

Medical Disaster Conference

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Dartmouth College
Hanover, New Hampshire

Conference Report



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PREFACE

This conference report was prepared with the assistance of all workshop participants. It documents the findings, insights and recommendations for near and far term response strategies to a biological weapons terrorist attack. Emphasis was given to resource, logistics, and command and control needed to implement the strategies. Results are applicable to U.S. communities and military bases. While the workshop focused on practical response options at local, regional, state and federal levels, the results may contribute to a National strategy for preparing and responding to weapons of mass destruction.

The workshop was co-sponsored by the Thayer School of Engineering, the Dartmouth Medical School, the C Everett Koop Institute, and the Improved Response Program under the Nunn-Lugar-Domenici Domestic Preparedness Program performed by the U.S. Army Soldier and Biological Chemical Command.

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DISCLAIMER

The findings in this report are not to be construed as an official Dartmouth College or Department of Army position unless so designated by other authorizing documents.

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Table of Contents

ACKNOWLEDGEMENTS.....	ii
PREFACE.....	ii
Conference Participants.....	iv
Executive Summary.....	viii
Opening Remarks.....	1
Conference Goals and Approach.....	2
Terrorist Threat Review.....	5
Scenario and Initial Response.....	7
Resource Requirement and Allocation Model.....	10
Resource Estimates.....	17
Group Assignments and Problem Summary.....	19
Evening Presentations and Demonstrations.....	21
Medical Disaster Conference Panel Discussion on Threats and Response Plans.....	21
The University of Texas University Affiliated Research Center Chem-Bio Program Objectives.....	21
Office of Emergency Preparedness, Health and Medical Emergency Preparedness & Management.....	22
Biological Weapons (BW) Response Issues & Strategies.....	23
Catastrophic Terrorism: Are We Prepared?.....	23
Telemedicine.....	24
The National Institute of Urban Search & Rescue (NIUSR) Basic Functional and High Level Models for Incident Operational and Disaster Management.....	24
Simulation Technology for Counter-Terrorism Applications.....	24
Robots for Medical Response Demonstration and Talk.....	25
Group Findings.....	26
Town Manager, Emergency Management and Fire Group.....	26
Medical Response/Mass Care Group.....	27
Law Enforcement Group.....	31
Technical Group (Technology, Simulation, Robotics and Telemedicine).....	33
Resulting Resource Requirement and Allocation Model.....	37
Biological Response Strategies.....	38
Near-term Strategy.....	38
What needs to be done to implement the strategy?.....	39
Long-term Strategy.....	40
Evolving Near and Long-term Strategies.....	40
Comments on National Strategy.....	42
Implementation (10 Point Action Plan).....	43

Table of Figures

Figure 1: BW Response Template and Key Decisions.....	9
Figure 2: Casualty Situation Template	11
Figure 3: Scenario and Resource Variables.....	12
Figure 4: Resource List.....	13
Figure 5: Resource Requirements.....	14
Figure 6: Resource Availability	15
Figure 7: Resource Requirements vs. Allocation	16
Figure 8: States contained in the approximate 100-mile radius of Hanover, New Hampshire.....	17
Figure 9: Resource Requirement Graph	20
Figure 10: Cybercare Response System responds to a biological attack in Hanover VT through the homeland defense network and provides remote medical assistance....	35
Figure 11: Homeland Defense Network expands cybercare to both Hanover and New York City and activates additional remote resources from across the country.....	36

Appendices

APPENDIX A – Emerging Technologies: Recommendations for Counter-Terrorism, Overview and Edit Volumes

APPENDIX B – Presentations and Supplements

- Medical Disaster Conference Biological Response Resources and Logistics Overview and Agenda (Slides)B-1
- Terrorist Threat Review (Slides)B-2
- Detailed Attack Scenario (Narrative).....B-3
- Improving Local and State Agency Response to Terrorist Incidents Involving Terrorist Weapons—Interim Planning Guide (Report)B-4
- How Do I Build My Own Area Personnel Annex? (Slides).....B-5
- Critical Skills Human Resources (Paper)B-6
- Break-Out Group Assignments and Discussion (Slides)B-7
- Medical Disaster Conference Panel Discussion on Threats and Response Plans (Slides)B-8
- The University of Texas University Affiliated Research Center Chem-Bio Program Objectives (Slides)B-9
- Office of Emergency Preparedness, Health and Medical Emergency Preparedness & Management (Slides)B-10
- Biological Weapons (BW) Response Issues & StrategiesB-11
- Catastrophic Terrorism: Are We Prepared? (Paper).....B-12
- Telemedicine (Slides)B-13
- The NIUSR Basic Functional and High Level Models for Incident Operational and Disaster Management (Slides and Paper)B-14
- Simulation Technology for Counter-Terrorism Applications (Slides)B-15
- Technology Panel Solutions (Slides)B-16
- Resource Requirement and Allocation Model for Conference Scenario (PDF of Excel Spreadsheets).....B-17

APPENDIX C – Conference Participant List

Executive Summary

The Medical Disaster Conference held at Dartmouth College in Hanover, New Hampshire, on June 13–15, 2001 was designed to address recommendations for the application of emerging technologies for counter-terrorism and discuss ongoing work concerning response strategies for biological incidents. The conference focused on two key goals: 1) developing a resource, logistic, and command and control strategy to respond to different scales of biological incidents, and 2) conceptualizing a future biological response system that employs distributed command and control, telemedicine, and robotics. Communities and military bases throughout the country would benefit from a practical resource and logistics response strategy that also includes plans for future technological advancements.

The participants of the conference included members of local, state, and federal agencies, business, academia, and volunteer organizations. The participants listened to presentations on topics such as terrorist threats and response plans; resource requirements, estimates, and allocations; and the roles of agencies, telemedicine, robotics, and simulation technology in counter-terrorism. The participants were also presented with a terrorist attack scenario and were divided into three responder sub-groups to address resource-intensive elements of a near-term biological response. The sub-groups were Town Manager, Emergency Management and Fire; Medical Response/Mass Care; and Law Enforcement. An additional group, the Technical Group, addressed the areas of technology, simulation, robotics, and telemedicine and focused on long-term technological improvements to biological response. The responder groups and the technology group met at the conclusion of the group discussions each day to exchange results.

As a result of the conference, participants were able to devise a regional response concept for identifying, obtaining, and applying response resources in the timeframe dictated by the temporal sequence of consequences during the course of a biological incident. The concept, based on the rapid integration of diverse resources, requires local, state, and federal agencies to plan and understand the strategy before an event. Participants also developed a biological response resource and allocation model and a long-term strategy that centers on a national distributed command and control system and simulator. The system is designed to integrate response and communication at the local, state, and federal levels. A distributed command and control system would provide a platform for advanced cybercare systems to reduce the impact of a biological incident by providing rapid detection, identification, and treatment. It was suggested that the near and long-term strategies be adopted as a national strategy for responding to biological terrorism. A 10-point action plan was developed to assist with the implementation of this national strategy.

Opening Remarks

Dean Lewis Duncan

I want to welcome you to Dartmouth College and the Thayer School of Engineering. The problem of biological terrorism and its possible impact on our country is serious. While our generation has created the issues, it may be a future generation that actually has to deal with them. I encourage all of you to directly face the problem of biological and other forms of terrorism and to seek future solutions. Please do not hesitate to contact me if there is anything that we can do for you during the conference to add to its success.

C. Everett Koop

Our nation is ill prepared to respond to a catastrophic medical disaster such as that resulting from a terrorist biological attack. Such a disaster is a question of when, not if. America as a culture does not understand “prevention” and does not provide ground for preparedness. We act after the fact, if at all, despite the scientific evidence of global warming or smoking disease. We resist responding to crises whose consequences are not imminent. The medical community, government, and citizens are process-oriented people. We do not respond when the consequences are far down the road. The Bush administration does not get it—the National Institute of Health’s budget was doubled, but it will be poorly applied for 20 years. The Centers for Disease Control and Prevention was cut by 10%—they are primary responders. In major medical disasters such as the military casualties in Korea, triage is necessary to weigh issues of saving one large surgical case vs. many smaller cases. Destruction of the Amazon rainforests and forests in Russia are other activities with long-term effects that are being ignored. I wish the participants well in developing ways to respond effectively to the very real and very complex problem of biological terrorism. The work of this conference is important.

Conference Goals and Approach

Joseph Rosen, MD and Richard Hutchinson, PhD

Goals

The results of an earlier conference at Dartmouth College Institute for Security Technology Studies led to the development of broad recommendations for application of emerging technologies for counter-terrorism. (See Appendix A “Emerging Technologies: Recommendations for Counter-Terrorism, Overview and Edit Volumes^{*},” edited by Joseph Rosen and Charles Lucey, January 2001.) Ongoing work sponsored by the U.S. Army Soldier and Biological Chemical Command as a part of the Nunn-Lugar-Domenici Domestic Preparedness Program focused on near-term response strategies for biological incidents.

By bringing these two efforts together and continuing the search for ways to improve the response to large medical disasters, conference participants were able to focus on two key goals:

1. Develop a resource, logistic and command and control strategy to respond to different scales of biological incidents.
2. Conceptualize a future biological response system employing distributed command and control, telemedicine and robotics.

Currently, an integrated biological incident response strategy is defined within the federal response plan, and response requirements can be estimated. However, the sources, transportation, integration and control of response resources are not defined. This gap in knowledge would jeopardize an effective response. Some time after a biological attack, hospitals would begin seeing increasing numbers of ill and would begin emergency operations as their capacity is reached. Then, the hospitals would fill up, lock down, and the ill and worried-well would begin to back up. The hospitals would soon become non-functional because of staff burnout and lack of resources. At that point, the entire area medical infrastructure would become ineffective in responding to the biological incident. The ensuing confusion would hinder the effective use of additional outside resources when they arrive. The recent Top Officials (TOPOFF) biological exercise in Denver demonstrated this outcome.

A practical resource and logistics response strategy is needed to avoid this situation. Thus, the first conference objective is vitally important to developing a complete strategy for biological incident response. Communities and military bases throughout the country need the strategy, which would help with any type of disaster producing massive numbers of medical casualties.

* Hyperlinks to appendices are shown as underlined text.

Concepts for a future response system are unknown. Thus there is no vision for future improvements in response, which might be implemented incrementally as near-term preparations continue. Even more serious, there is no vision of a system that could cope with future biological agents that go beyond our current knowledge base. What if a germ is “engineered” in the future that is contagious and resistant to both treatment and prophylaxis? The second conference objective is aimed at such a situation in order to have a vision of how future technology can aid in biological response.

Approach

The goals of the conference are formidable. A prerequisite for success was assembling a group of participants with the necessary knowledge, experience, and motivation to deal with the diverse and complex issues. This requirement was fulfilled by the extremely strong group of participants listed at the front of the report. Participants with a diversity of relevant backgrounds came from local, state, and federal levels, and from business, academia, and volunteer organizations. All came because of their personal and professional interest.

The diverse group then needed to focus on the workshop goals. A scenario was presented as a realistic example of biological terrorism against which to formulate response strategies. The scenario included casualty projections, a response strategy overlaid on Hanover, NH and surrounding communities, resource requirement estimates, and available resource estimates. These factors were used as a starting point to allow participants to immediately begin working on resources and logistics strategies. Other groups of responders and medical experts had previously developed the response strategy that was accepted here as a starting point.

