

**Network Management in Emergency Response:
Articulation Practices of State-Level Managers Interweaving Up, Down and Sideways**

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ABSTRACT

Large-scale emergency response requires managing inter-organizational networks across federal, state and local levels of government, as well as with non-profit and private sector organizations. Planning for such network management is intrinsically problematic due to the unpredictable nature of emergent crises. Instead, emergency management personnel must respond to each contingency of an emergency in a situated, somewhat ad hoc manner. In this paper, we focus on the centrality of state-level emergency managers as intermediaries between federal and local levels, to answer the research question: *What is the role of the state-level personnel in managing vertical and horizontal networks and collaboration during emergency response?* In reporting our results, we draw from an ethnographic study of emergency preparedness and response exercises, and use a practice lens for viewing the actions of emergency managers as they construct their emergency response(s). We find that much of what state-level emergency managers do can be explained as articulation practices, constructing the emergency response just-in-time, and further that these practices interweave temporally across logistical, jurisdictional and governance domains. We conclude by discussing theoretical implications for network management and practical implications for understanding and improving emergency response.

1.0 Introduction

Although “every emergency is local” (Comfort 1999; Dynes, Quarantelli & Kreps 1972), it is also true that many of the budgetary and personnel resources for major disasters and terrorist activity issue from the federal level. Orchestrating emergency response therefore often gives rise to tensions between local and federal participants, with state-level emergency personnel functioning as intermediaries, managing network collaboration, resources, and expectations. Thus state-level emergency managers play an essential role in managing networks and collaboration among a wide range of participants in a unique, non-routine work arrangement.

This paper presents empirical findings about the practices that state-level emergency managers employ in this kind of emergency response. Our results contribute to knowledge about network governance. We report findings from ethnographic fieldwork, utilizing a practice-based approach (Brown & Duguid 2001; Orlikowski 2002; Suchman 2007; Weber & Khademian 2008; Fosher 2009) to view the actions of state-level public managers during emergency response. We find that these practices can be understood as *articulation* practices through which emergency managers work to re-configure an area’s or a group’s networks and capacities up and down levels of government, as well as across (both within a state and laterally with other cooperating states). We further uncover that these just-in-time practices interweave across logistical, jurisdictional and governance domains. We illustrate our findings with data from our ethnographic observation of emergency response exercises and interviews of emergency response personnel. These findings contribute to general knowledge about what happens on the ground during emergency response. We conclude by discussing theoretical implications for public network management and practical implications for understanding and improving emergency response more generally, including recommendations for the training of emergency managers, and for the design of cross-agency information sharing systems.

2.0 Background

There is increasing recognition that interagency collaboration and networks, both formal and informal, are necessary for emergency or crisis response (Solansky & Beck 2009; Kapucu et al. 2010). Concurrently, interest is growing in the areas of interagency network management and

governance, along with awareness of the need for empirical research in this area (Hall & O'Toole 2000; Agranoff 2004, 2006; Rhodes 2007; Provan & Kenis 2008; Moynihan 2009).

Yet while much of the research on network management and governance is oriented toward longer-term policy networks, the situation of network management for emergency and crisis response remains under-studied, with Moynihan's (2009) work on ICS being a notable exception. This area is important because while planning aspects of emergency preparation have traditionally been oriented towards facilitating various routine operations, it is the non-routine aspects of emergencies that contribute to their characterization as emergencies.

Somers and Svara (2009) concur on the need for an Incident Management System to be flexible and scalable. At the same time, the National Response Framework, the National Information Management System (NIMS) and the Incident Command System (ICS) reflect these principles as strategies for U.S. homeland security and emergency preparedness and response (EP&R) (DHS 2008a, 2008b; FEMA 2009) (Moynihan 2009). In an emergency, information needs are even more challenging than in a planned event¹: emergency response personnel need – and need to make sense of – a greater volume of information, and the types and timing of information required are driven by unfolding and unforeseen events, making planning less useful overall (Henderson 2009; Birdsall 2010).

Because tensions often emerge between federal and local levels in emergency management situations, we have chosen to focus on state-level emergency managers as intermediaries who manage collaboration across the response networks. In particular, our research seeks to answer to the question: *What is the role of the state-level personnel in managing vertical and horizontal collaboration during emergency response?*

In the next sections, we describe our research and data collection method, followed by our findings about 1) the complexity of the field within and through which the response must be organized, and 2) the articulation practices of emergency managers as they organize the response to an incident. Lastly, we discuss theoretical and practical implications of these findings for understanding and promoting effective emergency response.

¹ Planned events, such as visits by national leaders or visiting heads of state and government or public events that draw large crowds (e.g., a Presidential inauguration, the Boston Marathon (EOPSS 2009)), fall within the purview of emergency management due to the potential for significant consequences if something goes wrong.

3.0 Methods

Because theory on our research question was nascent, we undertook qualitative field research. Our research approach was based upon comparative case studies (Eisenhardt 1989; Yin 2009). Our research team included several social scientists with differing backgrounds from both an independent government-sponsored research organization and a research university. This diversity of researcher backgrounds helped to limit bias (Eisenhardt & Graebner 2007: 28) during data collection and analysis.

3.1 Approach to Data Sources

Our goal was to collect primary and secondary data from a geographic cross-section of states involved in emergency situations calling for a range of response activity. We established contacts with many emergency response agencies at three levels of government in the United States over an 18 month period, and were successful in obtaining access to three large-scale exercises involving a broad range of players. Data collection was challenging due to emergency managers' reservations about how the data might be used. In particular, we encountered numerous instances of emergency managers and responders expressing quite serious concerns about possibilities that our research products might be used as evaluations which could negatively impact their future funding (especially in an atmosphere of ongoing budget cuts).

Because obtaining access to data sources was difficult, we took opportunistic advantage of as many different sources as possible and gathered data using multiple methods for each source. This approach had the advantage of supporting analytical triangulation which increased our construct validity (Eisenhardt 1989, Eisenhardt & Graebner 2007). We were able to observe at state-level emergency exercises in two states and one other interstate (regional) event involving state-level participation. In addition, we interviewed several high-ranking emergency management personnel in these and other states, including one interview with the director of an Emergency Operations Center (EOC) in a fourth state. Additional data collection methods included: arranging meetings and interviews with EP&R personnel, formal and informal discussions with independent contractors working in the EP&R arena, attending conferences and participating in a class on the Incident Command System (ICS)². We also held conversations

² Taught by Homer Emery through the *Homeland Defense Journal*, April, 2009 in Arlington, VA.

with systems engineers working in EP&R areas in the course of scoping our research question and obtaining access for data collection. Further, team members obtained other background information by reviewing newspaper articles, web sites, and archived materials. Data collection opportunities and methods are summarized in Table 1.

Due to the sensitive nature of the exercises we observed, confidentiality concerns prohibit us from providing identifying details of our sources. Because multiple states participated in each of the exercises, we can report that at the macro level the regional exercises and interviews involved federal, state, county and local personnel from ten states in the Northeast, Southeast, Midwest and Southwest regions of the United States; all occurred between 2008 and 2010.

