass casualties because of the 'amplification' created by the spread of the disease.
- Not all of the weapons commonly associated with 'Weapons of Mass Destruction' will cause large numbers of casualties.
  - Radiological bombs disperse radioactive material, but this material does not significantly increase the number of prompt fatalities.
  - Most chemical agents cause damage only in large quantities. They are difficult to handle and their lethality is vulnerable to high winds.
  - Many biological agents will not cause large numbers of death because they are hard to disperse.

## WMD 101

### WMD versus WMD

- All of these weapons have to the potential to be 'Weapons of Mass DISRUPTION'.
- Their biggest effect is to spread panic among the population and disrupt the normal functioning of society.
- An example: In Goiania, Brazil in 1987, a derelict cesium source from a medical radiation unit was opened by scavengers releasing large quantities of cesium-137. Local emergency rooms were quickly overloaded with people claiming to have radiation sickness when only about 10% of them were actually ill.
- Psychologists point out that lack of understanding of the threat is a central cause of panic.





# The 'Technical' Challenges to Security

- Controlling radioactive material especially in Russia.
  - Extensive US-Russian programs are already in place, but much work remains to be done.
  - International controls of non-weapons-grade nuclear material are weak in many countries.
- Chem/Bio Detection.
  - Biologists and chemists can identify almost any micro-organism or chemical, but the time-scale is too long (days versus minutes).
  - Expect the greatest technical advances in this area.
  - Many of these advances will be 'pulled' because of other uses.
- Intelligence/Information
  - Increased processing power, network speed, and falling hardware costs will open new doors for surveillance (more on this later).

# The Non-Technical Challenges to Security<sup>1</sup>

- Build alliances and treaties.
  - Comprehensive Test Ban Treaty, Biological Weapons Convention, Chemical Weapons Convention, Kyoto, International Criminal Court.
- Strengthen US diplomacy.
  - Significant staffing shortfalls at many Foreign Service posts.
  - The US diplomatic corp is part of an extended defensive perimeter.
  - International affairs receives about 1% of the federal budget.
- Expand our committment to democracy, the environment, energy, and economic development.
- Promote free trade.
- Expand and globalize preventive threat reduction.

<sup>1</sup> - 'Beating Terror', Richard G. Lugar, *Washington Post*, Jan. 27, 2003.

# Using Science and Technology to Find Solutions

- There is NO cheap, universal, magic bullet!
- Prevention.
  - Prompt detection of nuclear, biological, or chemical agent.
  - Intelligence.
  - Vaccines.
- Response/Mitigation.
  - Treating disease or injury.
  - Clean-up.



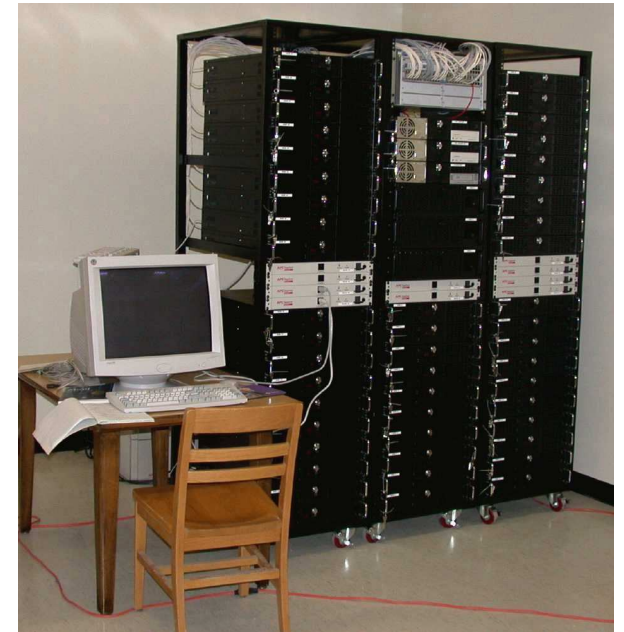
Portable (?) detector for chemical and biological agents. Cost: \$100,000



Chem/bio decontamination foam from Sandia National Lab

## Information Security/Warfare

- We have open borders both physically and electronically.
- Many activities leave an electronic signature.
- Computing power is getting cheaper.
- Bandwidth is growing.
- Computing is becoming pervasive.

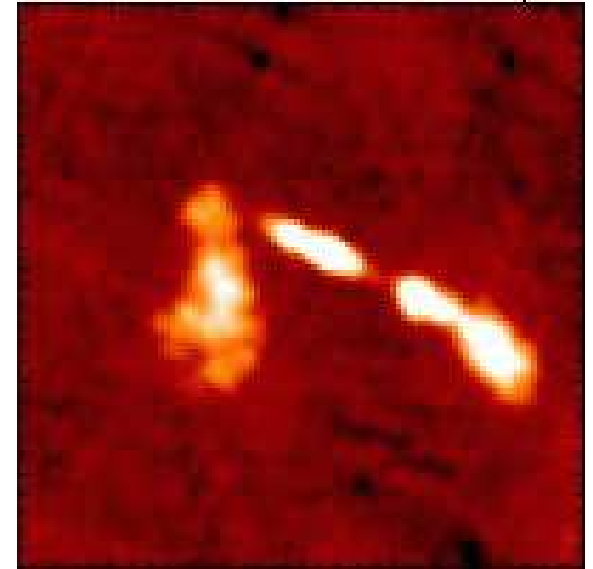


Supercomputer at the University  
of Richmond

Can we find the signature of terrorists  
before they act?

# Data Mining

- Some of the largest databases in the world are used in nuclear and particle physics and astronomy.
- The picture to the right is from a project at Lawrence Livermore National Laboratory to scan the night sky automatically searching for galaxies of a particular shape.



- Corporations now use data mining techniques to analyze their companies and 'characterize' their customers.
  - Models of each customer are developed based on their buying habits, inquiries, *etc.*
  - Models are used to target marketing, predict future buying behavior of customers (You!), identify gaps in services.

## Total Information Awareness

- The DARPA Information Awareness Office (IAO) will imagine, develop, apply, integrate, demonstrate, and transition information technologies, components, and prototype closed-loop information systems that will counter asymmetric threats by achieving total information awareness that is useful for preemption, national security warning, and national security decision making.



# Assessing Risk

What should you stay awake worrying about at night?

Number of Deaths in 2000	Cause
2,400,000	All causes
46,000	Car and truck accidents
29,000	Suicide
20,000	Poisoning
17,000	Homicide
14,000	Falling
4,000	Drowning
3,000	Fire
2,000	Environment

Source: U.S. National Center for Health Statistics, National Vital Statistics Report, Vol. 50, no. 15, Sept. 16, 2002. Web: [www.cdc.gov/nchs](http://www.cdc.gov/nchs) .

## What are all those abbreviations?

Abbreviation	Full title	Status before 9/11	Status after 9/11
CTBT	Comprehensive Test Ban Treaty	Not supported by administration.	No change.
NPT	Non-Proliferation Treaty	See CTBT.	No change.
ABM	Anti-Ballistic Missile Treaty	US is scheduled to withdraw.	No change.
BWC	Biological Weapons Convention	US withdraws.	No change.
CTR	Cooperative Threat Reduction	Faced significant budget cuts.	Budget restored.