

Joint Advisory Committee on Communications Capabilities of Emergency Medical and Public Health Care Facilities



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**JOINT ADVISORY COMMITTEE ON COMMUNICATIONS CAPABILITIES OF EMERGENCY MEDICAL
AND PUBLIC HEALTH CARE FACILITIES**

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EXECUTIVE SUMMARY

In recent years, large-scale emergencies have exposed communications failures in our EMS and health care systems. Disaster events not only have overwhelmed emergency response communications capacity, they have uncovered emergency medical and hospital communications systems that are antiquated and unable to harness the benefits of modern communications technologies.

The communications technologies upon which life-saving decisions depend are often outdated, fragile, limited only to voice, and woefully inadequate to respond to a mass casualty or disaster event. Too often today, EMS responders, doctors, and nurses must practice 21st century medicine with 20th century communications technology. Modern broadband communications networks and applications present an enormous opportunity to radically improve the manner in which emergency information is shared by health officials. Broadband services enable bandwidth-intensive information such as video, pictures, and graphics to be transmitted faster and in a more-reliable and secure manner. When married with wireless technology, broadband enables the real-time, reliable transmission of bandwidth-intensive information in a mobile environment.

By taking advantage of modern communications technologies, we can begin laying the foundation for a mobile, digitally connected health care system. And by extending broadband to every American, we can further extend the benefits of modern health care through telemedicine, remote monitoring, and telecommuting.

The Joint Advisory Committee on Communications Capabilities of Emergency Medical and Public Health Care Facilities (JAC) is recommending a systematic, coordinated, and comprehensive strategy to improve emergency communications throughout the ranks of first responders and public health facilities. The strategy encompasses all components in the chain of emergency response – spanning receipt of a 9-1-1 call, EMS dispatch, onsite communications, transport communications, hospital communications, interagency communications and coordination, treatment of victims, and identification of outbreaks.

By transitioning to broadband networks, emergency communications systems can:

- Enable voice and data convergence
- Facilitate the transmission of real-time video, pictures, and graphics in a mobile environment to create virtual emergency rooms at the scene of accidents, in the wake of disasters, as well as en route to hospitals.
- Bridge silos that isolate relevant data
- Make communications more redundant and resilient
- Maximize the efficiency and reliability of packet routing

- Ensure better surge capacity and traffic prioritization
- Enable backwards compatibility with legacy systems
- Increase the ability to use off-the-shelf technologies

The JAC looked comprehensively at the nation’s current communications capabilities across the continuum of emergency medical and public health communications. It found that we are asking 9-1-1 call takers, EMS responders, and public health services to do some of the most important jobs in the country, yet they are using technologies that the private sector has largely moved beyond.

This lack of modern communications capabilities for emergency medical and public health personnel not only limits their ability to save lives and save money – but it limits communications with patients, their families and their other health experts. It means that the productivity improvements driven by IP networks and IT investments can be seen almost everywhere throughout our economy – except in EMS, hospitals, and other public health facilities.

To address the shortcomings in our emergency medical and public health communications systems, the JAC recommends that the United States:

- Foster interoperable broadband networks, both wireline and wireless, which permit critical health-related information to be transmitted rapidly, reliably, and securely.
- Improve interoperability through better interagency coordination and the use of common protocols.
- Use mobile broadband services and applications to create virtual hospitals at the scene of accidents, and disasters.
- Advance life-saving capabilities such as telemedicine, remote monitoring, and telecommuting by encouraging network and application innovation and deployment.

To advance these goals, the Committee recommends:

1. *Policymakers encourage the deployment of interoperable, standards-based broadband networks built on common and standardized Internet Protocols that can transmit bandwidth-intensive information such as video and graphics in a rapid, reliable, and secure manner.*
2. *Congress establish a federal interagency coordinating committee on emergency communications systems to establish strong, consistent national (federal) guidance, standards and direction to insure consistent development of compatible communication systems across the nation.*
3. *The federal government renew its commitment to develop, harmonize, and ensure widespread adoption of shared standards and protocols.*
4. *Federal and state agencies develop common criteria for all contracts and grants supporting emergency communications.*
5. *Greater coordination, investment, and utilization of telemedicine technologies for both day-to-day and emergency response.*
6. *Better coordination between existing systems to be able to share and analyze real-time data across systems and provide better communications during times of emergency.*

7. *The Department of Homeland Security lead an effort to create and coordinate a geospatial Command and Coordination System, based on open enterprise architecture, to allow common patient and emergency vehicle tracking for better situational awareness for all Emergency Medical and Public Health Care Facilities.*
8. *First responders, health care personnel, and patients have ubiquitous access to broadband services and applications by fostering a regulatory environment in which private sector companies build robust broadband networks and providing targeted funding.*

By harnessing the power of modern communications technology and infrastructure, the United States can enable modern medicine to be utilized more effectively outside of hospitals. Robust broadband networks can route emergency-related communications traffic rapidly, securely, and reliably, and ensure that patient information is available in remote locations.

The communications capabilities of our nation's emergency medical and health care systems need a radical overhaul. But with the proper focus and the commitment of both the public and private sectors, the United States can marry 21st century medicine with 21st century communications capabilities.

ABOUT THE JOINT ADVISORY COMMITTEE

The Joint Advisory Committee on Communications Capabilities of Emergency Medical and Public Health Care Facilities (JAC) was created by Congress to examine the communications capabilities and needs of emergency medical and public health care facilities.

Specifically, the Joint Advisory Committee is charged with assessing:

1. Specific communications capabilities and needs of emergency medical and public health care facilities, including the improvement of basic voice, data, and broadband capabilities;
2. Options to accommodate growth of basic and emerging communications services used by emergency medical and public health care facilities; and
3. Options to improve integration of communications systems used by emergency medical and public health care facilities with existing or future emergency communications networks.

I. INTRODUCTION

Every day, health care and emergency medical workers are asked to do some of the most important jobs in one of the most mission critical environments anywhere. Life and death decisions frequently hinge on efficient data flow, near-instant communications, and whether a communications connection is reliable and secure in a mission critical environment. Yet the communications technologies upon which life-saving decisions depend are often outdated, fragile, limited only to voice, and woefully inadequate to respond to a mass casualty or disaster event.

We have seen how Internet Protocol (IP) based communications has transformed almost every aspect of our lives and every sector of our economy. But emergency medical and health care are the great outliers in the digital revolution. Modern broadband communications services, especially mobile applications, are used only in a piecemeal fashion—for limited tasks like scheduling appointments and accounting—not as a means of improving communications, transforming health care delivery, or getting prepared for or mitigating the next disaster. A mechanic often has better access to a car’s service records than doctors and responders have for their patients.¹

In recent years, large-scale emergencies have exposed communications failures in our EMS and health care systems. The Joint Advisory Committee was commissioned as a part of 9/11 Commission Act of 2007 – implementing the recommendations of the September 11th commission. On the fateful morning of September 11th, among the thousands of casualties was our communications infrastructure – hampering communications at the very time when emergency medical workers and public health care facilities needed it most. When the World Trade Center’s twin towers collapsed, major communication gaps were exposed leaving people without the ability to call for help, to locate loved ones, or access basic information. Ambulances couldn’t talk with police by radio, some two-way emergency medical radios failed, data between dispatcher and ambulance data terminals didn’t work properly causing further delays, and while beds were available only 26% of burn-injured patients were routed to burns centers because dispatchers didn’t have information on bed availability.²³ Likewise, Hurricane Katrina created a humanitarian crisis

¹ Jiffy Lube, for example, uses state-of-the-art computing technology to educate customers about vehicle maintenance services, share customers' maintenance histories across its network, and provide services that satisfy vehicle manufacturers' warranty requirements. This gives drivers the freedom to visit any service center with the peace of mind that their records can travel with them. <http://www.jiffylube.com/about/historyandmission.aspx>

² “September 11, 2001 radio communications,” Wikipedia, at http://en.wikipedia.org/wiki/September_11,_2001_radio_communications

³ “Learning From 9/11: Study Reviews Hospital’s Disaster Preparedness”, September, 111, 2006 <http://www.medicalnewstoday.com/articles/51578.php>; Journal of Burn Care & Research, Volume 27, Number 5.

and spotlighted the dire state of emergency medical communications. Behind the hurricane's eye, another fundamental communications disaster unfolded – knocking out the 9-1-1 network; cutting off hospital communications; highlighting an inability of emergency medical workers to communicate with each other; and creating a nightmare of inaccessible patient records. It once again highlighted the need for fundamental change in our emergency medical and health care communications systems.

But these communications disasters are just the tip of the iceberg. Disaster events not only have overwhelmed emergency response communications capacity, they have uncovered emergency medical and hospital communications systems that are antiquated and unable to harness the benefits of modern communication technologies.

Even in responding to day-to-day demands, the emergency and trauma care communications system in the United States is often stretched to its limits.⁴ For example:

- The 35 year old Emergency Medical System (EMS) network is fragmented, out-dated, fragile when needed most, and generally limited only to basic voice communications. The current system is comprised of balkanized systems, using disparate bands of spectrum and often incompatible standards. Emergency workers generally do not have access to broadband or the seamless flow of voice, video, and data that broadband enables. It means medical responders, ambulances, and medevac units cannot share real-time advanced vital signs, video, patient records, or other information with the hospital or across the emergency response communications chain.
- 9-1-1 public safety answering points are also utilizing outdated communications technologies that limit their ability to integrate life-saving data (from caller or car), to share data with emergency medical workers, or to withstand a disaster itself.
- Within health facilities, adoption of integrated IT solutions and interoperable communication systems remains the exception rather than the rule. It creates woeful inefficiencies and bureaucracy, delaying the benefits and vast cost savings that come from IT modernization, slowing adoption of electronic medical records and e-prescribing technologies, and increasing potential for medical mistakes – which are all exacerbated in a disaster situation.
- And because these various communications networks and data systems are not integrated, it leaves us ill-prepared to detect, avoid and mitigate emerging public health emergencies,

⁴ The numbers are astounding. Every year, Americans make more than 200 million 9-1-1 calls. EMS personnel respond to more than 16 million calls for transport. 110 million Americans visit a hospital emergency room per year. And millions more interact with the health care system for non-emergency care. Each case -- whether an automobile crash, heart attack, near drowning, unscheduled childbirth, or gunshot wound -- demands urgent medical communications and information. And with the coming retirement of baby boomers, we are about to see an exponential increase in the number people who need transport, have health emergencies, or simply need care.

or to even address daily life-threatening events or emergencies. For example, our inability to share real-time voice, video, and data among first responders, hospitals, state/local health departments, and the CDC undermines our ability to detect, prevent, and respond to outbreaks – whether e-coli, bird-flu, or bioterrorism related events.

Timely access to information and near-instant communications can save time, save money, and save lives:

- An estimated 1,000 deaths a year are linked to delayed emergency medical response.⁵ For example after a sudden cardiac arrest, the chances of reviving someone diminish an estimated 7-10 percent per minute without defibrillation.⁶ Every second counts. Few people survive untreated after more than 10 to 12 minutes. Better information, technology and communications can often speed response.
- More than 90 percent of the estimated 30 billion healthcare transactions in the United States each year are still conducted by phone, fax or mail - putting the medical system radically out of synch with the way business is conducted in every other sector of the economy.⁷ As a result, the information needed to treat a patient is often not available where and when it is needed.
- Between 44,000 and 98,000 people die in hospitals each year as the result of medical errors – causing more deaths than vehicle accidents, suicide, homicide, or breast cancer.⁸ Yet connecting doctors with networked electronic systems for ordering medicines has been shown to reduce the incidence of serious medication errors by 86 percent.⁹ It is estimated that more than two million adverse drug events and 190,000 hospitalizations per year could

⁵A USA Today study found that most big-city EMS systems are fragmented and slow, and as a result they lose about 1,000 lives a year that could be saved. “Six minutes to live or die,” USA Today by Robert Davis, 5/20/2005
<http://www.usatoday.com/news/nation/ems-main.htm?loc=interstitialskip>

⁶ According to American Heart Association recommendations, <http://www.ohsonline.com/articles/44643/>

⁷ Statement of Janet Marchibroda, CEO, eHealth Initiative, Testimony Before the Subcommittee on Health of the House Committee on Ways and Means, June 17, 2004. At <http://waysandmeans.house.gov/hearings.asp?formmode=view&id=1654>

⁸ See *To Err is Human, Building a Safer Health System* By Linda T. Kohn, Janet M. Corrigan, and Molla S. Donaldson, Editors. Committee on Quality of Healthcare in America, Institute of Medicine, National Academy Press, Washington, D.C. (2000) Available at <http://books.nap.edu/books/0309068371/html/index.html>.

⁹ In many cases, physicians do not know what drugs a patient is currently taking because of the lack of information technology and connectivity. “The Impact of Computerized Physician Order Entry on Medication Error Prevention.” by: David W. Bates, Jonathan M. Teich, Joshua Lee, Diane Seger et al. In: *Journal of the American Medical Informatics Association* (6), 313 (1999).

be prevented using modern IT and communication systems, saving up to \$44 billion annually in medication, radiology, laboratory, and hospitalization expenditures.¹⁰

- Improving and integrating health care communications enables the broader health care IT transformation, which is estimated to save as much as \$165 billion a year and create up to \$2200 in savings per year for a family of four.¹¹

Taken together, the United States is still years away from having emergency communications systems that can uniformly share information across geographic or organizational boundaries using common network technologies, protocols, and applications in order to take advantage of the advanced capabilities that modern communications networks can deliver. These shortcomings highlight the fundamental need for ubiquitous and interoperable next generation emergency networks.

The opportunity is greater than the challenges:

It is time to reinvigorate and renew our national strategy and commitment to improving health care and emergency communications. This report offers a prescription for progress. Rather than offering more band-aid solutions, it suggests a fundamental and purposeful transformation of our emergency and health communications capabilities.

By taking advantage of modern communications technologies, we can begin laying the foundation for a mobile, digitally connected health care system, and implement a vision that ensures every health care facility and emergency responder is connected to each other with broadband. And by extending broadband to every American, we can further extend the benefits of modern health care through telemedicine, remote monitoring, and telecommuting, especially in the event of a flu-pandemic or other event.

During four months of intensive research, outreach, and study, the JAC focused on one of the most fundamental and pervasive problems of in the delivery of emergency medical care – how to communicate seamlessly in an emergency and to foster a broader health care transition to modern communications technologies.¹² While JAC has identified a number of key findings and recommendations, none is as important as enabling health-related communications to reap the

¹⁰ The Value of Computerized Provider Order Entry in Ambulatory Settings. By: The Center for Information Technology Leadership (2003).

¹¹ Business Roundtable, http://www.businessroundtable.org/pdf/Health_Retirement/Improve_Health_Care_Through_IT_Ad_06192007.pdf and <http://www.businessroundtable.org/newsroom/Document.aspx?q=5986BF807822B0F1ADD4E8022FB51711FCF50C8>

¹² The Advisory Committee's members, listed in Appendix A, held four public meetings; received presentations from health care, communications, technology, and government sectors; members reviewed current research and promising projects already underway; and the committee gathered input from the public. The final report was approved at its January, 2008 meeting.

benefits of modern communications technologies that are built on Internet Protocol, speed, reliability, and mobility.

In order to improve integration of communications systems with existing and future networks, JAC is recommending a systematic, coordinated, and comprehensive strategy to improve emergency communications throughout the ranks of first responders and public health facilities. The strategy encompasses integration of all components in the chain of emergency response – spanning receipt of a 9-1-1 call, EMS dispatch, onsite communications, transport communications, hospital communications, treatment of victims, and identification of outbreaks.

By transitioning to modern-managed IP networks, emergency communications systems can:

- Enable voice and data convergence
- Facilitate the transmission of real-time video, pictures, and graphics in a mobile environment to create virtual emergency rooms at the scene of accidents, crimes, and disasters, as well as en route to hospitals.
- Improve mobility and inter-agency communication
- Bridge silos that isolate relevant data
- Make communications more redundant and resilient
- Maximize the efficiency and reliability of packet routing
- Ensure better surge capacity and traffic prioritization
- Enable backwards compatibility with legacy systems to enable integration with existing or future emergency communications networks
- Increase the ability to use off-the-shelf technologies
- help future-proof the communications transition

For hospitals, the merger of modern communications, information and medicine is opening up newfound opportunities. Modern technologies can improve health care by reducing the time required to discover, triage, diagnose, consult, and treat patients. They can link medical expertise with distant patients. New communications technologies promise to revolutionize health care -- saving money, saving time, and saving lives.

The government has already taken critical steps forward toward achieving this future, as outlined in Appendix B. While enormous progress has been made, much of this existing work has been disconnected, stove-piped, uncoordinated, and underfunded. Enabling a vision of the use of next generation networks by first responders and health care facilities won't merely require investment in modern managed IP communication technology, it requires:

- a broader vision
- thoughtful planning
- better integration
- more regional coordination
- better training
- reliance on open and interoperable standards

- improved federal, state and local inter-agency coordination
- greater investments in broadband infrastructure
- and a faster transition to IP-based communications networks

The opportunities are potentially endless and as revolutionary as the deployment of the first ambulance radio or hospital pager. Yet enabling more effective communications in an emergency will not happen by accident, nor progress by inertia. It will only happen if we make pragmatic and smart choices to advance our communications future. It takes fundamental change.

Disaster situations can exacerbate communications shortcomings:

1. **Inability to communicate.** During Katrina, the incompatibility between police, fire and EMS radios made it difficult for first responders to talk with each other and with first responders in nearby towns. Hospitals in New Orleans faced major difficulties communicating with local and state officials to replenish depleted supplies and arrange for patient evacuations when hospitals could no longer operate.
2. **9-1-1 network failure.** The limits of our outdated 9-1-1 communications infrastructure were on display during Katrina when thirty-eight 9-1-1 call centers failed due to the failure of a single switch at a time when they were needed most. The 9-1-1 system had no ability to roll over 9-1-1 calls when the system failed. It slowed Katrina response, potentially cost lives, and highlighted a nationwide shortcoming.
3. **Nightmare of patient records in mass casualty situation.** Hurricane Katrina highlighted the need for interoperable electronic health records when the hurricane destroyed paper-based patient records -- separating 1.2 million people from their medical records and taking with it such knowledge as what type of chemotherapy was being administered to cancer patients and how much insulin certain diabetics needed.
4. **Families unable to locate loved ones.** When the World Trade Center's twin towers collapsed, many people lost the ability to call for help, to locate relatives, and to access information about what was happening or where to go. During 9/11 and Katrina, thousands of families couldn't locate loved ones, find where patients were hospitalized, and, as a result, they flooded already imperiled communication networks.
5. **Basic communications failures.** Hurricanes Katrina and 9/11 demonstrated the need for redundant forms of communications for EMS, hospital personnel, and others that could be readily deployed when a disaster destroys the existing communications infrastructure. Hospitals, emergency responders, FEMA, the New Orleans Mayor and others relied upon IP networks, satellite communication, and nomadic VoIP technologies to restore communication.
6. **Post-event communication failures.** After 9/11, public health programs in lower Manhattan, such as AIDS clinics, were left without a method of contacting clients to ensure they continued to receive medication, hospitals had trouble contacting reserve staff and utilizing even basic phone lines.