Table 1. Data Sources

<u>Collection Method</u>	<u>State A</u>	<u>State B</u>	<u>State C</u>	<u>State D</u>	<u>National</u>	<u>Metropolitan</u>
Exercise Observation	Hurricane Exercise [HUR] in cooperation with FEMA & several other states – Focus on debris management	Chemical, Biological, Radiological, or Nuclear Event Drill [CBRNE] – Focus on local response in interstate region	Communications Coordination Exercise [COM] in cooperation with the United States Northern Command (NORTHCOM) & several other states; Hurricane scenario		[Efforts to gain access to National event] Attendance at After-Action Review [AAR] from one national event (2 hours)	[Efforts to gain access to Metropolitan City event by phone and email with State Police]
Meetings/ Interviews	Open discussions with Director of State A’s EOC [EOC A] (2 meetings, 1.5 hours each) Interview with State A’s EOC Logistics Director [EOC Log]	Meetings with FEMA Region staff [FEMA B] (2 meetings, 1.5 hours each)	Numerous brief, <i>in situ</i> conversations with participants Discussion with NORTHCOM [NORTHCOM] representative at the Exercise	Phone interview with Director of State D’s EOC [EOC D] (1 hour)	Meetings with FEMA Region staff (1 hour each) Discussions with Systems Engineers [SE] working on EPR systems	

<u>Collection Method</u>	<u>State A</u>	<u>State B</u>	<u>State C</u>	<u>State D</u>	<u>National</u>	<u>Metropolitan</u>
Conference / Classes					Attendance at two NEMA conferences [NEMA] (2 days each) ICS Boot Camp [Class] (2 days)	

3.2 Observations and Interviews

We observed three large-scale exercises as part of our data collection as summarized in Table 1. The first observations occurred at a state-level hurricane response exercise (referred to as HUR in the analysis). HUR involved federal (FEMA, military and other participants) as well as a full contingent of state, county and local agencies. The multiple-day exercise was part of a regional activity covering preparation for and response to a severe hurricane. The exercise was simultaneously conducted in four other states within the same FEMA region. In addition, emergency managers in the observed state interacted with counterparts in a distant state to test an Emergency Management Assistance Compact (EMAC), and also communicated with responders from Canada.

The second exercise is categorized as a chemical, biological, radiological, or nuclear event drill (CBRNE). While the focus was on local response to the CBRNE incident, the simulated incident itself would affect multiple states in a larger geographic area. Representatives from FEMA and other federal agencies were present at the exercise, as were representatives from emergency operations centers in two adjoining states. The exercise itself involved two locations, the incident location plus the command center, where the observations took place.

The third exercise (COM) also involved a hurricane scenario with federal, state and local participants. It was held in conjunction with a larger exercise being run by NORTHCOM and involving several other states. Observations occurred over multiple days, at the state-level event headquarters as well as in smaller local outposts that were participating in the role play.

Interviews were conducted using a semi-structured interview protocol by a team of researchers. Interviews were typically held at the site where the EP&R work occurred, permitting additional observation. Interviews lasted between sixty and ninety minutes.

Researchers typed up their notes shortly after each interview or period of observation. We also obtained circumstantial data via our efforts to secure observational access to several other (state, city, and national) events, even when that access was ultimately not permitted.

More specific details on the exercise locations, timing and participants cannot be released due to the sensitive nature of such exercises. For purposes of our analysis, unattributed quotations or references within the examples are referenced by exercise or interviewee role, with the understanding that each is supported by transcriptions, protected by non-disclosure agreements (NDAs), of interviews or interviewer notes.

3.3 Analysis

Our analysis procedure was consistent with recommendations by Yin (2009) and Eisenhardt (1989). We took several precautions to counteract potential investigator bias during the analysis phase. The data collection and case-writing phases overlapped, during which time the team held weekly meetings to compare data, discuss interviews and observed events, iteratively refine constructs and develop emerging themes, incorporating the views of different members of the research team.

Each interview or event was separately analyzed and a report on it was written up prior to the cross-state analysis. In addition to triangulating across multiple sources of data, multiple people with different backgrounds were involved in the writing and reviewing of each individual report. The first author then conducted cross-state analysis, reviewing all of the original field and interview notes, the observational reports from exercises, and memos on the high-level themes, before completing a round of coding across the four state data set. These results were reviewed by other members of the team. Relevant literature was iteratively compared with the emerging results to further refine our findings and was incorporated in the written products.

4.0 Findings

4.1 Network Complexities

It is well known that during larger emergencies, responders from different agencies and organizations must coordinate their actions to meet emergent needs. When emergency management extends above the local level – to state and federal levels – complications arise due to the vast numbers of potential actors within each level of the response effort (Comfort 2002, 2007; Moynihan 2009). Furthermore, although planning and preparation are helpful, emergency

response is ultimately constituted through “execution” (Birdsall 2010) – the working out of specifics for resolving each contingency as it arises. These contingencies cannot be foreseen and comprise the impetus for organizational realignment by emergency managers. Our interest is in how that collaboration occurs *in situ* during emergency response, when the complete list of activated organizations and the precise nature of their involvement could not have been foreseen, even though network relations may have already been established.

We first provide our findings about the complexity of network relations for emergency management, and the role of state-level emergency managers as intermediaries in bridging between federal and local emergency response activities. We then discuss two additional complicating factors which frequently interact with managers’ efforts to organize the primary levels, rendering the overall organizing process even more complex. We follow this with description and illustration of state-level managers’ actions as *articulation* across the three domains of logistics, jurisdiction and governance.

4.2 Vertical and Horizontal Dimensions of Network Management

State-level emergency managers work with network relations vertically (upward to the Federal level, downward to the intra-state regional and the local) and horizontally (with non-government entities and with other states).

4.2.1 Upward: State <=> Federal

During the emergency management exercises we observed, the primary relationships that state level emergency managers had with federal level agencies were with FEMA. Relationships with other federal agencies depended upon specifics of each emergency, and relate to the agencies’ participation in ESFs (FEMA 2008). For example, the COM exercise was partially integrated with a larger NORTHCOM exercise. Other federal partners that state-level emergency managers commonly engage with – not solely during exercises – include the Transportation Security Administration (TSA), the Federal Bureau of Investigation (FBI), and the Army Corps of Engineers (ACE). One EOC director also indicated that his EOC occasionally collaborates with the Secret Service [EOC D].

These upward relationships did not always work out easily and gaps between state and federal agencies were evident. For example, both of the state-level EOC exercises that we observed were initiated by federal agencies (one by a FEMA region, the other by NORTHCOM). In the COM exercise, the state was much better organized and oriented towards its own hurricane

scenarios initially than were the federal exercise planners at NORTHCOM; hence it made sense for the state to move ahead and run its own exercise with federal participants mainly just observing. Different people at NORTHCOM had different perspectives on this – the NORTHCOM exercise lead (not onsite at the state exercise) was troubled by the state’s independence, whereas the NORTHCOM observer at the exercise indicated that the Feds are only meant to help states if the states need/ask for help and that this state seemed to be doing more than fine on its own without federal help.

