Incident Command System: A Developing National Standard of Incident Management in the U.S.

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ABSTRACT

This paper is a critical examination of the U.S. Incident Command System ("ICS") as an organizational structure and information gathering tool for emergency management from the perspective of a career emergency management officer who became a graduate student in information management following 35 years of public service. In addition to examining the ICS, and assessing its current weaknesses in the area of information management, the paper proposes a low-cost, COTS approach to automating the ICS information gathering and dissemination process.

Keywords

Incident Command System, emergency management, emergency response management information systems

INTRODUCTION

The events of 9/11, numerous western wildfires, and other natural disasters (particularly earthquakes and hurricanes) have clearly demonstrated that no jurisdiction has sufficient emergency services to handle large-scale emergencies within their own resources. Even "small" emergencies frequently involve multiple departments from within either a single jurisdiction or assistance from adjacent mutual aid departments. The fire service (also the early leaders in the concept of mutual aid) was the first emergency response profession to recognize the need for a national standard for emergency incident management (C^3I). One author, Ted Goldfarb, contends that the concept of ICS within the fire services goes back at least 150 years, using a Currier & Ives lithograph of a mid-19th century fire ground to make his point (Goldfarb, 1997). "Following the devastating 1970 brushfire season in Southern California, a consortium of local, state, and federal fire agencies developed the ***Incident Command System*** ['ICS']" (Cardwell, 2000). The consortium, Firescope (http://www.firescope.org/) , has become the *de facto* American national standard making body, with the active support of the National Fire Protection Association. Law enforcement agencies, who are much less likely than the fire services to be involved as the incident command for large-scale incidents, were slow to adopt the ICS concept. For law enforcement, the 1984 Los Angeles Olympics served as the first major implementation of the ICS in a law enforcement-led environment. Over the years the Firescope ICS was adopted by all state and most local emergency response agencies, the Federal Emergency Management Agency, all federal agencies with wildfire response requirements, and even the U.S. Coast Guard. California and New York were among the first states to mandate its use by state law (Cardwell, 2000).

Mutual Aid

Although there had long been a general awareness that emergencies could easily overcome the internal resources of even the largest state, this key component of emergency preparedness had been handled in an unstructured fashion until relatively recently in the United States. "Mutual Aid" as used in the United States refers to a formal compact between jurisdictions that define the emergency services that the supporting jurisdiction(s) are willing to provide, the terms for reimbursement for services provided, and the legal authorities of the first responders when serving outside their home jurisdictions. The mutual aid compacts normally provide that a first responder working outside of his/her jurisdiction in the requesting host jurisdiction holds the same authority as a local first responder in the host jurisdiction and enjoys the same liability protection that they have when "in territory." Thus, an Emergency Medical Technician or Firefighter from Maryland responding to an emergency in Virginia would have the same legal status as a Virginia Emergency Medical Technician or Firefighter. The most frequent exception to this general policy concerns law enforcement authority: special provisions are required when a police officer is working outside of his/her home state. Where routine cross-border cooperation is anticipated, officers are frequently certified in both states. In the Washington, DC metropolitan area supporting police officers are individually deputized as US Marshals to grant them law enforcement authority in the host jurisdiction.

Standardized, properly executed, and practiced, mutual aid systems are now recognized as essential. Bilateral mutual aid agreements, particularly involving fire departments, between adjacent jurisdictions, have been in place for many years. See also (Van Dusen 2003) for an example of local mutual aid. "Many local jurisdictions have agreements in place, but

they vary widely across the country. Moreover, many are not formal agreements, and do not address key issues such as liability and compensation" or qualification portability (NEMA, 2004). Wider regional mutual aid compacts started to become common in the early 1970's. For example, the Metropolitan (Washington, DC-MD-VA) Council of Governments established a law enforcement pact for the region in January, 1971 and a fire, rescue and ambulance services pact in February, 1973 (Metropolitan Washington Council of Governments). The first of the multi-state pacts, the Southern Regional Emergency Management Assistance Compact was developed by the 19-member Southern Governors' Association. The southern regional pact was opened to other states in 1995, and was ratified by Congress (Public Law 104-321) as a national model in 1996 (Freedberg 1002). Prior to 9/11 forty states had joined the compact, now known as the Emergency Management Assistance Compact (EMAC). On September 17, 2001, New York became the 41st state to join. As of June, 2004, 48 states (all except California[2] and Hawaii), the District of Columbia, and Puerto Rico have joined (EMACWEB.org). The EMAC, which has been ratified by each participating state legislature, provides a standard, simplified method for a state governor to request assistance, and for other states to provide the requested support. Key aspects of the compact are that the licenses, certificates or other permits issued in the supporting state shall (with the exception of police powers) be deemed valid in the state requesting assistance; emergency response personnel from a supporting state will receive the same liability protection as would similar employees in the requesting state; the requesting state is responsible for any workmen's compensation claims or death benefits incurred by the supporting state; and, the requesting state will reimburse the supporting state for any losses or damages and other expenses incurred (EMAC Orientation, n.d.).