The participants were then divided into three responder sub-groups to address the most resource-intensive elements of near-term biological response. The Town Manager, Emergency Management and Fire Group addressed command and control and resource and logistic support. The Medical Response/Mass Care Group addressed care of casualties, prophylaxis and immunization, disease recognition, and utilization of medical resources. The Law Enforcement Group addressed control of affected area and population with emphasis on security at medical facilities and supplies. Each group included federal, state and local responders and managers.

A fourth group, the Technical group (consisting of technology, simulation, robotics and telemedicine), addressed long-term technological improvements to biological response. Opportunity to exchange results between the responder and technology groups was planned in the agenda. It was essential that practicing emergency responders, health care providers, and technical experts interacted to openly discuss operational needs and technical concepts.

The next sections of the report summarize the terrorist threat review, attack scenario, resource requirement and allocation model, and resource estimates. These models were provided to the participants before they separated into the four groups to address the

conference goals. The overall goal of these presentations was to focus the participants on the issues of the conference, see Appendix B-1. See Appendix C for list of participants.

Terrorist Threat Review

Russell Chisholm, Special Agent

The President signed U.S. policy on terrorism on June 21, 1995. It outlines federal agency responsibilities and assigns the FBI as the lead investigative agency to reduce U.S. vulnerabilities. The most dangerous type of terrorist is the individual. It is difficult to penetrate a group of one. Examples include Ted Kazinski, the Unabomber, and Mr. Dregor, who worked in nuclear power plants in the New England area. Non-aligned terrorists (bin Laden, right-to-life) are the next most difficult types of terrorists to deal with. Doomsday cults, identified groups (Hizbollah, IRA, Hamas), state-sponsored terrorism (Libya, Syria), and insurgents/rebels complete the spectrum of terrorists. The latter are primarily a threat overseas.

The overall threat of a weapon of mass destruction (WMD) incident in the U.S. is low but increasing. Biological toxins (ricin) are relatively easy to develop and pose the most serious threat at this time. Industrial chemical sabotage (blowing up trucks, trains, or warehouses) is the second most serious WMD threat. Biological pathogens (anthrax, plague) are the third most serious threat, and radioisotopes around explosives that cause a radiation discharge (nobody has ever tried this) are the fourth most serious threat. Military grade chemical weapons are difficult to make and, therefore, are less likely to be used in an attack. Least likely to occur is a nuclear explosion because of difficulties in acquiring or making the device.

Several incidents have occurred within the U.S. involving biological agents. The most significant incident occurred in 1984 when the Rajneesh Foundation infected 715 people with salmonella in an attempt to manipulate a local election. Members of the Patriots Council used ricin to unsuccessfully attack a U.S. Marshal; the agent was placed on his doorknobs. Four individuals were convicted under the Biological Weapons Antiterrorism Act. Thomas Leahy was found to possess ricin, *Clostridium botulinum*, and weaponized nicotine sulfate and was also convicted under the Biological Weapons Antiterrorism Act. Prior to the millennium celebration, Thomas Lavy was caught at the Canadian border with 130 grams of ricin, \$89,000 in cash, and four guns with more than 20,000 rounds of ammunition. Larry Wayne Harris was able to obtain three vials of the bubonic plague. He has not been charged with possessing biohazardous material, and he attends many of the biological conferences. He now markets "germicides" commercially. Following this publicity, a number of "copy cat" anthrax outbreak scares occurred. Between 1994 and 1998, there were less than 5 reports; after Harris, there were multiple reports within a single month.

Downtown D.C. was blocked off because of a potential biological release, which was later found to be a hoax. The city was partially paralyzed. Anthrax letters are often distributed to government offices, news agencies, clinics, etc. There is now a way for local agencies to test for anthrax to determine if an exposure occurred. Within 48 hours, the tests can identify the serious known biological agents. All states in New England have this ability to quickly respond and identify such agents.

Trends in WMD terrorism include hoax threats to create disruption, multiple targets through letter threats, open source design information, and isolated crime without a terrorism motive. Open source information on WMD is available on several websites. Some recipes are purposely booby-trapped. Teaching videos are available for making ricin and bombs.

Looking into the future, interest in WMD material will continue to increase, and the threat of hoaxes, blackmail, and mass disruption is high. However, explosives, shootings, and kidnappings will continue to be the most likely terrorist options.

To address these threats, the FBI utilizes applicable statutes that provide jurisdiction such as the Biological Weapons Antiterrorism Act. It applies a WMD threat assessment process to deal with specific threat incidents. Do the people have the resolve? Do they have the technical ability to conduct the attack? Is the attack operationally practical? FBI has developed profiles from experience that help in making these assessments, and other government agencies cooperate and consult to decide how best to respond to specific events.

The FBI Counterterrorism Center focuses on combating terrorism domestically and internationally by obtaining, analyzing, and disseminating all information related to individuals and groups involved in terrorism within the U.S. and to terrorists who threaten any U.S. person or interest here or abroad. Regionally, the Joint Terrorism Task Force in Boston coordinates law enforcement activities among federal, state, and local agencies and includes 250 special agents and emergency response, bomb tech and SWAT teams, each HAZMAT capable. Should a WMD incident occur, FBI headquarters could deploy a WMD Operations Unit and a hazardous materials response unit to the impacted area. Thus, the FBI stands poised to meet the threat of WMD. However, “fighting terrorism is like being a goalkeeper. You can make a hundred brilliant saves but the one shot that people remember is the one that gets past you” (Paul Wilkenson).

Slides used in this talk are included in Appendix B-2.

Scenario and Initial Response

Mohamed Mughal, PhD and Charles Crawford

Scenario. The scenario used in the conference is summarized below. The full text as presented at the conference is in Appendix B-3.

Day 1

- Clandestine bio-attack at Dartmouth College Sports Coliseum.
- Roughly 5000 attendees, primarily from counties of Grafton, Orange, and Windsor; roughly 300 people are from the away team's town.

Day 2

- Business as usual.

Day 3

- Thirty-five people report to area doctors' offices, clinics, and hospitals with non-specific flu-like symptoms.

Day 4

Between midnight and 8am: Seven patients with fever, headache, malaise, prostration, and non-productive cough enter hospital emergency rooms via ambulances or with family members. Another 26 patients walk into emergency rooms complaining of flu-like symptoms.

Between 8am and noon: One-hundred and fifty-two (152) critically ill patients enter emergency rooms, and other health care facilities are swamped with less severely ill patients. By 10 am, expanded surveillance indicates a growing number of both critically and less severely ill patients.

Between noon and 6pm: An additional 152 critically ill attempt to enter local health care facilities and 600 more enter indicating illness.

At 3pm: Dr. Gougelet receives a preliminary diagnosis that the disease is pulmonary tularemia, a non-contagious but approximately 35% lethal disease if untreated.

Treatment: Streptomycin (15 mg/kg IM twice daily) or Gentamicin (2.5 mg/kg IM or IV 3 times daily) in acute care centers and hospitals; Doxycycline (100 mg orally twice daily) or Ciprofloxacin (500 mg orally twice daily) at neighborhood emergency health centers or community outreach.

Emergency medical system: Five acute care centers at the Dartmouth College arena and gymnasium (200 beds each) and at three high schools in Hanover, Lebanon, and Hartford (200 beds each), for a total of 1,000, beds were opened.

Five neighborhood emergency help centers were set up: three in public buildings in Hanover, Lebanon, and Hartford; one in the Dartmouth Student Health Clinic; and one in the County Health Clinic in Hanover.

An extensive community outreach effort throughout the Valley region was immediately initiated.

Medical branch in Emergency Medical Operations Center implements command and control of medical resources.

Initial Response. A very aggressive response was built into the scenario to allow participants to concentrate on the resources and logistics needed to support an effective response. Thus, it was assumed for purposes of the conference that the affected communities had implemented the biological weapons (BW) response template shown in Figure 1. The conference focused on the shaded elements.

The scenario took the response through the public health surveillance and active investigation elements of the template to the point where the emergency response functions would be activated. Early recognition of the outbreak and an aggressive response were built into the scenario. The highlighted elements, command and control, prophylaxis & immunization, care of casualties, control of affected area & population, and resource & logistic support, are the most resource-demanding elements of the response template and were the focus of the conference. Each of these elements is described in the *Interim Planning Guide* contained in Appendix B-4.

A model of resource requirements and allocation was developed to assist participants in developing a resource and logistics strategy. The estimates of resources contained in the model resulted from extensive prior work with emergency responders and managers from around the country. The model is presented in the next section, Resource Requirement and Allocation Model, followed by an explanation of how available resources were estimated.

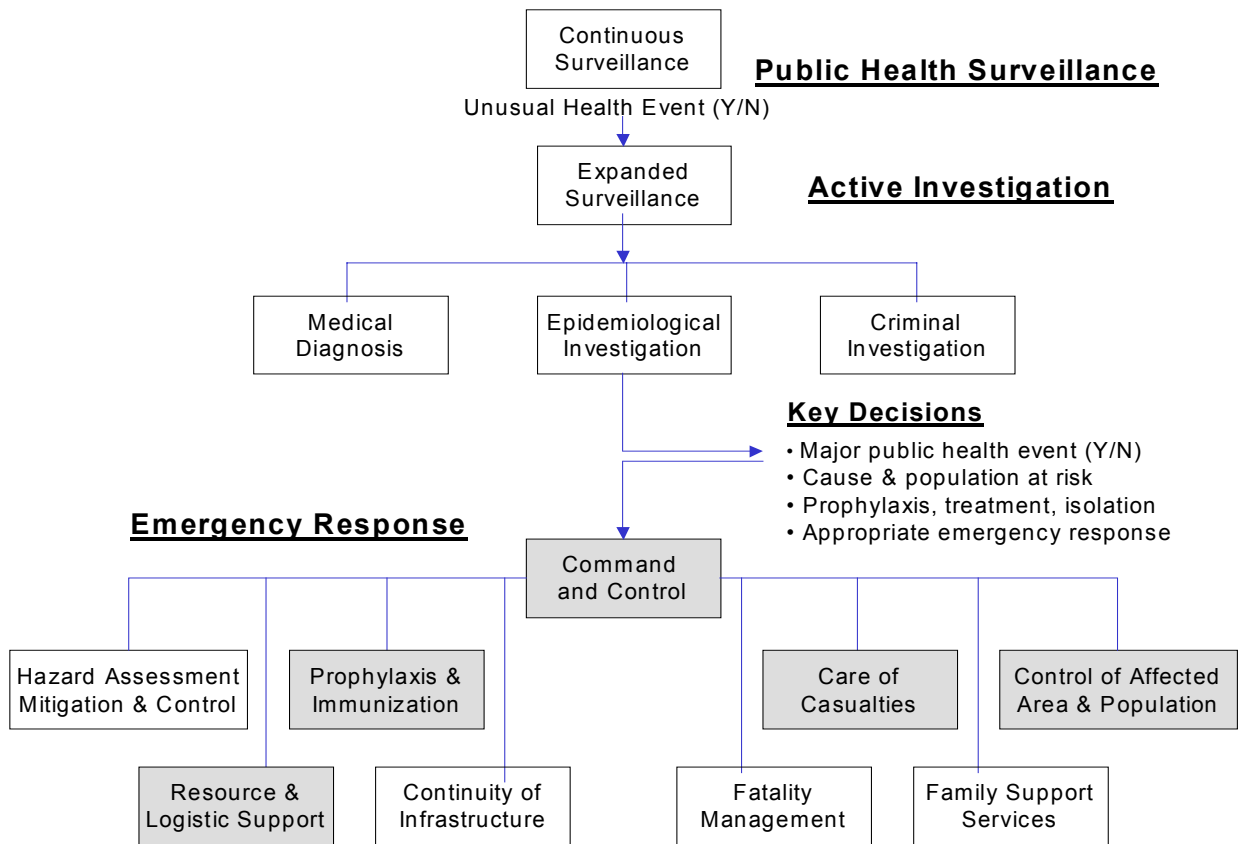


Figure 1: BW Response Template and Key Decisions

Resource Requirement and Allocation Model

Eddie Ayala

The Resource Requirement and Allocation Model is a tool designed to aid in BW incident response planning. The model was developed using Microsoft® Excel® spreadsheet software, which was selected for its availability and ease of use. The model's development and validation process included review and input by numerous local, state, and federal experts. The resource estimates within the model can be easily tailored for any size of attack. Variables to customize this model are number of people exposed, number of area hospitals, and type of biological agent. The spreadsheets in the model contain formulas depicting the relationship between numbers of casualties and resource requirements. Resource requirements are tracked on a daily basis throughout the response.

