

MANAGING IN A DANGEROUS WORLD - THE NATIONAL CRITICAL INCIDENT MANAGEMENT SYSTEM

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Abstract

Systems engineering, project management and organizational structure play important roles in the success of any organization. Now more than ever, these elements are vitally important for successful emergency response coordination and major security initiatives during any large-scale emergency response. After the terrorist attacks on September 11, 2001, the successful implementation of the Incident Command System (ICS) by the Arlington County (Va.) Fire Department served as a catalyst for a later mandate by the Department of Homeland Security (DHS). All DHS funding recipients are required to utilize the new National Incident Management System (NIMS) for organizing any critical emergency responses to a terrorist attack, disaster, or other critical response requirement. NIMS is the Nation's first standardized management approach that unifies Federal, state, and local lines of government for incident response. The NIMS system evolved from the Incident Command concepts pioneered by the Phoenix Arizona Fire Department and the State of California. This paper will outline and overview the background, history, use and applications of the NIMS system, with a focus on the ICS within NIMS. This collective management effort's goal is to continue to protect our citizens from the results of natural disasters and acts of terrorism. This paper will identify areas where the engineering management field can make a contribution to this important endeavor as well.

Introduction

Modern fire protection, emergency medical, and rescue services have evolved to accommodate a tremendous expansion over the years. Compton and Granito (2002) discuss that as the number of people increases, hazards tend to increase proportionately. With a greater population density, it is likely that fire, medical and rescue emergencies will increase. There is a greater need for transportation of people and commodities, therefore, the likelihood is that aircraft and auto crashes, railroad derailments, spills of hazardous materials, accidents and so forth will occur more frequently. Increased population also translates into increased consumption of manufactured goods, with operations requiring the storage, heating and

mechanical processing of raw materials, some of which are quite inherently hazardous, either alone or in combination with other materials. These issues, combined with existing threats from natural disasters and terrorists in recent history, have led to a growth in project planning for emergency contingency planning at all levels of government, as well as private sector planning for corporate protection. The new National Incident Management System is an evolutionary result of years of planning and experience to accommodate the growth and threats facing our emergency response personnel.

On February 28, 2003 the Homeland Security Presidential Directive 5 requested the development and administration of the National Incident Management System to prevent, prepare for, respond to, and recover from terrorist attacks, major disasters, and other emergencies. The objective of this system is to ensure that all of the various levels of government across the United States have the capability to work efficiently and effectively together using a single national comprehensive approach. The background of the NIMS and specifically the ICS component will be outlined below.

Background

The Incident Command System (ICS) and the Fireground Command System (FGC) have played a critical role in the development of the current National Incident Management System (NIMS). The Fireground Command system (FGC) was pioneered by the Phoenix Arizona Fire dept in the 1970's. At this same time, the Incident Command System (ICS) was being developed and implemented in the state of California. Both systems (FGS and ICS) provide an approach to managing any incident – large or small- by dividing the problem into components of a command and control structure corresponding to responsibilities and objectives, and then designating officers to be responsible for outcomes. As the incident grows, components are added and then grouped under headings using a common vocabulary so that responders from all jurisdictions know where they fit into the command structure at any given scene. (Mathews, 2004)

As an example, at an emergency incident regarding hazardous materials, officials from the local fire department, law enforcement, public health, and

environmental quality are integrated into a single command structure that coordinates and oversees all aspects of the event.

Prior to the use of FGC, ICS, and now NIMS, response organizations acted under multiple commanders, and many times operations, planning and other responsibilities lacked coordination. This often resulted in safety shortcomings for the general public and emergency responders. Accountability for performance has now changed and leaders of agencies are being held responsible where they may not have been previously.

Lessons Learned from September 11, 2001.

McKinsey & Company and Titan Corporation consulting after-action reports found many commonalities between Arlington County (Va.) Fire Department and FDNY responses. The lessons learned are simple and universal and center on the need for realistic joint training, reliable interoperable communications, and discipline up and down the chain of command. They also addressed better command-and-control facilities and more robust abilities to supply initial and replacement equipment, as well the ability to contact off-duty replacement responders as needed and provide them the equipment they required, such as protective clothing, self-contained breathing apparatus, and other equipment. The McKinsey Report highlighted its number one recommendation to improve FDNY's internal and operational capabilities in emergency situations by using its operations center to coordinate incident command and control throughout the city (to expand the use of the Incident Command System). The Titan Corporation Report cited the use of the ICS system used by the Arlington County Fire Department as something others should emulate. Again, the results of these recommendations have resulted in the final National Incident Management System (NIMS), which will be outlined and discussed below.