In July, 2000, an "International Emergency Management Assistance Memorandum of Understanding" was adopted at the 28th Annual Conference of the New England Governors and Eastern Canadian Premiers. This MOU established a standard framework to be enacted by the participating jurisdictions (the States of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut and the Provinces of Quebec, New Brunswick, Prince Edward Island, Nova Scotia and Newfoundland), and further provides that additional states and provinces may also become a party to the compact. The New England/Eastern Canada compact generally follows the principles of the NEMC (Canadian Intergovernmental Conference Secretariat 2000).

The U.S. National Incident Management System

In March, 2004, the U. S. Department of Homeland Security (DHS) announced a mandatory, nationwide, National Incident Management System ("NIMS"). NIMS was issued February 28, 2003 under the authority of Homeland Security Presidential Directive (HSPD)-5.

> "HSPD-5 requires all Federal departments and agencies to adopt the NIMS and use it in their individual domestic incident management and emergency prevention, preparedness, response, recovery, and mitigation programs and activities, as well as in support of those actions taken to assist State, local, or tribal entities. The directive also requires Federal departments and agencies to make adoption of the NIMS by State, tribal, and local organizations a condition for Federal preparedness assistance beginning in FY 2005." (U.S. Department of Homeland Security, 2004, cover letter by Secretary Tom Ridge)

NIMS supplements, rather than replaces, the *National Response Plan* (NRP), and regional, State, and local response plans. The NIMS has two fundamental principles: (1) the system must be flexible, so that it can be used routinely by all types of domestic incidents, regardless of their cause, size, location or complexity; and (2) where appropriate, highly structured, standardized operational structures (U.S. Department of Homeland Security, 2004).

NIMS consists of a multi-layered approach to organizing emergency management across all levels of government through-out the United States. At the highest level, it establishes six core components:

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

This paper will concentrate on the two core components that most directly relate to actual emergency incident management: command and management, and communications and information management. The two key organizational systems in the NIMS are: (1) the ICS; and (2) Multi-agency Coordination Systems.

INCIDENT COMMAND SYSTEM (ICS): ORGANIZATIONAL STRUCTURE

The ICS is the tactical level of the NIMS for managing on-scene and direct support activities. Although ICS originated with the wildfire community, NIMS mandates its use in all areas of domestic incident management:

> "A basic premise of ICS is that it is widely applicable. It is used to organize both near-term and long-term field-level operations for a broad spectrum of emergencies, from small to complex incidents, both natural and manmade. ICS is used by all levels of government – Federal, State, local and tribal – as well as many private-sector

> and nongovernmental organizations. ICS is also applicable across disciples. It is normally structured to facilitate activities in five major functional areas: command, operations, planning, logistics, and finance and administration." (U.S. Department of Homeland Security, 2004)

While NIMS mandates that field command and management functions must be performed in accordance with a standard set of ICS organizations, doctrines, and procedures, it is intended to be fully modular and scalable: only those components that are actually required for a particular incident are actually implemented. See (Coleman 1999) for a discussion of scalability. In addition to standardizing emergency response management components, the ICS also mandates common terminology (and the use of "clear text" rather than tactical codes) to enable diverse entities to work together. While ICS is an ideal C^3I model, in actual practice it is often abused and misused. See (Nicholsen 1999) for an example of how things can go wrong in the real world. See also (Morris 1997) for practical advice on putting the theory into practice.

Although the NIMS-approved ICS has 11 core management characteristics at the incident management level, five are particularly important: (1) common terminology; (2) modular organization; (3) manageable span of control; (4) integrated communications; and, (5) chain of command and unity of command/unified command.

