

The Development of a Crisis, Emergency, and Risk Management Enabling Technology Center

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Abstract

This paper describes the justification for and the creation of a National First Responders Technology Center at The George Washington University in Washington, D.C. In addition to supporting academic educational and research requirements, the lab will become a test bed for innovative technologies...or as one student termed it a “technology petting zoo” that will support first responders in the United States. Its primary objective will be to connect these first responders to the Washington based agencies and technology companies that are creating emergency management information technology. The establishment of this center responds to a need identified by the National Research Council and the President’s Information Technology Advisory Council. The center will provide an interdisciplinary approach to problem solving and will provide unique education and training opportunities for the future emergency managers and first responders.

Introduction

This establishment of an Enabling Technology Center (ETC) at the George Washington University (GWU) will involve agencies of the United States (US) Government and select private industry partners in long-term research and development collaborations that are focused on crisis management and incident response, more specifically first responder needs.

The need for such an ETC is well documented:

- The U.S. National Research Council in its 1996 report *Computing and Communications in the Extreme* recommended (p. 110) that “the establishment of

one or more technology testbeds for computing and communications systems in crisis management...”. The President’s Information Technology Advisory Committee in its February 1999 report (www.hpcc.gov/cc/report) recommended the “establishment of enabling technology centers which will conduct research on the application of information technology to particular problems of national importance.” Emergency and crisis management are specifically mentioned as examples of these problem areas.

- Technology initiatives such as the Global Disaster Information Network (GDIN) (www.gdin_international.org) and the U.S. based Extreme Information Infrastructure (XII) project are based on the assumption that existing and emerging technologies can be more effectively utilized by first responders.
- The threat and risk of crisis incidents are growing nation-wide, as also is the awareness and involvement of first responder organizations and needs that accompany related activities. Nevertheless, Federal funding for crisis incidents and response is not always being directed to organizations that are involved “first-hand” in first responder activities.
- First responder tools are being developed with little or no consultation so that the end user needs are not being met. Furthermore, this lack of end user involvement has also limited the impact and full realization of advances that cutting edge research and development in information technology (IT) could provide.
- There are no clear National priorities or directives to guide the development and production of requirements for equipment and tools which are needed for crisis incident management and response.

It is envisioned that the proposed ETC will provide not only the multidisciplinary environment that will be needed to meet the aforementioned needs, but will also provide unique education and training opportunities for the future workforce that manage and respond to crisis incidents.

The National First Responders Technology Center (NFRTC) Mission and Vision

Mission Statement: The National First Responders Technology Center (NFRTC) will develop and maintain an interactive relationship between a broad spectrum of first responders, Federal Government research and funding agencies, The George Washington University and elements of the private manufacturing sector in an effort to optimize synergistic energies in the design, development and utilization of technology, equipment, training and doctrine which are used by first responder agencies in all-hazard response.

Vision: The National First Responders Technology Center, in association with participating first responder organizations, Federal agencies and private sector partners, will become a world leader in the research and development of:

- Disaster and emergency response techniques, management, and decision analysis methods utilized by first responder organizations responding to all-hazards incidents, whether contained or multi-county/state/federal response to large scale and long term crises of any proportions.
- Disaster and emergency response tools and equipment for every responder at any level of crisis, including communications-information management equipment, fluid flow modeling software, hazardous substance analysis packages, search and

rescue-extraction equipment, damaged structure analysis hardware/software packaging and first-responder safety concerns of both traditional hazards and modern threats of weapons of mass destruction (WMD).

- Disaster and emergency response doctrine and training to support interoperability, organizational structure, best practices and operational coupling between local capabilities and national goals.

The First Responder's Question

The ...question that is probably much more important is what degree of consultation is going on with on-the-ground first responders that actually I think ought to be driving this vehicle and vetting their requirements, their experience, their expertise up through the system, you know, as these things get designed.

Hon. Silvestre Reyes (Texas), former Chief of the Texas Border Patrol and proclaimed relative of 16 firefighters, at Hearings devoted to the Federal Response to Domestic Terrorism Involving WMD-Training for First Responders, March 21, 1998

The First Responder's Problem

To the credit of the federal government, it has designed programs to assist the fire service and other local emergency services agencies. These programs have grown and improved over the past several years. But, so have the number response teams of one kind or another that have been created by federal agencies to respond in the event of an incident to assist us. My observation here is that finite funding for incident response is going to federal agencies, most of whom would not be part of a first response and many who will not be involved until much later or perhaps not at all.

