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THESIS

ACHIEVING SHARED SITUATIONAL AWARENESS DURING STEADY-STATE OPERATIONS IN NEW YORK STATE: A MODEL FOR SUCCESS

by

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March 2010

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This thesis explores the terms *situational awareness*, *shared situational awareness* and *common operating picture* as they apply during steady-state operations. It argues for the importance of shared situational awareness in support of group decision making during the transition from steady-state to response operations, examines existing models of information sharing, and proposes two new models.

The thesis concludes that New York State should leverage its Disaster Preparedness Commission interagency coordination architecture to establish a governing body with responsibility for assessing current practices, identifying gaps, and developing strategies to ensure that an all-hazards public-safety shared situational awareness exists through a daily common operating picture.

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ABSTRACT

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LIST OF ACRONYMS AND ABBREVIATIONS

Ag&Mkts	Department of Agriculture and Markets
AMS	Administrative Messaging System
AOR	Area of Responsibility
ARC	American Red Cross
CCTV	Closed Circuit Television
CEMP	Comprehensive Emergency Management Plan
CI	Critical Infrastructure
COP	Common Operating Picture
CROP	Common Relevant Operational Picture
DEC	Department of Environmental Conservation
DHS	Department of Homeland Security
DMNA	Division of Military and Naval Affairs
DoA	Department of the Army
DOB	Daily Operational Brief
DOH	Department of Health
DOJ	Department of Justice
DOS	Department of State
DOT	Department of Transportation
DPC	Disaster Preparedness Commission
EAS	Emergency Alert System
EMA	Emergency Management Agency
EMS	Emergency Medical Service
EOC	Emergency Operations Center
ESF	Emergency Support Function
FB	Functional Branch
FDNY	Fire Department of New York
FEMA	Federal Emergency Management Agency
IAP	Incident Action Plan
ICS	Incident Command System
IDB	Intelligence Daily Brief

IJ	Investment Justification
Intel	Intelligence
JFO	Joint Field Office
JTMC	Joint Transportation Management Center
LE	Law Enforcement
MAC	Multi-Agency Coordinating Group
MTA	Metropolitan Transportation Authority
NAWAS	National Alert and Warning System
NGO	Non-Government Organizations
NITTEC	Niagara International Transportation Technology Coalition
NWS	National Weather Service
NYC Watch	New York City (Office of Emergency Management) Watch Command
NYS	New York State
NYSEMO	New York State Emergency Management Office
NYSIC	New York State Intelligence Center
NYSP	New York State Police
NYSPIN	New York State Police Information Network
OFPC	Office of Fire Prevention and Control
OHS	Office of Homeland Security
PANYNJ	Port Authority of New York and New Jersey
PDA	Personal Data Assistant
PFO	Principle Federal Official
PH	Public Health
PSC	Public Service Commission
REP	Radiological Emergency Program
SA	Situational Awareness
SECC	State Emergency Communications Center
SEMO	State Emergency Management Office
SEOC	State Emergency Operations Center
SFA	State Fire Administrator
SHSSWG	State Homeland Security Strategy Working Group
SITREP	Situational Report

SPR	State Preparedness Report
SSA	Shared Situational Awareness
State Mil	State Military
STICC	State Transportation Information Communications Center
TC	Target Capability
Thruway	New York State Thruway Authority
USCG	United States Coast Guard
USJFCOM	United States Joint Forces Command

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I never see what has been done; I only see what remains to be done.

— Buddha

It is difficult to describe the CHDS experience to others. The discourse, the friendships, the challenges, and the overall personal and professional growth that I have experienced at CHDS do not easily translate to a brief explanation. It has been far more gratifying than I anticipated, and I will forever appreciate the assistance of those who contributed to my experience. I have learned a great deal from my classmates. I want to thank them each for their dedication, support, and participation in this experience. The camaraderie we developed was the best part. I will miss our time together.

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I. INTRODUCTION

A. PROBLEM STATEMENT

Over the past decade the need for information sharing between public safety agencies to combat terrorism at all levels of government has been discussed and written about extensively. Hurricane Katrina demonstrated that a lack of information can significantly hamper response and recovery activities during a nonterrorism disaster as well (United States House of Representatives [Katrina Report], 2006). Increasingly the discussion of information sharing has expanded from the terrorism-centric framework that dominated pre-Katrina to be inclusive of all hazards that may impact our nation (United States Department of Justice [DOJ], 2008). New York remains a target for future terrorist attacks, and countering that threat needs to remain a priority for the state and its local partners. New York State law enforcement personnel have partnered closely with their federal and local partners, establishing a robust information-sharing environment and highly functioning state-level fusion center. Recent arrests and foiled attempts by terrorists in New York demonstrate the effectiveness of the information-sharing efforts between local, state, and federal law enforcement agencies. But terrorism is not the only hazard that New York and its citizens face.

Since September of 2001, New York State has experienced 26 disasters that have resulted in a presidential disaster declaration. Of those, only two were no-notice events, and fortunately none of the events since September 2001 were terrorist attacks. The remaining 24 presidentially declared incidents were weather related, and the conditions that led to the disaster's occurrence emerged in the days and hours preceding the event (Federal Emergency Management Agency [FEMA], 2010). Other crises have occurred within the borders of the state that, while they did not result in a presidential declaration, were significant events that required state public safety leaders[1] to directly engage in

[1] The term "public safety" is intended to include state agencies that have responsibility and authority within the emergency management and homeland security domains including fire, EMS, law enforcement, emergency management and health care. "Leaders" refers to the executive and senior-staff-level personnel of these agencies and members of the Governor's executive chamber operational staff and senior advisors.

response-and-recovery-phase decision making. Examples of these events include airline disasters (e.g., American Airlines Flight 587; Continental Flight 3407), waterway emergencies (e.g., MV Stellamare, SS Ethan Allen), violent events (e.g., Binghamton mass shooting; East Greenbush I-90 standoff), major fires (e.g., Deutsche Bank; Riverview Home), and health care crises (e.g., H1N1 pandemic; Haitian medical relief efforts). Clearly New York regularly experiences major crises, both notice and no-notice, which challenge its leaders to engage in rapid decision making. The situation dictates that New York ensure that its public safety information sharing architecture is robust, thorough, and accurate to support rapid joint decision making.

In order to effectively make effective decisions and provide leadership for the safety and well-being of the citizens of New York State, the governor and key state leaders must have access to as much near real-time, accurate, and comprehensive information as possible. During response-phase operations, the State Emergency Operations Center (SEOC) serves as the focal point for information sharing and gathering, providing a structure for needed support for executive decision making. It is during day-to-day operations ("steady-state") that gaps exist in information sharing, resulting in a fragmented understanding of the "state of the state." Executive leaders recognize the importance of understanding the operating environment of their jurisdictions on a daily basis (Chen, 2009). In public safety professions this is referred to as a common operating picture: a concise outline of the current events, factors affecting those events, the trending patterns of the events and what considerations key decision makers should be focused upon (Copeland, 2008). An accurate, comprehensive common operating picture (COP) ensures that the goal of shared situational awareness among public safety leaders is supported (Nofi, 2000). Shared situational awareness (SSA) provides the basis for informed decision making, particularly in group settings, and precludes key decision makers from having to spend precious time gathering status information on baseline and peripheral issues when they are working to lead a rapid and effective response to a crisis (Fan, Sun, & Yen, 2005). It is critically important, therefore,

that New York State identify the most effective manner in which to develop and maintain an environment of information sharing that supports shared situational awareness by leveraging a common operating picture during steady-state operations.

B. RESEARCH QUESTION

While New York State has tremendous capability to develop, gather, and share information in the all-hazards environment, currently its methods rely upon disparate technological solutions, information sharing predicated upon formal organizational hierarchies, informal interagency relationships, and too often, the happenstance of information discovery. Additionally, for the information captured and disseminated, there exist no clear guidelines or understanding of what information should be captured and how it should be assessed and packaged (Standard Content Elements) from the executive leadership, agencies' leadership, or a multidisciplinary oversight group.

The purpose of this thesis is to consider how New York State can improve its daily SSA and COP efforts. It will seek to provide an understanding of the concepts of situational awareness (SA), shared situational awareness (SSA) and common operating picture (COP) and how they support decision making. Secondly, this research effort explores how mental models support collaborative group efforts, including task completion and decision making, particularly groups comprised of members from disparate entities. This thesis argues that existing models of information sharing fail to provide enough dimensions for members to fully understand the concepts of SA, SSA, and COP. To fill this gap, this thesis provides a proposed new architecture of SA, SSA, and COP. In the later chapters, this new model is applied to New York State's current information-sharing efforts, identifying several areas of potential improvement. In conclusion, recommendations for addressing the existing gaps are provided and modeled with the new architecture.

C. SIGNIFICANCE OF RESEARCH

This research is timely for several reasons. The current budget crisis facing the nation has had particularly untoward impacts on New York State's budget and government operations (Hakim, 2009). All indications suggest that this crisis will not soon pass and that long term solutions must be found to ensure program sustainability. Agency leaders are understandably being directed to find the most efficient ways in which to restructure service delivery, with an emphasis being given to exploring and leveraging joint agency operations. (J. R. Gibb, director, New York State Emergency Management Office, personal communication to the author, 2009) This thesis seeks to identify where synergies between state agencies can be leveraged to achieve SSA and COP in such a manner as to reduce duplicative efforts while maximizing results.

The financial crisis is not just a New York phenomenon but one affecting the entire nation. As a result, public safety programs find themselves struggling to maintain budgeting priority within their jurisdictions. This has resulted in the emergence of an ongoing national discussion regarding the future sustainability of fusion centers. In September of 2008, the United States Department of Justice's Global Justice Information Sharing Initiative published a supplement to its 2006 document *Baseline Capabilities for State and Major Urban Area Fusion Centers*. The document included comments received electronically, as well as those provided during the invitational Fusion Center Baseline Capability Focus Group held in January of 2008. Participants discussed many areas of fusion center mission scope and operation. One relevant topic discussed was the existing reference in the Baseline Capabilities document that fusion centers may have mission scopes that are one of three possibilities: terrorism only; "all-crimes"; or "all-hazards" (United States Department of Justice [DOJ], 2008). The efficacy of leveraging the New York State Fusion Center, which is currently "all crimes" in its scope, to support and contribute to all-hazard SSA and the COP will be discussed.

This project also seeks to clarify definitions and provide a framework for their use during steady-state operations. The terms "situational awareness," "shared situational awareness," and "common operating picture" are undeniably well established

in the contemporary public safety lexicon. Casual conversation by the author with practitioners during the writing of this thesis demonstrated a basic understanding of the terms by many but also a difficulty at providing a concise definition or even a common set of definitions during steady-state operations. One official, with responsibility for planning at the Department of Homeland Security, conceded to the author that the terms are used with ambiguity by domestic homeland security and public safety practitioners and that, while definitions exist, the terms are often used interchangeably. (DHS Official, confidential personal communication to the author, 2010) So, while an understanding of the terms exists, the learned use of the terms by practitioners may be more attributable to repetitive exposure and observation. This is a less-successful model of organizational learning than through formal lessons and education (Rogoff et al., 2003). Since words have meaning, our goal should be to ensure that practitioners fully understand the terms and concepts that are used to structure their tasks and missions. As the industry of homeland security matures, improved understanding of these concepts must be sought. Better knowledge and understanding will improve tasks and actions and lead to overall organizational learning (Fiol & Lyles, 1985).

Finally, to remain competitive and relevant businesses and public sector organizations must continually assess the current and future needs of their customers (Bryson, 2004). Many contemporary writings about homeland security process improvements cite various elements of the 9/11 Commission Report as one of the motivations for change in the way business is conducted by public safety entities. As a result of these efforts, new institutions and mechanisms have been established to bolster our nation's collective abilities in many aspects of our homeland security apparatus. We must be careful, however, to avoid seeking an "end state"; for just as we find one solution to an existing problem, external factors will shift, new technologies will emerge, or a new threat will advance. It is our duty to regularly consider new ways in which to provide these services to our citizens and strengthen our capabilities. As Thomas Jefferson remarked: "As new discoveries are made, new truths discovered and manners and opinions change, with the change of circumstances, institutions must advance also to keep pace with the times" (Jefferson, 1810).

It is from this perspective that the author began this effort. This research should be understood as an attempt to review the current information-sharing environment to ensure that New York State, with its history of major disasters and horrific terror attacks, remains a leader in homeland security practices. While the main focus of this thesis is the development of a model to support shared situational awareness via a common operating picture for New York's leadership, it may also serve as a guide for other states and jurisdictions as they examine their efforts and processes.

One final point of clarification is that it is important to distinguish that this thesis seeks to explore information sharing during "static" periods (steady-state) of state operations and on "the rest of the state," defined as those elements that fall outside the needed information that will be captured and reported by the planning section of an affected jurisdiction's activated Incident Command System structure during the response and short-term recovery phases of an incident (Federal Emergency Management Agency [FEMA], 2004). Homeland security practitioners should read this document with an understanding of the scope of its analysis. The broad situational awareness being discussed here may have relevance to and integration with an established ICS structure; however, it is not intended to examine the efficacy or operations of the Incident Command System or its planning subunit as delineated by federal and regional guidelines.

D. RESEARCH METHOD

The research portion of this thesis is qualitative. It seeks to explore the current relationship between New York State's state-level public safety agencies in their efforts to achieve shared situational awareness (SSA) via a common operating picture (COP) during steady-state operations. The intent is to identify existing gaps in all-hazards information sharing, discuss the relationship of information sharing, and identify recommendations to improve the process and final SSA environment and COP product.

The first step in this effort is to conduct a thorough literature review of the research and documents that provide definitions, including their importance and constructs, of the terms "situational awareness," "shared situational awareness," and

"common operating picture." By developing a clear understanding of what those three concepts are, particularly what they are in domestic steady-state operations, an assessment of the state's current efforts and possible needs for improvement can be understood.

It was through this literature review that the importance of shared mental models was identified. The second step in this research project then became an examination of current mental models used to depict public safety information sharing, with a focus on the goal of such efforts being achieved SSA. While useful, the widely used model does not adequately provide for the inclusion of additional elements (e.g., time and events) that, with a new mental model shared between practitioners, may allow for a better understanding of the processes of information sharing that will support a more effective SSA via a COP. The next step of this process is the development of two new proposed mental models for SSA and COP.

The final steps in this effort include a case study of New York's state-level SSA and COP efforts. An exploration of what constitutes the state's public safety infrastructure, how information is shared during steady-state operations between the various elements, and the application of an existing and two new models of information sharing will seek to examine the current efforts towards SSA via the COP. Based upon any gaps that are indentified in this process, this research effort will conclude with a series of recommendations, complete with their proposed application being modeled, in an effort to provide insight into how New York State can continue to improve its already robust capabilities in the domains of SSA and COP.

E. CHAPTER OVERVIEW

The goal of this research project is to examine how New York State's public safety infrastructure can develop and support an all-hazard shared situational awareness through a common operating picture during steady-state operations. Chapter II reviews the relevant literature, considering how the terms "situational awareness," "shared situational awareness," and "common operating picture" have been used and defined, including their role and importance, in civilian and military doctrine and reports and

academic research. The chapter then reviews the support that information and shared situational awareness provide to decision making, with an emphasis on group decision making.

Chapter III describes how New York State currently engages in all-hazard information gathering and sharing, including a description of key agency responsibilities and practices.

Chapter IV discusses current models used to demonstrate how information is shared between entities to create shared situational awareness in the public safety domain. Following a discussion of the inadequacy of the current models, a new architecture is proposed for creating a shared mental model among public safety practitioners. Finally, the chapter reviews the role that mental models play in individual and group task and decision-making efforts.

Chapter V applies the model process to New York's state-level information-sharing architecture in an effort to demonstrate visually how information is shared, where gaps exist and how the state is currently failing to achieve a comprehensive shared situational awareness during steady-state operations.

Chapter VI outlines several recommendations for improving New York State's current process and applies the model to demonstrate how the implementation of these recommendations will result in increased shared situational awareness and a common operating picture.

II. LITERATURE REVIEW

A. OVERVIEW

The literature and research related to the terms and concepts of situational awareness (SA), shared situational awareness (SSA), and common operating picture (COP) can be grouped into a taxonomy of several subcategories (e.g., definitions; importance; role; scoping; process). But because any existing definition includes its purpose and frequently cites its importance, it is difficult to separate a review of one (definition) from the others (purpose or importance). As noted earlier, the terms have become embedded in the vocabulary of contemporary public-safety practitioners via exposure from other practitioners and federal guidance documents. "Situational awareness" and "common operating picture" are frequently cited in civilian guidance documents developed and provided by the Department of Homeland Security (DHS), the Department of Justice (DOJ) and the Federal Emergency Management Agency (FEMA), predominately related to their uses during response operations.[2] Military field manuals and guidance tools similarly provide definitions and support their importance (Department of the Army [DoA], 2008). The context in which the terms are used in these documents provides the basis for their commonly understood (or misunderstood) definitions. The clearest and most thorough examination of these terms as knowledge-management concepts, applied at both the individual and group level, exists within research focused on their application in military domains. Therefore, this literature review categorizes the literature by civilian[3] and military uses and considers their definitions in context.

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[2] The application of "emergency management" is recognized to exist in four phases: mitigation; preparedness; response, and recovery. While usually depicted as a "cycle," with one phase leading to the next in a circular fashion, it is important to recognize that the phases overlap significantly. For example, the recovery phase begins during the ongoing response phase. Efforts undertaken for mitigation, which would occur in the mitigation phase, take place during both the recovery phase and as stand-alone mitigation-phase activities during non–recovery phase periods. This thesis will use these terms based upon this definition.

[3] "Civilian" literature is defined as the body of guidance material and doctrine created by domestic homeland security and emergency management agencies including DHS, FEMA and others.

B. CIVILIAN LITERATURE

Civilian doctrine does not use the term "shared situational awareness," but "situational awareness," when discussing how different agencies and jurisdictions need to share information related to the operating environment. This usage, through its contextual use, emphasizes the importance and the possible untoward effects on decision making when it does not exist. Additionally, it suggests that SA must be understood to be flexible in scope, insomuch that the environment in which SA is being sought must have defined boundaries (e.g., an identified disaster, a geographic region). To consider these understandings, several documents are reviewed, particularly those that represent benchmark events in the nation's recent history.

Contemporary homeland security and public safety practices and terminology are often traced back to the key findings of the 9/11 Commission Report (National Comission on Terrorist Attacks upon the United States [9/11 Report], 2004). The 9/11 Report spends considerable time exploring how information existed within the "silos" of various government agencies, during the months prior to the terrorist attacks and during response operations on that day. Relevant to this research effort is its use of the term "situational awareness," since at no time does the report use the term "common operating picture." In several footnotes, "situational awareness" is used to refer the reader to additional material exploring how a specific discipline's practitioners achieved SA during response operations. Examples include references to dispatchers, Fire Department of New York (FDNY) command personnel, and air traffic controllers (9/11 Report, 2004, pp. 543, 545).

The uses of SA in these contexts suggest an interpretation of the term to refer to discipline-specific knowledge-management process, rather than an integrated, multidisciplinary awareness. In this instance, situational awareness can be objectified to mean the body of information related specifically to the area of responsibility of each group, rather than the broader scope of the incident. The report does, however, point out that the lack of a unified command post, attributed to both situational and procedural impediments at the time, resulted in a lack of integrated awareness among the city's

response agencies. (9/11 Report, 2004, p. 321) This provides a broader definition, encompassing the entire event and a multidisciplinary view of it. Taken together, the different uses of SA in the 9/11 Report support the notion that SA is a commonly shared set of situational elements bounded in a mutually understood context.

In 2005, Hurricane Katrina provided another opportunity for the nation to respond to a major disaster whose effects and implications required significant and timely interjurisdictional and interdisciplinary information sharing. "The Federal Response to Hurricane Katrina: Lessons Learned" was completed by the Department of Homeland Security and distributed publically in February of 2006 (United States Department of Homeland Security [DHS], 2006 [Katrina Report]). Its findings related to operational information sharing are more broadly applicable to the wider emergency-services community than the intelligence-focused findings of the 9/11 Report. What the report does not directly do is to define either SA or COP. The context in which it uses these terms does support the claim that situational awareness is the development of a shared body of knowledge about a commonly understood and scoped incident.

Throughout the report an emphasis on the lack of information sharing and inability of decision makers to receive comprehensive information in order to make decisions, coordinate resource requests, and manage deployed resources—or to gain a complete understanding of the dynamics of this disaster—is repeatedly discussed. It notes the lack of a fully realized ICS implementation at all levels of government, particularly the local and state levels, as the key failing in establishing comprehensive information sharing. At the federal level it identifies the development and maintenance of incident situational awareness as key roles and responsibilities of both the principle federal official (PFO) and the federal joint field office (JFO). The report's description defines the boundaries of SA by stating that the JFO's goal of building upon local and state SA allows for all other federal agencies operating in support of the response to receive SA related to their discipline or agency-specific missions (Katrina Report, 2006).

In this instance, situational awareness can be interpreted to encompass a field of view of a subset area (the disaster) of a broader area (the nation) through the description

of the role of the PFO. Here the report notes that the PFO serves as "a primary point of contact and source of situational awareness locally for the Secretary of Homeland Security" (Katrina Report, 2006, p. 41). Even if the intention is that the PFO will serve as the primary source of information gathering for the federal leadership, it is specific to this incident. Given that the president and all federal agencies' leaders hold responsibility for the entire nation at all times, even when an event dictates focus on an affected region, situational awareness is bounded as it applies solely to the incident. When pursuing SA, it is important to mutually understand what the scope of the area being understood comprises (United States Coast Guard [USCG], 1999).

While the Katrina Report provided a scoping of situational awareness specific to the area impacted by an event, other civilian documents utilize the term in reference to knowledge management within a broader operating environment. For example, a recent draft document jointly developed by DHS and DOJ entitled "Considerations for Fusion Center and Emergency Operations Center Coordination" (FEMA & DOJ, 2010, p. 5-1) defines COP as above; however, it emphasizes the importance of routine information sharing to achieve situational awareness in its definition of steady-state operations: "Steady State: Steady state is the posture for routine, normal, day-to-day watch operations and situational awareness, contrasted with temporary periods of heightened alert or real-time response to threats or incidents."

