A CROSS-JURISDICTIONAL AND MULTI-AGENCY INFORMATION MODEL FOR
EMERGENCY MANAGEMENT

BY

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A Thesis Submitted to the Faculty of Graduate Studies in Partial Fulfillment of the
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ABSTRACT

"Only when public administration fully accepts and prepares to meet the challenge of achieving efficient and effective crisis management will we see a significant reduction in human suffering and economic loss due to unnecessary exposure of people and property to the risks associated with a complex, technological, urban society." W.J. Petak (1985)

Emergency management and the coordination of disaster-related activity are information-intensive, both in terms of the level of detail required and the diversity of information that must be generated, evaluated, and acted upon. Because the effectiveness of the information system supporting emergency management influences the success of disaster response, a commensurate level of attention to the system through which this information travels is necessary.

Although organizations at all three orders of government in Canada are dedicated to emergency management, there are indicators that the response structure may be somewhat *ad-hoc* and that the information system used to support crisis decision-making may not be fully capable of serving the cross-jurisdictional and multi-agency effort usually associated with disaster response.   To optimize coordination in crises, public officials involved in the policy and administration of emergency management must better appreciate and more fully address the distinctive communication and information requirements surrounding emergency management.

Serving as a baseline for this study were the various criticisms, made post-Red River Basin flood of 1997, that overall coordination across the municipal, provincial and federal jurisdictions was lacking and that decision-making and response activity, in general, were delayed. Based on the literature reviewed, the interviews conducted, the author's personal experience, and the use of Structured Systems Analysis and Design Methodology, this study proposes a simple and effective cross-jurisdictional and multi-agency information model for emergency management.

A well-designed information system is "the most important tool of crisis management" (Heath, 1999). The model proposed in this paper is one upon which subsequent design and implementation of such a system may be undertaken.

ACKNOWLEDGMENTS

DEDICATION

For Lillis,

who encouraged me to complete my graduate studies and who willingly gave up her access to all flat surfaces in favor of my books, papers, and study material during the production of this work. Thank you for your love, patience, support, and for the continuous provision of coffee.

LIST OF ABBREVIATIONS

ABBREVIATION	MEANING
C^2	Command and Control
CTT	Central Task Team
DND	Department of National Defence (Canada)
DOD	Department of Defense (U.S.)
EMO	Emergency Management Organization
EOC	Emergency Operations Centre
EOCC	Emergency Operations Coordination Centre
EPC	Emergency Preparedness Canada
ESM	Emergency Site Management
FEMA	Federal Emergency Management Agency (U.S.)
GIS	Global Information System
GPS	Global Positioning System
ICS	Integrated Command System
LA	Local Authority
LO	Liaison Officer
NATO	North Atlantic Treaty Organization
NDM	Naturalistic Decision-Making
NGO	Non-Government Agency
RPD	Recognition-Primed Decision-Making
SSDAM	Structured Systems Development and Analysis Method

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CHAPTER 1 - SITUATING THE STUDY

Introduction

Emergency[1] management is not generally considered in the mainstream of Public

Administration. Nevertheless, disasters experienced in the 1990s, and their consequent

social, economic, and political consequences, are moving this discipline into the national

political spotlight. Provincial and federal governments have responded to recent natural and

man-made disasters with financial and other supports. Events such as the avalanche of

February 2000 in Kangiqsualujjuaq, Quebec, the Swiss Air disaster off the coast of Nova

Scotia in 1999, the Ontario/Quebec ice storms of 1998, and the Red River Basin flood of

1997 have brought issues of emergency management to the attention of the public.

Emergency management organizations at all three levels of government are specifically

dedicated to the coordination of emergency management activities[2] and to the

administration of disaster financial assistance programs. This thesis examines a crucial

aspect of emergency management, namely the generation and utilization of information to

guide decision-making in crisis situations.

Background

In Canada, the responsibility for emergency management rests primarily with the

Local Authority (LA)[3]. Provincial, territorial and federal governments recognize, however,

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[1]   For the purposes of this chapter, the term "emergency" will, unless otherwise specified, be used interchangeably with similar terms such as "crisis" and "disaster." The term "crisis," however, is more fully developed at Chapter two.

[2]   There is unanimous agreement in the literature that the four phases typical of emergency management activity are *mitigation, preparedness, response,* and *recovery.* These phases are not necessarily sequential nor are they mutually exclusive of one another. Each one encompasses complex and often elaborate activities that require the participation of cross-jurisdictional and multi-agency officials and practitioners of emergency management (Grant, 1996). See Glossary for definitions of italicized terms.

[3]   The LA is typically defined by provincial and territorial legislation as (a) the council of an incorporated northern community, (b) the council of a municipality, (c) the council of an incorporated city, town or village, (d) the resident administrator or council of a local government

that in the course of protecting life and minimizing the destruction to property, the LA may eventually become overwhelmed by the event and may exhaust its financial, human and other resources. At that point, the LA can, under existing statutes, call for the support of the next higher level of government. In formal and legal terms, however, the LA maintains responsibility for the overall direction and control of response operations.

Canadian emergency planning guidelines suggest that, at the first level of responsibility, i.e., at the LA level, the requirement for information[4] is initially contained within the boundaries of the affected area. Local immediate response agencies such as police, fire and ambulance services will be communicating with the local Emergency Operations Center (EOC)[5], which is typically staffed by municipal officials and representatives of emergency services. Industry and other private sector institutions in the immediate area may likewise be feeding information into the local emergency management system, as might volunteer agencies and non-governmental organizations (NGOs) which are also on-location.

When, in the course of the crisis, local resources are no longer adequate or sufficient to continue the fight to protect life and property, a request for provincial assistance is necessary. In anticipation of this request for assistance, the provincial or territorial Emergency Management Organization (EMO), on behalf of the minister responsible for the legislation regarding emergency mitigation, preparedness, response, and recovery, is

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district, (e) the provincial or territorial authority responsible for Native jurisdictions, (f) the provincial or territorial authority responsible for (i) provincial or territorial parks, (ii) Crown lands, and (iii) wildlife management areas or wildlife refuges, (g) the Minister of Indian Affairs and Northern Development appointed under the *Indian Act* (Canada) with respect to a reserve as defined by that Act, (h) The Minister of National Defence with respect to a Canadian Forces Base, and (i) the Minister responsible for national parks under the *National Parks Act* (Canada) with respect to a national park.

[4]   See Glossary.

[5]   See Glossary.

already monitoring the situation and is in communication with those ministries and agencies that may be called upon to provide support.

Once the province or territory has entered into the situation, the information requirements naturally increase. Moreover, the information system[6] expands, becomes more complex and demands integration. Information not only continues to flow horizontally on the local plane but must now travel vertically to the provincial or territorial Emergency Operations Coordination Centre (EOCC)[7] and from there horizontally again to the departments involved. Communications[8] are further complicated by the fact that staff and resources belonging to various departments, agencies, NGOs, industry and other systems[9] may already be in location, *i.e.*, at the disaster site, and vital decision-making information may already be travelling directly to their parent command posts or operations centres in addition to, or to the exclusion of, the local EOC and the provincial or territorial EOCC.

Eventually, when a provincial or territorial government has exhausted its resources in support of disaster response activities, the provincial minister responsible for provincial or territorial emergency measures legislation will request the support of the federal government from the federal minister responsible for the *Emergency Act* (Minister of National Defence). Once the federal government and its resources become involved and another layer of coordination is appended to the already complex communication network, the information requirements are increased dramatically. A good example of the complexity

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[6] See Glossary.

[7] See Glossary.

[8] See Glossary.

[9] Wide reaching departments such as those involved in the provision of health, social services, highways and transportation have extensive information *networks* supplementary to the existing local and wide area networks serving all departments. Italicized terms are further defined at the Glossary.

that can arise from cross-jurisdictional, multi-agency response is the Canadian portion of

the Red River Basin flood of 1997. The response for this emergency involved the federal

government, 8,000 troops from the Canadian Forces, the Manitoba provincial government

through a number of departments and agencies, seven rural municipalities, the City of

Winnipeg, six towns, one Indian Reserve, several NGOs (e.g., the Salvation Army, the

Mennonite Disaster Relief Committee, the Red Cross), church groups, the private sector,

and several hundred thousand volunteers.

Statement of the Problem

The conduct of local emergency management activities, such as situation monitoring

and decision-making (i.e., properly determining priorities, effectively allocating resources,

and selecting the better courses of action) is contingent on the ability and capacity to

transmit, receive, share, and interpret meaningful[10] information. As the conceptual

representation of the existing information flow at Figure 1 depicts, the involvement of

several levels of government and multiple other agencies adds to the complexity of ensuring

that key players receive the information necessary to effect optimum performance and

decision-making.

Various reports published after the Red River Basin flood of 1997 identified

problems relating to communications and to the impact these problems may have had on

the decision-making process within the emergency response structure. For example, The

Ernst and Young Report, commissioned by the Province of Manitoba to review and evaluate

its emergency preparedness and response to the event, stated that the province's

departmental response was uncoordinated and that information was not properly shared

(1998, p. 28). The report went on to explain that each provincial department had its own

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[10]   Wilensky (1967) posits that meaningful information must have six characteristics. It must
be clear, timely, reliable, valid, comprehensive and diverse.
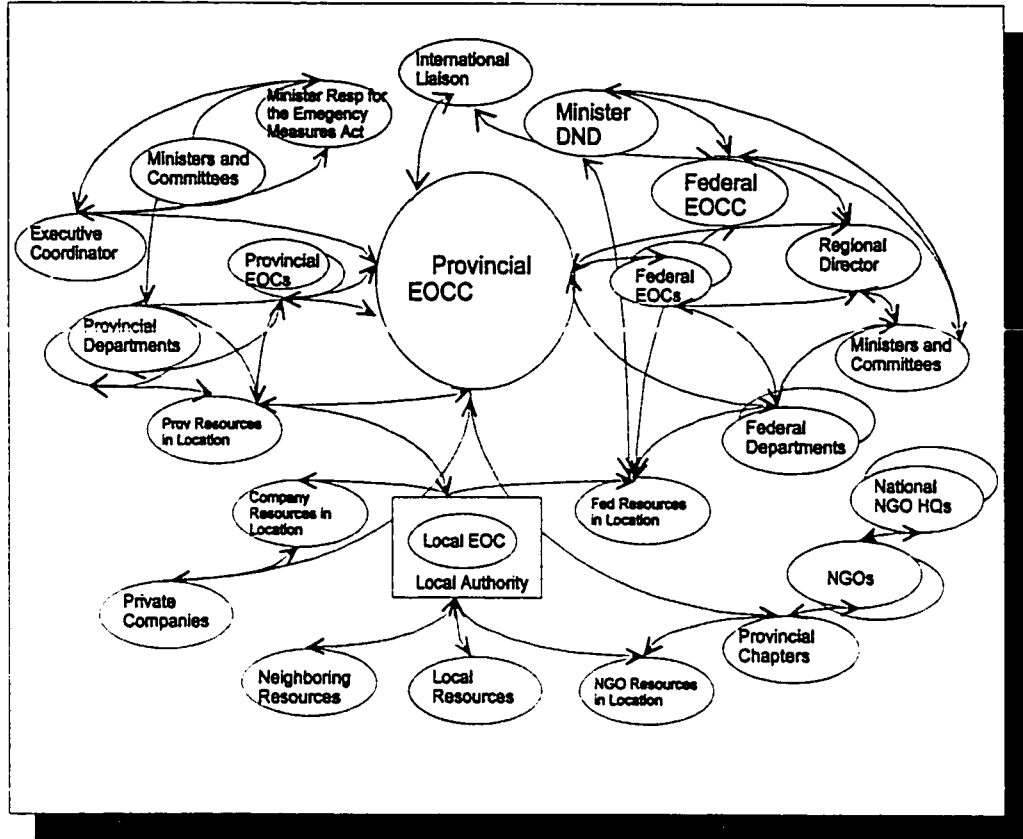
Figure 1 - Existing Information Model

internal source of information and relied solely on its own field people to gather intelligence. Consequently, the report found that the decision-making process was conducted in a disjointed and fragmented manner (Ibid.). Tait and Rahman, writing to the International Red River Basin Task Force of the International Joint Committee, reported that all LAs in the path of the rising water expressed even more serious concerns about "unilateral" decision-making and "usurpation of municipality responsibilities" (1997, p. 30).

Information was treated as proprietary and was not shared among the various other departments involved, nor in some cases, the LA (Ernst and Young, 1998, p. 28). The

difficulty in obtaining information from provincial departments was a great concern to the decision-makers at the LA level (Tait and Rahman, 1997, p. 46). Tait and Rahman noted "differential rates of communication in the actions of some government departments." "Ownership of the problem," according to their findings, "seemed to be one of the contributing factors to this difficulty. When departments did not see a problem as their own, reactions to it were uneven" (Ibid., p. 35).

