

A COMMUNITY LEARNS: *The Austin, Texas, Response to Hurricane Katrina*

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IN 2005, THE WORLD BANK found that the 360 natural disasters in 2005 caused \$159 billion in damages. This amount represents a 71 percent increase in total losses when compared to 2004 losses. Hurricane Katrina alone caused \$125 billion of the economic losses in 2005.¹ Over the last few decades, the number and impact of disasters has increased dramatically, from fewer than 100 natural disasters in 1975 to more than 400 in 2005. The total number of people who lost their homes, crops, animals, livelihoods, or health because of a natural disaster—most doubled between 1990 and 1999.² In this period, an average of 188 million people were affected by disasters per year.³

Austin, Texas, located approximately 500 miles from New Orleans, received close to 19,000 evacuees when Hurricanes Katrina and Rita struck the Gulf of Mexico coastline.⁴ An ad hoc network of relief services operated by the City of Austin, local nonprofits, and individuals provided most evacuee aid. This spontaneous response illustrates the compassion and generosity of area residents rather than a high level of preparedness in Austin's disaster relief system. Thus, after the crisis passed, Austin residents evaluated their performance, learned from their mistakes, and are implementing practices and procedures which will enable them to provide a more cohesive and higher quality response to future relief efforts. Austin has been so successful in planning a coordinated response to future disasters that it has gained the trust and admiration of cities located on the Texas Gulf Coast. Austin and Galveston have entered into an agreement in which Austin would shelter up to 7,000 residents of Galveston County in the event of an evacuation.⁵

A report from the World Bank warns that the impacts from natural disasters will continue to increase unless comprehensive hazard approaches are created and implemented to mitigate and reduce disaster risks.⁶ The kind of advance planning that Austin has done will improve the coordination of disparate entities

as they converge to provide relief to evacuees. This case study examines the importance of using compatible technology and abiding by a plan that coordinates the actions of individual agents. The study emphasizes the importance of having solid disaster communication or incident management system familiar to all responders, whereby each entity has the ability to effectively communicate with organizations providing relief, such as city, state, and national officials, as well as nonprofit organizations, media outposts, and individual residents. The number of people affected by natural disasters each year from 1975-1984 to 1996-2005 has nearly quadrupled;⁷ it is essential that cities have established resources and organizational capacity to respond to a large-scale disaster.

AUSTIN PREPARES FOR THE HURRICANE

Mainstream media, such as radio, television, and newspapers, have traditionally been used to disseminate information to residents.⁸ The City of Austin used these methods to begin informing local residents of the arrival of evacuees less than 24 hours before the first large wave arrived at the Austin Convention Center, the intended temporary housing for thousands of evacuees.⁹ Information sent over the Internet via tools such as Web sites and blogs supplemented traditional communication methods. The Internet proved to be a fast and effective way for the city to provide instant updates to the public.

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became evident that an immediate evacuation of New Orleans would test disaster relief plans of the entire Gulf Coast region and require enormous resources. Beyond helping to evacuate residents from New Orleans, cities and states were expected to provide necessities such as food, shelter, health care, and communication tools to residents displaced by Katrina. As relief services in Louisiana were rapidly overwhelmed by evacuee demands, it became obvious that Austin would

play a significant role in providing relief to evacuees. Austin officials, businesses, charitable organizations and volunteers began preparing the region for the imminent strain posed on an infrastructure designed to meet the needs of 1,000 evacuees at most.¹⁰

The City of Austin first broadcast a call for volunteers through local television stations and Austin360.com, a local news and event Web site, on a Friday night after the conclusion of the ten o'clock news. Because the city was using less traditional methods of communication to request volunteers to prepare the Con-

vention Center, the city could not anticipate the number of volunteers who would respond. In a testament to the power of technology to reach numerous people instantaneously, the Convention Center, which needed assistance from about 100 people, received assistance from approximately 500 volunteers by midnight on Friday.¹¹ The outpouring of support from the local community emphasized the ability of off-peak television programs and newer technologies such as the Internet to communicate with and energize large numbers of people.

As Hurricane Katrina progressed, more information about the disaster was disseminated through the Internet. The City of Austin used its newly launched Katrina Web site to communicate with the public. Web sites similar to Austin360.com emerged and local bloggers provided a forum for multiple users to post up-to-date information from different geographic locations within the region affected by Katrina.