Chief Gary Marrs, Oklahoma City Fire Dept., Testimony to the House Subcommittee on Oversight, Investigations, and Emergency Management, May 4, 2000

When all is said and done, our first responders will always be the first on the scene at any suspected terrorist incidents involving weapons of mass destruction. This is a hard notion for some of our colleagues and some in the Federal bureaucracy to understand, that when there is an incident, it will not be a bureaucrat from some civil defense agency responding, it will not be the Seabrook team from the Marine Corps or the National Guard responding. In the first few minutes, across this country, as it has been for the past 240-some years, the first responder to every incident involving the potential threat of loss of life and injury to our communities will be the fire and emergency service network; 32,000 organized agencies, 85 percent of them volunteer, responding to disasters—hurricanes, flood, tornadoes, but now facing the threat of terrorist incidents like the bombing in Oklahoma City.

Hon. Curt Weldon, Chairman, Military Research and Development Subcommittee, Hearings devoted to the Federal Response to Domestic Terrorism Involving WMD-Training for First Responders, March 21, 1998

There is no assessment that will provide a basis for clearly defined and prioritized equipment requirements based on threat and risk, and there is little consensus among federal, state, and local officials on the types of equipment needed for a city to prepare for a CBRN terrorist incident at various levels.

We believe that there is an established and well documented need for a center dedicated to the research and development of technologies and doctrine that support the all-hazard needs of first responders -- fire, police, and emergency medical technicians. This Center will provide technological and information systems support of the tactics, techniques and procedures used by first responder and will develop all-hazards doctrine for the use of this technology. It will be a technology test bed capable of conducting formal and rigorous testing of first responder-focused systems and insuring that first responders' feedback is fed back into the development process.

The Answer

As a Federal Enabling Technology Center under the guidelines of the President's Information Technology Advisory Committee (PITAC), the NFRTC will establish doctrinal and technological continuity between the nation's strategic disaster response goals and the capabilities of the local organization that respond to emergencies and disasters. The center will accomplish this effort along three lines:

First, a multidisciplinary task force of experts, the Center will conduct the ongoing mission of capturing after action data and analyzing the data for lessons learned. Second, lessons seeming to require technological solutions will be passed on to a NFRTC technology team. The technologies team will oversee research for potential technical applications, oversee the development of applications and conduct field testing in cooperation with first responder organizations. Third, lessons that suggest the need for procedural solutions will be handed to a doctrine team to develop procedures and training methodologies. Both the technologies and doctrine teams will work together to ensure that doctrine and technology are mutually supportive, that impacts on organizational structure are reconciled, and that both technical and doctrinal developments support national strategic goals. We believe that this bottom up approach, which begins with input from the experiences of first responders, is the best way to increase the effectiveness and safety of first responders while linking them doctrinally, operationally and technologically with federal agencies and private industry.

The National First Responders Technology Center

The NFRTC represents the link between users and the technology community. The NFRTC conducts two primary functions: 1) technological development, 2) doctrinal (procedural) development.

Research and Development of Technology Applications. The center will engage in private and public partnerships and conduct research in the application of advanced information and communication technologies that support first responder missions and requirements for interoperability with other first responders and with state and Federal emergency management. Ideas for development will come from two sources: the interface with first responders as well as from collaboration with the various hazard-specific centers at the regional and national levels.

Testing. An ongoing collaboration with nationally known first responder organizations such as the Fairfax County Search and Rescue and the National Fire Academy will be used to test prototype equipment and systems at testbed facilities and in the field. Final validation of equipment and information systems will rely on organized field testing by first responders using scientific measures and validation methods that are developed in coordination with first responders, industry experts and the university.

Doctrine and Training. Technology alone does not represent a comprehensive solution but must be framed in an organizational context and used by real people. The doctrine and training team will develop hazard-specific tactics, techniques and procedures geared toward integrating technical means into organizational structures and toward establishing interoperability among first responders and between echelons. Understanding the impact of new technologies on the organization will be a key area of concern as will be the creation of effective training methods. A comprehensive disaster response doctrine will be supported by appropriate technologies that enhances first responder effectiveness and safety while improving interoperability both laterally and vertically.