This definition expands SA to include the entire jurisdiction (operating environment) under the area of responsibility of public-safety leaders. Another example can be found in the 2008 Private-Sector Coordination Support Annex to the National Response Framework, which repeatedly states the need for public-safety entities to establish information-sharing mechanisms with the private sector in an effort to jointly develop and share situational awareness during routine operations but emphasizes the importance of information sharing to achieve COP during emerging incidents. (United States Department of Homeland Security [DHS], 2008) If SA, as defined by this body of work, is the sharing of information between disciplines and jurisdictions, with one purpose being the support of a COP, then what is a "common operating picture"?

As noted, in the civilian literature, the term "common operating picture" is referenced solely to its use during response-phase operations. In these instances it applies COP in reference to a single disaster or incident. For example, FEMA provides this definition, which is representative of many others:

> A common operating picture (COP) offers a standard overview of an incident, thereby providing incident information that enables the Incident Commander/Unified Command and any supporting agencies and organizations to make effective, consistent, and timely decisions. Compiling data from multiple sources and disseminating the collaborative information COP ensures that all responding entities have the same understanding and awareness of incident status and information when conducting operations (FEMA, 2009b).

This definition supports an understanding that a COP is a product of a successful SA environment. If situational awareness is the culmination of comprehensive information sharing between jurisdictions, agencies, and decision makers having authority and jurisdiction for the operating environment, as mutually agreed upon and understood, then a common operating picture is a compilation of that body of knowledge, captured and distributed. The gap that exists within the civilian literature is that it fails to consider, by definition or guidance doctrine, the use of a COP during steady-state operations. Additionally, the definitions provided fail to fully explain individual versus group situational awareness. Finally, while this body of literature emphasizes the importance of SA and COP in support of decision making, it does so in a very cursory manner.

C. MILITARY DEFINITION

The majority of literature that provides a clearer definition of situational awareness and common operating picture, including their elements and purpose, is provided by researchers and practitioners considering them in the domain of military use. It is in this body of knowledge that situational awareness and shared situational awareness are identified as two distinct concepts. Additionally, the depth and

thoroughness of the literature allows for a more nuanced understanding of SA, SSA, and COP, thus setting the stage for later modeling of these concepts.

Nofi (2000) examines the definitions of "common operating picture" and "situational awareness" and finds through his extensive literature review that considerable ambiguity exists. He points out that the term "common operating picture" is used in several existing definitions of situational awareness and that the reasons for each, and the elements that comprise them, are similar (e.g., gathering facts, comparing them to the broader situation, developing options). His research supports the conclusion that to achieve SA, the participating parties must understand the scope of each. His definition of situational awareness perfectly summarizes the concept for public-safety officials. He defines SA as:

> The result of a dynamic process of perceiving and comprehending events in one's environment, leading to reasonable projections as to possible ways that environment may change, and permitting predictions as to what the outcomes will be in terms of performing one's mission. In effect, it is the development of a dynamic mental model of one's environment (Nofi, 2000, p. 1).

If we assume that members of a specific organization share a predominately equal understanding of their organization and have equal access to data and information related to their agency's operating environment, then the definition provided can be broadened to mean that SA is held by not just an individual but also a group comprised of like members. This assumption is necessary in order to understand shared situational awareness in the multijurisdictional or multidisciplinary environment. Also, it is noteworthy that this definition is applicable in both response phase and steady-state periods and supports the fact that situational awareness exists at all times, so long as adequate situational updates are provided to the group members.

Nofi (2000, p. 12) defines the difference between situational awareness and shared situational awareness when he defines the latter: "SSA implies that we all understand a given situation in the same way."

In the multijurisdictional or multiagency environment, the "we" in his definition is the group of agencies and leaders having a vested interest in understanding their shared operating environment in the same manner. From this we can conclude that situational awareness is maintained by the organization and shared situational awareness is sought between organizations and others. It is a metacognition of the operating environment that extends beyond the scope of the single agency's area of responsibility to include its counterpart agencies and all other relevant elements that can potentially affect the operating environment. Achieving SSA is an important task for the disparate leaders of a community's public-safety infrastructure and leaders to seek.

The goal of public safety agencies is not just to respond to emergencies but to prevent them from occurring. Burton and Stewart (2007) define situational awareness: "The process of recognizing a threat at an early stage and taking measures to avoid it" (Burton & Stewart, 2007).

During steady-state operations, one goal of SSA is to provide a commonly held view of the shared landscape in order to identify potential emerging incidents, thus allowing for prevention and mitigation efforts to be initiated.

Another goal is to provide the same common view so that, should a no-notice event occur, public safety leaders can begin their response-phase decision making with the same understanding of the preincident operating environment. For instance, the SA for a police department might include the current and historical levels of criminal activity, force capabilities and deployment, and ongoing investigations and operations. The SA for the fire department in the same jurisdiction will also include agency-specific elements including jurisdictional risk and fire hazard, areas of frequent false alarms, and other similar issues. To the command elements within those agencies, their independent SAs include discipline-specific terminology and concepts, augmented by an understanding of the agency's history, internal politics, and even individual members' capabilities. To share their respective SAs to achieve SSA, they must ensure that the other understands the incident, event, or circumstances through a similar field of view, taking care to provide context and forecasting. This can be a challenging process.

For example, to one degree or another, the department heads and agencies' leaders in a city can be assumed to have an understanding of the basic operating structure of their shared community's transportation system. When they are notified that a water main break has resulted in affected roadways being closed, their respective agency's SA is updated by this situational element. Their understanding of their agency's operating environment is modified based upon the impact that this event has on their operations and responsibilities. The fire chief, transportation chief, social services director, EMS chief, and mayor's office all have at least slightly differing SAs of the same event. For the leaders of this community to achieve SSA, they need to find a common field of view and understanding of the event and its impact on the larger community. For even if the impact on their specific area of responsibility is minor or non-existent, the impacts upon another department may have cascading consequences on their department. Further, should additional disruptions occur that do have a negative impact on their operations, they need to understand the current operating environment to better understand this new challenge. This sets the stage for better decision making.

Nearly every reference that espouses the importance of SA, SSA, and COP does so under the reasoning that, as information and knowledge-management concepts, they support decision making (Knight, 2005; USCG, 2004; 9/11 Report, 2004; Katrina Report, 2006). The psychologist Arthur Blumenthal noted that an individual's decision-making process includes assessing a current situation or stimuli against a similar one held in memory (Blumenthal, 1977, cited in Saaty, 2008). To make a decision for a course of action, we need to understand the problem, understand the options available to us, and understand the probable outcomes (success and failure) of each option (Zeleny, 1977). Achieved shared situational awareness provides the information to support decision making, particularly since decisions are frequently made by a group, rather than a single leader during the response phase of an incident.

For instance, tactical decisions are made in a shared decision-making environment if a unified-command model is being employed by the operating agencies, and strategic decisions are made by the multi-agency coordinating group (MAC) in an EOC or similar setting. Even if the final decision is made by a single leader, research

supports that leaders will defer to the judgment of the participating group during times of high stress, so long as a level of trust in that group's capabilities exist (Driskell & Salas, 1991). While some individuals or distinct groups may bring new information to the table at the time of the decision process, it is noteworthy that research supports the notion that in group decision-making environments shared information is much more likely to be discussed and incorporated into the final process of decision than information held by just one or a few of the group members (Larson, Foster-Fishman, & Keys, 1994). Should a diverse group enter the decision-making process without as complete a shared situational awareness as possible, then there is a likelihood that information key to the decision process will be missed. It is necessary, therefore, for all of the participants in the group decision-making process to enter that process with as achieved an SSA as possible. But too much information can be counter-productive.

Over the past thirty years, improvements in telecommunications and computing ability have again transformed the workplace and society. As computers became smaller and less expensive, they began to appear in more and more workplaces. The ability to network computers, first within organizations and then across the world with the advent of the Internet, led to an unprecedented ability to access and share information. The work environment has changed dramatically for the contemporary public-safety practitioner. Cellular telephones, lap-top computers, the Internet, PDAs, "smart phones," mobile data terminals, dash-mount cameras, CCTVs, broadband access, and GIS systems have resulted in not just an ability for the practitioner to gain and share tremendous amounts of detailed information about incidents, persons, and situations; this access has created an expectation among many leaders that no detail will be missed when information is collected and collated.

On its surface, this ability to access so much data and information would seem to make sense, particularly in support of making informed decisions. We use information to understand the world around us. The information elements we receive help us to develop a context (SA) in which to develop an understanding of the event or environment we are concerned with or need to make decisions about. However, too

much information can be a distraction and too little can fail to adequately create the level of awareness that we need to accurately understand the operating environment (Edmunds & Morris, 2000).

An earlier analogy described a fire department and police department seeking to achieve SA and SSA just between those two agencies and their administrative leadership. A real-world jurisdictional-based SSA requires a far more diverse set of contributors. Even beyond the public safety and public support agencies that make up local and state governments, many more situational elements can rightly be considered germane to developing a truly comprehensive SSA. Recently the increased recognition of the important role that the private sector, with its majority control and responsibility for our nation's critical infrastructure,[4] plays in our national and homeland security has resulted in widespread recognition of the interconnected nature of the dynamic systems, both public and private, which support and drive the lives of our citizens. As public-safety practitioners are driven to engage their private-sector partners, particularly in the protection, mitigation and preparedness mission areas, the amount of available data and domains that could be considered for inclusion in a jurisdiction's SSA and COP becomes almost untenable. To meet this challenge, public-safety leaders must engage in a thoughtful analysis to collaboratively determine what domains will be included in their SSA and COP, and what situational elements will be captured.

But, simply sharing information between organizations and people does not mean that the goal of SSA has been achieved. As stated, the entire group must understand the situation in the same manner and context. To accomplish these goals, the participants in the process of developing a shared situational awareness must agree to what will be included in their SSA, including scoping (geographic and domains); situational elements (sector and/or discipline-specific data); and audience (who is injecting and who is receiving) (USCG, 1999). Public-safety leaders must engage in a dialogue to determine the scoping of shared situational awareness specific to their

[4] While several federal documents posit that the private sector owns and operates 85% of the nation's critical infrastructure, there does not exist an identifiable source to support this oft-repeated statistic. As such, the author will concede the rational conclusion, however, that the private sector has a majority stake in the nation's CI.

operating environment. When considering what situational elements are relevant to the SSA, they must also determine how that information will be communicated and, if the situational element does not require an immediate notification, at what time and in what way they will ensure that SSA exists. In an operating environment that is constantly changing, there exists a need to regularly ensure that all vested parties are "up to speed" on the SSA. A common operating picture serves this function (Knight, 2005).

D. UPDATING SA & SSA VIA THE COMMON OPERATING PICTURE

Situational awareness is not static. As one U.S. Coast Guard officer points out, situational awareness changes frequently and needs to be updated moment to moment (Comperatore & Rivera, 2008). If situational awareness is contained within the consciousness of the practitioner or group at all times, like data stored in a server, then how do we update the data?

Throughout the day public-safety practitioners are exposed to multiple sources of information that update their situational awareness. Television sets are strategically placed in many offices to allow instant access to breaking local and national news. Public-safety leaders of response organizations often keep radio scanners on their desks to allow them to maintain awareness of the incidents that their agencies are responding to. Personal data assistants (PDAs) allow for the delivery of situational element updates to be delivered quickly and widely via e-mail, text message, and other methods. In today's networked communication-centric society, maintaining situational awareness is more easily achieved than ever before.

By definition, SSA means that all participants share the same view of the operating environment. To assume that the provision of updated situational elements to public-safety leaders via various communications modalities means that an SSA fails to recognize that some elements may be missed and some may be misinterpreted or not understood. To develop and maintain SSA, it is important for all members to regroup, ensure complete visibility of the conditions of the operating environment by all members, and ensure that a common interpretation of the environment exists.

During response operations, the incident command system (ICS), when properly implemented, establishes operational periods which culminate in an incident action report (IAP) and, often, a situation report (SITREP). Those documents are the embodiment of the COP, as defined in the civilian literature discussed earlier. As stated, understanding the operating environment during steady-state operations is just as important. The common operating picture is a culmination of the SA and SSA efforts and environment.

Johnas Landgren, a researcher on this topic, writes that the Common Operating Picture is a "resource in making sense of what is going on and a background in order to negotiate what to do" (Landgren, 2006).

The United States Joint Forces Command (USJFCOM) provides definitions of two terms, COP and CROP (Common Relevant Operational Picture), which are similar. The nuanced differences between them, however, provides the civilian public-safety practitioner with a clearer understanding of a COP. These definitions, while here presented specific to the mission of the USJFCOM, are also reflective of the others provided in the military domain literature (Treurniet, Lasschuyt, & van Hekken, 2005; Knight, 2005; Nofi, 2000).

> Common Operation Picture (COP): "A single identical display of relevant information shared by more than one command. A common operational picture facilitates collaborative planning and decision making." (USJFCOM, n.d.)
>
> Common Relevant Operational Picture (CROP): "A presentation of timely, fused, accurate and relevant information that can be tailored to meet the requirements of the joint force commander and the joint force and is common to every organization and individual involved in a joint operation." (USJFCOM, n.d.)

The latter definition captures the nuances and elements discussed during the exploration of SA and SSA. It supports the common understanding that, during steady-state operations, a COP is a shared understanding of the operating environment, including all necessary components to provide context and to support decision making, based upon conditions at a defined point in time. It will include discipline-specific

issues, broader community issues, and incidents occurring or anticipated to occur. It provides a "snapshot" understanding of the state of the community at a single point in time, ensuring that all leaders are on the same page.

There are many ways in which communities choose to achieve this state, including morning situation reports, electronic dashboards, conference calls, in-person briefings, GIS platforms, and collected agency reports bundled together and shared for common reading. This thesis does not seek to discuss the efficacy of the tool used to communicate the COP. Rather, it seeks to examine the concept of the COP, its importance, challenges, and in a future chapter, the mental models that public-safety leaders share in their understanding of the SSA and COP. Research on the topic of the efficacy of one methodology over another exists, and many smart practices have been identified across the nation. It is for each community to determine how it will "reset" its SSA through the use of a COP, and at what intervals.

E. CONCLUSION

From this discussion and in the context of this thesis, we can conclude that situational awareness is the body of knowledge maintained by an individual or a single agency related to his or its field of expertise within the identified area of responsibility (operating environment). It includes internal and external factors, including historical events, that provide an understanding and context of what has happened, what is currently happening, and what may happen in the future in various circumstances. Shared situational awareness is the state achieved when an identified group of actors holds communal knowledge and understanding of a situation and perceives it, its history, and potential future(s), in the same way. It is a metacognition of the operating environment that extends beyond the scope of the single agency's area of responsibility to include its counterpart agencies and all other relevant elements that can potentially affect the operating environment.

A common operating picture is a "snapshot" created at a specific moment in time that captures the SSA, based upon SA inputs (situational elements) from all necessary

domains and disciplines. The elements and its scope are understood and agreed upon by all of the actors who must comprehend the COP.

The next chapter will provide an overview of New York's State information-sharing architecture, including a scoping of the hazards that New York faces, which agencies constitute its public-safety infrastructure, and how the agencies incorporate their individual situational awareness towards a shared situational awareness.

III. ASSESSING NEW YORK STATE

A. INTRODUCTION

The purpose of this thesis is to examine New York's state-level, steady-state public safety shared situational awareness efforts and its pursuit of an all-hazards common operating picture. Thus far this thesis has dealt in the somewhat esoteric exploration of concepts and definitions. This chapter will apply those terms to New York in a more explicit manner.

To conduct this assessment, it is necessary to first identify the scope of the public safety situational awareness and shared situational awareness being discussed. From that definition, the state agencies involved, their roles, and the current information-sharing construct can be explored. To further examine the current information-sharing process, a review of the state's three major points of information gathering, analysis, and dissemination is provided: the State Emergency Communications Center (SECC), the State Transportation Information Communications Center (STICC) and the New York State Intelligence Center (NYSIC).

B. SCOPING OF "ALL HAZARDS" IN NEW YORK STATE

It is important to understand the complexity of New York in order to understand the scope of the term "all hazards" as it applies in this assessment. While the geographic size of the state places it near the median of all states, its differing topographical features and proximity to the Great Lakes and the Atlantic Ocean provide it with a diverse climate that frequently experiences extremes in weather systems. With nearly 20 million residents and an average of more than a million tourists and commuters adding to the overall population during a normal work day, New York is one of the nation's most populous states. The economy of the state is incredibly diverse as well, with vast swaths of rural farmland in the "upstate" regions that separate its 62 cities, including the larger cities of Buffalo, Rochester, Syracuse, and Albany. The "downstate" region is one of the more densely populated areas of the nation and holds one of the epicenters of global

politics and finance: New York City. The state's critical infrastructure includes massive transportation, commercial manufacturing, and shipping and telecommunications systems that provide the foundation for the daily operations of the state, its communities, and its citizenry. As 9/11 demonstrated, absent rapid response to mitigate against, respond to, and recover from disruptions to these systems, cascading consequences can result, whose effects can be felt worldwide for long periods of time (Makinen, 2002). This complexity supports the need for a solid SSA of the operating environment by the state's public-safety leaders.

The term "all hazards" is well established in the lexicon of contemporary emergency management and homeland security. Its use indicates a planning and preparedness posture that includes all hazards that may affect a jurisdiction. What it is not intended to convey is a focus by every jurisdiction on every possible hazard. Federal guidance doctrine in conjunction with professional emergency-management program-development processes require that every jurisdiction should engage in a sound risk-assessment program to determine the types of hazards and threats that its community may face, including natural and man-made hazards. This assessment should culminate in the creation of a risk portfolio that includes a hierarchical prioritization of hazards, based upon their likelihood of occurrence and the deleterious impact that they may have (FEMA, 2009a; FEMA, 2001).

New York State's history includes dozens of major disasters, both man-made and natural, as well as thousands of local and regional emergencies that have resulted in lives being lost, people being injured, and families and communities being significantly disrupted. In 2007, New York State's Emergency Management Office (SEMO) coordinated the development of the state Hazard Mitigation Plan (New York State Emergency Management Office [NYSEMO], 2007). The process included participation by other state agency partners, private and public-sector subject-matter experts, and representatives of local government, and resulted in the completion of a hazard

assessment of the entire state (Appendix 1).[5] The resulting assessment for New York State identified the following natural and technological hazards: drought; earthquake; hurricanes; landslide; winter storm; flood; subsidence; tornado; wildfire; extreme heat; hail storm; power failure; and dam failure. This list is applicable to the entirety of New York State, and given the natural and man-made diversity of the state, as discussed earlier, specific hazards rank higher in likelihood and impact in some regions more so than others. For the purposes of this thesis, it is unnecessary to consider them in order of likelihood. To the leadership of the state's public safety agencies, an understanding of all of the hazards is necessary in order to develop an SSA at any given time.

Absent from the list compiled by the state Hazard Mitigation Plan, as they are outside the scope of that document, are many man-made risks, whether accidental or intentional. The history of events occurring in New York includes many transportation accidents, major urban fires, hazardous-material releases, and failures of critical infrastructure such as bridges and rail systems. Major events affecting the health of New Yorkers have occurred regularly as well, including diseases and food and agriculture crises. Those events must also be considered in the state's future risk profile.

Additionally, the state of New York has experienced ,and is almost certain to experience again, the full spectrum of man-made criminal activities, from localized violent crimes affecting a single family or business to the behavior and impacts of domestic and international criminal organizations. The identification, monitoring, intervention, and response to these activities require extensive work by New York's significant law enforcement community. While not often characterized as a hazard, criminal behavior frequently results in the disruption of local and regional communities and must be included in the state's risk portfolio.

[5] For a complete chart, taken from the NYS Mitigation Plan, see Appendix 1. Full details of each hazard, including historical occurrence, GIS mapping of specific locations, and extensive scientific discussion and mapping of future event likelihood by geographic region can be found within the Mitigation Plan available at http://www.semo.state.ny.us/programs/planning/hazmitplan.cfm.

Finally, closely aligned to but distinct from criminal activity, terrorism, whether domestic or foreign born, has been and remains a significant hazard for New York State. The form that the terrorism threat will take if and when it emerges as an event in the state may be one of a vast number of possible hazard types (e.g., shooting; explosion; WMD). As such, the final inclusion in the state's all-hazard profile is terrorism.

Having determined specific risks that the state faces allows for the next step in this assessment: identifying the state and key partner agencies that monitor for emerging event indicators, and conditions that increase event likelihood during the preparedness phase and provide incident assessment, monitoring, and response support during the response phase. From that list will we be able to then discuss how information is shared among agencies during steady-state operations.

C. NEW YORK STATE'S PUBLIC SAFETY INFRASTRUCTURE

The governor of the state of New York holds the authority to direct any state agency to bring its resources to bear in efforts to prevent or respond to any disaster or emergency (New York State Executive Law [NYSExecutive Law], 2006). There exist more than 80 state agencies and departments within the executive branch directly under the governor's jurisdiction. Additionally there are more than 200 state authorities and several agencies and departments that support the legislative and judicial branches of the state government. The identified hazards that New York State faces can be categorized in several general domains: fire; health; law enforcement (criminal and intelligence); weather; geophysical; transportation; critical infrastructure (e.g., power, fuel, water, telecommunications); food and agriculture; and environmental (e.g., hazardous materials). Disasters and emergencies usually affect more than one of these domains, and the more complex events frequently affect them all.

New York is a "home rule" state, which means that local government holds primacy for governing (New York State Constitution [NYSConstitution], 2010). As such, the state government generally operates in support of local and regional preparedness and response activities. However, New York's agencies have varying degrees of authority, jurisdiction, and responsibility to provide direct service to the

citizens in all phases of emergency management in order to prevent, prepare for, and recover from a crisis. A brief overview of how each domain is addressed at the state level in the preparedness and response phases, and specifically which state agencies and their external partners are involved with information management (SA & SSA), will provide a platform from which the assessment of their current information sharing can be better understood. It is noteworthy that many agencies hold responsibility in more than one domain. For ease of understanding and exploration, however, this review will identify the agency and its partners that have predominate responsibility.