EVACUEE INTAKE AND TRACKING

When evacuees arrived in Austin, systemic flaws in the existing emergency provider network emerged. The biggest problem was ineffective communication between groups of responders, a direct result of the siloed nature in which these organizations were accustomed to operating. The task of registering evacuees in shelters—and tracking their medical needs and movements—demonstrated the disjointed nature of the intake response. Aid agencies traditionally responsible for registration lacked the technology to efficiently collect information from evacuees. Evacuee information at the Convention Center was entered into Microsoft Excel spreadsheets at ten autonomous check-in stations. The low ratio of computers to evacuees created long lines. The use of Excel made it impossible to search all the data at once; to find an evacuee, aid workers had to search each spreadsheet individually.¹² Because of these technological constraints, aid agencies relied on the City of Austin to help register evacuees and meet their needs.

The information technology staff for the City of Austin quickly realized the need for a centralized, Web-based evacuee information program to be used by volunteers. Once recognized, a program meeting these requirements was created in less than eight hours.¹³ This Internet-based database—accessible to Austin city employees and other cities granted access by the City of Austin¹⁴—stored the location of individual evacuees, which reduced the duplication of evacuee information processed at multiple times or locations. Thanks to the centralized database, volunteers were able to access the number and needs of evacuees in each shelter, information critical to determining the quantity of food and other supplies needed.¹⁵

While the City of Austin was able to quickly assemble a database for intake and tracking, challenges resulted from the need to overcome diverse input formatting methods. These challenges underscore the need for universal data entry standards immediately accessible to evacuees and relief responders. Universal standards underlie efficient disaster management informatics tools.

MEETING EVACUEE HEALTH NEEDS

The Convention Center shelter was designed to promote personal hygiene and cleanliness in an enclosed and densely populated environment. Austin-Travis County Health and Human Services Department (ATCHHSD) provided most health services, including cot placement, space partitioning, and evacuee health care. They created an incident-command structure that provided health care 24 hours a day to evacuees through the coordination of volunteer physicians, nurses, therapists, optometrists, and emergency and medical services from local fire departments and other health care practitioners.¹⁶

ATCHHSD implemented various health prevention measures for evacuees. For instance, they coordinated educational campaigns on effective practices to reduce and eliminate the spread of disease and conducted regular surveys to identify illnesses in the Convention Center. Hand-washing was emphasized through distribution of hand sanitizer to evacuees leaving the bathroom area or heading towards the dining area. Moreover, while conducting surveillance, health teams of one emergency management technician or registered nurse and two additional health staff surveyed the Convention Center to identify long-term health issues not identified in the initial health screenings.¹⁷

Beyond direct care practices to reduce disease, ATCHHSD used several methods to study illness patterns from the hurricane-affected regions of the Gulf Coast to predict possible outbreaks in Austin. The collection of Gulf coast clinical data through the Real-time Outbreaks and Disease Surveillance (RODS) system enabled public health officials to forecast disease outbreaks in Austin while keeping patient information confidential. Surveillance systems responsible for monitoring over-the-counter medication sales analyzed reports from hospital infection control practitioners in both the Gulf Coast and Austin regions.¹⁸ Teams of volunteers recorded mortalities and diseases from local Austin hospitals while other teams investigated communicable illnesses within the shelter. Positive lab tests and staff reports from the clinics, childcare centers, skilled nursing areas, and kitchens were compiled daily and reported to ATCHHSD and the Center for Disease Control. A worker surveillance program monitored the health of emergency responders in the shelters and local hospitals.¹⁹

ATCHHSD's focused response to evacuee health was instrumental in reducing disease outbreaks in the Convention Center. The timely creation of an incident command center, frequent educational campaigns, continual surveillance, and analysis of daily health reports for the region provided evacuees with health care services that minimized exposure to illnesses. The attention to detail and clear hierarchy of information flow allowed for a rapid response to health issues and enabled evacuees to obtain or maintain a healthy existence in the Convention Center.

MEETING EVACUEE COMMUNICATION NEEDS

After evacuees were admitted into shelters, and basic needs such as food, shelter, and health care were met, evacuees encountered a shortage of communication

tools. While the city set up telephone and Internet connections when initially organizing shelters, most of the technology was actually intended for administrative purposes and not for use by evacuees.²⁰ While some evacuees brought cell phones to the shelters, donated replacement batteries often did not match phone specifications and evacuees were left without a method of communication.²¹ As a result, computers were distributed to Austin shelters.