Those interviewed by the Ernst and Young consulting firm perceived that "political" barriers, such as partisan political disagreements, could also have been responsible for the "stymied" openness between participants and for the general unwillingness to share information (1998, p. 28). Each provincial department was perceived as wanting to be the expert. As an unintended consequence of running independently, the provincial departments were reported to have, at times, provided conflicting information to the public and to the other departments and agencies responding to the event (Ibid.).

Conflicting information was also generated as a result of a failure to provide central coordination and to establish clear authority for the release of information to the media. For example, while LA officials were reassuring their municipalities that they were not going to be evacuated, the provincial EMO was issuing evacuation orders (Ernst and Young, 1998, p. 32). Many felt that provincial authorities could have been more pro-active with the media and that the delivery of media interviews needed to be better planned (Ibid.). The news media tend to sensationalize information in an effort to scoop the story, and measures to prevent rumours and to quash "informal" information networks should have been taken (Ibid.). Media relations, *i.e.*, communication between news reporters and the public, as well as between news reporters and those who were responsible for the management of emergency response, could have been improved (Ibid.).

More problems relating to the passage of meaningful information included a lack of full-time and experienced provincial liaison staff at the disaster sites to gather local intelligence, to facilitate the flow of information, to filter out redundant and extraneous information, and to help prioritize resource requests (Ibid., p. 30). As a consequence of this shortfall, provincial department personnel, including staff at the EOCC, were unfamiliar with the local conditions and incapable of incorporating local knowledge into their decision-making and recommendations (Ibid., p. 31; Tait and Rahman, 1997, pp. 30-31). LAs were treated as though they all faced the same threat, had the same response capabilities, and faced identical impacts (Tait and Rahman, 1997, p. 30). The knowledge and advice of local experts and inhabitants seemed to have been ignored by provincial authorities and the military (Ibid., p. 19; Manitoba Water Commission, 1998, p. 86). Exacerbating the lack of liaison staff at the LA and compounding the problem of miscommunication and misunderstanding was the lack of LA representation on EMO committees (Manitoba Water Commission, 1998, p. 87).

The absence of a dedicated Liaison Officer (LO) at the LA compelled its personnel to call the EOCC directly to pass information. Unfortunately, the information received from these sources was often improperly "packaged," uncoordinated, and at times, contradictory (Ernst and Young, 1998, p. 30). The information throughput to the EOCC was overwhelming. Moreover, because of the large volume of oral *versus* written information, and a lack of common terminology, information was often miscommunicated and misunderstood (Ibid.).

The sheer volume of incoming telephone calls was not only difficult to manage, it overloaded the EOCC resources. On more than one occasion, when City of Winnipeg officials attempted to call the EOCC, the telephone was not answered (City of Winnipeg, 1998, p.15). At other times, city staff was instructed by EOCC duty personnel to call back

on a public access telephone line, which not surprisingly, was also very busy (Ibid.). Because of the EOCC's inability to properly manage the large number of incoming calls, LA personnel ended up calling individual provincial departments directly to pass on or to receive information (Ernst and Young, 1988, p. 30). In spite of their efforts, the southernmost LAs received no official information regarding the actions being taken by the neigbouring state of North Dakota (Tait and Rahman, 1987, p. 47).

Even the cellular telephone network overloaded at times, causing the loss of cellular telephone communication (Tait and Rahman, 1997, p.46). Although an informal and alternate communication network was established by the LAs to obtain advice and support from each other prior to the occurrence of the disaster, during the flooding this network was also lost (Ibid.). Facsimile transmission devices (fax) were used routinely to communicate between LAs and the EOCC. Unfortunately, these too proved to be inefficient (Ernst and Young, 1998, p. 31; City of Winnipeg, 1998, p. 14). Information generated from trusted agents, either at the flood-threatened locations or at the EOCC, often arrived up to 24 hours late with the result that responses from the decision-makers at the LAs and provincial government were not as timely as they should have been (Ernst and Young, 1998, p. 31). Consequently, LAs and the EOCC relied on more readily available media channels for their necessary information and thus incurred the delays and filtering inherent in news reporting (Ibid.). It is not surprising that "the LAs [and the provincial government] reported delayed response, difficulty in getting rapid advice, insufficient information, insufficient consultations, and inconsistent communications" (Tait and Rahman, 1997, pp. 30, 46).

Problems within the emergency response structure also contributed to the information system shortfalls experienced during this event. Specifically, provincial departments followed policy guidelines set by their departments ministries instead of those policies and decisions set by the Central Task Team (CTT), which was comprised of

departmental representatives, as established in the Manitoba Emergency Plan, to coordinate the overall provincial response to crises (Ernst and Young, 1998, p. 28). Tait and Rahman reported widespread belief that the emergency response structure outlined in the provincial emergency plan, represented at Figure 2, did not work (1997, p. 30).

The City of Winnipeg's Report on its own response to the flood of 1997 claimed that:

"[the] CTT did not meet on a regular basis. Nor was it clear whether or not the Flood Committee (a subcommittee of the Inter-Agency Emergency Preparedness Committee) was intended to act in addition to, or instead of, the CTT. For the meetings which did occur the dates, times, chairman and attendees were all quite variable. Furthermore, there were not agendas, minutes, or other records kept of each meeting. Some meetings were either convened or cancelled on short notice. For several of the meetings, both Water Resources and Highways were not present and, arguably, these were the two lead departments in the provincial response" (City of Winnipeg, 1998, p. 15).

The Ernst and Young report explained that, as the emergency progressed, the coordination and tasking role of the CTT deteriorated into one of "micro-managing" and that the authority may have shifted to the provincial Deputy Ministers' Committee along the way (1998, p. 21).

The Deputy Ministers' Committee comprises Deputy Ministers from the various departments responding to the event. Members of the committee convene to inform, advise, and to make recommendations to the Minister responsible for the Emergency Measures Act with respect to the provincial response. It implements the direction of the Minister and provides direction to the provincial departments within the response structure (Province of Manitoba, 1999, p. 18).
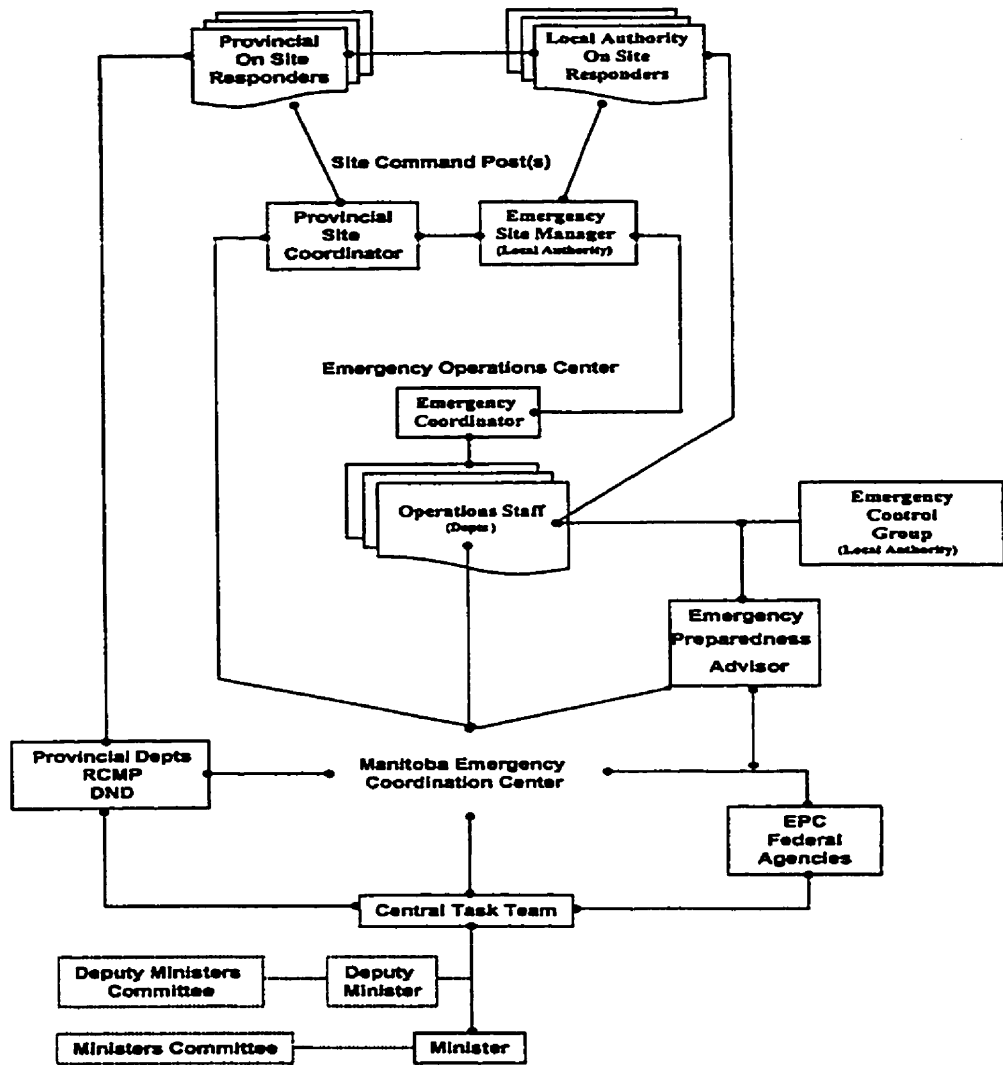
Figure 2 - Emergency Response Structure[11]

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[11]   Extracted from the Manitoba Emergency Plan, 1999, p. 9.

As the authority shifted, key personnel no longer attended the CTT meetings, partly because cabinet meetings were being held concurrently and partly because they perceived the erosion of the CTT's role and the drift of its members into narrower, more isolated deicison-making bodies had a correspondingly negative effect on the coordinating role of the provincial EMO (Ibid.). The Water Commission Report's findings indicated that LA officials were indeed confused as to what were the role and responsibilities of EMO and who was ultimately in charge (1998, p. 86).

Adding to the confusion, the complications of the information flow, and the constraints to decision-making were two separate structures of emergency management (namely, the "cooperation and coordination" and "command and control" structures) which coexisted during the entire period in which the military provided support to the province's flood of 1997.

The "cooperation and coordination" structure argues that organizational adaptability and operational flexibility are critical to the successful management of a crisis (Kuban, n.d., p. 8). Because disasters demand a cross-jurisdictional and multi-agency response, one organization's actions will invariably influence the outcome of the actions of others. The "cooperation and coordination" structure is designed to allow for this condition, as well as for variations in resource availability, jurisdictions, operational requirements, and organizational structures. In the "cooperation and coordination" model, the facilitation of inter-agency cooperation throughout the emergency management process is critical (Ibid.).

Furthermore, in keeping with the Canadian practice of emergency management, the "cooperation and coordination" structure respects the jurisdiction of the LA, emphasizing the responsibility that elected officials have to their constituents. It retains responsibility for response with those who have the best knowledge of their community. Finally, it implies the involvement, collaboration, and coordination of all key players in the emergency

management process (Ibid.).

The "command and control" structure used by the military, on the other hand, has an entirely different focus. NATO defines command as "the authority vested in an individual of the armed forces for the direction, coordination and control of military forces" (1988), and it defines control as "that authority which may be less than full command exercised by a commander over part of the activities of subordinate organizations, or other organizations not normally under his command" (Ibid.). According to Pigeau and McCann, command is typically characterized as an *attribute* or *a set of attributes*, whereas control is characterized as a *process* or *an aggregate of processes* (1995, p. 2). When command and control are used together, the result is the amalgamation of both definitions, *i.e.*, an attribute that is manifested through the authority and direction by a designated commander over assigned forces, and a process whose purpose is to perform functions through an arrangement of personnel, equipment, communications, facilities, and procedures (Ibid.).

A key finding of the interviews conducted by Ernst and Young was that the "cooperation and coordination" structure, characterized by looseness and flexibility, shifted to the "command and control" structure, characterized by rigidity and hierarchy (1998, p. 18). Equally important was the finding that no procedures were in place to manage the shift (Ibid., p. 19). Notwithstanding this difficulty, the interviewees at the Ernst and Young Report unanimously agreed that these two structures did "not dovetail well together" (Ibid., p. 18).