Common terminology runs through all aspects of the ICS. Each role within the incident management system has an "official" title and a clearly defined position description (see National Wildfire Coordinating Group). The National Fire Protection Association and the American National Standards Institute have developed national standards for the qualifications required of all fire department specialties (see NFPA/ANSI Standards 1000 – 1099). Standard definitions and nomenclature have been developed for the most common major resources, including personnel, facilities, major equipment, and even supply items, and have been given a "type" description that details the resource's capabilities and limitations (U.S. Federal Emergency Management Agency 2004a). All facilities in the vicinity of the incident that might be used (e.g., "command post," "staging area," "base camp," etc.) have been given standard names and definitions (U.S. Federal Emergency Management Agency, 2004b). The use of standard terminology is further reinforced by standard ICS forms.[3]

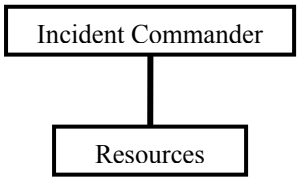
Firescope and the U.S. Forest Service began developing the ICS in 1970, and by 1982 the concepts were mature and widely implemented within the fire service, particularly with regard to wildfires. While the development of the ICS pre-dates Karl Weick's famous analysis, "The Collapse of Sensemeaking in Organizations: The Mann Gulch Disaster," (Weick 1993), it clearly incorporates several of his concepts to provide resilience: (1) virtual role systems; (2) the attitude of wisdom, and (3) respectful interaction. Weick's fourth source of resilience, improvisation and bricolage, is not specifically addressed by the ICS, but it also is not excluded. His second definition of "structure" clearly applies to the ICS: "... variously described as configuration, contextual constraints, or a vehicle that embodies dominant meanings, refers to a framework of roles, rules, procedures, configured activities, and authority relations that reflect and facilitate meanings."

Structure and Concepts

The standard ICS table of organization is intended to be modular, with only those components that are actually required being implemented in a given incident. In this "top-down" structure, any block not used is assumed to be handled by the next highest level present.

Figure 1[4] presents a fairly fully expanded ICS organizational structure that would be implemented at a complex, large-scale incident. By their very nature and training, command officers are not necessarily well suited to staff roles. Many large jurisdictions have adopted the concept of "command support companies" consisting of technicians that are specifically trained in supporting the ICS command structure. While command officers still maintain the ICS command roles, the command support company personnel handle the documentation and coordination roles that are often overlooked in an "officer-only" ICS. See (Daniels 2001).

At the opposite extreme, for example a small brush fire, the ICS organization chart could be as simple as:



The third key concept, manageable span of control, determines to a large extent the appropriate complexity of the ICS organization. Ideally "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" (U.S. Department of Homeland Security 2004).