Other communication shortcomings can be anticipated:

7. **Remote work access.** In the event of a flu pandemic, studies estimate approximately 25-40% of employees may need to report to work from home. Access to broadband networks, and the ability to enable remote access may be essential in such an emergency.
8. **Ability to use voice, data, and video over any network, and especially in a mobile environment.** Basic communications could once again be undone by the emergency event itself. Few other sectors face an equivalent need to maintain 24 hour, 7 days a week, 365 days a year service with absolutely no tolerance of downtime. Speed, reliability, convergence, more robust networks, mobility, voice interoperability over any IP network, use of off-the-shelf technology, and redundant access to IP-based communication systems (like satellite) can prove essential.

II. ASSESSMENT OF CAPABILITIES AND CHALLENGES -- A SYSTEM ON LIFE SUPPORT

The valiant and rapid response that comes from emergency medical personnel and hospital staff is rooted in seamless communications and up-to-date information. While today's medical technology may be impressive, its communications capabilities are not. These systems are far from achieving their full potential because of limitations in how systems can interact, data is analyzed, and disparate people and systems communicate.

The Joint Advisory Committee (JAC) looked comprehensively at the nation's current communication capabilities across the continuum of emergency medical, public health, hospitals (emergency rooms and trauma centers) and other medical centers. It found that we are asking 9-1-1 call takers, EMS responders, and health care workers to do some of the most important jobs in the country, yet they are using technologies that the private sector has largely moved beyond.

Today's medical communications systems are on life support. Recent disasters including 9/11 and Hurricane Katrina have underscored the limitations of the current communications infrastructure. Yet day-to-day communications are limited too. Lack of an integrated high-bandwidth communications system means that coordination among 9-1-1 dispatch, pre-hospital EMS, air medical providers, and hospital and trauma centers is often lacking. The communications shortfall leads to a cascade of negative consequences. For example:

- 9-1-1 public safety answering points, built on 40 year old technology, are generally limited only to voice. Every day around the nation, emergency calls are being dropped, 9-1-1 operators are being overwhelmed with multiple calls, and responses delayed for lack of information¹³. Likewise, 9-1-1 public safety answering points have no way to receive automobile automatic collision system data, to receive a cell phone photo from the scene, or to rollover calls to another call-center if they become overloaded in a mass casualty event.
- EMS personnel, when dispatched, often do not know how many may be injured or their conditions. On their way to a mass casualty event, they may not be able to communicate across multiple jurisdictions or with public safety.

“While today’s medical technology may be impressive, its communications capabilities are not. These systems are far from achieving their full potential because of limitations in how systems can interact, data is analyzed, and disparate people and systems communicate.”

¹³ Comcare: <http://www.comcare.org/Transport.html>

- At the scene, responders may lack access to specific information about hazardous or toxic situations, for example how to extract someone from an electric or hybrid automobile with high voltage lines running through the car.
- When the patient is reached, a paramedic can't access a patient's medical record, or transcribe additional patient health record information into that record using speech recognition, or add other data or video collected at the scene.
- Paramedics in the field are often unable to know whether a helicopter is on its way.
- If a helicopter is dispatched, the helicopter may not have access to the same information (voice, video, and text) in order to assess the severity of wounds, to capture medical records, and talk with paramedics directly while in-route.
- At the scene or in-route, EMS personnel are generally limited in their ability to send real-time, multi-vital sign telemetry (pulse, blood pressure, oxygen saturation, EKG, capnography), ultra-sound images, or other high definition video to the emergency room.
- Dispatchers and EMS personnel may not know which hospitals have beds, or are closed due to the event itself. Lack of coordination between EMS and hospitals can result in delays that compromise care -- even hospital to hospital communications capabilities is lacking.
- Fewer than a quarter of hospitals and health care providers in the United States have deployed electronic medical records and other digitized clinical systems for their inpatient settings.¹⁴ When prescribing drugs, doctors often don't have the ability to identify drugs that other doctors may have prescribed to prevent dangerous drug interactions.
- 90 percent of health care transactions are conducted by paper, fax and phone calls - putting the medical system radically out of synch with the way business is conducted in every other sector of the economy.¹⁵
- Early detection of infectious disease outbreaks around the country is limited because 9-1-1, EMS, trauma center and other data is not effectively linked and analyzed for outbreaks, syndrome surveillance, and bio-terror identification.

The common thread to these shortcomings is an outdated and outmoded communications systems that prevents the seamless flow of critical information among multi-jurisdictional and multi-disciplinary emergency responders and hospitals. In recent decades, first responders and healthcare organizations have targeted hundreds of narrow problems, and invested billions of dollars in

¹⁴ "Computerized Records Help UNC Health Care Doctors Treat Patients," By Marianne Kolbasuk McGee, June 1, 2006 <http://www.intelligententerprise.com/showArticle.jhtml?articleID=188700932>

¹⁵ Verizon CEO, Ivan Seidenberg, April, 18, 2006, <http://newscenter.verizon.com/press-releases/verizon/2006/page.jsp?itemID=29671085>

information technology. This approach, while valid at the time, has created communications chasms and information silos which prevent emergency responders and health experts from accessing needed information on a timely basis and improving the quality of care.

This lack of communications capabilities limits not only their ability to save lives and save money – but it limits communications with patients, their families and their physicians. It means that the productivity improvements driven by IP networks and IT investments can be seen almost everywhere throughout our economy – except in EMS and public health facilities.

Following is a more specific description of the state of current communications capabilities – looking first at EMS capabilities, and then public health.

1. EMERGENCY MEDICAL SYSTEM COMMUNICATIONS CAPABILITIES AND CHALLENGES.

Emergency Medical Services (EMS) play a vital role at the heart of the nation’s emergency and trauma care system. EMS provides response and medical transport for millions of sick and injured Americans each year through more than 16 million transport calls annually. These personnel deal with an extraordinary range of conditions and severity on a daily basis—from mild fevers to massive head traumas. Their work is challenging, stressful, at times dangerous – and can be undermined without modern interoperable communications and information. Modern communications capability has become one of the most essential needs for linking the more than 15,000 EMS systems and upwards of 800,000 EMS personnel (including emergency medical technicians (EMTs) and paramedics) with life saving capabilities.

EMS responders and their communications systems are often in the forefront of a broader emergency health communications system. EMS is not just about ambulances and paramedics. EMS workers have the critical job of quickly bringing the patient together with the appropriate type and level of care -- either at the scene, in the ambulance or other transport vehicle, or in a hospital.

To support these efforts, the EMS communications system must be able to send and receive timely information. They must be able to support communication across disciplines and players – spanning 9-1-1 dispatchers, first responders, transport (both ground and air), hospitals and trauma centers. EMS personnel need to be able to communicate as they drive across multiple jurisdictions which may have chosen different communications technologies. In a mass casualty event, departments from multiple jurisdictions may be called in and need to be able to communicate with each other, hospitals, and trauma centers. This ability to communicate effectively, seamlessly, and with the right information in hand can make life or death differences in an emergency or disaster.

Unfortunately, radios are not standardized, our 9-1-1 system utilizes communications technology that is not integrated with IP networks, and the incoming data can often not be effectively shared and communicated with the hospital environment. Advanced IP systems can bridge otherwise incompatible police and fire radio systems across jurisdictions in ways that increase the effective reach and coverage, flexibility and reliability of public safety communications by using a true network of networks. But these systems have yet to be widely deployed.

The original EMS networks, often still in use today, were developed in the early 1970's and consist of narrowband frequencies in the VHF and UHF bands. Later, paired UHF "med channel" bands were used for simultaneous voice and biotelemetry (simple electrocardiographic) communications, as well as for regional communications coordination in larger systems. In subsequent years, EMS providers adopted cellular technology and satellite technology in some rural and frontier regions. More recently regional and/or statewide systems have developed in the 700 and 800 MHz ranges. The list below illustrates the variety of communications modalities comprising the fabric of EMS communications systems today.

EMS Composed of a Variety of Communication Systems

- Plain Old Telephone Service (POTS)
- Cellular Telephone
- Personal Communication Systems (PCS)
- Specialized Mobile Radio Systems (SMR)
- VHF-Low Band Public Safety Systems
- VHF- High Band Public Safety Systems
- UHF Public Safety Systems
- 800 MHz Public Safety Systems
- Satellite Communication Systems
- Cross-patch between systems

This balkanized and often non-interoperable conglomeration of legacy communication networks that now exists has time and again shown its shortcomings in times of major disasters.

Incompatible radio systems throughout various jurisdictions can lead to significant problems in an emergency scenario. In many cases these disjointed systems are evolving without any well-planned, strongly enforced state EMS communications plans. This ad hoc non-system evolution, together with a 1970's era, narrowband infrastructure has created a fractured, fragmented EMS communications resources that prevents seamless interoperable communications capable of converging voice and data.

A. EMS SYSTEMS LACK INTEGRATED, INTEROPERABLE EMERGENCY/MEDICAL COMMUNICATIONS

Ambulances and hospitals are not equipped with common, interoperable radios.

One of the duties of the Joint Advisory Committee is to “*assess specific communications capabilities and needs of emergency medical and public health care facilities...*” This assessment suggests there are insufficient numbers of ambulances and healthcare facilities equipped with common “interoperable” radios to insure operational capability, particularly during large scale disasters involving many agencies.

“communication dead zones can be deadly zones”

There are a number of basic EMS communication challenges that thwart effective response.

- Almost all hospitals with emergency departments utilize radios, often more than 25 year old, operating in VHF Special Emergency frequencies. Even when functional, a single frequency hospital radio system can be quickly overloaded during disaster situations.
- A fragile hardware infrastructure and dependence on one primary RF channel or system (e.g. VHF, UHF) without redundancy leaves systems vulnerable to breakdown in large mass casualty incidents (e.g. Hurricane Katrina, 9/11);
- Hospital to hospital communications capabilities, once present but often now abandoned, are now needed but no longer available in many areas. Sometimes new systems have been developed which do not integrate with other EMS communications systems, creating complexity of use for hospital staff.
- Sending and receiving high-quality video and diagnostics such as portable ultra-sound require higher data transfer rates than the 9.6 kbs that narrowband frequencies can deliver. EMS and hospital personnel need mobile broadband services.

Unique rural EMS interoperability challenges persist.

Yet for EMS, rural challenges persist. EMS communication challenges, like all communication issues, are further intensified in rural America where costs are often higher, distances greater, and

funding harder to come by. Twenty-five percent of the nation's population is rural, 75% of the nation's geography is rural, and virtually the entire U.S. population travels at some time or another on highway systems that traverse rural areas. However compared to emergency medical response times in accidents in urban settings, rural response time is four times as likely to exceed the "Golden 10 Minutes" -- that time period in which a medic can significantly affect the medical outcomes of the patient.¹⁶ National Highway Traffic Safety Administration (NHTSA) data shows that although 24% of all crashes occur on rural roads, almost 60% of deaths involve these same rural roads. In a place where distance translates into time, the distance between the injured patient and life-saving care often leaves little room for decisional mistakes. Better information, technology, and communications can help bridge this life-saving gap.

However, communication dead zones can be deadly zones. Spotty rural wireless coverage can inhibit effective response. As urban areas embrace trunked 800 MHz and other systems providing greater channel capability, older traditional VHF/UHF EMS communications systems become marginalized. Rural ambulance services in the same region may not be able to use the new 800 MHz system because of cost/coverage issues (800 MHz requires more towers than VHF/UHF). As a result, when rural services occasionally take patients into urban centers, they may encounter an inability to access their destination hospital with their VHF/UHF radio because the hospital staff is reliant upon the newer 800 MHz system and has turned down or inadvertently turned off the old radio. Interoperable systems are essential.

Air medical evacuation systems have not fully maximized the capabilities for air-to-ground communications.

Aviation communication systems are also critical especially when a patient is inaccessible by an ambulance, where a patient needs to be transported over long distance or in situations when speed is of the essence. These air ambulances, like their terrestrial counterparts, must be able to communicate while providing medical treatment to a critically injured or ill patient. Likewise, they need communications capability that enables the transmission of voice and real-time vital signs from an aircraft to a physician on the ground.

A number of effective aviation communications systems rely upon satellite communication. These mobile satellite services provide global or near-global connectivity and high-quality voice, data, and tracking communications for both fixed and rotary wing aircraft.¹⁷ To support these systems,

¹⁶ The Golden rule: Do Unto Rural As You Do Unto Urban, JEMS, DECEMBER 2004 By Aaron Garman, MD, Thomas Kaspari, MD, Jacinta Klindworth, MD, Edward T. Schafer, Lori Zeller, DC, Christopher McLean, Gregory Rohde, Carla Anderson & Mary Niles

¹⁷ As an example, Iridium operates a fleet of satellites with global coverage and provides voice and data communications (with the ability to interconnect to the PSTN), backup systems, equipment monitoring, and flight tracking. Similarly, Inmarsat offers a diverse range of applications - from safety communications, weather and flight-plan updates, to email, internet and phone services – as well as secure tracking and monitoring of individual aircraft and advance logistics planning for efficient fleet management.

there is also a wide array of satellite communications equipment available from a number of manufacturers.¹⁸ These aviation technology systems have proven their effectiveness in the health care environment.¹⁹ Technologies are now emerging that can collect vital signs data from an airborne patient, using devices such as a wrist band, and send them directly to the health care providers. They enable aircraft and hospital staff to co-ordinate as the patient is transported to treatment facility. Despite their promise, these systems are far from ubiquitous.

The Next Generation Air Transportation System (NGATS), a multi-agency federal effort to completely overhaul the nation's Air Traffic Control system is fostering communication technologies that can be leveraged to improve EMS communications.²⁰ For example, the NGATS institute has launched a planning effort to develop and implement a fully operational low altitude airspace emergency communications, navigation, surveillance system applicable to civil, federal, and military first responders.²¹ The plan will identify potential solutions to equip emergency air services and disaster response assets in a low altitude route system. The systems will be designed to conform to standardized emergency medical operations and safety procedures for local, state, and federal emergency management operations.

B. EMS REMAINS STUCK IN BASIC VOICE TECHNOLOGY.

Imagine real-time video from the scene of a traffic accident made available to the emergency room to anticipate patient needs before arrival. If communications is to move beyond basic voice to include patient data, information, pictures, and video, then these radio communications systems must also move beyond narrowband to broadband Internet Protocol (IP) based communication systems. IP-based systems are capable of converging voice and data, maximizing the efficiency of packet routing, and often enabling backwards compatibility with legacy systems.

¹⁸ Aircell, for example, offers an all-in-one Satcom solution that supports a range of operational missions for both fixed-wing and rotary-wing aircraft. These devices provide ground and air connectivity, worldwide voice and data communications, and in-flight information services such as two-way datalink, ATC information, weather, and messaging. Sky Connect and Sky Trac also offer a variety of devices that enable voice and data communications and flight tracking. These are only a few of the many devices that are currently available for aviation satellite communications.

¹⁹ For example, hospitals in the Washington, D.C. area rely on Iridium's satellite system for an integrated voice and data application that connects helicopter operators (particularly medevac helicopter pilots) with hospitals and emergency personnel. Through this application, medevac helicopters can transmit and obtain emergency medical support using voice and data communications and information such as flight tracking and weather information.

²⁰ The systems is using modern IP and VoIP based communication technologies, See http://www.jpdo.gov/vision_100_law.asp

²¹ The NGATS institute has awarded a contract for an Emergency Management Operations Control System (EMOCS) in order to inventory programs and initiatives aimed at improving communications along these lines.

The ability to communicate using digital, rather than analog technologies, cannot only increase both the volume and speed of data transfer, it can also enable a broader range of life-saving capabilities. For example, pre-hospital 12-lead electrocardiography has been shown to improve times to reperfusion therapy, and to decrease patient morbidity and mortality.²² Likewise, geographic information systems, mapping, and navigation systems are enabling ambulances and their crews to get their quicker. Remote data access enables EMS personnel to record and provide real-time patient information to hospitals, dispatchers, and managers. Real-time video trials are now underway. However, these technologies are far from ubiquitous, integrated, or abundant.

Today, a teenager's cell phone can sometimes have greater communications capability than an ambulance. Today's consumer cell phones -- and their ability to send and receive videos, pictures, text and audio files; to interoperate with every other phone; to provide real-time mapping and navigation; to track other users on maps; to access the Internet and remote databases -- often offer greater access, more flexibility, and better capabilities than EMS systems provide today. As cellular networks transition to higher-speed 3G technologies, these wireless services are seeing an explosion in new innovation and capabilities. It is a proven example for how great leaps in communication capabilities can be advanced through open standards, Internet protocols, innovation, investment, and demand aggregation.

C. COMMUNICATIONS CAPABILITIES CANNOT ADVANCE WITHOUT IMPROVED PLANNING AND COORDINATION BETWEEN EMS, PUBLIC SAFETY AND HEALTH AGENCIES.

Coordinated communication planning is essential to ensure long-term interoperability. Some strides have been made in incorporating public health and medical facilities into the overall emergency planning matrix with the public safety, law enforcement and emergency management agencies in some states and localities. In fact, some communities, though not all, include representatives of area hospitals and public health facilities in their emergency operations' centers.

Linking paramedics with doctors.

With the help of a federal DOT grant, a new system in Tucson, Arizona is enabling IP based Telemedicine capabilities between the cities seventeen paramedic ambulances and the University Medical Center for trauma and other applications. In the first city-wide implementation of its kind in the country, the project includes installation of a MESH Wi-Fi broadband public safety IP network. Called the "ER Link," video cameras are being installed inside and outside of ambulances to provide a high-definition, wireless connection between doctors and paramedics.

²² Urban et al., 2002.

Still, public safety and law enforcement have been reluctant, in many instances, to include healthcare and public health when planning and purchasing communications equipment and systems. Medical information networks, such as telemedicine, and public health networks, such as Health Alert Networks, also often operate without any means for cross communication.

These independent systems produce a number of negative results including:

- diminished preparedness by trauma centers;
- patient transport miscues by emergency personnel;
- diminished ability to track patients and evacuees; and
- misallocation of available medical and public health resources.

These and other challenges related to the lack of coordinated communications systems are still common issues facing most communities both on a daily basis and during emergencies.

