Smarter Cities
Thought Leadership White Paper

21st century emergency management

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In the late summer months, a tropical depression forms over warm ocean waters. Meteorologists track the system as it increases in both size and intensity, becoming first a tropical storm and then a hurricane. Forecasters and computer models agree the new storm will likely make landfall over a major population center. As the hurricane strengthens, emergency management personnel prepare for what they fear will become headline news. Public agencies and private organizations throughout the region begin executing their respective emergency plans.

Meanwhile, on the other side of the country a lone actor executes a carefully designed plan for public violence. Unlike with the brewing storm, emergency management personnel have no advance warning and must immediately assess the situation and activate plans designed to prevent loss of life.

In both scenarios, response plans are in full motion. While the various regional agencies and organizations in each area have planned for these types of events, these groups still struggle to coordinate a comprehensive response. Plan execution revealed areas where interagency activities were not working together cohesively. It also showed where their respective preparedness and response plans overlap—and information-sharing challenges made real-time adjustments difficult at best.

How did we get here?

Around the world, incidents similar to these occur every day. Yet in event after event, emergency management (EM) personnel struggle to overcome institutional inertia that can impede an integrated response to fully-anticipated events as well as the challenges posed by unanticipated events. The reason is the historical evolution of emergency management.

Traditionally, emergency management as a practice was focused on disaster response. Only minimal EM resources were allocated to planning and preparing for an emergency, recovering and rebuilding from an emergency, or even ongoing activities that might reduce the impact or duration of an emergency event. This was because the discipline of emergency management originated from developing appropriate responses to wars and other externally-initiated attacks. In addition, early disaster research was almost exclusively supported by the US military.

As the Cold War waned, the EM focus shifted from traditional military threats and broadened to include both natural and manmade events. In 1979, a more formalized, civil-based approach was initiated with the formation of US Federal Emergency Management Agency (FEMA) and the associated EM workforce that included regional and local officials in addition to military personnel.

At the same time this new approach to emergency management was unfolding, the EM community introduced a four-phase model to address virtually all aspects of an incident, not just response. By 2012, the model was solidly established as a four-phase cycle and became the official operating approach. Shown in Figure 1, this model includes preparedness, response, recovery and mitigation.

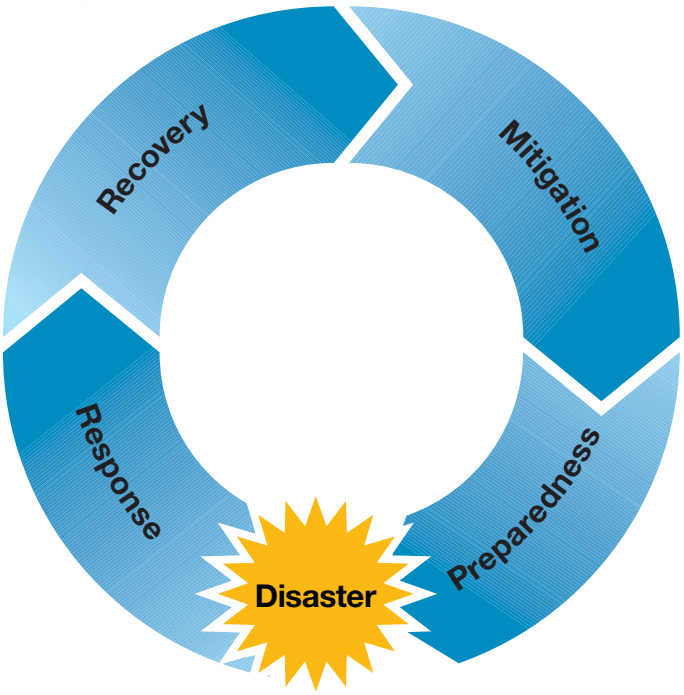

Figure 1. The four phases of emergency management.