The National Incident Management System (NIMS)

The NIMS is a core set of doctrine, concepts, principles, terminology, and organizational processes that are applicable to all hazardous situations.

The NIMS has six main components:

1. Command and Management
2. Preparedness
3. Resource Management
4. Communications and Information Management
5. Supporting Technologies
6. Ongoing Management and Maintenance

The Command and Management component includes the Incident Command System, which will be addressed in this paper.

Command and Management.

The NIMS standardizes incident management for all hazards and across all levels of government. The NIMS-standard incident command structures are based on three key constructs: The Incident Command System outlined below; Multiagency Coordination Systems; and Public Information Systems

The Incident Command System

The ICS is a management system designed to enable effective and efficient domestic incident management by integrating a combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure. ICS is to be used in a variety of applications to organize field-level operations for a broad range of emergencies, from small to large, natural and unnatural disasters. It is to be used by all levels of government, Federal, State, local, and tribal, as well as many private and nongovernmental organizations as well. The ICS is structured to facilitate activities in five major functional areas: command, operations, planning, logistics, and finance and administration (DHS, 2004). These functional areas are similar to a functional organizational chart one would see within a corporate setting, and are outlined in Exhibit 1.

Acts of biological, chemical, radiological, and nuclear terrorism represent additional challenges for the traditional ICS structure. Coordination efforts between Federal, State, local, tribal, private sector, and non-governmental organizations will be critical to the success of the management of situations that are not site-specific, are geographically dispersed, or evolve over long periods of time.

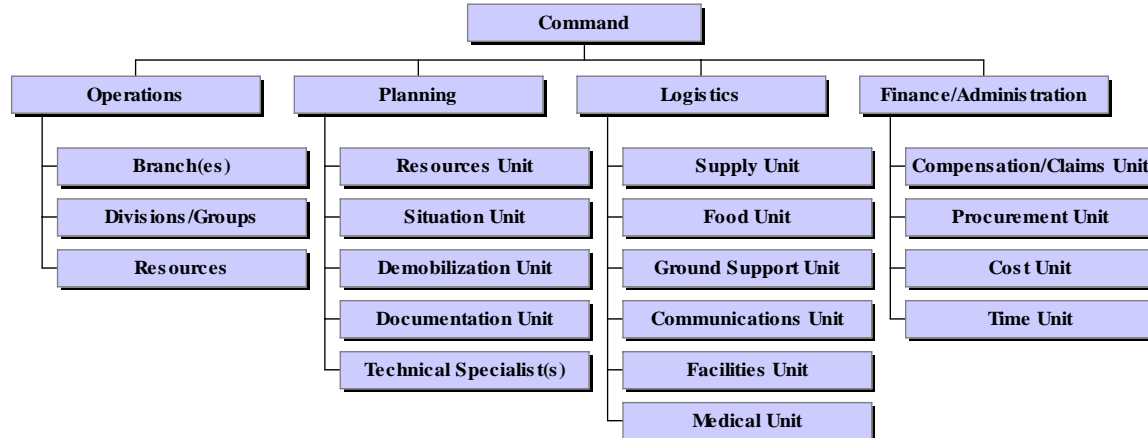
Management characteristics of the ICS will be outlined below, followed by a discussion of relevant areas representing areas for the engineering management profession's contribution.

Management Characteristics of the ICS.

The ICS is based on proven management characteristics that contribute to its strength and efficiency. DHS (2004) presents these characteristics:

1. Common terminology. This is essential to allow diverse management and its support entities to work together across a wide variety of management functions and hazard scenarios. Organizational functions, resource descriptions, and incident facilities require a common terminology. Major resources, including personnel, facilities, and equipment and supplies are used to support incident activities and are given common names and "typed" with respect to their capabilities to avoid confusion and enhance interoperability. Everyone "speaks the same language".

