

ArcGIS® for Emergency Management



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ArcGIS for Emergency Management

An Esri White Paper

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ArcGIS for Emergency Management

Introduction

ArcGIS® for Emergency Management is an openly available baseline configuration of mission-specific templates, tools, and applications sitting on top of the flexible and scalable ArcGIS platform reference architecture. The platform organizes, manages, and delivers appropriate information and data to emergency management personnel based on their specific missions and roles within the organization. As an organization begins to manage its data, perform hazard analysis and risk assessment for its areas of interest, and deliver information in an effective manner, it can begin to respond more effectively and recover more quickly.

ArcGIS for Emergency Management supports and enables common workflows across all aspects of the emergency management mission, from planning to response and recovery. It provides the analytic engine that creates the foundation of good preparedness for an organization by allowing it to conduct comprehensive risk and hazard analysis that identify community vulnerability and highlight mitigation priorities. It also allows better preplanning around events and scenarios that in turn leads to a higher level of overall preparedness. Implementing ArcGIS for Emergency Management promotes enhanced situational awareness to support better decision making by delivering information in a meaningful way for users. This includes alignment with the National Incident Management System (NIMS)/Incident Command System (ICS) and the National Response Framework (NRF).

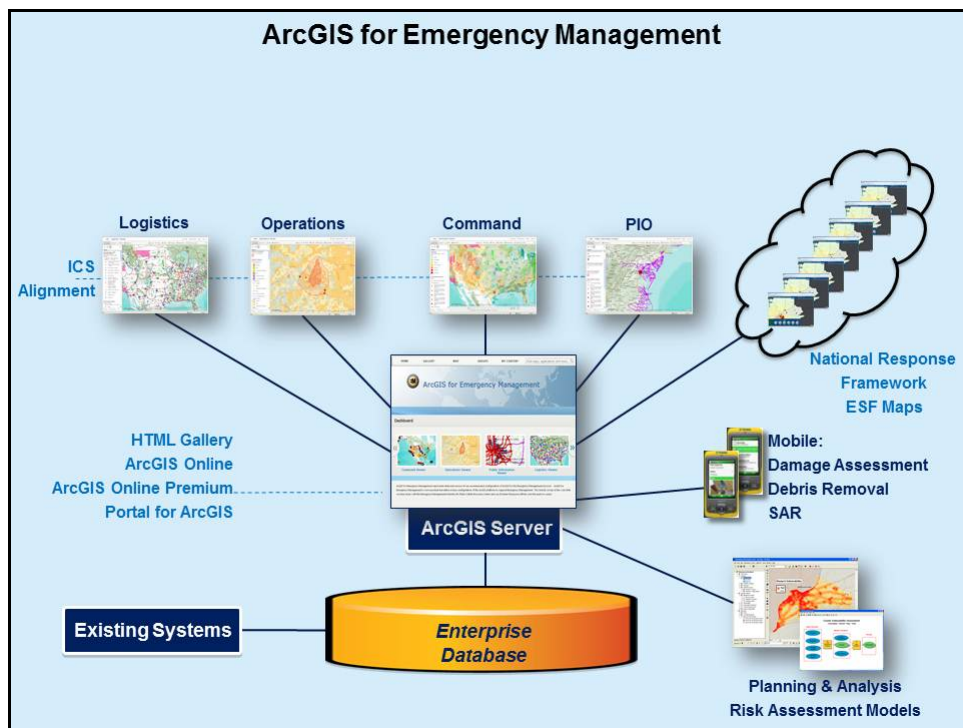
ArcGIS for Emergency Management provides organizations with a baseline configuration in support of these workflows through the use of templates. These include the following:

- Data model that includes public safety-specific features for operational data
- Common analytic tool and model for vulnerability analysis and impact assessments
- Situational awareness viewer that supports mission-specific delivery of data and tools
- Configuration guidelines for common authoritative data sources such as the Homeland Security Infrastructure Program (HSIP) and HAZUS
- Mobile projects to support emergency management missions including damage assessment
- Public information map that integrates social media
- Data exchange and catalog portal for collaboration and data discovery

Following is a general description of ArcGIS for Emergency Management and how the ArcGIS platform can be configured to provide the benefits described above.