Resolution of Organizational Impacts. In practice, the fielding of new technologies produces significant impacts on the structure of organizations. Under the current *ad hoc* process of fielding new systems, organizations typically find themselves struggling to reconcile new technologies with the existing organizational structure. The NFRTC will redress the *ad hoc* nature of the process by analyzing the potential impact of specific technical innovations prior to fielding. In parallel with the development of systems, the NFRTC will develop optimal organizational structures that compliment and leverage the opportunities presented by the fielding of new technologies. Then the NFRTC will recommend technology and structural innovations as a comprehensive package. Finally the NFRTC will follow through by assessing the effectiveness of the new structures and technology in action. This comprehensive approach to the fielding of technology will result in rational structures rather than disruptions or a new generation of unsolved problems.

Operational Coupling between Tactical Capabilities and Strategic Goals. Unlike the nation's armed services, first responders have no overarching strategy to link means to ends. There is no proponent to promulgate and defend equipment specifications; no schoolhouse to espouse a comprehensive set of best practices to guide first responder activities toward objectives; no funding authority to stoke the development of required capabilities. Nevertheless, Presidential Decision Directives charge organizations such as the Department of Justice and FEMA with specific responsibilities in managing and responding to national crises including weapons of mass destruction. It is anticipated that first responders, FEMA and the FBI will find themselves working side-by-side in response to major crises.

Strategic Areas of Focus

First responders bring a broad range of fire, law enforcement and emergency medical expertise in response to natural and technical disasters, crises and terrorist incidents. Their expertise in all-hazard response encompasses an wide range of scenarios

requiring skills in search and rescue, hazardous materials, emergency medicine, fire suppression, and so forth. The intent of the NFRTC is to serve the first responder in broad, yet fundamental, competencies as a all-hazards resource for technology and doctrine. Examples of the NFRTC's initial proposed areas of focus include: information operations, mass casualty operations and emergency medicine, extraction and rescue, toxic substances/hazardous materials/WMD, fire suppression and firefighting equipment, damage and structural assessment, and first responder/victim safety. The information operations and safety areas of focus serve as overarching competencies that are applicable to all first responder activities. The remaining five areas represent the core competencies of the NFRTC. The following list provides illustrative examples of likely research and development projects within the core competencies.

Information Operations:

- How, with the support of the appropriate federal agencies, the incident commander can make use of technologies to access near-real-time, all-source, synoptic data related to an ongoing crisis event.
- How first responders can communicate laterally among diverse first responder groups and vertically with national crisis managers in response to terrorist attacks involving weapons of mass destruction.
- How incident commanders and first responders can integrate their information systems with the emerging regional disaster centers.

Mass Casualty Operations and Emergency Medicine:

- How emergency medical technicians (EMTs) can manage the demands of treating and transporting mass casualties while the economic environment of the health care system reduces the number of hospitals and vacant bed capacity.
- How first responders can operate and provide treatment in a chemically contaminated environment; how first responders can conduct decontamination activities in the wake of mass casualties caused by chemical or biological weapons.
- How advanced technologies can provide diagnosis-supporting communication linkages between physicians and EMTs working in remote or cut-off disaster sites.
- How to disseminate clinical data concerning the incident to the medical community.

Extraction and Rescue:

- How new technologies can improve capabilities to locate and free trapped victims in collapsed structures.
- How remote sensing and satellite tracking technologies can be integrated into area search efforts.
- How advanced sensing equipment, such as portable accelerometers, can alert rescue workers of the pending collapse of damaged structures.
- How tracking and communications systems can assist teams working in the same structure from endangering one another.

Toxic Substances/Hazardous Materials/WMD:

- How robotics and chemical-biological detection devices can alert first responders to the presence of hazardous materials.

- How advanced chemical-biological protective gear can be adapted to widespread use by first responders.
- How micro electric-mechanical systems can assist first responders to identify toxic substances by performing high-speed, non-human analysis at the disaster site.
- How plume modeling and dissemination can be improved through advanced technologies and integration of remote sensing capabilities.

Fire Suppression and Firefighting Equipment:

- How technology can enable firefighters to more rapidly and confidently identify hazardous materials in burning structures and select appropriate fire suppression tactics.
- How technology can contribute to the development of non-toxic, non-mass flow suppression techniques.
- How robotics and micro electric-mechanical systems technology can improve firefighting in high rise structures.