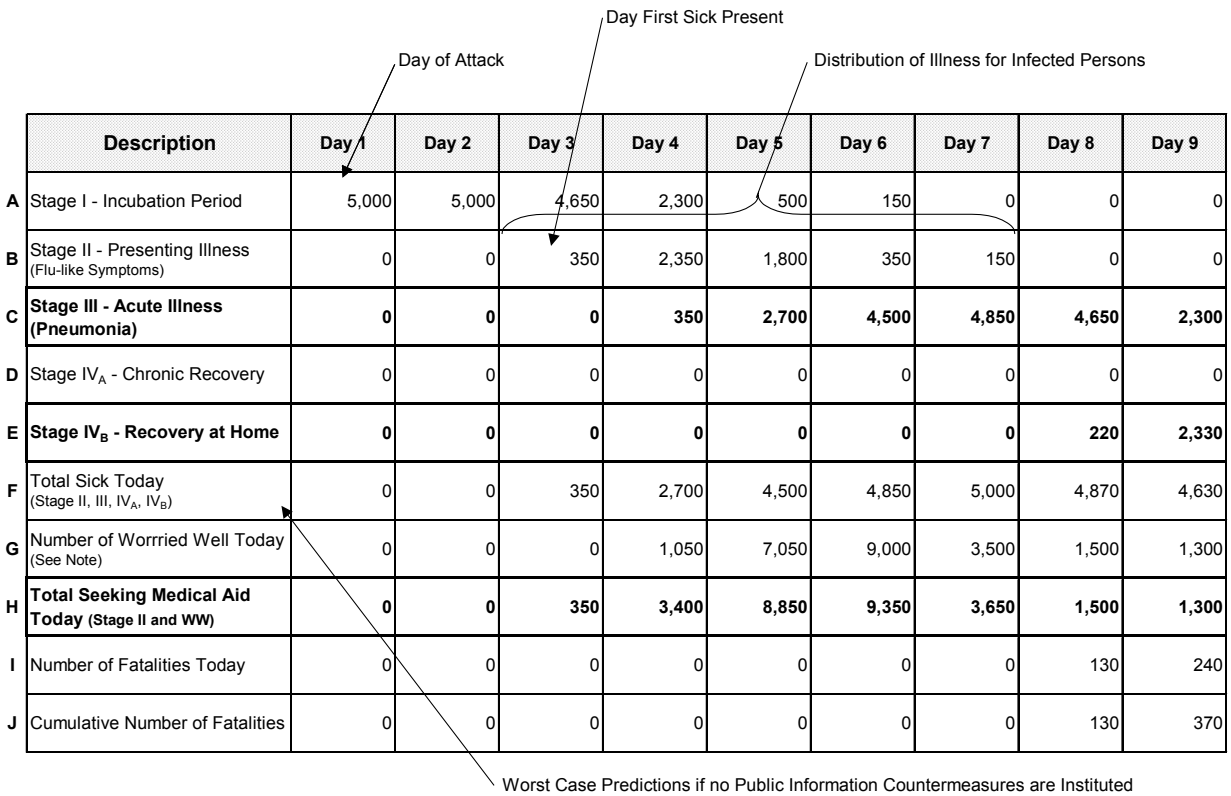
The model is comprised of the following worksheets:

- Casualty Situation Template
- Variables Table
- Resource List
- Resource Requirements
- Resource Availability
- Resource Requirements vs. Allocation

The activities under each element of the *BW Response Template* are also included for reference. This workshop focused on the following five template components:

- Care of Casualties
- Mass Prophylaxis and Immunization
- Command and Control
- Control of Affected Area/Population
- Logistics and Resource Support

The *Casualty Situation Template*, as shown in Figure 2, breaks down the total number of casualties by their symptomatology, distributed over a timeline. The template was developed with the assistance of U. S. Army Medical Institute of Infectious Diseases (USAMRIID). This element of the model is essential for response planning. The resources required to respond to a biological incident are largely based on the daily demand of people seeking medical aid, be they worried well or critically ill. Worried well are approximated as equal to five times the number of those actually ill.



Distribution of Presenting Illness: 7% 47% 36% 7% 3%

Incident Mortality Rate: 10%

Figure 2: Casualty Situation Template

The *Scenario and Resource Variables Table* controls the values of the different elements of the model. These fields can be manually adjusted, based on the community and the size of the event as depicted in the attack scenario. Some of these fields are linked to the resource requirements (e.g., maximum number of Acute Care Centers [ACC] sub-units and population of affected area). Other variable fields pertain to the availability of resources (e.g., percent of resources available at local, 100 and 200-mile radii, state, and federal). The variables set for the conference scenario are shown below in Figure 3.

TULAREMIA

Scenario Variables

Number of People Infected:	5,000
Number of Local Hospitals:	3
Number of Available Hospital Beds:	100
Maximum Number of ACC Sub-Units:	20
Maximum Number of NEHC's:	5
Population:	160,000

Resource Variables

% of Resources Available (Local):	10%
% of Resources Available (100 Mile Radius):	10%
% of Resources Available (200 Mile Radius):	10%
% of Resources Available (State):	0%
% of Resources Available (Federal):	0%

Figure 3: Scenario and Resource Variables

The **Resource List** contains essential personnel required to address the response elements in the *BW Response Template*. These people are key resources due to their skills or to the sheer number of a particular resource required. The list also includes essential equipment/material required to allow the personnel to perform their response functions. Figure 4 depicts a sample of the personnel resources; these are the resources linked to the five template components discussed (Care of Casualties, Mass Prophylaxis and Immunization, Command and Control, Control of Affected Area/Population, and Logistics and Resource Support) and do not include all possible personnel resources for other template components.

Personnel
Custodial/Waste Removal/Housekeeper
Driver (Bus or Truck)
Logistician/Transportation Manager
Medical Clerk/Communicator
Medical Director/Administrator/CEO
Nurse
Nurse Assistant
Paramedic/EMT
Patient Transporter
Personnel In-processor
Physician/Physician Extender
Police Officer
Respiratory Therapist
Social Worker/Case Manager
Volunteer (Affiliated)
Volunteer (Non-Affiliated)

Figure 4: Resource List

The **Resource Requirements Worksheet**, shown in Figure 5, links the *Casualty Situation Template*, the *BW Response Template*, and the *Resource List*. The result is a spreadsheet listing the activities from the response template, the resources (including equipment/material) associated with these activities, and the total number of resources required to cover two 12-hour shifts every day of the response.

Care of Casualties Activities

Sample Activities

- **Establish temporary wards and supportive care centers, (e.g. Acute Care Centers (ACC)) - 50 beds/unit**
 - Provide care to acutely ill
 - Provide treatment
 - Provide hospice care to terminally ill
 - Possible sites: nursing homes, hotels, shelters, office buildings
 - Provide childcare for staff

Resource Name	#/Unit	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
Physician/ Physician Extender	4	0	0	0	20	80	80	80	80	80	32	4	0	0	0
Nurse	8	0	0	0	40	160	160	160	160	160	64	8	0	0	0
Nurse Assistant	10	0	0	0	50	200	200	200	200	200	80	10	0	0	0
Medical Clerk/ Communicator	4	0	0	0	20	80	80	80	80	80	32	4	0	0	0
Respiratory Therapist	2	0	0	0	10	40	40	40	40	40	16	2	0	0	0
Social Worker/ Case Manager	4	0	0	0	20	80	80	80	80	80	32	4	0	0	0
Custodial/Waste Removal/ Housekeeper	5	0	0	0	25	100	100	100	100	100	40	5	0	0	0
Patient Transporter	4	0	0	0	20	80	80	80	80	80	32	4	0	0	0
TOTAL		0	0	0	205	820	820	820	820	820	328	41	0	0	0
TOTAL NUMBER OF ACC's		0	0	0	5	20	20	20	20	20	8	1	0	0	0
Gown	12	0	0	0	2,460	9,840	9,840	9,840	9,840	9,840	3,936	492	0	0	0
Mask HEPA	12	0	0	0	2,460	9,840	9,840	9,840	9,840	9,840	3,936	492	0	0	0
Splash Guard	2	0	0	0	410	1,640	1,640	1,640	1,640	1,640	656	82	0	0	0
Gloves (Pair)	24	0	0	0	4,920	19,680	19,680	19,680	19,680	19,680	7,872	984	0	0	0

Figure 5: Resource Requirements

The **Resource Availability Table** represents the total number of the listed resources locally, within 100 and 200-mile radii, state, and federal. The estimates shown in Figure 6 were prepared by Adam Geibel and are discussed in the next section, Resource Estimates.

Personnel	Total No. of Resources				
	Local	100 Miles	200 Miles	State	Federal
Custodial/Waste Removal/Housekeeper					
Driver (Bus or Truck)	460	17,350	92,910		
Logistician/Transportation Manager	20	680	8,221		
Medical Clerk/Communicator	20	3,540	24,010		
Medical Director/Administrator/CEO	6	1,654	13,370		
Nurse	900	15,350	131,780		
Nurse Assistant	870	13,485	168,072		
Paramedic/EMT	17	823	12,720		
Patient Transporter					
Personnel In-processor					
Physician/Physician Extender	469	8,280	84,200		
Police Officer	175	4,720	39,270		
Respiratory Therapist		430	5,470		
Social Worker/Case Manager		910	5,920		
Volunteer (Affiliated)					
Volunteer (Non-Affiliated)					

Figure 6: Resource Availability

The **Resource Requirements vs. Allocation** spreadsheet combines the information contained in the **Resource Requirements Worksheet** with the **Resource Availability Table**. The allocation of resources is calculated using the percent of resources available, as specified in the **Resource Variables Table** (Figure 3). For example, the total number of local nurses according to the **Resource Availability Table** is 900. The percent of local resources available to respond to this incident is 10%, as indicated in the **Resource Variables Table**. As a result, only 90 local nurses would be allocated, as shown in Figure 7 below. Nurses from 100 and 200 miles away would make up the shortfall.

In addition, this worksheet depicts the under-allocation of resources by subtracting the number of personnel allocated from the number of personnel required (e.g., Day 4 requires 98 nurses but the allocation is only 90, so there is a shortfall of eight nurses for that day). Within the resource model, it is assumed that local resources are immediately available; resources within 100 and 200 miles are available within 24 hours and 48 hours of request, respectively.

