University Centers for Research to Counter Catastrophic Terrorism

Lewis M. Branscomb, Harvard University

National Academies, January 29, 2004

The Academies' Study

- National Academy of Sciences, National Academy of Engineering, & Institute of Medicine initiated study with own funds after 9/11. Lewis Branscomb and Rick Klausner, co-chairs; 119 expert contributors, 46 reviewers.
- Presented to Congress and White House June 25, 2002.
- Published book entitled: *Making America Safer: The Role of Science and Technology in Countering Terrorism* August 2, National Academies Press [2101 Constitution Ave NW, Lockbox 285, Washington DC 20055.] Website: www.nap.org
- Download off web (free) books.nap.edu/html/stct/index.html

High Consequence Terrorism

- Terrorism is a very old threat to established societies – most often tactical with political objectives.
- **Tactical terror weapons** are usually guns or explosives;
- **High consequence weapons** are WMD or weapons from high tech economy itself.
- Aum Shinrikyo and Al Qaeda attacks set a new standard for level of intended destruction – "high consequence terrorism" is defined by social response required.
- Terrorists' advantages may be offset by organizational and research and innovation advantages of target societies.

Threat of Terrorism Will Be With US Forever

- Our competive economy creates vulnerabilities to high consequence terrorism.
- The World Trade Center attack sets a standard by which terrorists may measure.
- The S&T defense must enable a long term restructuring of our infrastructure to reduce the temptation that our vulnerability creates.

Terrorist targets (examples)

- Potential single point failures
  - UHV transformers in electric power distribution
- Critical control systems
  - SCADA software and Internet communications.
- Dependence of emergency response centers and other critical infrastructure on data networks.
  - Vulnerable to EMP and cyber attacks
- Large numbers of people concentrated in highly complex, fragile facilities in cities.
- Large numbers of people widely dispersed.
  - Attacked with biological pathogens or toxic chemicals
  - Delivered through processed food, letter mail, currency, newspapers….

Terrorist's choice of weapons

- Terrorists would prefer WMD if available
  - Nuclear weapons, bio-weapons, chemical weapons.
- Many accessible weapons are available from highly efficient, market economies
  - Ammonium Nitrate fertilizer and fuel oil
  - Chlorine shipments to water supplies
  - Fully fuelled large civil air transports
  - Radioactivity from nuclear power plants; toxic chemicals from certain chemical plants.
- Terrorists might use two or more weapons to enhance the effect
  - Cyber or EMP plus Explosives or Radiation weapons

What Kinds of Research Are Needed?

- "System of systems" analysis, modeling and simulation.
- Problem-oriented Interdisciplinary research:
  - Physical & life sciences, engineering, social science
- Basic research aimed at understanding threats and consequences, discovering better defenses.
- Both tactical issues (near term) and more basic (long term) technical issues must be addressed.

System of Systems Analysis

- Systems engineering for decision support and setting S&T priorities
  - Testing proposed system solutions
    - As designed through modeling and simulation
    - As deployed through red team testing
  - Characterizing cities, linked infrastructures.
- Homeland Security Institute to be created by DHS to do these functions
  - HSI is not a research organization and will need research support from universities and elsewhere.

Possible projects among universities & national laboratories

- Pathological organisms, toxic chemicals: detect, identify, evaluate, and respond to threats
- Computer and network security, message authentication, protection of SCADA software
- Sensors and data management from sensor networks, data mining, decision models;
- Border controls: biometrics and data mining
- Risk analysis, economic returns from dual use investment in hardening critical infrastructure in the private sector.
- Roots of terrorism, motivation and behavior of terrorists

Value of Basic Research in Reducing Vulnerabilities

- Make difficult problems more tractable
  - Olfactory sensors and other new powerful, stand-off detectors.
  - Secure computer operating systems, networks, SCADA and other critical applications.
  - Detection, diagnosis and treatment for genetically altered diseases – both natural and human developed
  - Design adaptive resilient electric power networks.
  - Predicting terrorists intentions; understanding their behavior.
- Understanding response to attack from complex systems such as cities, critical infrastructure.

Research and Associated Deployments In Industry Must be Sustainable

- To what extent can firms and owners be expected to invest in hardening?
- Where will firms get the research needed to design hardening strategies?
- Are there “dual benefit” – social and economic -- technical strategies they can adopt?
- Will there be a market for hardening technologies?
- Universities will have to collaborate with the owners of critical infrastructure and city facilities.

Universities Must Collaborate with Local Government, Industry & Feds

- Metro governments are on the firing line
- State governments control their interface to the feds
- Industry owns most of the facilities targeted by terrorists and must make the capital investment to harden them.
- Feds control the intelligence, the subsidies and the S&T, as well as the national strategy.

US STCT Research Should Be Linked Internationally

- Terrorist threats from “safe havens”:
  - Cyber attacks,
  - food contamination,
  - clandestine shipments of weapons in international freight.
- International services – air and sea transportation, telecommunications, global financial transactions.
- Economic damage to the world economy.
- Fairness and effectiveness of border controls.
  - Agreed standards for biometrics
- Possible rogue nation support for terrorist groups
  - Agreed strategy on nuclear weapons non-proliferation
- US Research Centers should be linked to similar work in EU, Russia, Japan, India and other friendly countries.

Open Communications of Research Work Will Be Essential

- Ambiguities of “sensitive but unclassified” must be resolved.
- University Centers may need links to National Labs or off-site facilities if classified material is likely to be generated of if access is needed.