Overall, the involvement of the Canadian Forces was appreciated. Nevertheless, the LAs were frustrated that the on-site military had limited authority and that all actions requested by the LA had to be directed up and cleared by the chain-of-command (Ernst and Young, 1998, p. 29; Tait and Rahman, 1997, p. 14). Chain-of-command decision-making caused, what was perceived as, unnecessarily long delays in obtaining authorizations for action, inconsistent decisions over time, and the countermanding of previously agreed

decisions (Tait and Rahman, 1997, p. 31). As a consequence of misunderstanding the "command and control" structure, effective communication channels between the LAs and the military were not established (Ernst and Young, 1998, p. 29). Moreover, because it appeared that the military's role was different from the one the LAs would have assigned to it, the LAs felt their control of the emergency was being challenged. They also felt that the military was overly cautious, unable or unwilling to use local expertise, slow to respond to local requests and needs, and reluctant to share information the LAs did not have (Ibid.; Tait and Rahman, 1997, p. 14).

Although the military viewed its assistance to the province of Manitoba as "extremely successful," it too reported certain informational and decision-making issues that contributed to problems encountered. For example, it recognized that both military and civil authorities had limited knowledge and understanding of the concepts, limitations to and procedures for the conduct of military support to provincial emergencies. The distinction between types of assistance to civil authorities and their related limitations were not widely understood within the military chain-of-command or by the civil authorities (Deputy Chief of Defence Staff, 1997, pp. A-2 - A-3, A-5).

Moreover, the military found that it lacked comprehensive joint operations procedures and information system compatibility (Ibid., pp. A-3 - A-4). The Deputy Chief of Defence Staff Lessons Learned Report indicated that certain difficulties were encountered in establishing a "common denominator" that would ensure a force-wide communication network. The Report also indicated that the military had difficulty using information from outside sources as well as from within the Joint Task Force network. For example, some sub-units could not communicate with each other (Ibid.).

Not unlike the LA, the Canadian Forces also experienced frustration in dealing with an unfamiliar structure. Ignorance of the differences between military and civilian methods of operations (*e.g.*, staff structure, decision-making process, planning principles) created friction and tension (Ibid., p. A-9). Further complications were experienced in dealing directly with federal, provincial, and municipal levels of government and in "de-conflicting" the distinct agendas and authorities of each (Ibid.). However, the Deputy Chief of Defence Staff Lessons Learned Report stated that a bridge of understanding, credibility and trust was eventually constructed. It further elaborated that after directed effort and adjustment, effective and comprehensive civil-military cooperation was finally established (Ibid., pp. A-8 - A-9).

The informational and decision-making concerns reported by Ernst and Young, Tait and Rahman, Bennett, the City of Winnipeg, the Water Commission Report, and the military constitute but a small portion of the observations and concerns raised regarding the management of the Red River Basin flood of 1997. Nevertheless, the importance of the information system, particularly as it relates to the process of decision-making, is vital to emergency management. Accurate and timely information is the lifeline of any management system, but it is particularly critical in disasters (Kuban, n.d., p. 10). Disaster management systems must enhance existing organizational structures and information transfer patterns. Moreover, effective disaster management systems must also facilitate the flow of information across organizational boundaries, as well as between the response agencies and the public (Ibid.). The key to efficient and effective response management is the level of information transfer that occurs between decision-makers and between the decision-makers and the community (Tait and Rahman, 1997, p. 35). Bennett goes so far as to suggest that some of the losses experienced during the flood of 1997 were probably attributable, in part, to poor or nonexistent communications and the absence of shared

understanding of the issues to be addressed (1998, p. 16).

Despite the foregoing informational and communication deficiencies, and seemingly more by good luck than by good design, the local authorities, volunteer agencies and NGOs, industry, and the provincial and federal departments who played a part were generally able to meet the challenges posed by the 1997 flood disaster. In the main, the citizen's perception was that the province, the federal government, and particularly, the Canadian Forces put together a massive cooperative effort to mount a successful response to an emergency that threatened more than 70 percent of Manitoba's population. The general public was left with a sense of extreme gratitude. However, future crises are a certainty, and a similar or larger flood will manifest itself one spring. Therefore, to improve their emergency management policies and practices, elected officials, appointed public officials, and other actors involved must strive to ensure future responses will be based on the best informed decision-making and best coordinated action possible.

Thesis Statement

Irrespective of the disaster's scope or the level of governmental support to the crisis, emergency management and the coordination of disaster-related activity is information-intensive, both in terms of the level of detail required and the diversity of information that must be generated, evaluated, and acted upon. It follows that a commensurate level of attention to the system through which this information travels is necessary. In fact, the system, which facilitates the transfer of information between key players, is critical to the success of emergency management and to a coordinated, cross-jurisdictional, and multi-agency effort. It is vital for public officials involved in the policy and administration of emergency management to have a thorough understanding of the communication and information requirements in order to maximize effective performance and decision-making in crisis situations.

Using the problems reported from the Red River Basin flood of 1997 as a baseline, and on the basis of the literature reviewed, the interviews conducted, personal experience, and the Structured Systems Analysis and Design methodology, this study proposes a simple and effective cross-jurisdictional and multi-agency information model in support of emergency management.

Methodology

This study provides a practical examination of the information system framework in support of decision-making in disaster situations and, proposes a simple and effective information model for cross-jurisdictional and multi-agency use which addresses those problems identified in the above "statement of the problem." This model should be generally applicable to any future disaster situation.

The study uses the informational and decision-making aspects of the Red River Basin flood of 1997, as presented in the following government sponsored and non-government sponsored after-action reports, as a basis for the generation of an information model in support of decision-making:

- ❏ the Ernst and Young Report, which was commissioned by the provincial government to review and evaluate the emergency preparedness and response of the Manitoba Emergency Management Organization with the object of providing recommendations to improve those areas requiring improvement,

- ❏ the Manitoba Water Commission Report, an internal and independent review of actions taken by the provincial government during the 1997 flood in order to provide recommendations,

- ❏ the Disaster Research Institute (University of Manitoba) Report, which was written for the International Red River Basin Task Force of the International Joint Commission, identifying the views of the principal officials of the Rural

Municipalities and making recommendations based on discrepancies between their perceptions and "best practices,"

❑ the City of Winnipeg's Report on its own response to the 1997 flood, written as required by the City's emergency plan and as requested by the Chief Commissioner in order to present an internally-developed self-assessment with recommendations for improvement,

❑ the Canadian Forces After-Action Reports, written by all three Environmental Commands (land, sea, and air) for National Defence Headquarters highlighting difficulties experienced and areas of concern, and

❑ the Deputy Chief of Defence Staff Lesson Learned Report identifying the lessons learned from Op ASSISTANCE (the codename for the Canadian Forces' support to the flood of 1997).

In order to gather additional data in the area of informational and decision-making requirements related to the flood of 1997 and to crisis circumstances in general, qualitative and open-ended interviews were conducted with senior officials at all three levels of government, and with other actors in the domain of emergency management and/or crisis decision-making. The selection of candidates was intended to reflect a geographical and organizational cross-section of expert views on the subject matter. The following participants were interviewed:

❑ Executive Coordinators at provincial emergency management organizations in Ontario and Alberta,

❑ Behavioural Scientists at the Defence and Civil Institute of Environmental Medicine (2),

❑ the Manager of the Information Coordination Group at Emergency

Preparedness Canada (1),

- ❑ Senior Operations Officers at Emergency Preparedness Canada (2),

- ❑ a Staff Officer at the Joint Operations Doctrine Branch of National Defence Headquarters (1),

- ❑ Operations Officer at a provincial emergency management organization (1), and

- ❑ Former Emergency Coordinators at various Rural Municipalities, who were in place during the 1997 flood (4).

All interviews were of approximately one hour's duration and were conducted in person according to Dexter's "elite interview" criteria (1970). In other words, the interviews featured the interviewees' definition of reality, and all participants were encouraged to introduce and explore the issue from their perspective. For most interviews, question development was based on the individual being interviewed, but in all cases the questions focussed on the subject of informational issues in support of decision-making. In the case of the interviews conducted with the former Emergency Coordinators, however, the questions at Appendix B were used with all respondents.

Interviews were tape recorded to ensure that responses were fully and accurately captured and notes were compiled on the basis of the tapes. Time constraints prevented the *verbatim* transcription of the interviews.

The study involved a literature review that focussed on decision-making theory and on the use of information to support better decision-making, especially in crisis situations. It also involved drawing on the writer's personal experience as a Canadian Forces Communications and Electronics Engineer, as a participant and observer in the domain of emergency management over the course of 22 years in the Canadian Forces, as the

provincial Domestic Operations officer from 1995 to 1997, and as a special project officer with the Manitoba Emergency Management Organization from 1998 to 1999.

The development of the cross-jurisdictional and multi-agency information model in support of emergency management was based on the Structured Systems Design and Analysis Methodology (SSADM), which provided a framework for the analysis of the informational problems, the determination of information requirements, and the preliminary architecture of the model.

Outline

Chapter one provides a background to the Canadian emergency management structure and a discussion of the informational problems this structure experienced during the Red River Basin flood of 1997. The background and discussion lead to the thesis statement and to a description of the methodology used in the completion of the study.

Chapter two differentiates normal from crisis decision-making and examines various decision-making theories as they pertain to both contexts. Chapter two underscores that decision-making, on whatever level and in whatever environment, implies the notion of gathering and evaluating information and concludes that good decisions flow from well-designed information systems.

Chapter three elaborates on this principle and concerns itself with information and communication theories in terms of how these might illuminate crisis decision-making and crisis management. Ultimately, it attempts to ascertain the specific information requirements of crisis decision-making and to conceptualize these information requirements flowing through an emergency management structure.

Chapter four builds a cross-jurisdictional, multi-agency information model which addresses the informational problems associated with the management of the 1997 Red River basin flood. The model provides a foundation upon which a standard emergency

management information system may be designed and implemented for crisis managers to better meet the next crisis, irrespective of its nature or its location.

Chapter five summarizes the main findings of the study, reinforces the conclusion that an emergency management information system is needed to ensure effective coordination of emergency management activities, and identifies areas for further research.

CHAPTER 2 - DECISION MAKING

Introduction

Decision-making, on whatever level and in whatever environment, implies the notion of gathering and evaluating information. This chapter reviews selected literature pertaining to decision-making, differentiates non-crisis from crisis decision-making, and examines various decision-making theories as they relate to both contexts.

Non-Crisis Decision-Making - Discussion

The topic of decision-making in non-crisis circumstances, *i.e.*, within the context of ordinary affairs, has been the subject of much examination through the years by many scholars. Various theories have been presented both to explain the outcomes of decision-making in different fields and to assist decision-makers with procedures for better decision-making. In most cases, these theories deal with decision-making as a systemic process with clearly defined elements and in a distinct sequence of steps. In other cases, the theories focus on how the wider, underlying political forces interact, how the values of decision-makers may change over time, and how the perceptions of the outcomes by the participants may vary. Generally, however, there is agreement in the literature that non-crisis decision-making takes place relatively slowly over time in a relatively stable environment which contains established goals, norms, and procedures.

Unfortunately, many examinations of non-crisis decision-making, do not adequately broach the condition of a cross-jurisdictional and multi-agency environment. Instead, they often presume a single, unified actor (making unilateral decisions, even when the focus is on governments that consist of a variety of organizations, not all of which share the same goals, perspectives and interests). The unified actor model does not fit with the changing environment of the public sector, which is characterized by rapid change, interdependence, the necessity for collaboration, shared authority and influence based upon continuous

interaction. However, literature on decision-making is slowly incorporating recognition of the complications of these new interconnected realities.

Although non-crisis conditions in the public sector more easily allow for a series of well-deliberated and related decisions, decision points[1], corrections, and adjustments in the course of decision-making, the non-crisis framework may restrict innovation and/or the choice of alternatives considered (Simeon, 1976, p. 555). This framework is made up of a variety of considerations including the nature of the institutional structure, procedural factors, the influence of power, social and cultural attitudes and ideas, professional standards, national or regional economic conditions, and anticipated political developments (Adie and Thomas, 1987; Graber, 1992).

Another potentially restricting element that might be included in this framework is the essential requirement to mobilize public understanding and support for the outcomes. Although these considerations might also appear in crisis decision-making situations, they are quickly subjugated to a lesser role by the "crisis condition" *dictum* that "decisions have to be made urgently or lives and property are lost" (Auf der Heide, 1989, p. 56). Moreover in crisis, people tend to allow their leaders, the decision-makers, more control over their lives (Hamblin, 1958).

Non-Crisis Decision-Making - Models

In examining non-crisis decision-making, Heath (1998), Klein (1998), Rainey (1997), Graber (1992), Kernaghan and Segal (1991), and Adie and Thomas (1987) all bring certain mainstream theories to the fore, namely:

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[1]   Decision points are points in time when reasonable options exist, which may be considered or taken by the decision-maker. Even if no other option is consciously considered, as long as one was available and was potentially known to the decision-maker, a decision is considered made (Klein, 1997, p. 16).