Such issues can also be addressed during planning and preparation, although this does not always occur. For example, at a 2008 National Emergency Management Association (NEMA) conference, state level emergency managers issued a challenge to FEMA: “Build it with us.” Yet at the 2009 NEMA conference, those same emergency managers lamented, “Where are the people they said would be in touch with us?”

4.2.2 Downward: State <=> Local

Being responsive to local and within-state regional entities is a primary responsibility of state-level emergency managers [26:22]. One EOC director referred to the county emergency management agencies within his state as their “primary customers” [P13]. Wild fires are an example of an emergency for which state-level coordination across intra-state entities is needed. As one interviewee noted, “[The local and regional agencies] just don’t have the people to do it.” [36:56] EP&R capabilities vary in how they organized within a state. This can work more or less well, depending in part upon whether there is a strong intermediary level (county, district, etc.) between the state and the localities.

4.2.3 Horizontal: Within-State

Relationships between agencies at the state level also present management challenges – both within a state and between states. For example, we observed in-state communication glitches with the respective governors during EOC exercise in two different states. One governor asked for an accounting of resources deployed during the exercise, how much all the assets, resources, and processes cost *and* which pot of money would be used to fund them (local, state, federal); but that information was simply not (yet) readily available for the exercise leaders to provide [COM]. The other instance involved a governor’s office effort to contribute to the exercise via a non-sanctioned communication channel, which necessitated someone leaving the EOC space to go to a quiet office to use the phone to “find out what he wanted.” [HUR]

Relationships between EOCs and other in-state agencies such as the state police and the state National Guard were also in need of attention during the exercises.

4.2.4 Horizontal: External

Because all states have their own rules, contracts, procedures and practices for both EP&R and its management, interstate cooperation of necessity requires a high degree of management and collaboration. Externally, states therefore have EMACs with other states, to send assets from state to state during emergency on a voluntary basis. We did not hear any dissatisfaction with the use of EMACs.

Public-private partnerships were also evident in the state-level exercises we observed, mirroring the ESF structures established at the national level in accordance with the National Response Framework. Several telecommunications companies participated in the COM exercise, with a representative of one assuming a primary role within the state-level emergency organization. Information sharing issues arose with regard to whether that particular company should have access to privileged information without the same information being shared with its competitors who were also participating in the exercise. Also at this exercise vendors were displaying their products and services in a “demo” area. At the CBRNE drill, tensions were evident between the management of the private facility that was the site of the drill, and contractors hired by FEMA to assess performance during the drill. In the HUR exercise, private-sector representatives sat in a side room where they could observe from behind a glass window.

As mentioned above, state-level EOCs are strategically positioned as conduits for federal funding to local level emergency response organizations. Local responders then have to cooperate with emergency management at the state level to receive federal funding. Yet state level emergency managers also sometimes find themselves caught uncomfortably in the middle. For example, one participant at the COM exercise expressed concern that Critical Infrastructure (federal) and Public Safety (state) communities focused on different risks relative to the same resource: a nearby nuclear power plant with old infrastructure that would require \$40M to modernize, could be at risk of leaking although this would open up very different public safety dangers than if it were breached by outsiders. We also heard concerns voiced for example, about a “local Fire Department having a bake sale to put fuel in vehicles, and [federal] money is going to the private sector.”

4.3 Complicating Factors

In addition to horizontal and vertical network management and collaboration, our data revealed two further complicating factors. We found that interagency relationships and roles can be greatly affected by ongoing organizational change, such as turnover in leadership and shifting goals. And changing technological contingencies associated with the communication and information systems used for emergency response activities present special challenges.

4.3.1 Organizational Change

No matter how much advance planning has been done, and how “typical” an emergency is, emergency management is still affected by evolving organizational and institutional changes which can render any particular collaboration arrangement inappropriate before it is even implemented. As one emergency manager at the COM exercise noted: “The product is evolving.” [36:86]

In three out of the four states where we obtained primary data, there had been recent changes in leadership. In the HUR exercise, the state EOC had a new Director who was concerned with making changes to overcome the previous isolationist culture, establishing new initiatives to improve interfaces with the governor’s office, FEMA regional office, and local communities. In the CBRNE case, recent changes in leadership at both the private corporation that owned the facility and its government regulatory agency led to distrust and misunderstandings. On the other hand, things also can improve with new blood. To wit, one participant at the COM exercise noted with considerable surprise that following a leadership change, “Military and Public Safety [were] working together well!”

4.3.2 Technological Contingencies

Emergency response is further complicated by, and therefore requires additional organizing to integrate the specifics of a broad range of technologies used for communication and information sharing. Different levels of government frequently rely on different potential channels of communication for obtaining necessary information, as do different agencies at the same level of government. At the state level, two different information systems are commonly used. WebEOC is a commercial product for managing unclassified information; it is used for communicating down with locals. HSIN (the Homeland Security Information Network) is designed for managing unclassified information and is used to communicate up with DHS. Additionally, WebFusion – a relatively new software system – provides access to multiple WebEOC systems and can be used to enable FEMA, TSA, DHS, FBI, and the Secret Service to

join with all the entities on WebEOC to share information [P26]. WebFusion is being deployed in different settings (Virginia 2010); one EOC Director was implementing it as a way to share resource and incident information among state and local agencies both during emergencies and for routine use.

Interoperability problems with technologies for information sharing between state and federal levels are not uncommon. A particularly significant one is that while most states use WebEOC, federal agencies obtain their information primarily from HSIN per the National Response Framework [EOC D]. Because federal use of data is more restrictive than that of local and state agencies, staff in the EOC must enter information into both WebEOC and HSIN. “It’s time-consuming to post information twice.” [EOC D]. And when a state had to share data with DISA during the COM exercise, it had interoperability problems with the DoD network. Technology interoperability problems interfere with communication and information sharing across both vertical and horizontal boundaries, requiring emergency managers to frequently piece together low-tech compromises to enable information to flow effectively.³

In addition to information and newer communication technologies, radio is essential for communicating with local emergency response personnel during a disaster which has destroyed normal communication capabilities. “Radio infrastructure as backbone.” [COM] However, many emergency response personnel do not have the necessary (radio) skills, and volunteer contributors – amateur radio operators (many of whom are retired military personnel) – play a key role as backup support [COM].

Not all technology in use was specifically designed for emergency support. Email, Twitter and Facebook provide easy access to a wide swath of participants as well as the public. Sometimes the software in use was not the officially sanctioned product. At the COM exercise, participants used Yahoo.com to collect feedback and lessons learned about the exercise itself.

³ One EOC director spoke about his vision of how WebEOC and WebFusion can be used for states, communities and federal agencies to reciprocally share information, with law enforcement sensitivities. His vision is for communities in the region and federal agencies to work off of the same hub, and everyone can see everyone else’s data. Users would be able to click on a “sensitive” box in cases where information is too sensitive to share outside certain authorized communities. One problem with this plan was that FEMA didn’t have direct access to WebEOC. FEMA would have to borrow someone’s WebEOC access to get its information [25:16].