	Resource Name	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12
PERSONNEL													
TOTAL REQUIREMENT	Nurse	0	0	0	98	270	312	305	277	267	175	111	102
ALLOCATION	Local/City				90	90	90	90	90	90	90	90	90
	100 Mile - Local/City					1,535	1,535	1,535	1,535	1,535	1,535	1,535	1,535
	200 Mile - Local/City						13,178	13,178	13,178	13,178	13,178	13,178	13,178
	State					0	0	0	0	0	0	0	0
	Federal						0	0	0	0	0	0	0
UNDER ALLOCATED (Total Requirement - Allocation)		0	0	0	8	0	0	0	0	0	0	0	0

Figure 7: Resource Requirements vs. Allocation

Resource Estimates

Adam Geibel

Building Your Own Area's Personnel Annex

The project required tabulating a census of critical skills needed to man emergency medical centers (e.g., Neighborhood Emergency Help Centers [NEHCs] and ACCs, see Appendix B-4) that were mobilized after a terrorist incident at Dartmouth College. In addition to those civilian personnel who could be found in the immediate area, it was obvious that additional help would be needed from within a 100 and 200-mile radii. Existing political boundaries (state, county, and FEMA region) statistics were found to be the best way to organize these resource requirements.

The college "impact area" included the three contiguous counties (Grafton County, NH as well as Windsor and Orange Counties, VT), while the 100-mile radius included both New Hampshire and Vermont. The 200-mile radius within FEMA's Region I (Figure 8) includes Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, Vermont, as well as the northeastern counties of New York.

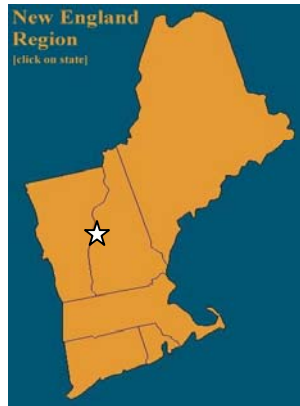


Figure 8: States contained in the approximate 200-mile radius of Hanover, New Hampshire

One of the secondary benefits of the research methods used to create the Area Personnel Annex was that Emergency Management personnel could follow the same logic to find the same information for their own areas of interest.

Office of Emergency Management personnel will have their files and county records at hand, although the level of detail can vary widely county-to-county. Some planners will have information-laden websites like Dartmouth-Hitchcock Medical Center Care Management Resource Directory (www.hitchcock.org/pages/OCM/resourcedirectory/contents.htm).

To supplement the local information, state and federal sources are needed. The following federal information websites were consulted: the U.S. Census Bureau (www.census.gov), Bureau of Labor Statistics (<http://stats.bls.gov>), the Bureau of Health Professions (<http://bhpr.hrsa.gov>), and the National Center for Health Workforce Information & Analysis (<http://bhpr.hrsa.gov/healthworkforce/tools.htm>). State information sources included the New Hampshire State Data Center (www.state.nh.us/osp/planning/sdc.html and www.nhes.state.nh.us/elmi/emplevel.htm), Vermont Labor Market Information (www.det.state.vt.us/~detlmi/wageincome.htm), Vermont Department of Labor & Industry (www.det.state.vt.us/~detlmi/lmnews.pdf), and the New Hampshire National Guard (www.nhguard.org).

Two examples of specific information sources are the 1999 State Occupational Employment and Wage Estimates (<http://stats.bls.gov/oes/1999/oesrcst.htm>) and the 1997 Economic Census Health Care & Social Assistance (www.census.gov/prod/www/abs/healthcr.html). Information that was three to five years old was the best available since the results of Census 2000 are still being released. In some cases, Area Resource File (ARFs), at <ftp://158.72.84.9/bhpr/nationalcenter/factbook/fb201.pdf>, provided useful historical data (circa 1996) for extrapolating ratios into 2001.

A “common language” was needed and found in the Standard Occupational Classification (SOC) system, used by U.S. government agencies to classify workers into occupational categories for the purpose of collecting, calculating, or disseminating data. While some states have their own coding systems, it would simplify a national response if planners deferred to the federal standard.

For example, **SOC 29-1111 Registered Nurses**: Assess patient health problems and needs, develop and implement nursing care plans, and maintain medical records. Administer nursing care to ill, injured, convalescent, or disabled patients. Includes advanced practice nurses such as nurse practitioners, clinical nurse specialists, certified nurse midwives, and certified registered nurse anesthetists. Advanced practice nursing is practiced by RNs who have specialized formal, post-basic education and who function in highly autonomous and specialized roles.

As the information from Census 2000 becomes available, not only will updated headcounts be possible, but also near-term future trends can be predicted and the planning responses tailored appropriately. For instance, the 2000 National Sample Survey of Registered Nurses Preliminary Findings (found at <http://bhpr.hrsa.gov>) indicates that, “more action is needed to keep the nation supplied with registered nurses; the nation’s RNs continue to grow older, and the rate of nurses entering the profession has slowed over the past four years.”

Slides used in this presentation are included in Appendix B-5. A detailed presentation on the estimates of resources is given in Appendix B-6.

Group Assignments and Problem Summary

Robert Gougelet, MD and Richard Hutchinson, PhD

The three response groups (Town Manager, Emergency Management and Fire; Medical Response/Mass Care; and Law Enforcement) were asked to start with the resource requirement estimates and the available resources estimates and match the appropriate resources to the requirements. They were to determine transportation and timing for employing the resources and develop a command and control strategy. They were asked to then refine all aspects of the response strategy. Slides used during this session are included in Appendix B-7.

The technology team was asked to identify ways to provide response resources remotely, to formulate a distributed command and control system, and to integrate these strategies into a future biological response system and simulator. They were asked to then refine all aspects of their future system.

To limit complexity, the groups were asked to concentrate on personnel resource requirements and give consideration to pharmaceuticals supplies but not address the needs for other equipment and supplies at this time. The latter should be addressed in a future conference.

The conference addressed a non-contagious disease, tularemia, in order to present a workable problem against which to develop a resource and logistics strategy. This strategy should be re-examined for response to a contagious disease.

Each group had a group leader charged with keeping the group focused, making response decisions should an impasse be reached, and providing the perspective of response officials. The group leaders for the four teams are indicated in the listing of conference participants at the beginning of the report.

A graphic representation of the biological response resource and logistics problem was provided to the participants as shown in Figure 9. The requirement for resources, as estimated by the resource model, to respond to a biological incident involving 5,000 infected casualties is shown as the black line. Available local resources (thick solid line) would respond quickly on day 4 but would fall far short of the total need. Local resources would become exhausted. State and federal resources (dashed line) would begin to reach the scene on day 5 and ramp up over the next 4 days.

The severe shortage of resources expected through days 5 to 8 would essentially preclude an effective response and would result in misery and chaos. The late-arriving state and federal resources would be applied more to the horrendous aftermath than to the response itself. While the resulting aftermath might be comparable to that of an instantaneous nuclear explosion, here the mounting chaos would unfold before the eyes of the world on CNN through four or more days.

Thus, filling the shortfall in resources through days 5 to 8 is critical to responding effectively to a biological incident. Since no strategy exists to date, the conference participants were charged with devising a practical strategy to fill this gap.

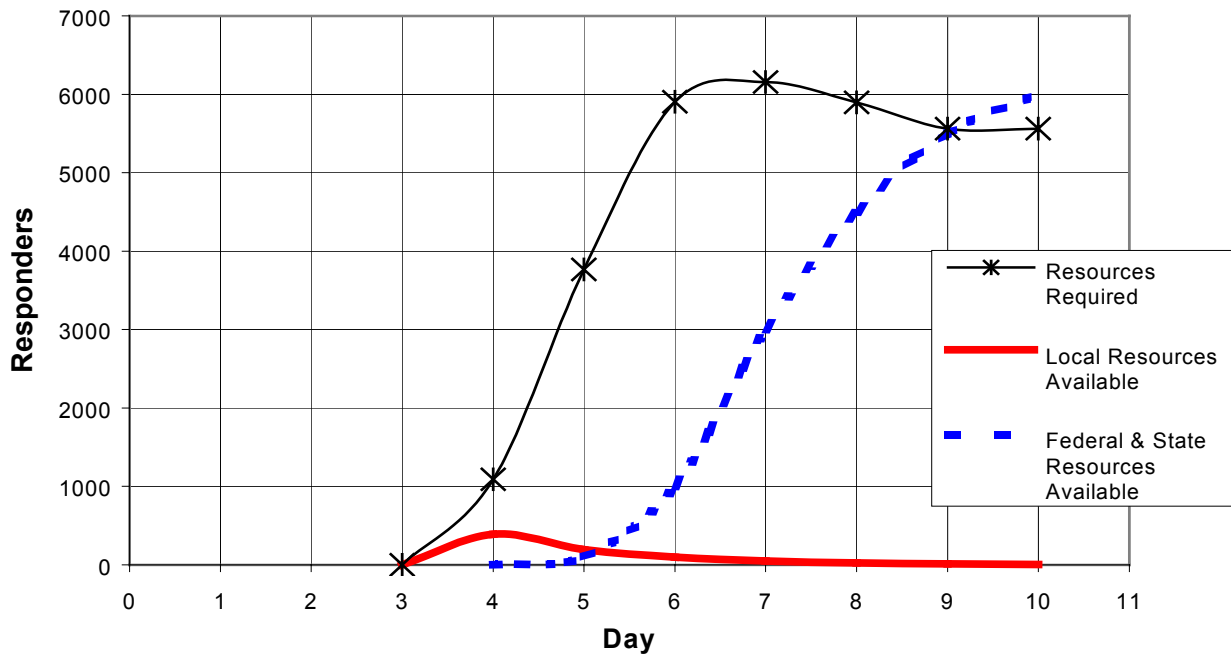


Figure 9: Resource Requirement Graph

Evening Presentations and Demonstrations

Medical Disaster Conference Panel Discussion on Threats and Response Plans

Joseph M. Rosen, M.D.

The recent U.S. Commission on National Security/21st Century found that “A WMD [weapons of mass destruction] incident on American soil is likely to overwhelm local fire and rescue squads, medical facilities, and government services,” and that “The combination of unconventional weapons proliferation with the persistence of international terrorism will end the relative invulnerability of the U.S. homeland to catastrophic attack.” The Commission concluded that “significant changes must be made in the structures and processes of the U.S. national security apparatus.”

While response plans currently exist for possible biological terrorist incidents, such as the Texas state response plan and the BW [biological weapons] response template, the U.S. medical system, including the hospitals, is not designed to respond to catastrophic medical disasters—epidemics and bio-weapons. The current system, originated by the Romans in response to the collapse of an amphitheater, is based on moving patients to central hospitals for care. But in catastrophic medical disasters, these facilities will be overwhelmed and the movement and centralizing of patients presents additional risks with contagious diseases.

We can overcome many of these limitations if we leverage advances in computer simulation, robotics and communications to advance from a hospital based care system to a cybercare system. Here telemedicine can create a new environment for health care at a distance by mobilizing the nation’s healthcare system through cyberspace and bring care to the afflicted sites wherever they may be, including the victims’ homes. Telesurgery has already been demonstrated at Stanford Research Institute and in support of local emergency response. (See the later talk on Telemedicine by Mike Caputo.) A cybercare system in conjunction with telerobotics can help mentor local responders during an actual incident. During the course of this workshop the technology team will consider these and other ways to use evolving technology to greatly improve our nation’s ability to respond to biological attacks.