D. INSUFFICIENT BROADBAND SPECTRUM CAPABILITY IS LIMITING COMMUNICATIONS ADVANCEMENTS.

As noted existing spectrum is more often than not allocated for narrowband operations. As such, EMS agencies also lack spectrum sufficient to support life-saving broadband applications. While mission-critical voice communications across and between the communications chain is still a paramount priority, EMS, dispatchers, and air response units need broadband capability going forward. The narrowband frequencies commonly used today do not support the evolving medical and communications technologies which can improve patient care. The use of real-time, multi-vital sign telemetry (pulse, blood pressure, oxygen saturation, EKG, and capnography), and the transmission of high quality video and possible diagnostics such as portable ultra-sound, require much higher data transfer rates than the 9.6 kbps afforded by narrowband frequencies.²³ Increasing data rates requires enough radio spectrum to support this convergence.

Others suggested to JAC that there are also spectrum needs around enabling better wide-areas alerting and two-way paging capabilities.²⁴

²³ The data transfer will be slower or nonexistent as these legacy systems are converted to narrower modulation requirements under the “spectrum re farming” process.

²⁴ Jim Weichman, [ex] Assistant Director of Communications, Monroe County, NY told JAC that the 900 MHz N-PCS provides a proven, vastly superior, more appropriate, and more affordable two-way paging alert solution with its own acknowledgement path. Access to an allocation of 900 MHz channel pairs will make N-PCS technology available to public safety agencies. <http://www.fcc.gov/pshs/docs/advisory/jac/pdf/improved-alert.pdf>

E. A "COMMON OPERATING PICTURE" HAS NOT COME INTO FOCUS.

One of the key lessons learned from the federal response to Hurricane Katrina was the need for a "Common Operating Picture" that provides real-time situational awareness across a number of agencies.²⁵ To support this higher level decision making tool and the development and use of a Common Operating Picture (like a disaster scene battlefield map), there is an underlying need for 'structured data connectivity' to allow multiple systems to communicate and merge data.

The Department of Homeland Security has been striving to create systems at an operation center level, while the core information that feeds into the system must come from those with boots on the ground -- from emergency room personnel, EMS responders, and other public safety personnel. The lack of structured connectivity across EMS, public health and other medical facilities to track victims and resources from the initial crisis into the health care facility, must be resolved in order to provide a Common Operating Picture. This underlying lack of structured connectivity, at a very simple geographically based level, is missing from emergency communications.

²⁵ The Federal Response to the Katrina After Action Report correctly identifies a global communications gap for Emergency Medical and Public Health Care Facilities, which is the lack of a 'Common Operating Picture' (pages 36, 50, 69, 100 and 103). Available at <http://www.whitehouse.gov/reports/katrina-lessons-learned.pdf>

2. PUBLIC HEALTH SYSTEM COMMUNICATIONS CAPABILITIES AND CHALLENGES

Despite the lag in adoption of IP technologies, today's health care system is filled with a plethora of exciting and innovative approaches to emergency communications. Public safety, hospitals and public health agencies are starting to be equipped with advanced communications services. Innovations in applications and systems such as incident management systems, electronic medical records and telemedicine have provided new opportunities to better respond and manage emergency situations as they occur. Many communities have come together to form inclusive systems to ensure all parties involved in emergency planning are working and talking together.

However, adoption of available technology and integrated or interoperable communications remains the exception rather than the norm, and those that have succeeded remain largely independent of one another.

The United States is still years away from having emergency communications systems that can uniformly share information across geographic or organizational boundaries and take advantage of the technical, medical and public health resources in place across the nation that can be called up and used at the place and in the time of need.

A. CURRENT PUBLIC HEALTH AND MEDICAL COMMUNICATIONS SYSTEMS FREQUENTLY DO NOT ALLOW COMMUNICATION BETWEEN DIFFERENT INSTITUTIONS.

A variety of excellent communications systems have been developed within many individual public health and medical institutions across the country despite a limited amount of available resources. These systems have been supported through federal Centers for Disease Control (CDC) and Department of Health and Human Services (HHS) preparedness funding, Federal Communications Commission (FCC) and HHS support for telemedicine as well as state, local and private sources. These systems involve a variety of networks (internet, wireless, satellite, *e.g.*), devices (cell phones, radios, blackberries, satellite phones, *etc.*) and communications methods (*e.g.*, videoconferencing).

Organizationally, these systems are most often independent of one another throughout the nation. In some areas, communication links have been established between public health agencies and hospitals, and between competing and non-competing healthcare facilities for such uses as telemedicine or health alert networks. However, neighboring hospitals and health systems

commonly use completely different communications and information systems that do not allow communications between institutions.

Regionally, planning for an effective, coordinated approach to emergency response is a challenge given the number of federal, state and local programs that operate as independent, siloed operations. Incident management systems, which provide a unified approach to identifying and responding to major emergencies, are fully or partially in place in 35 states and in use with several federal agencies and numerous city and regional agencies. For example, through a series of regional emergency management information applications, San Diego has integrated medical and health components to provide seamless communications within the incident command structure and across the medical response system including public and private agencies across the region.

Despite these isolated achievements, much needs to be done. Where there are islands of success, no protocols or frameworks are in place to link these independent efforts.

- While hardware and technical capabilities may be available, establishing coordinated, interoperable systems *and* coordinated governmental utilization of these communications systems pose a challenge, especially when working within competing, or un-aligned, healthcare systems or across governmental boundaries.
- Technically, the communications systems used for many public health and medical facilities, while adequate for normal use, may be insufficient during emergencies when bandwidth is at a premium and demand is high.
- Current telecommunications systems usually operate on networks that do not facilitate interoperability, especially with proprietary features such as encryption software and peripheral devices. This, in turn, forecloses the kind of seamless communications networks that are desired and needed.
- Adding to the difficulty is the fact that, during declared emergencies, federal agencies and programs often move into an affected region with their own stand-alone communications systems, compounding the interoperability problem facing the public health and medical communities.

B. THERE IS NO COMPREHENSIVE SYSTEM TO TRACK PATIENTS, OR THEIR RECORDS.

Getting better information, to the right people, more quickly is essential to saving lives. Whether accessing electronic medical records, tracking patients, or retrieving bed availability from a database, effective patient care relies on linking applications over IP networks.

Tracking patients, beds, and connecting families with loved ones.

Patient tracking and bed inventory systems are essential components of a comprehensive emergency communications system. But the system today is ill-prepared to track patients as they are received, evacuated to other hospitals, their condition throughout the process, and whether family members have been notified.²⁶ Such systems are essential to facilitate family reunification, to track those people not hospitalized, and create victim registries.

Major disasters can highlight coordination gaps. During and after 9/11 and Katrina, thousands of families couldn't locate loved ones. They swamped communications networks and limited personnel with an avalanche of requests for assistance. Likewise, the lack of a patient tracking system for EMS, hospitals and the medical examiner was traumatic for families trying to identify what happened to their loved ones after the recent shooting incident at Virginia Tech, requiring families to call multiple hospitals before learning that their loved one had died – or thinking they had died before finding them in a hospital.

Some states and regions are putting such patient tracking systems in place. The federal government has tried to accelerate such adoption through the development and funding of national standards such as the Healthcare Information Technology Standards Panel (HITSP)²⁷, the National EMS Information System (NEMESIS)²⁸ and the encouragement of regional approaches to increasing access to electronic records through Regional Health Information Organizations.²⁹ While helpful, many of the existing bed and patient tracking systems are not linked to EMS and public safety. This substantially diminishes the utility of those systems in emergency response activities.

If UPS and Fed Ex can track millions of packages transiting around the globe at any one time, and travel web sites can track real-time availability of hotel beds and airplane seats using modern communication and IT systems, then it should be possible to track thousands of people and beds in a mass casualty event.

Nightmare of patient records in mass casualty situation.

Ensuring that health records can be accessed over any network is essential in a disaster situation. Hurricane Katrina highlighted the need for interoperable electronic health records as thousands of people were separated from their health care providers and their paper medical records were lost. Several groups (like the Business Roundtable, AARP, and others) have recommended that all

²⁶ http://www.washingtontechnology.com/print/20_20/27157-1.html

²⁷ See http://www.ansi.org/standards_activities/standards_boards_panels/hisb/hitsp.aspx?menuid=3

²⁸ See <http://www.nemesis.org/>

²⁹ Regional Health Information Organizations (RHIOs) are a group of organizations with a business stake in improving the quality, safety and efficiency of healthcare delivery. RHIOs are the building blocks of the proposed National Health Information Network (NHIN) initiative.

Americans should have access to a secure, uniform, interoperable health care record system. They suggest that the adoption of a uniform health information system can improve the patient experience, increase positive health outcomes, and realize significant savings. The Administration has made some progress, but there are key challenges that must be overcome in implementing such an overall system. For example, while large healthcare systems have made considerable progress in implementing such medical record systems, individual physician practices and small-to-midsized independent hospitals have been slower to make the expenditures necessary to deploy such systems.

C. PROMISING TELEMEDICINE TECHNOLOGIES REMAIN UNAVAILABLE FOR MOST EMERGENCY RESPONSE PURPOSES.

Telemedicine can help bring technology closer to the point of care, and the expert closer to the patient. In an emergency, health care workers need the ability to extend care to wherever the patient may be located, and to expand their own capacity for emergency response. Telemedicine technologies can break down the walls that often limit health care, bring experts into a hospital setting, or connecting doctors in the hospital to the patient. This virtual emergency room is critical in urban, suburban, and rural areas alike.

Telemedicine and telehealth technologies not only can extend modern health care to rural areas in which care may not be available, but it can also provide an efficient and potentially cost-effective care alternative to people suffering from debilitating conditions all across the country. But in an emergency, these technologies can be especially important because the patient may not be in the emergency room. For example, telemedicine technologies became essential for caring for Katrina evacuees. Sometime you cannot bring the patient to the expert, but you can bring the expert to the patient.

These technologies are uniquely suited for providing essential links between national resources and local responders; for bringing experts to the patient; and for enabling needed mobility and surge capacity. Yet telemedicine technologies are underutilized, unprepared, and unavailable for emergency response.

Through federal, state and private investments, over 200 telemedicine networks exist throughout the country currently linking over 3,000 medical and public health institutions. These networks allow medical services to be provided between large hospitals and smaller clinics and other facilities such as prisons, community centers and individual homes. Such networks can provide critical regional and national resources in times of emergency. The FCC's new pilot program provides over \$400 million in funding to link local networks on a regional or multi-state basis, creating a network-of-networks that may link 6,000 health care providers and provides access to this network to public health officials in instances of public health emergencies. It's a critical first step in helping achieve a vision of a digitally connected health care system.

However, telemedicine and telehealth systems remain largely outside of emergency communications and planning sectors, and, internally, they are unprepared for emergency response. Therefore, this rich opportunity remains unavailable for most emergency response purposes. In addition, the lack of national reimbursement for many types of telemedicine services inhibits the deployment of telemedicine.³⁰ The best way to ensure access to medical and public health expertise in times of emergency is to build and support communications systems that link such institutions and support their use for the day-to-day delivery of healthcare.

D. DISASTER COMMUNICATION PLANNING IS STILL NOT MEETING THE CHALLENGES.

Healthcare communications capabilities in an emergency are still uncoordinated, uninformed, and underfunded. Yet despite increased federal and state funding since 2001 and lessons learned following 9/11 and natural disasters like large-scale hurricanes and floods, disaster communication planning in the healthcare arena remains sporadic, disconnected and under-funded.

9/11 and Hurricanes Katrina and Rita demonstrated the need for redundant forms of communications, including IP networks, satellite networks, and portable wireless systems that are readily deployed when a disaster destroys the existing communications infrastructure. Efforts in the wake of the disasters have been focused on redundancy, secondary communications systems, power backup, and moving to more survivable IP based communication systems.

A communications failure on 9/11

On 9/11, America witnessed its first modern communications failure. Among the thousands of casualties on 9/11 was our communications infrastructure. According to the National Academies³¹, on 9/11:

- 95% of cell phone calls at 11 a.m. failed to get through
- the central office for the phone system cut off 300,000 landline phones
- television stations were knocked off the air
- police and fire department radios failed

By contrast, only 2% of Internet addresses remained off-line for an extended period. The Internet's inherent network efficiencies were on display on September 11th prompting the National

³⁰ Reimbursement for consultations via interactive videoconferencing or through the use of store-and-forward electronic communications continues to be an important issue at the national, state, and local levels. State reimbursement policies for Medicaid vary across the country. Local systems third party payers have individual practices for payment that vary from region to region and state to state. See: <http://www.atmeda.org/news/Reiumburement%20White%20paperfinal.pdf>

³¹ "The Internet Under Crisis Conditions: Learning from the Impact of September 11", National Research Council, available at <http://books.nap.edu/openbook.php?isbn=0309087023> and <http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=10569>

Academies of Science to find afterwards that the Internet held up better than other communications technologies on that fateful day.³² 9/11 demonstrated IP networks overall resilience in an emergency through its flexibility, redundant packet routing, and adaptability. But six years after 9/11, America has done too little to build on these lessons and to advance the use of IP networks in EMS, public health and other medical care facilities in order to avoid future communications failures.

Communications failures during Katrina:³³

Katrina created another catastrophic communications failure and highlighted once again how fragile and woefully outdated the emergency communications system in this country has become.

In the wake of Katrina:

- Nearly 3 million telephone lines were knocked down
- Wireline switching centers failed
- Thirty-eight 9-1-1 call centers went offline
- More than 1,000 cell sites went out of service
- Over 20 million phone calls did not go through the day after the hurricane hit
- An estimated 100 broadcast stations were knocked off the air

As a result, hundreds of thousands of people were stranded without news and emergency information, the ability to contact emergency responders, or communicate with their loved ones. More importantly, emergency responders and hospitals had difficulty communicating, coordinating with one another, and doing their jobs.³⁴ IP based voice communications once again played a critical role in the aftermath of Hurricane Katrina. As many communications systems failed, IP based voice communication networks kept hospitals communicating,³⁵ enabled the Louisiana Department of Health and Hospitals to flexibly set up voice lines,³⁶ and even allowed the

³² "The Internet Under Crisis Conditions: Learning from the Impact of September 11", National Research Council, available at <http://books.nap.edu/openbook.php?isbn=0309087023> and <http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=10569>

³³ FCC Chairman Martin statement to Katrina panel: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-264196A1.pdf

³⁴ The lack of reliable communications following Hurricane Katrina hindered both the operation and evacuation of Charity Hospital in New Orleans for several days. (Government Technology, January 26, 2006 News Report, <http://www.govtech.com/gt/98123>).

³⁵ Baton Rouge General Hospital, which still had a broadband connection after the hurricane but no long distance services, was able to set up a VoIP service to communicate with the outside world. The hospital ultimately used nine voice-over IP converters and wireless-enabled laptops with VoIP software installed for long distance communications and to set up a public branch exchange for communications within the hospital and sharing patient data. (Government Technology, Aug 31, 2005, *By Corey McKenna*, http://www.govtech.net/magazine/channel_story.php/96493)

³⁶ The Louisiana Department of Health and Hospitals (DHH) was the first organization to deploy a pre-configured VoIP kit to gain phone service and Internet access in the wake of Katrina. 3Com Corporation donated the VoIP equipment to emergency and government organizations to support their communications needs in the aftermath of Hurricane Katrina.

New Orleans Mayor to communicate with the President when every other form of communication failed.³⁷

As FCC Chairman Kevin Martin later told the Katrina panel³⁸, *“I would also like to see a greater use of IP technologies that are capable of changing and rerouting telecommunications traffic. In the event of a systems failure within the traditional network, such IP technologies would enable service to be restored more quickly and would provide the flexibility to initiate service at new locations chosen by consumers.”*

Each kit included a VoIP phone system with voice mail and auto attendant, which enabled DHH to provide all callers with recorded information on recovery efforts and to the ability to route calls to the appropriate emergency personnel. The phone system was networked so that calls could be transferred between multiple locations. (Source: 3Com Release 9/1/05)

³⁷ After the failure of basic landline phone service, and mobile and satellite phones (which eventually lost battery power and could not be recharged) left city officials without an ability to communicate with the outside world for 2 days after the storm, New Orleans city leaders downloaded softphones and relied virtually entirely on VoIP services for five days in the wake of the storm. The Mayor’s staff got eight VoIP lines up and running from the mayor’s emergency headquarters. When President Bush called Mayor Nagin on August 31 from Air Force One, they spoke on an IP based VoIP voice line. (Source: Wall Street Journal, 9/9/05, Communications Business Daily)

³⁸ http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-264196A1.pdf

E. IMPORTANT EMERGING THREAT IDENTIFICATION NETWORKS ARE NOT INTEGRATED INTO THE HEALTH COMMUNICATIONS SYSTEM.

Linking health information networks is key to reducing the time it takes to detect and respond to disease outbreaks, whether they are naturally occurring or the result of a bioterrorist attack. Yet today's public health system cannot protect people from existing or emerging mass health threats such as disease outbreaks (like a pandemic flu), food contamination, or a bioterrorist attack, without access to timely and comprehensive information.

Current emergency communications networks are almost always designed and deployed to respond to immediate threats. However, the parallel public health communications systems, such as the Health Alert Network, National Electronic Disease Surveillance System (NEDSS) and the USDA Food Emergency Response Network are geared to the identification, communication and response to emerging threats such as infections, food contamination and biological hazards. These emerging threat networks have not received the attention or funding of the immediate emergency response systems and lack the communications capabilities to become reliable, strong components of the nation's defense against threats to the American population.

- **Linking Systems.** Linking data and systems can help create a better barometer to improve diagnosis and identification of outbreaks and potential bioterrorism incidents. 9-1-1 data may provide the diagnostic clues that may indicate an unusual infectious disease outbreak so that public health authorities can be alerted. Likewise when EMS data can be integrated and aggregated, it can create a powerful early detection system.

Linking the Centers for Disease Control and state/local health departments with EMS may be critical to the identification and rapid response to a widespread viral outbreak such as an influenza pandemic or bioterrorism event such as release of anthrax. One recent study found that twelve states lack an electronic disease surveillance system that can collect and integrate data from multiple sources, is compatible with CDC's national system, and is accessible electronically via the Internet.³⁹ Maintaining separate stove-piped systems for public health and emergency response that cannot share information presents a dangerous situation that at best could lead to harmful delays, and at worst could unnecessarily expose the public to avoidable threats.