Furthermore, non-electronic technologies such as phone, paper and seating plans are common because they facilitate ease of use and training. At the HUR and COM exercises, maps and organization charts were displayed on paper affixed to the walls. While such graphical information might fit just as easily into a database, participants find them more useful when visible in a stable, familiar location that they can glance at without needing to place hands on the computer keyboard or rearrange windows on a computer screen once hands were on the keyboard. One EOC director noted that electronic information may be more complete, but “first responders on the ground can’t fold it and put it in their pocket to leave both hands free... it’s not useful if it’s left in the car.” [EOC A]

Technological advances (or lack thereof) can also contribute to unanticipated glitches. Communications failures are so common that participants at the HUR exercise expressed surprise that the cell phone system did *not* suffer any failures. Yet changes can also be beneficial if anticipated; for example, less communications support is now needed for shelters, due to widespread use of cell phones [COM].

4.4 Articulation Practices

Our observations revealed that during an emergency state-level emergency managers spend considerable time on the phone and talking in person with each other, working to bridge gaps that response planners and information systems designers were not able to anticipate. We note that this work of organizing the response *in situ* and in real time can be understood as *articulation*. “*Articulation work*” comprises “the specifics of putting together tasks, task sequences, task clusters—even aligning larger units such as lines of work and subprojects—in the service of work flow” (Strauss 1988:164). Articulation work necessarily precedes the routinization of any organizational function and is instrumental for repairing organizational routines that have been disrupted, as is often the case in emergencies. It can be considered similar in some ways to “adaptive management” (Wise 2006) though articulation involves less formality and fewer distinct consensus-building discussion processes, in order to support resolution of time-critical emergent needs.

During an emergency, managers – particularly at the state level – are responsible for sustaining flows of work – of resources, information and control. These must be defined, refined and managed; all of which involves articulation. This working out of appropriate combinations of expertise, responsibility, and span of control for responding to emergencies is a large

challenge, requiring many trial and error attempts and iterative cycles of articulation before “getting it right.” This is because *the exact specifics of the emergency could not have been foreseen*; therefore the articulation work must often be conceived and carried out “just in time.” The “articulation process” is “the overall organizational process that brings together as many as possible of the interlocking and sequential elements of the total work, at every level of organization – *and* keeps the flow of work going” (Strauss 1988). It often entails “thinking out loud” (Fosher 2009).

Star & Ruhleder (1996) posit three levels of issues associated with developing information infrastructure, that reflect increasingly wider and more diffuse contextual effects. We follow their lead in characterizing three domains of coordination issues to be resolved in organizing emergency response, depending upon contextual establishment (or lack thereof) of authority. The key questions that emergency managers must address are:

- (i) Which resources will go where? (logistics)
- (ii) Who decides which resources may go where? (jurisdiction)
- (iii) How is it determined who has control over which resources? (governance).

Contingent upon the particulars of any specific emergency, these domains of logistics, jurisdiction, and governance must be addressed. Our data further reveal that while that articulation work occurs within each domain, these domains are interdependent so that efforts to resolve a logistics issue may necessitate that a jurisdictional or governance issue be addressed first, as a prerequisite to resolving the logistics concern. Further, we found that the practice of articulation work during emergency response entails interweaving across these domains in rapid, ad hoc fashion depending on the specific contingencies of any particular emergency situation.

4.4.1 Logistics

Articulation in the logistics domain entails coordinating arrangements for the distribution and application of material resources and services supporting recovery from the emergency. Logistics – including the flows of information and control needed to ensure that resources are made available when and where needed in a timely and cost-effective way – are often unpredictable in emergency management, requiring the engagement of state EOC personnel, local first responders, other state agencies, and federal agencies, all in unanticipated ways. Private-sector corporations, non-governmental organizations (NGOs), and ad-hoc groups of concerned citizens are often involved as well.

Logistics requires articulation work because in emergencies, resources are often not where they are needed, and frequently are not owned or controlled by the responder who will use or distribute them. For example, in HUR, logistical articulation included sending work crews to remove downed trees that were obstructing a particular road and directing truckloads of bottled water to certain sites within communities that needed them. Many logistical issues arise primarily between state and local levels. However in some cases, federal level agencies also must be involved, as when FEMA is responsible for providing bottled water, or the Army Corps of Engineers (in its Emergency Support Function⁴ – ESF – role) is needed to clear debris from public property (ACE 2009).

4.4.2 Jurisdiction

Jurisdictional articulation entails allocating control and responsibility for distribution and application of material resources, as well as for communicating with the general public or the media. Jurisdictional articulation can be quite complex due to the large number of organizations involved in emergency response (above the local level), the unpredictability of actual contingencies during any particular emergency, and the shared basis of authority (Moynihan 2009). A typical case involves the need to determine which agency or organization should be tasked with sending the crews to remove the fallen trees or deliver the water: which town, agency, utility company, etc. A less common example would be to identify which agency could provide aerial support for damage assessment after a storm [HUR].

Articulating jurisdiction entails the work of allocating control and responsibility for distribution and application of material resources, and for managing the needed information and labor. It may be suggested that these issues should be worked out in advance, and indeed this is the purpose and value of planning and exercises; but just as every emergency is local, every emergency is also unpredictable and not until it emerges in a specific situated time, geographic, and social context do all the consequent requirements for emergency response emerge. For example, while emergency management for floods and droughts can be planned for a specific geographic area, jurisdictional issues remain common, for example if a tree falls on power line, both the public works agency responsible for clearing the roads, *and* the utility company responsible for repairing it must be involved. But if one of those groups is detained on a prior

⁴ Emergency Support Functions are groupings of functions, and hence of government agencies, NGOs, and private-sector organizations, used to provide support during emergency response (FEMA 2008).

call, the other may be able to initiate work, or another equivalent group from a different jurisdiction may be tasked with filling in.

In the COM exercise, where there were differences of opinion over who should be in control (i.e., NORTHCOM or State C), the on-site NORTHCOM observer also indicated that the state had done its planning for the exercise in a more timely fashion, whereas NORTHCOM was slow to get their act together, and by the time they had instructions for states, that state was already well-underway with its own effort. As the NORTHCOM observer noted, “Doesn’t matter who tells the truck to move.” Other COM interviewees expressed a similar sentiment: “Don’t mess with success”; “Coalition of the willing”; and “NORTHCOM can learn from [this state]!” Similarly, in the HUR exercise, state level emergency managers altered a FEMA given timeline to allow for more intensive exercise of certain specific capabilities needed by State A.

Not all jurisdictional issues are easily resolved. At the COM exercise, one portion of the organizational chart was in continual flux throughout the four days of the exercise – it changed four times on the first day alone, and was still not stabilized by the final day. Similarly, at all three exercises we observed groups of participants sitting idle even when they could have been helping, because those in charge had not the time or focus to direct them. Another example from CBRNE involves who determines what should be revealed to the press and media – which are often involved in emergencies depending upon their nature and location. Our point here is that jurisdictional issues are not just legal, but also situational.

