

Strategic Alliances

Homeland Security

Drug Development Pipeline

Technology Road Map

Ocean Science & Technology

Nanotechnology

The Massachusetts Technology Road Map and Strategic Alliances Study

Work Group Report on:

HOMELAND SECURITY

A Science & Technology Initiative Report
March 2005

 Science & Technology
INITIATIVE

 **Mi** Mass Insight
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Keeping Massachusetts Competitive

Mass Insight Corporation is a public policy research and consulting firm that seeks to keep Massachusetts and its businesses and institutions globally competitive. Through client and leadership networks, the firm shapes public-private dialogues and delivers policy results on issues where state actions and investments affect profitability, growth and new jobs.

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A Mass Insight Corporation project supporting science and technology education, research and R&D strategic alliances in Massachusetts

The Science & Technology Initiative brings together a broad-based consortium of leading businesses, public and private universities, and economic development organizations to develop a Technology Road Map for Massachusetts. Its mission is to facilitate and support major science and technology education and research initiatives and R&D strategic alliances that maintain and expand the state's research, development, commercial and economic leadership in emerging technologies. The Implementation Phase of the Science & Technology Initiative focuses on promoting R&D Strategic Alliances among the public and private universities, teaching hospitals, government and industry in Massachusetts and New England to identify and build support for flagship R&D projects.

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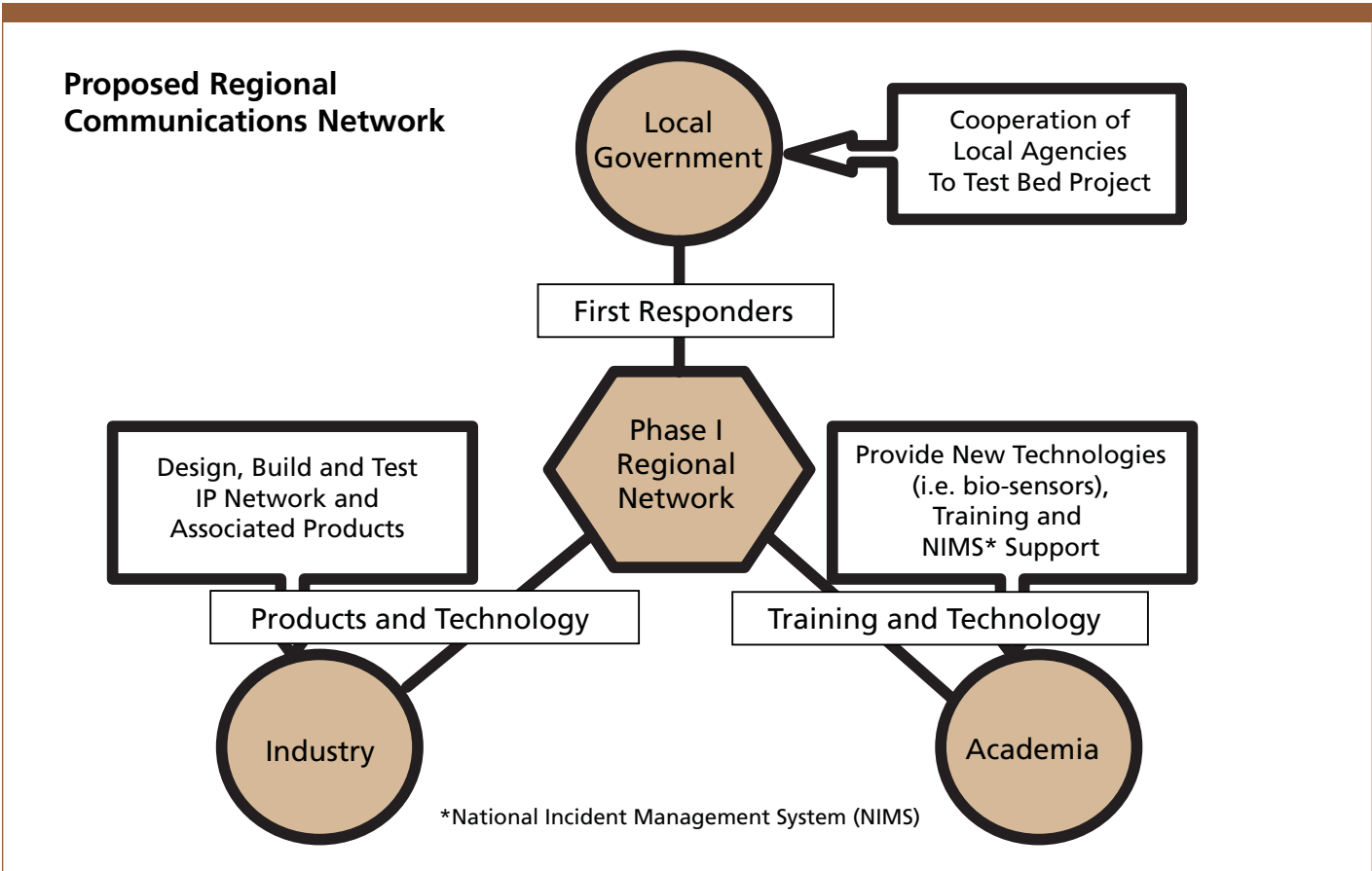
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Summary