- **Improving timeliness of data.** The events of 9/11 and subsequent anthrax attacks highlighted the need to improve the timeliness and predictive abilities of public health

³⁹ 38 state plus DC have a disease surveillance system which states track health that is compatible with CDC's national system, including integrating data threats in a manner compatible with the standards of CDC's National from multiple sources, using electronic lab reporting, and using an Electronic Disease Surveillance System (NEDSS).
<http://healthyamericans.org/reports/bioterror07/BioTerrorReport2007.pdf>

surveillance to better detect possible outbreaks. However, the timeliness for most current public health surveillance systems is not satisfactory for effective disease control, and must be improved. In spite of the high value of diagnosis for syndromic surveillance, most hospitals cannot send diagnosis data soon enough for timely, population-based syndromic surveillance. Rather than waiting for a diagnosis, the use of the patient's "chief complaint," when appropriately categorized, can speed early detection.⁴⁰

- **Using real-time emergency data.** Monitoring 9-1-1 data can allow earlier detection of outbreaks, and can be an integral component of a broader real-time syndromic surveillance system.⁴¹ People who may become ill may call 9-1-1 for assistance. As a result, an increase in health-related calls to 9-1-1 may provide a sign that an epidemic is emerging -- prompting public health officials to conduct an investigation. In addition, many 9-1-1 agencies use CAD systems to help manage the call, quickly gather information, triage calls into predefined categories, and store information in accessible databases. Not only is the data collected in real time, but it frequently includes the precise patient location, allowing data to be mapped on an ongoing basis. As soon as the 9-1-1 call has been completed, syndromic surveillance systems could analyze this information -- looking for atypical patterns by comparing incoming data to historical patterns. When a trigger alerts, automatic notification can be sent to designated officials in public health, EMS and 9-1-1.

The potential for early detection of health hazards is significant when datasets are linked to other elements of the health care system as part of regular, daily operational procedures. However, linking these disparate systems requires more effective communications integration, privacy safeguards, and robust data security.

F. THE HEALTH CARE SECTOR LAGS IN ITS IT TRANSITION.

IP-based communications technologies have as much potential to transform hospitals and healthcare delivery in the 21st century as ATMs and electronic banking did for financial services in the 20th century. IP communications have transformed almost every aspect of our lives and every sector of our economy. Anyone with an ATM card has near instant access to cash around the clock and around the globe; we communicate with billions of emails sent from millions of interoperable devices around the globe everyday; Fed Ex and UPS can locate and deliver millions of packages a day transiting around the globe.

⁴⁰ However, surveillance is hampered by the variability of free text "chief complaint" data.

⁴¹ See <http://www.cdc.gov/EPO/dphsi/syndromic.htm>

Americans now use IP networks for collaboration, communications, and a dizzying array of new capabilities. The glaring exception, however, is our EMS and health care systems.

According to an American Medical Association survey, while 96 percent of physicians use computers in their offices, and 84 percent have a computer network in place, these computers are often not interconnected with other resources in the health care system. Only 35 percent of physicians report a connection with a hospital or laboratory.⁴² This apparent isolation of health care IT usage limits efficiency, communication and productivity.

As a result, health care costs continue to be far higher in the United States than in any other advanced nation, whether measured in total dollars spent, as a percentage of the economy, or on a per capita basis.⁴³ Health care IT investments could help slow the rising costs of health care. However, as compared to other countries, the United States invests the least per capita in Health Information Technology.⁴⁴ By contrast as of 2005, the United Kingdom's public investment per capita in Health Information Technology (HIT) was nearly 450 times that of the United States.⁴⁵

Key systems include:

- **Electronic Health Record (EHR).** EHR systems provides a doctor with real-time access to patient information, complete longitudinal record of care, and can help provide capabilities if paper records get lost or are otherwise inaccessible in a disaster.
- **Clinical Decision Support (CDS).** Clinical decision support systems can provide doctors with state-of-the-art medical knowledge at the point of care as well as real-time diagnostic and treatment recommendations – helping to improve efficiency, for example, by reducing redundant lab tests.
- **Computerized Physician Order Entry (CPOE).** CPOE systems allow physicians and other providers to enter orders into a computer system – minimizing handwriting and other communication errors and potentially helping to reduce errors in drug prescribing and dosing. If all hospitals had Computerized Physician Order Entry, RAND estimates that around 200,000 adverse drug events could be eliminated each year, at an annual

⁴² Chin T. More than a third of medical practices are electronically connected. American Medical News 2002; January

⁴³ Health care costs are far higher in the United States than in any other advanced nation, and are rising significantly faster than the overall economy or personal incomes for more than 40 years. See "The High Cost of Health Care," New York Times Editorial, November 25, 2007.

⁴⁴ J. Cylus and G. F. Anderson, Multinational Comparisons of Health Systems Data, 2006, The Commonwealth Fund, May 2007
http://www.commonwealthfund.org/usr_doc/Cylus_multinationalcomparisonshtsysdata2006_chartbook_972.pdf?section=4039

⁴⁵ Ibid.

savings of about \$1 billion.⁴⁶ But today, only 15 percent of hospitals have deployed this new technology.⁴⁷

Telehealth/Telemedicine. Telemedicine and telehealth technologies can help extend modern health care to rural areas, provide an efficient and potentially cost-effective care alternative for home-bound patients, enable remote monitoring of patients, allow remote consultations, and facilitate better communications between EMTs in ambulances and emergency room physicians.

Despite having the world's best doctors, and hospitals, lack of modern communications and IT systems has created woeful inefficiency, a stifling bureaucracy, and enough mistakes to make medical errors the third-leading cause of death, behind heart disease and cancer.⁴⁸ These failings could be exacerbated when the next disaster hits. However if we act quickly and decisively, there is a potential that thousands of lives, and billions of dollars can be saved in the process. But it takes a more modern communications infrastructure.

G. THE FUNDAMENTAL NEED FOR IP-BASED NETWORKING REMAINS UNMET.

There is a fundamental need to modernize and invest in interoperable, survivable, standards-based, broadband systems and networks that can integrate existing and future networks. Studies suggest that the overall business case for Health care IT depends on the degree to which health data can be efficiently exchanged between different computer systems.⁴⁹ Without this networking capability, health data cannot follow patients as they obtain care from different providers, and responders can't communicate throughout the system.

The road to interoperability is paved with broadband and enabled by a number of factors. There is now a growing consensus that taking advantage of advances in information and communications technologies can mean a more feature-rich IP-enabled emergency response system. Most business and government agencies are already transitioning to IP-based networks because they are more efficient, cost-effective, secure, and reliable – providing new flexibility that was never before

⁴⁶ http://www.rand.org/pubs/research_briefs/RB9136/index1.html

⁴⁷ E. Poon, et. al. "Overcoming Barriers to Adopting And Implementing Computerized Physician Order Entry Systems in U.S. Hospitals" *Health Affairs*, July/August 2004: 184-189.

⁴⁸ The JOURNAL of the AMERICAN MEDICAL ASSOCIATION (JAMA) Vol 284, No 4, July 26th 2000 article written by Dr Barbara Starfield, MD, MPH, of the Johns Hopkins School of Hygiene and Public Health, indicates medical errors are the third leading cause of death in the United States.

⁴⁹ Walker J, Pan E, Johnston D, Adler-Milstein J, Bates D, Middleton B. The value of health care information exchange and interoperability. *Health Affairs*. 2005. Wang S, Middleton B, Prosser L, et al. A cost-benefit analysis of electronic medical records in primary care. *Am J Med*. 2003;114:397-403. and RAND http://www.rand.org/pubs/working_papers/2005/RAND_WR313.pdf

possible. These IP-based networks can enable major advances in the ability of emergency responders, 9-1-1 calltakers, medical and public health agencies to communicate more efficiently and effectively. The ability to send and receive critical information to, from and beyond emergency services networks, makes possible a set of potentially life-saving advances in disaster scenarios. These networks have the potential to empower patients with information, and doctors and nurses with the tools to improve the quality of care.

Unless there is purposeful attention paid to infrastructure requirements at the local, regional, and national level, it is unlikely that piecemeal technology adoption will result in the connected infrastructure necessary to realize the quality of care and economic efficiency gains promised by IT.

III. WHERE WE NEED TO BE -- A DIGITAL DIAGNOSIS

The full promise and potential of modern IT and enterprise Internet Protocol (IP) technologies have yet to reach health care and EMS. Information technology and IP-based networks are necessary elements of an adaptive, flexible, and responsive health system information communications network. Yet the health care sector is under-utilizing modern communication technologies; they are getting left behind, and the lack of IP-based networks and interoperable systems underlie this fundamental challenge.

Too often today, EMS responders, doctors and nurses must practice 21st century medicine with 20th century communications technology. The health care sector, which has yet to see the same productivity improvements that other sectors have seen from the move to online systems, still operates primarily with paper-based records – leaving the nation’s health care system strangled with high paperwork costs, administrative inefficiencies, cumbersome communications, and preventable medical errors.⁵⁰ If we are to unleash the full potential of our health and safety workers, then the information on a patient that resides inside a doctor's office must be capable of being sent across the network to hospitals, laboratories, specialists, insurers, and researchers. Enabling this transformation requires that patients, doctors, and administrators can manage their information securely and trust that sensitive medical information will be protected.

Like the arteries of a digital health care circulatory system, IP networks can pump live-saving information throughout the system and enable information flows to every extremity.

IP Networks are a basic building block of this digitally connected health care system. But to achieve their full potential, these IP networks must bridge all parts of the emergency communications chain – to create a seamless world of communications. Like the arteries of a digital health care circulatory system, IP networks can pump live-saving information throughout the system and enable information flows to every extremity.

⁵⁰ The Institute of Medicine estimates that between 44,000 and 98,000 Americans die each year from medical errors. Many more die or have permanent disability because of inappropriate treatments, mistreatments, or missed treatments in ambulatory settings. The current paper based system limits the ability to consolidate and distribute comprehensive patient information to those delivering care, and creates the potential of medical errors based on misinterpretation of patient details or delay in updating/relaying new information. See http://www.abovenet.com/newsandevents/events/docs/healthcare_webinar_abovenet_april17.pdf

1. THE EMERGING VISION OF IP'S POSSIBILITIES FOR EMERGENCY AND HEALTH CARE SYSTEMS COMMUNICATIONS

A. THE PROFOUND POTENTIAL OF AN INTEROPERABLE IP BASED EMERGENCY COMMUNICATION NETWORK OF NETWORKS.

With a commitment to planning, investment, and integration, IP networks can bring extraordinary improvements in communications. The potential for human benefit is profound. For example:

- **For 9-1-1 caller information.** Automatic crash notification technology could alert call-takers to a high-speed crash where the driver is incapacitated. A 9-1-1 caller could relay picture or video of an injured child taken at the scene with a cell phone.
- **For call-taker capability.** In a mass casualty event, or power or network failure, 9-1-1 calls can be received in overflow locations. Dispatchers can route patients to hospitals based on bed-availability.
- **For EMS patient monitoring.** Real-time biometry data and video enables monitoring of patients from the incident scene and on the way to the hospital utilizing a variety of telemetry tools. If a patient can't be moved immediately, remote consultation and diagnosis shortens the time to treatment, potentially saving lives and shortening recovery time.
- **For transport communications.** Cameras inside ambulances capture video of situations and patients to send to emergency room doctors for assessment, consultation, and preparation. As a result, an emergency room doctor's knowledge of the injury enables quicker and possibly more accurate treatment.
- **For emergency manager communications.** Emergency managers can more effectively respond to mass casualty events because event monitoring systems provide real-time maps showing 9-1-1 caller locations, available EMS resources, deployed resources, patient status, and disposition.
- **For doctor effectiveness.** Doctors are able to access electronic patient records (regardless of where those records are located), physician order entry systems (eliminating illegible handwriting that can lead to medical mistakes), and e-prescribing systems. As a result, doctors are able to avoid dangerous drug interactions by accessing the information about the drugs already prescribed.
- **For hospitals efficiency.** Hospitals are able to utilize a single network for voice, video, and data – delivering new capabilities, mobility, and savings. Hospitals could connect with remote experts who in an emergency provide surge capacity, remote patient monitoring, medical education and mentoring, and the delivery of basic health information.
- **For family pocketbooks.** By enabling broader health IT transformation and savings, the average family is projected to save thousands of dollars a year in health costs.

- **For remote patient monitoring and treatment.** At home, patients using broadband connections can check their pulse, screen their vision, monitor blood pressure, take their temperature, record glucose levels, and send this information in real-time to medical staff.
- **For outbreak detection.** Health officials could identify emerging health care trends or outbreaks sooner by monitoring, for example, types of medicines being prescribed, 9-1-1 call meta-data, or reported symptoms as people enter the health care system.
- **For life-saving research.** Researchers could sift through vast amounts of patient data to accelerate adoption of promising new treatments, or to spot dangerous drugs faster.
- **For triage center communications.** Hospitals that need to temporarily erect facilities for a triage staging area in an emergency could utilize wireless networks to establish remote communications and access all of their in-hospital application and services.
- **For communications providers.** Communications providers could manage networks to reduce costs, help eliminate single points of failure, extend capabilities, enable EMS, medical and public health to take advantage of private sector innovations, and ensure more robust communications in an emergency.
- **For statewide and regional system integration and coordination.** Emergency medical and health communications centers can integrate and coordinate the day-to-day needs of EMS, hospital, public health and related providers. These centers assure that appropriate resources are dispatched, that these responders are linked to medical overseers by the most expeditious means and to public health colleagues as needed for response and surveillance, and provide the ability to ramp up for major multiple casualty incidents.

B. EVER-GROWING RECOGNITION OF THE NEED TO MOVE TOWARD IP

Throughout EMS, medical, and public health facilities, there is a widely recognized need to extend communications capabilities beyond voice – to converge voice, video, and data and a plethora of applications using common networking technologies. Only then can communications systems used by emergency medical and public health care facilities be integrated with existing and future emergency communications networks.

By recognizing the power of IP-based communications technology – common in large and small businesses for improving communications and information sharing – EMS and public health entities can unite disparate users, adopt enhanced and secure applications that use open standards, and facilitate interoperability through a “network of networks” strategy.

There is growing agreement around this need, and a common vision is arising for the use of integrated IP networks.

- For public safety, for example, Silicon Flatirons has recommended the “development of a next generation network (“NGN”) for public safety ... [which] should be broadband,

Internet Protocol (IP)-based and capable of handling voice, data, image, video, and multi-media content.”⁵¹

- The FCC’s Network Reliability and Interoperability Council VII, Focus Group 1D, has recommended a “single, interconnected Internet Protocol system should be used for all emergency communications, connecting a wide variety of agency-run and public networks, both wireline and wireless.”⁵²
- For Hospitals, the Markle Foundation has recommended development of nationwide health information exchange built on common Internet protocol networks through a “Common Framework model ... [that] achieves a health information sharing environment with a decentralized “network of networks” approach based on common, open technical and policy standards and enforcement.”⁵³
- ComCare’s E-Safety vision is a “unified emergency Web services information architecture that ties together the various data systems used by law enforcement, fire, emergency management, public health, emergency medical, transportation, and homeland security and others” using Internet Protocol networks.⁵⁴

These progressive approaches need to be supported, linked and integrated. To make these visions a reality, hospitals and EMS providers need sufficient bandwidth – not just for day-to-day operations, but for surge capacity. These networks must be able to grow as technologies change, utilize common off-the-shelf technologies, and take advantage of the benefits that convergence brings.

⁵¹ Toward A Next Generation Network For Public Safety Communications, by Dale N. Hatfield and Philip J. Weiser, Silicon Flatirons Program, University of Colorado School of Law, May 17, 2007. At: http://www.silicon-flatirons.org/conferences/Hatfield_Weiser_PublicSafetyCommunications.pdf

⁵² http://www.nric.org/meetings/docs/meeting_20051216/FG1D_Dec%2005_Final%20Report.pdf

⁵³ The Connecting for Health Common Framework: Overview and Principles, Markle Foundation, <http://www.connectingforhealth.org/commonframework/docs/Overview.pdf>

⁵⁴ ComCare E-vision at: <http://www.comcare.org/ESafetyVision.html>

C. THE EMERGING VISION OF INTEROPERABLE IP-BASED NETWORKS FOR OUR EMS SYSTEMS.

The Advisory Committee set out to outline “where we need to be.” In an ideal world, EMS responders need to be able to connect anytime, from anywhere, with any device, regardless of the access method.

Below is the vision for where we need to head:

- ***Integrating and ensuring geographic interoperability with other public safety networks.*** Communications networks must be geographically integrated and based on functional needs enabling routine, reliable communications among EMS, fire, law enforcement, and other public safety agencies. Integrating EMS helps facilitate a more effective, coordinated, and cohesive response during both routine and large scale operations, and helps ensure optimal utilization of resources over large geographic regions.
- ***Ensuring wireless compatibility without gaps.*** Well-integrated radio, cellular, satellite, and other communications systems can provide robust, secure, and redundant service for both emergency and EMS-based community health service purposes.
- ***Integrating EMS with 9-1-1 dispatchers and calltakers.*** 9-1-1 calltakers and dispatchers must become an integrated node in an IP-based system of emergency broadband networks. Public safety answering points need the ability to integrate voice, caller geographic location, automatic vehicle location systems, vehicular automatic crash notification (ACN) systems, as well as user generated voice, text, and images into emergency response systems.
- ***Enabling EMS event monitoring systems.*** Every agency or facility with an EMS responsibility should be linked with an “EMS event and resource monitoring system”. These systems generally consist of a computer, mobile data unit (MDU), and/or personal data assistant (PDA) that enables access to overall data on activities in a general geographic area of responsibility. An icon on a map can mark all EMS and related resources including details about the availability of those resources. As soon as a PSAP enters information into a system, the screen can show the EMS dispatch by type (e.g. “cardiac.”) It enables easy one-stop access to real-time information on the type of call, patient(s) status, and disposition. Hospital staff, airmedical responders, and other EMS resources use the system to anticipate their involvement in an EMS event and/or to call in additional resources. It can be centrally coordinated by a regional or statewide emergency medical communications center.

- ***Enabling smarter decision-making in the field and better preparation at the receiving facility.*** Robust EMS communications systems can help make available on-line medical resources and enable transmission of relevant real-time patient data to a receiving medical facility. Such capabilities potentially allow medical decisions of greater complexity to be made in the field and permit a greater degree of preparation at the receiving facility – saving time, improving outcomes, and potentially saving lives.
- ***Developing patient records data earlier in the process.*** Communications systems enable data collection and facilitate commencement of patients’ medical records earlier in the course of their injuries/illnesses.
- ***Transmitting and receiving real-time patient data.*** Telemedicine and electronic patient monitoring and reporting technologies fully support emergency and EMS-based community health service operations.

Dispatching Digital Ambulances.

In Texas, they put their digital dreams on the road. The DREAMS (Disaster Relief and Emergency Medical Services) effort links medics in the field with doctors in the emergency room. This digital EMS system includes a high-tech interactive digital ambulance. The program develops and tests a variety of telemedicine and telecommunications technologies that feature real-time remote monitoring of patients who are in locations where hospital care is not readily available. These technologies are being designed to offer emergency medical care in rural areas, on the battlefield, and in disaster areas.