- Comprehensive Rationality,

- Incrementalism,

- Bounded Rationality and *Satisficing*,

- Mixed Scanning,

- Aggregation,

- Garbage Can, and

- Public Choice.

Each one of these theories will be examined briefly in order to present an incorporated perspective of non-crisis decision-making.

Comprehensive Rationality. The theory of comprehensive rationality is the most widely accepted theory of non-crisis decision-making in government (Adie and Thomas, 1987, p. 199). Its approach uses logical, precise procedures that are characterized by clarity of objectives, reliance on information, explicitness of evaluation, a high degree of comprehensiveness of overview, and wherever possible, quantification of values for mathematical analysis (Lindblom, 1959). Decisions based on comprehensive rationality involve a multi-step analysis. For example, the target problem is separated from other problems or, at least, is subjected to meaningful consideration in comparison with other problems. The consideration of the problem yields goals, values, or objectives which are subsequently clarified and ranked according to their importance. Alternatives for dealing with the problem are examined. Consequences for each alternative are investigated and compared. Finally, the correct alternative, *i.e.*, the one that is believed to maximize the attainment of the goals, values or objectives while minimizing the consequences, is chosen

(Anderson, 1984, p. 8).

Another way of representing the multi-step decision-making process associated with comprehensive rationality is posited by Klein (1998, p. 261). His model of comprehensive rationality consists, first, of collecting objective information that can be described and checked by others. Next, tasks, ideas, arguments, or problems must be decomposed into small basic elements so that different calculations might be performed on them. These small basic elements must then be decontextualized from the often too ambiguous big picture. The necessary calculations, *i.e.*, the range of formal procedures such as deductive rules of logic and statistical analysis must be applied to them in order to determine the courses of action available from which to choose[2]. Finally, the whole process of analysis and representation must then be open to public scrutiny (Ibid.).

Advantages to the use of comprehensive rationality in non-crisis decision-making circumstances include the reduction of the chance that an important option will be overlooked, and the maximization of the chance that the decisions will be reliable, *i.e.*, that they will yield the same result each time for the same analysis. It provides the benefits of an orderly, systematic, and quantitative decision-making approach and it provides a general strategy that applies in situations where goal agreement and technical knowledge are high. Comprehensive rationality supports a broad and vigorous search for many options rather than deep searches of only a few, and it allows the decision-maker to use declarative knowledge, *i.e.*, knowledge which can be explained. It can be particularly useful in helping novice decision-makers determine what they do not know. It also serves well in providing higher authority with the evidence it often seeks that alternatives were considered.

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[2]   Techniques typically used in rational decision-making to help the decision-maker make sense out of complicated choices are operations research, statistical decision theory, decision trees, cost-benefit analysis, and *systems analysis* (Klein, 1998; Kernaghan and Siegel, 1991; Lindblom, 1959). Italicized terms are further defined at the Glossary.

On the other hand, comprehensive rationality presents certain disadvantages. One of them, according to Klein, is that the small basic elements vital to the process are likely to depend on individual goals and methods of calculations and are therefore potentially at risk of being identified arbitrarily (1998, p. 262). Other problems relate to the difficulties of using ambiguous rules, setting up the calculations, trying to apply rational methods to a large set of factors, and trying to work out the implications of all the different combinations (Ibid.).

An even more important limit on rational decision-making in practice is the difficulty of ranking goals, values, or objectives in a pluralistic society. As Kernaghan and Siegel suggest, the issue becomes: "Whose goals and whose values should predominate in decision-making?" The best technical analysis available, they add, is useless if there is no agreement on the answers to these questions (1991, p. 116). Even if there were agreement on "who" and "what," the requirement for comprehensive analysis potentially introduces severe complications as a result of the theory's stipulation that the decision-maker find and compare all potential solutions. Fortunately, because the non-crisis environment is somewhat time-tolerant and allows room for correction and adjustment, the limits of comprehensive rationality, in that environment, may be of slight consequence.

Klein suggests that rational thinking is like foveal[3] vision, which provides the ability to make fine discriminations but is not sufficient alone to maintain orientation and is irrelevant during in the dark. Similarly, rationality lets decision-makers make fine discriminations between ideas. However, the decision-maker needs peripheral vision to detect where to apply the analysis and calculations (1998, pp. 260-1).

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[3]   The fovea is a small depression in the retina at the back of the eye. This is the area of the greatest acuity.

Comprehensive rationality poorly serves the decision-maker who is lacking all the information required, who is unsure how to do the ratings, who disagrees with the weights, or who runs out of time before a decision can be made. The assumptions of comprehensive rationality are indeed restrictive. Irrespective of crisis or non-crisis conditions, rarely is there the time or the information needed to make this type of appraoch work. Although comprehensive rationality may play a dominant role in a few decision-making situations, it is more likely that its role in most decision-making situations is limited at best. Adie and Thomas suggest that comprehensive rationality as a decision-making technique is not applied very easily in practice (1987, pp. 200-202).

Lindblom (1959) echoes the concerns raised above and adds that for complex problems, rational decision-making is impossible. Rational decision-making is overly dependant on intellectual capacities, sources of information, time, and money, all of which are in short supply. Although decision-makers may strive for rationality, cognitive limits, lack of information, time limits, and other uncertainties force them to adopt another way of thinking their decisions through. One alternative is for decision-makers to make choices and/or change the policies incrementally by way of successive limited comparisons between the *status quo* and other nearby alternatives. Another is to undertake a limited or bounded search among options and choose the most satisfactory one after as much consideration as can be managed within the constraints imposed by the situation. These approaches involve ascertaining the preferences of interested groups, calculating how the various alternatives benefit or harm these groups, balancing diverse political interests, and ultimately negotiating with representatives of conflicting interests (Graber 1992).

Incrementalism. The theory of incrementalism, or the method of successive limited comparisons, attempts to answer some of the difficulties identified with rational decision-making theory. Realism, intuition, economy of information, relevance, flexibility, resilience,

and loose structure characterize incrementalism, according to Adie and Thomas (1987, p. 203). Moreover, incremental decision-making is exploratory in the sense that goals and means are adjusted in the light of experience, and it is continuous in the sense that there is no single decision or right solution to a problem[4] (Kernaghan and Siegel, 1991; Lindblom, 1959).

Adie and Thomas list a number of incrementalist strategies to cope with complexity (1987, p. 203). These include simplifying the problem through omission; *satisficing* by adopting policies that will satisfy the demands being made and suffice for the present; adopting a remedial approach that seeks workable solutions to eliminate known and/or limited social ills rather than to produce best solutions towards some desired, future state of affairs; making use of feedback loops by deliberately making decisions that leave open the possibility of doing better the next time; and making use of bottlenecks to create more time to clarify problems and whether or not to make a decision at all. Incremental decision-making should make it easier for one group to anticipate the kind of moves another might make, and easier to make corrections so as to avoid serious lasting mistakes (Lindblom, 1959, p. 27).

However, a variety of criticisms of incrementalism are also present in the literature. Lindblom (1959) himself alludes to the lack of a built-in safeguard for all relevant values, which may lead decision-makers to overlook excellent policies for no other reason than that they are not suggested by the chain of successive policy steps leading up to the present. Incrementalism is too conservative in its approach and it does not take account of major

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[4]   The better decision, however, is likely the one upon which political agreement is found (Adie and Thomas, 1987).

social innovations, nor does it sufficiently differentiate between fundamental[5], incremental[6], or routine/procedural[7] decision-making approaches (Etzioni, 1967). Rather, it mistakes routine decision-making for all decision-making and does not include those situations when decision-makers are prepared to expend the costs in terms of time, personnel, and effort in order to make more fundamental decisions, *i.e.*, more radical changes to policy. It also ignores the fact that power is unequally distributed within society. By stressing that the best decision is often the one on which political agreement can be found, the incrementalist accepts that privileged and well-organized groups have the advantage.

Dror provides yet another critical view of incrementalism by stating that, for it to work, extant policies must be basically satisfactory so that marginal change is all that is necessary in order to achieve desired results (1988). If the existing policy is flawed,

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[5] Fundamental decisions are significant departures from approaches previously taken in policy areas, and involve higher degrees of uncertainty and complexity. As a rule, far more resources must be devoted to anticipating possible outcomes from fundamental decisions. Moreover, more information is necessary, not only to obtain support to make and implement a fundamental decision, but also to plan and persuade (Lindquist, 1988, pp. 101-2).

[6] Incremental decisions tend to be reactive and remedial in nature. The makers of incremental decisions are rarely interested in redesigning policies from top to bottom, and instead tend to make marginal changes to prevailing policies. Moreover, incremental deviations from the *status quo* are more likely to be found acceptable by decision-makers because outcomes are easier to predict; more is known about current practice than radical proposals. Limited policy changes are also attractive because social problems are rarely solved; decision makers realize they will inevitably confront the same problems in the future; and incremental changes are easier to justify and to gain support for, in political terms. It follows, that decision-makers have incentives to consider problems successively and in isolations from other problems, so that they can produce temporary solutions and move on to the next problem (Lindquist, 1988, p. 99).

[7] Routine decision-making occurs when a formal, pre-existing, long term consensus is in place regarding the nature of the courses of action available. Very little deviation from the ordinary is ever anticipated under this category of decision-making. Routine decision systems are designed and intended to anticipate and respond to problems that may arise in program performance or environmental conditions. Responding to problems under the category of routine/procedural decision-making are often reduced to checking standard operating procedures or some other such anticipatory guidelines. However, routine does not preclude decision-making. Rather, decisions establish procedure, trigger particular programs, and identify and solve problems that were not [originally or previously] anticipated by routines" (Lindquist, 1998, pp. 96-8).

incremental change is futile. Likewise, incrementalism is inappropriate when radical change is called for (Ibid.). Incremental decision-making lends itself only to problems which remain more or less constant and which are disposed to incremental change. The most obvious difficulty on this point occurs when a problem arises and must be resolved, but there simply are no previous conditions upon which to make incremental changes. In order for incrementalism to be relevant, there must be strong continuity in the available means for coping with problems. For example, faced with new problem-solving methods, technology, or knowledge, decision-makers would be hard pressed to make an incremental change at the outset (Adie and Thomas, 1987, p. 202). It follows that in the face of crisis conditions, the decision-maker is justified in seeking a better decision-making routine.

Mixed Scanning. As an alternative, or rather as a modification, to the incremental approach to decision-making, Etzioni calls for a hybrid approach that combines rationality and incrementalism wherein a scanning of alternatives is mixed, in the sense that only a few aspects of a problem and only a few alternatives are selected for intensive analysis (1967). This fundamental review process would occur when faced with rapid change, when unusual circumstances occur, or when there has been prolonged neglect or mistaken treatment of a problem (Kernaghan and Siegel, 1991; Adie and Thomas, 1987).

Etzioni's mixed scanning theory of decision-making provides a reminder that decision-making within government typically varies in scope and magnitude and that the approach taken must be appropriate with the level at which the decisions are being made. For example, mundane, incremental decision-making may predominate the lower levels of bureaucracy. However, more encompassing scanning of alternatives may be prevalent at higher levels. Mixed scanning seems to provide for greater theoretical recognition of those occasions when bold, forthright policies are called for and are possible (Adie and Thomas, 1987, p. 205). Although this decision-making technique realizes some economy of time and

information by not having to review all possible courses of action, the maintenance of the "intensive analysis" requirement may preclude its effective use in crisis circumstances.

Aggregation. Graber describes an aggregative model of non-crisis decision-making wherein the decision-making process involves a combination of information, advice, and options drawn from many groups, internal as well as external (1992, p. 127). These groups are brought together to develop various alternatives and to vote for the option they prefer. The final choice, then, represents an aggregation of individual preferences rather than the negotiated outcome of incremental decision-making. Although the aggregative process may be good for generating ideas, Graber warns that it may be unrealistic because it tends to ignore political interests, agendas, and power relationships among the participants (Ibid.).

The Garbage Can. March and Olsen offer a non-crisis decision-making model that involves drifting into decisions without a well-planned search for relevant information and without making explicit choices (1979, p.26). In this garbage-can model, various options are discussed, but more as a way to debate goals than to reach a decision. They contend that the more deliberative decision-making models are, the more unrealistic they are. In most decisions, they argue, problems are not fully understood, goals are not clear, and interpersonal relationships are unpredictable. In their view, solutions are generated haphazardly, and final decisions emerge only from the interplay of a garbage-can collection of disparate ideas, judgements, and non-decisions. Viewed in this way, attempts to gather information that is relevant to a decision are mostly window dressing and are, even if sincere, futile (Graber, 1992, p. 128).