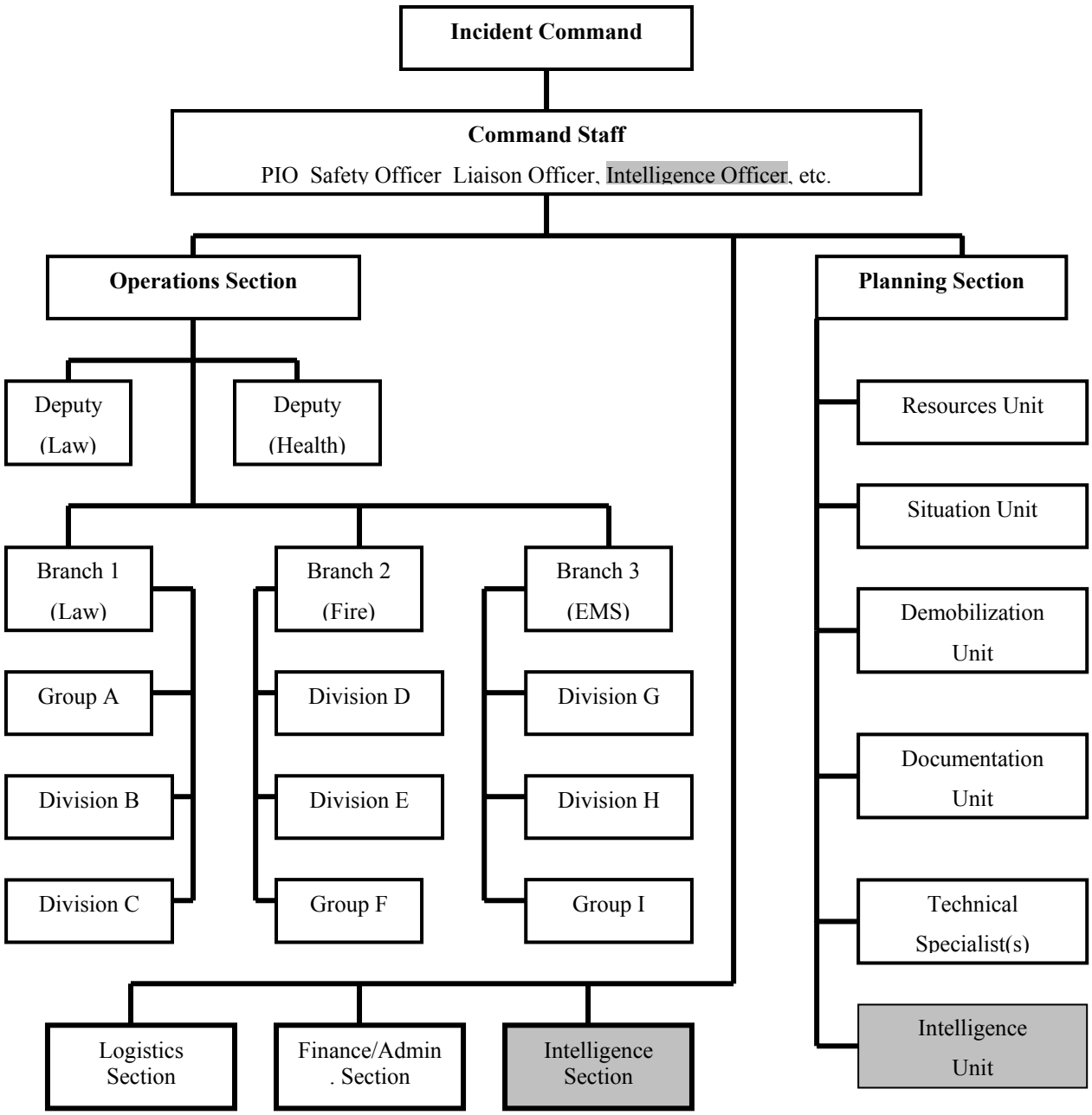


Figure 1: ICS Organization Chart

Within the Operations Section, Branches can serve multiple roles. They can be geographical, functional, or even tactical (i.e., a reserve component). Branches are created as needed to maintain an approximate five-to-one span of control. The term "Division" always refers to a physical or geographic responsibility, while "Group" always refers to a functional responsibility. Resources within the Operations Section consist of "single resources" (individual personnel or a single equipment item and associated personnel); "task forces" (a pre-designated combination of personnel and equipment, such as a search and rescue team or a five-engine working team); or "strike teams" (a set number of resources of the same kind and type that have an established minimum number of personnel, for example, a wildfire line crew) (U.S. Department of Homeland Security, 2004). In ICS terminology, "type" is a number between one and four, with the lower numbers having the higher capabilities (see Firescope 2000a).

The intelligence function is unique within the ICS, as it does not occupy a fixed location on the ICS organizational chart. Depending on the specific nature of the incident, and any specific "need to know" restrictions, the intelligence function can consist of a command staff officer, a unit within the Planning Section, or as a separate General Staff section. In rare circumstances, it could also be a Branch within the Operations Section.

The fourth key concept, integrated communications, requires a common communications plan and interoperable communications processes and architectures (US Department of Homeland Security 2004). In an ideal world, this would be accomplished by a common, standardized platform. See (Firescope 2000b) for California's model state-wide mutual aid communications system. Where equipment and frequencies are not compatible, the communications plan may require the use of a mobile communications unit to relay messages between systems, or the use of a system such as the TRP-1000/ ACU-1000 Transportable Intelligent Interconnect System with integrated audio gateway switch.[5]

The fifth key concept, chain of command and unity of command/unified command is perhaps the most fundamental concept of the ICS. Chain of command and unity of command, and unified command are treated as separate concepts in the DHS manual. As these concepts are inter-related, I have combined the discussion. The concept of chain of command and unity of command requires that each and every individual involved at the incident site have one and only one supervisor, and that both responsibilities and authorities are clearly defined. "Unity of Command" applies when circumstances require an integrated command team rather than a single incident commander. The unified command concept may be necessary "in incidents involving multiple jurisdictions, a single jurisdiction with multiple agency involvement, or multiple jurisdictions with multi-agency involvement (U.S. Department of Homeland Security, 2004).