Similarly, inter-local and mutual aid agreements lay the foundation for jurisdiction but details must still be worked out when resources are needed across organizational boundaries in emergency response (NENA 2005). Our data reveals that such decisions about jurisdictional issues are not always easy or obvious for emergency managers.⁵ For example, at the HUR exercise members of an ESF noted that requests for assistance should be filtered at the regional level (between local and state), because some situations were not considered significant enough at this time to warrant state level attention. Similarly, participants in another ESF in the same exercise noted that some of the requests they received should also have had decisions made at a lower level, indicating that jurisdictional boundaries were not always clear or consensual. On the other hand, some requests assigned by HUR’s Logistics Director led to questions by other participants about why their agency was not asked to provide the services that were typically

⁵ Nor are they easy for other types of managers either.

their responsibility. Furthermore, financial, legal, regulatory, budgetary and publicity restrictions on individual agencies can often overshadow agencies' ability to collaborate for immediate emergency response, inevitably impacting effectiveness of the overall response effort.

4.4.3 Governance

Articulation work in the governance domain entails resolving ambiguities and conflicts over jurisdiction especially as they occur between members of different agencies not accustomed to working together. These issues often emerge in terms of institutional and policy constraints on power, control, legitimacy, procedural justice – when the need to ensure that “due process”⁶ (Gerson & Star 1986) is followed.

This is common especially when participants normally compete with each other for funding. At times such interagency differences supersede other concerns. When participants at the COM exercise heard that we were studying their emergency management process, one went out of his way to share a story about two state regional task forces that steadfastly refused to work together. Each task force wanted to “knock down missions faster than the other” as part of their ongoing competition for funding. Our interviewee opined that the key issues were likely training and personality, with problems beginning higher up the command chain rather than with the task forces themselves, although millions of dollars had been directed into technology upgrades which were justified in terms of solving the problem. “They keep blaming problems on equipment, while they’re sitting in an orange, three-quarter of a million dollar truck!” [36:88]

Another pertinent example was framed in terms of regulatory issues – an SE interviewee noted that state and local EP&R operate under a different regulatory and legal scheme than the Department of Homeland Security (DHS) Office of Intelligence and Analysis (I&A), and that this difference is a “big big issue” for those engaged in anti-terrorism work. [P31]

Another example occurred at the HUR exercise, where tasks sent out to one ESF necessarily involved several agencies – questions were then raised about how to manage accountability for the agencies that were not the lead on the task.

The governance domain of articulation is where relational aspects of networks are especially important. Governance negotiation work is frequently conducted using relationship management techniques. This entails interactional strategies and tactics such as negotiation,

⁶ In this context, “due process” refers to ways of negotiating power relationships and decision methods that respect the concerns of all stakeholders, so that they can support the results of the negotiation (Gerson & Star 1986).

persuasion, manipulation and coercion (Corbin & Strauss 1993). One basic governance approach simply involves establishing common ground for representatives from federal and local agencies to meet and discuss matters of concern. For example, when some of the local providers at the COM exercise expressed concerns during the hotwash⁷ afterwards – that they were not being utilized or exercised enough – a DHS representative was also present to assure them that although the federal levels were unaware of the difficulties local and state levels deal with, the Department of Defense and NORTHCOM were fully pleased with the level of effort.

State-level emergency managers use a variety of approaches to manage response with local-level responders; many of these approaches involve relationship management techniques and capabilities. For example, one member of an incident management team (IMT) counseled: “herd the group – rely on their expertise.” One state-level entity even changed its name and mission to reflect a shift from “Command & Control” to “Coordination.” Longer-term planning for capability development also helps: an EOC director spoke about establishing an advisory council which holds regular meetings and takes on a variety of EP&R-related projects, an in-house grass roots effort to develop collaborative relationships among responders, cultivating the trust that is supportive of informal collaboration. [EOC A]

At the COM exercise, the slogan “leave your logos and egos at the door” was repeated throughout the day in an effort to sway those participants accustomed to a more hierarchical, “command and control” approach towards a more horizontal collaborative approach. One member of the incident management team (IMT) counseled: “[We] need to connect with public safety in the specific hit area before the hurricane hits. Call them: ‘we’ve got taskforces assembled, tell us what you need.’ ([which] gets them thinking to prepare).”

Articulation for emergency response takes place against a backdrop of long-term budgetary and financial concerns – other governance issues that often must be addressed first. We found that emergency managers were often concerned with balancing emergency management against ongoing budgetary and financial considerations; in practice, many governance issues requiring negotiation were framed in terms of budgetary and financial consequences. A COM emergency manager was concerned about obtaining a final correct version of resource assignments, because it would be reviewed by local governments (each

⁷ A hotwash is a meeting of all participants immediately following the end of an exercise, in which they comment on what went well, what did not go so well, lessons learned, and recommendations for improvement.

looking for their own assets in the list). There were also often-voiced concerns about how state and local responders would be paid for their time while participating in an exercise, and how much money the state legislature had allocated for the training exercise.

Another, more incentivizing approach was that of channeling federal Homeland Security grants through state-level EOCs which has had the effect of motivating local agencies to work more closely with the state-level EOC. At the COM exercise, local participants were repeatedly reminded that the state spent \$2B (of federal money) on equipment with 96 cents out of each dollar going to local jurisdictions.

Also in the COM exercise, there was considerable discussion about how to order resources – which could be ordered through the state ordering system, which responded slowly, or through a federal system which was much faster; the question of “Who picks up the tab?!?!?” was repeated rhetorically and decisions were therefore usually made in terms of proceeding through formally-approved channels.

Our data revealed that emergency managers often experienced challenges in resolving these issues. For example, members of one ESF team participating in the HUR exercise noted that requests for assistance should be filtered at the regional level (in between local and state), because some situations were not considered emergencies at this time at the state level. Similarly, participants in another ESF noted that some of the requests they received should also have had decisions made at a lower level, indicating that jurisdictional boundaries were not always clear or consensual.

Other governance issues may emerge as cultural issues, when people from different groups have differing expectations. For example, HUR exercise participants in the Food and Water ESF noted that there would be times when they entered information into WebEOC, and the response they received had nothing to do with what they put in – the problems were with understanding each other’s language, acronyms, etc. Another source characterized a state police organization as “a hard group to break into.” [SE]

Informal collaborative networks are especially significant in governance articulation. As a representative from FEMA indicated, it is “better to consider social relationships” than to solely rely on formal hierarchies during an incident. A common saying in a cross-organizational coordination group is: “When you need a friend, it’s too late to make one,” [COM] which points to the importance of training and continuity across incident management opportunities.