Public Choice. Public choice, another model of non-crisis decision-making, aims to explain collective decisions in terms of self-serving behaviour in decision makers, whether individuals, politicians, or bureaucrats. It also serves to explain the interactions between these groups. However, this model of decision-making leads to strongly stated propositions

about what decision-makers would be expected to do in a given set of circumstances. The difficulty in determining the value of public choice decision-making is that courses of action are presumed to be based on the particular decision-making group's motivations, which are typically subjective (Kernaghan and Siegel, 1991, pp. 120-122).

Non-Crisis Decision-Making - Analysis

An Incorporated Perspective. Non-crisis decision-making, irrespective of the approach or theoretical conceptualization, entails four major phases, each requiring the gathering and processing different strands of information. The first phase involves problem analysis, the second yields various options to cope with the problem and their exploration, the third speaks to the selection of a course of action, and the fourth phase entails monitoring the consequences of the decision and generating feedback about changes that might be required.

Analysing the Problem. Since assembling *all* the facts is invariably impractical, *satisficing* is a viable alternative that allows fact-finding to stop when a reasonably satisfactory solution has come into view. However, because the facts of a particular situation are frequently unclear, decision-makers, in an attempt to cope with this fog, may delay their appraisal until more information is available, or they may decide to take no action at all. Alternatively, they may draw on institutional memories for analogous events of the past and on the insights gained in coping with them. Relying on past institutional experiences, however, may pose certain risks. For example, contextual changes, which may falsify analogies, may be overlooked. Likewise, too much stock may be placed on lessons learned from events that have only occurred once or twice before. Additional relevant information and suggestions must, therefore, be sought from as broad a spectrum of informants as time and resources will allow (Graber, 1992, pp. 119-120).

Decision-makers, unfortunately, are often constrained in their information gathering by authorizing legislation, internal inflexibility and inadequate information systems, political considerations, or psychological characteristics. Moreover, they may often feel compelled to tap only the sources that are likely to support the goals of the institution's leadership and the authorities on which the institution depends. At best, such constraints are apt to severely discourage innovative approaches to various situations and may limit effective decision-making (Ibid.).

Exploring the Options. Decision-makers must have enough information about their institutional internal environment, the external environment in which the situation is developing, the activities of other public and private actors, as well as certain aspects of the political culture, to be able to judge the kinds of decisions that can or should be implemented. Coordination of various approaches to the problem may become consuming, as might the process of determining whether to invoke a decision to retain the *status quo*. Implementing small incremental change is generally easier than opting to make a major or radical change in direction (Ibid., p. 121).

The exploration of options in the public decision-making arena must also involve consideration of public scrutiny and media attention. Although not intended as a determinant in decision-making, it is essential to be aware of the perceptions and acceptability of the various options and of the possible reactions from interested external groups. Solutions that run counter to the preferences and wants of those affected by them are more difficult to implement. Disappointed groups must be mollified by acceptable explanations or appeased in other ways. For acceptable explanations to be presented, the consequences of the choices under consideration must be considered even though this process may lead to controversies among decision-makers that can threaten the necessary institutional consensus (Ibid.).

<u>Selecting the Course of Action</u>. This phase brings the scientific principles and theoretical concepts and models described earlier into play, *i.e.*, comprehensive rationality, incrementalism, bounded rationality and *satisficing*, mixed scanning, aggregation, garbage can, and public choice. Graber posits that, depending on the circumstances, these differing decision-making routines may be used singly or in combination (1992, p. 122). Pinfield sees decision-making as a mixture of rational and anarchic processes (1986, p. 382). Whenever goals and procedures are clear and uncontested, decision-making moves in rational steps from problem recognition to resolution. Otherwise, the process may tend towards anarchy[8] (*i.e.*, doing things solely because the decision-maker said so). The critical factor in determining which process prevails is the clarity and acceptability of goals, and the steps to reach them.

<u>Feedback</u>. Once the decision is made and implemented it is important to monitor the consequences so that adjustments can be made, if necessary. Decision-making in general and feedback in particular are learning processes through which government gains knowledge of the environment in which it operates and develops the ability to make sound decisions (Graber, 1992, p. 131).

Crisis Decision-Making - Discussion

Although the terms "crisis," "disaster," "catastrophe," and "emergency" are all often used interchangeably in the general literature, the term "crisis" predominates in the decision-making literature. Therefore, for the purposes of the immediate discussion, "crisis"

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[8]   It is possible that Pinfield here is trying to elaborate on the concept of "intuition." Beach and Mitchell also present a contingency model of decision-making, arguing that the type of strategy a decision-maker uses changes depending on the context of the decision task - using rigorous analytical methods here, and non-analytical methods there. In explaining non-analytical methods they suggest terms like "gut feeling," tossing a coin, and "eeney meey miney moe" (Beach and Mitchell, 1978, pp. 439-449). Klein argues that what Beach and Mitchell are really trying to describe is intuition (Klein, 1998, p. 34.). Intuition is covered under its own heading below.

will be used exclusively.

What is a crisis? To some, a crisis may represent an event involving a loss or a potential loss of some treasured thing, whether it is as simple and personal as a wallet or as complex and intangible as a social program. Regardless of the perspective, whether individual, social, psychological, physical, political or economic, a crisis seemingly emerges from nowhere, takes the victim(s) by surprise, challenges normality and order, and has a substantial consequence. In the context of this chapter, however, a crisis is better represented by the following definitions and descriptions:

❏ Fritz defines a crisis as "an event, located in time and space, in which a community undergoes severe danger and incurs losses such that the social structure is disrupted and the fulfilment of all or some of its essential functions is prevented" (Dynes, 1970, p.78).

❏ The Canadian Privy Council Office formally defines a crisis as "a period of danger for the [community], resulting from a natural or man-made mishap, debacle, or disaster. [It] need not pose a serious threat to human life, but it must somehow challenge the public sense of appropriateness, tradition or values, safety or security in a way that threatens the integrity of the [community]" (Environment Canada, 1991, p. 44).

❏ Rosenthal, Hart, and Charles describe crises as having three main features: a severe threat, an urgent need to make decisions, and a great deal of uncertainty (1989, p.10). They further characterize a crisis as involving extreme collective stress compounded by overloaded communication channels, incomplete information and consequent rumour spreading, an inundation of outside assistance including volunteers, emergency personnel, and media, an irrational aversion of the affected population to the relief effort, and immediate allegations concerning who is to be blamed, and who is taking advantage of the emergency situation (Ibid., 1989, p.16).

❑ The US Federal Emergency Management Agency views a crisis as an occurrence of a severity and magnitude normally associated with death, injury, and property damage, which requires extraordinary procedures, resources, and support from government. A crisis usually develops suddenly and unexpectedly and demands immediate, coordinated, and effective response by multiple government and private sector organization to meet human needs and to facilitate speedy recovery (Auf der Heide, 1989, p.51).

Drawing upon these sources, crises have a number of characteristics. They can happen with little or no warning, anywhere, anytime. The circumstances surrounding their occurrence are inevitably rife with uncertainty; pose a threat to a community's social, physical, political, economic, organizational, and natural environments; and demand the making of fast, critical decisions by senior officials and practitioners of emergency management. All crisis response activity is conducted under intense time pressure, is subject to *ex post facto* public scrutiny, and is organizationally draining in terms of physical, financial, and human resources.

What is Crisis Management? Public officials and practitioners of emergency management jointly practise "crisis management" in order that some order or normalcy to a disaster-affected community can be regained as quickly as possible. To promote a better understanding of "crisis management," the following fragmented definitions and descriptions are provided. Crisis management involves:

❑ the process of developing and implementing policies and programs to [mitigate] and to cope with the risks associated with natural and man-made hazards (Cigler, 1988, p.5),

❑ the discipline and profession of applying science, technology, and management functions to deal with extreme events that can injure or kill large numbers of people, do extensive damage to property, and disrupt community life (Drabek and Hoetmer, 1991, Introduction),

☐	in relation to potential or real emergencies, any measure that plans in advance, any measure that reduces the risk and uncertainly and allows for more outcome control (Heath, 1998, p. 12),

☐	a collection of anticipatory measures that enable a [community] to coordinate and control its responses to an emergency (Nudell and Antokol, 1988, p.20),

☐	a process that requires planning, coordinating, communicating, and decision-making (Auf der Heide, 1989; Charles and Kim, 1988; Cigler, 1988; Comfort, 1988; Drabek and Hoetmer, 1991; Fink, 1986; Quarantelli, 1985; Rosenthal, et al., 1989; Sylves and Waugh, 1990), and

☐	the process of returning a [crisis-affected community] to near-normal daily activity (Government of Canada, n.d.).

"Crisis management" may indeed be taken to imply pre-crisis activities such as taking preparatory action. However, it is on those aspects of "crisis management" that relate specifically to the on-spot and real-time activities of communicating and decision-making that this discussion will focus. Although the theoretical basis of non-crisis decision-making may, in principle, be applied to crisis decision-making, crisis characteristics such as time compression, threat to life and property, stress, and novelty preclude non-crisis decision-making approaches in crisis.

Crisis Decision-Making vs. Non-Crisis Decision-Making

In a crisis, decision-making is, more often than not, a transversal exercise, crossing many jurisdictions and many agencies. It is typically more pragmatic, concentrating on what must be accomplished regardless of procedural or legal limitations (Warheit and Dynes, 1969, p. 13). Because of the high intensity environment surrounding crisis management and specifically because of the potential risk to lives and property, the context in which decisions are made emphasizes urgency and vigilance (Fink, 1986; Auf der Heide, 1989;

Janis, 1989). Information requirements increase exponentially. Indeed, as the problems relating to a crisis become more complex, ambiguous, and unstable, more meaningful information is required to resolve uncertainties and to effect decision-making (Graber, 1992).

Non-crisis decision research involves the study of decision-making as a discrete process, *i.e.*, one that is based on comprehensive rationality and that can be separated from the context and examined normatively. In contrast, the study of crisis decision-making is based on actual decision-making behaviour and on cognitive-based models of decision strategies. (Rasmussen, 1997). Decision-making in crisis finds the traditional normative models unsatisfactory (Klein, et al., 1993).

Crisis decision-making implies the goal of containing and reducing a crisis, as it is defined at the outset of this chapter, to *status quo ante*. The more crises are prevalent or fateful, the more good crisis decision-making becomes essential. Moreover, because important and largely irreversible decisions may be taken during crises, it is vital that the processes of decision-making and policy-making be converged and fully integrated [9] (Dror, 1988, p. 181). In other words, those who make the decisions should not subsequently have to convince or sell the policy-makers on the chosen course, running the risk that failure might cause having to go "back to the drawing board." Convergence and integration of decision-making and policy-making have the added benefit of not being allowing the finger to be pointed at either the decision-maker or the policy-maker – they are one and the same.

Behavioural and prescriptive studies of crisis decision-making, including the psychology of individuals and groups under stress, are pervasive. However, the trouble

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[9]   However, as cautioned by Auf der Heide (1989), Dynes (1970), and Scanlon (1970), it is important that convergence in other areas such as personnel, material resources, and especially, information be avoided. Convergence in these areas, they explain, may lead to information overload and be difficult to disentangle.

with most earlier studies was that their authors had never participated in a real high-intensity, crisis decision-making incident (Dror, 1988, p. 182). Almost as if in response to this, a crisis decision-making research discipline, otherwise known as the Naturalistic Decision-Making (NDM) movement, was initiated[10].

The study of NDM concerns itself with how crisis managers use their individual experience to make decisions in field settings, how they handle all of the typical confusions and pressures of the crisis environment, such as uncertain, ambiguous and/or missing information; time constraints; ill-defined, shifting and/or conflicting goals; and dynamic and continually changing conditions (Klein, 1998, p. 1). NDM researchers are also interested in how decision-making takes place in an environment which is characterized by cross-jurisdiction and multi-agency constraints, ill-structured tasks, high stakes, and team interaction (Flin, et al., 1997, p. 1). Indeed, the NDM environment is charged with extraordinary exigencies. The real-time reaction of crisis managers to the unique conditions of crises and their capacity to act in spite of a maelstrom of activity and emotion set crisis decision-making apart from non-crisis decision-making.