Advanced Micro Devices, an Austin technology company, donated Personal Internet Communicators (PICs), small computers developed for use in developing countries equipped with the Windows CE operating system and Microsoft Word. A local Austin nonprofit organization that provides technology training and computer access to the community, Austin Free-Net, administered the Katrina PICs. Touted as user-friendly, PICs were equipped with basic Internet functions such as email and web browsing. However, due to limited prior computer exposure, some evacuees experienced difficulty using these devices. In retrospect, the PICs were an inefficient communicative device for many evacuees who were first-time computer users.²²

With detailed instructions on how to use the PICs and a lower evacuee-to-computer ratio, evacuees could have more effectively used communicative tools. The large number of evacuees and few available electronic resources slowed attempts at communicating with loved ones, FEMA, and other aid agencies. To mitigate these problems in the future, Austin has pre-registered companies to donate cell phones and batteries to evacuees and has devised explicit instructions for navigating the Internet and entering personal information into databases.²³

MANAGING VOLUNTEERS

The 14,000 volunteers who responded to the call for manpower overwhelmed the 2,000 available volunteer positions. At first, the excess of volunteers created more problems than it solved.²⁴ While responding to evacuee needs and coordinating with the 75 aid agencies providing relief services, organizations had to simultaneously manage the intake, training, and coordination of volunteers.

Legal requirements placed on relief organizations further complicated the situation. Background checks became necessary as the intent of some volunteers came into question; organizers had to fend off less-than-honest potential “volunteers,” such as ambulance-chasers, lawyers, and apartment locators. It was also necessary to stop the flow of homemade cookies and cakes unusable due to liability concerns.²⁵ Residents and corporations took it upon themselves to hold drives for food and personal items, which enabled evacuees to receive some necessary items. Their efforts, while well-meaning, were inefficient, as drives received too many of some items and not enough of others.²⁶ These processes could have been simplified or avoided with a coordinated volunteer information and management system.

While databases are used for most types of management and information containment, Austin Free-Net’s volunteer management system shows that low-tech tools can also be used effectively, at least temporarily. Austin Free-Net main-

tained a “volunteer notebook” at the shelter where volunteers documented each shift’s significant happenings, detailed to-do lists, made recommendations for improvements, and listed important contact information. In the future, Austin Free-Net intends for this method to be converted into a technical device supporting multiple user entries.²⁷

DEVELOPING AUSTIN’S NEW DISASTER RESPONSE PLAN

Since Katrina in August of 2005, Austin has reassessed its capacity to respond to major disasters by analyzing successes and failures during the months it housed evacuees. City employees have evaluated the city’s effectiveness at accommodating newly arrived evacuees, meeting evacuee health and communication needs, managing volunteers and numerous local organizations, and coordinating a plan of action.

Austin’s new disaster response plan has two main components: innovative use of technical devices and a cohesive community response plan. These two components are complementary and provide organizational structure through which Austin may increase its capacity to respond to future disasters.

INNOVATIVE USE OF TECHNICAL DEVICES

Since Katrina, city employees, residents, and organizations have invented and improved devices that can benefit both evacuees and management as well as help to disseminate information. Some devices can be used with traditional communication methods, such as radio, television, and print media. For instance, mainstream media outlets can direct viewers to visit specific web sites for up-to-the-minute information.²⁸ More informed residents can use their talents to help spread information to the community by increasing the reach of messages or translating English messages into other languages. Decentralized reporting like blogging, a grassroots movement, draws more residents into relief efforts and fosters a more inclusive and thorough response to an emergency.

FOR EVACUEES

During Katrina, community voicemail provided evacuees with a voicemail account accessible from any telephone. This enabled evacuees to begin the process of rebuilding their lives without having to wait to save enough money to purchase phone service and a phone number. This idea could be extended to other technologies, such as automated text-to-voice technology, allowing messages to be viewed as emails or heard as voicemails depending on which communication device was more accessible.²⁹ Since Katrina, the city of Austin has implemented a program manned by management personnel that provides callers with solutions 24 hours a day, seven days a week. This program provides users with a single point of contact and could be used in situations similar to Katrina.³⁰

In a disaster, people may need medical care but cannot access their medical records due to geographical relocation and confidentiality requirements of the Health Insurance Portability and Accountability Act (HIPPA). If electronic health

records were available during Katrina, distraught evacuees would not have had to remember when they had operations or the names of their prescriptions; patients dependent on medical services would have been identified before their health declined. With this technology, patients could access their health information and schedule appointments from a computer and choose with whom and how much information they share with new doctors. After Katrina, the city's Community Care Services Department began using an electronic medical records system in its clinics that allows system-wide access regardless of the physician location and monitors prescription information to alert the physician of potential drug interactions.³¹ This ensures that clients who choose to participate in this program will have their medical records readily available.