1. Fire

The New York State Office of Fire Prevention and Control (OFPC) is a department within the Department of State (DOS). The DOS is led by the Secretary of State who is a member of the governor's Executive Chamber. The OFPC is helmed by the State Fire Administrator (SFA) and has approximately 100 employees who provide training and guidance to local firefighters and hazardous material responders. OFPC also provides direct services in support of local agencies including fire investigation; hazardous materials technical assistance; mutual aid coordination; and technical rescue assistance (including coordination of the New York Task Force—2 Urban Search and Rescue Team).

To develop and maintain domain and agency situational awareness, the office has regionally assigned members who develop relationships with county and local-level fire leaders. Should a local jurisdiction request assistance with incident response, a telephone call is placed to a contracted dispatch center in the state capital region, and the appropriate bureau within the agency is contacted. If the agency is involved in a response, a technical assistance form is completed and circulated within the agency. Should a member of the agency become aware of an emerging incident, whether through formal notification or open media sources, then other members, including leadership personnel are notified via e-mail or telephone. The agency has personnel assigned to the NYS Office of Homeland Security (OHS) for the purpose of grants and technical program assistance. This member is also assigned to provide a fire-service-industry

perspective to the NYS Intelligence Center (NYSIC). While that assignment does allow for some sharing of situational awareness merely by proximity, no formal regular situational awareness process, other than the technical assistance form, is in place within the agency or between this agency and others to promote shared situational awareness.

The NYS Department of Environmental Conservation (DEC) has responsibility for the state's wildfire program. During steady-state conditions, state forest rangers and DEC firefighters monitor seasonal weather conditions and provide open-source reports to several state agencies and the public. Agency operations are updated via internal communications to promote agency SA, however, no contribution to SSA between agencies is made during steady-state operations. During active responses, the DEC notifies SEMO of its activities and provides a regular situational report. This information is captured in the State Emergency Communications Center (SECC) daily brief and shared with all agencies to promote SSA.

2. Health

The NYS Department of Health (DOH) Office of Public Health Emergency Preparedness is responsible for the coordination of all phases of emergency management in the public health domain including community-based and facility-based healthcare systems. This agency holds significant regulatory authority over local and regional providers and has established numerous incident-monitoring systems that provide regular data from local entities to the office during both steady-state and response operations. Regional offices interact extensively with local providers, thus furthering the agencies' situational awareness capabilities. During steady-state activities, however, SA is maintained via situational injects provided by telephone or e-mail within the agency hierarchy. No formal arrangement exists for information sharing between this agency and other state agencies, and no regular steady-state SA report is compiled or shared for SSA.

It is noteworthy that the SECC provides an answering service for the entire NYS DOH organization. The scope of this responsibility includes answering calls from healthcare providers and the public and then directing the caller to the appropriate

member of DOH. To determine the appropriate unit within DOH for the call to be directed to, the SECC staff must ascertain the issue at hand. As a result, the SECC acquires the situational element being delivered to DOH and shares with the State Emergency Management Office (SEMO). While this process does enhance interagency information sharing, it is loosely organized and unreliable as not all situational elements are routed through the SECC, and the intent of the arrangement is merely for operational efficacy, not information sharing.

3. Law Enforcement–Criminal

The New York State Police (NYSP) is the primary state law enforcement agency. Several other agencies have police or peace officer status (e.g., NYS Park Police; NYS Forest Rangers; NYS Corrections), but the NYSP is the state's largest direct policing and investigative agency. Given the extensive number of members operating across the state at all times, their direct communications and partnership with local emergency dispatching agencies and local police agencies, coupled with demand for the specialized services that they offer (e.g., bomb squad; hostage negotiation; special tactics teams), the agency has significant visibility of local and regional incidents in all domains.

As a paramilitary organization, communication within the chain-of-command is taken seriously, and incidents—even those not specific to law enforcement—are reported to at least the regional leadership. Incidents that are germane to the organization's command leadership and full agency situational awareness are captured and shared via an electronic report in their administrative messaging system (AMS). There are identified incidents for which an AMS must be completed, but in a broad sense anything that affects the agency's strengths, capabilities, or notable incidents that included members' involvement are reported. The AMS is open-source insofar as it is broadly shared within the agency. The agency does not, however, compile a daily SA report nor does it provide a regular report to other state agencies in support of SSA.

4. Critical Infrastructure (Power, Fuel, Water, and Telecommunications)

The NYS Public Service Commission (PSC) regulates the state's electric, gas, telecommunications, and water utilities. As such, it requires near-immediate reporting of service disruption by the entities it regulates and external partners. The PSC maintains SA via internal electronic and voice communications and provides both situational element updates to the SECC via e-mail when events are occurring and regular (at least daily) summary reports as well to promote SSA. The SECC forwards both situational elements as they arrive, as well as including summary reports in the SECC daily brief in an effort to support full SSA between agencies.

New York is home to six electric generating nuclear-power reactors located at three sites. The responsibility for coordinating the state's Radiological Emergency Preparedness (REP) program is shared between three agencies: SEMO, DOH, and PSC. While each of these agencies has specific areas of responsibility related to the nuclear power plants, their operation, safety issues, and regulation, situational elements that arise in any one agency's area of responsibility are shared with the others. Additionally, all situational elements related to REP are provided to the SECC and then shared broadly with all agencies. This results in a well-developed and maintained SSA for REP.

5. Food and Agriculture Safety

Through education, training, regulation, and program assistance, the NYS Department of Agriculture & Markets (Ag&Mkts) works to provide for the safety and quality of New York's food production, delivery, and sales. This responsibility is partially shared with the NYS DOH, which also has regulatory authority in the area of food safety. Similarly to the processes employed by DOH, the regulated entities are required to report emerging incidents in a timely fashion to Ag&Mkts. Members of the agency share information internally via e-mail and telephone to maintain agency SA; however, no regular reporting period has been established. The intertwined nature of the regulatory relationship between Ag&Mkts and DOH requires frequent interagency

communications and sharing of situational elements. Here again, the SECC provides an answering service for Ag&Mkts, and the SSA results are similar to that found in the relationship with DOH.

6. Environmental

The NYS Department of Environmental Conservation (DEC) holds primary responsibility for the wellbeing of the state's air, water, and land resources. On a daily basis it provides monitoring and reporting of the current air quality, monitors impacts on the water supply (e.g., rainfall/drought conditions), and provides weather forecasting that specifically considers the environmental dynamics of each region of the state. These reports are generated internally, with the support of external partners (e.g., National Weather Service), and shared electronically, both internally and broadly to state agencies and others. The SECC captures these daily reports and rebroadcasts them to all state public-safety agencies in support of SSA.

An additional responsibility of the DEC is the monitoring and response to hazardous-materials incidents. DEC is responsible to coordinate the mitigation of hazardous-material releases and operates a regionalized "spill response" program to provide technical assistance to local government and the responsible party[6]. Internal agency SA is achieved via e-mail and formal incident reporting. Given the frequent involvement of other agencies, such as OFPC, NYSP, SEMO and/or DOH, in response to hazardous-materials incidents, interagency communication related to local-incident situational elements is common, though in an informal manner. DEC does report major incidents to the SECC as a matter of protocol. These situational elements are then forwarded to all public safety agencies, supporting SSA.

The remaining hazard domains are best considered by examining the three primary information-management centers operated by the state of New York: the NYS Intelligence Center (NYSIC); the State Emergency Communications Center (SECC);

[6] The "responsible party" refers to the owner/operator of the facility or transportation modality that has responsibility for the product in their possession. Examples include the trucking firm that carries liquid fuel or the manufacturing plant that creates compound chemicals.

and the State Transportation Information Communications Center (STICC). They share a common mission of information gathering and dissemination. Each of these centers is operated by a lead agency, but all rely upon information situational elements and domain and agency reports to be provided by external partners to achieve their mission. The remaining domains each fall within the mission scope of one of the information management centers.

7. The New York State Intelligence Center (NYSIC)

The New York State Intelligence Center (NYSIC) is the primary state fusion center, as designated by the governor. New York created the NYSIC in the years immediately following the events of September 11, 2001. Under the direction of the NYSP, the NYSIC provides 24/7/365 terrorism- and crime-related data and information gathering to local, state, and federal law enforcement agencies across the state and, when needed, across the nation and international borders as well. Intelligence analysis is conducted by investigators from the NYSP Bureau of Criminal Intelligence and analysts from the NYS Office of Homeland Security.[7] The center monitors situational updates from national and local law enforcement sources and open-source media outlets for emerging events 24/7 to support its members' SA and ensure notification of NYSP leaders and intelligence personnel should a relevant event occur or information become available at any hour. The Federal Bureau of Investigation maintains a presence in the center during business hours, as do several members of local and county law enforcement agencies from various locations across the state. Relationships and, when necessary, formal agreements have been established with many other partner agencies, including dozens of federal law enforcement and intelligence agencies to enhance information sharing.

[7] The New York State Office of Homeland Security (OHS) has several missions; however, only the intelligence analysts assigned to the NYSIC have operational responsibility during steady-state and response phase operations. The remaining missions are related to grants management and program support. As such, OHS's SA and contribution to the state's SSA are considered within the scope of the NYSIC.

Similarly to most fusion centers, the original mission scope of the NYSIC was the prevention of terrorism. However, that mission quickly evolved to adopt an "all crimes" approach. Leveraging the strength of having local and county law enforcement agencies' members assigned to the center and having local, state, and national law enforcement databases interconnected with the facility, the NYSIC provides support as outlined above for other missions beyond just terrorism, including criminal acts such as gang activity, cyber-crimes, financial crimes, arson, major investigations (e.g., murder, robberies) and human and drug/contraband trafficking. Additionally, specialized operational and technical support for investigations can be provided to law enforcement agencies that request it. (Captain Doug Keyer, NYSP, personal communication with author, March 9, 2009)

When actionable intelligence is developed by the center or received from local or federal sources, the NYSIC provides analysis from the state perspective and, if appropriate, makes immediate notifications to law enforcement agencies and the state's leadership. The NYSIC routinely produces a variety of intelligence products for law enforcement agencies and periodically provides nonsensitive information and products to partner state agencies and other public-safety disciplines at the local and regional level. The center produces a daily nonclassified report that summarizes ongoing major events, criminal and terrorism-related trends, open-source media reports, and other law-enforcement-specific information that is shared widely with the state's law enforcement community. Non–law enforcement state-level leaders, at both the agency level and the Executive Chamber level, receive this report in the early business hours of the day via e-mail. As will be discussed later, neither the SECC nor the STICC are recipients of the products of the NYSIC.

Additionally supporting the center's situational awareness is access to the New York State Police Information Network (NYSPIN), which is operated by the NYSP and interconnected to every police agency across the state. Police agencies, by regulation, are required to report major incidents and officer safety information, within a defined time frame from their occurrence. This supports SA within the law enforcement community as well.

The NYSPIN system also captures information from the National Weather Service (NWS) and the NYS Department of Transportation related to weather events and roadway incidents (e.g., closures, obstructions) respectively. Law enforcement officers, dispatch personnel, and both NWS and DOT personnel are able (and in some situations required) to enter the information, which is then shared broadly across the state. The addition of transportation and weather information supports a more "all hazards" approach to SA for law enforcement and the center as well.

These efforts support a broad situational awareness within the state's law enforcement community for both terrorism and criminal activities. The sharing of the daily brief and the periodically produced intelligence-analysis products to various state agency leaders and executives supports the updating of shared situational awareness of the current criminal and terrorism related operating environment of the state and nation.

The recent addition of personnel from the OFPC to the center, albeit on a part-time basis, has begun to broaden the scope of the center's focus from strictly law enforcement to the wider public-safety audience. A new intelligence product, produced regularly, targeted specifically to the fire and EMS communities within the state supports the effort to transition from a law enforcement SA to a multidisciplinary, public safety SSA.

8. The New York State Emergency Communications Center (SECC)

The New York State Emergency Management Office (NYSEMO) operates the State Emergency Communications Center (SECC), a 24/7/365 monitoring and communications center located in NYSEMO headquarters. During the Cold War era, state civil defense offices and the federal government recognized the need to be able to quickly communicate during times of crisis. The National Alert and Warning System (NAWAS) was established to provide a telephone platform for states to communicate with other states and the federal government in a secure and expeditious manner. The SECC was established to house the NAWAS. The end of the Cold War did not negate the need for rapid interstate communication, and today every state maintains a state "Warning Point" that provides this function, most often within their state Emergency

Management Agency (EMA). Over the years the SECC has evolved to meet the challenges of the modern era, broadening its responsibilities and the scope of its situational awareness efforts.

The mission of the SECC is to develop an all-hazards SA and then share information broadly across state and local agencies to promote SSA. The SECC collects data and information, both secure and open-source, related to emerging events and incidents from a variety of sectors and then forwards that information to state and local public-safety leaders, predominately those with responsibility for the state's efforts related to consequence management. Utilizing data sources such as broadcast media, Internet news feeds, telephone notification, and e-mail notifications from a variety of partner agencies and jurisdictions, the SECC ensures that this information is then forwarded to appropriate SEMO and state and local agency personnel. Examples of the information gathered and the incidents monitored include weather, traffic, major fires, residential evacuations, incidents at the nuclear-power plants located within the state, public-work disruptions (e.g., water or steam main breaks, natural gas leaks), mass-casualty incidents, transportation incidents (e.g., train derailments, aircraft incidents, boat accidents), missing persons/active searches, major national and international events, geophysical (e.g., earthquake, tsunami, volcanic), weather forecasts and events, and law enforcement activity that results in a disruption to a community (e.g., road closures, evacuations). The SECC also receives and disseminates daily operational briefs from federal sources such as the Federal Emergency Management Agency (FEMA), which supports a national scoping of the SA and SSA.

The SECC maintains the 24/7 access telephone numbers of two state agencies that the public and discipline-specific local and regional agencies use to contact an agency-specific representative to report information or seek assistance. As discussed, agencies currently relying upon the SECC for this assistance are the NYS DOH and NYS Ag&Mkts. Additionally, members of the public routinely call the SECC, seeking services from many different state agencies, and therefore the SECC periodically has access to situational elements from other disciplines as well. Finally, the SECC is the site of the state's Emergency Alert System (EAS), which serves as a public alerting and

information tool for both state and local governments during crises. The presence of the EAS within the SECC provides it with immediate notification of major emerging events, thereby allowing for the immediate update of its SA and, through the immediate notification to others, an update to the state's public-safety leadership's SSA as well.

During steady-state operations, the SECC disseminates the situational elements it collects via e-mail. While the dissemination of these situational elements is intended to support SSA, the volume can be overwhelming. During a recent day[8] of steady-state operations within the state, the SECC forwarded more than 80 e-mails containing situational updates related to a variety of hazard domains during the eight hours of normal, daytime, business operations. As discussed in a previous chapter, too much information can be distracting and result in a diminished SA and SSA. This challenge is compounded when events requiring the state agencies to respond and support local government are occurring. During a recent snow event[9] that impacted a large area of the state but did not change the operating posture of the state, the SECC forwarded more than 180 situational elements in a single day. The issue of information management—specifically how the SECC manages and disseminates situational elements during steady-state operations in support of SSA—will be examined in the next chapter.

In order to support SSA via a common operating picture (COP), the SECC creates and disseminates a daily "all-hazards" operational brief. This product is issued to state public-safety leaders by 0800 hours each morning and contains a summary of events, the consequence of those events, any active follow-up needed or ongoing by state and local agencies, and other relevant news and information emerging from around the world. While the daily operational brief (DOB) is intended to serve as the basis for a common operating picture in support of shared situational awareness, it is not shared with the NYSIC and does not capture all disciplines' updated information, thus reducing the effectiveness of the effort to achieve a comprehensive, all-hazards SSA via a COP.

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[8] The author, as a recipient of the situational elements from the SECC, monitored and counted the e-mails on February 15, 2010.

[9] The author monitored and counted the e-mails on February 25, 2010.

9. The New York State Transportation Information & Coordination Center (STICC)

The New York State Transportation Information & Coordination Center (STICC) is housed at and operated by the NYS Department of Transportation (DOT). The STICC is operated 24/7/365 with the primary mission to monitor the state's transportation infrastructure and share updated situational elements in support of both agency- and discipline-focused SA and interagency SSA. The primary sources for transportation-related situational elements are the ten Traffic Management Centers that operate regionally across the state. Eight of these centers are operated by DOT, while the remaining two, the Niagara International Transportation Technology Coalition (NITTEC) and the Joint Transportation Management Center (JTMC), are managed by a consortium of which DOT is a member. Local and regional transportation agencies and authorities report their system's operational status, including any service disruptions, to the regional TMC, which in turn reports this to the STICC. Major participants in the state's transportation infrastructure include the authorities that operate key airports, tunnels, bridges, and railroads. Examples of these agencies include the Port Authority of New York and New Jersey (PANYNJ), the Metropolitan Transportation Authority (MTA), Amtrak, CSX Railroad, and others.

To support discipline-specific and interagency SA as well as SSA, the STICC shares situational elements via e-mail to public safety leaders at the local and state level whenever such information becomes available. To support a domain-specific SSA via a COP, the STICC compiles and disseminates a daily operational brief seven days a week by 0600 hours each day. While the NYSIC does not receive the daily STICC operational brief, the SECC does receive these situational elements and the daily operational brief. The SECC further disseminates both to its target audience in support of an all-hazards SSA. The lack of integration of the products, including the lack of review of the final product prior to dissemination, inhibits the pursuit of a genuine SSA via a developed all-hazards COP.

10. Defining the Audience of Shared Situational Awareness

In order to assess the efficacy of the current SSA efforts of New York's state-level pubic-safety agencies during steady-state operations, the membership of the group that has been referred to as the "leaders" must be defined. The governor and his Executive Chamber staff, which includes the Director of State Operations, legal counsel, Public Affairs Office, and the many deputy secretaries who hold administrative and managerial oversight for various state agencies, are, of course, the "leaders" of the state. No single deputy secretary holds responsibility for all of the agencies that have responsibility for the various domains identified. For instance the traditional "public safety" agencies do report to a common deputy secretary (Figure 1);[10] however, the remaining identified agencies each has its own reporting structure. This separation in reporting hierarchy requires that individual agency leaders work to ensure intersectional information sharing.

Individual state agency leaders do, however, have significant inherent authority and responsibility to direct the operations of their respective agencies. During the response phase of incident management, members of the Executive Chamber, including the governor, are often directly involved in guiding the state's response efforts. During steady-state operations, the leaders of the state agencies that have been identified in this chapter work together to support the collective missions of the agencies. Given that the scope of this thesis is the steady-state operational period, the targeted audience for shared situational awareness includes the commissioners and directors of the agencies that have been identified as well as their senior and executive team leaders. Because all of these leaders do not report to the same member of the Executive Chamber, the need for a common operating picture to support SSA, developed and coordinated by the disparate agencies, is even more important.

[10] The shaded boxes represent the agencies that are most frequently involved in the state's response during response-phase operations and therefore have the greatest stake in the achievement of a comprehensive, all-hazards shared situational awareness.

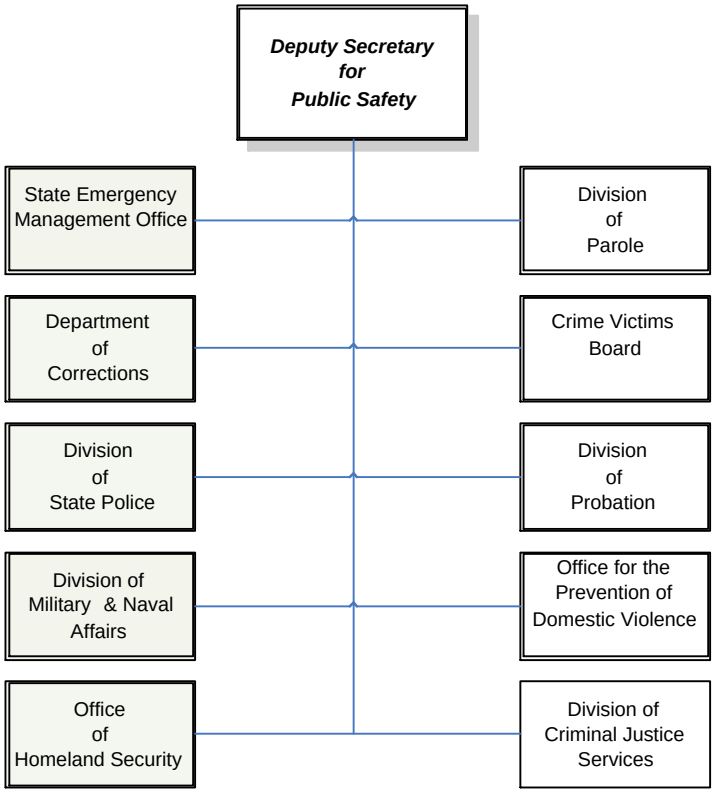

Figure 1. New York State Deputy Secretary for Public Safety—Organizational Chart

11. The Division of Military and Naval Affairs (DMNA)

One additional agency must be included in the identified group of New York's public-safety leadership, the Division of Military and Naval Affairs (DMNA). DMNA is home to the state of New York's National Guard units. While not directly responsible for the maintenance or operation of any of the domains that have been identified, DMNA's mission and structure includes two key elements that require it to be part of the state's steady-state SA and SSA efforts.

If the goal of steady-state SSA is to support rapid and effective decision making at the onset of emerging incidents, DMNA's inclusion of situational elements in its own SA related to national and international security issues is important. The division's J3 unit is responsible for developing and maintaining an up-to-date situational awareness at

all times. Each morning a daily COP is created and the director of the Joint Staff is briefed. This brief includes not just the state's operating environment, but national and international situational elements as well.