Damage and Structural Assessment:

- How technology can speed the post-earthquake structural damage assessment process.
- How the efforts of law enforcement, search and rescue and structure assessment can be better integrated through technology.
- How technology can improve procedures for stabilizing structures in support of search and rescue efforts.

First Responder and Victim Safety/Personal Protective Equipment

- How to protect first responders operating in environments contaminated by chemical, biological or nuclear weapons.
- How to rapidly portray and disseminate contamination information to other first responders as detection teams discover contaminated areas.
- How technology can improve fire and chemical protective gear, especially the problem of heat buildup in the suits and communication through protective masks.

Collaboration with Disaster Technology Centers

The NFRTC performs a function unique from other centers. Rather than focus on a particular hazard, or a particular region or a particular technology group; the center focuses on a particular user group, the first responders and their operational needs with respect to all-hazard response. Consequently, there will be strong incentive for the NFRTC to collaborate with other federally-funded disaster technology centers.

The thrust of collaboration will be to exploit the specialized capabilities and expertise of other centers toward applications that benefit the first responder. The nature of the collaboration will vary according to the focus of the respective disaster centers, whether hazard-specific or technology-specific. Regional centers tend to specialize in responding to a group of interrelated regional hazards and therefore possess rich operational experience. In some instances, NFRTC-sponsored testing and validation of first responder equipment and procedures will take place at a hazard or technology-specific center where suitable resources are already in place.

For disaster centers focused on research into specific hazards such as the National Earthquake Center and the National Hurricane Center, the NFRTC could facilitate the incorporation of new hazard-specific technologies into first responder doctrine, equipment and training. Or the NFRTC could form an alliance with a center for the purpose of developing a technological solution to a problem, such as the need for Urban Search and Rescue Teams to be aware of and communicate with other teams working within the same collapsed structure.

Collaboration with Federal Agencies

In addition to the fundamental partnership with the Federal Emergency Management Agency, the NFRTC will collaborate closely with federal agencies that have a stake in first responder capabilities. Collaboration with the Department of Defense and the Department of Justice will be fundamental to establishing capabilities in accordance with emerging national goals for crisis and disaster response. Compatible systems and common doctrine are the keys to establishing interoperability across jurisdictions and between hierarchical echelons. A list of valuable Federal collaborators is likely to include but not limited to:

- The Federal Bureau of Investigation (FBI)
- The Department of Defense (DoD)
- The Public Health Service (PHS)
- The Department of Energy (DoE)
- The Environmental Protection Agency (EPA)

The purpose of the NFRTC's collaboration with federal agencies is twofold: first, to support and reconcile stated national response capability goals with needs as articulated by first responders; second, to provide federal agencies a clearing house for first responder all-hazards technology applications and training.

First responders have criticized the Federal Government for channeling national resources into federal programs and federal teams that may or may not be available to respond to local emergencies. They have also criticized the government for failing to appoint a federal coordinator for multi-agency training efforts. The NFRTC can help to redress first responder concerns by playing an important advisory role in the effort to rationalize federal efforts with respect to first responders.

Collaboration with Private Sector Information Technology and Manufacturing Industries

The third area of collaboration will be that between the NFRTC and the private Information technology - manufacturing sectors. Such a collaborative effort is desirable because the current methods and equipment utilized by the nations First Responders are derived from these the private sector entities. A secondary aspect is that of the economy of scales that the private sector will introduce, this being its ability to led and adapt to shifting market demands while maintaining an infrastructure capable of developing and disseminating vast quantities of goods and services. There are several venues where in certain market forces will contribute in the development of the NFRTC and all venues will be pursued thought the initial

intent on the private sectors involvement will be in the area of personnel, infrastructure and expertise rather than a financial investment on their part.

Synergistic Effects of Uniting GWU, Federal Funding Agencies, Private Sector Partners and the NFRTC

The are three basic entities which conceive, design, research, produce, market and purchase all products used by all persons and industries in the US: the government (be it local, state or federal), universities and the private sector. Each has its own characteristics and method of developing a product, however there are synergistic energies that will arise with the unification of the three that does not exist within either as a standalone entity. Synergy often arises with the unification of divergent philosophies or trades, but in the instance of this proposed NFRTC, the three bodies each will have a unique interest in participating in a project from the conceptualization stages to the marketing of a finished product: this interest being the benefits of association.