Homeland Security presents a major opportunity for this region to once again play a leading role in the defense of the United States as it did during the Cold War. Seizing that opportunity requires a new and more collaborative approach to a very complex set of problems.

A large-scale project designing and building a next-generation integrated, adaptive regional infrastructure for communications and decision-making in emergencies would demonstrate that leadership. The project would boost industries engaged in building the infrastructure as well as those deploying it. In the shorter term, building a high-level collaborative network of research institutions would position the region to more effectively compete for Homeland Security funding.



A fully integrated communications network to improve emergency response and prevention and preserve business continuity during crisis situations

Massachusetts and New England have been virtually invisible in Washington on homeland security.

The National Challenge

Homeland security has become one of the top national priorities since the terrorist attacks of 9/11. It is a massive shift for a country that has not felt the imminent threat of foreign attack in nearly two hundred years. The Federal Government will spend \$46 billion on homeland security in fiscal 2005, and the President has proposed spending of nearly \$50 billion in 2006.

The mission of homeland security protection is two-fold. The primary goal is to prepare for and prevent attacks on the United States; failing that, to respond to and recover from attacks that do occur. Attacks can target people, property, infrastructure and the economy. Much of what the Department of Homeland Security has done in its first several years has been in response to what has already happened. The focus going forward will be to direct funding and programs toward preventing terrorist attacks.

The homeland security mission was characterized by Ed Woollen, Vice President for Homeland Security for Raytheon, as a search for solutions to prevent attacks on three distinct scales:

- Small scale: car & truck bombs, suicide bombers (1–100 casualties)
- Medium scale: using an aircraft as a weapon, bombing a crowded building (100–10,000) casualties

- Large scale: Thermonuclear explosion, infectious agent attack (10,000–10,000,000 casualties)

The response to these threats is complicated by several considerations. The more catastrophic the event, the less likely it is to occur. So investments in homeland security must protect against extremely unlikely events that would cause massive destruction as well as events that are almost certainly likely to happen but will cause much less damage. Further, the real measure of success for a terrorist attack is causing disruption on a much larger scale than the attack itself inflicts. For example, an introduced biological threat to the food supply might actually affect very few people, but if it caused a crisis of confidence, the impact could be devastating to the economy and the nation.

The agencies involved have defined problems that characterize these threats. The federal government's research and development funding is focused on finding solutions to those defined threats. Most of the problems require a multi-disciplinary approach with the funding agencies outlining the problem they want solved. They assume that no one institution can address these problems, so they will fund a team that best articulates how it can solve the problem as it has been posed.

This is a different model from the investigator-driven research that characterizes other areas of R&D and requires a different approach — one that focuses on building

teams and problem solving. The challenge for Massachusetts, as it will be for other regions, is organizing itself to address this model.

Mel Bernstein, Director of University Programs for DHS, expanded on this challenge when he observed at a Mass Insight R&D Breakfast Briefing that Massachusetts and New England have been virtually invisible in Washington on homeland security. Massachusetts may have more capability than many other regions of the country, but without focus and collaboration, the money will not flow here.