Additionally, DMNA's resources are frequently utilized to support response-and-recovery-phase activities by the state in support of local government. Since 2001, DMNA has also played a major role in the state's homeland security mission areas of prevent and protect, with its standing force of personnel, via Task Force Empire Shield, providing daily security missions in the metropolitan New York City region. For these reasons, it is imperative that DMNA's leadership have access to the state's "all-hazards" SSA and contribute its SA to the broader SSA as well.

D. CONCLUSION

New York is fortunate to have a well-developed public-safety infrastructure to support the needs of its local and regional governments and partner organizations. Its agencies and information-management centers have access to a great deal of data and information at all times. This chapter has explained in detail the scoping of the term "all hazards" as it applies to New York State, which agencies are responsible for information management for the hazard domains that were identified, and how they share information in support of agency-specific situational awareness and interagency shared situational awareness, and the desired target audience of the steady-state SSA. It also demonstrates that the existing processes result in a fragmentation of information, with information from only a few of the identified hazard domains being forwarded towards a comprehensive shared situational awareness. In order to develop recommendations to correct this information-sharing gap, it is necessary to assess the current situation further.

Definitions are only one way in which people understand concepts and the interrelated nature of the tasks and missions to which they are assigned. For instance, a building contractor may say to its work crew that they are going to build a house. Each person hearing that statement will conjure different mental images and models of what a "house" is, what it looks like, and how the components they will use (lumber, nails,

shingles, piping, wiring) will fit together to build the house. In order for each worker to effectively complete his task and for the entire team's efforts to culminate in a structurally sound dwelling, the contractor will have a blueprint drawn that depicts in detail how the various elements come together for success. The next chapter will discuss the concept of mental models: what they are; what examples exists for shared situational awareness and common operating picture; their strengths and weaknesses; and offer a new architecture for a mental model that provides a more complete understanding of how SA, SSA and COP come together.

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IV. MODELING SSA AND COP

From the segment of the scientific community concerned with cognition and knowledge management, there exists extensive literature that greatly details the cognitive processes, group dynamics, and knowledge management skills that are employed by individuals and groups in an effort to achieve individual or group situational awareness. To understand what it is they are collectively seeking to accomplish, which will enable them to better achieve their individual tasks, it is important for the various team members to share a common understanding of how their contribution interacts with others and leads to goal achievement. Individuals organize knowledge into structured, meaningful patterns that can be subdivided into these classes: concepts, components, and the interaction between concepts and components. These classes are further understood and expressed by individuals in a variety of terms such as time, categories, or cause and effect. If we are asking people to achieve tasks such as information gathering not just from the standpoint of what is important to their domain (i.e., agency) but, rather, as part of a larger, shared, and interactive domain, then it is important that all of the individuals involved understand the construct in which their contribution will be used. A shared mental model supports this goal as it provides a "heuristic function by allowing information about situations, objects, and environments to be classified and retrieved in terms of their most salient and important features" (Cannon-Bowers, Salas, & Converse\, 1993, pg. 226).

The existence of a shared mental model not only enhances individual task efforts but also group decision making as it provides structure, definition and understanding of the team and the task (Cannon-Bowers, Salas, & Converse, 1993). Therefore, individual homeland security/emergency management practitioners tasked with contributing to and creating situational awareness, shared situational awareness and common operating picture will be more likely to succeed if they share a mental model of the SA, SSA, and COP.

Before an exploration of existing and proposed mental models is provided, it is important to understand what they are not. Mental models are tools for orientation and instruction about information sharing and process. As stated, they are important tools in that they support a common understanding among practitioners. They allow for a basic assessment of existing and proposed processes as well. Each has limitations, however, and no individual tool should be considered a complete "blueprint" for information sharing or the development and execution of SA, SSA, or COP.

The definitions and understandings of situational awareness and shared situational awareness are supported and frequently modeled using a basic, two-dimensional diagram. Nofi's (2000) diagram of situational awareness and shared situational awareness (Figure 2) provides a representation that is easily understood and makes sense. Each of the contributors ("A," "B," and "C") share a portion of their individual SAs with the others, with the areas of overlap depicting shared areas of SA. Assuming that all relevant and needed contributors are represented and that all of the individuals within the target audience of the SSA are able to access the center region of the model (as identified by "ABC"), the locus of information and context that is Shared Situational Awareness exists within the center-most area of overlap.

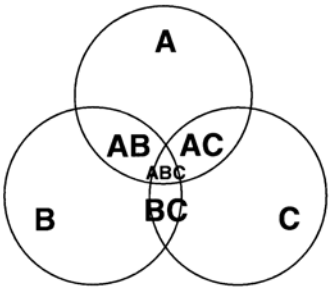

Figure 2. Situational Awareness and Shared Situational Awareness (Nofi, 2000, p. 33)

This two-dimensional map of SA and SSA supports the definitions of the concepts that have been discussed. It is probably the most likely diagram that a practitioner would draw if asked to create a model of both SA and SSA. It reflects the information-sharing doctrine in both response-phase activities (e.g., Unified Command, Multi-Agency Coordinating Group) and steady-state activities (e.g., fusion center intelligence products).

Over the past decade, public-safety practitioners have been exposed to dozens of various information flow models, each showing how data and information does or should be shared between different agencies, different disciplines, and different levels of government. To the practitioner seeking to develop a criminal or terrorism intelligence product, the contributors would include agencies that have data, information, and/or intelligence that is relevant to the creation of a comprehensive understanding of a given target (e.g., group, person, situation, or other target). The SSA can be drawn from the area of greatest overlap to create a comprehensive, multidisciplinary and/or multijurisdictional intelligence product.

The *U.S. Department of Justice* law enforcement information sharing program (DOJ, 2005) provides a diagram (Figure 3) that seeks to demonstrate what the authors considered the current mental model at the time of publication; it displays displays how information is shared among law enforcement practitioners on the topic of criminal and terrorism intelligence.

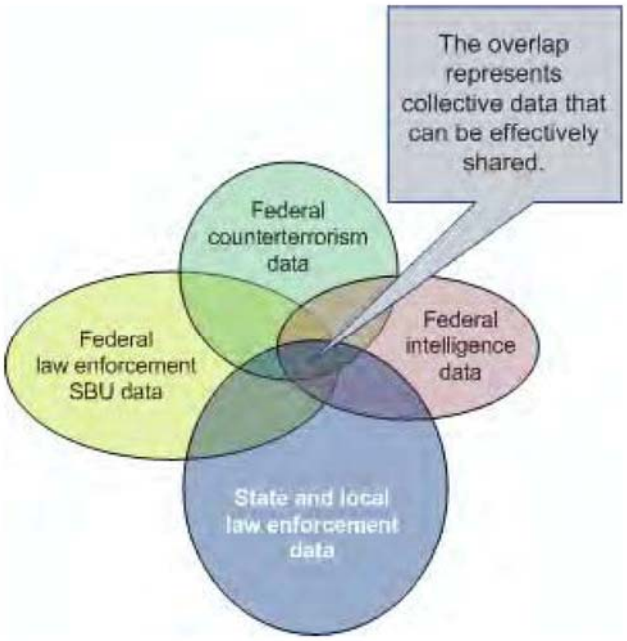

Figure 3. Mental Model (DOJ, 2005, p. 2)

This represents a typical use of the Nofi (2000) model of information sharing towards creating a shared situational awareness. It is effective and leverages the research discussed earlier that supports the efficacy of a shared mental model for understanding complex tasks. The DOJ (2005) report advocates for improvement in the process of information sharing and again provides a diagram in an effort to create a new mental model of its idealized end-state of interagency information sharing (Figure 4).

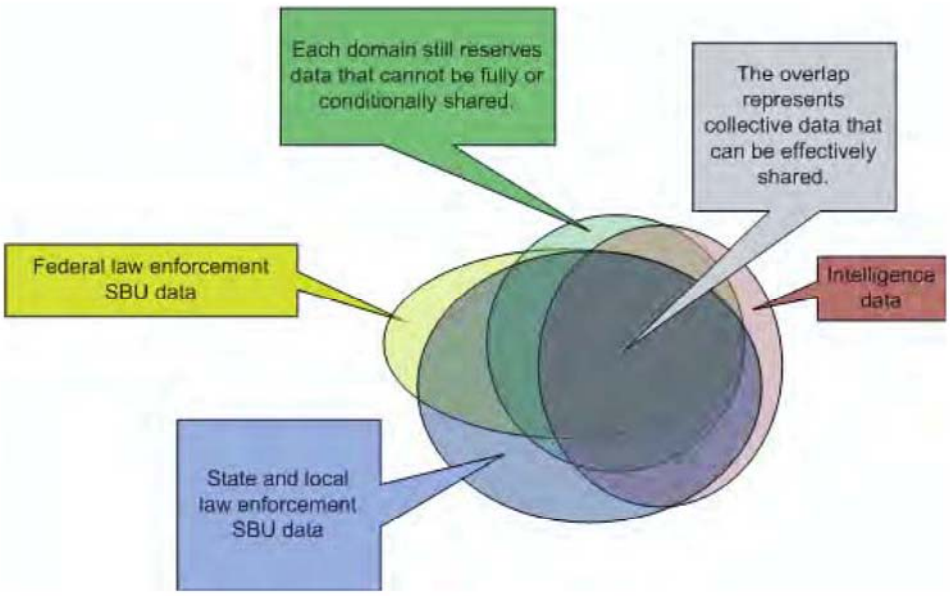

Figure 4. Mental Model (DOJ, 2005, p. 12)

These overlapping circle models are useful and provide a basic mental model for practitioners. They demonstrate the participants and the area of information sharing. With proper labeling, they can depict specific inputs (e.g., discipline-specific information) and tasks to be achieved (e.g., area of analysis). They are also flexible in that circles can be added and removed as the participants in the process change. Additionally, outlying entities can be reflected by circles that do not overlap,

demonstrating the existence of potential or needed contributors and their absence from the process. This model works well for what it is designed to accomplish.

There is a significant level of subjectivity within this model however. In the previous examples from DOJ (2005), the extent of overlap, which increases significantly between the first example and the second, intends to convey an increased percentage of existing information between entities being shared. What this model cannot do, nor is it designed to do, is to provide practitioners with hard statistics or to identify specific products, processes, or methods of interagency communication that support or hinder the level of information sharing. This does not diminish the value of the model; however, practitioners do need to understand the limitations.

While the COP could be depicted, if, for instance, it was drawn into the center ("core") area of greatest overlap, the previous model does not provide a view of the product(s) being sought. But just writing the intended products of the effort onto the chart does not provide detail adequate for a complete understanding by the practitioner.

A more complex example, one that includes many more information-sharing partners, seeks to show the information-sharing relationship and includes the additional details of the direction of information flow. The products produced by these efforts do have some of these needed elements (Figure 5).

Again, for its intended purpose, this model is effective; supporting the creation of a shared mental model among a common and invested audience, the flow of information, the products being sought; it even provides detail as to the level of expected contribution by each practitioner (agency) to the product (e.g., "read" versus "write").

Both of these models have usefulness when seeking to establish a common understanding among disparate agencies and jurisdictions of steady-state SA, SSA and COP and will be employed in the next chapter which seeks to model New York State's current efforts. However, the definitions identified in the last chapter require that contributors to this process also incorporate two additional elements: events and time. New models are needed to provide practitioners with a framework to understand the genuine complexity of SSA and COP.

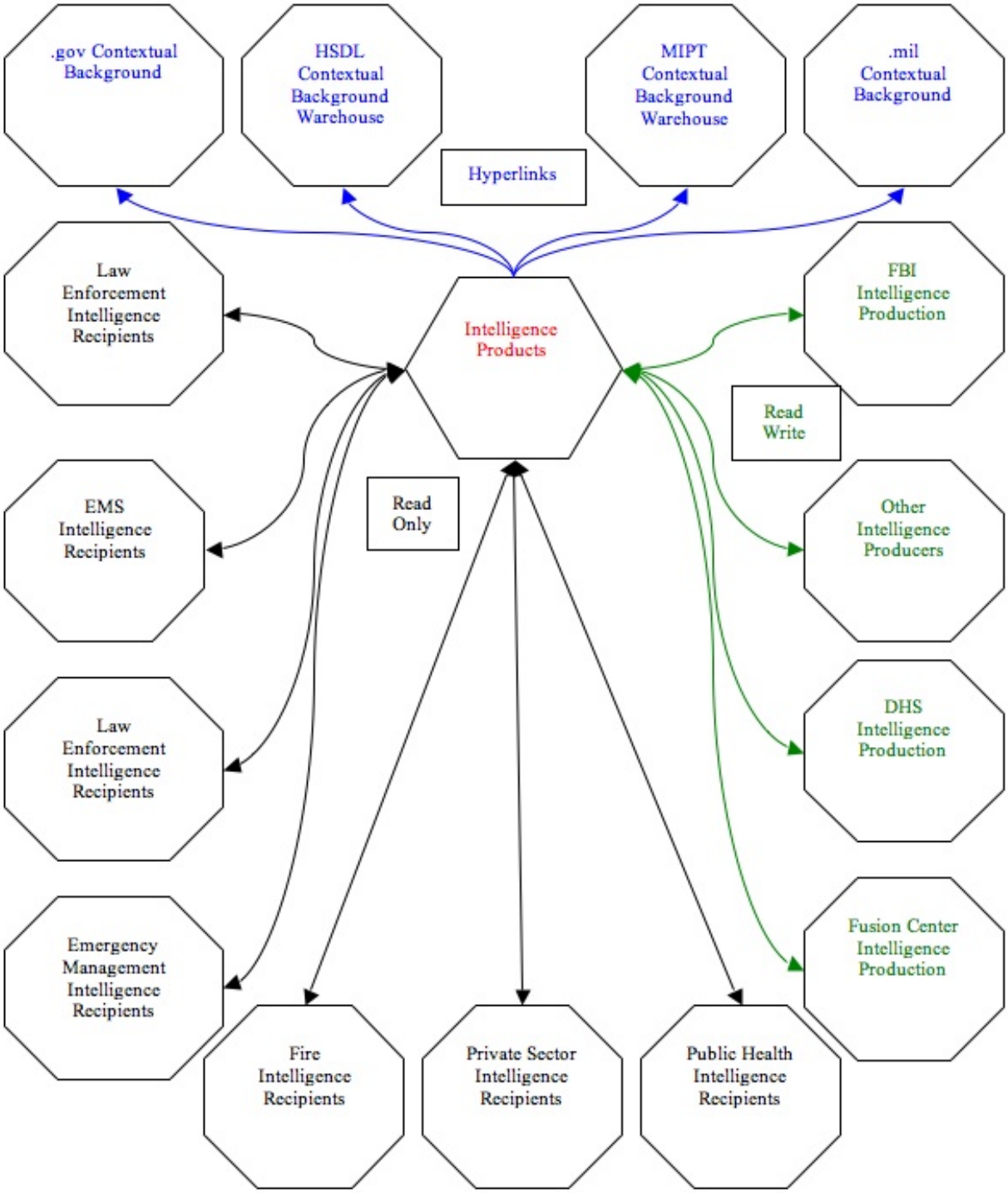

Figure 5. Homeland Security Information Source Network (Eaneff, 2008)

A. NEW MODELS FOR SA, SSA AND COP:

The previous models solely represent information sharing: individual agency SA and shared information for SSA. There are dimensions to the SSA and COP processes that are missing. If the definition of SSA means that all necessary parties share an understanding of the operating environment then, as explained in the previous chapter, in a rapidly changing environment (e.g., the steady-state operations of a jurisdictions), the development of a COP dictates that the dimension of time be added to the modeling process. By modeling the time at which various SAs are merged to create an SSA via a COP, practitioners can review their SSA to determine if a truly comprehensive SSA is being captured in the COP.

A suggested model that includes the dimension of time leverages an X-Y axis graph. Most homeland security/emergency management leaders hold responsibility for a defined jurisdiction (e.g., city, state, region of the nation) and elements (e.g., agencies and/or systems) within those boundaries. In this model, the X-axis represents the area of responsibility (AOR) within the scope of the leaders and practitioners. It is expected that this will generally represent the geographical boundaries and the domains of interest (e.g., weather, critical infrastructure) that the parties have agreed need to be included in their SSA and COP.

The Y-axis represents time. In this model it allows for a representation of when reports are generated, stemming from an individual agency's or domain's SA. Each agency and domain that has been identified to be included in the SSA and COP is represented as a single line advancing forward in time, with a horizontal line drawn to indicate the time of its daily input into the SSA. While each is represented as a single-line arrow in this model, it is worthwhile to consider each line as cylindrical (standing on end), with each agency's cylinder containing its respective SA. This understanding builds from the previous Nofi (2000) model concept. In this example (Figure 6), multiple agencies are represented. On the right side of the graph, the letter "R" represents the

generation of a report of their SAs. Within the space of the report generation is the area in which sharing among leaders is sought to create a genuine SSA. Absent a connection between reports, true SSA is absent.

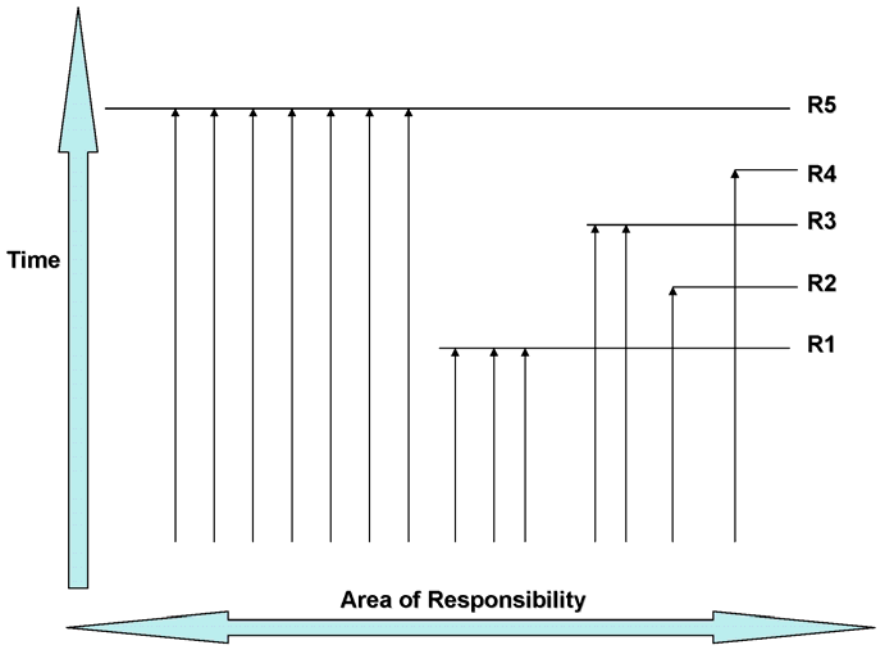

Figure 6. Fragmented SA reporting

If the goal is to create a shared situational awareness via a common operating picture, then a single report ("R") or COP, should be generated. In this instance, five reports are generated, three of which offer SSA from various agencies, but a comprehensive SSA and COP is lacking. Assuming that all inputting agencies have access to all reports, the fact that they are generated at different times during the day diminishes the ability to have a single SSA and COP.

The benefit of this model is that it allows a jurisdiction to examine who is contributing to the process and the timing of their contribution. Leaders can recalibrate efforts based on an assessment using this model, among other factors (e.g., processes, information security, practicality), to achieve a single-timed COP as depicted below (Figure 7).

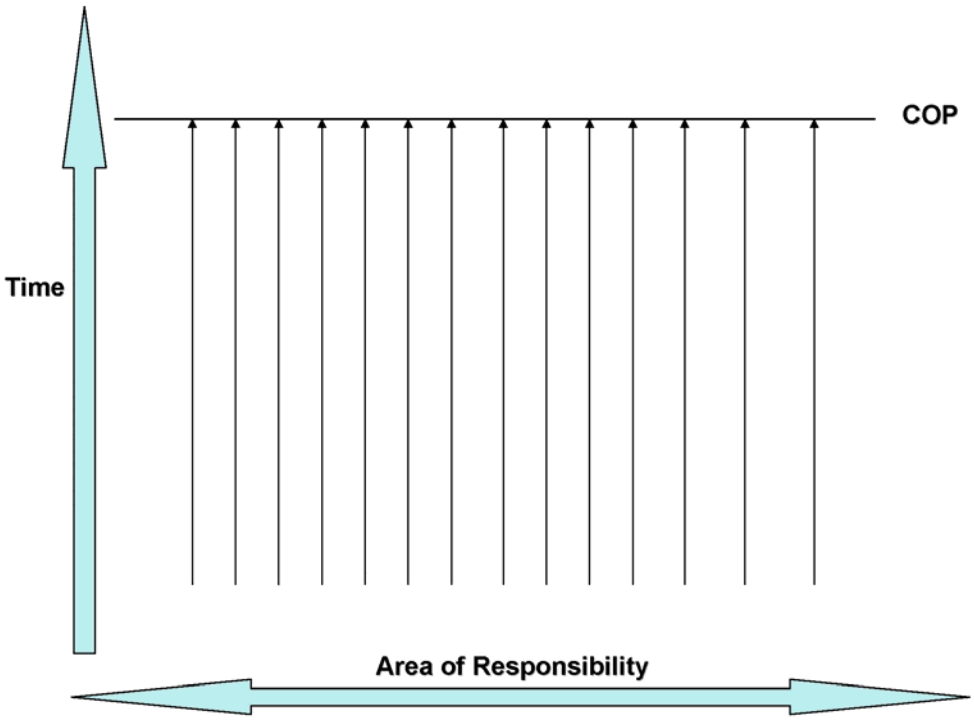

Figure 7. Single Point-in-Time Reporting to Achieve Comprehensive SSA and COP

While there is value in this model, there are also limitations that need to be understood. It does not allow for assessment of the quality of contribution, nor does it depict the ability or lack of ability for other agencies to review the products represented by "R" in Figure 6. The intention is merely to provide leaders with an ability to share a mental model of their collective SA sharing efforts towards an SSA via the COP. This model, as well as the next new model and previous Nofi (2000) model, will be applied in the next chapter during the assessment of New York State's current daily information sharing efforts.