It is the stated mission of the NFRTC to take advantage of the synergistic effect and unify these parties such that the researchers, producers and users are working as one entity to not only develop products for the First Responder industries, which will be of maximum benefit to the end user, but also to unify the bodies such that each will benefit through the association in such a way so as to assure the long term survival of the Institute. A graphical representation of the interactions is presented in figure 1

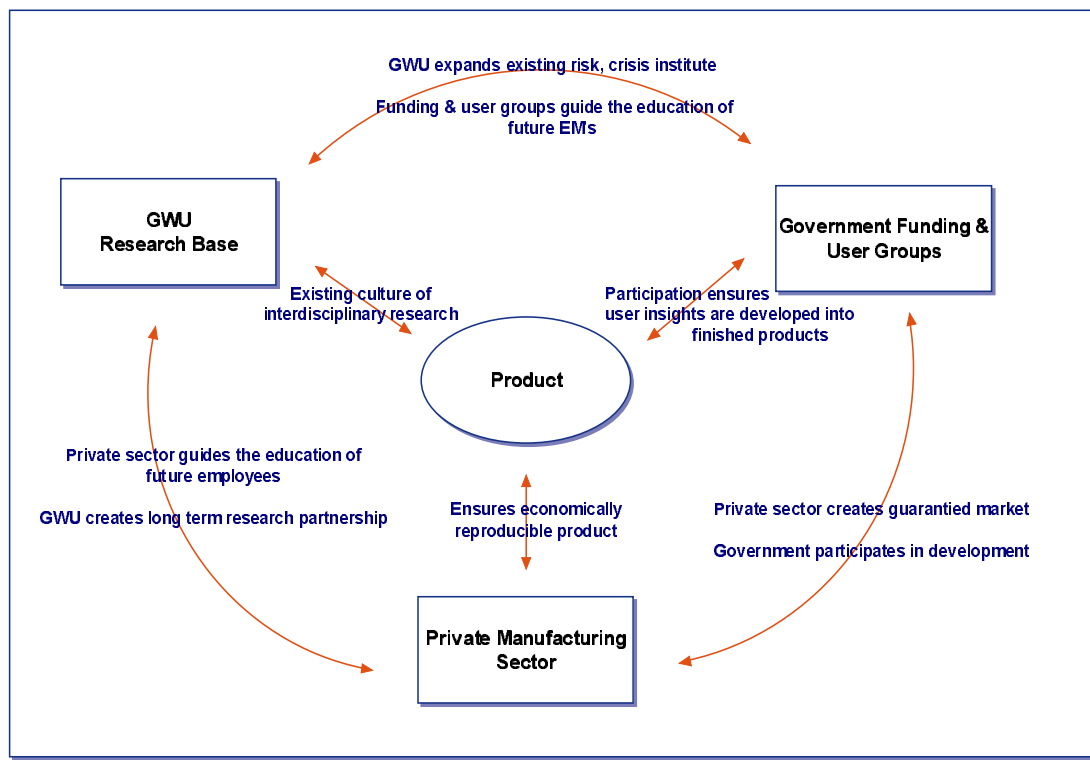


Figure 1
Synergistic Impacts of the NFRTC

The George Washington University as a base of operations

George Washington University is the proposed location for The First Responder Technology Center. The Institute of Risk, Crisis and Disaster Management at The George Washington University is an established and respected educational entity with a long history in doctrinal development with respect to risk mitigation, crisis and disaster response both domestically and internationally. Organizations such as the Fairfax County Search and Rescue Team base its worldwide operations locally and has an established testing and training facility from which a full fledged test-bed facility can be launched.

The GW location in the Foggy Bottom area of Washington is in close proximity to a number of agencies that are involved in emergency management activities. Chief among them are the Federal Emergency Management Agency, The American Red Cross, the U.S. Army Corps of Engineers, the National Aeronautics and Space Administration, the Department of State (U.S. Office of Foreign Disaster Assistance), the Environmental Protection Agency, the National Oceanic and Atmospheric Administration, the Federal Bureau of Investigation, and the Department of Energy. Washington based international organizations with significant disaster related programs include the World Health Organization, the Organization of American States, and the World Bank. The creation of the National First Responders Technology Center at The GW University will, therefore, have international as well as national implications and benefits.

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