# THE INNOVATORS

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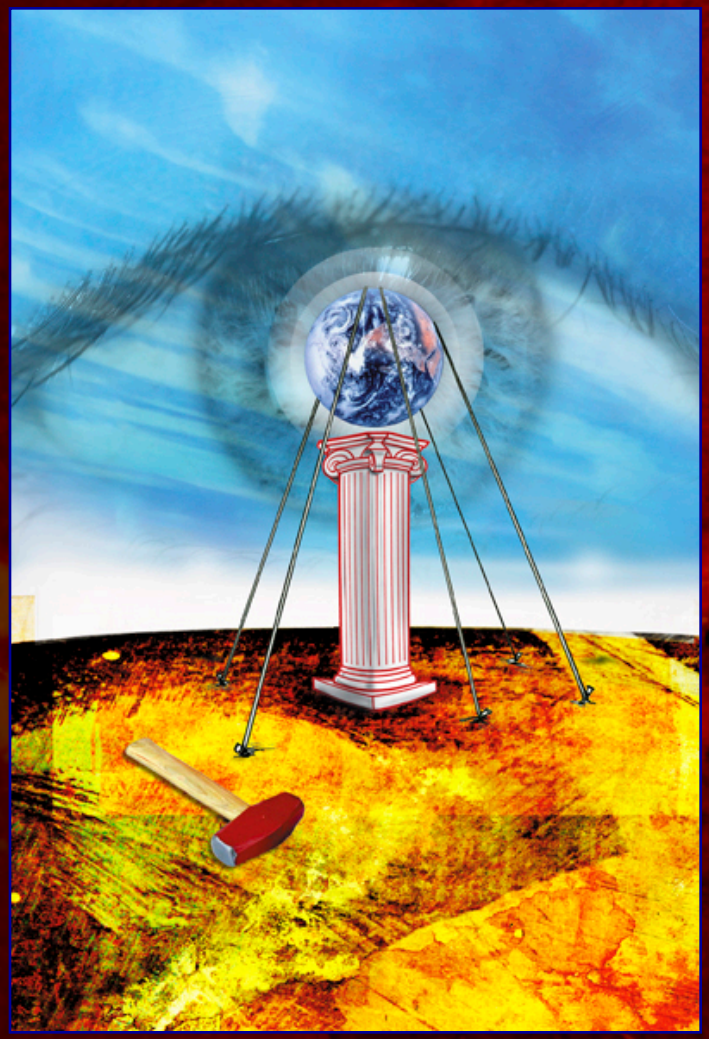
# THE INNOVATORS:

## Cutting-edge Discoveries: Transforming Lives, Fueling the Economy

Spring 2007



# THE INNOVATORS:

## Biological Warfare:
## The New Face of Terrorism

Thomas Preston, Ph.D.

**Associate Professor**
**Department of Political Science**

**College of Liberal Arts**

***We must be prepared*** for a future where biological warfare and bioterrorism will significantly threaten our security – both here at home and abroad!

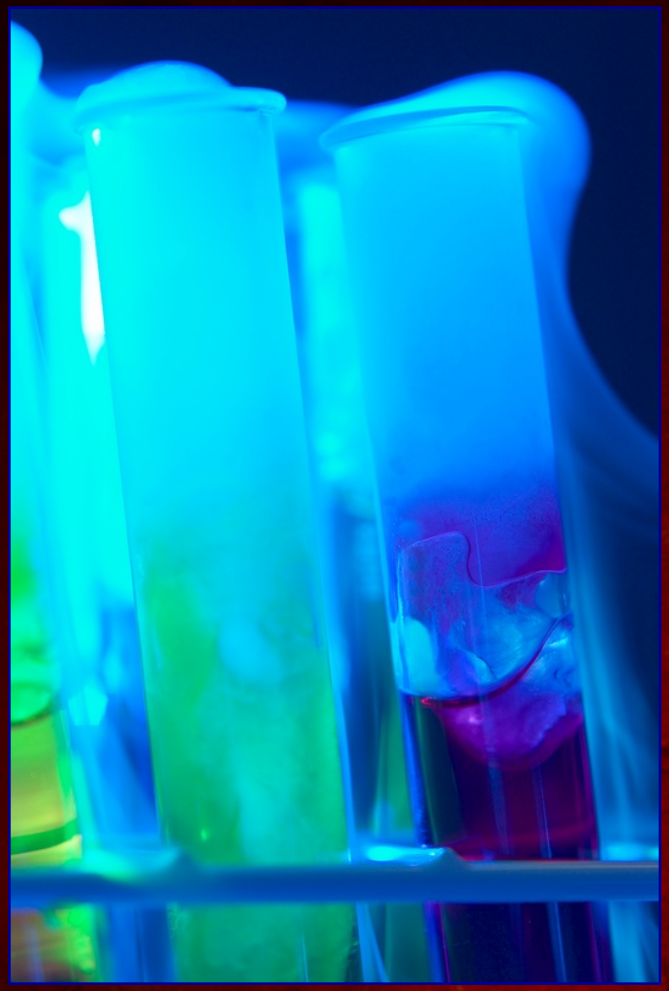
# We must be prepared.