It may also be helpful for practitioners to consider how events (e.g., incidents, disasters, planned events) interact with their individual SAs and their collective SSA. Since the terms SA, SSA, and COP are most frequently used and understood by practitioners during the response-phase of incident management, then it is easier to

begin an exploration of new modeling within that domain. Reduced to its narrowest parameters, an incident is understood as a single event (e.g., flood, fire, explosion) which conjures a mental image of the specifics of that the type of event (e.g., rising water, smoke billowing from a building, a fireball followed by strewn damage). By definition we assume that the event has a location inherent since the basic report of what is happening will include the location identifier. So mapped geographically, the two dimensions of the event are the event itself and its location.[11] But simply mapping the event, while useful in certain settings, does not allow for the demonstration of the event in support of SSA. Nor does it allow practitioners to understand how the event, particularly what phase of the event, will be captured by the COP. It may also be helpful to share an understanding that an event occupies an area within the shared AOR. Another new model may serve to assist practitioners to develop a common understanding of events and their interplay with SA, SSA, and the COP.

To understand the addition of the "event" element, we can use the frequently cited analogy of a stone being tossed into a pond, creating ripples that expand outward from the center (location of the event). In public safety the "expanding ripples" do not just represent the geographic area affected (e.g., the number of acres burning in a forest fire); the "ripples" also represent all cascading consequences of the event or "incident complexity."[12] As the event ripples outward, the third dimension of "space" is introduced into the mental model. The contributors to and recipients of a COP should understand the various systems affected by occurrence of the initial event in order to, first, understand the situation and, secondly, make decisions related to it.

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[11] While it is understood that the mapping of an event in three-dimensional space requires three coordinates, in this instance the concept is the identification of a single point location on a two-dimensional map, which requires only two coordinates.

[12] Incidents are often referred to by practitioners in casual descriptions as "large" or "minor," suggesting to someone unfamiliar with incident management that their physical or geographic size is the sole determinant. The National Wildfire Coordinating Group has categorized "types" of incidents and scaled them as Type 1 through Type 5, based upon incident complexity. Determining incident complexity includes assessing many factors including the area involved, the threat to life and property, political sensitivity, organizational complexity, impacts on critical infrastructure, jurisdictional boundaries, values at risk, incident behavior, strategy and tactics, and agency policies. For a review of Fire Complexity Analysis, see http://www.fs.fed.us/r3/resources/fire/line%20officers%20guide/chapters/pdf%20files/ch%206%20incident%20complexity.pdf.

Just as in the previous model, the event mental model requires the inclusion of the element of time. In the initial two-dimensional mapped model of the incident, the inclusion of the time of the incident does not add the dimension of time, which is, in that instance, a static component (e.g., the second plane hit the South Tower at 0903 hours). The time dimension in this event model represents the movement of the event and its consequences through the space-time continuum.

The world-renowned physicist Stephen Hawking describes in simple terms many complex concepts in his 1988 book "A Brief History of Time." It is his modeling that explains the occurrence of an event in space-time, which he used so adeptly to explain to the layman complex theories such as black holes that provide a working event model for SSA, SA, and COP.

Hawking's model (Figure 8) demonstrates that the rippling effects of an event do not happen instantaneously with the event occurrence. Rather as time passes after the event (e.g., hijacked airplane strikes the World Trade Center), the consequences, whether very close in time to the source (e.g., explosion and fire) or more distant (e.g., U.S. military forces invade Afghanistan), both emanate from the same singular event but exist at different points along the time axis. His model provides a visual representation of the "stone in the pond" analogy.

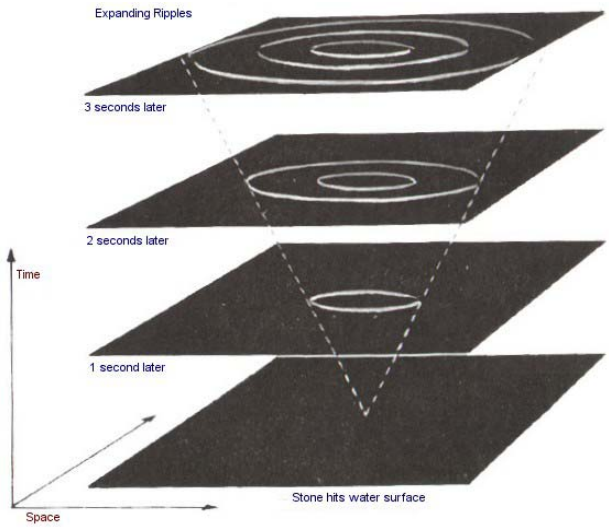

Figure 8. Hawking's Model (Hawking, 1988, p. 26)

This multi-dimensional model does an excellent job of representing the mental model that practitioners share to facilitate a mutual understanding of an incident during response-phase operations, particularly how the cascading consequences of the incident expand outward. What it does not provide, however, is a complete model for the entirety of SSA, or the location of the COP, for the practitioner or leader whose responsibilities exceed the operational space affected by this single event. A more complex model, yet still one that is easy to understand, provides the basis for capturing the entire area of responsibility (space) and event(s) within during steady-state operations.

In order to include the entirety of "space" that remains within the area of responsibility of the homeland security leader, we can use Hawking's (1988) explanation of how a black hole theoretically exists in the universe as the basis for this model. He explains what happens within a star, including its gases, particles, and atoms, and the forces acting within and upon them, to create the event (or "singularity" to use his term) known as a black hole. The tremendous gravitational force generated by the black hole create a "point of no return" in proximity to the black hole at which everything that passes this line (referred to as an "event horizon") will fall into the black hole. Things that remain on the other side of the event horizon are unaffected by the black hole.

To model this phenomenon Hawking (Figure 9) structures the "past," including everything that occurred to lead to the formation of the event, as entirely within the "past light cone." Everything that will be affected by the existence of the black hole is captured in a mirror image space further forward in the time axis and labeled the "future light cone." The line that separates the "future light cone" from the rest of space is known as the "event horizon." Once something (e.g., light) passes over the event horizon, its future lies entirely within the "future light cone" of the black hole (Hawking, 1988).

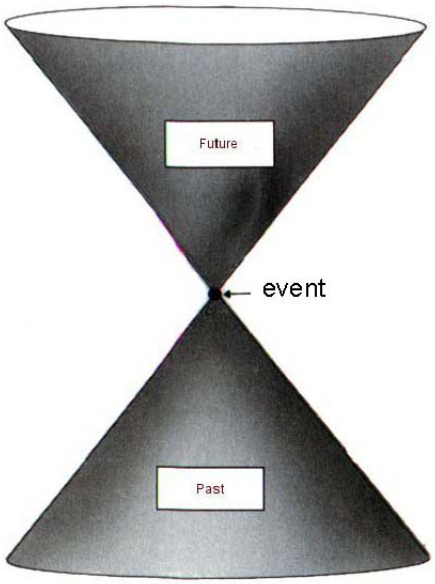

Figure 9. Hawking Model (Hawking, 1988, p. 26)

To transition from the theoretical to the more practical, we can imagine a spaceship that passes through the event horizon of a black hole. When it does, it will find itself in the "future light cone" of the black hole, now destined to be affected (destroyed) by it. In this area the gravitational forces are so extreme that the spaceship is helpless to escape and will ultimately be destroyed by the black hole. Since no force can overpower the gravitational force that exists in the "future light cone" of a black hole, the only option for the ship's crew will be to destroy the black hole before the spaceship falls close enough to be destroyed. Once mankind figures out how to travel through great distances around the galaxy, this will become a challenge that needs to be overcome. Today it provides a good understanding of a model that is applicable to SSA and COP.

If we apply Hawking's concepts to create a new Event Model[13] for SSA and COP in public safety, then the "past light cone" is filled with all of the forces and events that resulted in the event's occurrence. The "future light cone" is the predicted space, which represents the future area affected by the event. As noted previously, the homeland security/emergency management leader cannot focus merely on a single event within his jurisdiction. Therefore, the model needs to represent the entire "space" or area of responsibility (AOR) for which the practitioner holds responsibility in addition to events occurring within.

By using the "time" (Y axis) and "area of responsibility" (AOR) (X axis) on the next model (Figure 10) as representative of geographic boundaries of the AOR, the space that falls outside of the "light cones" of the event occurring in their AOR represent the areas unaffected by the event, but still within the AOR. By adding the horizontal line at the "present," the model reflects the location in time at which the COP is created, in this case at the time of the incident and therefore at the delineation between the past and future "light cones." Here we see the time of the COP "snapshot."

[13] In this example models, all events are depicted using the past and future "light cones" as explained by Hawking (1988). This is done for ease of understanding. The modeling of actual events may be more easily understood by the use of other shapes, particularly to replace the ever-expanding future "light cone." In these example Event Models, the open end of the future "light cone" depicts event termination. It may be useful to consider using a diamond shape to represent the initial expansion and subsequent contraction of an event within the AOR.

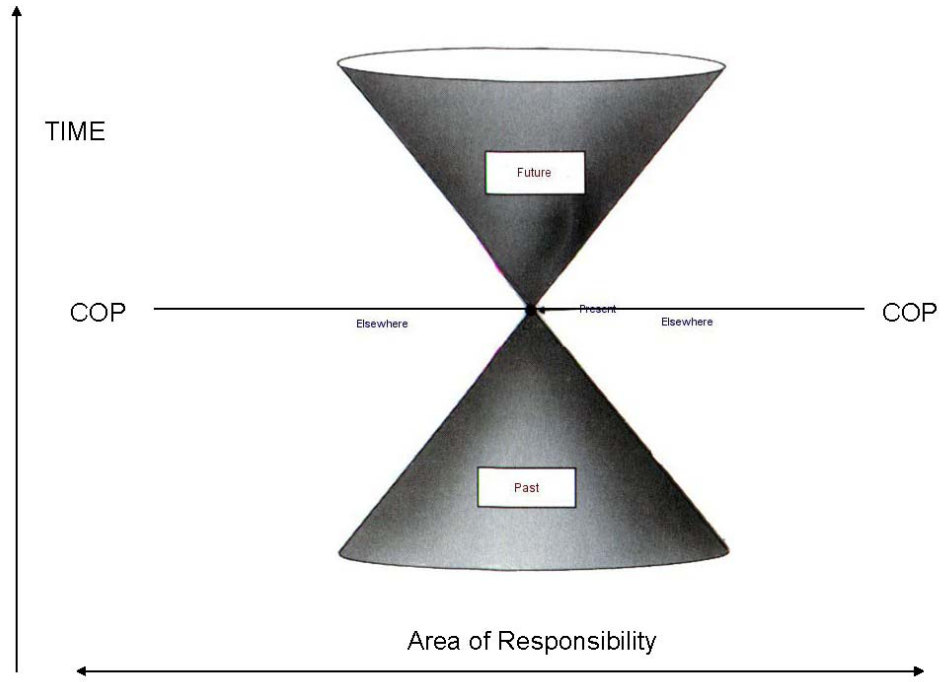

Figure 10. Single-Event Model, Depicting the AOR, a Single Event, the Movement of the Event's Effects through Time, and the Production Time of the COP (after Hawking, 1988)

The complete COP, as defined earlier, includes information and data from sources that are not affected by an ongoing event or events. To complete the new model (Figure 11) we need to add the final element of specific agencies and/or systems that fall within the AOR, are affected by events within the AOR, and need to be captured by the COP. We can represent the agencies and/or systems that the leader is responsible for or whose presence is required to achieve comprehensive SSA as labeled arrows within the model. Each line represents a single domain or discipline (e.g., police, fire, weather). Within each element's line exists its individual SA as it moves forward in time. By layering ongoing and known future events, we can model which domains and/or disciplines are affected by the events. All domains/disciplines not affected by an event exist within the AOR space but do not cross an event future or past light cone. If there

was no event occurring, then the model would just include the individual discipline/domain lines moving forward in time. That no forces or events are ongoing or predicted to affect the multitude of elements that the contemporary homeland security/emergency management leader must concern himself with is highly unlikely. The presence of the single event model within this model (Figure 11) is merely illustrative of one scenario.

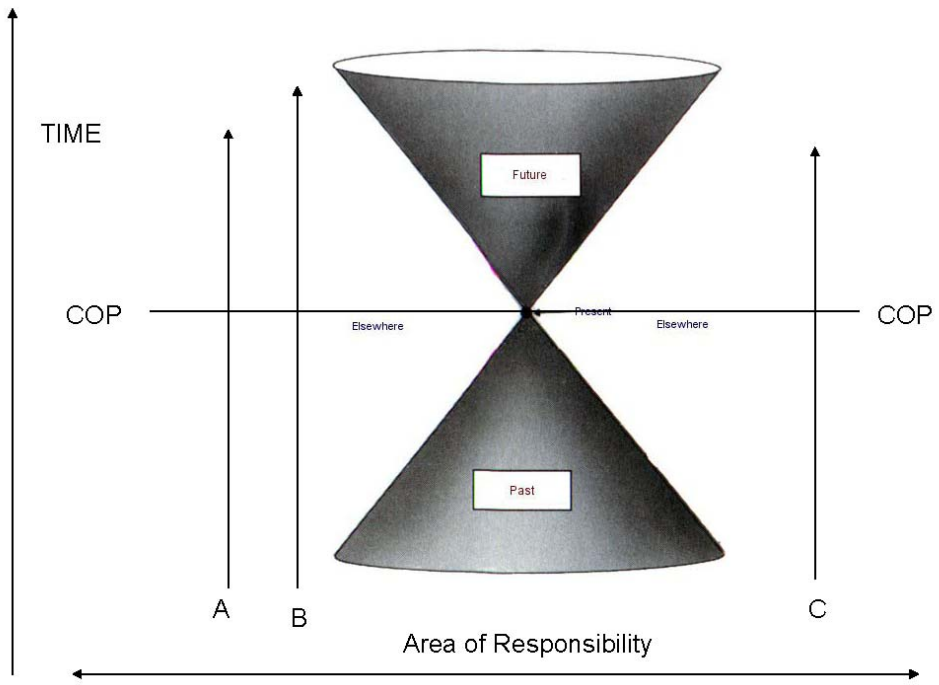

Figure 11. Single-Event Model with Inclusion of Unaffected Disciplines/Domains (after Hawking, 1988)

The model is purposefully scalable insomuch that events can occupy more or less of the AOR space. The scaling is anticipated to be representative of the "size" of the event, as discussed earlier, be it a minor (e.g., bridge closure) or major (e.g., regional flooding) event within the larger context of the leader's AOR. The most likely scenario is that a model of a geographically large jurisdiction will have multiple event cones, of

various sizes, within the boundaries of the AOR. The COP will be created at a time that crosses both future and past "light cones" of the multiple events (Figure 12).

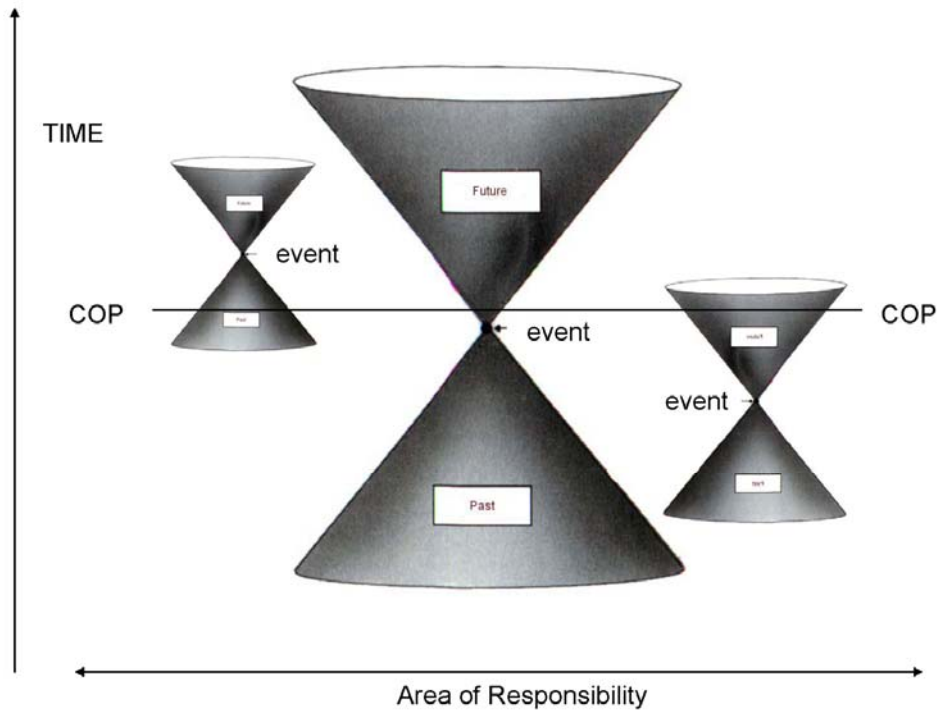

Figure 12. Multiple-Event Model, Two of Which Occurred Prior to the COP, and One of Which Is Anticipated to Occur in the Future (after Hawking, 1988)

In this last example event model (Figure 13), at the time of the COP, two events have occurred, and one event is predicted in the future (e.g., a scheduled mass-gathering incident). Two disciplines/domains ("A" and "I") fall outside of any event influence. Discipline/domain "B" is solely affected by future Event 1. Disciplines/domains "C," "D," "E," and "F" are all affected by Event 2 throughout its entire life cycle. Finally, Event 3 fully involves discipline/domain "G," but discipline/domain "H" has involvement only in the past in the event, was unaffected for a period of time, and then recently reentered the event's life cycle as the event nears completion.

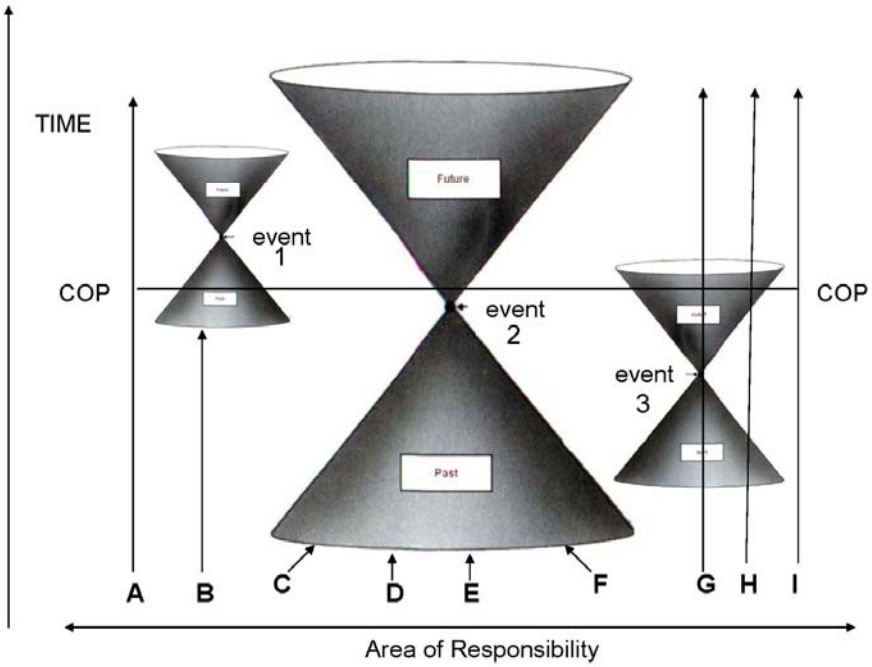

Figure 13. Multiple-Event Model with Inclusion of Affected Elements (after Hawking, 1988)

B. CONCLUSION

As discussed in the introduction to this chapter, mental models are intended to provide assistance with contextualizing the interrelationships between various elements of a complex task. By developing shared mental models, practitioners can better understand their roles, the importance and contributions of their individual tasks to the larger effort, and they can achieve greater individual and collective success. Using models such as the ones depicted in this chapter also allows practitioners to visualize how their efforts interplay and where opportunities for improvement may exist.

It is equally important to understand the limitations of these models, particularly for the purposes of the discussion in this thesis of SA, SSA, and COP. There does not exist a single model which captures all of the elements and

interagency/interjurisdictional relationships that ultimately must exist to achieve a comprehensive SSA and COP. Attempting to include all the elements would result in an overly complex and difficult-to-understand model. Further complicating the already challenging task of achieving SSA and COP must be avoided.

The next chapter will apply these modeling concepts to New York's state-level public safety infrastructure to provide a perspective and understanding of its current data and information sharing efforts as they relate to SA, SSA, and COP.

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V. MODELING NEW YORK'S EXISTING SYSTEM

This chapter includes the application of the three models discussed in the previous chapter in an effort to identify any gaps or opportunities to improve information sharing as it relates to achieving an SSA through a COP in New York State. It is important to reiterate that the models are not designed to be merely "fill in the blank" assessment tools. They are, as defined in the previous chapter, a set of tools with the specific purpose of developing a shared mental model among practitioners, to understand how information sharing and knowledge management is, in this case, currently constructed. Absent accompanying explanatory narrative, which was provided in Chapter III, the models do not adequately demonstrate the information-sharing construct. What they do, in this instance, is to provide a visualization of the complexity of the challenge and periodically identify gaps in the information sharing system.

A. DOMAIN MODELING

Based upon the risk assessment that New York has conducted, major groupings (domains) of the identified hazards that are part of the state's risk profile were created. They included fire; health; law enforcement (criminal and intelligence); weather; geophysical; transportation; critical infrastructure (e.g., power, fuel, water, telecommunications); food and agriculture; and environmental (e.g., hazardous materials). From the information management systems for these domains as described, the two-dimensional, overlapping AOR model, as described by Nofi (2000), can be used to demonstrate current levels of information sharing between domains and in relation to the three major information-management centers in New York State (Figure 14).