At another Mass Insight breakfast meeting, Ed Woollen of Raytheon laid out the challenge for Massachusetts in homeland security with stark clarity:

- Massachusetts stepped up to the challenge of the Cold War and became the national leader in tackling the hard problems. But homeland security is a different type of war — **recycling the same approaches and research that worked then will not succeed in the future.**
- The new type of thinking that will solve the problems of homeland security **demands interdisciplinary and collaborative teams** who articulate not why their research is worthwhile, **but how their collective research and development talents solve the problems that have been articulated.**

- Massachusetts has the intellectual capacity to again be a leader **if it can bring its resources together in interdisciplinary and collaborative teams to address the big problems.**

...collaboration among public and private organizations would enable an iterative model of research, design, build and test that could not be achieved by any sector on its own

Project Concepts

Initial discussions and interviews led to an overall project concept that builds on the strengths of Massachusetts institutions and industry in information technology, communications and networking, decision making and policy, sensor technology and biological threats. Information networks that depend on all these technologies and competencies are the enabling infrastructure for both emergency response and the normal functioning of commercial and civil society.

A terrorist incident or natural disaster disrupts these information networks, potentially creating a much larger danger than the incident itself. An **integrated, adaptive communications infrastructure**, already in place and used for training and monitoring, can enable rapid response, mitigate societal and business disruption and restore normal operations as quickly as possible. Rapid response and restoration of normal societal function significantly reduces the human and financial cost of the incident and reduces the effectiveness of terror as a weapon.

This infrastructure is a complex adaptive system. It is more flexible and less dependent on point-to-point communications and fixed networks. Such a system enables real-time, distributed decision-making. The infrastructure would fuse sensing, communications, information and decision making capabilities. It could be implemented in this region through a collaborative approach uniting the R&D capabilities of our universities and fed-

erally-supported research facilities with the operational expertise of our government, health care, utility and commercial sectors. There is no such integrated infrastructure at present, although some of these sectors have individual plans and procedures in place.

Implementing a working integrated, adaptive system requires a combination of research and development, architecture, technology development and deployment, and policy. A collaboration among the public and private organizations in this region, building on the institutional strengths in place, would enable an iterative model of research, design, build and test that could not be achieved by any sector on its own.

Pilot Project

Because of the ambitious scope of this project, a pilot implementation would be essential. The state's Regional Competitiveness Councils were asked to identify focused projects highlighting the technological capabilities of companies in their region that could be completed in a reasonable amount of time. The Northeast Regional Competitiveness Council developed a project proposal initially focused on a virtual network to improve collaboration among first responders, but soon expanded to a wider range of critical service providers, including healthcare and environmental agencies.

The heart of the system is an IP (internet protocol) network that interconnects and trans-

ports all sources of voice or data over a smart network that can be remotely provisioned to create mission critical talkgroups, as well as access and monitor mission critical data from anywhere on the network. Each device on the network will possess its own IP address. This private network will use those frequencies already allocated for public safety use, as well as unlicensed frequency bands to enable special applications.

Constraining coverage to a specific region, limiting the types of technology, focusing on building a working system and limiting the number and type of other organizations connected to the network makes such a project achievable in a fixed time period. But coupling this project to the design and architecture of a larger scale, state-wide infrastructure as outlined above provides a path to a much larger implementation.

A parallel discussion involving the University of Massachusetts Amherst SEPRI Center, MITRE and others has suggested the possibility of a testing and deployment center, where technologies developed by companies for implementations like this pilot could be tested and validated.

High-Level Multi-Institutional Response

Additionally, research and interviews for this work group have made clear that this region has not made a case for itself as a vital player in advancing homeland security nationally. Although there have been a few highly visible projects like the Boston University National Biocontainment Laboratory, the region is not seen as visible by many in Washington.

This could be addressed through the creation of a **collaborative homeland security rapid reaction and response center**. Homeland security is a new mission and both the mission and the Department of Homeland Security continue to evolve. The approach to homeland security R&D is different than previous large R&D programs. There are few existing institutional linkages between universities and funding sources.