FOR DISASTER MANAGEMENT PERSONNEL

During Katrina, it was clear to the City of Austin that it needed an evacuee intake and tracking database. At the time of the disaster, evacuees who lost their identification wristbands were reentered into databases and pertinent evacuee information was confused with other evacuees' details or made inaccessible. After Katrina, city programmers created the Capital Area Shelter Hub Plan, a tracking database that links evacuees to housing locations. The database supports multiple intake centers and searches by evacuee name, date of birth, gender, address, phone number, disaster type, last four Social Security digits, primary language, or disability. It ties information regarding medical records, private health insurance, Medicare, Medicaid, and other social services to individual evacuees and lets evacuees choose with whom each piece of information is shared. With a database, families can more efficiently search for missing members and disaster management personnel can more efficiently track evacuee numbers and allocate resources appropriately.³²

Since Katrina, the city of Austin has also produced a periodically updated volunteer database containing information on vetted volunteers. The database is searchable by various parameters, including availability, willingness to fulfill specific responsibilities, and skills and experiences including computer security, childcare, health care, languages, and medical skills. The city has recruited, credentialed, and trained 400 volunteers for its Community Emergency Response Team.³³ The city also created a database to store the goods and services pledged by corporations who have agreed to assist emergency providers during a large-scale emergency.³⁴

FOR INFORMATION DISSEMINATION

The volunteer notebooks used in Austin shelters, while more or less effective, often proved to be repetitive and unintelligible, and they could not be accessed remotely. To correct these problems, wikis could be used in place of notebooks. Wikis are a type of content management system that collaborate and promote the open sharing of knowledge. They allow users to create and edit Web page content from any Web browser. The software supports hyperlinks and allows the organization of contributions to be edited in addition to the content itself. Using wikis could improve on the volunteer notebooks because real-time, reader-corrected

data would streamline volunteer requests for supplies and enable disaster personnel to analyze progression with real-time entries.

The improvised blogging during Katrina has developed into a blogging network to facilitate the dissemination of information. Post-Katrina, Austin recruited technological entrepreneurs to create an emergency blogging network that provides rapid access to official information, increasing coordination between city employees, residents, corporations, grassroots organizations, and the media available 24 hours a day. Under the new system, official bloggers activate the city's emergency response system when specified criteria defining a disaster are met and post an "emergency badge" logo on their Web pages to denote official information.³⁵ The use of credentialed bloggers should greatly increase the reach of communication from the city.

Another program the city has planned is CodeRED. The CodeRED database is a confidential compilation of Austin residential and business contact information. Users can enroll on the city's website to receive official information in the event of an emergency. Through this program, city officials can contact up to 60,000 people per hour with pre-recorded emergency instructions.³⁶

For the most up-to-date disaster information, the city of Austin recommends owning a National Oceanic and Atmospheric Association (NOAA) Weather Radio transmitter.³⁷ National Weather Radio (NWR) consists of a network of radio stations that transmit the latest weather information from a nearby National Weather Service office. NWR is an "all hazards" network broadcasting warnings and event information for all types of emergencies including natural, public safety, and environmental disasters.³⁸

The quality of collection, management, and dissemination of information determines the quality of services provided to evacuees. The most effective tools include a reliable wristband identification system for volunteers and evacuees; a single, flexible, layered intake database; assigned and tracked cot numbers to aid in location of evacuees within the shelter; and daily communication between volunteers and evacuees via print newsletters or video boards.³⁹

The city has already begun using a volunteer database, evacuee intake and tracking database, electronic health records, community voice mail, CodeRED, and NOAA radio. To further improve its disaster response system, the city should consider volunteer wiki management and continue with the plans for an official blogging system.