Work in NDM is progressed by practical problems as opposed to hypothesis testing, which is typically associated with non-crisis decision-making theory, and is driven by curiosity about how crisis managers make decisions under the extremely stressful settings marked by a crisis environment. The study of NDM addresses those areas not specifically dealt with by non-crisis decision-making theories. For example, NDM research focuses on tasks with multiple event feedback loops, concentrates on decisions where multiple crisis

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[10]   The NDM movement was initiated in 1989 in answer to a growing interest by basic and applied researchers in the generalizability of many research findings outside the laboratory setting. What the NDM framework offers is more than just a critique of traditional approaches. It offers a different set of models and methods along with a different approach to supporting [crisis] decision-making through training and design (Klein, 1997).

players are involved, concerns itself with the impact of stress on decision-making, and relates well to cognitive research and processes.

In contrast to the typical sources of power[11] found in non-crisis decision-making, *i.e.*, deductive logical thinking, analysis of probabilities, and statistical methods, those in crisis decision-making lean towards intuition, mental simulation, metaphors and analogies, and story-telling (Klein, 1998).

Intuition. Intuition is the term used by crisis decision makers and practitioners of crisis management to define their "sense of knowing." Its use is usually characterized by a feeling that something is not "right," expectations are not being met, or there is a mismatch or anomaly in the situation. However, in the context of the study of crisis decision-making, intuition is more properly defined as the ability to recognize key patterns and deviations from the familiar and prototypical in order to deduce the dynamics of a situation. One reason decision makers and practitioners often cannot describe what they have noticed or exactly how they judged whether the situation was typical or atypical is because of the subtleness of these patterns and deviations. Another reason is that the decision maker or practitioner is reacting to things that are not happening rather than to things that are (Klein, 1998, pp. 31-34).

While some may believe intuition to be an inborn trait, there is no evidence showing that some are blessed with it and others are not (Ibid., p. 33). Intuition is dependent on the use of experience. Dependency on experience is the *sine qua non* of the unconscious ability to recognize things without knowing how the recognizing is accomplished (Ibid.). Otherwise said, experience unconsciously affects the way decision-makers see the

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[11]   Klein defines sources of power as the analytical abilities of breaking a problem down into elements and performing basic operations on these elements as a way of solving a problem (1998, notes).

situation. The power of intuition enables the crisis manager to size up a situation quickly and immediately, as well as to determine how to proceed, which goals to pursue, what to expect, and how to respond. Described in this way, intuition does not sound very mysterious.

Mental Simulation. Mental simulation can be related to imagination, *i.e.*, the ability to imagine people and objects consciously and to transform those people and objects through several transitions, finally picturing them in a different way than at the start (Klein, 1998, pp. 3, 45-74). It is central to crisis decision-making routines because it constitutes the power that lets crisis managers play out and observe how a course of action might be carried out. It allows skilful decision-making and problem resolution under conditions where non-crisis decision making does not work. It helps explain the cues and information received so that the situation may be better interpreted and problems better diagnosed. It helps generate expectancies by providing a preview of events as they might unfold and by letting a course of action be run through mentally in aid of preparation. By allowing a search of pitfalls, it also enables a decision to be made whether or not to adopt the course of action under consideration (Klein, 1998, pp. 45-74).

Mental simulation offers an alternative to non-crisis decision-making analytical strategies and models which are largely ineffective in crisis situations (Ibid.). For example, in comparison to the standard comprehensive rationality model (identify the set of options, identify the ways of evaluating these options, weigh each option, conduct a rating, select the option with the highest score as the course of action), the mental simulation model has the crisis manager perform an identification of the situational needs in which past events are explained and future events are projected; specify the parameters of the situation, including the initial state, the terminal state, and causal factors; assemble the action sequence; and perform an internal evaluation for coherence, applicability, and

completeness. If the mental simulation is acceptable, the action sequence can be run, if not the process would begin anew (Ibid.).

However, on the down side, the ability to use mental simulation depends on having the knowledge-base and experience to set up the mental simulations in the first place. Moreover, mental simulation takes effort to effect, particularly under stress and fatigue, and can be very complicated when the situation intensifies. The more serious drawback is that the crisis manager, left unchecked, can imagine any contradictory evidence away (Ibid.).

Metaphors and Analogues. These language devices allow the crisis manager to draw on experience by suggesting parallels between the current situation and something else previously encountered. They direct crisis decision-makers' thinking by framing situation awareness, by identifying appropriate goals, and by flagging relevant pieces of information. Analogues, for example, provide a structure for making predictions when there are many unknown factors. They function like experiments, linking interactive sets of causes to outcomes. By taking into account the difference between the analogue and the current case, crisis decision-makers can adjust the analogous data to derive a prediction. Analogical predictions are most helpful when there is a good database but not enough information to apply a more rigorous analysis. Analogues are also useful in generating expectancies and solving problems (Klein, 1998, pp. 197-213).

Crisis Decision-Making - Models

NDM researchers, such as Flin, et al. (1997), tend to view the process of crisis decision-making as a function of four interdependent aspects - namely, the quality of the decision problem or the characteristics of the decision situation; the ability of the decision-maker to cope with the problems of the situation; the extent of the crisis manager's

experience-base and knowledge; and the complexity of the coordinating structure[12]. NDM researchers, such as Orasnau (1997), focus on the cognitive processes and requirement involved in crisis decision-making and further categorize crisis solutions and decisions in terms of four models (each of which will be examined below):

❑ Ruled-Based Decision-Making,

❑ Choice Driven Decision-Making,

❑ Creative Decision-Making, and

❑ Recognition-Primed Decision-Making.

Rule-Based Decision-Making. Orasnau (Ibid.) describes rule-based decision-making as conceptually the simplest decision-making model, particularly when a condition matches a component of a condition-action rule, which should trigger retrieval of the appropriate response from long-term memory. Reflex-like, or fully integrated habitual behaviour, she suggests, tends to be resistant to interference from stressors[13]. On the negative side, crisis decision-makers who use the rule-based approach may tend towards delivering inflexible "book" decisions that can be wrong in a given set of circumstances. Nevertheless, this approach may be acceptable when applied by flexible, earnest, and experienced practitioners. However, the use of these approaches by average people with limited

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[12]   Although it is outside the scope of the paper to provide a detailed description of the coordinating structures used in support of crisis management, it suffices to mention that there are no less than three typical configurations: the *Incident Command System* (ICS), the Command and Control (C^2) system (see Chapter one), and the *Emergency Site Manager* (ESM) system. Italicized terms are further defined at the Glossary.

[13]   Decisions that fall into this RPD category may be of the "GO - NO GO" types of responses, in which two very clear and opposing actions are associated with different conditions or in which a single action follows from a single condition. RPD decisions/responses are highly prescribed and proceduralized to eliminate the need to think about what to do in high-risk time-limited situations (Orasnau, 1997).

experience, who would potentially apply only half-understood principles in a crisis situation, could end up complicating rather than alleviating the crisis conditions (Heath, 1998, p. 220).

Choice-Driven Decision-Making. Choice-driven decisions, as described by Orasnau, are more complex than rule-based ones and are invoked when there is no rule guiding the course of action. There may, however, exist default or favoured responses. Nevertheless, the cognitive processes that are involved in choice-driven decisions place greater demands on working memory than they do in the rule-based schema. For example, choice-driven decision-making options will be assessed against constraints and considerations retrieved from memory. This approach may be vulnerable to stressors and may falter when several constraints compete or when no ideal solution exists (1997).

Creative Decision-Making. Creative decision-making is needed when no response is retrievable from memory or standard procedures, no guidance is available, and no training previously received is applicable. In these cases, a candidate solution must be invented to meet the immediate goals. Subsequent evaluation can only be conducted in light of existing constraints (Ibid.).

Recognition-Primed Decision-Making (RPD). RPD describes the decision strategy used most frequently by crisis managers with experience. It explains how they use their experience to make difficult decisions without recourse to comprehensive rationality (Klein, 1998). It can be thought of as a fusion of the "intuition" and "mental simulation" models. It allows crisis decision-makers to quickly size up the situation, to recognize which course of action makes the most sense, and to rapidly evaluate the course of action through imagination. Klein identifies three variations of the RPD model (1998).

In the basic variant (*if known situation, then known action*), the experienced crisis decision-makers recognize the situation as typical or familiar and understands, by intuition, what types of goals make sense. Consequently, priorities are set. Then, by mental

simulation, crisis decision-makers examine how the events have been evolving so far and postulates how they will continue to evolve. This process yields an estimate of what can be expected next. Typical action is identified, and the course of action is implemented. By checking whether the expectancies are satisfied, crisis decision-makers can judge the adequacy of the mental simulation[14]. The processes involved in the basic variant usually happen so quickly and automatically that crisis decision-makers may not even be aware of it. The important feature of the basic variant, which is also key to the remaining two variants is that the recognition process involves sub-processes or by-products - namely, understanding plausible goals, understanding relevant cues, identifying typical action, and evaluating expectancies.

Klein's second variant of the RPD model (*if unknown situation, work out until known, then known action*) accounts for a more complex situation with potential errors and demands more attention by crisis decision-makers (Ibid.). When faced with an unknown situation, crisis decision-makers will be unable to recognize it as being either typical or unique. Either Information does not clearly match a typical case, or it maps onto more than one typical case. In this variant, crisis decision-makers must further diagnose (by pattern matching or story-telling) the situation in order to recognize it and will likely require more information. Another potential error presented by this variant involves an expectancy violation, which forces crisis decision-makers to reconsider their initial interpretation of the situation.

In the last variant (*if known situation, known action fails, then reevaluate known actions until correct choice found*), Klein forces the rejection of a course of action, which in

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[14]   The greater the violation, *i.e.*, the less expectancies are satisfied, and the more effort it takes to explain away conflicting evidence, the less confident crisis decision-makers will feel about the mental simulation and diagnosis.

turn forces crisis decision-makers to re-visualize the action and to redo the estimate in order to choose the correct course of action (Ibid.). This process encourages either a *satisficing* approach or a successive limited comparison approach to resolving this condition.

Irrespective of the variant, the RPD model of crisis decision-making is a means with which crisis managers can use experience to react expeditiously and make good decisions, often without having to evaluate any options. Generally, the RPD process, as applied by experienced crisis decision-makers, responds well to those features that characterize crisis decision-making situations, particularly time pressure, high stakes, inadequate information, ill-defined goals, poorly defined procedures, cue learning, and dynamic conditions. It does not, however, account for teams, organizations, or issues of managing workload and attention, nor does it fully describe the strategies available to crisis decision-makers when, even if rarely, they do have to compare options in crisis situations.

Crisis Decision-Making - Analysis

<u>An Incorporated Perspective</u>. The intent of the foregoing discussion and the examination of prevailing crisis decision-making models serves to underscore the differences between crisis decision-making and non-crisis decision-making and to promote a better understanding of the constraints of time, uncertainty, and consequence on decision-making in crisis situations. Crisis decision-making is not an alternative to non-crisis decision-making, nor does it offer a "best way" to effect choices. It does, however, demand that decision-makers possess a certain level of experience in order that decisions can be made in spite of the noise[15] surrounding crisis circumstances while there is still a

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[15]   Noise includes the interference due to environmental conditions as well as distractions and competing sounds of other *transmissions*. Interference can either originate from human-based communication barriers, *e.g.*, different languages, different perceptions and meanings assigned to words, different beliefs and psychological orientations, or from degradation of communication systems due to obstructions by physical materials. Barriers and noise also include background commotion (machinery, voices, alarms and static), as well as intrusive thoughts and states of physical sensation (Klein, 1998, pp. 114-5). Graber adds that conflicting

requirement to make them. But experience alone does not assure satisfactory outcomes, decision-makers must also be aware of the inhibitors they face.

Crisis Decision-Making Inhibitors. Many factors inhibit crisis decision-making, especially if they are left unchecked. It is, therefore, vital that decision-makers understand them and endeavour to minimize their effect. The inhibitors include:

- self-imposition or self-indulgence (Rosenthal, et al., 1989),

- undue simplification of the problem (Dror, 1989),

- rejection of views and evidence not in agreement with existing bias(es)(Heath, 1998),

- jumping to unjustified conclusions (Assefa and Wahrhaftig, 1989),

- wrong size and/or composition of the decision-making group (Graber, 1992),

- wishful thinking concerning adopted options (Dror, 1989),

- locking on decisions, in spite of negative feedback (Ibid.),

- substitution of group solidarity for achievement of task as group goals (Ibid.),

- shifts in risk propensities (Ibid.),

- fatigue phenomena (Ibid.),

- insidious swings between euphoria and depression (Ibid.),

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or unrelated *messages* in the transmission *channels* may interfere with the transmission and effects of desired messages and that these impairments or interferences are also referred to as noise (1992, p. 6). Italicized terms are further defined at the Glossary.