While I recognize that unique circumstances (either jurisdictional limits or conflicting legal authorities) may necessitate a unified command, I believe that this structure should be avoided whenever possible. For example, the Metropolitan Washington Regional Emergency Coordination Plan and the related mutual aid compacts designate a single Incident Commander, with liaison officers representing the unique jurisdictional and functional roles. Management by committee is always inefficient, and can quickly deteriorate to multiple commands operating out of a single facility with only minimum coordination. The U.S. military has considerable experience working with "unified commands" with multi-service and even multi-national components, but it has always designated a single commander (see Salas et al 2001). In those rare circumstances where multiple conflicting interests/authorities exist, I would prefer to see the multi-agency and/or multi-jurisdiction coordination occur at the Multi-agency Coordination Systems level, and not at the ICS-level. Even when a clear C^3I structure exists, "stuff happens." Fog, communications problems, and simple misunderstandings can come into play. See (Smith and Dowell 2000)..

In the traditional ICS model, the senior on-scene operational officer from the agency with primary responsibility becomes the Incident Commander upon arrive at the scene. Although more senior officers may arrive later and assume the IC role, the first Incident Commander has two critical roles: first, the first response chief officer normally has the pre-planning responsibility for the hazard involved; and second, in the very earliest stages of the incident, the first IC must size-up the situation and determine if additional resources are required.

As the initial stages of most emergencies involve fire, rescue, hazardous materials, or emergency medical services, the initial incident commander is frequently the senior fire services official on the scene. This is not always the case. The Los Angeles Olympics was a classic case where law enforcement held the lead role. For other instances where law enforcement may be the lead, see (Conner 1997). Criminal use of weapons of mass destruction may also recommend law enforcement involvement at a very early stage, if not as the initial rescue and recovery stage, at least very soon after. See (Carlson 1999).

Over time, as more senior officers arrive, the initial Incident Commander moves down to become the Operations Officer. In the later stages of the incident, the focus may change to security, where a police officer may become the Incident Commander, or in the "clean-up" stages, the Emergency Management Office may become the lead agency. While transfer of command is normally a formal process, the senior lead-agency officer on the scene is the *de facto* Incident Commander upon his/her arrival on the scene. While legal fictions may exist, it is impossible in the real world for the senior relevant official to avoid responsibility, even if he/she has not yet formally assumed the role of "Incident Commander." While some commentators may advocate "command teams" where the senior officer assumes the role of "Support Officer," there is no way that the "top dog" can become a "cat." (Kreis 2004) presents a controversial and not widely accepted view that the later-arriving senior command officer should assume the role of "Support Officer", leaving the initial chief officer in the role of Incident Commander unless or until the situation gets out of hand. He further advocates that additional senior command officers assume Senior Advisor roles, rather than actually assuming line command roles. This structure no doubt reinforces the junior officer's training, but it is a complete reversal of the "golden rule": he who wears the gold (i.e., has the most gold stripes on his sleeves), rules. If you are on scene, and are the ranking officer, you are expected to be in command, and will be held responsible by the body politic. Even if the senior officer has not yet officially assumed command, if he observes an inherently unsafe situation, he must immediately assume command and take action. In 24/7 operations, the role of Incident Commander may pass multiple times, and may even include out-of-jurisdiction officials assuming the role of IC.

Recent literature contains many discussions of the proper way to expand the ICS structure as additional command officers arrive on the scene. (Wallace 2003) argues that the first-responding command officer should remain the Operations Officer even when more than one senior command officials are on the scene. Wallace maintains that the first responding chief-officer has unique knowledge of the situation, and that the second-responding senior officer should assume the role of planning Officer, rather than Operations Officer.

Larger-Scale Organizational Structures

Some incidents, such as wide-spread floods, tornados, earthquakes, or chem.-bio incidents may exceed the capabilities of a single ICS organization. The NIMS recognizes this potential with an intermediate level called "area command." This imposes a layer between the multiple ICS organizations and the Multi-agency Coordination Systems. Under an Area Command, multiple ICS's are placed under the control of an Area Command. Area commands frequently follow jurisdictional boundaries, but may also include geographic areas within a single jurisdiction. Area commands are particularly effective when region-wide communications failures prevent the MCS organizations from effectively controlling the region-wide emergency without exceeding the five-to-one span of control guidelines (U.S. Department of Homeland Security, 2004).