COHESIVE COMMUNITY RESPONSE PLAN

Technology plays a vital role in ensuring quick, positive outcomes. Through the innovative use of traditional and new technological communication tools, residents may connect with others who have skills helpful in responding to a disaster. With the assistance of innovative methods of communication, people come together in new ways to improve the efficiency and quality of service for evacuees.

Austin residents took the initiative of founding the Central Texas Citizen Corps Council (CTxCCC) to reduce the impact of an emergency. The Austin chap-

ter works closely with local emergency officials and the United States Department of Homeland Security. Their purpose is to fill gaps in service provision, avoid duplication, facilitate training drills, and coordinate a Community Emergency Response Team (CERT). The Central chapter consists of representatives from the City of Austin and Travis County first responder departments, emergency management agencies, and community service groups.⁴⁰

After Katrina, various agencies created emergency response drills to test improvements to response plans. From a drill in October 2006, the Red Cross learned that it needed to renegotiate with Dell, Inc. for more computers and tape down specific instructions next to each computer for evacuee reference. Other issues included miscommunication or lack of communication to volunteers and shelter management. For instance, some volunteers did not clearly understand their roles, managers' responsibilities for each shelter were different, and volunteer placement was slow. Once this problem was discovered, volunteers received detailed job descriptions and shelter management training programs were instituted. Furthermore, the Central Texas Volunteer Resource Center evolved from a partnership between the Office of Emergency Management (OEM) for the City of Austin and the Red Cross. Volunteer intake centers will be located in the neighborhood recreation centers run by Austin's Parks and Recreation Department. Agencies who participate will be allotted space in the Resource Centers for volunteer intake, screening, training, and scheduling. The Red Cross now has a database of more than 500 trained shelter managers and untrained general volunteers who are willing to assist in an emergency. The organization can activate 3,000 volunteers within 24 to 48 hours.⁴¹

Austin's ad hoc response to Katrina has developed into a network of agencies devoted to providing emergency services during a disaster. The OEM for the City of Austin spearheaded the organization of formal and informal Austin agencies and is currently finalizing the official emergency response plan for Austin. The plan includes the self-determined responsibilities of entities in the Austin area that have pledged their support to meet specific needs during the next emergency. The plan, described below, is designed to activate support from these agencies in a way consistent with the severity of the disaster and strives to use the strengths of each organization.⁴²

When disaster strikes, the Red Cross awaits an alert from city emergency personnel from Central Texas Citizen Corps Council (CTxCCC). The Red Cross liaison to the City of Austin coordinates with Red Cross personnel to activate general volunteers, computer experts, volunteer trainers, and others. The city determines the order in which the shelters are to be opened and the Red Cross is responsible for assigning shelter managers to each shelter. The Red Cross has access to information from other relief agencies via a real-time blog that posts immediate needs such as shelter requirements and the number of volunteers needed in a particular capacity in a particular place. This method has been tested

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and works well. The Red Cross is more prepared for a disaster than it was just prior to Katrina.⁴³

The database first used in the Convention Center has been updated with the assistance of Harte Hanks, a targeted marketing company based in San Antonio. The first Web-based model has been enhanced and can currently schedule 53 sites and keep track of volunteers' qualifications, credentials, and certificates.⁴⁴ The online system can also load money on debit cards for evacuees. Because the system is Web-based, volunteers can register themselves, their personal details, and their availabilities. The Red Cross also plans on using either a wiki or other Web-based method of disseminating information externally through mainstream media. Currently, they are working to improve their connectivity so that case-work can be directly entered into a centralized database.⁴⁵

The scale of Katrina was beyond the scope of Austin's disaster plan. "Large-scale" now has new meaning.

More than 12,000 emergency response personnel (including business owners, building managers and staff from the University of Texas and Austin Independent School District) are equipped with pagers that use the Austin Warning and Communication System (AWACS). Outgoing alerts are coordinated by the city's Emergency Operations Center. This system could be improved by upgrading from the current alphanumeric pagers to more modern devices, such as BlackBerry handhelds. Instead of only brief alphanumeric messages, a BlackBerry can receive text messages, calls, and even attached files.

Another system Austin has adopted is Automatic Vehicle Locators (AVL). This technology uses geographic information systems and satellite technology to pinpoint where emergency medical service vehicles are at all times.⁴⁶ While this is valuable for managing mobile resources, the tool could be more helpful if it incorporated personal locators for all responders. These locators would only be used in emergency situations. They would enable coordinators to efficiently move responders and volunteers around in the field, saving time and resources.