The program has resulted in numerous accomplishments, discoveries, and improvements. These digital ambulances – capable of communicating with voice, video, or text -- can deliver high-quality video and real-time patient data to the remote ER physician, greatly enhancing the physician's situational awareness in the ambulance to support the medical decision-making process. The ambulance hardware integrates communications systems with commercial, off-the-shelf medical and computer devices such as digital video cameras, GPS navigation systems, rugged laptops, signature pads, bar-code scanners, vital signs monitors, 12-lead EKGs, portable blood analyzers, ultrasounds and more. The system allows the ER physician to receive video, audio, real-time medical data, and text from the ambulance and transmit audio, text, and video annotations to the ambulance. The ER physician can remotely control the multiple video cameras in the ambulance to pan, tilt, or zoom to view the patient's injuries. With colored, on-screen markers, the physician can coach the EMTs through treatment that extends beyond normal EMS protocols. To make it all possible, they combine multiple low-bandwidth communications systems like cell phones, satellite phones, and data radios in order to produce enough bandwidth to send things like video.

D. THE EMERGING VISION OF INTEROPERABILITY IN OUR HEALTH CARE NETWORK.

America is still just in the beginning stages of an incredible IP revolution. Most experts believe we have seen only a fraction of its potential, and that the best is still ahead. On the horizon are a host of new data intensive network applications that can help make Americans more healthy, safe, and secure. Innovation in networking technology is essential to helping unlock these extraordinary new opportunities.

From prescriptions to medical histories and life-critical hospital charts, patient care today relies on an increasingly antiquated, costly, and error-prone system of pen-and-paper notations. The potential of information technology to reduce the number of medical errors, reduce costs, and improve patient care is enormous.

Some hospitals are striving to become largely paperless and filmless – by making patient records, lab results, clinical decision support, prescription systems, physician order entry, and health information exchanges accessible over the network. Radiology can complete a series of X-rays and make them immediately available to an entire team of orthopedic surgeons, instead of first waiting for the film to develop and then hand-delivering them to every necessary surgeon. It reduces paperwork bottlenecks, increases staff productivity, and helps cut down on the amount of time a patient generally waits for healthcare decisions.

There is broad national agreement that we need a national health information communications network. The JAC heard testimony from leaders of the successful Health Emergency Response Data System (HERDS) network, a New York based health information exchange application, recommending that we need a national health information communications network infrastructure – with a national plan, standardization, and a funding process.⁵⁵

E. UNIVERSAL BROADBAND'S ROLE IN THIS VISION FOR THE FUTURE.

Ensuring that every American has access to broadband service throughout the country is also an essential health care communications imperative. Broadband access can mean access to telemedicine applications, health information, and the ability of health care workers to work remotely in an emergency.

⁵⁵ Presenters included Mary Ellen Hennessy, Deputy Director, Division of Primary and Acute Care Services, New York State Department of Health and Ivan J. Gotham, Ph.D., Director, Bureau Healthcom Network Systems Management, New York State Department of Health, <http://www.fcc.gov/pshs/docs/advisory/jac/ppt/nysdoh102907.ppt>

Telemedicine and telehealth can:

- Extend the continuum of patient care beyond the “walls” of a hospital
- Make possible remote access to clinical services for patients
- Enable distance education, disease management, consumer outreach
- Provide significantly improved, cost-effective access to quality healthcare

Broadband also enables a host of remote patient monitoring technologies. Whether patient procrastination, age, isolation, or distance, sometimes patients do not stay in regular medical contact and do not seek appropriate medical care until there is a medical emergency. Innovative home health-care monitoring devices and systems now allow doctors to remotely monitor high-risk patients and their blood-pressure, pulse, and other measures over broadband. Progress can be monitored and intervention made before a medical crisis occurs. These technologies can avoid expensive house calls, provide real-time feedback, and allow resources to be focused on the most urgent cases. Some are even using video over broadband for regular video consults.

Telemedicine is not just about connecting health care to people at home. Every hospital, clinic, doctor’s office, and medical facility should have also affordable access to broadband. Broadband access can help level the playing field between urban and rural medical capabilities. With broadband, training becomes more accessible; second opinions don’t require long car trips for patients; and live-saving technologies can often be extended to wherever the patient may be located.

As FCC Chairman Kevin Martin correctly notes⁵⁶, *“In order to receive the benefits of telemedicine, electronic health care records, and other healthcare benefits, health providers must have access to underlying broadband infrastructure. Without this underlying infrastructure, efforts to implement these advances in health care cannot succeed.”*

2. THE NUTS AND BOLTS OF IP NETWORKS: UNDERSTANDING THE ATTRIBUTES AND PROMISE OF IP.

IP networks, common in Fortune 500 business, are essential for enabling a converged IP network of networks for emergency communications. JAC heard testimony from a number of witnesses who outlined some of the key benefits of integrating and utilizing IP-based communications systems. Compared to traditional analog voice communications systems, IP networks offer a number of inherent advantages and capabilities that are essential for improving both EMS and health care emergency communications.

⁵⁶ http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-07-198A2.pdf

A. IP NETWORK ATTRIBUTES:

- **Interoperability.** IP networks can enable interoperability regardless of the transmission layer (leased line, DSL, WiFi, WiMax, Mesh, Satellite, Microwave, P25, Cellular). Technologies like Radio over IP can enable interoperability with legacy systems.
- **Affordability.** Converging voice, video, and data onto a single network not only helps hospitals become better prepared in a disaster, it also allows health care institutions to harness communications cost savings of up to 70 percent.⁵⁷ Importantly, using IP networks also enables broader health care IT transformation, which is estimated to save the health sector between \$77 billion and \$165 billion a year and deliver annual savings to the average family of about \$2,200.
- **Converge-ability.** Utilizing voice, video, and data applications across a single converged managed network. Utilizing Radio over IP (RoIP) in the field, and the related IP Multimedia Subsystems (IMS) in the enterprise.
- **Compatibility.** By utilizing common open protocols and standards, IP networks and technologies like Radio over IP that utilize VoIP in their core can bridge the gap between legacy and leading-edge technologies, by utilizing—rather than stranding—prior investments.
- **Continuity** – Ability to use a variety of alternate IP-based communications networks, to use voice and data applications from any available broadband connection in an emergency, and to utilize a variety of flexible network configurations, and bandwidth allocation services.
- **Resiliency.** Utilizing IP network’s inherent distributed architecture to enable multiple packet pathways between any two points, eliminating many single points of failure, and enabling the network to automatically and efficiently work around failures.
- **Agility.** An integrated, agile networking platform, capable of utilizing common off-the-shelf IP-based applications and services, is necessary for delivering dynamic IT applications for healthcare organizations. Over IP, Hospitals and EMS workers can connect to Regional Health Information Networks and a variety of applications for electronic medical records, e-prescribing, patient tracking, and syndromic surveillance to name just a few.
- **Mobility.** Extending communications, patient data, telemetry and rich media to and from the point of care. In the hospital, integrating IT systems on handhelds, converging fixed and wireless networks using IMS, boosting mobility and health care productivity.
- **Accessibility.** IP VPNs and other technologies can enable remote access to voice and data applications which can be essential in enabling telemedicine, communicating in the event of a major quarantine, and extending the productive hours of the day.
- **Scalability.** EMS and health facilities must be able to grow capacity as needs change over time, but also to add surge capacity in a mass casualty or other emergency. Managed IP networks better assure that capacity is available for critical applications when that capacity is required –

⁵⁷ <http://www.globalcrossing.com/news/2005/march/07.aspx>

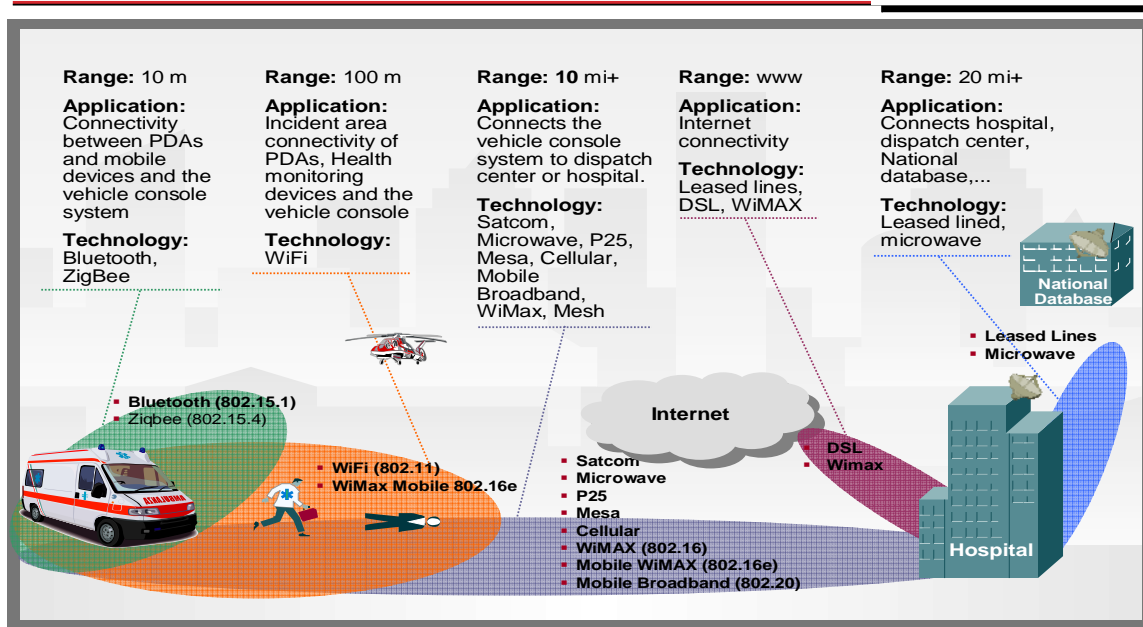
enabling a guarantee of a certain level of network performance – especially in times of network congestion.

- **Extendibility.** IP networks enable care to be extended through telemedicine to nearly any broadband-capable location, and can extend capabilities to nearly any device, application, or service connected to the Internet.
- **Secure ability.** Managed IP networks and security applications that protect traffic and systems against unauthorized intrusion and malicious attack are a linchpin for protecting privacy and enabling end-to-end security management as required to meet HIPAA regulations, and to protect public safety communications.⁵⁸

B. NEXT GENERATION IP PLATFORMS FOR EMERGENCY MEDICAL AND PUBLIC HEALTH COMMUNICATIONS NETWORKS

There are a variety of different communications capabilities used by emergency medical responders, which offer different communications ranges and speeds. Different technologies have been deployed based on geographic constraints and existing infrastructure – often leading to stove-piped solutions. What is needed are next generation networks that can span these systems.

Emergency Medical Services



Emergency Medical and Public Healthcare Communications 5 Source: Harris Corporation

⁵⁸ The Health Insurance Portability and Accountability Act (HIPAA) of 1996 requires end-to-end encryption of data traveling between medical locations, thus encouraging the use of customer premises-based VPNs in that vertical.

The transition to IP-based networks would also set the stage for large-scale converged systems rollouts. However, to utilize these capabilities, IP networks must be scalable, capable of prioritizing emergency traffic, and must be managed to minimize latency and enable real-time converged communications. The chart below highlights some of the network considerations for enabling these applications.

Converged Network Needs and Capabilities

Application/Use	Needs	Network Consideration
<p><u>Voice</u></p> <p>For:</p> <ul style="list-style-type: none"> ○ Consultation/instructions between physician, medic and patient ○ 9-1-1 incoming calls ○ Communication within hospital enterprise and with public 	<p>Between:</p> <ul style="list-style-type: none"> ○ Public and 9-1-1 ○ 9-1-1 dispatch and EMS ○ EMS and public safety ○ Jurisdictions ○ EMS and hospital ○ With aerial transport ○ Hospital to hospital ○ With public 	<ul style="list-style-type: none"> ○ Network must support bi-directional, full duplex voice (voice over IP - VoIP). ○ Network needs QoS to support real-time communication (low latency/jitter) ○ Perceived voice delay must be minimized
<p><u>Data</u></p> <p>Store & forward video/images, streaming biometric data, medical history, patient tracking, etc.</p>	<p>For:</p> <ul style="list-style-type: none"> ○ Electronic medical records ○ Patient tracking ○ E-prescribing ○ Connecting with Regional Health Information Networks ○ EMS transmission of real-time, multi-vital sign telemetry (pulse, blood pressure, oxygen saturation, EKG, capnography), ultra-sound images, or other high definition video. ○ Hospital/lab transmission of high definition X-rays, MRI, 3D Catscans, Ultrasound video, X-ray fluoroscopy, remote diagnostics ○ Communicating with providers, patients, insurers ○ Biometry monitoring devices 	<p>File transfer can tolerate longer latency/jitter. In general data that can be passed tolerating delay or buffer time has less stringent requirements for the network.</p>
<p><u>Media-Rich Communication</u></p> <p>Video for observing an accident scene, patient or for physician – patient/medic interaction</p>	<p>Enables:</p> <ul style="list-style-type: none"> ○ On-scene video ○ Telemedicine ○ Telepresence ○ Consultation ○ Collaboration 	<p>Video resolution and frame rate and quality are linked to available bandwidth, latency and jitter. High-resolution video/images may be sent as store and forward (not real time).</p>

3. PUTTING THE CAPABILITIES OF IP INTO ACTION.

A. IP'S ROLE IN HOSPITAL NETWORK CONVERGENCE.

Converging voice, video, and data onto a single network not only helps hospitals become better prepared in a disaster, it also allows health care institutions to harness telecommunications cost savings of up to 70 percent,⁵⁹ integrate disparate applications in entirely new ways, and boost productivity by as much as 15%.⁶⁰ Convergence is so well-accepted in the private sector that by the end of 2006, an estimated 21% of enterprise phone lines were served by converged IP networks.⁶¹ In fact, the convergence of voice and data is the fastest-growing technology segment in the enterprise communication sector.⁶²

However, the health care sector is significantly lagging other industries in network convergence. While the business sector is increasingly adopting a wide array of converged IP data and voice solutions, there is a troubling higher than average lack of adoption of converged IP technologies in the health care sector. For example, 43% of health care IT managers say they have not yet deployed a converged IP network – significantly higher than the rest of businesses in America (32%). Health care is also the least inclined sector to plan on converging network capabilities any time soon. Fewer than half of health care respondents indicate an intent to deploy or expand current converged deployments over the next 18 months.⁶³ Of those that do plan to invest in convergence, 26% of respondents from the health care sector said disaster recovery planning is a key driver for implementation of a converged network.

Because the health care sector is behind in its adoption of converged IP technologies, they are lagging in other key IP technologies. For example, the Health Care segment lags other US industries in the adoption of both VoIP and IP VPN solutions, with 23% and 32% adoption rates, respectively, vs. 33% and 37% among US businesses, respectively.⁶⁴ Although VoIP can provide

⁵⁹ <http://www.globalcrossing.com/news/2005/march/07.aspx>

⁶⁰ Avaya estimates businesses can achieve an estimated 15% increase in personal productivity through smarter communications technologies like VoIP.

⁶¹ 14.7 million enterprise IP telephony lines, according to Gartner research. Business Week, July 10, 2006, CEO Guide to Technology, By Rachael King, "Internet Telephony: Coming in Clear"

⁶² According to the Telecommunications Industry Association, computer-telephony integration (CTI) was the fastest-growing component of the enterprise market in 2005 with a 10.5 percent increase to \$5.7 billion. Videoconferencing equipment, which rose 10 percent to \$825 million, came in a close second.

⁶³ Ibid

⁶⁴ In-Stat Health Care Sector analysis: <http://www.instat.com/abstract.asp?id=224&SKU=IN0603082DDHC>

essential cost savings, the lag in adoption of IP VPNs is especially troubling because they can be essential for providing mobility, remote access while ensuring data integrity, and security in accordance with HIPAA.

Technologies that Enable Convergence:

While IP networks can enable these benefits, not all IP networks are built the same. Converged healthcare, clinical, business, and EMS applications, can only perform well on well-designed managed networks with sufficient bandwidth to enable reliable, secure, application-aware networking. Bandwidth needs are likely to expand as networks move from handling simple data, to handling richer media like converged voice, video, remote diagnostics, high-definition imaging, and even tele-presence technologies. As digital images become clearer, their files become larger.

As bandwidth needs grow, so too will the use of real-time communications applications that require steady streams of bandwidth. However, converged networks create unique network management challenges. Many of the emerging real-time life-saving technologies (remote surgical procedures, tele-presence networks, and even converged voice and video) require very consistent and predictable handling of traffic by the network. Packet loss, delays in packet transmission (“latency”), and inconsistent packet delivery interval times (“jitter”) have significant impact on a variety of emerging real-time health care applications.

To reduce latency and jitter, managed networks are generally needed that can prioritize real-time (and potentially life-saving) communications ahead of packets used for file transfer and e-mail. IP Multimedia Subsystem technology is a network technology designed specifically to overcome these convergence challenges.

IP Multimedia Subsystem – converging VoIP, video, data and mobility

One of the key technologies that will help enable network convergence is called IP Multimedia Subsystem (IMS) -- a next generation managed network architecture which enables the convergence of voice, video, and data over both wired and wireless networks. IMS enables voice communications over an IP network utilizing VoIP’s Session Initiation Protocol (SIP) -- providing one common signaling protocol for all the infrastructure components, as it establishes and then controls all sessions – whether voice or multimedia data.

IMS architecture has some important advantages for health enterprises because it can speed convergence and integrate a variety of access methods and applications. IMS enables a common set of features and functionality across a variety of devices (whether a computer, mobile phone, PDA, or a traditional telephone set), over wired and wireless networks, and without regard to the physical location of the user. It means that rather than having three devices -- one to access a wireless network, another to access a wireline network and its services, and perhaps a third for a specific kind of emergency or private communications capability -- an IMS-enabled network allows any device to access a variety of common services.

IMS convergence enables:

- **Access independence** -- Access from a mobile device, computer, traditional phone, stationary device, or PDA
- **Global mobility** – Access from wherever a user happens to be
- **Consistent experience** – Consistency across wireline, wireless, fixed or mobile access
- **Seamless transitions** – Ability to seamlessly move across access networks and not drop the call. For example, communications can be *mobile* when a doctor is en-route to the hospital, and then through an unnoticeable network transition, the conversation continues over a *fixed* line once she gets to the hospital.
- **User based functionality** -- Users can control the communications mode - voice, text, pictures, video – communications type – person-to-person, person-to-group, or person-to-content communications, wherever they happen to be, and on whatever device they choose.

IMS architecture holds particular promise for emergency communications:

- For emergency responders, IMS can allow responders to communicate using any device, instead of requiring specific devices for specific kinds of communications.
- For hospitals and other facilities who use public or enterprise networks to communicate and are not on public safety licensed bands, they could interoperate with first responders at the network level.
- For consumers, once IMS is broadly deployed by network operators, as expected, it can enable emergency audio broadcast alerts to be received by users according to their location and circumstances – perhaps some retrieving the voice message from their mobile or landline phone, while others receive the same alert information via text on a portable device, or via email at their computer.