Exhibit 1. The Incident Command System (DHS, 2004)



2. Modular organization. The incident command system organizational structure develops in a top-down, modular fashion. This is based on the size and complexity of the incident, as well as the specific hazard environment created by the incident. Separate functional elements can be established, each of which may be further subdivided to enhance internal organizational management and external coordination. Responsibility for the establishment and expansion of the ICS modular organization ultimately rests with the Incident Commander (IC), who bases these on the requirements of the situation. With increased complexity, the organization responds by expanding from the top down as functional responsibilities are delegated. Concurrently, the number of management positions expands to adequately address the requirements of the incident.

3. Management by objectives. Management by objectives is a widely used management approach that uses a four-step process for achieving the incident goal. This is communicated throughout the entire ICS organization. The Management by Objective approach includes: establishing overarching objectives; developing and issuing assignments, plans, procedures, and protocols; establishing specific, measurable objectives for various incident management functional activities, and directing efforts to attain them, in support of defined strategic objectives; and documenting results to measure performance and facilitate corrective action.

4. Reliance on Incident Action Plan. Incident action plans (IAPs) provide a coherent means of communicating the overall incident objectives in the contexts of both operational and support activities.

An IAP is an oral or written plan with general objectives reflecting the overall strategy for managing an incident.

5. Manageable span of control. Span of control is key to effective and efficient incident management. Within ICS, the span of control of any individual with incident management supervisory responsibility should range from three to seven subordinates. The type of incident nature of the task, hazards and safety factors, and distances between personnel and resources all influence span-of-control considerations.

6. Predesignated incident locations and facilities. Various types of operational locations and support facilities are established in the vicinity of an incident to accomplish a variety of purposes, such as decontamination, donated goods processing, mass care, and evacuation. The IC will direct the identification and location of facilities based on the requirements of the situation at hand. Typical predestinated facilities include incident command posts, bases, camps, staging areas, mass casualty triage areas, and others, as required by the incident.

7. Comprehensive resource management plan. Maintaining an accurate and up-to-date picture of resource utilization is a critical component of domestic incident management. Resource management includes processes for categorizing, ordering, dispatching, tracking, and recovering resources. It also includes processes for reimbursement for resources, as appropriate. Resources are defined as personnel, teams, equipment, supplies, and facilities available or potentially available for assignment or allocation in

support of incident management and emergency response activities.

8. Integrated communications. Integrated communications are facilitated through the development and use of a common communications plan and interoperable communications processes and architectures. This integrated approach links the operational and support units of the various agencies involved and is vitally necessary to maintain communications connectivity and discipline and enable common situational awareness and interaction. Preparedness planning must address the equipment, systems, and protocols necessary to achieve integrated voice and data incident management communications.

9. Establishment and transfer of command. The command function must be clearly established from the beginning of incident operations. The agency with primary jurisdictional authority over the incident designates the individual at the scene responsible for establishing command. When command is transferred, the process must include a briefing that captures all essential information for continuing safe and effective operations.

10. Chain of command and unity of command. Chain of Command is a series of command, control, executive, or management positions in hierarchical order of authority. This refers to the orderly line of authority within the ranks of the incident management organization. Unity of command means that every individual has designated supervisor to whom they report at the scene of the incident. These principles clarify reporting relationships and eliminate the confusion caused by multiple, conflicting directives. Incident managers at all levels must be able to control the actions of all personnel under their supervision.

11. Unified Command. This is established when incidents are multijurisdictional. In Incidents involving multiple jurisdictions, a single jurisdiction with multiagency involvement, or multiple jurisdictions with multiagency involvement, unified command allows agencies with different legal, geographic, and functional authorities and responsibilities to work together effectively without affecting individual agency authority, responsibility, or accountability.

12. Accountability. Effective accountability at all jurisdictional levels and within individual functional areas during incident operations is essential. To that end, the following principles must be adhered to:

1. **Check-In.**
All responders, regardless of agency affiliation, must report in to receive an assignment in accordance with the procedures established by the IC.
2. **Incident Action Plan**
Response operations must be directed and coordinated as outlined in the IAP.
3. **Unity of Command.**
Each individual involved in incident operations will be assigned to only one supervisor.
4. **Span of Control**
Supervisors must be able to adequately supervise and control their subordinates, as well as communicate with and manage all resources under their supervision.
5. **Resource Tracking**
Supervisors must record and report resource status changes as they occur.