As the graphical representation shows, the EM process is iterative and each phase is intertwined with the others. Each phase leads into the subsequent phase, and various entities and jurisdictions lead efforts depending upon the phase and the activity within that phase. Ultimately, the lessons learned from the incident and response to it should impact subsequent adjustments within the preparedness phase.

Preparedness

The preparedness phase includes much of the pre-event planning that occurs in anticipation of an event. This includes identifying and allocating the personnel, training and equipment necessary to respond to the event as well as developing jurisdiction-specific and inter-jurisdictional plans for delivering those physical assets during an emergency. The key components of this phase are:

- Threat assessment
- Resource assessment and acquisition
- Inter- and intra-jurisdictional cooperation
- Drills and exercises
- Plan documentation

Response

The response phase begins the execution of the plans and allocation of resources identified in the preparedness phase. As the name suggests, response also includes the immediate actions necessary to save lives, protect property and meet basic human needs, as well as initiate the short-term recovery process. Key components of this phase include:

- Activation of emergency protocol
- Medical assistance and first aid
- Shelter and evacuation
- Search and rescue
- Secondary damage reduction

Recovery

The recovery phase includes developing, coordinating and executing service and site restoration plans with both an immediate focus as well as a more strategic perspective. Short-term recovery focuses on restoring critical systems such as roadways and utilities, removing debris or contaminated material, and other tasks required to re-establish the affected area's normal daily operations.

Long-term recovery typically includes more strategic activities, such as rebuilding housing, restoring social and economic structures, and providing for the long-term care of affected individuals. In addition, the emergency managers analyze the event as well as the preparedness and response phases to extract valuable lessons, satisfy any post-incident reporting requirements and trigger mitigation initiatives. Key components of this phase include:

- Damage assessment
- Cleanup
- Restoration of critical systems and facilities
- Provision of temporary basic needs
- Basic reconstruction

Mitigation

As you might suspect, the mitigation phase is both distinct as well as integrated throughout the entire process. As a distinct phase, mitigation follows recovery and includes activities that help reduce losses from subsequent events. Since at its core it focuses on reducing the ongoing effects of disaster-inflicted damage, mitigation activities can be identified and carried out in each of the other three phases. Key components of this phase include:

- Improved reconstruction
- Legislative planning
- Regularly scheduled vulnerability and risk assessments

Legacy-induced challenges

The national defense foundation on which traditional emergency response processes were built has left a legacy—a rigid, hierarchical approach to emergency management that remains today. Since law enforcement agencies and fire departments share this hierarchal structure, and they typically lead EM efforts, this legacy is reinforced.

Much like a military, first responders typically aggregate domain expertise in defined channels or units such as an anti-terrorism unit within a law enforcement agency or a hook and ladder truck within an urban fire department. While this helps define and gather high-level expertise, the resulting knowledge silos can create a challenge for modern emergency management.

How this impacts your emergency management efforts

Regardless of where you look, even today's smallest local jurisdictions have complex interconnections that can break down under a siloed operational model. In the most basic developed society, for example, the collection and removal of trash or incident-related debris can contain unrecognized complexities.

There may be private and governmental collection entities, each of whom depends on the transportation network to operate. Furthermore, those entities often aggregate the refuse at a centralized location where it is then transferred by surface, rail or water to an additional location for final disposal. During an incident, these connections are strained and can break down.

Debris removal is just one small example of how interconnected today's basic societal needs have become. Comparable complexities exist for other societal infrastructure such as power, water and medical services—as well as the most basic economic activities within a region.

Citizens increasingly expect these services to be uninterrupted, or at the very least to have those service interruptions minimized. Throughout the incident cycle, these residents expect more from EM personnel than ever before.

- **Preparedness**: Residents expect EM personnel to better anticipate both natural and manmade events, to develop more comprehensive and coordinated plans for those events, and to practice those plans more frequently.
- **Response**: Residents demand more efficient and more effective reactions to incidents. This requires more cohesion between the numerous stakeholders involved in executing those comprehensive and coordinated plans.
- **Recovery**: Residents desire a faster "return to normal" after an event, as well as an assurance that they won't have to experience the same thing again.
- **Mitigation**: Residents increasingly want better prevention against known or anticipated consequences to incidents.