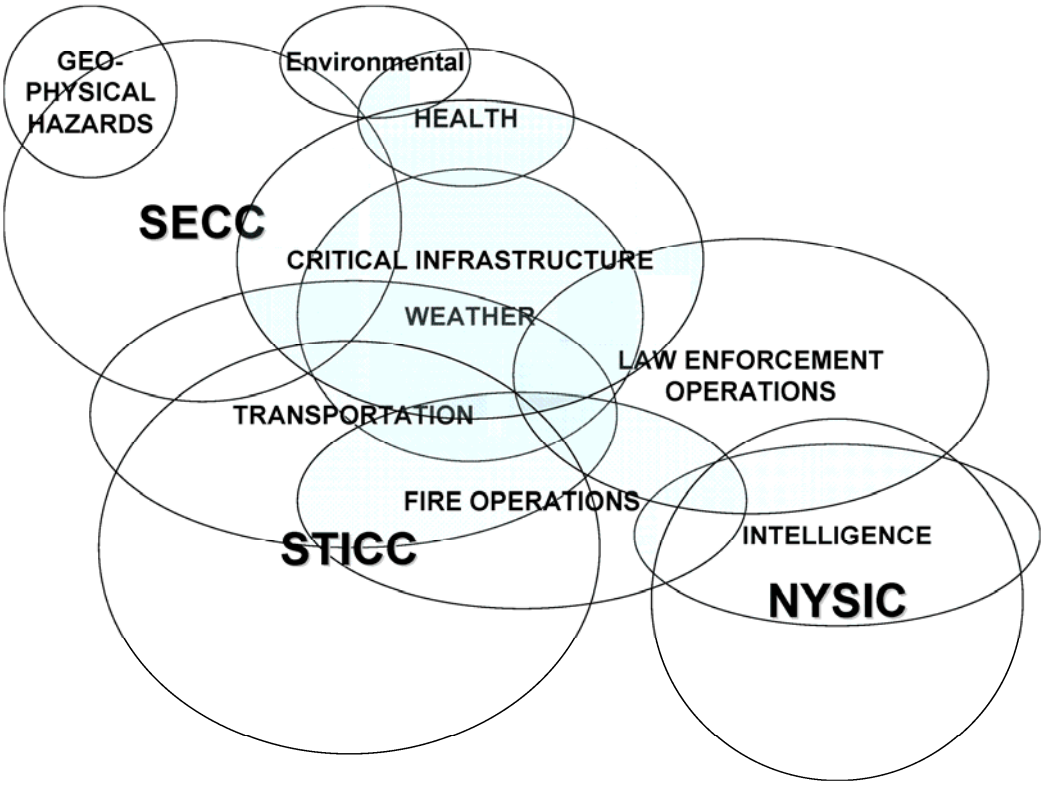

Figure 14. NYS Hazard Domains Information Sharing (after Nofi, 2000)

This model provides practitioners from different agencies and disciplines the ability to see how the broad domains of identified risk area overlap. The areas of overlap are created by formally established processes of information sharing. The model identifies a gap between the law enforcement and intelligence domains and the domains captured by the SECC, which purports an “all hazards” mission set.

A more nuanced application of this model, which identifies specific agencies, including local and private-sector partners, provides a closer look at agency-specific information sharing (Figure 15).

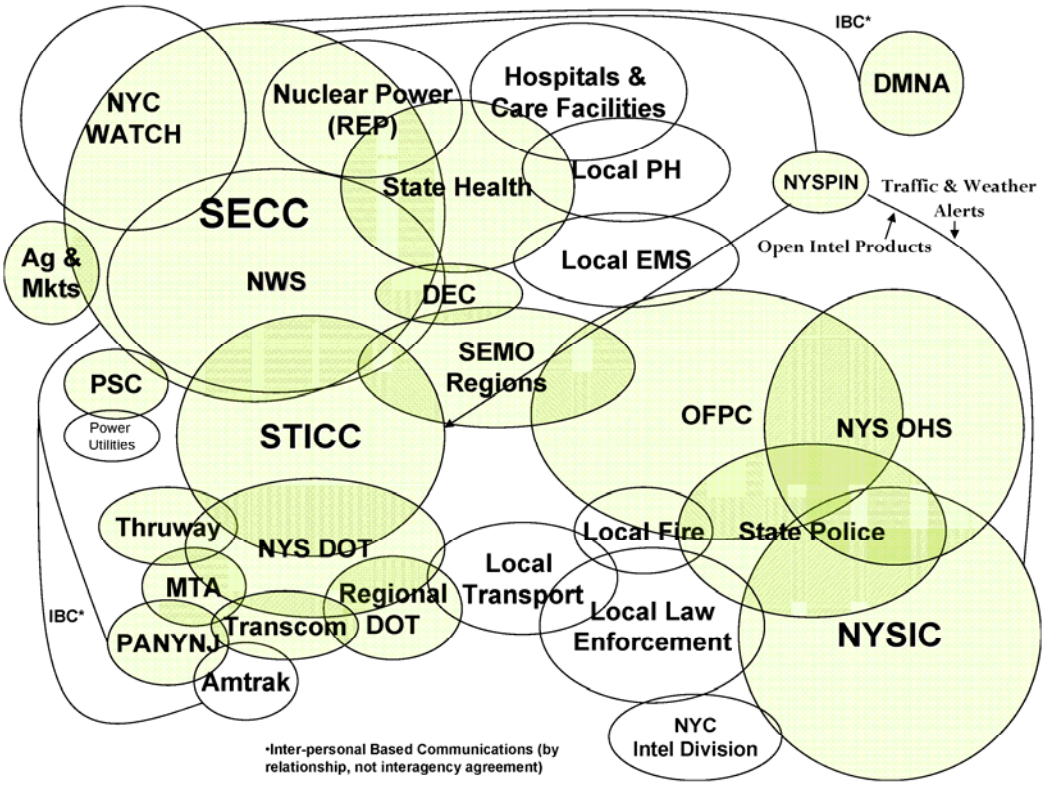

Figure 15. NYS All-Hazards State, Local, and Private-Sector Information-Sharing Model (after Nofi, 2000)

This model also demonstrates some of the information sharing, including the sharing of situational elements based upon existing interpersonal relationships. The areas of overlap are representative of formal information-sharing agreements and processes.

Again, a clustering of the intelligence and law enforcement information can be seen in one area with the “rest” of the risk area information being captured in the other corner. Additional models need to be applied to New York’s practices to further assess the pursuit of situational awareness and shared situational awareness.

B. MODELING OF SITUATIONAL AWARENESS TO CREATE SHARED SITUATIONAL AWARENESS

If the goal is to create an environment of shared situational awareness, then a model of the current practices that demonstrates how individual agencies formally share their respective situational awareness with others is needed.

In the next model (Figure 16), the risk domains are represented along the X-axis, which represents the entirety of the steady-state, risk-based public-safety operating environment for New York State. Each line represents a single domain's SA moving forward in time. Based upon the descriptive information of how information management is achieved by agencies to develop the SA for each domain, coupled with how they pursue SSA via a daily common operating picture, a line is drawn to the right indicating the introduction of SA into the SSA environment on the right side. Since the daily COP product generated by the STICC is captured by the SECC and shared, the transportation domain is represented within the SECC daily operations brief.

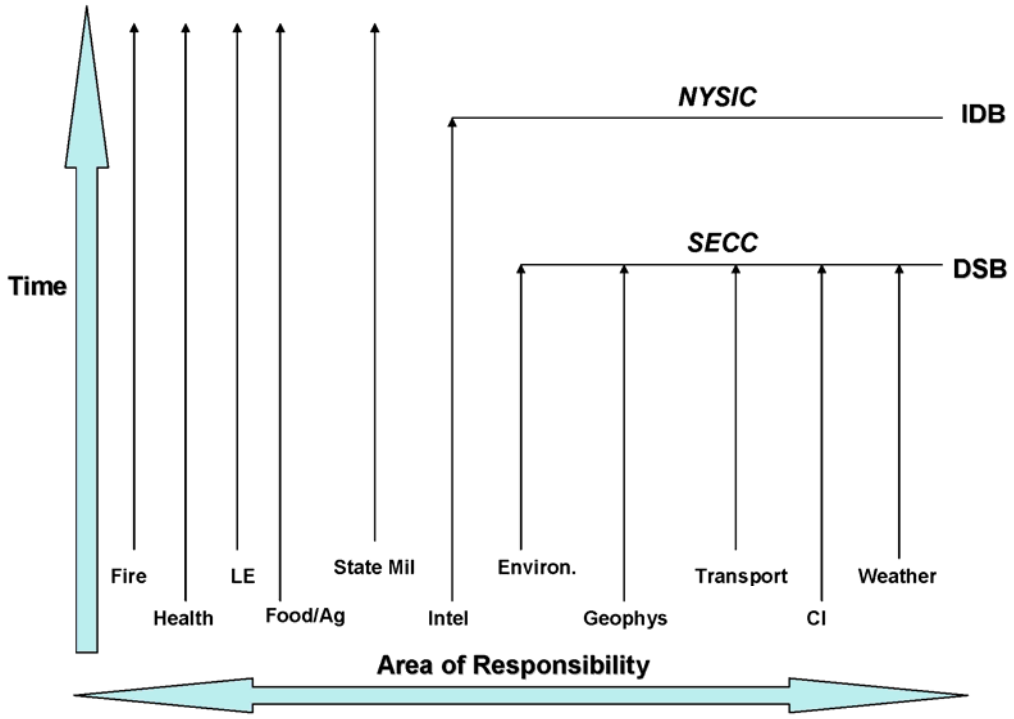

Figure 16. SA and SSA Model of NYS Hazard Domains via COP

When applied to this modeling tool, this model demonstrates the insular manner in which many agencies' situational awareness exists. It does not represent the information and situational elements of other domains captured by the SECC, STICC, or NYSIC via open-source reporting, interpersonal communication, or in the case of the SECC, via telephone answering-service support.

It is noteworthy that the three products created by the three information management centers are further disseminated. Two (the SECC and STICC) converge to create partial SSA within their respective audiences, however, the Intelligence Daily Brief (IDB) put forth by the NYSIC is not shared with the either the other two centers or with all of the public-safety leaders that occupy the environment on the right side. Five of the eleven hazard domains are not represented in the SSA environment at all (absent

that which may be incidentally gathered by one of the information-management centers). As a result of these processes and as demonstrated in this model, New York State fails to achieve a comprehensive, all-hazards shared situational awareness during steady-state operations.

One final model can be applied to assess how ongoing events that do not result in the state's transitioning from steady-state operations to a full response phase factor into the information-sharing environment. By including a model of the state's SSA efforts during the response phase, a deeper understanding of information-sharing gaps can be achieved.

Event Modeling of Situational Awareness and Shared Situational Awareness

There are frequently ongoing events and factors that affect the operating environment of the state that do not require activation of the state's Emergency Operations Center (SEOC). Those events and factors are captured by the individual agencies' SA and shared, or not, in the manner that has been described. One goal of steady-state information sharing is to create the SSA from which rapid and effective interagency decision making can be made should an event suddenly emerge or should a situation evolve that requires the state's posture to transition from steady-state to an operational posture.

By modeling New York's information-sharing process during a recent event[14] that required a transition from steady-state to operations, using the event model described in the previous chapter, an assessment of SSA at the time of transition can be provided.

[14] During the week of February 21, 2010, a series of dynamic weather systems affected broad swaths of New York State. The entire state experienced prolonged periods of inclement weather, and near-record levels of snow accumulated in various regions. The high water content of the snow resulted in significant disruptions to transportation systems and disrupted electric power supply to densely populated regions for periods exceeding 72 hours. The state maintained a steady-state posture during days 1through 3 of the event and transitioned to a response phase on day 4, with a partial activation of the SEOC and all affected agencies reporting SA to the SEOC for inclusion in the incident SITREP.

In the first event model (Figure 17), an emerging snow event is depicted.[15] This event is described as regional in geographic scope and moderate in complexity. The percentage of the AOR space it occupies supports that its effects are impacting all identified public-safety hazard domains. The "real-world" effects include disruptions to the transportation system; loss of electrical power; stress on local fire, EMS, and law enforcement first-responder organizations; and impacts on regional healthcare facilities.

In the current information-sharing environment utilized by New York State, absent activation of the SEOC and a transition to the response phase, information sharing continues as normal in steady-state operations.

From this model it becomes apparent that, despite all domains being impacted by the event, five domains (fire, health, law enforcement, food/agriculture, and state military) continue to maintain insular agency situational awareness. Any information that the evolving event has on their agency operations or discipline domains remains segregated from the rest of the state's public-safety leaders. This demonstrates a lack of shared situational awareness during an evolving event. should the situation rapidly deteriorate, requiring a transition to the response phase, considerable information will need to be shared between discipline leaders to achieve the SSA necessary to initiate joint decision making.

[15] In this event model, the incident is depicted using a diamond shape. The shape chosen to represent an event is at the discretion of the practitioner using the model. In the previous chapter the shape of the event was merely illustrative and keeping in line with the theory of the model as utilized by Hawking (1988).

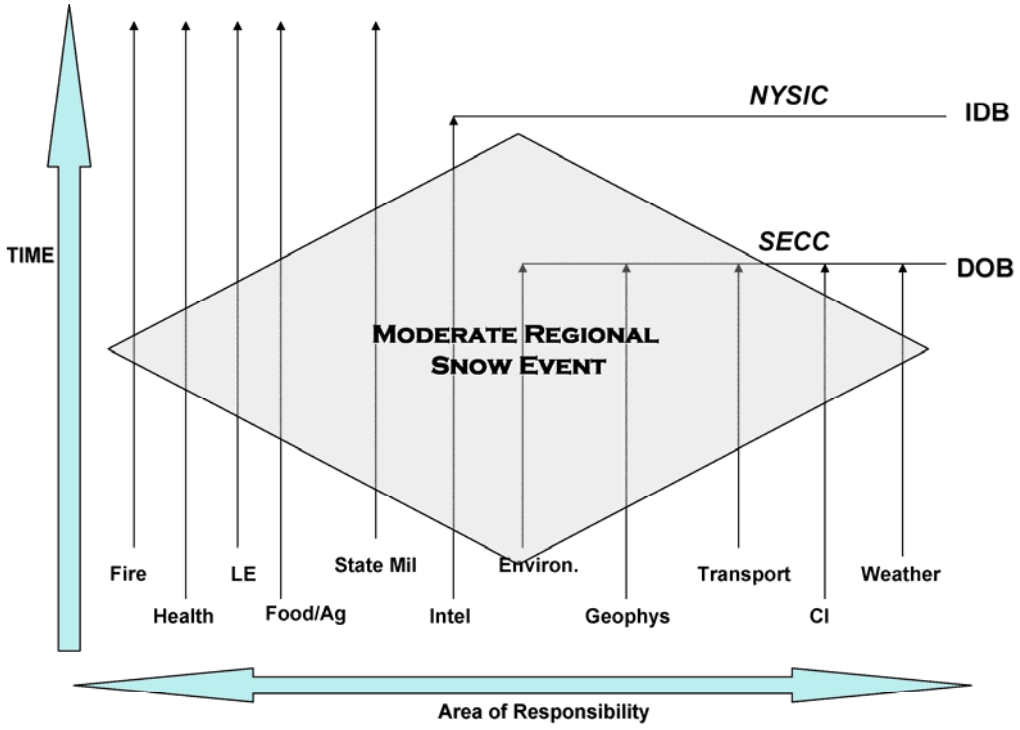

Figure 17. Steady-State Information Sharing during Moderate Regional Snow Event

During response phase operations in New York, the state utilizes the incident command system (ICS). This dictates that operational periods will be established and a situation report (SITREP) will be compiled, with input from all relevant disciplines and agencies, and disseminated to ensure SSA is achieved. This practice is well established in New York's emergency management program, formally endorsed by the governor and adhered to by state agencies. it is worthwhile to model this same snow event in the response phase to assess the entirety of New York's information-sharing efforts. The contrast between steady-state and response-phase-operations information sharing also allows for an understanding of the gap that exists between the two states of SSA.

In this model (Figure 18), nearly all domains are represented in the SSA development process, with agencies' and disciplines' SA contributing to the greater SSA

effort. Yet, the intelligence community (NYSIC) remains absent from both the contribution effort and the receipt of the SITREP. Again, a fully realized, comprehensive SSA is not achieved.

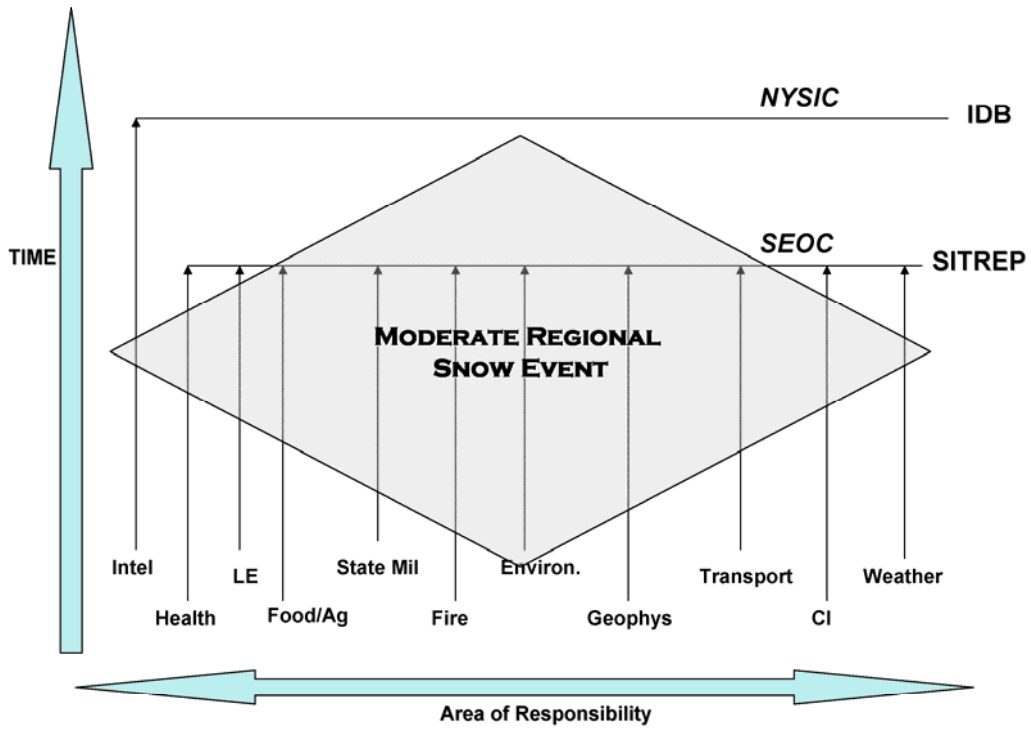

Figure 18. Response Phase Information Sharing during Moderate Regional Snow Event

C. CONCLUSION

The goal of this chapter was to model New York's public-safety information management and sharing architecture. Utilizing the modeling tools discussed and suggested allows for a visualized understanding of the interaction between the agencies and hazard domain–specific situational awareness that is created and how existing processes of information sharing contribute or fail to contribute towards the goal of a comprehensive public safety shared situational awareness. From the narrative description provided in Chapter III and the modeling conducting in this chapter, several conclusions can be drawn.

New York State has identified the scope of the hazards that exist in its risk profile. State agencies with responsibility, jurisdiction, and authority to engage in information gathering, assessment and sharing, in support of their and others' steady-state and response-phase operations have developed extensive information-management systems in support of hazard domain/agency-specific situational awareness. Significant gaps exist, however, in the sharing of individual agencies' SA towards a comprehensive shared situational awareness.

The three information management centers provide both regular situational element updates and daily common operating picture products towards the shared situational awareness. That the products are not shared between all three information management centers, nor compiled and transmitted on the same schedule, suggests that the resulting SSA that is achieved does not meet the definition of a genuinely comprehensive SSA as previously defined.

The lack of formal arrangements between agencies and the lack of a single point of leadership to drive the cohesion of information fusion has resulted in a fragmented and incomplete SSA during steady-state operations. As demonstrated by the event model, even during the emerging phase of incident evolution information gaps exist. While outside the scope of this thesis, a gap between the intelligence domain and the incident-specific SA exists that suggests that even during response-phase operations a fully realized SSA is not achieved.

One of the primary goals of a comprehensive shared situational awareness among public-safety leaders is to support effective decision making. The absence of an SSA can both hinder and degrade the timeliness and effectiveness of state efforts in support of local operations during crises. Given the dynamic and challenging risk profile that New York possesses, its public-safety leaders must work together to correct this situation. The next chapter offers recommendations for how New York can achieve a comprehensive, public-safety shared situational awareness during steady-state operations.

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VI. RECOMMENDATIONS FOR NEW YORK STATE

Frequently when opportunities to improve a system or a gap in a current process are identified, the recommendation is to create a new task force, working group, or committee to examine the problem, identify possible solutions, and implement change. New York State has an opportunity to leverage its existing construct for addressing interagency information sharing by continuing the implementation of an evolution of its all-hazards planning processes that is already underway. In order to provide clear recommendations for how New York can fill the current information-sharing gap and achieve an all-hazards, public-safety shared situational awareness during steady-state operations, it is first important to understand how the state has organized its approach to all-hazards emergency management and homeland security.

A. NEW YORK STATE EMERGENCY MANAGEMENT PLANNING AND RESPONSE CONSTRUCT

Section 22 of New York State Executive Law, Article 2-B (2006) establishes and identifies the roles and responsibilities of the state Disaster Preparedness Commission (DPC). Comprised of 23 state agencies and the American Red Cross (ARC), the DPC meets biannually to ensure that the state's mission for all-hazards emergency management is being achieved. The DPC is responsible to ensure the preparation of state disaster plans; directing state disaster operations and coordinating those with local government operations; and coordinating with federal, state, and private recovery efforts. In 2003, the state of New York began an effort to reorganize its planning methodology. The effort culminated in the development of a restructured state Comprehensive Emergency Management Plan (CEMP) into three distinct, but interconnected volumes.

- Volume 1: All-Hazard Mitigation Plan (FEMA-approved in 2007)
- Volume 2: Response and Short-Term Recovery
- Volume 3: Long-Term Recovery Plan

Volume 2 of the state Comprehensive Emergency Management Plan is titled "Response and Short-Term Recovery." The purpose of this document is to identify the state's overarching policies, authorities, and response organizational structure that will be implemented in an emergency or disaster situation that warrants a state response. In addition, this document identifies the concept of operations, lines of coordination, and the centralized coordination of resources that will be utilized in directing the state's resources and capabilities in responding to and recovering from a disaster. Further, this document serves as the basic foundational framework for the state's response levels and the operational basis on which functional and hazard-specific annexes are be built. The structure of New York State's plans is identified in Figure 19 below. (D. Dematteo, Acting Chief, NYSEMO Planning, personal communication with author, November, 2009).