ArcGIS for Emergency Management Configuration

ArcGIS for Emergency Management is designed to organize and deliver the baseline tools and data typically needed to support an emergency management organization. This delivery includes desktop, server, mobile, and web access using a common repository of data and tools that is managed by the ArcGIS platform. These data and tools have been typically accessed by a single web-based common operating picture (COP), the user experience and access when and where appropriate have been difficult. ArcGIS for Emergency Management promotes access to these data and tools via multiple mission-specific maps or applications that are based on a user's role or responsibilities. These maps and applications are available throughout the organization on any device and are intended to provide targeted and meaningful delivery in support of specific mission requirements. Aligning delivery to a user's mission facilitates the user experience and removes the burden of searching for the right data or tool to answer a specific question. Just as a good traditional paper map helps sift away the noise and focus attention on the task at hand, mission-specific intelligent maps and applications can do the same thing in a digital environment, from any location in the field to the office. These mission-specific views can then be used on both a daily basis and during incident support. The graphic below outlines a baseline configuration of the ArcGIS platform—the common operating platform—that aligns with a common emergency management organization structure and mission.



Data Management

Emergency management relies on a multitude of data that drives analysis and helps inform decision makers. Creating, editing, and managing this data is the foundation of ArcGIS as the common operating platform. Data comes from many different sources (spreadsheets, web services, business systems, etc.) and can quickly overwhelm decision makers. However, normalizing the data by geography presents patterns that become apparent—tabular data begins to tell a story that supports decision makers. Once data is captured, personnel can begin to feed analytic models and drive intelligent maps or applications that provide insight into how an event is unfolding or a decision impacts an organization. But data management is not just about consumption. Sharing relevant and authoritative data and information products with organizational partners is vital, and ArcGIS provides the mechanism to do that. ArcGIS for Emergency Management is built on sound data management and data sharing capabilities that allow users to form common communities that open the door for collaboration.

Planning and Analysis

Raw data might not be useful, but analyzed information is. ArcGIS provides the analytic engine to turn the raw data stream into actionable information. Planning and analysis are most commonly performed through the use of ArcGIS Desktop, but the common operating platform allows access to analytics that can be executed from any location. Analysis is critical to supporting the emergency management life cycle. It is how an organization can analyze risk, understand vulnerability, identify mitigation priorities, develop comprehensive response plans, and test the impact of different event scenarios. The following are examples of common planning and analysis functions for emergency management:

- Conducting a jurisdictional vulnerability analysis based on the occurrence or presence of several elements:
 - Critical infrastructure
 - Natural hazards
 - Technological hazards
 - Historical risk
 - Vulnerable populations
- Resource management and preplanning
- Modeling loss estimates and impact analysis for events using HAZUS
- Building incident action plan (IAP) maps
- Planning for special events and promoting common incident command and control

Situational Awareness and Response

As an organization begins to fuse and manage all its disparate data within the common operating platform, delivery and access for situational awareness have historically been achieved through a web-based viewer frequently referred to as the common operating picture. As access to data and dynamic information has increased over the years, the traditional COP has become cluttered with too many datasets and tools so use is difficult. Regardless of what users' roles in the organization are or the workflow they are trying to accomplish, they all use the same COP and are forced to find the data or tool they need to answer a question and move on.

ArcGIS for Emergency Management is designed to change the way content is delivered and allow information to flow across the organization in a direct and concise manner.

ArcGIS for Emergency Management addresses this by providing mission-specific maps and applications that tailor situational awareness to the role each decision maker or staff is responsible for. This ArcGIS for Emergency Management configuration, with multiple mission-specific viewers in place of one COP, also aligns with NIMS and delivers data and tools based on the ICS framework. A logistics chief has a very different need and use case than an incident commander does. By aligning each view to the organization structure, each person enters into a user-friendly experience that makes sense based on mission requirements. This can be further tailored to even more specific delivery and aligned to the NRF Emergency Support Functions (ESF), which are responsible for an even finer-grained detail of the organization. ESF 1—Transportation organizations should only be presented with the data (transportation infrastructure) and tools they need, not a catchall system that appears foreign. The following baseline configuration guidance for ICS command, operations, logistics, and public information and for ESF 1–15 is provided as a starting point for better situational awareness. The high-level design of these views is as follows:

Command Executive Dashboard

The command dashboard provides situational awareness for decision makers and command staff in a dashboard-type environment. This view is always on and running as a high-level overview of a jurisdiction and the current status it faces. It includes major hazard feeds (weather, earthquake, tsunami, hurricane, etc.) but can also be connected to crisis information management system (CIMS) or computer-aided dispatch (CAD) data to show high-impact events in the community. As a reference to assess the impact of these events, the view should contain the risk/hazard analysis data layers for the organization and the vulnerability analysis conducted. This is not a heavy-lifting viewer with a lot of data or tools but a clean interface designed for maximum consumption or situational awareness without the noise. It should be focused solely on command, departmental executives, or elected officials.