When the scale of an emergency incident exceeds that capacity of an ICS, or even a set of Area Commands, Emergency Operating Centers (EOC) are the preferred higher-level command structure. In a single jurisdiction incident, the EOC is typically a physical facility where authoritative representatives of the local government meet to coordinate the incident, and to set priorities between those incidents and other concurrent incidents. Some multi-jurisdiction regions have established hard-site EOC's, while the more common implementation is a "virtual" EOC where the various jurisdictions are linked by telecommunications, and perhaps a shared emergency management information system. The EOC concept works only when the agency/jurisdiction representatives have true authority to act on their agencies'/jurisdictions' behalf. Prior to 9/11, it was common for agencies to designate lower-level staff members who lacked the ability to commit their agencies for EOC duty. This was proven to be totally ineffective. The EOC's perform a valuable role interfacing between the distributed ICS and area commands, and the elected local government. Their role is policy, and the allocation of resources between competing incidents, and not the micro-management of the individual incidents (U.S. Department of Homeland Security, 2004).

In rural areas, or even metropolitan regions without a close-coupled regional coordination plan, real or virtual EOC's may not exist. Therefore, the NIMS recognize a less formal structure called "multi-agency coordination entities ("MCE")." These frequently *ad hoc* organizations share many of he functions of the traditional EOC, but normally lack the C^3I infrastructure of an EOC. Ideally, these MCE entities meet periodically to address multi-agency, multi-jurisdiction response emergency preparedness issues, and at least annually conduct "table-top" exercises. In these less formal arrangements, the role of regional emergency response plans and mutual aid compacts become even more important (U.S. Department of Homeland Security, 2004).

THE INCIDENT COMMAND SYSTEM AS INFORMATION MANAGER

Although the command and control features of the Incident Command System are the most frequently discussed in the literature, the information gathering and presentation features of the ICS are also highly significant. The ICS community has adopted a set of common forms to document all phases of the incident management process. Using a common set of forms, and strict definition of terms, allows responding units from different jurisdictions and disciplines to clearly communicate, and for information to be consistently rolled-up from the lowest operational units.[6] It also provides a standardized format for post-incident reviews.

The five most common forms are frequently maintained on whiteboards for ease of updating and presentation of the current status of the operation. While this has its advantages, it also has the potential of critical historical data not being maintained. To counter this problem, some jurisdictions maintain two versions of the information, one on the whiteboards, and the second in a paper copy. This can lead to a less than accurate record, as the paper copies do not always reflect the changes on the whiteboards. Recently some departments have adopted the practice of taking digital photographs of the whiteboards after each change.

The highest-level summary document is ICS-201, ***Incident Briefing***, a four-page (or panel) overview of the current status of the incident. This form is maintained at the Incident Command Post, and is used to provide a common overview of the incident. The first page is a map of the incident; the second page is a concise summary of the current objectives and actions; the third displays the current organizational chart; and the fourth provides an overview of the resources en route and on site.

The summary document is supported by four more detailed documents: ICS-203, ***Organizational Assignment List***, ICS-205, ***Incident Radio Communications Plan***, ICS-206, ***Medical Plan***, and either ICS-208, ***Site Safety and Control Plan*** or ICS-215A, ***Incident Safety Analysis (LCES)*** (Lookouts, Communications, Escape Routes, and Safety Zones). If aviation units are supporting the incident, ICS-220, ***Air Operations Summary***, would also be used.

Large-scale, long-duration incidents also use ICS-209, ***Incident Status Summary***. This three page document, normally prepared as a change-of-command or shift-change briefing document, provides a quick overview of the incident to date, a review of the current situation, a 72-hour forward look, and a review of the committed resources.

More detailed supporting documents are maintained at the operational unit level. These include unit assignment lists, check-in lists, equipment/unit inventories, demobilization checklists, etc. Generally the detailed information from these lower-level organizations is only consolidated after the fact, with only summary-level information directly available in the Command Post.

Other ICS documents cover important administrative and financial data. These documents include injury and claims logs, cost worksheets, and formal demobilization information.

Although the current hard-copy based ICS information collection and presentation formats perform an essential function, the system has some inherent limitations. Information maintained at various organizational and physical locations is not readily available at other locations, and detail is often lost in voice-based roll-up communications. Lower-level units frequently do no have a good understanding of the over-all incident, or how their operations relate to the mission. The full level of information available at the scene is not available at the Emergency Operations Center. In a worst-case scenario, where a Command Post or unit command location is directly involved in the incident (as happened n the Twin Towers incident in several cases), the documentation could be completely lost.