13. Deployment. Personnel and equipment should respond only when requested or when dispatched by an appropriate authority.

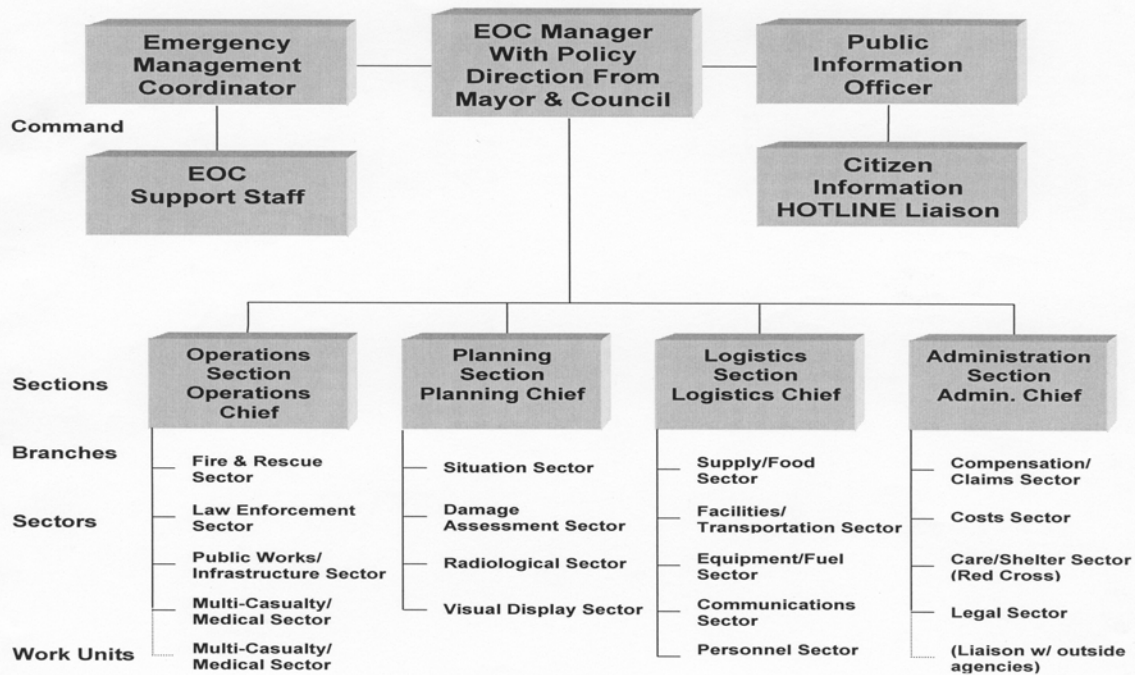
14. Information and intelligence management. The incident management organization must establish a process for gathering, sharing, and managing incident-related information and intelligence.

Application of NIMS in Emergency Operations Centers (EOC)

An emergency operations center (EOC) is the physical location where the coordination of information and resources to support a domestic incident management activity takes place. An EOC may be a temporary facility or may be located in a more central or permanently established facility. EOC's may be organized by major functional disciplines (fire, law enforcement, and medical services, by jurisdiction (Federal, State, regional, county, city, and tribal), or some combination of these.

The purpose of an EOC is "to establish a central location from which government, at any level, can provide interagency coordination and executive decision making for managing a major response and recovery effort while providing other essential services simultaneously" (Compton, 2004). Exhibit 2 is an example of a particular scenario for an EOC, with the appropriate functional representation for each of the four NIMS sections. Three occasions can activate an EOC: a single accident that grows in scale; multiple simultaneous incidents; or a National, State, regional or community-wide event.

Exhibit 2 Emergency Operations Center (EOC)



Incident examples. An example of a single incident EOC activation utilizing the NIMS protocol would be a large-scale evacuation, extended hazardous materials incident, an extensive brushfire, a hostage incident, or a terrorist event. Multiple simultaneous events could be a tornado with several touchdowns, explosions with widespread secondary fires, civil disturbances such as riots, and/or a terrorist event. A community-wide event could be a power failure as the one that affected Canada and the Eastern US in 2003, floods, a hurricane, civil disturbances, and/or terrorist events.