In fact, emergency managers made a point of telling stories about situations in which higher level teams were careful not to step on local toes. One story involved the US Army Corp of Engineers, which interacts through FEMA, and has more experience than states; yet states want to be in control. The situation is handled by FEMA sending the Army Corps of Engineers to simply “*deliver*” resources so that the state could then still retain control over how the resources were used.

Sometimes governance articulation work necessitates involving higher level third parties as broker. At the HUR exercise, utility crews from a neighboring country were held up at the national borders, HUR emergency managers asked the State Police to contact Border Patrol to expedite crossing contacts. And when people from the Health & Medical ESF noted that they weren’t asked to participate in very much of the exercise, they planned to get HHS (Health and Human Services, a federal level agency) involved to facilitate future mission assignments. Furthermore, discussions about these connections often included reference to a specific named individual who could be expected to provide assistance on the other side of the boundary.

In this section we have described logistical, jurisdictional and governance domains of articulation practice which managers employ to resolve needs arising during complex incident management. In the next section, we examine how state-level managers interweave these forms of articulation across both vertical and horizontal boundaries.

4.5 Interweaving Articulation Threads

Just as the details of emergencies cannot be predicted, emergent contingencies do not lend themselves to being separated cleanly either by scope of authority or concentrated blocks of time. Rather, multiple requests for assistance frequently need to be worked out in parallel as the contingencies and responses each unfold at their own pace. As a result, the situated practice of articulation work entails interweaving different threads of levels, locales and domains temporally throughout the course of emergency response.

Further, the process for responding to any particular need during an emergency also often requires state level emergency managers to articulate the response using multiple means. For example, during the hurricane exercise, requests for assistance came in via WebEOC, and a response was entered through WebEOC – then a (paper) Action Request Form was filled out and signed by Logistics Coordinator; the form was then handed or faxed to the appropriate ESF representative. When tasking a mission, if possible the representative would walk over just to

confirm that the task has been received. In the COM exercise, the tracking process entailed copying and pasting from an asset tracking spreadsheet to a sitrep (situation report) document and a map with icons (which could be displayed). An example taken from the hurricane exercise is displayed in Table 2.

This series of interactions took place during the state-level EOC HUR exercise, as part of a larger multi-state FEMA exercise, with local and state regions participating in addition to FEMA and state-level ESFs. The exercise scenario was 24 hours “post landfall” of the hurricane, which started at 9 a.m. and took 12 hours to move through the state; and was being played in real time. Because it was a training exercise, more things were being explained than might be during a real emergency which we indicate as [Training] in the articulation domain column.

The conversation(s) took place in the “logistics” office, a small room at the back of the larger EOC, with a sliding glass window that opens into the larger space, making the main screen visible. Within the small office are the Logistics Coordinator (already familiar with his job) and two assistants in training, plus our two observers. Because the transcript is from fieldnotes rather than an electronic recording, it is incomplete and may not be entirely accurate; nevertheless, we posit that the general sequence and relative meaning of statements remains instructive.

Table 2. Interweaving

Time Increment	Observation	Articulation Domain	Communicative Mode	Government Level	Locale: G-City	Locale: L-Town	Locale: M-Town
1	As the exercise gets underway, we see two events listed on the Significant Events blog at the front of the EOC:						
2	One event from G-City, building collapse at the prison.		Significant Events Blog projected on large screen in EOC	Local	event blog: building collapse at prison		
3	Another from L-Town – lost three fire trucks.		Significant Events Blog projected on large screen in EOC	Local		event blog: lost three fire trucks	
4	Logistics director remarks that no one has put the L-town event into WebEOC yet.	[Training]	Event not in WebEOC				
5	“that would be covered by mutual aid”	Jurisdiction				mutual aid, not state	

Time Increment	Observation	Articulation Domain	Communicative Mode	Government Level	Locale: G-City	Locale: L-Town	Locale: M-Town
6	“see, it says ‘local assistance’”	[Training]					
7	“covered by [local] mutual aid agreement, not going to be state [level]”	Jurisdiction					
8	“G-City– we need to take care of. They lost all communications except radio. Let me go see if I can get help with that” ... will check with [expert].	Logistics & Jurisdiction	Radio	Local	lost all comms except radio; EOC needs to help		
9	RFA from M-Town: trees down blocking road.	Logistics	Request For Assistance form, in WebEOC	Local			trees down blocking road
10	Contact regional Electric Company			Intra-state region, private sector			contact Electric Utility
11	“We [logistics] want to assign this.”	[Training]	F2F				need to assign
12	Assign to Mass Highway – they clear roads.	Jurisdiction	F2F				assign to ESF1 - State Hwy Dept.
13	ESF [Emergency Support Function] 1 – Mass Highway	Jurisdiction	F2F				
14	[Staff member] makes phone call to Region 3&4:		Dialing phone	Intra-state Region			
15	“Can you handle that with mutual aid agreements?”	Jurisdiction	Request by phone	Intra-state Region / Local		handle w/ mutual aid?	
16	“And please let us know the outcome... Just call EOC headquarters and ask for logistics.”	Jurisdiction	Request by Phone				
17	<i>Through the window in the Logistics office, someone from the Ops group stops by, indicating a need to do an IAP [ICS Incident Action Plan]. [Staff member] will go to a separate quiet room to do it.</i>		walk-by, ICS form, F2F, quiet room	State, Federal (FEMA)			

Time Increment	Observation	Articulation Domain	Communicative Mode	Government Level	Locale: G-City	Locale: L-Town	Locale: M-Town
18	Sylvia calls MEMA Region 3 HQ w/ requests for bottled water and chain saw crews.	Logistics & Jurisdiction	Request by phone	Intra-state Region			request to Region 3 for chain saws
19	Need a number for G-City – the Prison	Logistics	Phone #		need a number		
20	Will reassign...	Jurisdiction	Reassign in WebEOC				
21	They're putting it in backwards	Training	incorrect WebEOC				
22	They assigned it through the DCR [Dept. of Conservation and Recreation], W. Mass Regional Office.	Jurisdiction		Intra-state Region / Local			
23	ESF 12 Liaison – is not on WebEOC – he gave it to Logistics Director on paper.		Paper, not WebEOC	Intra-state Region, Local, ESF-12			

The excerpt in Table 2 demonstrates the interweaving of these different threads throughout emergency response. A look down the “Articulation Domain” column reveals that there was back-and-forth interweaving of logistical and jurisdictional issues over time. At the same time, the participants’ focus shifts from the first crisis situation to the second and back to the first. Also through the same period, the communication mode shifts from co-present conversation, to computer (WebEOC, etc.), to walk-by messenger, to phone (and fax?) and back again.

When articulation requests from higher levels of government are issued, they may take temporarily take precedence over logistical and jurisdictional concerns. For example, at a later point during the same exercise, a participant stopped by the logistics window and indicated that the governor had put in a request for assistance, though not through the formally correct channels; dealing with this request took precedence over the other ongoing activity, with one participant relocating to a quiet office to speak with the governor’s office by phone to learn what was wanted. Similarly, in the Communications exercise when concerns were raised about differences in privilege (or disadvantage) granted to representatives from different (competing)

telecommunications companies, these issues were sidelined at the time, but necessarily addressed later.