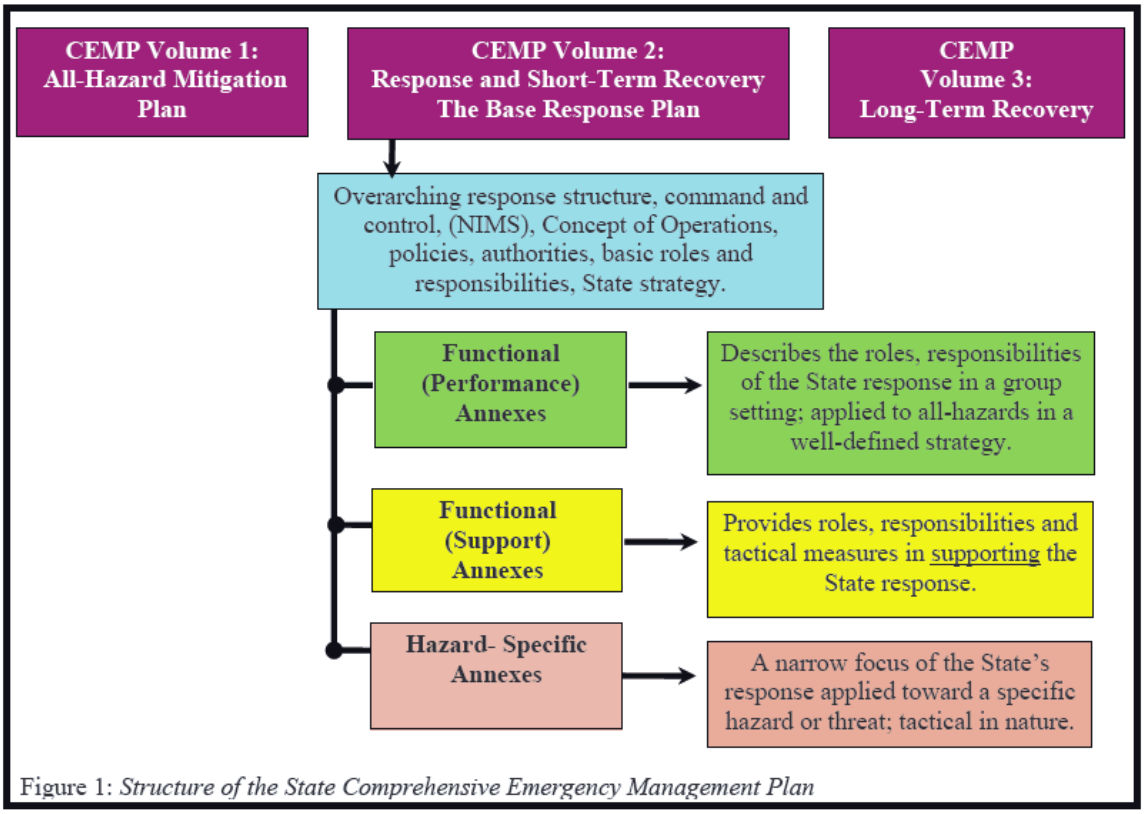

Figure 19. Structure of the State Comprehensive Emergency Management Plan

In 2009, New York State, in an effort to better align its emergency-management and homeland security efforts and to ensure the integration of current federal planning

and grants-management guidance doctrine, began to refocus its preparedness efforts to include ten functional branches. Predicated upon the incident command system (ICS) concept of response-phase branch planning, the ten functional branches are designed to support the full spectrum of the emergency management cycle, including mitigation, preparedness, response and recovery. The functional branches provide a platform for interagency coordination (including local, state and private sector/NGO partners) of various activities in the different phases of emergency management. During the response phase, the functional branches are responsible, if activated, to support the efforts of the state's response by assisting with the application of needed capabilities in support of local government, as well as serving as an interface with the federal emergency support functions (ESFs). During the preparedness phase (steady-state), the functional branches serve as the backbone of the state's planning efforts, including the development of strategic and tactical response plans as well as developing strategies for investing federal grant dollars.

This effort began with the development of a crosswalk that integrates the current federal preparedness guidance doctrine and grants management practices into a planning construct that reflects New York's needs. The full crosswalk reflects not just the federal guidance that drives their missions, but also the state's guidance, including the New York State Homeland Security Strategy goals and objectives. An abridged version of the crosswalk is provided in Appendix 2. Based upon this assessment, the following functional branches were established[16]:

- Human Services
- Transportation Infrastructure
- Critical Infrastructure and Key Resources
- Emergency Services
- Agriculture and Animal Protection
- Public Health

[16] Several of the functional branches were in existence prior to the restructuring efforts of 2009; however, this effort resulted in a rescoping of all of the groups' missions and responsibilities.

- Law Enforcement and Security
- Communications
- Emergency Management
- Intelligence & Information Sharing

Each of the functional branches, which are chaired by state agency representatives, currently report to the New York State Homeland Security Strategy Working Group (SHSSWG). Per its direction, they have been assigned the responsibility to address appropriate federal grant funding investment in their assigned capabilities drawn from the federal Target Capabilities List (DHS, 2007).

Overall, the branches work to determine the current level of each target capability; identify financial investment prioritization; create strategic and tactical capability-based and risk-based discipline-specific plans; and ensure interorganizational operational coordination. Central to this research project is the existence of the Intelligence & Information Sharing functional branch. The recommendations that will be provided related to that functional branch are the core efforts that the state should consider to correct the existing gap in its efforts to achieve shared situational awareness. There are other steps that the state should consider taking as well, steps that will lay the foundation for success in filling the current information-sharing gap.

B. NEW YORK STATE HOMELAND SECURITY STRATEGY WORKING GROUP (SHSSWG):

As noted, the functional branches currently exist under the auspices of the SHSSWG. There are responsibilities assigned to the groups that fall outside the scope of that body's area of responsibility. For all efforts related to completing required federal reporting (e.g., the state Preparedness Report) and for developing strategies for the investment of federal grant dollars, the functional branch leaders report to the State Homeland Security Strategy Working Group (SHSSWG), led by the Office of Homeland Security. The SHSSWG is an agency-created entity that does not have the force of law or regulation to support it. For all of their efforts during the preparedness phase for strategic and tactical planning and activities undertaken during responses to

crises, the functional branches report to the state Emergency Management Office. This duality in reporting requires considerable coordination between OHS and SEMO to ensure that the directions being provided to the functional branches, including their current project priorities, do not conflict. It also creates confusion among functional branch leaders as they currently serve two masters. That the functional branches have been reconstituted and, in some cases, created, with their scope expanded to include preparedness-phase activities is a major achievement. The leadership and coordination element of this effort needs to be modified if long-term success is to be had and to lay the foundation for improving all of the state's capabilities, including information sharing.

Recommendation 1.a: Create the SHSSWG as a Committee within the DPC.

The state of New York should reconstitute the existing State Homeland Security Strategy Working Group (SHSSWG) to serve as the leadership team for the functional branches. To achieve this, the SHSSWG should be created under the legislatively mandated Disaster Preparedness Commission (DPC). This will provide the committee with greater legitimacy within the state's executive branch and among state agencies. Additionally, it will lend it credibility to the efforts of the group by broadening the number and scope of agencies that have visibility of and a say in its efforts.

Recommendation 1.b. The SHSSWG should adopt an all-hazards mission scope.

Since its inception more than twenty years ago, the DPC has maintained an all-hazards approach to emergency preparedness and response activities, including terrorism. While the functional branches approach their efforts in planning, capabilities assessment, grants management, and response activities from an all-hazards perspective, the SHSSWG was created to manage federal homeland security grants, historically with a focus on the hazard of terrorism. Its responsibilities have increased to include the completion of the annual state Preparedness Report (SPR), a process that is all-hazards in scope. Additionally, the NYS Homeland Security Strategy was revised in the fall of

2008 to adopt a broader scope, including multiple references to natural hazards that fall outside the traditional mission areas of homeland security (New York State Office of Homeland Security [NYSOHS[, 2009).

Given this expansion in scope of the existing guidance and practices, the SHSSWG should be reconstituted, including a new name that reflects its all-hazards focus, with a new mission and vision to meet every challenge that New Yorkers may face. It should be co-chaired by SEMO and OHS to ensure appropriate representation of the mission sets. This will allow for the homeland security mission sets of prevent and protect to be integrated with the ongoing emergency management efforts of mitigation, preparedness, response, and recovery.

C. NEW YORK STATE'S RISK PROFILE: HAZARD PROFILING EFFORTS

As noted in the hazard scoping discussion in Chapter IV, New York faces many risks and hazards. Since the identification of the hazards that New York faces provides its definition of "all hazards" and provides a scoping of the domains and information that should be participatory in its efforts to achieve a public safety shared situational awareness, the state must ensure that it has a process in place to develop and maintain an accurate, up-to-date portfolio of its hazards. To be all-hazards, this must include not just natural hazards but also man-made hazards, whether accidental or intentional.

Currently the responsibility to develop and maintain an up-to-date profile for natural hazards rests with the State Emergency Management Office (SEMO), which chairs the All-Hazard Mitigation Plan Working Group whose responsibility it is to complete the regular review of these hazards. Criminal and terrorism risk profiling is accomplished by the Office of Homeland Security and the New York State Police, with other law enforcement agencies at the state and local level providing input. Natural hazards risk profiling is important in the process of predisaster development of mitigation plans and the implementation of mitigation projects, both of which help to avoid or reduce the loss of life and damage to property when disaster does strike. The development of risk profiling by law enforcement officials allows for the targeting of

resources and capabilities within the Homeland Security mission sets of prevent and protect. While these two efforts have differing purposes, ideally they would culminate in a single, all-hazard risk profile for the state. [17] The only current formal, multiagency and multidisciplinary process for risk identification is accomplished by SEMO during its regular efforts to update the state Hazard Mitigation Plan. The group does not meet regularly but rather convenes only in the months preceding a FEMA-imposed deadline for the submission of an update and revision to the state's mitigation plan. As a result, the hazard profile for the state can be many months out of date.

Criminal and terrorism risk profiling is conducted on an ongoing basis by New York's law enforcement community. The results of these efforts are not shared except that both terrorism and crime are identified by law enforcement personnel as an existing risk. To develop a single, all-hazards risk profile, the All-Hazard Mitigation Plan Working Group should be restructured.

Recommendation 2.a: Formalize and Restructure the All-Hazard Mitigation Plan Working Group.

The All-Hazard Mitigation Plan Working Group should be established as a sub-committee of the Emergency Management functional branch under the DPC. This will provide the group with the legitimacy it needs to ensure proper membership and participation through the authority of the DPC. This will also require the group to engage in an ongoing effort, reporting its progress at each DPC meeting, rather than the current process of convening in the months preceding a plan revision deadline as established by FEMA. By working continuously on this effort, the state will maintain an up-to-date hazard risk profile at all times.

[17] It is recognized that many of the steps that law enforcement and intelligence officials take to develop a jurisdiction's crime and terrorism hazard profile include information that is at the very least FOUO and often classified. The risk assessment being considered here is merely to identify, in broad terms, what the risks include (e.g., domestic terrorism, organized crime) and where in the ranking of likelihood those risks exist when compared with natural and technological hazards.

Recommendation 2.b: Create and Maintain an All-Hazards Risk Profile for New York State.

Once the Hazard Mitigation Plan Working group is formally established, its membership should be expanded to allow for the achievement of a regularly updated all-hazards risk profile of the state. The core membership of the group should include representatives of the state agencies that have responsibility and jurisdiction for hazard domains that have been identified in this project, including the intelligence and law enforcement community. The group should develop relationships with local governments and partner with federal and private-sector organizations that can contribute insight and expertise into various hazards, including research and scientific support. The risk profile developed by the group should include the full spectrum of hazards and risks that may threaten or disrupt the lives of New Yorkers.

D. NEW YORK STATE'S INFORMATION MANAGEMENT CENTERS: STICC; SECC AND NYSIC

New York State's three primary information-management centers serve the state and its leaders well with their current efforts. How their collective efforts can be better coordinated to achieve an all-hazards, steady-state shared situational awareness via a common operating picture will be discussed under the next set of recommendations. The recommendation that stems from this research effort is that the mission and scoping of the three centers remain the same.

Recommendation 3: Ensure Synergy and Coordination of the Information Management Centers (STICC, SECC, and NYSIC) via an Information Sharing Governing Body.

Given the volume of information they manage, the number of partners they receive and draw information from, and the complexity of the hazard-domain areas they each maintain responsibility for, the focus of future efforts should be directed towards better integration and synergizing of the three centers' information-sharing efforts.

E. GOVERNING BODY FOR SA, SSA, AND COP COORDINATION – INTELLIGENCE AND INFORMATION SHARING FUNCTIONAL BRANCH

The Intelligence & Information Sharing functional branch was created in 2009, born from existing efforts to coordinate the investment of federal homeland security grant dollars. Its mission and focus have been within the realm of terrorism and criminal activities. Unlike several other functional branches, it did not exist in the functional branch process prior to this time and, therefore, does not have an existing scoping document, which identifies a branch's area of responsibility and goals related to planning, preparedness, and response activities. It is chaired by the director of the New York State Intelligence Center (NYSIC), a state police captain, and its membership includes senior and executive staff leaders from the Office of Homeland Security, state police, Division of Military and Naval Affairs, Office of Fire Prevention and Control, and Emergency Management Office.

Prior to its assignment as a functional branch, the group was merely an "Investment Justification" (IJ) multidisciplinary working group ("IJ team")[18] that convened during the annual grants cycle and solicited recommendations for projects for spending related to the target capability of information sharing. When New York expanded the role of the functional branches in 2009 to include grants management, the Intelligence and Information Sharing IJ team became the Intelligence & Information Sharing functional branch. Since that time it has, appropriately, been focused on the efforts needed to develop the state's investment strategy for the 2010 SHSGP monies. The grant cycle will be ending soon, and this branch is well-positioned to address the challenges identified in this research project.

Of the 37 identified target capabilities (TC), one TC clearly captures and identifies the concepts of SA and SSA during steady-state operations, as defined in this

[18] Prior to the 2010 State Homeland Security Grant Program cycle, the Office of Homeland Security, through its SHSSWG, created "IJ teams" which were assigned target capabilities, appropriate to the membership of each team. The IJ teams have subsequently been absorbed by or evolved into standing functional branches as described.

paper, as they relate to the terrorism hazard. Target capability 6 is "Information Gathering and Recognition of Indicators and Warnings." It defines the capability as such:

> The Information Gathering and Recognition of Indicators and Warning Capability entails the gathering, consolidation, and retention of raw data and information from sources to include human sources, observation, technical sources and open (unclassified) materials. Unlike intelligence collection, information gathering is the continual gathering of only pure, unexamined data, not the targeted collection traditionally conducted by the intelligence community or targeted investigations. Recognition of indicators and warnings is the ability to see in this gathered data the potential trends, indications, and/or warnings of criminal and/or terrorist activities (including planning and surveillance) against U.S. citizens, government entities, critical infrastructure, and/or our allies. (DHS, 2009)

The definition of this target capability fits perfectly within the current scope and mission of the Intelligence & Information Sharing FB as it relates to grants management. As this FB moves forward to develop its mission scope for planning activities, the activities that have been identified by the Department of Homeland Security also lay a solid path for the Intelligence & Information Sharing FB to follow (DHS, 2009). They include:

- Develop and Maintain Plans, Procedures, Programs and Systems
- Develop and Maintain Training and Exercise Programs
- Gather Information
- Identify Suspicious Circumstances
- Screen Information

One of the key findings of this research paper is that there are solid efforts in place to develop agency and domain specific situational awareness. It is in the sharing of that information with all relevant agencies and leaders that a gap exists. To address this gap, a multidisciplinary approach is needed, one that considers all hazards and how information is shared to create a genuine SSA. It is noteworthy that the concepts expressed in both the definition and recommended activities for the relevant target capability are easily modified to encompass an all-hazards mission scope. As such, several recommendations are provided for how the Intelligence & Information Sharing

functional branch can be leveraged to direct New York's efforts to achieve shared situational awareness during steady-state operations.

Recommendation 4.a: Expand the Mission and Scope of the Intelligence & Information Sharing Functional Branch.

To develop and coordinate the implementation of a set of policies, guidelines, and practices that transcend several agencies and areas of expertise, a single coordinating body is needed. This entity must have the authority and responsibility to achieve this mission as well. Since the Intelligence & Information Sharing functional branch will be exploring the policies and practices related to information capture, sharing, and dissemination as it relates to two of the state's identified hazard domains (crime and terrorism), there is no reason why it cannot also be leveraged to coordinate the development of policies and practices related to all of the state's hazard domains.

As noted, the Intelligence & Information Sharing functional branch currently focuses on terrorism and criminal activities. The current participating agencies, to one extent or another, do capture the identified hazard domains of law enforcement—criminal; law enforcement—intelligence; fire; weather; geophysical; and critical infrastructure. With an expansion in this functional branch's membership to include state agencies that can augment the existing understanding of the hazard domains that are partially understood by the present membership, the missing elements of the state's hazard domains, including transportation, health, food and agriculture, and environmental can be included by adding members from the state agencies with lead responsibility for these domains to the FB, as outlined in Chapter III. The expansion of the membership will also ensure that the state agencies that operate the three information management centers identified in this project (NYSIC, SECC and STICC) are part of the effort. This would provide the Intelligence & Information Sharing functional branch with the membership necessary to adopt an all-hazards approach to its efforts.

Recommendation 4.b: Develop Policies, Procedures, Guidelines and Processes for the State of New York's Agencies Related to Information Sharing and Management in Support of an All-Hazards Shared Situational Awareness, Including the Creation of a Daily Common Operating Picture Product.

Save for the handling of secure and sensitive information and data, the processes by which information is captured and shared for unsecured, all-hazards shared situational awareness is not dissimilar from the existing processes for sharing information related to crimes and terrorism. Once the holder of the information determines what information can and should be shared with other agencies, a process is employed to disseminate that information. To achieve a public safety all-hazards shared situational awareness, New York State needs to develop policies, guidelines and processes that result in a comprehensive and inclusive sharing of its public safety information.

To accomplish this, the Intelligence & Information Sharing functional branch should review the current practices, most of which have been identified in this research effort, employed by agencies and partners who contribute to the state's SSA. It should be directed by the DPC to develop policies, guidelines, and processes for consideration by the DPC for implementation by agencies that would accomplish the following:

- Ensure that all necessary data and information that is available and relevant is provided to or captured by the appropriate state agencies and state information management center (SECC, NYSIC and/or STICC);
- Establish policies and guidelines that determine what situational elements are provided in real time to various audiences (e.g., state public safety leaders; local and federal partners; executive branch leaders) and by what communications methodologies;
- Determine the scope and format of a New York State daily common operating picture report, including the process by which information is captured, analyzed, reviewed, approved, and included; at what time the document is distributed; and to what audience;

- Establish policies and procedures for the handling and dissemination of sensitive, secure and classified information, including the development of a standard set of policies that all state agencies must adopt to ensure the protection of sensitive information;
- Ensure that the target audience for sensitive and secure information is appropriately comprehensive;
- Identify the most effective methodology for sharing situational elements and the daily COP, while maintaining the integrity of information security and considering the ease of access and cost (e.g., Homeland Security Information Network);
- Identify information gaps in identified hazard domains and state agency-specific situational awareness efforts and work with state agencies as well as local, federal, and private-sector partners to fill those gaps; and,
- Identify methodologies and practices that can be employed to provide private-sector groups with greater access to all-hazards information to promote a broader shared situational awareness during steady-state operations.

These recommendations will be iterative and require considerable effort and commitment by the personnel and leadership of the state's agencies. They are also considered in the scope of the current operating environment. As new technologies, practices, and threats emerge, they must be reconsidered in light of those changes.

In the current environment, however, the implementation of these recommendations should serve to correct the information-sharing gaps identified in Chapter IV. If we assume that the recommendations directed to the Intelligence & Information Sharing functional branch are successfully implemented, the end result will be a coordination of hazard domain and state agencies' individual situational awareness. The establishment of a daily common operating picture that is vetted by all appropriate entities and inclusive of all necessary agency and domain information, can be developed.

Once it is delivered to the defined audience of public-safety leaders in a method that is accessible and understood, only then can an all-hazards, public-safety shared situational awareness be achieved. The model of the current efforts to achieve SSA (Figure 17) will then be outdated. These recommendations will result in a new model (Figure 20).