Rather than have universities deploy new and additional resources individually, a more productive approach would be a consortial arrangement, bringing together a high-level leadership group with technical support from the universities, teaching hospitals, federal research facilities, state and local government, and businesses to present a coherent view of regional capabilities to the federal government on homeland security and to more effectively respond to opportunities.

*The Federal Government will spend
\$4.2 billion in Homeland Security
related R&D in fiscal 2005*

The Funding Environment

The Federal Government will spend \$4.2 billion in Homeland Security-related R&D in fiscal 2005, a 16% increase over fiscal 2004. The President's 2006 budget requests \$4.4 billion, a 5% increase, as even Homeland Security feels the effects of tightened domestic spending.

NIH will have the largest homeland security R&D spending at \$1.8 billion (42% of the total) reflecting the high priority on bio-terrorism. DHS is next with \$1.2 billion (29%), followed by the Department of Defense with \$362 million (8.5%) and NSF with \$326 million (8%).

Funding for R&D within the Department of Homeland Security is increasingly concentrated in the Science & Technology Directorate. Within S&T, the University Programs organization oversees the University Centers of Excellence program. These are multidisciplinary, multi-institutional centers targeted at specific problem areas with identified scientific and knowledge gaps.



The program requires outreach to industry, government labs and local government. The centers in place include:

Homeland Security Center for Risk and Economic Analysis of Terrorism Events (CREATE) — to study risk analysis related to the economic consequences of terrorist threats and events.

- \$12 million for 3 years
- USC and partners University of Wisconsin, NYU, NCSU, Carnegie Mellon, Cornell

Homeland Security National Center for Foreign Animal and Zoonotic Disease Defense — to address potential threats to animal agriculture.

- \$18 million over 3 years
- Texas A&M and partners University of Texas Medical Branch, UC Davis, USC, University of Maryland

Homeland Security Center for Food Protection and Defense — to understand agro-security issues related to post-harvest food protection.

- \$15 million over three years
- University of Minnesota and partners Michigan State, University of Wisconsin, North Dakota State, several other universities and food companies

Massachusetts has an outstanding opportunity to compete for and win a new center, the **Center for the Study of High Consequence Event Preparedness and Response**. The Center is to research a range of topics related to a major terrorist attack or other disaster. Topic areas include:

- Preparedness – government, community, first responder, individuals and the private sector
- Prevention and deterrence – what combination of technologies and policies can improve deterrence?
- Decision-making – understanding decision-making before, during and after a disaster
- Effective response networks – what mix of traditional and ad hoc networks, both technological and organizational, will work most effectively
- Modeling and simulation – for planning and preparedness

This Center fits squarely into the project concepts developed by the initial work group discussions. The University of Massachusetts Security, Emergency Preparedness, and Response Institute (SEPRI) was created with these issues in mind and has been anticipating such a center request. UMass SEPRI is leading an effort to win this competition, targeted at \$15 million over 3 years.

Beyond the University Centers, there is a range of large scale research and development initiatives within the DHS S&T Directorate. These larger-scale initiatives are more industry-focused, and the bigger projects will involve large integrators, but Massachusetts companies should be technologically capable of participating. Some of the leading initiatives include:

- Biological Countermeasures (\$407 million in 2005)
- Radiological and Nuclear Countermeasures (\$130 million in 2005, \$246 million proposed for 2006)
- Interoperable Communications (\$81 million in 2005)
- Standards Development (\$40 million in 2005)



The Department of Homeland Security will also send \$2.5 billion in Homeland Security grants to the states in fiscal 2005. The system delivers Homeland Security money directly to the states to deploy as they see fit within a set of broad programs, very much like block grants. Put in place under former Secretary of Homeland Security Tom Ridge, its focus on funding states directly reflects his background as a Governor. This structure could

change under Secretary Chertoff, whose experience is more at the federal level. To date, earmarks have not been permitted for Homeland Security funding, so close attention to DHS programs has been essential for identifying funding opportunities. Should this change, many in Washington expect a feeding frenzy, so Massachusetts should keep a close watch on developments.