- Despite 9/11 and the anthrax postal attacks, terrorism is a threat that is poorly understood
  - Most Federal efforts to improve biopreparedness have been underfunded or superficial

# We must be prepared.

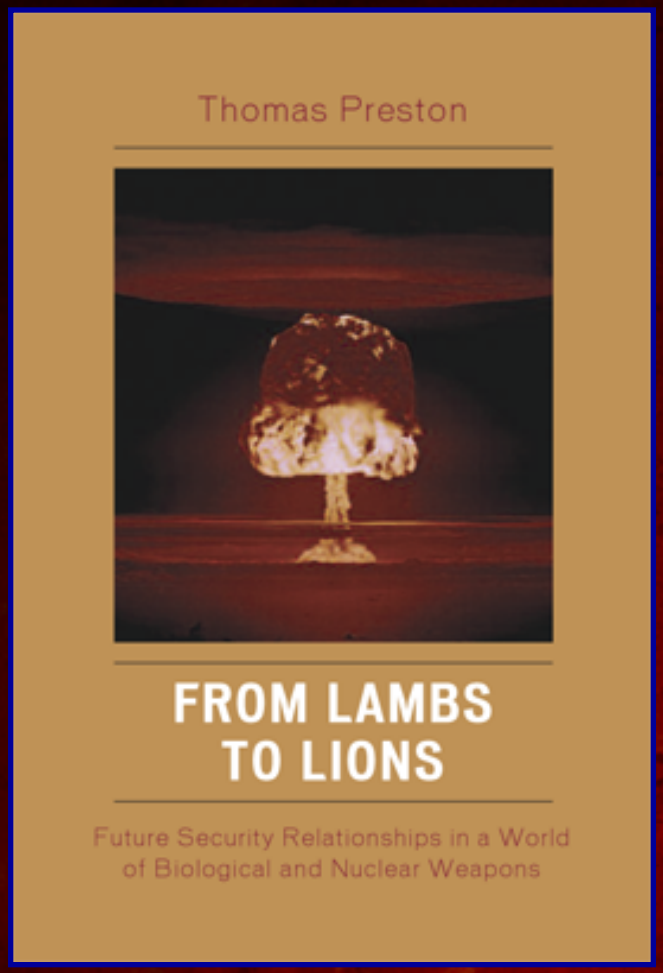
Five years after 9/11, we find ourselves vulnerable to a new ‘strategic surprise’ in the form of bioterrorism.

# But why is this the case?



- Lack of understanding about the utility of bioweapons and how they could be used
- Lack of future thinking on our part – “preparing to fight the last war”
- Past is not always prologue

## Thomas Preston. From Lambs to Lions: Future Security Relationships in a World of Biological and Nuclear Weapons. Boulder, CO: Rowman and Littlefield, 2007.




Explores:

- The growing threats posed by both nuclear and biological weapons proliferation over the coming decades from both state actors (like Iran and North Korea) and non-state actors (like Al Qaeda)
- How these threats will alter our existing security relationships

## Thomas Preston. From Lambs to Lions: Future Security Relationships in a World of Biological and Nuclear Weapons. Boulder, CO: Rowman and Littlefield, 2007.

For example:

- How might a nuclear North Korea or Iran constrain U.S. freedom of action in its foreign or military policies?

## Thomas Preston. From Lambs to Lions: Future Security Relationships in a World of Biological and Nuclear Weapons. Boulder, CO: Rowman and Littlefield, 2007.


- What might be the impact upon U.S. security of the current biotechnical revolution and spread of bioweapons know-how to opponents?

## Thomas Preston. From Lambs to Lions: Future Security Relationships in a World of Biological and Nuclear Weapons. Boulder, CO: Rowman and Littlefield, 2007.

- How might terror groups, like Al Qaeda, possibly make use of biological weapons in future attacks against the U.S. or its allies around the world?