USING TECHNOLOGY TO RESOLVE CURRENT PROBLEMS IN ICS INFORMATION MANAGEMENT

Advances in technology over the past five years offer the emergency response community new tools to resolve the existing deficiencies in the current hard-copy based ICS information management structure. The development of low-cost wireless networking systems with reliable 100-meter ranges now allows the rapid establishment of local area networks. C. W. Bostian, S. F. Midkiff, W. M. Kurgan, L. W. Carstensen, D. G. Sweeney, and T. Gallagher, researchers at Virginia Tech and SAIC, have been working since 1999 to develop a rapidly deployable broadband network that can cover an incident several kilometers in size. Their research proposes adapting COTS 28-30 GHz band technology originally designed for the Ka-band satellite environment, to link a central hub to up-to eight remote sites, and potentially to a Ka-band satellite network (Bostian *et al* 2002). Cost constraints, at least at the present time, may limit deployment of this technology to individual jurisdictions. However, their concept could be implemented in easily transportable containers that could be rapidly deployed anywhere in the United States by military air transport. The hub, satellite up-link, and several remote stations could fit inside a single C-130 transporter, with an additional three remotes fitting in a second C-130. A C-17 transporter could easily carry the entire package of hub, uplink, and eight remote stations. Under this concept, a full system could be deployed and made operational in less than 12 hours. FEMA would appear to be the most suitedl host for such a capability, with National Guard transportation.

On the software side, all of the ICS documents can be easily implemented as PDF/F documents. The individual documents could be easily posted to a server located at the Command Post, and to a central server located at the Emergency Operating Center. Standard web browsers could be used to access the information. Projection video could then replace whiteboards for displays at the Command Post. This technology would, at very low developmental costs, overcome several of the more critical defects in the hard-copy based system: information sharing at all levels, accuracy in roll-ups, and assurance that all data would be available after the incident. In addition to the formal information management requirements imposed by the ICS, the addition of a simple communications package, such as WebCT™ (an academic communications tool used at the University of Maryland, College Park and many other universities) could prove an informal digital communications link supporting threaded messages, chat, and whiteboard communications.

Implementing a PDF/F-based ICS information collection and presentation system would be an important first step, but this does not appear to be the ultimate solution. The longer-range solution would be to develop a SQL database system that fully mimics the full "look and feel" of the existing ICS system. Maintaining the full "look and feel" is essential to acceptance by the emergency response community, and would significantly decrease training requirements. Two AMCIS2004 papers provide an insight to the importance of user acceptance. Erman Coskum and Martha Grabowski reported on their research on the impact of user interface acceptance. They noted "where the practitioners are familiar with one display format (directly replicating the paper format used for years), changing the display format may reduce user acceptance and add unwanted complexity and training needs (Coskim and Grabowski, 2004)." Stella Ying Shen and Michael Shaw discuss the role of the ICS in emergency management from the perspective of coordination theory and the theory of task-technology fit (Shen and Shaw, 2004).

CONCLUSION

The ICS may well not be the "ideal" structure for large-scale emergency management, but at least in the United States it is currently "the only game in town." Clearly ICS-based management and emergency-response information systems are not the only possible solutions to the problem of knowledge management in support of emergency management. However, the mandatory use of ICS in all jurisdictions in the United States, and the ease of implementing such systems, makes this a critical topic. Eleven ISCRAM2004 papers[7] discuss other potential emergency support systems. Murray

Turoff, Michael Chamer, Bartel van de Walle and Xiang Yao recently proposed a very detailed, theoretical model for the design of an emergency management system, "DERMIS," to support emergency management at the regional or national emergency operating center level (Turoff *et al.* 2004). To date the Computer Supported Cooperative Work (CSCW) literature, with few exceptions, has ignored the ICS. Although some of these other systems show great promise, particularly within specific industries and in Europe, in the United States clearly the best "bang for the buck" lies with developing ICS-based emergency support systems that can be rapidly implemented under field conditions, and with the minimum of additional training.

ACKNOWLEDGMENTS

I would like to thank Vedat Diker, College of Information Studies, University of Maryland, who supervised my independent study "Trends in Information Management in Support of Emergency Management" during 2004, for his support and encouragement.

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[2] California does have bilateral mutual aid agreements with adjacent states, but the terms are significantly different than those contained in the EMAC.

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[4] Figure 1 was derived from DHS Appendix 1, Tabs 1-5

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