Slides used in this talk are included in Appendix B-8.

The University of Texas University Affiliated Research Center Chem-Bio Program Objectives

Steve Kornguth, Ph.D.

The objective of the University Affiliated Research Center (UARC) chem-bio program is to minimize, by 2015, the operational and combat capability constraints posed by the

chem-bio threat. The consortium of participants includes the University of Texas system in Austin, Dallas, Galveston and San Antonio; the Texas Department of Health and first responders; the Texas National Guard and 6th Civil Support Team; and the Institute for Defense Analyses and the Central Texas FBI. The research is focused in three broad areas: 1) scientific validation of a chem-bio incident (situation awareness systems-sensors, signatures), 2) medical countermeasures (biosurveillance-archival data, vaccine, pharmaceuticals, and transport), and 3) communications (security, medical, public, resources mobilization and intelligent software agents). In addition to performing research in these areas, the Center is integrating efforts between the Texas National Guard and the Metropolitan Medical Response System and conducting technology demonstrations. Key early successes include generating high affinity antibodies to anthrax toxin, demonstrating a new vaccine against multiple pathogens, and identifying “signature” flags in the health system for early warning of a chem-bio event.

Slides used in this talk are included in Appendix B-9.

Office of Emergency Preparedness, Health and Medical Emergency Preparedness & Management

Malcolm B. Johns, LCDR

The U.S. Department of Health and Human Services (DHHS) is the lead agency within the federal government to provide health and medical services to states and localities during an emergency. The Office of Emergency Preparedness within DHHS coordinates and directs this support utilizing their own resources and those from other federal agencies and volunteers. This support system, called the National Disaster Medical System (NDMS), is in place and ready to immediately supplement state and local medical resources anywhere in the country by utilizing resources that are dispersed around the country. The system includes disaster medical assistance teams (DMATS), national medical response teams for WMD, and separate teams for burn, pediatric, crush medicine, mental health, veterinary medical assistance, disaster mortuary, international medical/surgical, and management support. Department of Defense provides medical supplies and equipment, evacuation and logistic assets, and specialized teams to the NDMS. To enhance existing local planning and medical response to terrorist incidents involving WMD, DHHS is sponsoring metropolitan medical response systems (MMRS) in U.S. cities throughout the country. Preparedness for WMD incidents can only be achieved by linking the response systems of first responders, medical services, public health, law enforcement, and emergency management.

Slides used in this talk are included in Appendix B-10.

Biological Weapons (BW) Response Issues & Strategies

Michael B. DeZearn

With an unplanned biological response, hospitals would likely accept increasing numbers of sick personnel until they are full and would then begin to divert ill and worried well. Later, because of staff burnout and resource limitations, local hospitals would become non-functional. To avoid this possible situation, a group of emergency and medical responders and managers, and state and federal agency officials, held a series of workshops to develop a practical, effective biological incident response strategy. The resulting strategy is community based, integrates regional, state, and federal response assets, and takes into account a wide range of casualties. The strategy focuses on care of casualties and worried well by expanding existing medical capabilities and using outside aid and non-traditional resources. By pre-planning, an effective response to a biological incident appears possible and can potentially reduce death and suffering by 50%. The response strategy will be used as a baseline for conducting the workshop at Dartmouth.

Slides used in this talk are included in Appendix B-11.

Catastrophic Terrorism: Are We Prepared?

Stephen M. Duncan

Traditionally, Americans never viewed the terrorist threat as real. Recent commissions concluded that the U.S. could be subjected to a weapon of mass destruction attack with little or no warning and that such weapons pose a grave threat to U.S. citizens. However, our nation's defenses against a catastrophic terrorist attack lack a strategic or a comprehensive National Plan and are poorly organized. Low-level officials without sufficient money have handled the problem. It needs to be addressed by the President or Vice President so that resources and accountability are present. In the current administration, Vice President Dick Cheney is charged to forge a unified strategy across all federal agencies. As the new Administration begins to engage in actions that are commensurate with the dangers we face, people like those at this conference must "face front" and step forward to help our new leaders.

The full text of Mr. Duncan's presentation is included in Appendix B-12.

Telemedicine

Mike Caputo

Access to the patients is problematic in rural trauma incidents. Often discovery is late, care is rudimentary, and transit times are long. As a result, telemedicine has been used for 30 years in Vermont. Forty videoconferencing systems are in place using off-the-shelf technology such as the Polycom Viewstation. Rural trauma providers believe the telemedicine system is equivalent to what helicopters did in Vietnam to enhance rural trauma care. Response is rapid and two lives were potentially saved to date. Advances in infrared imaging and cellular transmission are being considered to enhance the system.

Slides used in this talk are included in Appendix B-13.

The National Institute of Urban Search & Rescue (NIUSR) Basic Functional and High Level Models for Incident Operational and Disaster Management

Bobby L. Hartway

Currently, the U.S. response system is made up of autonomous pyramids at local, regional, state, and federal levels. Network connectivity between the pyramids is a must, while continuity is needed across a number of levels. Achieving connectivity and continuity requires communications interconnect accessibility, data accessibility, and data interoperability. These in turn require communications networking, shared protocols, and data mapping. A model system was presented that addresses the different incident operational phases: preventing, planning, preparing, responding, recovering, and rebuilding.

Slides* and a paper used in this talk are included in Appendix B-14.

Simulation Technology for Counter-Terrorism Applications

Curtis Lisle, Ph.D.

Simulation tools are available today for synthetic command and control. Applications of simulation in counter-terrorism include 1) security review of existing cities, and 2) what-if scenario training—create models of urban environment for analysis, do tactical planning, practice command and control decision making, rehearse response, practice information flow, and test effectiveness of response plans. One approach is to build a high quality model of the environment, which will allow a vast amount of information to be understood. Here, visual *and* derived databases are used for both rendering and analysis. The model needs to include all the calculations, analyses, and queries necessary for any simulated behavior. Quality versus efficiency tradeoff is necessary for physical

* [Hyperlinks to the separate sections of Appendix B-14 \(slides and paper\)](#) are shown as underlined text.

models, which can contain an analytical model that is displayed as a rendered model. Users of these models can then interact with the rendered simulation model to help visualize the situation. Such models can be used in training and in live operational modes of a command and control centers as a powerful tool to advance counter-terrorism efforts.

Slides used in this talk are included in Appendix B-15.

Robots for Medical Response Demonstration and Talk

Polly Pook

Robots are currently being designed and tested to access hazardous terrain (either biohazard or rubble). The K8 is an urban terrain model with good survivability and good stair climbing ability. Ariel is designed for finding mines in a surf zone. It is completely amphibious. The All-Terrain Robotic Vehicle ATRV Junior can be autonomous or tele-operated and can carry a 200 lb payload.

Five to ten years into the future, robots will be able to fit into small areas and monitor for biological and chemical agents. Geckos are being studied to see how they are able to climb smooth surfaces. A small robot with nanoscale suction cups like the Gecko's was built and tested. Throwbots could be installed inside a grenade launcher and launched into an environment. Swarms of robots are being tested to obtain broad area coverage quickly. Once robots are spatially positioned, they can feed back temporal information. A swarm of 12 robots was tested and a swarm of 120 is being developed to investigate teamwork, clustering, and dispersion.

Currently, robots relay information back to people. An Internet-controlled robot is available today. It routes live video and two-way audio channels and can move around and make observations. The K8 robot was demonstrated with onboard infrared and halogen lights, a camera, and listening audio. It is simple to operate, weight 45 pounds, and costs \$45k. Its goal is rapid response to reach a destination quickly and to see what is going on. The K8 is designed to support the K9 in a police or Army force. It is not bulletproof since bulletproofing adds weight. Battery life is 1.5 hours with NiCad and three to four times longer with higher quality batteries.

A doll that has many facial expressions recently went on the market. This feature could be incorporated into a future Cyber Responder that could approach and apply care to individuals and be less scary.

In the future, robots could be present during biological or other incidents to provide sensors, communication, and manipulations. They would operate without concern for the infectious hazard and would reduce the need for emergency responders who might otherwise have to enter an extremely hazardous area.

Group Findings

Town Manager, Emergency Management and Fire Group

Mike Clark, Captain and Michael DeZearn

Fire Captain Mike Clark, Hanover Fire Department, led the Emergency Management and Fire group. The rest of the group was comprised of emergency management personnel from the surrounding towns and counties, the New Hampshire Emergency Management Office, FEMA region 1 planners, the local New Hampshire National Guard Civil Support Team, and a Selectman from Hartford, VT.

The group determined that the best way to manage the emergency as well as the influx of outside help was to organize the response under the Incident Command System (ICS) and to recognize that the various Emergency Operations Centers (EOCs) would be in a support role to the needs of the medical community. To efficiently manage the influx of resources, personnel, equipment, and expendables, the group assigned all logistics functions to one area of the ICS.

They also determined that there needed to be a central reporting point for assets arriving as a result of the medical emergency. The central reporting point would direct the vehicle drivers to the appropriate receiving points for the material they were transporting. The exact sites of these receiving points would have to be determined during a detailed planning meeting after the current workshop. Additionally, the group decided that given the expected size of the FBI response, a separate area, probably the community airfield, would be reserved for that organization.

Manchester airport would be used as a central delivery point and can accommodate C-130 cargo planes. Other airports can accommodate larger jets and are within two hours driving distance. A chief of logistics would be assigned to the regional EOC and would designate the staging areas and assemble the necessary logistics and warehouse personnel from regional volunteers and other identified local individuals.

Other receiving centers would be established for incoming emergency personnel and volunteers. These centers would be opened at the Lebanon National Guard Armory, the U.S. Army Cold Regions Test Center, and the Lebanon Air Port. In-processing personnel would come from the American Red Cross, National Guard, and other identified local individuals.

The group further decided that the tracking of all expenditures related to the emergency was critical to obtain reimbursement from higher levels of government. As a result, this function had to be set up as soon as the local state of emergency was declared and coordinated with the area medical facilities and other local EOCs.

By the end of the second day's discussions, the group decided that the optimal command and control solution to the problem of managing the requests for support originating with

the various medical care facilities, both permanent and temporary, would be to establish a regional EOC. Representatives of the various community and County EOCs in the affected area would staff this EOC. The location of a regional EOC, and who would be in charge, was deferred until a later meeting.

The group felt that the media would be incredibly important during a biological response. Law enforcement efforts could be hindered by the release of sensitive information. Chaos could ensue without proper communication. After the initial medial release, local authorities could be overwhelmed with phone calls. People would be incensed if information was denied. If people saw that things were being done and that help was being deployed, then they would be calmed. The risk of panic is extreme and will ensue quickly with a contagious disease or if reporters say it's contagious.

A large problem is accounting for volunteers who arrive from remote locations. Someone or some system must account for them and assure their protection, care, and feeding. Responders need a 12-hour window where they can be away from the casualty area. The American Red Cross was identified to assist with housing. Hotels, motels, and schools would be utilized. Food for volunteers would come from the Dartmouth College cafeteria and from local restaurants. Vermont Transit and Dartmouth Coach could be used to transport casualties.