The challenge, then, is to blend the historical EM approach and the resulting organizational silos with an operational framework where basic services are increasingly interconnected. And do so within the resource-constrained environment experienced by most regional and local emergency managers.

21st century emergency management

To address the challenge of blending siloed domains with the realities of an increasingly interdependent societal structure, we can look to one of three distinct solutions. First, we could seek to uncouple the integrated structure of our society. That is neither likely nor desired.

Second, we could physically break down the siloed domains and create an all-encompassing emergency management organizational structure. Unfortunately, the institutional and political realities make this option challenging for most regions and localities, and can dilute specialized expertise within individual domains.

So if changing the societal structure is impractical and integrating the physical organizational structure across the EM landscape is politically and financially imposing, is it possible to meet growing public expectations? If so, can we do it quickly enough to be prepared for the next incident?

The third option

The short answer to those questions is YES. To understand how we can achieve this vision, we have to reflect on the military model from which the traditional EM operational structure evolved.

Like EM leaders, military leaders generally face similar challenges of siloed domain expertise and resources in an increasingly interconnected operational landscape. To meet these challenges, modern military forces increasingly rely on technology. Advancements in information gathering, analysis and sharing have helped integrate the military's siloed domains and resources with great success, and provide the agility that remains essential for adapting to rapidly changing environments.

This same technology model has already been successfully applied to the EM environment, and not just in an isolated support role. Rather, these technology applications have supported the full spectrum of EM activities—helping prepare for, respond to, recover from and coordinate mitigation for incidents around the globe.

Preparedness

As the foundation upon which EM activities reside, the preparedness phase allows you to "practice as you intend to play." Through tabletop exercises, EM managers can walk through the complete cycle for a likely incident. This allows the EM managers to identify required tools, potential pitfalls and information channels as well as missing institutional agreements and operating arrangements. They can then take direct steps to address identified shortcomings and use subsequent tabletop exercises and full-scale drills to test whether those shortcomings have been adequately addressed.

Technology offers the ability to accelerate preparedness tests and manage the growing complexity of this phase. Traditionally, tabletop exercises have taken substantial time resources as well as one or more large rooms with papers spread out over an expansive conference table—not to mention the effort required to design the exercise and document results. New tools can now supplement and automate many parts of the tabletop exercise.

For example, IBM designed and created a capability assessment tool for a world-renowned emergency management agency. As a self-assessment tool for state and local governments, the tool streamlines the process of evaluating current capabilities related to:

- Physical resources such as equipment, commodities, personnel, teams and facilities.
- Procurement, including processes and resources.
- Infrastructure, such as transportation and utilities.
- Agreements with governmental and private organizations.

This allows for a structured, consistent comparison against baseline operational standards as well as the ability to identify areas for targeted improvement and create a roadmap to both mitigate weaknesses and enhance strengths.

Response

Response is when EM personnel have the opportunity to execute what they have practiced. Although it is just one phase, response is often what the public thinks of when they think about emergency management. Therefore, failures and successes in this phase can dramatically impact the political and financial support for an EM program.

Available technology tools bring opportunities for tremendous improvements in the response phase. Rapidly deployable data and information-sharing systems can use secured cloud solutions, allowing communication to continue even when infrastructure is damaged or limited in scale. This helps ensure the right decision is made to apply the right resources at the right time.

For example, the IBM® Intelligent Operations Center solution and platform work hand-in-hand with specialized tools to serve as the coordination point for a vast array of customizable software and communication media. Mapping software and geographic information systems (GIS) can help you understand and visualize data to make decisions based on the best available information. And situational awareness and decision-making tools such the IBM emergency management center solution, which includes specialized industry-leading business partner solutions, can help you understand the possible decisions and predict the consequences of various options.