IMS can speed convergence, integrate public and emergency communications beyond what is available today, and enable a rich new set of services that can be critical in an emergency. While IMS standards continue to be improved and perfected, many network providers are already embracing it. Many observers believe IMS will become the standard architecture to support multi-application networks of the future.

Healthcare facility convergence empowers the mobile health care workforce:

Communications mobility is essential in healthcare facilities. In an industry where even seconds can make a difference, un-tethering health care workers from fixed-line communications carries benefits far beyond the bottom line. IP mobility solutions provide an up-to-the-minute means to track down a caregiver, check a patient's lab results, or communicate with a co-worker.

Health care has a huge mobile workforce. Many medical workers don't sit at desks, but constantly move from patient to patient. Doctors are often affiliated with more than one hospital, may also work at clinics as well as in private practice, may be on-call from home, and must be reachable no matter where they are. Home health care nurses are mobile by nature too.

In this mobile setting, traditional fixed line phone systems sometime are more a means for leaving a message and playing phone tag, rather than a medium for a live two-way conversation. But a delayed response time of even five minutes can sometimes have a big impact on the patient. Cell phones, which could bridge health care mobility needs, have in some cases been restricted in hospital areas due to concerns that sensitive medical equipment could be affected by RF interference.⁶⁵ Many hospitals are now turning to Wi-fi enabled VoIP phones which have the opportunity to provide new flexibility, features, and mobility.

One common device converges three cutting-edge technologies -- WiFi, VoIP, and speech recognition -- to create a new life saving communication tool. These wearable communication badges use voice recognition to enable hands-free, voice commands which enable workers to call out a name to initiate a conversation – almost like a Star Trek communicator. One study found that for a 300 bed hospital, these voice activated phones saved nurses 1,100 hours per year and the

Bridging Human Language Barriers.

Language barriers can be a major hurdle to the delivery of emergency care. Twenty-three million Americans have only limited ability to speak English – representing 8.6% of our nation's residents. Many studies have shown lack of English skills is a primary barrier to receiving adequate health care. To meet their needs, some forward thinking hospitals are turning to converged VoIP and video networks to bridge language barriers between doctor and patient. Once an IP network is deployed, the move to voice and video over IP enables each patient to receive care in his or her own language through the delivery of remote translation in real-time where the hospital does not have an on-site translator for that particular language. It is an example of the type of technologies that can be possible if we accelerate IP network convergence.

⁶⁵ For example, the FCC's web site says, "hospitals have limited the use of mobile phones, due to concerns that sensitive medical equipment could be affected." <http://www.fcc.gov/oet/rfsafety/rf-faqs.html#Q14>

hospital 3,400 hours a year.⁶⁶ While saving time and saving money are important, hospitals are also now finding these wireless voice badges can also prove essential for inclusion in hospital disaster preparedness plans.⁶⁷

A reliable and secure Wireless Local Area Networks (WLAN) is key for these types of health-care deployments. U.S. hospitals and healthcare facilities are already deploying Wi-Fi networks at a rapid pace, spending a total of \$650 million on wireless local area networks (WLAN) in 2005. By 2010, it is projected that figure will grow to more than \$2 billion.⁶⁸

B. RADIO OVER IP - EMS CONVERGENCE AND INTEROPERABILITY

While hospitals are beginning to reap the rewards of IP networks and the communications convergence and interoperability they enable, EMS convergence and interoperability is just as critical. To foster this kind of EMS interoperability, there is growing consensus around the need for interoperable communication gateways that can integrate dissimilar systems by converting land mobile radio, wireline, and cellular audio into common Voice over IP (VoIP) protocols, and then leveraging the ubiquity of wired IP networks as a common transport medium to tie the various agency networks together.⁶⁹

These scalable IP-based Radio over IP (RoIP) systems, as some are called, can transcend the limits of today's legacy systems and address the need for common digital public safety radio communications standards for first responders and homeland security and emergency response professionals. They can do so by linking legacy systems in a way that is spectrum-efficient and increases the effective reach and coverage, flexibility and reliability of public safety communications.

Utilizing IP-based open standards based gateways and networks enables highly secure, interoperable communications between disparate systems. These systems are designed to work with existing and future radio-based and wire-line systems, including legacy public safety radio networks (P25 and non-P25 radio networks and devices), as well as other communications systems

⁶⁶ Vocera saves hospitals hours, By Glenn Fleishman, at <http://www.wifinetnews.com/archives/003083.html>

⁶⁷ See "Wireless Voice Communication in Hospital Disaster Preparedness and Recovery," at http://www.vocera.com/solutions/documents/Disaster_Preparedness_WP_WEB.pdf

⁶⁸ according to market research firm Kalorama Information

⁶⁹ See for example, The President's National Security Telecommunications Advisory Committee (NSTAC) report on Emergency Communications and Interoperability which for example discusses the need for 4.3.3 Internet Protocol-based Interoperability for first responders at <http://www.ncs.gov/nstac/reports/2007/NSTAC%20Report%20on%20Emergency%20Communications%20and%20Interoperability.pdf>

including cellular phones, laptops, IP phones, and a variety of networks including wireless, traditional telephones, broadband, and satellite. EMS responders with legacy access devices and those with new multi-network access devices capable of utilizing any available IP-based access networks can communicate with each other. The power of the IP-based networks approach helps enable first responders to have the flexibility and tools they need for effective response and, most importantly, allows public safety agencies to extend and modernize their existing radio networks so they work together with other existing and future communications networks and devices.

For emergency managers, being able to interchangeably link systems helps to unify command and control – making it more flexible by enabling dispatchers and incident commanders to manage operations from one or more locations.

Reliance on IP-based communications also provides more options for rapid response for deployment or restoration. For example, in the aftermath of 9/11, Katrina, and other disasters, wireless and wired IP networks have been quickly deployed to enable both voice and data communications. For example, when the I-35 bridge collapsed in Minneapolis, the developer of the municipal Minneapolis Wi-Fi network, only one-sixth deployed at the time, quickly enabled unfettered access for data and VoIP transmissions – which proved particularly valuable as traditional communications networks in the city were overwhelmed.⁷⁰

Reliance on IP networks and IP gateways also enables investments in networks to be shared across a broader range of stakeholders, and reduces costs by capitalizing on existing communications investments and avoids unnecessary upgrades to existing radio networks.

C. IP CAN MAKE THE DIFFERENCE FOR NETWORK SURVIVABILITY.

IP Networks can be especially advantageous in an emergency.

Few other industries face an equivalent need to maintain 24 hour, 7 days a week, 365 days a year service with absolutely no tolerance of downtime. But those companies that do, often rely upon more survivable IP networking technologies.

IP networks, designed by the Defense Department to withstand a nuclear attack, have some inherent advantages over traditional communications systems in an emergency. The transformation to decentralized broadband networks with multiple paths between any two points and the Internet's packet communications protocol enhanced network capabilities, eliminate many single points of failure, and enables the network to automatically and efficiently work around failures. In a disaster, communications systems have collapsed as a result of the emergency event itself.

⁷⁰ See Carol Wilson, Muni Wi-Fi Boosted by Post-Disaster Performance, Telephony Online (Aug. 9, 2007) (*available at* http://telephonyonline.com/home/news/muni_wifi_minneapolis_080907/).

However by utilizing common IP networks, systems can often be run over any available IP network.

Communications redundancy is critical not just in time of major disasters but because anything from a blizzard to a construction accident can disrupt communications.

Hospitals need confidence in a crisis and the ability to continue working regardless of the circumstances. In the post-Katrina, post-September 11th world, more and more businesses and hospitals are turning to next generation network technologies to ensure that their enterprises are sustainable through periods of significant interruption caused by a disaster or any other unforeseen event. The significant impact from each hour of downtime due to a flu pandemic, hurricane, terrorist attack, or other catastrophic disaster could lead to disastrous consequences.

Enabling continuity of service and remote access.

In the event of another major disaster or quarantine, hospital workers may need to communicate from more geographically-dispersed locations. In its Katrina Order, the FCC directed its Public Safety and Homeland Security Bureau to continue to “work with the Nation’s health care” ... “communities to include, in their business continuity planning, robust emergency communication plans that ensure that these entities will be able to function during emergencies such as an influenza pandemic. Such emergencies could result in sudden and significant shortages of personnel, changes in communications traffic, possible disruptions to communications networks (i.e., due to increased telecommuting by the nation’s workforce and society in general during an influenza pandemic), and lack of manpower to immediately repair affected communications networks.”

Hospitals need communications continuity plans, enabling basic voice and data to resume as quickly as possible after a major outage or attack. Such remote access is often enabled by IP technology. The ability to maximize the efficiency of the network, to guarantee minimum levels of availability, enable remote access using IP VPNs, and utilize any alternative and available IP network may be essential in such an emergency.

In the event of a major 9/11 type attack, anthrax attack or flu-pandemic, offices could be inaccessible but employees will still need to communicate. Workers with access to broadband could still work using IP VPNs and broadband-enabled nomadic VoIP phones, and could immediately work from home or other broadband-enabled locations. By disconnecting voice from the underlying infrastructure, nomadic interconnected VoIP allows displaced workers to utilize their existing work phone number from any broadband-enabled location.⁷¹

⁷¹ In southern Florida, not only does the state emergency management agency utilize VoIP for its disaster needs, but small businesses in Florida too have turned to nomadic VoIP because when phone lines go down in a hurricane, small businesses can maintain communications with clients with their existing work number simply by plugging their phone

The White House flu pandemic plan, for example, suggests every business have a plan in place to allow employees to work from home. However, one in four Americans say they likely would lose their job or business if they had to stay at home for seven to 10 days in a severe flu pandemic.⁷² Broadband is an essential ingredient in enabling people to continue to work from home – especially if they needed to care for someone sick at home or as a means to quarantine.

The use of IP VPNs – which can provide secure remote access -- is a critical enabler. Already, 32% of enterprise networks in the health care sector are utilizing IP VPNs – a number projected to continue to grow.⁷³ Continued uptake of IP VPN technology not only promotes worker mobility, it is also essential to protecting the security of data traversing networks, and connecting hospitals to each other in broader health networks.

Avoiding unanticipated traffic spikes in an emergency

Congestion is not limited to your local highway at rush hour. Broadband networks can become congested too. Utilizing network management technologies can lessen congestion on broadband networks, just like traffic lights help prevent gridlock. While network congestion happens every day, it tends to be limited in scope and short in duration and thus less likely to impact real-time IP communications. On the other hand an unanticipated spike in traffic due to an extraordinary situation such as a breaking news event or the failure of a critical network element can increasingly lead to events with longer duration and broader scope of impact.

For example:

- In December 2006, a 7.1-magnitude earthquake off the coast of Taiwan cut a major undersea cable. The resultant re-routing of network traffic jammed the other Internet traffic routes throughout much of Asia resulting in Internet service for millions that was painfully slow or non-existent.⁷⁴
- Sometimes network congestion can happen because of a major news or sporting event. For example during basketball playoffs, the NCAA March Madness on Demand website generates more than 19 million video streams over several days resulting in one of the largest live Internet events ever.⁷⁵ Some believe this single Internet streaming event, could over-extend the Internet

into any working broadband connection – or booting up a laptop in a Starbucks and be back in business. “VoIP provides small business with a defense against hurricane damage”, June 12 2006, Sun-Sentinel

⁷² “One in Four Say They’d Lose Job or Business if They Had to Stay Home in a Pandemic”, by Charles Hoskinson OCT. 27, 2006

⁷³ <http://www.instat.com/abstract.asp?id=224&SKU=IN0603082DDHC>

⁷⁴ http://www.breitbart.com/article.php?id=061227100430.q1satn81&show_article=1

⁷⁵In 2006 web site organizers planned for 80gbps in traffic while in 2007 they are planning for 160gbps <http://www.xchangemag.com/hotnews/73h984212.html>

and slow necessary business applications to a crawl -- essentially crippling the network.⁷⁶ Even a rock concert can stretch the bounds of Internet traffic.⁷⁷

- With less warning, Internet traffic would also spike in the wake of a terrorist attack, flu pandemic, or other natural emergency that suddenly causes millions of people to turn to the Internet. For example, industry executives warn that, in the event of a bird flu outbreak, “the demand for communication will soar,” and the Internet’s ability to handle that surge is “definitely the most vulnerable part of the equation.”⁷⁸

While congestion could impact communications over the open Internet, managed networks help ensure communications reliability. Whatever the cause of traffic congestion, managed networks and traffic prioritization can help maximize the likelihood that all traffic will be delivered and that time-sensitive applications will operate in a satisfactory manner despite unusual network conditions. As networks grow in importance, it is critical to enable innovative network technologies that maximize the likelihood that mission critical applications won’t be impacted by congestion. Managed IP networks, where traffic is separated from the general Internet infrastructure, help to better assure that capacity is available for critical applications when that capacity is required.

Managed networks can also enable emergency traffic to be prioritized through the network. In the same way that cars move to the side to allow an ambulance to get through more quickly in an emergency, technologies like “differential services” can help speed network traffic in an emergency by giving it preferential treatment.

Likewise, there are a number of priority communication services which, although underutilized, could nonetheless be beneficial in an emergency.⁷⁹ The Government Emergency Telecommunications Service (GETS) can provide EMS, 9-1-1 and medical workers priority access to the switches that route telephone calls when telephone networks become congested. Similarly for wireless networks, the Wireless Priority Service (WPS) is an optional feature that can be added to regular cellular service to provide priority communications for key personnel during disasters. If communications networks go down, pre-enrollment in the Telecommunications Service Priority

⁷⁶ Could March Madness cripple the network? By Andrew R. Hickey, News Writer, 15 Mar 2006, http://searchnetworking.techtarget.com/originalContent/0,289142,sid7_gci1173125,00.html

⁷⁷ Exceeding any other online event, the Live Earth one-day global concert packed the Internet with 9 million video streams -- <http://www.reuters.com/article/internetNews/idUSN0724055520070707>

⁷⁸ Patrick Thibodeau, Flu pandemic could choke Internet, requiring usage restrictions, ComputerWorld, Feb. 12, 2007 (<http://www.computerworld.com/action/article.do?command=viewArticleBasic&articleId=9011125>) (quoting Renate Noone, vice president of professional services at SunGard’s Availability Services unit, and Bernard O’Neill, vice president and chief network officer at Prudential Financial Inc.).

⁷⁹ See <http://www.txregionalcouncil.org/ep/GETS-WPS-TSPProgramSummaries.pdf>

(TSP) program helps ensure that the telecommunications service provider restores the TSP services on a priority basis before it restores any non-TSP services.

The role of satellite in survivable communications.

There is also a need to increase redundancy in mobile networks. The first 24-48 hours after an emergency are critical in the world of first responders. During an emergency, traditional tower based wireless communications infrastructure and equipment can be destroyed or damaged – as was the case during Katrina. However, it is also a time when the need for mobility and communication is at a peak. Emergency medical personnel and first responders must be in constant contact with their coordinator, hospitals, police, fire, and each other.

In its Katrina order, the FCC directed its Public Safety and Homeland Security Bureau to continue to *“educate and encourage the ability of health care providers to employ a plurality of communications systems (e.g., land mobile relay systems, satellite communications, and/or high frequency communications) on premises, outside of their facility, and facility-to-facility.”*⁸⁰

Health care providers must have access to communications tools that can survive the incident itself, especially because there is no time to set up new infrastructure at each new location in an emergency. Satellite technologies can be a critical adjunct during the search and rescue period. Satellite networks can provide seamless voice and data communications without relying on terrestrial infrastructure. Satellite handsets also offer the mobility of standard wireless handsets, and some networks also offer data capability.

Furthermore, satellite networks can interconnect with other existing communications networks, including wireless, wireline, terrestrial CMRS networks and public safety networks. There are currently two satellite operators offering 2-way radio (PTT) over satellite that can be cross banded to terrestrial CMRS (ESMR) networks and public safety land mobile radio (LMR) networks. These attributes can make satellite technologies ideal for use in the 24-48 hours immediately following a disaster as well for day-to-day public safety use where coverage by other technologies is a challenge. At least three satellite companies are working towards future networks that will provide seamless satellite/cellular (MSS/ATC) capability contained within the form factor of today's wireless handsets.

Similarly, JAC heard that one and two-way paging services, which also often utilize satellite capabilities, are a cost-effective and reliable choice for health care organizations, and are necessary in a disaster situation.⁸¹

⁸⁰ Paragraph 9, Katrina Independent Panel report, Federal Register / Vol. 72, No. 132 / Wednesday, published July 11, 2007

⁸¹ USA Mobility indicates that, *“paging technology has also proven to be more survivable and reliable during and after crisis situations. Two examples of this are during 9/11 and Hurricane Katrina, when landline and cellular networks became overloaded and unusable, paging networks continued to deliver reliable performance to its large user bases in both the healthcare industry as well as the government and first-responder sectors.”* At <http://www.fcc.gov/pshs/docs/advisory/jac/pdf/usa-mobility-wireless.pdf>

4. ACHIEVING THE POSSIBILITY OF IP.

A. INVESTMENTS CAN BE MINIMIZED, AND CAPABILITIES MAXIMIZED, BY RELYING ON OFF-THE-SHELF TECHNOLOGIES.

There are key similarities between the type of IP networks that hospitals and EMS providers need and what other sectors have utilized to improve capabilities, track customer data, provide mobility, enable interoperability, converge voice and data, and protect privacy. Other sectors like banking and finance have lowered costs and improved capability through heavy investments in managed IP networks, commercial wireless services, and off-the-shelf technologies to meet their needs. The opportunity to exploit the latest commercially available technologies to provide emergency agencies with better control and capability is just as significant for health care and EMS.

There are number of key reasons why other sectors of the economy have relied upon the rapid advancements of commercial technologies for their communications needs. Adopting and adapting commercially available technologies can generate significant economies of scale while making networks more dependable during crises. They can enable the emergency response community to focus on finding the best means for achieving goals (for example increasing mobility or convergence) rather than locking themselves into specific preconceived types of technologies.

As PCIA noted in its submission to JAC,⁸² there are a variety of available communications infrastructure technologies, including wireline, wireless, WiMax and broadband services, which can be essential for health care providers, first responders, as well as to the public at large. They suggest that wireless capacity will need to grow to support data-intensive applications, and, therefore, network operators must increase capacity to handle the traffic demands of those networks. To do so, they suggest that Congress must create an investment climate that is hospitable to wireless investment, and policies that encourage broader and more reliable wireless infrastructure deployment.