In summary, the group felt that the emergency described in the workshop's scenario would be manageable by the community with augmentation from resources available within a 2-hour drive of Hanover. They also felt the regional EOC concept had a great deal of merit for all emergencies, not just the medical emergency that was the focus of this workshop. The group intends to further develop this concept in further discussions after this workshop.

Medical Response/Mass Care Group

Robert Gougelet, MD and Mohamed Mughal, PhD

The Medical Response/Mass Care Group, led by Dr. Robert Gougelet, consisted of over 20 local, state, and federal medical responders from both the civilian and military sectors. Civilian response organizations represented included the New Hampshire (NH) Medical Examiner's Office, the Visiting Nurses Association, the Vermont (VT) Department of Veteran Affairs, the Federal Department of Health and Human Services (DHHS) Office of Emergency Planning, DHHS Region 1, the NH Bureau of Emergency Medical Services, NH Rotary International, members of Dartmouth University's medical faculty and the VT/NH chapter of the American Red Cross. Military response organizations included the NH Air National Guard (NG), the Civil Support Team of the Massachusetts NG, and DoD Reserve Affairs.

This large and diverse group tried to answer this question: Given the scenario, what resources are required for an effective response? In the process of answering this

question, the group also discussed resource availability and transportation and application of medical resources.

The group focused primarily on readiness issues during the first day. To facilitate discussions, Dr. Gougelet challenged the group with the overall question, “What do you want?” The answers are as follows:

- Early reporting
- A high index of suspicion on the part of the medical community for these symptoms
- A working surveillance system in place
- Existing mutual aid agreements between adjoining communities
- An accepted and executable plan for “the paperwork” associated with managing the response, including who’s in charge, how to credential visiting medical personnel, how to pay additional medical personnel
- It is important that the plans not be “paper plans”, but that they be exercised and understood by all necessary participants

One of the most critical and limited resources during a bio-attack will be the availability of qualified medical personnel, including physicians, nurses, and EMTs. Localities should have plans in place to augment the numbers of these personnel on short notice. Sources for this augmentation could include military units and hospitals, mutual aid agreements with adjoining communities, or activation of the NDMS. This augmentation is needed even in Hanover, NH, which has an unusually high number of physicians.

The group also discussed the concept of the “worried well.” As a whole, the group felt that this phenomenon would definitely emerge and that it would have a significant impact on response by loading the existing medical infrastructure. However, many in the group also felt that the emergence of and the total number of worried well could be mitigated with a well-planned and executed public information strategy. At a minimum, this strategy would include providing the affected population timely and accurate updates regarding the nature and symptoms of the given disease. It should not be forgotten that some people would resist going to the hospital because they think they might catch the disease if they have not already been exposed.

The group also discussed the criticality of effective triage to help focus the application of limited medical resources. However, triage would be difficult due to the relatively non-descript flu-like symptoms of most BW agents. Despite this challenge, medical organizations should work to develop and distribute effective triage guidelines for the major BW agents.

Once it becomes apparent that the medical community is dealing with the consequences of a deliberate, criminal terrorist act, they should immediately notify the FBI and other pertinent local law enforcement agencies. They should also be prepared to cooperate with criminal investigators while simultaneously continuing to provide medical services to patients/victims.

Pending the nature of the disease (contagious/non-contagious), the local community should consider evacuating non-affected medical patients to other areas of the nation to receive their non-BW-related medical treatments. This would unencumber medical space and resources for BW patients. If the disease is contagious, other communities may be unwilling to receive any medical patients from the affected area. In this case, the local medical community should immediately postpone all elective or non-essential medical procedures.

Although not discussed during the group meetings, Dr. Gougelet did discuss the potential of integrating Disaster Medical Assistance Teams (DMAT) into a Modular Emergency Medical System (MEMS) during a post-workshop team discussion. Based on his experience as a DMAT commander, Dr. Gougelet indicated that DMAT personnel could conceivably be organized to effectively fall into and help operate portions of the MEMS, including neighborhood emergency help centers (NEHC), acute care centers (ACC), and sector outreach functions. See Appendix B-4 for detailed description of MEMS concept.

A few overall themes or general findings emerged from the discussions. Although participants acknowledged the daunting aspects of responding to the medical catastrophe of a biological terrorist attack, none of them felt that it was impossible. Out of necessity, the overall response would engage all three tiers of government (federal, state, and local) and include civilian and military responders from both the public and private sectors (utility companies, transportation companies, private hospitals, etc.). Early and accurate surveillance is crucial to reducing morbidity and mortality. Local communities should invest in reliable surveillance systems. Most hospitals and other medical facilities already operate at near-full capacity. Since there is not much latent capacity, it is crucial that local communities have practiced and practical plans for the rapid expansion of their medical facilities. Possible use of public schools as emergency treatment areas and the assistance of Red Cross volunteers were indicated.

The group then turned to the specific resource and logistic issues relating to the attack scenario. They decided that the Medical Command Center (MCC) would be established at the Dartmouth-Hitchcock Medical Center (DHMC) with a direct link to the Regional EOC as well as communication links to the regional hospitals and to the NEHC and ACC established to cope with the high numbers of ill and worried well. The Medical Command Center would be staffed initially with local administrators and augmented later, if necessary, with additional administrators from a 100-mile radius. The Medical Command Center would request resources from the Regional EOC. The Regional EOC would request, receive, and assign incoming personnel to the emergency medical centers and outreach as requested by the Medical Command Center.

The establishment of NEHC during Day 4 of the scenario was given highest priority because of its ability to distribute antibiotics and information to reduce both the occurrence of disease and panic. American Red Cross volunteers at pre-planned locations could open and operate the NEHC facilities. The initial skeleton staff could be drawn locally and would include one doctor, one nurse, two Red Cross volunteers for

clerical support, two facility personnel from the facility housing the NEHC, and two security officers drawn initially from the local police departments but who would quickly transition the job to the National Guard. This staff would be immediately augmented with needed resources from a 100-mile radius of Hanover at the request of the Governors of New Hampshire and Vermont. These resources would begin to arrive within hours of the Governors' request with most arriving during Day 5 of the scenario. Non-affiliated volunteers from the local area would work under the direction of health care professionals to help with patient movement and flow, communications, and housekeeping/waste removal.

American Red Cross volunteers could open ACC facilities during Day 4 and assist with clerical support. The skeleton medical staff could be provided by regional DMATs supported by facility personnel from the facilities housing the ACCs. As with the NEHC, the skeleton staff would be augmented by resources from a 100-mile radius of Hanover at the request of the Governors of New Hampshire and Vermont. Non-affiliated volunteers would help with patient comfort, transport, and housekeeping/waste removal.

Community outreach would commence on Day 5 and would make use of the local postal service to deliver antibiotics and information to each family and to gather information posted on mailboxes by residents regarding those that are ill. Existing outreach functions would be maintained for critical functions such as delivery of oxygen. Nurses, physicians, and Red Cross volunteers drawn from a 100-mile radius would sector the affected communities and provide medical and mass care to the critically ill that stay at home. National Guard officers would provide security throughout each sector of the community as well as command and control links and two-way communication links to the Medical Command Center. Outreach personnel would instruct family members and neighbors how to provide supportive care to the critically ill. The outreach function would provide an on-the-ground capability to reach and assist all community members independent of the communication infrastructure and their ability to reach a hospital or ACC. Feelings of isolation and panic would be reduced and cross infection would be minimized.

Overall, the group felt that pre-planning and the use of regional personnel could effectively bridge the gap in response that was depicted in Figure 9. The group felt that at least 10% of the physicians, nurses and other specialists would come to the affected area to assist if the Governors proclaimed a state of emergency and requested the assistance. Further, the use of up to 10% of the local population to serve as non-affiliated volunteers was felt to be reasonable. Group members noted that volunteers often play a key role in large-scale emergency responses. Effective use of these volunteers will require a centralized receiving, credentialing, and deployment center as planned by the Town Manager, Emergency Management and Fire Group.

Law Enforcement Group

Joseph Esty, Chief, William Lake and Charles Crawford

The Law Enforcement group was led by Joseph Esty, Chief of Hartford Police Department, VT and included officers from Hanover, NH and the Army National Guard.

Following the terrorist threat review and workshop scenario, the law enforcement group tried to answer three questions:

- Given the exercise scenario, do the estimated required number of police/security forces approximate the numbers of police officers listed in the Resource Requirements Model?
- Determine the transportation and timing of the additional police/security forces to the Hanover area.
- Develop a command and control strategy for integrating arriving forces into the Hanover area.

The town of Hanover, NH has 19 sworn officers with 3 officers on duty being considered a full shift. Within the three county area surrounding Hanover, there are approximately 50 sworn law enforcement officers at the local level.

If the scenario unfolded as described in the exercise, the Hanover police/security forces would have to expand from 19 (existing force) on day 3 to 187 on day 4 (first day of awareness), to 285 on day 10 (max resource day), and taper off to 108 on days 19 through 21.

The general consensus of the group was that the 50 sworn officers (three county area) was a sufficient number of personnel to perform strictly law enforcement functions such as arresting individuals, using deadly force, and upholding the law.

The augmentation forces would primarily be performing security/traffic duties such as maintaining security around hospitals, acute care centers, EOC, maintaining traffic flow, etc. Therefore, the augmentation force could draw from National Guard personnel, non-local officers, or State Troopers. The number of support personnel delineated in the Resource Spreadsheet appeared to be a reasonable estimate of the support that would be required.

The optimal solution would be to have all of the augmentation personnel come from a single organization (National Guard). This would greatly reduce the logistic support requirements on the Hanover Police Department for the following reasons:

- National Guard organizations are largely self sufficient; they can feed, shelter, and care for their own people.
- They bring their own organic command structure.
- They also have their own communications and transport assets.

The least desirable solution was to bring in small numbers of officers (groups of 1 to 15 officers) from many local jurisdictions to augment the Hanover Police Department. Rather than relieve the burden on local police departments, this option would likely increase the burden because of the following reasons:

- No commonality of command and direction for the many jurisdictions.
- No commonality of communications equipment or radio frequency allocation.
- Shelter and feeding of the diverse personnel/jurisdictions would be a logistical nightmare.

This option was undesirable and the law enforcement group concluded that the only practical solution to a real-world event was to bring in National Guard troops.

The group expected the National Guard to begin arriving on scene within 12 hours of notification. Within 24 hours of notification, the Guard would be on site in full strength. Hanover Police Department felt that they could stretch their resources to cover this critical period. However, it was cautioned that the local police departments could not cover the community much past the 24-hour window. There is a concern that Guard forces requested by law enforcement might be siphoned off for other support areas, thus leaving the community at risk.

Physical integration and command and control integration of guard forces is not expected to be a risk issue. The National Guard Commander would integrate both himself and his senior staff into the EOC. The EOC would prioritize the missions and the Guard could proceed to execute those missions. Again, the Guard has their own organic command structure, communications, and transportation, thus allowing them to operate with this kind of freedom.

A key to calming the people is collaboration with the media. Quelling fears of a contagious disease when the disease is actually non-contagious is key. Also, there should be a plan, even if things do not go as planned. “The plan is nothing, but planning is everything” (George Patton).

