Science and Security in an Age of Terrorism

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Outline:

1. What is the problem?
2. What are the challenges?
3. How can science help (and how it can't)?
4. Examples.
5. What does it all mean?

Assessing the Threat

- How does the weapon hurt me?



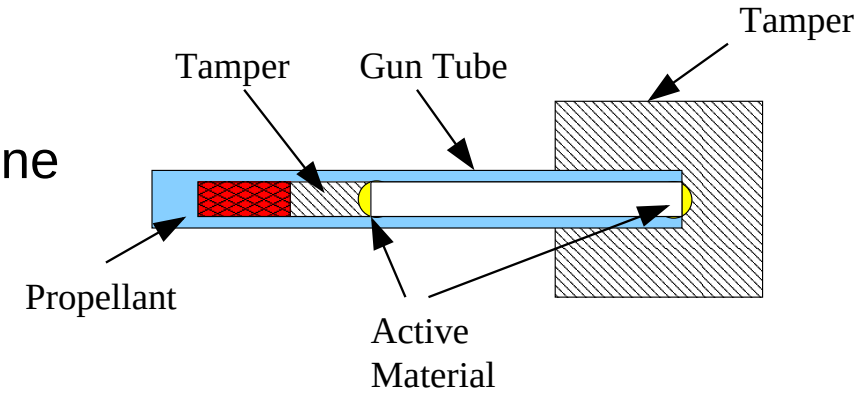
- Can an opponent obtain and deliver it?


- How can I respond to the threat?
  - prevention
  - mitigation (*i.e.* cleanup, cures, *etc.*)
  - retaliation

Weapons of Mass Destruction (WMD) 101

Nuclear Bombs

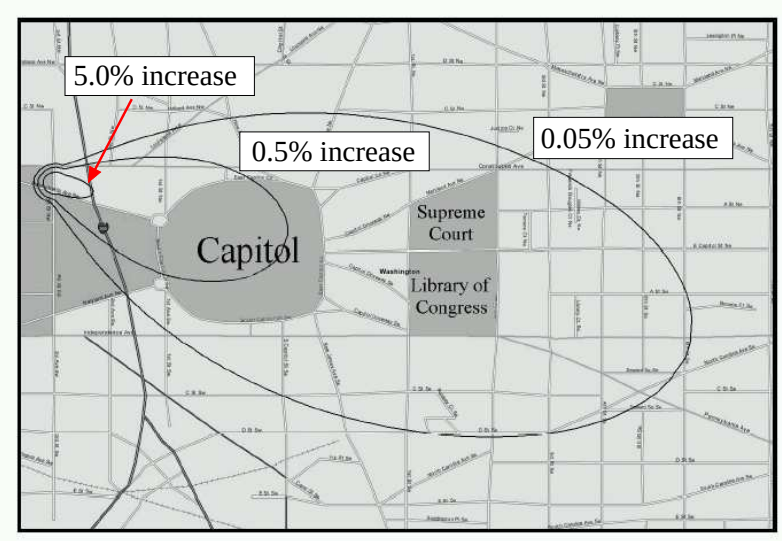
- How does it hurt me?
  - Massive release of energy (blast, light) that can cause hundreds of thousands of deaths, long-term increase in cancer rates.
- Can an opponent obtain and deliver it?
  - Building one from scratch can be done by nation-states, but not terrorists.
  - Building a bomb with stolen 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 ('Dirty') 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 occurs as in the bio case.

Effect of chemical blistering agent [1]

- Can an opponent obtain and deliver it?
  - Many agents need only standard lab equipment.
  - Delivery is difficult for causing mass casualties.

[1] - *Chemical Warfare by Iraq in Iran-Iraq War*, Stockholm International Peace Research Institute, http://www.iranvision.com/iraqchemicaluse.html, Last accessed: 2/4/03.

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 and Response.
  - 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).

Using Science and Technology to Find Solutions

- There is NO cheap, universal, magic bullet!
- Prevention.
  - Prompt detection of nuclear, biological, or chemical agent.
  - Intelligence, law enforcement.
  - 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

The Non-Technical Challenges to Security[2]

- 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 commitment to democracy, the environment, energy, and economic development.
- Promote free trade.
- Expand and globalize preventive threat reduction.

[2] - 'Beating Terror', Senator Richard G. Lugar (R-Ind), *Washington Post*, Jan. 27, 2003.