## Nuclear and biological proliferation are rapidly changing the ‘rules of the game’ of power politics.

- The Athenians and Melians during the Peloponnesian War
- “the strong do what they will, and the weak suffer what they must”
- ‘Melian Dilemma’

## How does the proliferation of biological weapons capabilities and know-how change the nature of the threat we face from bioterrorism?

- Over the coming decades, bioweapons will pose a far greater threat to U.S. security than nuclear weapons
- Bioweapons will be more readily available and impossible to control using traditional counter proliferation policies

**The threat is not a static one, but a constantly evolving one.**

# How does the proliferation of biological weapons capabilities and know-how change the nature of the threat we face from bioterrorism?

- For terrorists, bioweapons provide the ultimate in stealthy, asymmetrical warfare and are well-suited to both clandestine development and employment

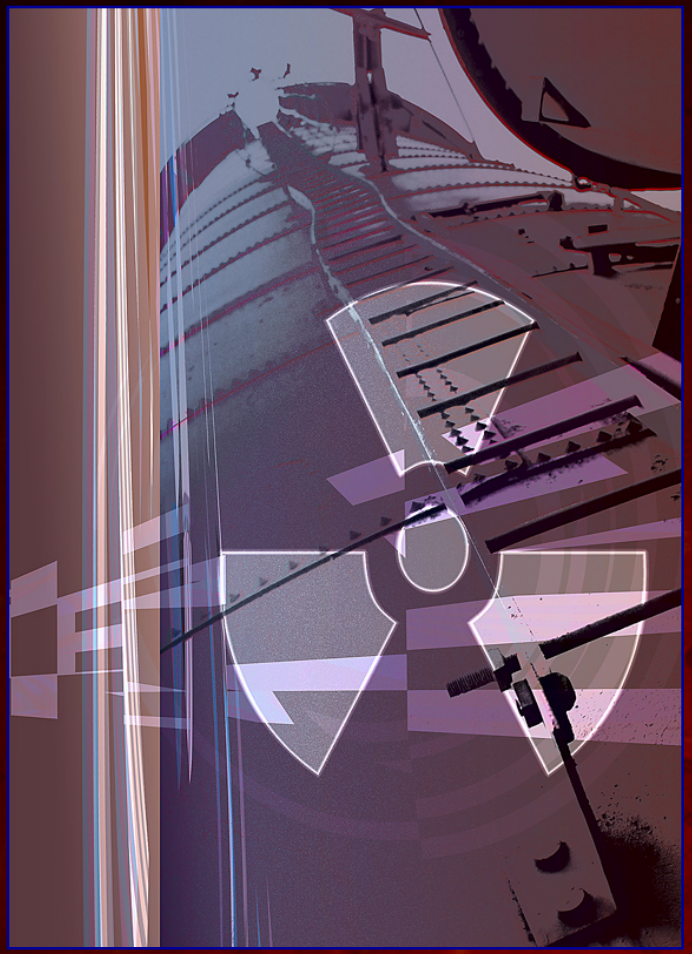
# Between 9 and 20 STATES are suspected of having offensive bioweapons programs

- Strong ‘disincentives’ discourage STATES from acknowledging programs or using them offensively
- Bioweapons, reserved for only the most extreme threats to central national interests (like regime survival, maintaining territorial integrity, etc.), are not considered for less serious threats
- Deterrence holds

## Between 9 and 20 STATES are suspected of having offensive bioweapons programs

- In contrast, NON-STATE, terror group actors are impossible to DETER in a “classical-sense”
- Groups like Al Qaeda (who value instrumental violence and creation of mass casualties) would likely use such weapons if they obtained them

# How difficult would it be for a terror group to acquire the requisite technology and knowledge needed for making bioweapons?



- Creation of ‘effective’ bioweapons is no simple task!
- It is extremely unlikely terror groups composed of members with limited training in the biological sciences or relying upon internet sources alone could actually carry off an effective large-scale attack

# How difficult would it be for a terror group to acquire the requisite technology and knowledge needed for making bioweapons?