Technical Group (Technology, Simulation, Robotics and Telemedicine)

Joseph Rosen, MD and James Peoples

Our role as technologists is to see how to bring remote resources from beyond 200 miles to the infected community. Backfilling of resources on a national level is needed to sustain the response as local and regional responders become exhausted. In addition, remote resources can be applied quickly without transportation delay, and they are not subject to the infectious hazards of the incident. The FBI estimates confirmation that a disease is not contagious will require approximately 48 hours. Until the disease is identified, it would be best to minimize the people coming to the event site in order to avoid infecting responders and further spreading the disease.

A distributed command and control system is needed to link remote resources. Technology is available today for such a system. The U.S. Army does distributed command and control as their bread and butter. Ft. Hood is a great remote resource because both a hospital and the Army's digital war fighting center are located there. Southern Command has a similar capability in Florida. What is missing is national doctrine for responding to a biological incident.

A simulation system embedded in a distributed command and control system would be able to run an attack scenario quickly and predict what will happen. An example is, "what will happen if I treat XXX patients/day?" This capability would allow response exercises to be played out on a national basis and would contribute to the test and improvement of the response doctrine. It would also be a tool to assess and support national policy.

Application of national resources during an emergency will require trust. For example, if all of the National Guard can be considered an equally distributed capability, then they will respond from the best location. A distributed command and control system would apply national physical resources as well as remote resources to the affected site.

Oak Ridge National Lab software, Responder Assets Management System (RAMS) has 16 tools that allow local emergency teams (police, fire) to develop a detailed response plan. One tool allows the development of a detailed visual database of important buildings (e.g., with a click on the floor plan, the user gets a 360° image to pan around in the room). Another tool estimates the number of responders needed given a guess at the infectious agent and the number of people exposed. This local-based system could be link into the distributed command and control system for national assistance.

Telemedicine technology is already in use and could be applied to remote response to a biological or natural disease outbreak. A telemedicine clinical consultation system supports much of rural Vermont and other areas in northern New England. The system performs dermatology and surgical follow-ups. Trauma support allows surgeons to take care of cases from their homes in the evening. The military also uses remote triage.

Bandwidth is necessary to implement a distributed command and control system and to apply remote resources. What would it take to obtain the necessary bandwidth from Texas and Florida?

Internet 2, which is the backbone of optical carrier, OC48, is a possible infrastructure. However, not everyone is connected. Boston has internet2 and OC3, but this does not come to Dartmouth. Only OC3 exists at Dartmouth. A fiber optic connection could be run from the closest high-bandwidth node (with OC48) to Dartmouth to bring the bandwidth here. Marines control and lay their own infrastructure and could lay down a fiber optic line from the back of a jeep quickly. In the future, robots could lay fiber optics as well as provide mobile video/audio from wherever it is needed. The system could be assembled by collaborating with Sprint, AT&T, and videoconferencing such as Kinko's.

The required bandwidth needs to be estimated and a plan specifying bandwidth created. Requirements could be determined by running empirical models through simulation in command and control. Predictions would indicate the amount of robots needed and the nearest bandwidth node to connect to. The President could then execute an order so that satellite bandwidth is available in times of emergency.

The Technical Group envisioned the distributed command and control system, titled "homeland defense network (HDN)" to functions as follows:

- Establish the process so that the President and/or others can respond quickly and issue an order for nation-wide mobilization of remote resources and distributed command and control.
- Mobilize the civilian response teams first since they can respond while HDN is bringing in the bigger national resources.
- Notify the military responders (such as Texas/Ft. Hood, Florida/South Command) that they have been ordered to provide support.
- Decide the size of the bandwidth and effort needed by running empirical models. Predictions will indicate the amount of robots needed, and the nearest bandwidth node to connect to.
- Have needed bandwidth to Dartmouth laid by military or others.
- Deploy robots to establish situational awareness—deploy eyes and ears.
- Establish HDN command and control center.
- Perform decision process about which remote response teams should be initially requested and then request them.
- Have command and control decision to determine the perimeter of the affected region for quarantine if required. Establish the connections between onsite and remote command and control.
- Apply remote medical aid and observation through the "Cybercare Response System."

The group then worked through the conference scenario to see how HDN and cybercare response would function.

Hanover and the surrounding communities begin to respond to a major medical emergency on Day 4 for the scenario. HDN would be given an initial notice of activity by the local EOC and would go to Stage 1 alert. HDN would query for a count of local responders and medical capacity. Upon receiving a preliminary diagnosis of tularemia, HDN would advise CDC so that they can mobilize medical supplies. Later in the day, as NEHCs and ACCs are opened in the Hanover area, HDN would activate Texas, Florida, and California for assistance in cybercare. HDN system simulator would begin to run a resource analysis model to estimate resource targets. Cybercare Response System would then be activated to assist local clinicians (Figure 10).

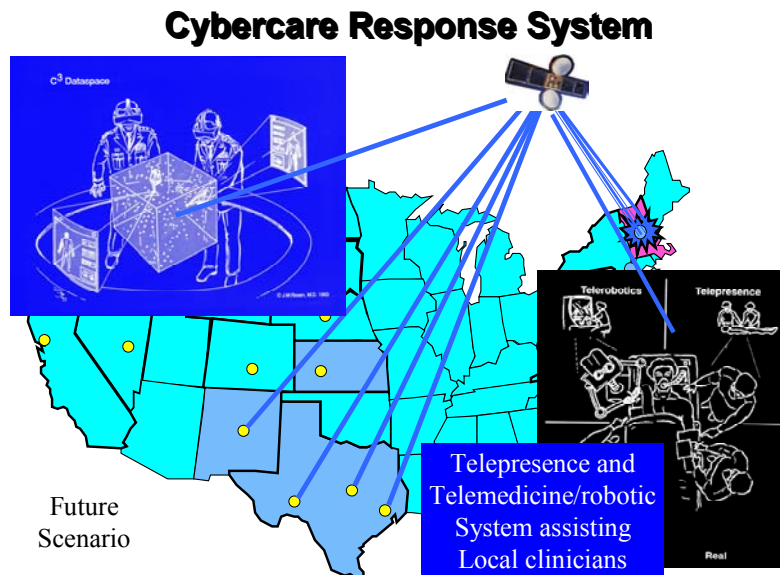


Figure 10: Cybercare Response System responds to a biological attack in Hanover, NH through the homeland defense network and provides remote medical assistance

To activate the cybercare system, HDN would commandeer a portion of existing communications infrastructure and provide centralized computer operations to direct outside assistance to the infected community including triage. During Stage 2 alert, virtual centers via 3D telepresence from Texas communicate command and control options. Triage is turned over to the homeland defense network. Robots are deployed according to epidemiology results to provide medical deliveries, reconnaissance and situational awareness. HDN evaluates conditions of early responders by pupil response test and begins the backfill process.

During Day 5, Stage 3 alert, HDN receives a request for help from New York City and Washington D.C. which are experiencing evidence of a biological attack. HDN would activate additional resources from around the country and coordinate assistance to the three stricken localities (Figure 11). Robot responders would be deployed to treat or vaccinate, navigating by GPS sites. Experts from around the country would be connected via telepresence to primary care doctors' offices for accurate treatment of each individual case.

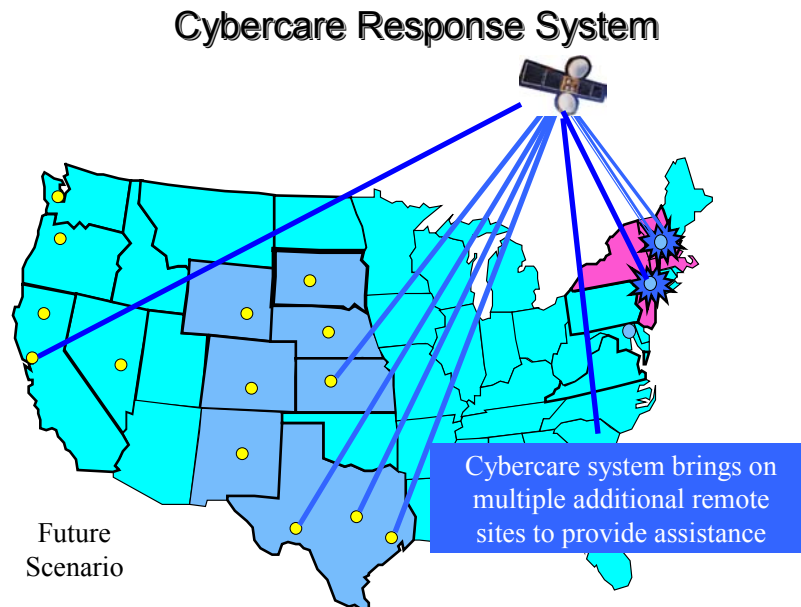


Figure 11: Homeland Defense Network expands cybercare to both Hanover and New York City and activates additional remote resources from across the country

The slides used to present the results of the Technology Group are included in Appendix B-16.

Resulting Resource Requirement and Allocation Model

Eddie Ayala

A PDF file of the resource requirement and allocation model incorporating the results of the group's findings is presented in Appendix B-17. Here the detailed resource requirements for responding to 5,000 infected victims plus worried well in the Hanover, Lebanon, Hartford area of New Hampshire and Vermont are presented. These requirements are then matched to available resources, which appear sufficient for an effective response. The resources are drawn largely from a 100-mile radius of the affected communities by a declaration of emergency and call-up by the two state Governors.

The absolute accuracy of the model is not known. Rather, the model represents the considered judgment of emergency managers and responders that have given in-depth consideration of response to a biological attack. The resource requirements were first documented for large-scale attack scenarios with anthrax and Venezuelan Equine Encephalitis (VEE) in New York City (see "Executive Summary of the 1998 Summary Report on BW Response Template and Response Improvements," <http://www2.sbcom.army.mil/hld/>). The estimates were later refined in Wichita, Kansas and Pinellas County, Florida. The model was completed by adding resource allocation estimates during this conference. The estimates within the model are considered to be "in the ball park" and "reasonable." The accuracy of the model will be improved over time as different groups use it to conduct planning and exercises.

One way to deal with questions of model accuracy is to run the model at different scales of attack and then to develop response plans capable of handling that broad range of casualties. This approach is also consistent with the nature of the biological terrorist problem—it is highly variable and non-predictable. Thus the strategy needs to be robust enough to deal with that uncertainty and, likewise, with possible model inaccuracy.

Biological Response Strategies

Joseph Rosen, MD, Robert Gougelet, MD and Richard Hutchinson, PhD

Near-term Strategy

This conference resulted in the first complete strategy for responding to biological terrorist incidents, complete in scope if not in detail. Prior work focused the efforts of many emergency responders and managers from around the country and resulted in the biological response template exercised in the conference and documented in Appendix B-4. This strategy was first developed to address biological attacks on New York City, but it was then further validated and refined in Wichita, Kansas; Pinellas County, Florida; and Dover, Delaware. In addition, other communities are using the template to develop their local biological response plans and others have independently arrived at the same strategy. Still, questions remained on how to amass the personnel resources needed to implement the strategy. It was found that no city had adequately addressed the issue of personnel resources for responding to a large-scale biological attack involving thousands to tens of thousands of infected citizens. (See Figure 9 for a pictorial representation of the resource problem.)

This conference, as one of its goals, focused on filling this knowledge gap on resources and logistics. Conference participants arrived at a “regional response concept” for identifying, obtaining, and applying the needed response personnel in the timeframe dictated by the course of a biological incident. The concept is predicated on local, state, and federal planning before the event. Then during an actual biological event, local medical and emergency response resources would initiate the response by establishing a skeleton system of locations and activities into which outside resources could be *quickly* integrated and *effectively* utilized. The outside resources would come from 100 and 200-mile radii of the affected community.