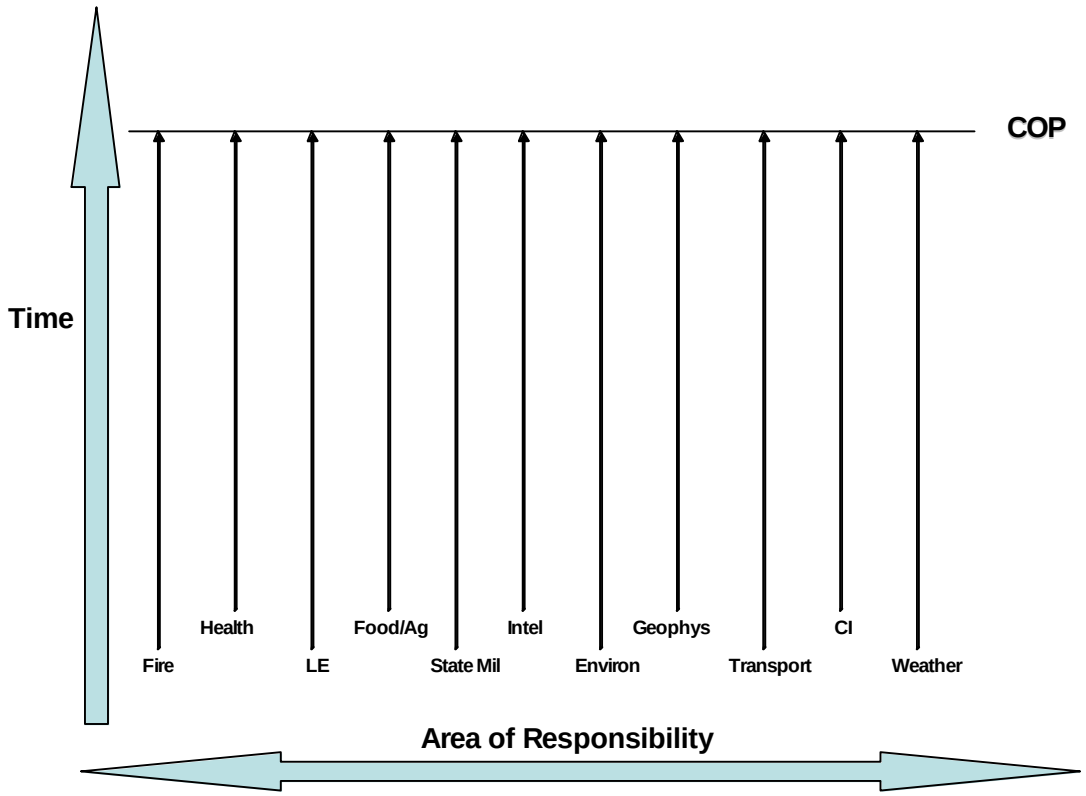

Figure 20.]=iol974SA & SSA Model of Hazard Domains via COP following Recommendation Implementation

F. CONCLUSION

The recommendations for the state of New York are conceptualized to leverage its ongoing efforts to synergize its approach to managing all phases of emergency management: mitigation, preparedness, response, and recovery. Additionally, they consider the Homeland Security mission areas of prevent and protect. The efforts initiated by the state's public-safety infrastructure over the past few years to adopt an all-hazards approach to planning, project identification, and financial investment

strategy development laid a solid foundation for how the state can achieve an all-hazards, public-safety shared situational awareness, via a common operating picture, during steady-state operations.

These recommendations are not "all or nothing." It is anticipated that the implementation of a set of recommendations for any of the areas identified will result in tangible improvements in the current information-sharing environment. The functional branches are well established and have accomplished a great deal of success, as they are currently configured with a dual-reporting (SEMO and OHS) structure. The advocacy to pursue the implementation of a single reporting structure under the Disaster Preparedness Commission seeks to codify this process as an institution within the state's disaster and emergency-management architecture. To achieve the goal of a steady-state, all-hazards SSA via a COP, the implementation of the recommendations provided for the Intelligence & Information Sharing functional branch is necessary.

The ability to achieve a partial solution should not be considered "good enough," however. It is the skill and leadership provided by the current set of functional branch leaders and key personnel at state agencies that has achieved the results to date. As with any organization, the state agencies and executive leadership will change in the future. It is incumbent upon today's leaders to set the stage for success for future generations.

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VII. CONCLUSION

> Vision without action is a dream. Action without vision is simply passing the time. Action with Vision is making a positive difference.
>
> –Joel Barker (Thinkexist, 2010).

This thesis explores how New York State can pursue an all-hazards, public-safety shared situational awareness via a common operating picture during steady-state operations. It examined the concepts of situational awareness and shared situational awareness, how they are used in contemporary public-safety lexicon, and the literature that has defined their meaning and application in both civilian and military domains. It concluded the first phase of this research by providing a definition of each and determined that the common operating picture is a "snapshot" in time of the operating environment.

By exploring the purpose of information sharing and the importance of collective information understanding, as it relates to and supports joint decision making, this paper determined that an established SSA not only enhances the ability of public-safety leaders to make day-to-day operational decisions but also provides them with a baseline shared understanding of their common operating environment when an untoward event emerges suddenly. Given the history of New York State, its propensity to experience disasters and emergencies, both man-made and natural, achieving an SSA is critically important. The most effective way to accomplish this is through the creation of a daily common operating picture product.

Shared mental models provide a conceptualization for decision makers of how the disparate components of a highly complex and interactive system, such as their jurisdiction and all of the systems operating within it, work together and affect one another. Additionally, it allows for a greater understanding of their role, the roles of their agencies and partner entities, and the potential outcomes of the decisions that they may make during crises.

The research and theoretical aspects of this project transitioned to the pragmatic by reviewing how New York State's state-level public-safety architecture currently engages in information management, including the sharing of individual agency and hazard domain information. Through a narrative description coupled with the application of several models of how the current processes interact and connect, a gap was identified. While great efforts are currently being undertaken by various state agencies, the information being collated and pushed toward the audience that is the state's "public safety leadership" is incomplete. Additionally, the information is not integrated into a single "snapshot" or COP. As a result, the emergence of a no-notice event that requires state-level public-safety leaders to make decisions requires them to first spend time gathering information about the state of the state's operating environment. Given the potential outcomes of not acting swiftly and decisively in the face of an emerging crisis, New York cannot afford to have its leaders operating with anything less than the most efficient level of leadership possible. This is true for any jurisdiction including towns, cities, and other states.

Despite this effort focusing specifically on New York, information management and sharing are important features of any locality's public-safety program. Within the discussion of situational awareness, shared situational awareness and common operating picture are examples of these concepts being applied at a local level to a generic jurisdiction. While states create their own unique architecture for how they provide emergency management and homeland security programs, in addition to other public safety services, the goal of achieving a comprehensive, steady-state SSA should be common among all jurisdictions. This research should serve as an example for other jurisdictions. Based upon their own hazard assessment, every community and state should determine which agencies hold responsibility and jurisdiction to capture hazard-specific data and information. Each agency should then assess the completeness of its situational awareness. Working together and developing both a narrative and modeled understanding of their current practices, they can then identify any existing gaps in their

pursuit of a steady-state SSA environment. It is anticipated that the efficacy of the daily COP product suggested for New York State would be similar for other jurisdictions as well.

The challenges to New York's current efforts are not insurmountable. They exist due to existing policies and practices by state agencies. There is no evidence that they were created intentionally. In fact, during the entirety of this research project, every state agency's representative who worked with the author to ensure accuracy in assessment of his agency's information-management efforts, as well as the executive teams at the state Emergency Management Office and Office of Homeland Security, conveyed an urgent appreciation for this effort. All noted that the current construct was not operating at the most efficient level and that steps should be taken to address this. The final conclusion of this thesis is the identification of the group of leaders who hold responsibility to address this issue.

In her well-researched thesis, Yi-Ru Chen explored the high expectations of Tier 1 UASI chief executives (e.g., mayors and governors) for situational awareness and notifications from their fusion centers and recognized that an engagement gap existed between chief executives and fusion centers. Her analysis concluded that much of the responsibility for determining what information is important to chief executives and their staff, including the timing and manner of delivery, rests with the stated needs and requirements of chief executives. Chen also uncovered through her research that senior staff and trusted advisors are key to identifying chief executive needs and requirements due to the chief executive's demanding schedule. Therefore, public-safety leaders should actively engage chief executives or their senior staff and trusted advisors (Chen, 2009).

The decision to take action in New York rests with the senior and executive staff members of the agencies and the state's executive leadership. Agency-level leaders must engage the state executive leadership in this process. Despite the repeated expressions of interest and desire to see the processes improved, it must be noted that the current challenges are human caused. We cannot change the course of the next hurricane, steering it away from the shores of southern Long Island. We cannot slow the falling of

lake-effect snow across the “south town” suburbs of Buffalo. What we can do is work together to continually assess and improve our information sharing efforts. The citizens of New York expect and deserve nothing less.

APPENDIX 1: NEW YORK STATE HAZARD PROFILE

Natural Hazards	Definition
Drought	A prolonged period with no rain, particularly during the planting and growing season in agricultural areas. Limited winter precipitation accompanied by moderately long periods during the spring and summer months can also lead to drought conditions.
Earthquake	The sudden motion or trembling of the ground produced by abrupt displacement of rock masses, usually within the upper 10–20 miles of the earth's surface.
Hurricane	Tropical cyclones, formed in the atmosphere over warm ocean areas, in which wind speeds reach 74 miles per hour or more and blow in a large spiral around a relatively calm center or "eye." Circulation is counterclockwise in the Northern Hemisphere.
Landslide	The downward and outward movement of slope-forming materials reacting to the force of gravity. Slide materials may be composed of natural rock, soil, artificial fill, or combinations of these materials. The term landslide is generalized and includes rockfalls, rockslides, block glide, debris slide, earth flow, mud flow, slump, and other such terms.
Winter Storm (Severe)	Includes ice storms, blizzards, and can be accompanied by extreme cold. The National Weather Service characterizes blizzards as being combinations of winds in excess of 35 miles per hour with considerable falling or blowing snow, which frequently reduces visibility.
Flood	A general and temporary condition of partial or complete inundation on normally dry land from the following: • Riverine flooding, including overflow from a river channel, flash floods, alluvial fan floods, and ice-jam floods. • Riverine flooding including dam-break floods; • Local drainage or high groundwater levels; • Fluctuating lake levels; • Coastal Flooding; • Coastal erosion
Subsidence	Depressions, cracks, and sinkholes in the earth's surface which can threaten people and property. Subsidence depressions, which normally occur over many days to a few years, may damage structures with low strain tolerances such as dams, factories, nuclear reactors, and utility lines. The sudden collapse of the ground surface to form sinkholes, many yards wide and deep within the span of a few minutes to a few hours, poses immediate threat to life and property.
Tornado	A local atmospheric storm, generally of short duration, formed by winds rotating at very high speeds, usually in a counterclockwise direction. The vortex, up to several hundred yards wide, is visible to the observer as a whirlpool-like column of winds rotating about a hollow cavity or funnel. Winds have been estimated to be in excess of 300 miles per hour.
Wildfire	Any instance of uncontrolled burning in grasslands, brush, or woodlands.
Extreme Heat	Temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks are defined as extreme heat. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground.

Natural Hazards	Definition
Hail Storm	Showery precipitation in the form of irregular pellets or balls of ice more than 5 mm in diameter, falling from a cumulonimbus cloud.
Technological Hazards	**Table 3-1**
Power Failure	Any interruption or loss of electrical service due to disruption of power generation or transmission caused by accident, sabotage, natural hazards, equipment failure, or fuel shortage. A significant power failure is defined as any incident which would require the involvement of the local emergency management organization to coordinate provision of food, water, heating, shelter, etc.
Dam Failure	An uncontrolled release of impounded water resulting in downstream flooding.

APPENDIX 2: NEW YORK STATE FUNCTIONAL BRANCH CROSSWALK

Functional Branch	Target Capabilities	Emergency Support Functions
Human Services	Mass Care, Volunteer Management and Donations (2)	#6 Mass Care Emergency Assistance, Housing and Human Services
Ag & Animal Protection	Food and Agricultural Safety and Defense Animal Disease Emergency Support (2)	#11 Agriculture and Natural Resources (except Historical Restoration)
Public Health	Medical Surge, Triage and Pre-Hospital Treatment, Medical Supplies Management and Distribution, Fatality Management, Mass Prophylaxis, Laboratory Testing, Isolation and Quarantine, Epidemiological Surveillance and Investigation, Environmental Heath (9)	#8 Public Health and Emergency Services
Emergency Services	WMD/ HazMat Response and Decontamination, Search and Rescue, Fire Incident Response Support (3)	#4 Firefighting #9 Search and Rescue
Law Enforcement & Security	Explosive Device Response Operations, Counter-Terrorism Investigation and Law Enforcement, Emergency Public Safety and Security (3)	#13 Public Safety and Security
CIKR	Critical Infrastructure Protection, Risk Management, Restoration of Lifelines (3)	#3 Public Works and Engineering #12 Energy
Emergency Management	Planning, Structural Damage Assessment, Economic and Community Recovery, EOC Management, On-Site Incident Management, Critical Resource Logistics and Distribution, Responder Safety and Health, Emergency Public Information and Warning, Community Preparedness and Participation, Citizen Evacuation and Shelter-in-Place (10)	#5 Emergency Management #7 Resource Support #10 Oil and Hazardous Materials Response #14 Long-Term Community Recovery and Mitigation #15 External Affairs
Communications	Communications (1)	#2 Communications
Intelligence & Info Sharing	Intelligence Analysis and Production, Information Gathering and Recognition of Indicators and Warnings, Intelligence and Information-Sharing and Dissemination (3)	N/A
Transportation Infrastructure	N/A	#1 Transportation

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LIST OF REFERENCES

Banbury, S., & Trembley, S. (2004). *A cognitive approach to situation awareness: Theory and applications*. Burlington, VT: Ashgate Publishing.

Barker, J. (n.d.). Joel Barker quotes. Thinkexist.com. Retrieved February 27, 2010 from http://thinkexist.com/quotation/vision_without_action_is_a_dream-action_without/211242.html

Bryson, J.M. (2004). Strategic planning for public and nonprofit organizations. Hoboken, NJ: John Wiley & Sons.

Buckley, W. (1998). Society—A complex adaptive system: Essays in social theory. London: Taylor & Francis.

Burton, F. & Stewart, S. (2007). Threats, situational awareness and perspective. *STRATFOR*. Retrieved January 10, 2010 from http://www.stratfor.com/threats_situational_awareness_and_perspective

Cannon-Bowers, J. A., Salas, E., & Converse, S. (1993). Shared mental models in expert team decision making. In N. J. Castellan (Ed.), *Individual and group decision making*. (pp. 221–46). Hillsdale, NJ: Lawrence Erlbaum Associates.

Chen, Y. (2009). Tell me what I need to know: What mayors and governors want from their fusion center. Master's thesis. Naval Postgraduate School, Monterey, CA.

Comperatore, C., & Rivera, P. K. (2008). Threats to situational awareness. *Crew Endurance Management* 5. Retrieved February 10, 2010 from http://www.uscg.mil/hq/cg5/cg5211/docs/CEMSnlpubs/Vol_5_Issue2.pdf

Copeland, J. (2008). Emergency response: Unity of effort through a common operational picture. Carlisle Barracks, PA: U.S. Army War College.

Department of the Army. (2008). FM3: Operations field manual. Retrieved January 5, 2010 from http://www.army.mil/fm3-0/fm3-0.pdf

Driskell, J. E., & Salas, E. (1991). Group decision making under stress. *Journal of Applied Psychology* 76(3). Retrieved January 7, 2010 from http://www.floridamaxima.com/groupdm.pdf

Eaneff, C. S. (2008). Evaluating the impact of contextual background fusion on unclassified homeland security intelligence. *Homeland Security Affairs* 4. Retrieved February 12, 2010 from http://www.hsaj.org/?fullarticle=4.1.3

Edmunds, A., & Morris, A. (2000). The problem of information overload in organizations: A review of the literature. *International Journal of Information Management* 20: 17–28.

Fan, X., Sun, S., and Yen, J. (2005). On shared situation awareness for supporting human decision-making teams. Retrieved January 13, 2010 from http://agentlab.psu.edu/lab/publications/ai4hs.pdf

Federal Emergency Management Agency. (2001). Understanding your risks: Identifying hazards and estimating losses. FEMA 386-2. Retrieved February 20, 2010 from http://www.fema.gov/library/viewRecord.do?id=1880

Federal Emergency Management Agency. (2004, November 23). NIMS and the Incident Command System. Retrieved November 28, 2009 from http://www.fema.gov/txt/nims/nims_ics_position_paper.txt

Federal Emergency Management Agency. (2009a). Developing and maintaining state, territorial, tribal and local government emergency plans. FEMA. Retrieved February 20, 2010 from http://www.fema.gov/pdf/about/divisions/npd/cpg_101_layout.pdf

Federal Emergency Management Agency. (2009b). NIMS FAQ: What is a common operating picture? Retrieved January 9, 2010 from: http://www.fema.gov/emergency/nims/FAQ.shtm

Federal Emergency Management Agency. (2010). Disaster information by state. Retrieved January 10, 2010 from http://www.fema.gov/femaNews/disasterSearch.do?pageInfo.pageStart=1

Federal Emergency Management Agency and United States Department of Justice. (2010). Considerations for fusion center and emergency operations center coordination. Global Justice Information Sharing Initiative.

Fiol, C. M., & Lyles, M. A. (1985). Organizational learning. *Academy of Management Review.* 10. Retrieved February 10, 2010 from http://www.jstor.org/pss/258048

Hakim, D. (2009, November 26). Stalemate in Albany as state nears its last dollar. *New York Times*, Retrieved November 28 2009 from http://www.nytimes.com/2009/11/27/nyregion/27budget.html

Hawking, S. (1988). A brief history of time: From the big bang to black holes. New York: Bantam Books.

Jefferson, T. (1810). Letter to Samual Kercheval dated July 12, 1810. Retrieved November 30, 2009 from http://www.monticello.org/reports/quotes/memorial.html

Knight, D.W. (2005). The Fourth Wish. In Visualisation and the common operational picture (COP) (pp. KN1-1 – KN1-10). Meeting Proceedings RTO-MP-IST-043, Keynote 1. Neuilly-sur-Seine, France: RTO. Retrieved November 15, 2009 from http://www.rto.nato.int/abstracts.asp.

Landgren, J. (2006, March 2). Common operating picture: Information technology and emergency & crisis response. Message posted to http://jonaslandgren.blogspot.com/2007/03/common-operating-picture.html

Larson, James R., Foster-Fishman, Pennie G., and Keys, Christopher B. (1994). Discussion of shared and unshared information in decision making groups. *Journal of Personality and Social Psychology* 67(3): 446–61.

Makinen, G. (2002). The economic effects of 9/11: A retrospective assessment. *Congressional Research Service.* Retrieved February 20, 2010 from http://www.au.af.mil/au/awc/awcgate/crs/rl31617.pdf

National Commission on Terrorist Attacks upon the United States. (2004). The 9/11 Commission report. Government Printing Office. Retrieved November 15, 2009 from http://govinfo.library.unt.edu/911/report/911Report.pdf

New York State Constitution. (2010). The constitution of the state of New York, as amended and in force since January 1, 2010. Retrieved February 20, 2010 from http://www.dos.state.ny.us/info/constitution.htm

New York State Emergency Management Office. (2007). New York State standard multi-hazard mitigation plan. Retrieved February 10, 2010 from http://www.semo.state.ny.us/programs/planning/hazmitplan.cfm

New York State Executive Law. (2006). State and local natural and man-made disaster preparedness. NYS Executive Law; Article 2-B. December 2006. Retrieved January 10, 2010 from http://www.semo.state.ny.us/uploads/Article%202-B.pdf

New York State Office of Homeland Security. (2009). New York State homeland security strategy. Retrieved March 3, 2010 from http://www.security.state.ny.us/publications/2009_NYS_Homeland_Security_Strategy.pdf

Nofi, A. (2000). Defining and measuring shared situational awareness. Center for Naval Analyses. Alexandria, VA. Retrieved November 14, 2009 from http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA390136&Location=U2&doc=GetTRDoc.pdf

Rogoff, B., Paradise, R., Arauz, R. M., Correa-Chavez, M., & Angelillo, C. (2003). Firsthand learning through intent participation. *Annual Review of Psychology* 54. Retrieved January 5, 2010 from doi:10.1146/annurev.psych.54.101601.145118

Saaty, T. L. (2008). Decision making with the analytical hierarchy process. *International Journal of Services Sciences* 1(1): 83–98.

Srinivas, H. (n.d.) Information for decision-making: Finding the information. Retrieved January 30, 2010 from http://www.gdrc.org/decision/info-decision.html

Stearns, P. N. (1998). *The industrial revolution in world history*. Boulder, CO: Westview Press.

Treurniet, W., Lasschuyt, E., van Hekken, M.C. (2005). Towards providing a Netherlands national COP. In *Visualisation and the common operational picture* (pp. 4-1 –4-2). Meeting Proceedings RTO-MP-IST-043, Paper 4. Neuilly-sur-Seine, France: RTO. Retrieved November 15, 2009 from: http://www.rto.nato.int/abstracts.asp

United States Coast Guard. (1999, December 15). U.S. Coast Guard common operating environment (USCG COE). Commandant instruction 5230.59. Retrieved January 7, 2010 from http://www.uscg.mil/directives/ci/5000-5999/CI_5230_59.pdf

United States Department of Homeland Security. (2006). The federal response to Hurricane Katrina: Lessons learned. Retrieved January 5, 2010 from http://www.gpoaccess.gov/Katrinareport/mainreport.pdf

United States Department of Homeland Security. (2007). Target capabilities list: A companion to the national preparedness guidelines. Retrieved February 10, 2010 from http://www.fema.gov/pdf/government/training/tcl.pdf

United States Department of Homeland Security. (2008). National response framework. Retrieved December 5, 2009 from http://www.fema.gov/pdf/emergency/nrf/nrf-core.pdf

United States Department of Homeland Security. (2009). Responder knowledge base: DHS TCL details. Retrieved March 2, 2010 from https://www.rkb.us/contentdetail.cfm?content_id=113235

United States Department of Justice. (2005). Department of Justice law enforcement information sharing program. Retrieved 12 February 2010 from http://www.justice.gov/jmd/ocio/onedoj_strategy.pdf

United States Department of Justice, Global Justice Information Sharing Initiative. (2008). Baseline capabilities for state and major urban area fusion centers: A supplement to the fusion center guidelines. Retrieved January 4, 2010 from http://www.it.ojp.gov/documents/baselinecapabilitiesa.pdf

United States House of Representatives. (2006). A failure of initiative: Final report of the select bipartisan committee to investigate the preparation for and response to Hurricane Katrina. Retrieved January 7, 2010 from http://www.gpoaccess.gov/Katrinareport/mainreport.pdf

United States Joint Forces Command. (n.d.) Common relevant operational picture (CROP). Retrieved February 13, 2010 from http://www.jfcom.mil/

Wise, C. R. (2006). Organizing for homeland security after Katrina: Is adaptive management what's missing? *Public Administration Review* 66(3): 302–18.

Zeleny, M. (1977). *Multiple criteria decision making*. New York: McGraw-Hill.

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