- However, this does NOT rule out the ability of such groups to develop effective capabilities IF they acquire individuals with graduate-level expertise (or higher) in the relevant biological sciences
- OR, if they obtain technical advice from those who once worked in state-run bioweapons programs

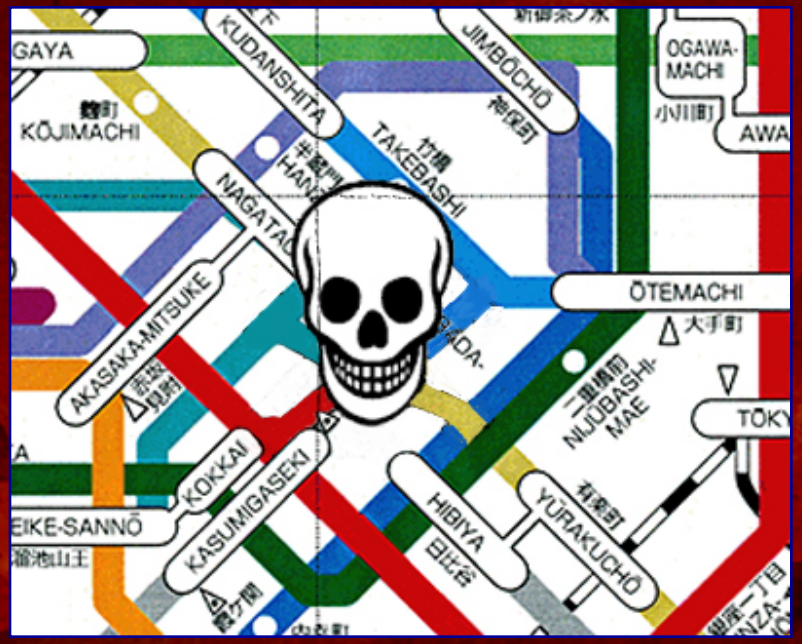
# How difficult would it be for a terror group to acquire the requisite technology and knowledge needed for making bioweapons?

"Brain drain" problem

- Former Soviet BW program employed 65,000 people at its height
- The whereabouts of as many as 7,000 former bioweaponeers with significant weapons knowledge are unknown

# How difficult would it be for a terror group to acquire the requisite technology and knowledge needed for making bioweapons?

- Japan's Aum Shinrikyo cult



## How difficult would it be for a terror group to acquire the requisite technology and knowledge needed for making bioweapons?

## “Knowledge is the real weapon”

# How difficult would it be for a terror group to acquire the requisite technology and knowledge needed for making bioweapons?

- Massive state-run programs NOT required
- Project Bacchus
- ‘Dual-use’ problem surrounding this technology
- The cost estimates for a bioterrorism facility vary quite widely, from $2 million to $200,000
- For a truly small-scale operation, the price could be even lower

# How effective could bioterrorism be and what are the possibilities?

- Effectiveness of bioweapons accepted as fact by all the major state-run bioweapons programs
- Pentagon conducted 239 open air bio-warfare tests during the 1950s and 60s on airports and subway systems, across entire cities and regions of the country using aircraft or boats
- These tests conclusively demonstrated that even small amounts of material could effectively contaminate thousands of square miles

# How effective could bioterrorism be and what are the possibilities?

- Office of Technology Assessment study warned 100 kilograms of anthrax released by aircraft over Washington, D.C. would kill somewhere between one and three million people

# How effective could bioterrorism be and what are the possibilities?

- Open air test over San Francisco created a cloud of simulants that covered the city, spread twenty-three miles inland, and would have infected an estimated 800,000 people

# How effective could bioterrorism be and what are the possibilities?

- Tests in the New York City subway system used an open container of an anthrax simulant placed on the subway tracks

# Bioterrorism could also inflict tremendous economic damage:

- Models predicting the economic impact of various bioterror attacks on the suburbs of a major city warned of costs ranging from
  - $477 million per 100,000 people exposed to brucellosis
  - $5.5 billion per 100,000 exposed to tularemia
  - $26.2 billion per 100,000 exposed to anthrax

## Bioterrorism could also inflict tremendous economic damage:

- The anthrax mail attacks in 2001 (with two letters) ended up costing the U.S. post office $5 billion ($2 billion in lost revenue and $3 billion to clean up contaminated facilities, buying irradiation machines, etc.)
- The economic costs of 9/11 to clean up lower Manhattan was $40 billion

## Other possible avenues for inflicting economic harm would be the use of agricultural bioterrorism.

- Foot and Mouth Disease
- Animals become contageous 7-10 days PRIOR to visible symptoms
- Highly concentrated nature of our markets
- A release of foot-and-mouth would spread within five days to as many as 25 states through the normal, regulated movement of animals from farm to market

## Other possible avenues for inflicting economic harm would be the use of agricultural bioterrorism.

- $19 billion outbreak in Taiwan in 1997 that nearly destroyed its pork industry caused by a single pig imported from Hong Kong!
- Overall, U.S. food production alone accounted for earnings of over $991 billion in 2001.