A radius of 100 miles around Hanover, NH was found to contain more resources than that required for the scenario. Many of the responders, including doctors and nurses, would be volunteers requested by the State Governors under a state of emergency to respond to an affected community. Not every doctor or nurse in the 100-mile radius could or should respond. If only one in ten responded (10%) there would be sufficient resources for the incident. Conference participants felt that this was a conservative number and that a higher percentage would respond if asked.

Also responding from within the 100-mile radius would be highly organized personnel that include U.S. Public Health Service (PHS) Disaster Medical Assistant Teams (DMATs), American Red Cross volunteers, and the National Guard. Their expertise, emergency response pre-training, and organization would be utilized to expand the local response skeleton into a functioning system into which other volunteers would be utilized. The conference identified the following critical areas of support for these three groups:

- **Public Health Disaster Medical Assistant Teams (DMAT).** Provide skeleton medical staff to open up and oversee acute care centers for critically ill victims.
- **American Red Cross volunteers.** In concert with local emergency managers, open up facilities for neighborhood emergency help centers and acute care centers, assist with clerical/communications, help staff receiving centers for responders/volunteers coming into the area, assist with housing and feeding of volunteers and victims, and assist with community outreach to victims in their homes.
- **National Guard.** Provide security and traffic control throughout the afflicted community in support of local law enforcement officers, help staff material and personnel receiving centers, and assist with distribution of supplies, personnel, and food.

These three groups have the expertise, organization and manpower “muscle” to significantly assist with a biological response. Undoubtedly there are other areas where these groups would assist, and other federal and state agencies and volunteer organizations would be involved. For example, the Federal Bureau of Investigation would direct the criminal investigation and the Federal Emergency Management Agency would coordinate federal support. However, local communities would retain the lead in both planning for and responding to biological incidents, as the response must be locally based to be timely.

The regional response concept appears practical because it utilizes personnel resources already in existence and would therefore have a modest cost. It appears effective because it can be implemented quickly, as long as the preplanning is done and the strategy is understood.

What needs to be done to implement the strategy?

Because the strategy is based on the rapid integration of diverse resources during the actual event, participating parties would need to both accept the strategy and preplan its implementation. The participating parties include federal agencies such as the FEMA, FBI, Department of Health and Human Services, and the Department of Defense; state agencies such as the Office of Emergency Management; and local emergency response agencies, in addition to the public from which critical resources would be drawn. In addition, local city executives and State Governors would need to accept the strategy because they would be responsible for taking key actions during an incident, such as calling up volunteers.

The conference also resulted in the Dartmouth biological response resource and allocation model that can help emergency managers in any community think through the what, when, who, and how of responding to a biological incident. Addressing the number and timing of resources and how they will work together is absolutely necessary

to achieve a *real* biological response plan. Without this level of consideration, a biological response plan is likely to be “smoke and mirrors” that will fall apart in an actual event.

Long-term Strategy

A long-term strategy evolved during the conference that is centered on a national, distributed command and control system and simulator. The system would integrate response and communication at local, state, and federal levels. Requests for assistance would normally flow from local to state to federal levels, and assistance would flow from federal and state levels to the affected community. The distributed command and control system is needed to quickly and effectively apply the nation’s vast resources to incidents that would otherwise overwhelm a community’s capability. The system is also needed to deal with multiple incidents occurring simultaneously or with incidents that spread such as contagious diseases.

The distributed command and control system would provide a platform through which advanced cybercare systems would be used to help each individual in the afflicted community. Telemedicine, a component of cybercare, would bring the appropriate doctor or health expert into the home of an afflicted citizen to quickly assess the problem and prescribe treatments. Advanced health monitors in homes and apartments would monitor for disease in each occupant on a daily basis and identify the early onset of infection. This information would be monitored centrally in the distributed command and control center to provide real-time surveillance for any type of disease outbreak. Immediate and preventive treatment would then be administered by electromedicine synthesized in the home or directly in the body through electronic prescriptions. Remote controlled robots would assist local responders in providing supportive care and security surveillance and delivering medications and supplies to afflicted people in their homes.

The distributed command and control system coupled with the cybercare system would greatly reduce the impact of a biological incident by rapid detection, identification, and treatment. It would minimize the spread of disease by reducing the need for responders to physically enter the infected area. It would allow the nation’s collective resources to be harnessed remotely and rapidly to cope with multiple incident sites and contagious diseases.

Evolving Near and Long-term Strategies

There are aspects of the long-term strategy that would immediately assist the near-term strategy. For example, volunteers responding to a Governor’s call for help at a stricken community could call a central number before departing for the location. Timing, ingress routes, and specific instructions could be relayed back to each caller, which would improve the timing and control of the response. The number of volunteers in each of the needed categories would be continuously monitored, which would allow for expansion or contraction of the call-up area depending on the incident as it unfolds. The distributed

command and control center in the long-term strategy would be ideally suited to perform these functions.

Should multiple incidents occur in the same geographical area, the distributed command system could be used to direct volunteers between localities where they are needed most. Currently, there is no command and control system that could perform these functions. The local command and control system would be completely utilized in implementing the response and utilizing the outside help when it arrives.

One of the challenges to overcome in implementing the near-term strategy is reaching consensus that the strategy is sound and should be employed. A distributed command and control system and simulator that could support national exercises offers a practical way to test the strategy, which in turn would foster adoption and improvement.

Lastly, a distributed command and control system and simulator offers the necessary platform to evolve from current practice and technologies to advanced response systems that leverage new technologies. These new technologies are evolving through market demand and can help immensely to improve emergency response. There are no technical barriers to establishing a distributed command and control system and simulator to capitalize on this win-win situation.

Comments on National Strategy

Joseph Rosen, MD and Richard Hutchinson, PhD

Mr. Stephen Duncan emphasized in his presentation both the lack of and the need for a national strategy to deal with a catastrophic terrorist attack. The lack of a strategy may seem surprising given the number of high level committees, Congressional hearings, newly created institutes, and exercises devoted to weapons of mass destruction response that starting in 1997 with the Nunn-Lugar-Domenici Domestic Preparedness Program. There must be reasons why a national strategy does not exist.

Two observations are offered as relevant. First, understanding the potential problem of biological warfare against U.S. population is highly complex. Such understanding is acquired only by considerable effort expended over a period of months/years rather than hours/days. Few executives and government officials are able to devote this level of time to understanding or working on the problem. Second, biological warfare, if it comes to pass, will represent a problem in reality; there will be real sick people, and they will need certain care and medications at a specific time if they are to be saved. Problems in reality demand solutions in reality, honest solutions that address the realities of the problem. But Washington operates on a political process by design, which is not a process well adapted to solving problems in reality. So perhaps it is not surprising that a national strategy has not yet evolved inside of the Washington beltway.

Adding to these observations is another complication. The response and therefore preparations for a biological incident will *necessarily* involve the nation's health community, the emergency response community, and volunteers from the population. This sector of the population is so broad and diverse that it could be considered representative of the U.S. population. If biological preparations must be that broad based, then how could a small think tank or an individual government official hope to come up with and implement a plan acceptable to that broad population. Herein may be another reason why a national strategy has not been put forth—who would have the political courage?

There is hope when we remember that the U.S. population is able to deal with problems in reality. Perhaps what we need is a national strategy not from Washington, but rather one from the people—“of the people, by the people and for the people.” We believe that the near-term strategy completed during this workshop represents such a strategy. It was developed through the honest effort of a broad crosscut of U.S. responders, emergency managers, and medical personnel and represents a solution in reality. The long-term strategy developed during the workshop offers a way to evolve the near-term strategy into a much more capable future response system.

We suggest that the near and long-term strategies, which incorporate the principle of evolution and flexibility, be adopted as a national strategy for implementation by the people of the country in concert with government.

Implementation (10 Point Action Plan)

Joseph Rosen, MD and Richard Hutchinson, PhD

The regional response concept appears practical because it utilizes personnel resources that already exist and that are close enough to respond in the required time frame. The regional response concept could be implemented quickly and at a low cost, as long as the strategy is understood and accepted by participating parties and regional preplanning occurs.

At the moment, there is no proponent for implementing a consistent biological response strategy. The individual communities are each developing their own strategy. While this approach may be sufficient, it is a very slow process and coalescence into a uniform strategy throughout the nation is problematic. Action by a top-level government official is needed to speed the process.

Technology to implement a distributed command and control system is available today and a pilot system could be assembled immediately. Telemedicine is being done currently in rural areas of Vermont. When video conferencing becomes as standard as the telephone, then telemedicine will likely become widespread. In-home health monitors are now being marketed for some indicators of certain diseases. Future ones will become more sophisticated and could electronically be linked for disease surveillance. These trends in medical care are driven by the desire for improved health care. Such advances would be directly applicable to responding to a biological incident.

Work could begin immediately to develop and pilot test a distributed command and control system and simulator. The system would capitalize on these technology advances in medical care while helping to implement the near-term regional response concept. The barriers are national will, sponsorship, and money. A high-level proponent is again needed.

As a caution, previous work on the biological response template indicates that its full implementation could reduce death and economic loss by approximately 50%. This savings is immense, but the remaining level of loss would still be totally unacceptable. Ultimately, biological warfare must be prevented. A global strategy to do so is needed.

The following 10-point action plan is recommended to implement the near and long-term strategies resulting from the conference.

10 Point Action Plan

1. A national authority (the Vice President is suggested) is informed of the near and long-term biological response strategies that resulted from the conference and prior work.
2. The national authority endorses the near and long-term biological response strategies resulting from the conference as practical approaches ready for immediate implementation, test, and improvement by local, state, and national agencies.
3. The four key national agencies, FEMA, Department of Health and Human Services, American Red Cross, and Department of Defense endorse the regional response strategy to their regional offices, giving them authority to work with and support local communities and states to implement the strategy.
4. The national authority endorses the regional response strategy to the State Governors and City Executives for their consideration and offers to provide the national level support that is a part of the strategy to support local response activities. (Indicate that the strategy came from the people in the response community and that the national agencies wish to support the strategy and keep local communities in the lead of response planning and action.)
5. The national authority obtains concurrence in the regional response strategy by Governors and representative City Executives.
6. The national authority gains Congressional support (appropriations) for development of a distributed command and control system and simulator, first as a pilot and then as a deployed national system, to enhance the near-term regional response strategy and provide a platform to evolve the long-term strategy for remote response with distributed assets. Federal Emergency Management Agency takes the lead with technical support from the Departments of Defense and Health and Human Services to develop, test, and implement a distributed command and control system and simulator.
7. Agency supports exercises and tests at local, state, and federal levels to help implement, test, evaluate, and refine the regional response strategy and the distributed command and control system.
8. Federal Emergency Management Agency performs exercises and tests using the pilot distributed command and control system and simulator to evaluate alternate approaches and to test new technology.
9. After testing the pilot system, Federal Emergency Management Agency implements the distributed command and control system nationally and ties it into participating states and local EOCs.

10. The national authority supports and assembles an international team to develop a global strategy to prevent biological terrorism. (See proposal for “Global Strategy to Prevent Biological Terrorism” in Appendix A “Emerging Technologies: Recommendations for Counter-Terrorism, Edit Volume,” edited by Joseph Rosen and Charles Lucey, January 2001, pages 225-232.)