Operations/Tactical Planning View

The operations/tactical planning view provides a picture of the ongoing situation and response within a jurisdiction. It is the heaviest viewer for tools and data and would contain the most information about the operational aspects of an incident. It should provide tools that allow operations staff to manage field operations, answer questions about impact, illustrate and convey planned activities, and monitor response efforts such as search and rescue or damage assessment. This view should be connected directly to the field personnel who are collecting information in real time. It should also report the status of activities in relation to a stated goal. As the operations staff makes decisions, the ability to mark up the map with incident symbology that conveys status should also be included.

Logistics/Resource View

Logistics officers need visibility into the status, availability, and location of resources while working on the management of resources for an organization. This workflow includes the ability to query and task relevant commercial or emergency rental resources potentially needed for events (dump trucks, potable water, portable toilets, lumber, etc.) based on location in proximity to an incident location. The logistics viewer also provides updated information on the transportation network for appropriate routing and movement of resources in addition to incident information and needs coming from the operations and planning sections.

- Public Information View** During crises, communication with the public is critical to both educate and inform on current plans, activities, and decisions. In return, the public can provide valuable information to the organization and, in essence, become a force extender on the ground. The public information view provides awareness to citizens regarding response and recovery aspects. This viewer is targeted to non-GIS users and is intended to be lightweight, with limited tools and data for the public to access. The data provided will be a subset of the larger operational data that has been approved for public release and disseminate value-added alerts or operational data to inform. Likewise, the viewer can be adapted to collect information from the public through controlled entry forms for volunteered geographic information (VGI) from the crowd or to harvest public information from social media sites (e.g., Twitter®, YouTube®, Flickr®).
- ESF Viewers** When emergencies occur, the Federal Emergency Management Agency (FEMA) and many states organize around 15 ESFs as defined in NIMS. These represent functions and services that are critical for incident management and recovery. ESFs also become the communication channels between all levels of governments for specific tasks. Each ESF plays a specific role, and therefore, these viewers provide users with more targeted delivery during an incident. As an example, ESF 1—Transportation is responsible for aviation/airspace management and control, transportation safety, restoration/recovery of transportation infrastructure, movement restrictions, and damage and impact assessment to infrastructure. The ESF 1 mission requires specific data and tools that are much different than those of ESF 9—Search and Rescue, which is responsible for life-saving assistance and conducting search and rescue operations.
- Briefing View** When an incident briefing is required, it is often done by various officials representing the ESFs above and commonly uses static presentations based on text only. ArcGIS for Emergency Management aligns the data to the ESF mission and, as a result, creates dynamic maps in support of briefings and decision support. Using a tool like ArcGIS Explorer Online in presentation mode, an organization can show the different ESF views dynamically, along with the high-level ICS views, to support live briefings during an operation. The data is current, and the content is relevant without having to stop operations to build briefing materials. All these maps are being updated in real time as users conduct their missions.
- Mobile Capabilities*** A final component of ArcGIS for Emergency Management, and perhaps the most critical, is the mobile component. Building tools and applications that work in the field and empower knowledge workers to complete their workflows in a more streamlined manner is an important part of completing the information life cycle. These mobile applications connect the field to the office using the same common operating platform and are largely deployed in support of command and control (incident management), response (search and rescue; situational awareness), and recovery (damage assessment; debris removal) workflows. As workers in the field access the application on their mobile devices, they see the same symbology and data that those in the office are using. As they begin their work, the application should align to their mission by providing only the data and collection tools needed, thereby removing any irrelevant information.
- Summary** ArcGIS for Emergency Management is a scalable reference configuration of a common operating platform with viewers and tools designed to support general emergency management workflow requirements. ArcGIS for Emergency Management is designed to deliver content and allow information to flow across an organization in a targeted and

meaningful way. By deploying the ArcGIS platform and developing the views and tools described in this document, an organization can truly achieve visibility into all facets of the emergency management life cycle. As organizations begin to shift focus on deploying a common operating platform, they can start to engage users in a meaningful and mission-specific way. This means aligning with common standards (NIMS/ICS) and workflows in emergency management and delivering mission-specific maps and applications directly to the knowledge worker without the need for GIS training. Moving the focus from a picture to a common operating platform not only enhances situational awareness but also empowers users by providing better understanding, collaboration, visualization, and rapid dissemination of critical information when and where it is needed most.



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