A Non-Technical Solution: Preventive Threat Reduction

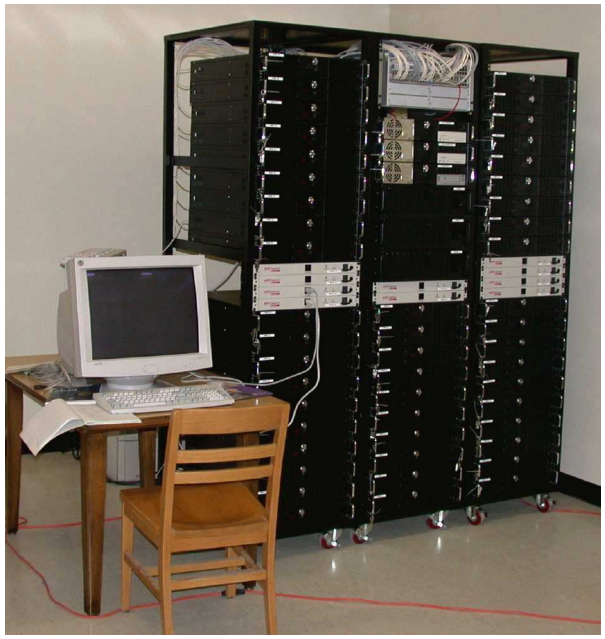
- The US spends taxpayer monies to remove and reduce weapons to increase homeland security.
- The Nunn-Lugar programs in cooperation with Russia spend ≈$1B each year dismantling and securing the Russian nuclear weapons complex and destroying chemical and biological weapons.
- Operation Sapphire in 1995 removed 1300 pounds of insecure, weapons-grade uranium from Kazakhstan.

Russian Missile Sub Dismantlement

- Removal last summer of about 90 pounds of weapons-grade uranium from Vinca Institute in Serbia (with help from Ted Turner).
- Destruction of Scud missiles in Bulgaria.

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.

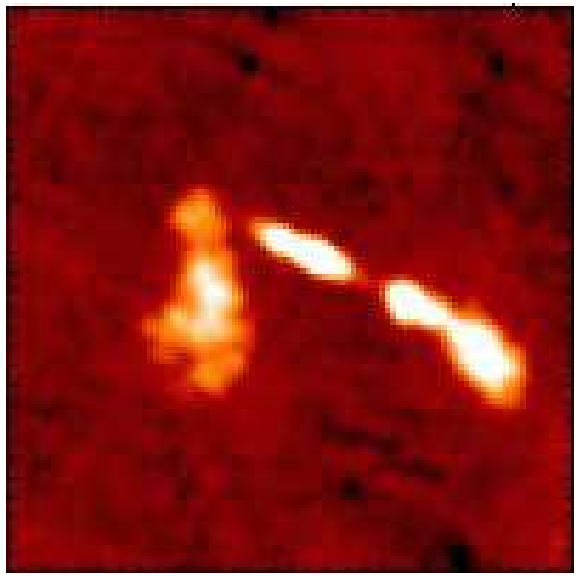


Supercomputer at the University of Richmond

Can we fi nd 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.[3]

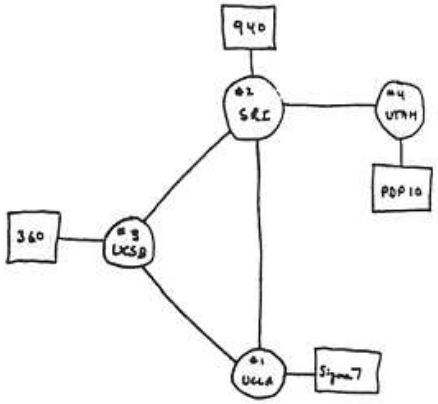
Program Manager
Admiral John Poindexter

- The above statement means the office will fund projects to develop new computing methods for surveillance.
- The program began about one year ago and only in the last few months has it come under significant public scrutiny.

[3] Information Awareness Office homepage , DARPA, http://www.darpa.mil/iao/.

Challenges Facing Total Information Awareness

- Will the technology work?
  - How can privacy be maintained?
  - What are the electronic signatures of terrorists?
  - How will the technology respond to countermeasures?
  - Will the program be swamped by false positives?
- Should we even try?
  - What information can the government collect?
  - What government agencies can do the collecting?
  - Who can the government collect information from?
  - What information is admissible in court?
  - Who is in charge of oversight?
  - **Who owns your information?**
- Is this any more intrusive than private sector ‘modeling’?
- Has Big Brother arrived? Or is this just another Federal boondoggle?



ARPANET, 1969

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 .

Conclusions

- Do we live in a safer world than during the Cold War? Yes, sort of.
- Is nuclear, biological, or chemical terrorism likely? Yes, sort of.
  - The weapons of choice will be guns, knives, and explosives. The attraction of nuclear, biological, or chemical terrorism is the potentially large psychological effect.
- What can be done? Lots, but it will take time, money and leadership from the US.
- What can I do?
  - Learn! Panic is the chief enemy.
  - Engage! Discuss these issues with others.
  - Vote! Write to Congress.

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 withdraws.	No change.
BWC	Biological Weapons Convention	US withdraws.	No change.
CTR	Cooperative Threat Reduction	Faced significant budget cuts.	Budget restored.