Recovery

As long-term response gives way to short-term recovery, the task of returning to pre-incident functionality begins. Activities such as debris removal, utility restoration and infrastructure rehabilitation are fully under way. Because of the interconnected nature of a modern society, and the higher number of governmental and private participants, managing the logistics of these complex activities can be a challenge.

Technology can help emergency managers orchestrate these logistics. The same information-sharing tools used during the response phase can help speed resource application to the rebuilding efforts as well as integrate mitigation measures into the rebuilt infrastructure. Big data tools can help analyze after-action reports as well as track the success of long-term recovery efforts over many years.

Solutions from IBM include software applications from business partners or third party providers that can be adapted to monitor recovery activities. Then, big data tools such as IBM Cognos® can integrate with these solutions to provide valuable insights from after-action reports that help feed into the mitigation and subsequent preparedness phases.

Mitigation

Although identified as a distinct phase, mitigation is also integrated with each of the other phases. The results of the mitigation phase become inputs and considerations for the preparedness phase—seeking to help reduce the risks and impacts of future incidents. Likewise, mitigation results are integrated with recovery efforts where infrastructure modifications can help prevent large-scale losses from future incidents.

Like the other three phases, mitigation can benefit greatly from the application of technology. For example, digital mapping and GIS technologies help with floodplain analysis and insurance programs. Along with GIS technology, advanced mathematical modeling and predictive analytics can use simulations to project the physical, economic and social benefits that improved societal structures will have on a future incident.

Implementing an emergency management technology solution

Citizens expect more from their EM professionals: comprehensive planning, swifter and better coordinated response, accelerated recovery and integrated mitigation. While hardware and software tools can help you meet these expectations, the real power of technology comes when it works cohesively across all four phases. Therefore, your technology partner should be able to articulate how their solution can effectively address all four phases of emergency management.

As an example of that type of vision, the IBM emergency management philosophy is based on the broader IBM Smarter Cities® philosophy. This means IBM emergency management solutions use existing systems to gather data that can drive more educated planning and response decisions, analyze that information for proper response actions and mitigation steps, then integrate those informed decisions into an effective response and recovery.

Just as importantly, implementing a comprehensive EM technology solution can be complex in even the most basic of regions or localities. The diversity of communication components and geospatial applications, along with data collection, storage and analysis tools applied to four distinctly different, yet interrelated, phases requires a broad set of hardware, software and technology integration knowledge and skills.

IBM technology partnerships illustrate how an EM solution provider can address the technological complexity found in the emergency management environment. Recognizing that the needs of regional and local EM professionals include specialized capabilities, IBM has established several key partnerships with industry leaders to provide such capabilities for clients. These partnerships allow IBM solutions to integrate with leading GIS providers, and include specialized analytics and intelligence capabilities in the toolbox. They provide industry-leading, next generation situational awareness in real time, as well as decision support and consequence management solutions.

Why IBM?

Cities everywhere are reinventing themselves. They are reimagining essential systems, infrastructure and service delivery to promote growth, sustainability and enhanced quality of life. Cities are better integrating across functions, capitalizing on new insights, creating system-wide efficiencies and collaborating in new ways to turn challenges into opportunities while building the strong, differentiating identities that attract new citizens and businesses. Because enhancing public safety is one of the most important strategic ways to achieve this, IBM has developed a comprehensive vision for how a 21st century city can use technology to speed emergency response.

Combining world-class business, industry and technology expertise, IBM provides the integrated solutions that help visionary leaders achieve their objectives. Drawing on thousands of client engagements and proven strength across the breadth of city operations, only IBM offers the experience that today's challenges demand.

For more information

To learn more about IBM solutions for emergency management, please contact your IBM representative or visit:
ibm.com/smartercities

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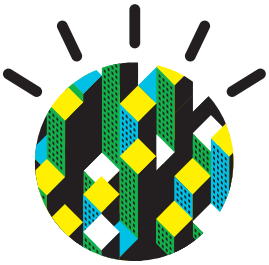

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