Similarly in other comments received by JAC, ReFLEX indicated that many of the essential ingredients for mission critical high-risk communications systems – like comprehensive radio coverage, dependability, flexibility, functionality, and interoperability, throughput, and cost effectiveness – are often developed through experiences from general public subscribers for which public safety can benefit.⁸³

⁸² See: <http://www.fcc.gov/pshs/docs/advisory/jac/pdf/pcia-jac.pdf>

⁸³ See <http://www.fcc.gov/pshs/docs/advisory/jac/pdf/reflex-homeland.pdf>

When hospitals are free to choose among many wireless and IP network competitors, prices drop and innovation rises. As HHS has put it, *“the federal government will provide a vision and a strategic direction for a national interoperable health care system, but will rely on a competitive technology industry, privately operated support services, and shared investments. The private sector must develop the market institutions to deliver the products and services. It can best ensure that health information technology products are implemented in ways that meet the varying needs of American health care across settings, cultures, and geographies. And only it can continue constant innovation and ensure that products are delivered on an affordable basis.”*⁸⁴

B. PROMISING PROJECTS ARE ALREADY UNDERWAY.

At the heart of this communications transition is a move to interoperable IP-based networks. These next generation IP-based networks are not merely speculative possibility, they are quickly becoming a reality.

- In the Washington D.C. region, the Capital Wireless Integrated Network (CapWIN) is a state-of-art wireless IP network integrating data, images and conferencing for linking EMS and first responders in the region.⁸⁵ It is said to be the first multi-state, inter-jurisdictional transportation and public safety integrated wireless network in the United States. The effort began when a suicide jumper on a bridge highlighted incompatible communications systems which prevented emergency personnel from different jurisdictions on the scene from being able to communicate with each other.⁸⁶ They had to send runners back and forth to carry messages between responders. Now, CapWIN provides a "communication bridge" allowing more effective multi-agency response to critical events. Medical, police, fire, and others can keep up with homeland security and emergency situations around the metro area by logging in from secure virtual private network clients on their PCs, personal digital assistants, wireless phones and police radios. To make it accessible using any Internet-connected device, they made extensive use of off-the-shelf technologies (like cellular

⁸⁴ HHS Fact Sheet--HIT Report At-A-Glance, July 21, 2004. <http://www.hhs.gov/news/press/2004pres/20040721.html>

⁸⁵ CapWIN is a state-of-art wireless integrated mobile data communications network being implemented to support federal, state, and local law enforcement, fire and emergency medical services (EMS), transportation, and other public safety agencies primarily in the Washington, DC Metropolitan area. See faq at: <http://www.capwin.org/index.cfm?fuseaction=t2&ID=26>

⁸⁶ "D.C. deploys wireless net for first responders" By Carolyn Duffy Marsan, Network World, 08/31/06 <http://www.networkworld.com/research/2006/090406-sept11-first-responders-dc-wireless.html>

broadband technologies), use IP-VPNs to connect agency networks together, and rely on open standards.⁸⁷

- In Virginia, the COMLINC (Commonwealth's Link to Interoperable Communications) project leverages Voice over Internet Protocol (VoIP) technology to allow disparate radio systems, multiple agencies, from different jurisdictions, with incompatible radio equipment, to communicate within Virginia. When fully implemented, it will also use a state-wide MPLS IP network that will support an IP based Next Generation E-9-1-1 implementation, and other state public safety communication.⁸⁸
- In Norway, St. Olav's Hospital used a robust IP network and wireless networks to convert its 11 building campus into one massive "hotspot" accessible by a variety of devices - transportation robots, laptops and telephones.⁸⁹ Data created by hospital equipment and patient monitoring devices, like the ECG can travel seamlessly from one instrument and be made available to user output devices. Software systems use the network for nurse calls, service ordering. They use VoIP, streaming video, and an IP network for all communication. And because it's a managed network, security features are built in. Patients are enjoying IP-based entertainment terminals in their rooms. It has not only reduced costs, but improved access to information, less duplication of effort, faster response times and shorter patient stays.
- The Maryland Institute of Emergency Medical Services System (MIEMSS), as cited in a recent Institute of Medicine EMS study, has a best practice communications center for the integration and coordination of EMS, hospital, public health and other related communications.⁹⁰ This statewide communications system not only performs these functions on a day to day basis but is capable of ramping up for major events. Similar statewide emergency medical communications coordination and integration centers operate now in Idaho and Alabama.

⁸⁷ "CapWIN public-safety network plans new services" By Susan M. Menke http://www.gcn.com/online/vol1_no1/34915-1.html

⁸⁸ See http://www.ocp.virginia.gov/Initiatives/documents/Interop_Initiative_Overview_2007.ppt

⁸⁹ <http://www.longwoods.com/product.php?productid=18495&cat=457>

⁹⁰ "Emergency Medical Services at the Crossroads"; Institutes of Medicine; 2006; pp. 68-69.

- Tucson, Arizona, has deployed one of the nation’s first video based EMS telemedicine systems in order to improve responsiveness and help save lives.⁹¹ The system called ER-Link uses a wi-fi mesh network to send 12-lead patient telemetry data and real-time video to provide in-depth, information to the hospital in trauma situations before the patient arrives. The live video in the ambulance enables remote diagnosis and visual analysis by nurses and doctors at Tucson’s University Medical Center.

The problem isn’t that these solutions aren’t being done somewhere; the problem is that these solutions aren’t being done everywhere. Even when these promising projects are deployed, there is often no requirement for coordination between jurisdictions and no national solutions. As Secretary Chertoff explained at a May 8, 2006 Tactical Interoperable Communications Conference, *“the biggest barrier to interoperability is not technology [the challenge] has to do with, rather, human beings. It has to do with how do we get people to be able to use this equipment in a way that makes interoperability not just a theoretical possibility, or a technological possibility, but an actual, workable, day-to-day solution.”*

The problem isn’t that these solutions aren’t being done somewhere, the problem is that these solutions aren’t being done everywhere.

⁹¹ See http://www.tropos.com/pdf/success_stories/tropos_success_story_tucson.pdf and [http://www.emsresponder.com/web/online/Top-EMS-News/Tucson-to-Launch-Ambulance-to-Hospital-Video-Conferencing/1\\$5561](http://www.emsresponder.com/web/online/Top-EMS-News/Tucson-to-Launch-Ambulance-to-Hospital-Video-Conferencing/1$5561)

IV. A PRESCRIPTION FOR PROGRESS: JAC'S KEY FINDINGS AND RECOMMENDATIONS

The U.S. is home to the best doctors, the most capable emergency medical workers, and the most-capable communications technologies and networks available in the world today. But, somehow, we have failed to marry our health and emergency medical systems with advances in communications and information technologies.

We can and must do better. The opportunity is potentially boundless. It is time policymakers and stakeholders get serious about modernizing these communications systems. These networks provide consumers, businesses, and government customers with end-to-end, real-time, reliable broadband connections that enable the transmission of bandwidth-intensive video and data applications. The attributes of these networks (speed, reliability, security, sophistication) should serve as the foundation of our nation's health care communications networks. By connecting health care providers via broadband, we begin the process of laying the foundation for a digitally integrated health care system. Such an outcome would enable the implementation of a vision that ensures every health care facility, 9-1-1 call center, and emergency responder is connected both with each other and to a vast array of life-saving information and expertise. It helps ensure that each patient receives the most appropriate care, at the optimal location, with the minimum delay.

Achieving this vision takes a major reorientation of government policy, as well as a fundamental paradigm shift as to how public safety and health providers approach their communications needs. Continuing the status quo is no longer an option. EMS, medical and public health care facilities cannot change the system on their own. A broad range of players have critical stakes in this transformation. But policymakers have an especially profound duty to provide the leadership, vision, strategic investments, and to illuminate the pathway forward. Lives can be saved, as can thousands of dollars per family.

In light of this opportunity and the recommendations we send to Congress, it is critical that we continue to foster an environment for innovation, investment, and market-based solutions. Ten years ago, it was difficult to conceive of the dizzying array of Internet-enabled communications technologies that are now at our doorstep, or the opportunities they would present for interoperability, health IT, or health transformation. These opportunities are now in-hand because there is a burgeoning marketplace driving innovation. Wireline and wireless networks are growing in sophistication, reliability, and speed. These networks can do for the health and public safety community what they have done for consumers, businesses, and governments – improve efficiency and effectiveness. It is therefore imperative that policymakers continue to adopt policies that allow

network innovation, and that this engine of opportunity continue forward. Our nation's readiness for the next disaster depends upon it.

Thus, to improve integration of communications systems used by emergency medical and public health care facilities with existing or future emergency communications networks, JAC is outlying several key findings, options, and recommendations.

Key Findings:

- Foster interoperable broadband networks, both wireline and wireless, that permit critical health-related information to be transmitted rapidly, reliably, and securely.
- Improve interoperability through better interagency coordination and the use of IP.
- Use mobile services and applications to create virtual hospitals at the scene of accidents, crimes, and disasters.
- Advance life-saving capabilities such as telemedicine, remote monitoring, and telecommuting by encouraging network and application innovation and deployment.

Key Recommendations:

1. Encourage interoperable broadband networks

The Committee recommends policymakers encourage the deployment of interoperable, standards-based broadband networks built on common and standardized Internet Protocols that can transmit bandwidth-intensive information such as video and graphics in a rapid, reliable, and secure manner. It is now abundantly clear that policymakers must set a new national goal of transitioning EMS, 9-1-1, and public health communications to broadband capable networks. Today's outdated, fragile, and often incompatible networks leave us ill-prepared to confront the disasters looming around the corner, or to take advantage of the quality of care and economic efficiency gains promised by IT modernization. Unless there is purposeful attention paid to communication infrastructure requirements and investments at the local, regional and national level, it is unlikely that piecemeal technology adoption will result in the connected and robust infrastructure necessary for survivable communications in a disaster, or even for day-to-day emergency care and patient monitorization.

These next generation networks should:

- Utilize commercially available IP-based managed networks
- Be capable of converging voice, video, data, and other applications over the same network
- Provide sufficient bandwidth for rich-media and telemedicine applications

- Provide rapid, reliable, and secure end-to-end connectivity to ensure the delivery of mission critical information
- Be capable of increasing bandwidth dynamically to meet surge capacity in the event of a disaster
- Be capable of prioritizing communications to ensure that bandwidth and key communications are available in a disaster
- Utilize standards-based off-the-shelf technologies

Specific initiatives:

- Improve ability to transmit media-rich real-time patient data between emergency responder and the remote ER physician (e.g. multi-vital sign telemetry, interactive video, portable ultra-sound transmission) by expanding wireless public safety broadband availability.
- Close the connectivity and coverage gaps in rural EMS by investing in the development of rural/frontier EMS communications systems to support community paramedicine and emergency communications needs. Encourage the use of off-the-shelf technology that could reduce the costs of deployment in rural areas.
- Improve the safety, quality, and efficiency of hospital based emergency care by funding efforts to improve hospitals' broadband connectivity, improve communications interoperability with EMS systems, and expand telemedical connection to rural/frontier health facilities and community paramedicine providers.
- Improve federal emergency response coordination by directing FEMA, DMAT, and CDC to utilize advanced communications capabilities and ensure immediate coordination with local and regional emergency communications capabilities.
- Deploy \$1 billion in Public Safety Interoperability Communication Grants. The Departments of Commerce and Homeland Security have allocated nearly \$1 billion in grants to public safety agencies to deploy interoperable communications systems. The awards will help state and local first responders improve public safety communications during a natural or man-made disaster. However, interoperability must be ensured not just for police, fire and EMS, but for emergency rooms, trauma centers, public health offices and others in order to truly enable seamless communications in an emergency.
- Improve funding for EMS providers. The JAC agrees with conference report language accompanying the Homeland Security Appropriations Bills for the past two years recommending that no less than ten percent of State Homeland Security Grants and the High Threat, High Density Urban Area Grants go to EMS providers. Adequate funding can help better train and equip responders to provide critical life-saving assistance

which is to include interoperable communications for emergency medical and health care providers.

- g. Ensure Emergency Medical Services can survive a disaster's financial impact. Due to statutory ambiguities, reimbursement for ambulance providers and health care facilities have too often been reduced, delayed or denied, for legitimate and requested services provided by ambulance firms. Eliminating the ambiguities in the Stafford Act, as suggested in Appendix F, can help ensure rapid response and appropriate reimbursement. The JAC also agrees with the FCC's Independent Katrina Panel implementing the NSTAC's recommendation that telecommunications infrastructure providers should be afforded emergency responder status under the Stafford Act and that this designation should be incorporated into the National Response Framework and state and local emergency response plans.
- h. Prioritize funding for the development of statewide emergency medical communications coordination and integration centers such as those operating in Maryland, Idaho and Alabama which serve to effectively coordinate all communications among EMS, hospital, public health and other related responders for both day-today and mass casualty events.

2. **Improve interoperability through better interagency coordination**

The Committee recommends Congress establish a federal interagency coordinating committee on emergency communications systems to establish strong, consistent national (federal) guidance, standards and direction to insure consistent development of compatible communication systems across the nation. Bridging today's balkanized communications systems requires strong federal leadership in supporting a comprehensive, coordinated approach to improving emergency communications. Continued fragmentation at the federal level is unacceptable.

- This Federal Interagency Committee on Emergency Communications Systems (FICECS) should be empowered to make guidance changes and include high-level participation from the Departments of Homeland Security, Health and Human Services, Transportation, Commerce, the Federal Communications Commission, and the Centers for Disease Control. It should be administered by the US Department of Homeland Security's Office of Interoperability and Compatibility and Office of Emergency Communications (USDHS OIC and OEC).
- To improve communications, the FICECS should be responsible for (a) ensuring coordination among Federal agencies involved across the full continuum of emergency communication planning, (b) establishing base-line communication benchmarks to which all systems must at a minimum achieve, (c) developing a coordinated strategy for migrating the

nation's EMS, 9-1-1, public safety and public health communications systems to IP-based interoperable networks, (d) developing strong, consistent, guidance to states and localities to ensure all systems are migrating toward the same common interoperable national framework, and (e) collecting data on the progress in order to map the deployment of compatible systems nationwide, and measure progress toward national interoperability performance goals.

- To ensure federal coordination is integrated with state and local efforts, the FICECS should be supported by a specially created advisory committee comprised of key stake holders including representatives of state, local, EMS, health facilities, public health, public safety, communication experts, and others. The advisory committee must be adequately funded to allow participants to be reimbursed for travel to meetings.
- DHS and other federal agencies should be encouraged to ensure that emergency medical personnel are treated as public safety personnel under the Stafford Act and other provisions, the same as fire fighters and law enforcement. In this context, the purpose is to enable emergency medical personnel and agencies to be protected and reimbursed for participation in disaster events.

3. **Enable consistent efforts through use of common standards and federal grant guidance coordination**

Ensuring seamless communications across emergency responder and public health communication systems takes better coordination and use of common standards and protocols.

The Committee recommends the federal government renew its commitment to develop, harmonize, and ensure widespread adoption of shared standards and protocols. Information and data can only be shared easily and securely between systems and agencies when they use widely accepted standards and protocols. Numerous studies have found that a key factor inhibiting the rate of adoption of new health care technologies is the lack of development of common health care IT standards. Only with common national standards can states and regions create systems with similar structure and compatible capabilities.

- Accelerate efforts to adopt electronic medical records and ensure their availability in a disaster by taking interim steps to identify a minimal set of uniform patient data and corresponding protocols for sharing data among all healthcare, emergency response and public safety institutions within a region during a time of declared disaster.
- Develop and deploy patient and bed tracking systems with nationally mandated information sharing provisions with adequate resources made available to states and regions to meet this critical need.

The Committee recommends federal and state agencies develop common criteria for all contracts and grants supporting emergency communications. Federal, state and local policymakers must work in a more coordinated manner to ensure existing and planned emergency communications systems are interoperable, use common networks, transition to broadband, and employ the same technical standards and communication protocols. The criteria should 1) embrace common technical standards, communication protocols, and data formats, 2) ensure interoperability between existing and future emergency communications systems -- including related software, peripheral and other associated systems, 3) make the transition to broadband networks capable of converging voice, video and data and enabling telemedicine applications, 4) integrate with state plans, 5) support both day-to-day and disaster activities, and 6) ensure regular training and testing of communications systems.

- This coordination should occur across the emergency communications chain – encompassing emergency medical systems, public safety, 9-1-1 PSAPs, hospital preparedness, emergent threat, and health alert networks.
- The federal interagency committee described above should include the leadership of all relevant funding programs and be empowered to enact program changes that ensure coordinated action.

4. Advance capabilities through better network integration

- The Committee recommends greater coordination, investment, and utilization of telemedicine technologies for both day-to-day and emergency response.* Existing telemedicine networks and state health information systems can be essential components of a region’s emergency communications and response systems. They can be critical for providing care at alternate care sites, delivering surge capacity in an emergency, enabling access to advanced specialists, and extending assistance from one state to another, yet telemedicine technologies are often underutilized, and unavailable for emergency response.
- The Committee recommends better coordination between existing systems to be able to share and analyze real-time data across systems and provide better communications during times of emergency.* Public health, hospitals, community health centers, nursing homes, EMS and public safety all have critical roles to play in providing real-time threat information in order to protect the American public.
- The Committee recommends the Department of Homeland Security lead an effort to create and coordinate a geospatial Command and Coordination System, based on open enterprise architecture, to allow common patient and emergency vehicle tracking for better situational awareness for all Emergency Medical and Public Health Care Facilities.* Emergency Medical and Health Care Facilities lack a ‘common operating picture’ for situational awareness and connectivity during mass casualty and disaster events. This system requires

development of an overarching governance group, sustainable funding for the core backbone by the Federal Government, and local participation for customizing their own unique interface requirements.

5. Ensure that first responders, health care personnel, and patients have ubiquitous access to broadband services and applications by fostering a regulatory environment in which private sector companies build robust broadband networks and providing targeted funding

- a. *The Committee finds that ensuring every American has access to broadband throughout the country is an essential health care communications imperative.* Home broadband access can unleash new health opportunities by enabling access to distant telemedicine applications, remote monitoring technologies, health information, and the ability of health care workers to work remotely in an emergency.
- b. *The Committee finds that ubiquitous broadband networks give first responders and health care professionals the ability to share information in a rapid, reliable, and secure manner, and, increasingly, in a mobile environment.* The greater the access in the United States to broadband services, the more information and expertise can be shared. And the greater the availability of broadband services, the greater the opportunity for first responders and health care professional to access critical information in real-time. Mobile broadband services in particular present an opportunity extent broadband access to the scene of accidents, crimes, and disasters, helping to mitigate or prevent injury and death.
- c. *The Committee finds that, without an infusion of capital and the adoption of the same kinds of networking technologies that other enterprises have adopted, the health care sector will be ill-prepared for the next disaster and will miss out on the vast cost savings, and user benefits that the transition from analog to digital systems can deliver.* As a primary provider of health care, the federal government itself is likely to be the single largest beneficiary, saving enormous amounts of money, by accelerating this transition to IT applications and IP networks. Thus the federal government should enhance the safety, quality, and efficiency of hospital-based emergency care by funding efforts to improve hospitals' broadband connectivity, improve communications interoperability with EMS systems, ensure dedicated funding for uncompensated hospital emergency care, and expand telemedical connection to rural/frontier health facilities and community paramedicine providers.