- ❑ a lack of custom-design processes (Ibid.),

- ❑ reluctance to "think on the unthinkable" (Ibid.),

- ❑ scarcity of suitable methods and skilled practitioners (Ibid.),

- ❑ psychological reactions leading to decision distraction or freezing (Ibid.),

- ❑ overwhelming of reason by emotions and pressures (Heath, 1998),

- ❑ vagabonging (flitting or butterflying from goal to goal) (Ibid.),

- ❑ encystment or bolstering (focussing on one goal or decision at the expense of others) (Ibid.),

- ❑ relying exclusively on conventional wisdom, book answers, and lessons learned from previous events (Ibid.),

- ❑ refusal (not making any decision) (Ibid.),

- ❑ group mindsets (being afraid to oppose a course of action, or supporting a choice of one or more senior members out of respect for authority) (Janis, 1989),

- ❑ overconfidence (Heath, 1998), and

- ❑ euphoric acceptance of the illusions of unanimity or of being right and invulnerable (Ibid.).

Although studies on decision-making in crisis situations provide some important tentative and suggestive findings on error propensities and incapacities, Dror supports the notion that the research in areas related to the above "kitchen list" of inhibitors is quite neglected. He goes on to claim that these inhibitors are hardly accessible by the methods under which decision-making research is often based. Actual quality deficits of crisis

decision-making are, he suspects, very high, and they will remain so unless determined and sophisticated countermeasures are taken (1988, p. 183).

Main improvement proposals include, but should not be limited to, training and exercising crisis decision-making units, conducting simulations, open-ended contingency planning, and the inclusion of decision psychological advisors in crisis decision-making staffs (Ibid.). Unfortunately, when such improvements are considered, additional improvement-inhibiting forces come to the fore. For instance, as mentioned earlier, in important crises, senior public officials fulfill dominant roles, and their participation in training and preparatory exercises in crisis decision-making should, as a result, be a given. However, this study found no evidence that emergency management organizations include senior public officials in the conduct of their training and exercises.

The above inhibitors indisputably constitute areas to which attention must be paid in order to enhance decision-making. However, the issue of miscommunication during a crisis situation also has the potential to impair decision-making, irrespective of the technique used, and is equally deserving of attention. The inability to capture and transfer clear, timely, relevant, reliable, valid and comprehensive information jeopardizes the decision-makers' capacity to meaningfully evaluate any choices available in the course of disaster response. Because sound decisions rely so heavily upon the collection and evaluation of information, addressing the problem of miscommunication necessitates a detailed examination of information as it relates to crisis management.

CHAPTER 3 - INFORMATION

Introduction

This chapter looks more closely at the principle expressed at the end of Chapter two that sound decisions, especially in crisis situations, rely on the effective transfer of meaningful information. It provides an analysis of the information requirements associated with an emergency management information system, proposes requirement-driven solutions to the informational problems set out at Chapter one, and establishes the framework wherein a cross-jurisdictional, multi-agency emergency management model, upon which to build an emergency management information system, can be conceptualized. The model is more fully refined in the next chapter.

Informational Problem Analysis

Appendix F evolved in the course of this chapter's development. It served to clarify Chapter one's Statement of the Problem by concisely listing each criticism found at the various 1997 Red River Basin flood after-action reports, along with its corresponding possible causes. As the analysis of the problems and their potential causes progressed, it was determined that the causal factors of one problem could themselves be translated into problems. For example, one possible cause of the reported problem that "information was treated as proprietary" was identified to be that "each provincial department seemed to run independently and had its own internal source of information and relied solely on its own field people to gather intelligence." This cause was found to be a problem onto itself.

When a potential cause could be considered as a problem, it was copied to the "problem" column and analysed in turn, The process continued until a problem's cause finally revealed itself as a "lack" of some function or capability. The analysis concludes that the informational and decision-making problems experienced during the Red River Basin flood of 1997 can be attributed to a lack of staff (STAFF), liaison personnel (LO), training

and education (TRG), procedures, and, more germane to this study, a lack of an integrated

emergency management information system (CJMA). In fact, of the 34 problems analysed,

24 of them can be shown to be directly related to the absence of a cross-jurisdictional, multi-

agency emergency management information system (see Figure 3).
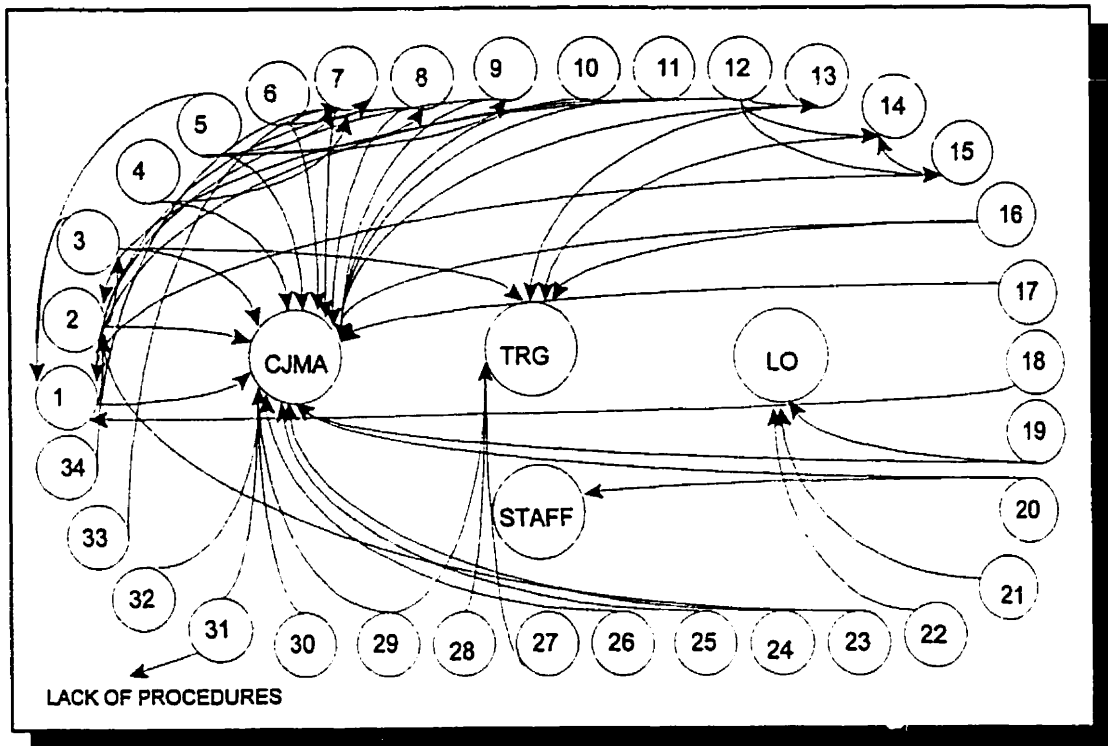
Figure 3 - Diagrammatic Representation of Appendix F

Information Requirements - Interview Findings

Interviews aimed at specifying information linkages and requirements at the LA EOC

were conducted with four of the seven emergency coordinators who were in office during

the Red River Basin flood of 1997 using the questionnaire at Appendix B. Although it was

hoped that the interview questions posed to the former local emergency coordinators would

generate more meaningful data, the interviews were constrained mainly by the time lapsed

since the event. All respondents reported that a clear recollection of the specifics under

investigation, after three years, was difficult. Moreover, in some cases, strong residual emotion got in the way of objective recounting and, in other cases, many of the questions simply did not apply. The most surprising constraint experienced was that many respondents had difficulty expressing and/or understanding the fundamentals of EOC/EOCC operation and identifying the information requirements that might have made the task easier to manage had they been in place. A general sentiment recorded during the interviews was that none of them would be eager to act in the capacity of an emergency coordinator again due to the difficulties experienced.

The interviews conducted with senior emergency management officials at the provincial government level to establish information requirements at the EOCC served to provide two more examples of uniquely different structures with correspondingly distinct information system concepts and reporting lines (the first example is shown at Figure 2).

The interview conducted with the behavioural scientists at the Defence and Civil Institute of Environmental Medicine confirmed the challenge of capturing the flow of information through complex space, i.e., moving through different jurisdictions and agency boundaries, each with different cultures, values, regulations, procedures, and information networks[1].

The interviews conducted and the information obtained at the federal level provided the greatest level of assistance in conceptualizing the flow of information through the emergency response structure.

All interviews confirmed and supported the requirement of this study's aim. The absence of a standard emergency management information system spanning the jurisdictions of government and the boundaries of the many agencies involved in responding

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[1]   See Glossary.

to emergencies was acknowledged, as was the ineffectiveness of those existing hierarchical diagrams that are intended to show communication flow. The informational and decision-making problems, as found at Chapter one, and the urgent requirement to address these were also confirmed.

Information Requirements

Ideally, an emergency management organization is supported by a well-coordinated, integrated crisis management structure and a corresponding information system which together facilitate the collection, analysis, processing, transfer, and management of information. Moreover, on paper, there may be well-organized, efficient education and training programs, policies, and procedures to guide governmental activity and decision-making during disaster circumstances. But in practice, as stated earlier in chapter one's Statement of the Problem, as confirmed by those emergency coordinators who were interviewed, and as observed by the author, the process of managing crises is prone to operate quite differently. Schneider's suggestion that overall governmental emergency management is "more accurately described as disconnected and uncoordinated," and "neither clearly articulated, completely supported, nor fully developed" supports the problematic observations of the 1997 Red River Basin flood's after-action reports, the anecdotal information gleaned from the interviews with local emergency coordinators, and this author's personal experience (1995, pp. 37, 39).

Indeed, Ernst and Young (1998), Tait and Rahman (1997), the City of Winnipeg (1998), the Deputy Chief of Defence Staff (1998), the Manitoba Water Commission (1997), and those emergency coordinators of the flood valley who were involved in the management of their municipal response all agreed that communications across municipal, provincial and federal jurisdictions, in general, were uncoordinated. This undesirable condition was exacerbated by response activities which demanded extraordinary cross-

jurisdictional and multi-agency cooperation. As a result, organizational delay, confusion, and impaired disaster response were inevitable.

The challenge, therefore, is to set out a framework within which information and crisis decision-making are wholly integrated. But, before engaging in building such a framework or model, it is important to examine the specifics of the information that usually flows through the emergency management information system.

Decision-Making Information. Whether crisis management is successful or not is, in part, gauged by how well emergency management organizations cope with the communication process[2], information flow, exercise of authority, and decision-making (Hightower and Coutu, 1996). In other words, effective crisis management depends upon the error-free transmission of meaning[3] and the ability of managers to use information in the reduction of uncertainty[4] and in support of expeditious decision-making.

"Crisis information must be effectively linked with decision-making" (Rosenthal, et al., 1989, p. 21). However, communicating information to coordinate activities and resources, across jurisdictional lines and among many differing agencies, is a complicated

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[2]   Lasswell identifies five major elements that conceptualize the communication process: *source users, messages, channels, destination users,* and effects. The importance of differentiating and identifying the source users originating communications is based on the assumption that the meaning and authoritativeness of the information will vary dependant on the source user. Once the information is suitably processed, it is distributed as a message, which incorporates the meaning that the source user intended to convey. This message is distributed through channels to the destination user(s). The received messages produce a predetermined effect or, contrarily, an unexpected effect (1971, p. 84). A sixth element, described by Graber (1992, p. 5), permits learning from past actions and incorporation of this new knowledge into future actions. *Feedback* bears information about the effect produced by the message and the consequences attributable to it. Italicized terms are defined at the Glossary.

[3]   See Glossary.

[4]   Uncertainty, a term also associated with risk and instability, generates confusion and lack of understanding. When information is missing, unreliable, ambiguous, inconsistent, or too complex to interpret, uncertainty prevails and decision-makers are reluctant to act. Unfortunately, by the time they do, the action has already been potentially delayed or has been overtaken by events (Klein, 1999, pp. 276-277).

task. Pigeau and McCann, for example, in their third in a series of papers that reasserts the vital importance of the human in Command and Control (C^2), focus on the establishment and communication of common intent, and its follow-on transformation into coordinated action (1998, p. 1).

Common intent, according to Pigeau and McCann, is a combination of an explicit aspiration and an operationally-relevant implicit interpretation, both of which must be shared between the parties involved in the achievement of coordinated activity (Ibid.,p. 9). The "explicit" nature of common intent means that it is conscious and publicly accessible. Moreover, this explicitness is the primary mechanism for initiating and maintaining goal-directed action among multiple members of a team or organizations.