## Genetic Engineering and advances in biotechnology are creating brand new, novel kinds of bio-threats.

- At the simplest level, this involves creating antibiotic resistance in pathogens
- This results in 30-60% mortality rates for Tularemia, 90% or more for Anthrax, and 100% for plague
- It is also possible, using more sophisticated techniques, to increase virulence and communicability of pathogens by DNA-shuffling (or accelerated evolution) to isolate strains you want

# Genetic Engineering and advances in biotechnology are creating brand new, novel kinds of bio-threats.

Genetic engineering can be used to 'insert' foreign genes into a pathogen to give it new characteristics

- Examples of 'Bad Gene Therapy'
  - Australian Mousepox experiments
  - Popov's Myelin toxin gene & Legionnaire's Disease work
  - Possibilities for combinations are endless:
    - Snake venom genes
    - Ability to evade vaccines, etc.

# Genetic Engineering and advances in biotechnology are creating brand new, novel kinds of bio-threats.

- Chimera's (or combination pathogens) are created using genetic engineering
- Soviet BW program produced Smallpox/Ebola and Marburg (hemorraghic fever) chimeras

## Genetic Engineering and advances in biotechnology are creating brand new, novel kinds of bio-threats.

- With entire genomes (or DNA sequences) of pathogens now freely available online, modern biotechnology allows us to not only more effectively engineer pathogens as weapons, but to create pathogens we don't have access to:
  - The smallpox genome could be modified to create a 'related pox-virus'
    – like monkeypox or camelpox
  - Scientists, using the DNA recipe for Polio, recently created a LIVE polio virus
  - The same technology could be used to create Ebola, Marburg, and many others

## Genetic Engineering and advances in biotechnology are creating brand new, novel kinds of bio-threats.

- Finally, another possibility would be to develop agents that turn the victim's own auto-immune system against itself
  - Bioregulators are natural substances produced in the human body which regulate metabolism and control physiological functions
  - The sky is the limit for what could be possible using bioregulatory peptides

# So What Can Be Done?

- No ‘silver bullets’
- But there are measures we should be taking – that both recognize the actual security threat we face and serve to minimize the impact upon us when a bioterror incident occurs
- ‘Damage limitation’ strategy

# What Can Be Done?

## Recommendations:


Recognize that counterproliferation strategies based purely upon “denial” of materials or technology can no longer be relied upon to prevent either state or non-state actors from obtaining WMD capabilities

- Bioweapons production equipment and know-how are already widespread and completely dual use in nature
- Knowledge represents the true WMD at this point (not the pathogens themselves)
- Nunn-Lugar Cooperative Threat Reduction Program

# What Can Be Done?

## Recommendations:

Resources need to be directed towards improving existing hospital facilities

- American Hospital Association estimated it would cost a minimum of $11 billion to upgrade the nation's hospitals to meet likely bioterror threats!

# What Can Be Done?
## Recommendations:

Serious lack of intensive care units in most U.S. cities

- Even those judged adequate under normal circumstances (30-40 beds in cities the size of Baltimore) – would be quickly overwhelmed in the event of a mass-casualty bio-attack
- Funding should be provided for development of national rapid response, mobile ICUs
- ‘Dual-use’ in the most positive sense!

# What Can Be Done?

## Recommendations:


We need to greatly increase level of government support available to the pharmaceutical industry for developing and producing new antibiotics, antiviral drugs, vaccines, and other treatments to counter biowarfare agents!

- It takes between $500-$800 million (and anywhere from 10-15 years) to bring a new drug or vaccine onto the market

# What Can Be Done?

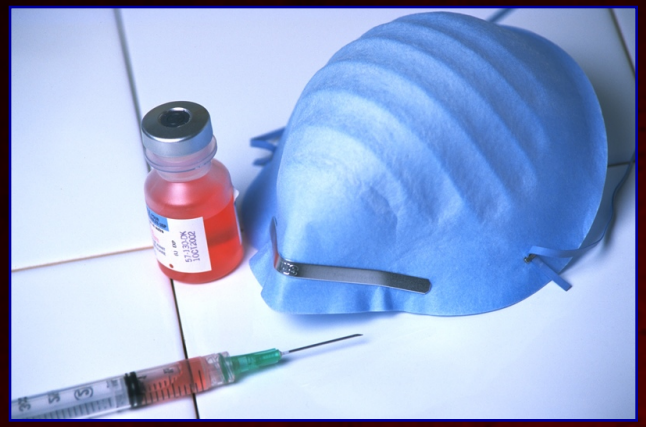
## Recommendations:

Increase level of government support available to the pharmaceutical industry

- Project Bioshield–set aside $5.6 billion over a ten year period to provide incentives for drug companies to develop new drugs, vaccines, diagnostic devices, and medical treatments for countering potential bioattacks
  - In 2000, out of 57 countermeasures needed to protect the public, only one was available
  - By 2004, only two were available (the anthrax & smallpox vaccines), and these are useful only against unmodified agents!
- Though expensive, a well-funded initiative would have great dual-use' benefits to the American public

# What Can Be Done?

## Recommendations:



We need to really think ahead regarding how the public will react to a bioterror attack, so that we can reduce the panic that may result and better prepare our first-response efforts

- Bioterrorism more likely to induce panic reaction in public
- Historically, epidemics of deadly diseases have created public panic and society breakdowns

# What Can Be Done?

## Recommendations:

We need to really think ahead regarding how the public will react to a bioterror attack

- First Responder and Medical Communities are not immune to this dynamic
- Recent poll found *20%* of U.S. physicians believe it is NOT their professional duty to continue to treat patients during an epidemic if it puts their own lives in danger!
- New Orleans police officers deserted their posts to look after their own families in the aftermath of Hurricane Katrina

# What Can Be Done?

## Recommendations:

We need to really think ahead regarding how the public will react to a bioterror attack

- Psychosomatic (or sociogenic) illness within the general population might complicate or disrupt the response efforts of authorities by overwhelming medical facilities
- ‘the worried well’
- Department of Defense estimates there would be five psychological casualties for every one physical casualty during a bioattack

# What Can Be Done?

## Recommendations:

We need to really think ahead regarding how the public will react to a bioterror attack

- Others predict for every person seeking medical care for physical injuries, at least 6 to 10 seen will present with psychological concerns
- ‘Worst case’ estimates place the number of psychological casualties to physical ones at a level as high as 50 to 1
- Approximately 80% of victims exposed to a terrorist attack will bypass the EMS system and seek direct access to medical care usually at a local hospital

# What Can Be Done?

## Recommendations:

We need to really think ahead regarding how the public will react to a bioterror attack

- Biological weapons are perhaps the perfect weapon for eliciting such sociogenic responses from a population given:
  - Stealthy nature of bio-agents and uncertainty over who is infected
    - Varying incubation periods
    - Early stages of illness often present clinically with same symptoms as flu

# What Can Be Done?

## Recommendations:

We need to really think ahead regarding how the public will react to a bioterror attack

- Biological weapons are perhaps the perfect weapon for eliciting such sociogenic responses from a population given:
  - Man-made events delivered by an unseen enemy will constantly worry public about new outbreaks from new attacks forever on the horizon
  - If attacks occurred nationwide at multiple locations, if there are subsequent attacks, or if a communicable agent is used, sociogenic illness could become widespread

# What Can Be Done?

## Recommendations:

We need to take seriously the need to improve our border security! It is necessary to reduce our vulnerability to nuclear, biological, or purely conventional terrorism.

- 600,000 cargo containers enter one of our nation's 361 seaports daily
  - Only 2-3% are inspected
- Over 400 million people cross our borders each year, including 122 million cars, 11 million trucks, and 2.4 million rail freight cars
  - Most only receive cursory inspections

# What Can Be Done?

## Recommendations:


We need to take seriously the need to improve our border security! It is necessary to reduce our vulnerability to nuclear, biological, or purely conventional terrorism.

- 3.7 million shipments of imported food arrive into the US each year with only 1% being inspected
- The US Coast Guard patrols 95,000 miles of shoreline with an antiquated fleet of ships and a workforce the same size as the NYC Police Dept.
- Little has been done to upgrade security at 15,000 sites producing toxic chemicals

# What Can Be Done?

## Recommendations:


We need to take seriously the need to improve our border security! It is necessary to reduce our vulnerability to nuclear, biological, or purely conventional terrorism.

- The US airline industry boards 1.5 million passengers a day, where we've spent $11 billion since 9/11 upgrading security
- However, 3.8 million people a day (boarding at 468 stations) ride the NY subway system where hardly any money has been spent.
- Making it a perfect bioterror target!

**The list goes on and on – obviously we can't afford to harden every soft target, but the obvious ones should be secured!**

# Questions?

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# Fall 2007

**The Innovators lecture series**

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