V. APPENDICES

- A. List of Advisory Committee Members
 - B. Government Efforts Underway
 - C. Legislative Charge to the Committee
 - D. Related Reports and Publications
 - E. Public Comment
-

Appendix A: Advisory Committee Membership

Members of the Joint Advisory Committee

Jim Bugel

Assistant Vice President, Federal Regulatory
AT&T Services, Inc.
(Chair)

Michael J. Ackerman, Ph.D.

Assistant Director, High Performance Computing & Communications
National Library of Medicine, National Institute of Health

John F. Adams, Jr.

NCS Spectrum Manager/Senior Principal Systems Engineer
Raytheon Company

Curtis M. Bashford

Vice President, General Devices

Donna Bethea-Murphy

Vice President, Regulatory Engineering
Iridium Satellite, LLC

James A. Corry

Vice President, Government Solutions
Mobile Satellite Ventures, LP

Drew E. Dawson

Director, Office of Emergency Medical Services
National Highway Traffic Safety Administration
U.S. Department of Transportation

Steve J. Delahousey

National Vice President of Emergency Preparedness
Emergency Medical Services Corporation

Col. Terry J. Ebberts

Director, Office of Homeland Security & Public Safety
City of New Orleans, LA

Eric K. Griffin

Director, Office of Emergency Management
Lee County, North Carolina

Lisa Kaplowitz, MD, MSHA

Deputy Commissioner for Preparedness and Response
Virginia Department of Health

Richard J. Liekweg

Chief Executive Officer
University of California, San Diego, Medical Center

Jonathan D. Linkous

Executive Director, American Telemedicine Association

Kevin McGinnis

Program Advisor/Communications Technology Liaison
National Association of State EMS Officials

John F. Nagel

Director, IT & Internet Applications
American Messaging Services
American Association of Paging Carriers

Thomas S. Nesbitt, MD

Director, Center for Health and Technology
University of California, Davis, Health System

Virginia Pressler, MD

Executive Vice President, Strategic Business Development
Hawaii Pacific Health

Murad Raheem

Branch Chief, Electronics and Communications
Office of Assistant Secretary for Preparedness and Response
U.S. Department of Health and Human Services

R. Shawn Rogers

Director, Emergency Medical Services Director
Oklahoma State Department of Health

Mike Roskind

Acting Director, Office of Emergency Communications
Office of Cybersecurity & Communications
National Protection and Programs Directorate
U.S. Department of Homeland Security

Karen Sexton

Vice President & Chief Executive Officer for Hospitals and Clinics
University of Texas Medical Branch

Jim Traficant

Vice President of Healthcare Solutions
Harris Corporation

Carl C. VanCott

Communications Specialist
North Carolina Office of Emergency Medical Services

John S. Wilgis

Director, Emergency Management Services
Florida Hospital Association

Christopher K. Wuerker, MD

Medical Director, MedSTAR Transport
Washington Hospital Center

Appendix B: Government Efforts Underway

The Federal Government Has Already Made Great Strides:

While several government programs have made great strides in addressing key aspects of emergency communications for EMS and public health facilities, much of this work has been disconnected, fragmented, and often conflicting.

- **Creating a National Health Information Infrastructure that advances electronic health records.** On April 27, 2004, President Bush signed Executive Order 13335 and called for the widespread adoption of interoperable electronic health records (EHRs) within 10 years. It established a National Coordinator for Health Information Technology who in turn has developed a strategic 10-year plan⁹² outlining steps to transform the delivery of health care by adopting EHRs and developing a National Health Information Infrastructure (NHII) to link such records nationwide.⁹³ EHR systems provide a doctor with real-time access to patient information, as well as a complete longitudinal record of care and can help provide capabilities if paper records get lost or are otherwise inaccessible in a disaster.
- **Deploying \$1 billion in Public Safety Interoperability Communication Grants.** The Departments of Commerce and Homeland Security have allocated nearly \$1 billion in grants to public safety agencies to deploy interoperable communications systems.⁹⁴ The awards will help state and local first responders improve public safety communications during a natural or man-made disaster.⁹⁵
- **Creating a nationwide, interoperable broadband public safety communications network.** On July 31, 2007, the FCC (in its Second Report and Order revising the rules governing the 700 MHz band) re-designated ten megahertz of public safety spectrum for the purpose of establishing a nationwide, interoperable broadband public safety communications network. It also created a single nationwide license for

⁹² The National Health Information Network <http://www.hhs.gov/healthit/onc/mission/>

⁹³ See Presidential Executive Order at <http://www.whitehouse.gov/news/releases/2004/04/20040427-4.html>

⁹⁴ Section 3006 of the Deficit Reduction Act of 2005, Pub. L. No. 109-171, directed the Assistant Secretary for Communications and Information, in consultation with the Secretary of Homeland Security, to establish and administer a new \$1 billion matching grant program to assist public safety agencies in the acquisition of, deployment of, or training for the use of interoperable communications systems that can utilize or enable utilization of reallocated public safety spectrum (700 MHz band) for radio communication.

⁹⁵ On September 30, 2007, the Public Safety Interoperable Communications (PSIC) Grant Program awarded \$968,385,000 to fund interoperable communications projects from the 56 States and Territories. <http://www.ntia.doc.gov/psic/>

this spectrum – the Public Safety Broadband License.⁹⁶ This network will facilitate effective communications among first responders not just in emergencies, but as part of cooperative communications plans that will enable first responders from different disciplines, such as police, fire, and emergency medical services departments, and hospital emergency departments, and different jurisdictions to work together in emergency preparedness and response.

- **Connecting potentially 6,000 predominantly rural health care facilities with broadband.** As part of its Rural Health Care Pilot Program, the FCC has dedicated more than 400 million dollars over 3 years to the construction of broadband networks for state-wide and regional healthcare networks reaching over 6,000 facilities in 42 states and 3 U.S. territories, most connected to a national broadband network.⁹⁷ Connecting health care providers plays a critical role in efforts to respond to disasters, natural and man-made. Participating health care organizations should, where feasible, provide public health officials with access to their broadband telehealth networks in times of public health emergencies.
- **Advancing a Next Generation 9-1-1 System Capable of Surviving a Disaster.** There are a variety of governmental efforts underway to modernize the nation's 9-1-1 network in order to make it more survivable in a disaster and to link it more directly with EMS and public health facilities. For example, the Department of Transportation has underway a Next generation 9-1-1 Coordination Initiative⁹⁸ which is providing approximately \$11 million over 2.5 years to develop a plan for an Internet capable 9-1-1 network. Congress has also acted to provide \$43.5 million for assisting public safety answering points with complying with FCC Phase II wireless E9-1-1 requirements⁹⁹ and has separately acted to provide advanced borrowing authority to speed up deployment of the money. Further, Congress is working to advance legislation that prevent the kind of 9-1-1 communication disaster that occurred during Katrina where thirty-eight 9-1-1 centers failed during the storm.¹⁰⁰

⁹⁶ July 2007 Second Report and Order - 22 FCC Rcd 15289

⁹⁷ FCC 07-198; WC Docket No. 02-60

⁹⁸ <http://www.its.dot.gov/ng9-1-1/>

⁹⁹ The Deficit Reduction Act of 2005 (P.L. 109-171) included a provision that would require \$43.5 million in proceeds from the spectrum auction of the 700 MHz band – set to occur before the end of 2008 – be allocated to fund ENHANCE 9-1-1 Act grants. See also: 47 C.F.R. § 20.18.

¹⁰⁰ S. 428 and HR 3403 --the 9-1-1 Modernization and Public Safety Act of 2007 – both of which have passed by their respective Commerce committees, would amend the National Telecommunications and Information Administration Organization Act to require grants for migration to an IP-enabled emergency network. They

- **Promoting EMS and public safety communication interoperability.** The Department of Homeland Security (DHS) established the Office for Interoperability and Compatibility (OIC) and SAFECOM¹⁰¹ in 2004 to strengthen and integrate interoperability and compatibility efforts in order to improve local, tribal, state, and Federal emergency preparedness and response. SAFECOM developed a Statement of Requirements for interoperable voice, data, video and multimedia communications which, for the first time, defines what it will take to achieve full interoperability and provides industry requirements against which to map their product capabilities.
- **Enabling Wireless Emergency Alerts.** Pursuant to the Warning, Alert and Response Network ("WARN") Act, the FCC recently commenced a rulemaking proceeding to facilitate the voluntary transmission of emergency alerts by commercial mobile service providers to their subscribers.¹⁰² The Commission sought comment on the recommendations made by the Commercial Mobile Service Alert Advisory Committee for the delivery of wireless emergency alerts. Such voluntary warnings could be especially helpful in mass casualty events.
- **Adopting Electronic Prescription standards.** The 2003 Medicare Modernization Act instructed the HHS Secretary to adopt electronic prescription standards and establish a Commission for Systemic Interoperability.
- **Improving Telehealth for Emergency Response.** In the closing days of the 109th Congress, the Senate and House passed S. 3678, the Pandemic and All-Hazards Preparedness Act which includes authorization for several telemedicine related initiatives. For example, language in the bill includes the establishment of pilot programs for multi-state networks of telehealth programs and charged HHS with exploring "Telehealth Enhancements for Emergency Response", including interconnecting on regional levels as well as interconnecting with regional health information networks, reducing legal barriers to multi-state networks, and integrating telemedicine into the National Disaster Medical System.¹⁰³

also require the E-9-1-1 Implementation Coordination Office to develop a national plan for migrating to a national IP-enabled emergency network.

¹⁰¹ <http://www.safecomprogram.gov>

¹⁰² The Commercial Mobile Alert System, Notice of Proposed Rulemaking, PS Docket No. 07-287 (released Dec. 14, 2007). The EDOCS link is: http://hraunfoss.fcc.gov/edocs_public/Query.do?numberFld=&numberFld2=&docket=07-287&dateFld=&docTitleDesc=.

¹⁰³ See bill text at: <http://www.govtrack.us/congress/billtext.xpd?bill=s109-3678>

- **Creating a national real-time hospital-bed tracking system to address a surge of patients during a mass casualty event.** The Department of Health and Human Services (HHS) is working to advance the National Hospital Available Beds for Emergencies and Disasters (HAvBED) System to create a national real-time hospital-bed tracking system to address a surge of patients during a mass casualty event.¹⁰⁴ Such a system aims to improve communications among hospitals with open beds during disasters.
- **Clinical Decision Support (CDS).** Clinical decision support systems can provide doctors with state-of-the-art medical knowledge at the point of care as well as real-time diagnostic and treatment recommendations. CDS systems help improve efficiency, for example, by reducing redundant lab tests. The Office of the National Coordinator of Health Information Technology (ONCHIT) within HHS has taken steps to advance CDS systems.¹⁰⁵
- **Computerized Physician Order Entry (CPOE).** CPOE systems allow physicians and other providers to enter orders into a computer system – minimizing handwriting and other communication errors and potentially helping to reduce errors in drug prescribing and dosing.
- **Encouraging a Plurality of Communication Systems and business continuity planning among health care providers.** In its Katrina order, the FCC directed its Public Safety and Homeland Security Bureau to continue to “educate and encourage the ability of health care providers to employ a plurality of communications systems (e.g., land mobile relay systems, satellite communications, and/or high frequency communications) on premises, outside of their facility, and facility-to-facility.¹⁰⁶” The FCC also directed the bureau to “work with the Nation’s health care” ... “communities to include, in their business continuity planning, robust emergency communication plans that ensure that these entities will be able to function during emergencies such as an influenza pandemic. Such emergencies could result in sudden and significant shortages of personnel, changes in communications traffic, possible disruptions to communications networks (i.e., due to increased telecommuting by the nation’s workforce and society in general during an influenza pandemic), and lack of manpower to immediately repair affected communications

¹⁰⁴ <http://www.ahrq.gov/prep/havbed/>

¹⁰⁵ <http://www.amia.org/inside/initiatives/cds/cdswhitepaperforhhs-final2005-03-08.pdf>

¹⁰⁶ Paragraph 9, Katrina Independent Panel report, Federal Register / Vol. 72, No. 132 / Wednesday, published July 11, 2007

networks.” On November 11, 2007, the FCC and HHS hosted a Health Care Summit on Emergency Communications: Preparedness, Response and Recovery.

Appendix C: Legislative Charge:

Legislative Charge:

Section 2201(c) of the Implementing Recommendations of the 9/11 Commission Act of 2007

(c) JOINT ADVISORY COMMITTEE ON COMMUNICATIONS CAPABILITIES OF EMERGENCY MEDICAL AND PUBLIC HEALTH CARE FACILITIES.

(1) **ESTABLISHMENT**—The Assistant Secretary of Commerce for Communications and Information and the Chairman of the Federal Communications Commission, in consultation with the Secretary of Homeland Security and the Secretary of Health and Human Services, shall establish a joint advisory committee to examine the communications capabilities and needs of emergency medical and public health care facilities. The joint advisory committee shall be composed of individuals with expertise in communications technologies and emergency medical and public health care, including representatives of Federal, State and local governments, industry and non-profit health organizations, and academia and educational institutions.

(2) **DUTIES**—The joint advisory committee shall:

(A) assess specific communications capabilities and needs of emergency medical and public health care facilities, including the improvement of basic voice, data, and broadband capabilities;

(B) assess options to accommodate growth of basic and emerging communications services used by emergency medical and public health care facilities;

(C) assess options to improve integration of communications systems used by emergency medical and public health care facilities with existing or future emergency communications networks; and

(D) report its findings to the Senate Committee on Commerce, Science, and Transportation and the House of Representatives Committee on Energy and Commerce, within 6 months after the date of enactment of this Act.

Appendix D: Related Reports and Publications

Related Reports and Publications

[HIMSS COMCARE Emergency Health IT Project Plan](#) (pdf)

[Telecommunications and Public Health comments Submitted by Tom Nesbitt](#) (doc)

[Findings From North Carolina Needs Assessment and Gap Analysis in Support of The Joint Advisory Committee](#) (pdf)
(November 19, 2007)

[Developing Partnerships with Community Health Centers for Emergency Preparedness Planning](#) (pdf)
Association of State and Territorial Health Officials (January 2007)

[Regional Approaches to Hospital Preparedness](#) (pdf)
Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science (2007)

[Best Practice - State and Local Government Continuity of Operations Planning: Communications](#) (pdf)
Department of Homeland Security, Lessons Learned Information Sharing

[HHS Seeks FCC Help Improving Emergency Medical Communications](#) (pdf)
COMMUNICATIONS DAILY (2 November 2007)

[Historical Foundation for the Development of a National Health Information Highway for Emergency Response](#) (doc)

[NSTAC Report to the President on Emergency Communications and Interoperability: Executive Summary](#) (pdf)
National Security Telecommunications Advisory Committee

[Phone Lines and Life Lines:How New York Reestablished Contact on September 11, 2001](#) (pdf)
The Association of State and Territorial Health Officials

[The Telemedicine Response to Homeland Safety and Security: Developing a National Network for Rapid and Effective Response For Emergency Medical Care](#) (doc)
American Telemedicine Association

[Overview of Communication Capabilities for The Healthcare Industry](#) (pdf)
USA Mobility Wireless, Inc.

Appendix E: Public Comment

The committee would like to acknowledge the helpful and informative public comments it received, and provide links to this information:

USA Mobility Wireless, Inc

<http://www.fcc.gov/pshs/docs/advisory/jac/pdf/usa-mobility-wireless.pdf>

Wireless Messaging for Homeland Security

<http://www.fcc.gov/pshs/docs/advisory/jac/pdf/wireless-messaging.pdf>

The ReFLEX™ Advantage In Homeland Security

<http://www.fcc.gov/pshs/docs/advisory/jac/pdf/reflex-homeland.pdf>

Improved Alerting Solution for Public Safety

<http://www.fcc.gov/pshs/docs/advisory/jac/pdf/improved-alert.pdf>

PCIA / The Wireless Infrastructure Association

<http://www.fcc.gov/pshs/docs/advisory/jac/pdf/pcia-jac.pdf>

Syniverse Technologies

<http://www.fcc.gov/pshs/docs/advisory/jac/pdf/syniverse-roaming.pdf>

American Hospital Association

<http://www.fcc.gov/pshs/docs/advisory/jac/pdf/comment-aha.pdf>

Coco Communications

<http://www.fcc.gov/pshs/docs/advisory/jac/pdf/comment-coco.pdf>

SouthernLinc Wireless

<http://www.fcc.gov/pshs/docs/advisory/jac/pdf/comment-southernlinc.pdf>

Appendix F: Suggested Statutory Changes to the Stafford Act

Emergency medical services must also be able to survive a disaster's financial impact. Unfortunately, there have been cases where ambulance services have responded to local and regional disasters, only to find out after the fact that their costs cannot be reimbursed in the same way that other emergency responders or even garbage services can. The Stafford Act authorizes the payment of federal funds from FEMA to state and local governments to pay for the extraordinary costs, including interoperable communications, associated with a federally declared disaster. However, due to statutory ambiguities, reimbursement for ambulance providers and health care facilities have too often been reduced, delayed or denied, for legitimate and requested services provided by ambulance firms.

The Stafford Act provides examples of the types of "emergency work" that are eligible to be reimbursed through FEMA administered disaster relief funds. It should include "ambulance services" in the array of services described in the Act. While "debris removal" and "rescue services" are listed, "ambulance services" and "services provided by ambulance personnel" are not listed as examples. Rapid and early ambulance response is critical. So is eliminating ambiguities around their ability to financially survive a disaster when their services have been requested. The Act should clarify that all types of ambulance providers who are part of the local or state government's emergency response system may receive funding from FEMA or other disaster relief funds. The following legislative language can implement this suggested change.

The Robert T. Stafford Disaster and Emergency Assistance Act (42 U.S.C. 5150) Section 307 should be amended as follows:

- * Strike out "reconstruction," and insert in lieu thereof

"reconstruction, ambulance services,"

The Robert T. Stafford Disaster and Emergency Assistance Act (42 U.S.C.5121 et seq.) should be amended to provide as follows:

- * "No language in this chapter shall be construed to preclude the disbursement of any funds made available under this chapter as reasonable compensation to a private organization, firm, or individual for the provision of ambulance services pursuant to a contract or other agreement with a federal agency or state or local government unit, or in response to an emergency request for ambulance services in the event of a federally declared disaster in the absence of a contract or other agreement."