The amounts distributed to the states are set on a per-capita basis, with an exception for one program focused on urban areas. Many in Congress felt that the grants should be distributed on the basis of actual threat level and this issue may arise again. Massachusetts will receive \$62.4 million in fiscal 2005.

Excluding the funding for the Urban Areas Security Initiative (UASI), Massachusetts is

ranked #13, in line with its population. Overall, Massachusetts ranks #10 due to the \$28 million from the UASI program. The program categories, with Massachusetts 2005 funding in parentheses, are:

- State Homeland Security Grant Program (\$21.9 million)
- Law Enforcement Terrorism Prevention Program (\$8.0 m)
- Citizen Corps Program (\$0.3 m)
- Emergency Management Performance Grant Program (\$3.6 m)
- Metropolitan Medical Response System Program (\$0.7 m)
- Urban Area Security Initiative (UASI) (\$28 m)

Federal Homeland Security-Related R&D		
R&D Funding by Agency (in millions of dollars)	FY2005 estimate	FY2006 budget
Health and Human Services	\$1,796	\$1,802
National Institutes of Health	1,774	1,781
Homeland Security	1,243	1,287
Defense	362	394
National Science Foundation	326	329
Agriculture	161	172
EPA	33	94
All Other	295	347
Total HS R&D	\$4,216	\$4,425

Source: American Association for the Advancement of Science, Analysis of R&D in the FY 2006 Budget

This funding supports the state homeland security strategies. Every state was required to create a state strategy which was then approved by the Department of Homeland Security before receiving funding. The Massachusetts state goals align very well with the strategic alliance project concepts:

- The Commonwealth will enhance its ability to assess risk and prevent future terrorist attacks or critical incidents.
- The Commonwealth will improve its ability to collect, analyze, disseminate and manage key information.
- The Commonwealth will improve preparedness by enhancing regional coordination.
- The Commonwealth will improve the ability of first responders to communicate at the scene of a terrorist attack or other critical incident.
- The Commonwealth will improve its ability to recover from a terrorist attack or other critical incident.

Economic/Industry Impact

For the immediate future, government spending will drive much of the economic impact of homeland security. The large integrated defense contractors with their expertise in complex systems integration are all exploring opportunities in Homeland Security. Ron Sugar, CEO of Northrop Grumman, focused a speech at Boston College in June 2004 on applying defense technology to Homeland Security. Earlier in 2004, the company was awarded a contract valued at \$350 million to build the Homeland Secure Data network for the Department of Homeland Security. MITRE Corporation in Bedford is applying a number of technologies it developed for defense to Homeland Security applications.

Byron Callan, Defense Industry Analyst for Merrill Lynch, has observed that some defense contractors are seeking partnering arrangements with large commercial technology and service firms to create a better alignment for Homeland Security opportunities. Building connections between the defense industry and commercial firms with expertise relevant to Homeland Security who have otherwise not been traditional partners presents an additional opportunity to foster growth.

Given the focus on recognizing and combating chemical, radioactive and biological threats, instrument firms and companies building sensor technologies are nearer term beneficiaries. Biotechnology firms that are focused on vaccines or therapeutics targeted at viruses and microorganisms should also see

an impact, although they are generally further from having products that can be deployed. The high priority of the threat from bioterrorism argues for a more aggressive exploration of collaborative opportunities at the intersection of biotechnology, information technology and systems integration firms.

Information and communications technology may see a large impact from homeland security as private sector and state and municipal governments begin deploying additional systems to ensure their ability to keep operating in a disaster. In the near term, firms focused on survivable networking or cyber security are more likely to see new opportunities.

Next Steps

- Support UMass/SEPRI-led effort to win DHS Center grant for “Center for Study of High Consequence Event Preparedness and Response.”
- Engage the State Executive Office of Public Safety and the Governor to generate interest in and support for the northeast regional pilot and the larger state-wide infrastructure project.
- Convene a meeting hosted by the Presidents of the University of Massachusetts, MIT & Harvard to focus on improving a regional response to homeland security-related research and development initiatives and related funding opportunities.
- Leverage the meeting to create a regional rapid response and outreach team for Homeland Security that will coordinate regional resources on an ongoing basis and also build visibility and an identity for the region in Washington as a homeland security center of excellence.



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