It is also worth mentioning sensemaking processes must sometimes precede the organizing processes – different levels of articulation and other issues can be mistaken for each other and until they are correctly identified, the problems cannot be resolved (Comfort 2007). Interactions between sensemaking and other issues (especially governance) can be especially difficult to untangle, especially in cases where lack of appropriate information sharing is attributed to ignorance or cultural resistance, when in fact it is due to out-dated or broken communication systems. For example, in the HUR exercise, local requests which should have been going through regional offices were coming directly to EOC. State-level emergency managers assumed that the problem was a training and jurisdictional issue, until they found out later that the communication capabilities of the regional HQs were down (i.e. logistics and governance domains).

5.0 Discussion

This work has focused on state-level emergency managers as central players in large-scale inter-organizational networks engaged in emergency response efforts; we have elucidated their role in and their practices for coordinating response between local levels of need (resource requirements) and other network sources of resource provision. We did this by first identifying dimensions of complexity faced by intermediary-level emergency managers, which may help to explain why many policies and information systems designed for emergency response and information sharing are not fully implemented as intended by their originators. We then identified three domains of articulation – logistical, jurisdictional and governance – through which state-level emergency managers coordinate response, in temporally and communicatively interwoven patterns. Our work has both theoretical and practical implications.

This helps to explain why the first domain of articulation work (logistics) is normally considered “regular” emergency management work while the other two (jurisdiction and governance) are sometimes viewed as impediments to doing “the work.” Indeed we find that these additional two aspects are where many of the difficulties in information sharing typically arise. However, we also assert that these latter domains comprise an intrinsic and crucial portion of emergency management and response work: such contingencies only cease to be issues *after*

they have been addressed, either worked out and solved altogether or become more routinized at which point they become invisible or taken-for-granted.

5.1 Theoretical Implications

Our work responds to calls for the study of lower and mid- levels of organizational and network management practices (Hall & O’Toole 2000; Agranoff 2004, 2006; Rhodes 2007; Provan & Kenis 2008; Moynihan 2009), especially in crisis situations (Garrett 2010; Kapucu, Arslan, Collins 2010). The value of our empirical work is the demonstration that, despite the importance of planning and hierarchical control, in emergency (i.e., non-routine) conditions, the organizing work of reconstituting social and governmental infrastructure can be viewed as significantly comprised of mid-level emergency management practices. Emergency response must be devised and carried out to meet and address contingencies *as they emerge* in an ad hoc manner, rather than via rote execution of plans. This finding echoes that of Suchman’s (2007) work on plans and situated actions.

We stress that such emergent needs for jurisdictional and governance articulation work are not indications that emergency managers are not doing their jobs correctly, or that more planning or technology are needed. Rather, these results demonstrate that such articulation work is central to the very nature of emergency (i.e., non-routine) management, because of the numbers of possibly emergent contingencies in, and organizations potentially contributing to non-routine operations. Our study of emergency response thus contributes this important insight to empirical knowledge about emergent public management networks and organizational forms more generally.

With regard to the growing body of work on network governance, our approach advances a focus on the role of intermediate nodes in the network, with participants working up, down *and sideways* to manage the networks, as opposed to more traditional perspectives on hierarchical top-down, or grassroots bottom-up organizing processes. Our work is consistent with Nonaka & Takeuchi’s (1995) highlighting of the importance of “middle-up-down management” in organizational knowledge creation, and complements their work by adding a sideways (internal/external) dimension.

With respect to knowledge about network management, our work highlights the role(s) of knowledgeable actors in constituting just-in-time articulation of emergency response, and capabilities for rebuilding response system as necessary (Kapucu & Van Wart 2008). Our work

contributes to the argument that network evolution during crisis or times of rapid change is often more like just-in-time network management bricolage (Anderson 2008) of situated initiatives, rather than a deliberate decision or choice process about type of network form per se (Provan & Kenis 2008). This work thus also supports Feldman & Khademian's (2002) argument that "to manage is to govern," especially in cases where change is more relevant than planning is.

5.2 Practical Implications

5.1.1 Implications for Training

Emergency management organizations are always getting new people on board, and always getting new technology (e.g., newest version of WebEOC) [EOC Log]. With people coming and going, new people always need to be trained. There is ongoing training for WebEOC, as well as instruction on how to order commodities or interact with members of other communities [EOC Log]. As one IMT member counseled: "As the event progresses – trainees are now leaning forward: 'we've got it!' But later, when the storm really hit: 'We don't have it!'" [COM]. Participants must participate in a number of exercises before they really learn how things work, how to fit in, what types of things can be changed, etc. As one EOC director put it: "We should train the way we work." [EOC A]

Using the same procedures for normal daily operations and for emergency response is important for training and familiarity reasons. This emphasis on the "abnormal as normal" has special value for understanding constructs of resilience (Edwards 2009) and return-to-normal-operations, and also has implications for the design of information sharing systems.

Exercises can also be and often are dedicated to improving a particular capability. For example, the purpose of the COM exercise we observed was to improve communication capabilities; for the HUR exercise the purpose was to examine critical resources logistics: distribution, debris management, and mass care.

Depending upon the goals of the training, different groups may need to be involved in the planning. Yet in training too, because so many different organizations are involved across multiple levels, jurisdictional and governance issues are common as well. Each organization has their own training person (e.g., FEMA, state EOC, Private Corp, state civil defense exercise training office). In the exercises we observed, the state acted autonomously in making significant changes to the exercise scenario they were given by the federal exercise organizers.

Some may argue that improved training obviates the need for articulation. Recent research suggests this is highly unlikely given the importance of communities coming together in unpredictable emergencies (Majchrzak *et al.* 2007; Cowen & Cowen 2010) and the need to train new members in temporary organizations (Bechky 2006); nevertheless we posit that articulation remains an important aspect of training. Training is not separate from actual emergency management; we posit that training remains important throughout *actual* emergency management when appropriately trained personnel may not be readily available.

It is important that people use the same system for routine and emergency work. A key recommendation is to tie the response system to the planning system to promote daily use of planning. This supports day-to-day use, and makes the capability portable. Preparation could include training modules (course enrollment) in it to get users comfortable with it. This would also help address the challenge of (not keeping information current, but) getting information in the first place. It would also ease trust issues of local responders concerned with whether they would retain access to whatever information they provided into the system. It is important for them to know that it will be given back to them. [DIR A]

Furthermore, in an actual emergency, technology may malfunction or otherwise become unavailable. In such situations, managers must communicate that functioning would roll back to alternative yet stable technological or manual systems and organizational structures. Training across these alternatives would facilitate technological articulation.

Exercises and Training Facilitate Articulation Work

Training is a key purpose of ongoing EP&R *exercises*. As one EOC Director noted: “Exercises are pretty key. Exercises are important to maintaining the skill set.” [P11] Repetitious training minimizes the need for articulation through routinization of processes that are found to be effective, such as how to be clear about who assigns a task and who is assigned to carry it out most effectively. Aspects of articulation processes that can be clarified during training do not then need to be worked out during an actual emergency, and management of a real emergency can then be that much more internalized. As one FEMA representative put it: “[We] need to work like greased lightning... need to drill the process, push through as quickly as possible” [P20].