Wireless communication between actors is also important. A recently formed statewide coalition aims to provide seamless wireless communication coordination between federal, state, and local first responders. Its goal is to ensure radio interoperability throughout the state. Austin gained interoperability between first responders with the implementation of the Austin-Travis County Regional Radio System.⁴⁷ Before this was organized, sheriff's constables and municipal police could not communicate with each other over their radios.

OEM has led the charge for comprehensive large-scale emergency responses to disasters via a state-of-art Emergency Operations Center (EOC). Primary emergency responders such as police, fire, and highway departments have physical access to one another on the bottom floor of the EOC for routine operations. For larger emergencies, such as Hurricane Katrina, the upper level of the EOC has phone banks and conference rooms for public utilities, nonprofit organizations,

and other emergency responders. The EOC also serves as a command center for communications involving other agencies such as Austin's Public Information Office and the Combined Transportation, Emergency and Communications Center (CTECC). The EOC is networked so that all responders use the same software. City officials from smaller cities as well as international officials have toured the EOC and used it as a model for their own disaster response centers.⁴⁸

Austin has a cohesive community response plan in place. Based on experiences during Katrina, the city is coordinating efforts between entities such as the Red Cross, individual residents, and various city responders. The high level of coordination required is a testament to Austin's dedication to have all affected parties represented in the planning process and using new technologies for the best possible response. Austin's Incident Management System, which integrates effective practices in emergency preparedness and response into a comprehensive framework for incident management, will be crucial for efficient and effective communication and avoidance of duplication in future disasters. It transitioned through three distinct phases in Katrina—from intake and stabilization, to long-term shelter services, and finally through a transition to living in a community. The city refined its plan even more in response to results of simulated emergency shelter and response trials. The challenge is to remain mindful of the lessons learned by emergency responders and continuously assess, adjust, and test coordinated responses to disasters.

LESSONS LEARNED FOR APPLICATION TO OTHER CITIES

Like many cities around the world, Austin believed it was prepared for a large-scale disaster. Prior to Katrina, the Austin area was equipped to provide temporary relief and shelter to an evacuee population of several thousand. The scale of Katrina was beyond the scope of Austin's disaster plan. "Large-scale" now has new meaning. An entire city within a city was built at the Convention Center.

In the process of adjusting pre-Katrina planned responses to meet the overwhelming needs of almost 19,000 evacuees from Katrina and Rita, three critical components of disaster planning and response emerged: self-reliance, resourcefulness, and flexibility.⁴⁹ Self-reliance on the part of emergency responders and residents was paramount. Residents were confident in their ability to respond to a large-scale emergency without relying on support from outside the community. The resourceful and flexible local emergency responders and residents used both traditional and innovative technological resources to quickly address evacuee needs. Austin's ability to rapidly transform a planned but inadequate disaster relief effort into an improved plan for future disasters demonstrates the importance of maintaining a response that is flexible, holistic, and creative in its approach towards the application of technology in managing large evacuee populations.

Katrina highlighted systematic failures in the region's response plan. Initially, Austin's response to Katrina was characterized by multiple organizations working independently to meet evacuee needs. This may be attributed in part to

limitations of communication. The pre-Katrina disaster relief plan relied on mainstream media such as radio announcements and television news syndications to facilitate the coordination between city officials, relief organizations, private corporations, and residents. These traditional methods, while functional, proved insufficient due to the large number of evacuees with immediate and unanticipated needs.

To address the needs of evacuees in Central Texas, Austin largely relied on technology and community support. Many of the difficulties encountered in Austin and the surrounding region were countered through the creation and adoption of appropriate technical solutions. The creation of innovative technological solutions applied and maintained by knowledgeable relief workers has improved Austin's ability to respond systematically and efficiently serve the needs of large numbers of evacuees.

Katrina proved to be a catalyst of change for Austin. It forced organizations accustomed to working in relative isolation to collaborate. It drove the creation of interconnected technological and organizational responses towards the goal of creating flexible, complex emergency response systems. Functionality and efficiency increased as the city integrated new technologies into planning. Austin has made strides towards the creation of an adaptable disaster response system composed of independent yet compatible systems capable of being pieced together for the most appropriate response to a situation. As large-scale disasters become more common and the economic, ecological, and human costs increase, the experiences and responses of cities need to be analyzed to further the development of responsive disaster management systems.

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