Representation within the four NIMS sections. Typical representation in the EOC Operations Section could include: fire, rescue, emergency medical services, law enforcement, FBI, military, construction and engineering, transit and aviation, streets, water and wastewater, power, gas, telephone, and utility companies.

Finance and Administration is vitally important to account for and receive funding and would typically include representation from cost accounting (finance, auditing), personnel resource accounting, claims and liability, risk management, and legal advisors.

The EOC Logistics section would typically be represented by personnel and staffing (personnel department, police, fire, public works, private sector, demolition, construction, etc), supplies and purchasing, care and shelter (facilities management, the Red Cross,

schools, National Guard) transportation and vehicles (bus systems, transit, public works, police, fire).

The Planning Section would typically include resource status (planning, fire, police, public works, federal agencies, etc.), and damage assessment (engineering, public works, building inspections).

Additionally, a public information function is critical as the principle point of contact for the media. It should monitor news reports, produce press releases and official statements, conduct press conferences, handle rumor control, as well as interview requests.

There are many possibilities of emergency scenarios, as well as combinations of emergency scenarios that provide one with a sense of the increasing complexity involved in such situations where the situation and the demand for resources is unknown. The advantage of the implementation of first nationwide NIMS program can be considerably appreciated.

Advantages of NIMS/ICS

(DHS 2004) cites that “NIMS incorporates incident management best practices developed and proven by thousands of responders and authorities across America. These practices, coupled with consistency and national standardization, will now be carried forward throughout all incident management processes: exercises, qualification and certification, communications interoperability, doctrinal changes,

training, and publications, public affairs, equipping, evaluating, and incident management. All of these measures unify the response community as never before.”

NIMS establishes ICS as a standard incident management organization with five functional areas -- command, operations, planning, logistics, and finance/administration -- for management of all major incidents. To ensure further coordination, and during incidents involving multiple jurisdictions or agencies, the principle of unified command has been universally incorporated into NIMS. This unified command not only coordinates the efforts of many jurisdictions, but also provides for and assures joint decisions on objectives, strategies, plans, priorities, and public communications.

Implications for Engineering Management

The complexities involved understanding all possible scenarios and combinations of emergency events are staggering. Especially daunting is the added human element under extreme stress. The Engineering Management (EM) body of knowledge has much to contribute to this important area that affects our lives in today’s complex and challenging world. Applications of many Engineering Management tools and expertise can be provided in many areas. Some of these EM topical areas would include enterprise mapping (Burton and Pennotti, 2003); modular and systems engineering design (Dasher, 2003), (Buede, 2000), and simulation programming for scenario testing and as a training tool for everyone involved (Chase et al., 2003), (Banks et al., 2000); project management with resource constraints (Cleland, 2004) and (Vairaktarakis, 2003); and Supply chain management for best practices implementation and supply replenishment models (Özer, 2003), (Simchi-Levi et al., 2003).

Anderson (2004) believes knowledge sharing and communication with outside organizations for new product development to improve first responder efficiency and safety provides a valuable contribution. Both the scientific and engineering management fields continue to play an undeniably important role to help our nation anticipate, monitor, and deter threats to our security in today’s complex world. These threats, both natural and unnatural can utilize sophisticated scientific and engineering techniques to develop the technologies for the identification of, recognition of, and protection from potential threats, as well as provide methods for better handling of emergency situations when they do occur.

Summary and Conclusions

This paper outlined the background, use and applications of the NIMS system, with a focus on the Incident Management System and the management

characteristics within NIMS/ICS. The successful implementation of the Incident Command System (ICS) used by the Arlington County (Va.) Fire Department, and others, served as a catalyst for a later mandate by the Department of Homeland Security (DHS). As a result, all DHS funding recipients are required to utilize the new National Incident Management System (NIMS) for organizing any critical emergency responses to a terrorist attack, disaster, or other critical response requirement. The NIMS system evolved from the Incident Command concepts pioneered by the Phoenix Arizona Fire Department and the State of California. NIMS is the Nation's first standardized management approach that unifies Federal, state, and local lines of government for incident response.

This collective planning effort’s goal is to continue to protect our citizens from the results of natural disasters and acts of terrorism. The review of the NIMS/ICS System has illuminated many areas that the engineering management body of knowledge can contribute to. Now more than ever, these elements are vitally important for successful emergency response coordination and major security initiatives during any large-scale emergency response.

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