In a course we attended on ICS, the instructor noted that while planning (as in pre-planning and ICS Planning-P) is often helpful and important, in rapidly changing incidents, plans

don't work; this is when prior training and shared experience becomes especially important in establishing the necessary knowledge base.

Much of that knowledge base becomes manifest in the relational network. One value of exercises is in working through leadership conflicts, and having regular meetings to establish familiarity and knowledge. Training also reveals when certain resources are needed and how many resources (staff, equipment, etc.) might be needed for each incident. More significant process improvements are also discovered through the lessons learned, which may be voiced during hotwashes and after action reviews, as well as appearing in evaluation reports.

5.1.2 Implications for Information Sharing Systems

While traditional types of information and communication technology (ICT) are designed and work adequately for organizations that are relatively stable, in emergency management, especially in the early stages when requirements are still being identified and the organizational processes are not yet routine, articulation work – rather than automation – must take precedence, especially to provide for use of the same system in both routine and emergency operations. Design of systems for information sharing during emergency response must therefore diverge in significant ways from more traditional organizational and IS design and development, or go the route of so many systems which end up not being used as designed.⁸

Designing emergency response systems that facilitate information sharing presents a challenge to ICT developers who are accustomed to designing systems that automate routine operations within a hierarchical structure, and that support foreseeable contingencies. Our results suggest that it may be most prudent for ICT designers to take a step back and consider the organizational and organizing realities of emergency management – which differ significantly from the routine operations of more traditional organizations automated by more traditional ICT. This points to a need to design systems for emergency management under conditions where concurrent and collaborative articulation work takes precedence at and across multiple levels, where jurisdictional and due process issues must be worked out *in situ* before knowledge about which organizational routines are appropriate to the restoration of order can be determined. Emergency systems for information sharing must therefore be able to accommodate fluctuating

⁸ This is precisely why the Incident Command System (ICS) is so useful: ICS is a flexible approach to incident management which allows emergency responders to structure their organization on the fly and modify it in real-time on an as-needed basis (Bigley & Roberts 2001; FEMA 2009).

and unpredictable circumstances and information sharing needs during emergencies to a much greater extent than more traditional ICT.

We therefore propose three design principles that may be helpful toward the design of information sharing systems across local, state and federal levels during emergency management. The first design principle is that *resource need requests must be tracked unambiguously*, as they transit different systems, organizations and organizational levels, and media (including paper). This implies the need to identify an emergency *situation*, comprised of a geographical location, the current status of the situation, and especially of emergent local needs associated with, as a primary information object. As an example, whenever a hurricane hits a metropolitan region, there will be needs for food, shelter, debris clearance, medical, and electrical utilities in specific districts at particular times. Emergency management systems support the tracking of individual event/need requests; each must be tracked separately throughout time and independently of specific resource providers.

The second principle is that the overall set of *resources* – whether those resources are associated with local, state, or federal authorities, or with private sector entities that participate in ESFs – *must be tracked*. Resource management tracking needs to detail what resources are available from and provided by which organizations (regardless of level) and where they are assigned or directed to (and current status of provision). While some emergency response information systems are focused on tracking resources for a specific set of stakeholders (e.g., firefighters, medical providers), others are working to leverage the National Incident Management System (NIMS) resource definitions to track a broad spectrum of resources. Overall resource tracking is a growing trend at the state level, e.g., Missouri (2007) and Florida (2009) and also in the District of Columbia (2007); one EOC director [EOC A] already had such a system under development.

This leads to the final principle, which notes that traditional systems design approaches, especially those in the waterfall family, have limited value when designing information and communications systems for emergency management. *Designers should begin by observing* several exercises and actual events before endeavoring to set specifications for new emergency management systems. Periodic observations will give designers insights into the flexibility needed to support the managerial and communications articulation that occurs during each unique incident. It is also not enough to consult with centrally located EOC users without

understanding how those with whom they interact in the field will employ a new or integrated system. The number of stakeholders directly or indirectly affected by any new or changed system is far greater than one might expect if these contingencies were not taken into account. We acknowledge that instituting this kind of observation as part of the design work process would entail a significant change in the design process for many software engineers who are not familiar with social and organizational considerations. In fact, this is an excellent example of how social and organizational issues interact with technical design factors.

5.3 Limitations and Future Research

There are a number of limitations to this work. We were able to gather our primary data from only four states; thus ours was a very small sample, not particularly strong in terms of theoretical sampling (Yin 2009, Eisenhardt 1989) and constrained opportunistically. Also, because we observed at exercises rather than actual emergencies, our results are tainted by the disparities between exercises and actual events, including that each exercise was only partial, and did not include all the actors that would be participating in an actual emergency. Furthermore, the exercises we observed did not allow for citizen input; actual emergencies would be very different because information sharing and communication would likely be quite affected by citizens using cell phones and Twitter (Crowe 2010). Thus, study of the practice of articulation should continue, with particular emphasis on the three primary domains (logistics, jurisdiction and governance) and the two complicating aspects (organizational change and the role of technology). With our findings in mind, future work should center on research questions building off of the observations and recommendations we make concerning the importance of and success factors for managerial articulation in the practice of emergency preparation and response.

In addition, from a structural perspective, we would encourage more research focusing on ESFs as vertical columns/pillars traversing local, state and federal levels for tracking resource management. Many states define ESFs as counterparts to those established at the federal level. For example, a state-level search and rescue ESF reached up to FEMA search and rescue for aerial support for damage assessment of specific localities. A state ESF concerned with animals stretched from an impacted local fishery to National Wildlife for assistance. Thus the ESFs are specifically empowered for vertical articulation, constituting columns or pillars spanning local to

federal connections within a specific support domain.⁹ We suspect that looking at these as columns or pillars that could be cinched together in a variety of ways at the state and other intermediary levels to coordinate across levels and avoid duplication, would be a particularly fruitful area of research.

Finally, from a systems design perspective, we believe that rendering each location-based emergency “situation” a first class data object, with nested objects for specific locales and needs would be worth trying, consistent with our information sharing system design principles. Developing and fielding such prototypes would be instructive in this regard. Case studies about the efficacy of technology design choices and approaches are also needed to document best practices at all three levels of government.

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⁹ There are differences between states in how ESFs are organized; these differences can complicate inter-state communications and management. For example, NRF has a “Communications” ESF, while New Hampshire has a comparable one named “Communications and Alerting”; similarly while NRF has an ESF for “Public Health and Medical Services,” Rhode Island has separate ESFs for “Public Health and Medical” and “Behavioral Health Services.” Maine does not define ESFs; the makeup of the state Emergency Response Team includes representatives of state agencies as established by the Governor’s Executive Order (Maine 2005), many of which correspond to ESFs.

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