Explicit aspiration is usually expressed in terms of goals or objectives, which are communicated using some modality (*e.g.*, verbal, visual, written, etc.) and transferred from a source user to a destination user by way of some medium[5] (Ibid, p. 3). Moreover, it demands a baseline level of literacy in the language being used; an available, high capacity, and reliable communications channel[6]; and a common terminology (Ibid., p. 6). Common terminology is particularly essential in an emergency management information system because it provides meaning to such terms as, position titles, disaster classification systems, emergency plan and implementing procedures, and assists those involved in the emergency management process to understand acronyms (Sikich, 1996, p. 69). The participation of many players across many jurisdictions and agencies usually implies slightly different meaning for terms. This phenomenon adds to confusion and inefficiency. Therefore, a concerted effort led by the provincial/territorial EOCC and supported by all

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5   See Glossary.

6   See Glossary.

departments, agencies, and LAs involved is necessary to implement common language and standard terminology. It can be as basic as establishing naming conventions for all personnel, equipment, resources, and facilities in and around the disaster area. (FEMA, n.d., p. 1-12)

However, Pigeau and McCann elaborate that meeting these conditions, albeit necessary to communications, does not suffice to assure the common achievement of an explicit aspiration. Group dialogue, "backbriefs," questions and arguments are also important to this goal. They cite as an example Pask, who posits that the test to know whether a communication was actually understood is to have it reiterated using different words (1976).

Once the explicit aspiration is properly communicated, it still only constitutes a portion of common intent – the precursor to coordinated action (Pigeau and McCann, 1998). In an environment of high intensity, high stakes, and high demands such as emergency management operations, time constraints and the consequence of delay may deny devoting excessive amounts of time to sharing explicit aspiration. Pigeau and McCann propose, therefore, that "only overlapping implicit intent can maximize success" (Ibid.).

The "implicit" nature of intent is largely unconscious and tacit (Ibid., p.1). It refers to connotations which are subject to the influence of expectations, beliefs, and/or values, and which are latent within a specific goal (Ibid., p. 4). Establishing shared implicit interpretation is not an exercise that can be conducted on the spur of the moment. Rather, it is "a critical preparatory activity" that requires support at all jurisdictions, by way of championing continuous education and training programs to which considerable time and effort must be devoted (Ibid., p. 6). These programs must emphasize the development of a consistent set of emergency management values and must encourage emergency management practitioners, elected officials and appointed officials at all levels of

government to be exposed to each others' expectations and beliefs in crisis circumstances (Ibid., p. 7).

Coordination Information. At the beginning of a locally centred crisis, while the LA's immediate concern is the protection of life and property, considerable attention must be paid to the acquisition and allocation of the resources[7] required to combat the threat to the community. LA resources may be immediately available in suitable quantities, and there may not yet seem to be justification to request support from neighbouring communities or the next higher level of government. Nevertheless, it is reasonable to assume that non-local authorities in proximity will be rendering assistance by providing their own resources to the fight. It is also reasonable to assume that nearby provincial/territorial and federal department offices may also lend assistance by virtue of their proximity to the crisis. Provision of support from these government agents located within the LA's boundaries does not constitute a breech of the principle that the LA must expend its resources before requesting the next level of governmental assistance. Rather, it is because these "external" organizations form part of the community that their involvement is natural.

In the course of responding to the emergency, resources move from one location to another depending on where they are needed most, and the LA EOC will be expected to know where these resources are and when they will be available next. As the situation worsens, all of the resources within the LA's boundaries may eventually be committed to fighting the disaster's effects, as may those belonging to the private sector, neighbouring communities, and local offices of the provincial/territorial and federal governments.

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[7]   Resources used in emergency operations are described by kind and type, and consist of all personnel and major items of equipment (including the crews required to operate and maintain them) that are available, or potentially available, for assignment to incidents. Resource kinds relate to function, whereas resource types relate to capability (FEMA, 1998, p. 4-2).

At the request of the LA, the province or territory may formally commit its own resources from various departments, and if necessary, federal resources may also be committed at the request of the province or territory. Message traffic concerning the tracking, allocation, and status of resources employed in support of the emergency comprise the bulk of the information that flows through the emergency management information system. It follows that the effective management of resources, especially if these originate from different agencies and from different jurisdictions, is a vital consideration in the discussion of information management. Without information, the correct resources to accomplish the task, to ensure resource safety, and to ensure cost-effective operation cannot be identified, selected or allocated, and the status of all resources assigned to an incident cannot be maintained.

Provincial/territorial and federal offices within the boundaries of the affected LA that are providing support to the emergency will be in communication with their parent departments from the start. As they become more involved and as the potential for a formal assistance request increases, the requirement for the parent departments to coordinate their activities and resource allocations appreciates. Departmental operations offices and/or EOCs must maintain contact with their representatives at the local level throughout the emergency's duration. Likewise, because of the potential for a formal assistance request, the provincial/territorial and federal EOCCs must also be monitoring[8] the local situation. In this manner, if the situation worsens or if there are any unanticipated operational needs for provincial/territorial and federal resources elsewhere, the government is better situated to provide an adequate response or to make a more informed decision regarding the allocation of its resources.

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[8]   The monitoring function which the EOCC undertakes could either be by way of dispatching an LO or by establishing a direct *channel* of communications with the LA EOC.

Because of the reliance on resource information, all organizations, agencies, and departments at all levels of government likely to be involved in emergency response activity must maintain a current inventory of resources that they can draw upon during an emergency. A list of resource information that is typically required at the local level is provided at Appendix D. Similar lists are necessary at provincial/territorial and federal levels.

During the disaster, status information identifying the condition of the resources must also be made available. Effective coordination requires the use of information of assigned resources that are performing active functions, of available resources that are ready for immediate assignment, and of out-of-service resources that are not yet ready for assignment. This information must be originated by those who control the resources.

Liaison Information. When source information is potentially unreliable, the placement of qualified emergency management liaison personnel on-site heightens the credibility of the sources. Moreover, the implementation of communication protocols to and from these more credible sources increases the level of confidence in the information received by them. The sooner a trained and experienced Liaison Officer (LO) is dispatched from the provincial or territorial EMO, the better.

Having an LO at the disaster location to conduct impartial observation and to relay meaningful information directly back to the EOCC, contributes to the reduction of uncertainty and to the improvement of coordinating, planning, and decision-making. By virtue of their training and experience, LOs are capable of facilitating the flow of information, assisting in the prioritization of resource requests, and filtering extraneous from significant information. Equally important, LOs are qualified to provide relevant advice and assistance to the impacted community. Although it is beneficial that liaison personnel be familiar with the local conditions, it is essential that they be capable of incorporating local knowledge in

their communications with the EOCC.

Public Information. An uninformed public is unpredictable (FEMA, n.d., p. 5-18). Media and liaison can be effective instruments in keeping the public informed. However, it is important that the information communicated to the public be stated factually, in terms that it will understand, and in terms that will satisfy its needs as opposed to solely the organization's expectations. Organizations tend to be unable to grasp that information they deem vital may not necessarily be vital to the people in the disaster area (Quarantelli, 1985, p. 13; Lerbinger, 1997, p. 32). Release of information must also be well timed. In other words, releasing information before all the facts are known is ill-advised. Moreover, it is important that the problem and corresponding actions be described carefully and reported succinctly and clearly. Those responsible for communicating to the public must use simple, non-technical language and must be sensitive to the local dialect (Lerbinger, 1997, p. 280).

If the public receives information that they do not perceive is credible, that does not serve to reduce their fears or uncertainties, or that does not feed any sense of denial they might have about the crisis, then they may look elsewhere and place more reliance on informal and unconventional sources of information (Schneider, 1995, p. 51). According to Graber, information carried by informal channels is typically more widespread, often more timely, and reportedly more accurate. However, she warns that "grapevine" communication has several drawbacks. It is unsystematic and generally generated and driven by self-interest. Moreover, its use may often be restricted to privileged groups. Worse, the information carried over the "grapevine" may degenerate into rumour, which involves the circulation of unsubstantiated and often erroneous information, particularly in time of crisis when information is already scarce to some (1992, pp. 109-110; Heath, 1998, p.119).

FEMA warns that rumours are sometimes as dangerous as the emergency itself and recommends that the facts and/or updates surrounding the situation be communicated as

soon as practicable and as often as required (n.d., p. 5-20). Gaining control over rumours is essential to the establishment of public calm (Ibid.)

Pre-disaster public safety and awareness campaigns must be conducted with a view to providing the public with the information that it may need in times of crisis and to provide it with an opportunity to better understand the hazards that are of priority concern in their area in order that it can better prepare for, respond to, and recover from any disaster or emergency that could strike the community. Education programs of this sort also provide insight into the emergency response structure and the services it has to offer (FEMA, n.d., p. 5-21).

Too Much Information. Although bureaucracies may effectively handle information relating to routine events, even large scale ones, the convergence of information and the denser information flow associated with catastrophic events can quickly and easily overload decision-makers. The main reasons for information-overload relate to the number of channels available and individual channel capacity. Busy signals and telephones ringing open at a coordination centre are clearly unacceptable conditions. Consideration must be afforded to the number of channels necessary to carry all of the information and to the capacity of each individual channel. Moreover, organizations must develop satisfactory ways to screen incoming messages so that those of higher priority can be identified immediately and routed without delay to their intended destination (Graber, 1992, p. 21).

Because victims of disaster need information about the situation they are experiencing, they may unintentionally impose added stress on responding agencies and departments by saturating them with inquiries. The consequent burden on communication channels that would otherwise be used to manage emergency response and coordinate activity and resources, not to mention the additional stress placed on the recipients of the requests, may also cause overload and breakdown (Auf der Heide, 1989). Provision must

be made for separate information channels for public use.

Another reason for information-overload is the complexity of the cross-jurisdictional and multi-agency network (see Figure 1) into which all disaster-related information is inputted and through which it travels. Identical messages can, potentially, be inputted at multiple points in the network contributing not only to redundancy but to blockages as well. At the local and provincial/territorial level, there are no information filters or screens to sort and route information along its way in the existing emergency management structure. A concentrated effort on the part of emergency management planners is therefore necessary to regulate information flows and to remedy the paradox of having too little meaningful information on the one hand and too much information on the other.

Meaningful information not only plays a critical role in reducing uncertainty, but it expands the range of options available to the decision-maker, provides some structure to complexity, and generates a greater situational awareness (Garigue and Romet, 1996, p. 3). However, it must be differentiated from information quantity. Simply adding more information into the decision-making cycle does not necessarily reduce the uncertainty decision-makers face or their reluctance to act. Rather, it is more likely that increasing the information load will introduce more information that lacks relevance, contributes little new knowledge, and/or is misleading and erroneous. It may also increase delay and, in the process, cause the decision-maker to lose opportunity. These exacerbations are undesirable, hindering, and potentially dangerous to decision-making.

Quoting James Q. Wilson, Graber makes the point that quantity of information does not necessarily constitute "a full, accurate and properly nuanced body of knowledge about important matters." Rather, it may constitute "a torrent of incomplete facts, opinions, guesses, and self-serving statements about distant events" (Graber, 1992, p. 56). Information flow regulations and procedures may become necessary to prevent an

information overload.

During the Red River Basin flood of 1997, water flow reports/forecasts were generated, once daily, by the provincial Department of Natural Resources and distributed to a list of interested departments and agencies such as the Regional EPC Director, the provincial EMO, and the Canadian Forces Domestic Operations Officer for the Province of Manitoba. On receipt of this report/forecast the provincial EMO would redistribute it to its list of interested departments and agencies, including the Regional EPC Director and the Army's Domestic Operations Officer. Likewise, on receipt of this report/forecast the Regional EPC office would redistribute it to its list of interested departments and agencies, including the Army's Domestic Operations Officer. By the end of the day, many departments and agencies had too many copies of this report/forecast. Tragically, as recounted by a local emergency coordinator, the LA had none. One type of regulation or procedure that might prevent this sort of information overload occurrence would be to impose a careful restriction on the number, length, or subject matter of inter-jurisdictional communications. On the matter of omitting the LA from the distribution list, more attention ought to have been paid to ensuring that those who needed information got information.

Auf der Heide's recommendation that all but the most essential information be subjected to a *triage*, is a good one (1989, pp. 55-56). This concept would involve the objective evaluation and classification of information for purposes of further processing and transfer and would consist of the immediate sorting of information according to its significance to the disaster circumstance. However, a *triage* system must only be implemented on the condition that the personnel or automated equipment performing the filtering is capable of relating the information's significance to the overall disaster effort without prejudices or preference (Ibid.).

The fact that some individuals, with whom the responsibility for conveying

information is placed, will lack experience and familiarity with the non-routine manner of communications may result in the wrong people getting the information (Auf der Heide, 1989; Drabek et al., 1981; Dynes, 1970; Quarantelli, 1982, 1985). Serious problems arise when non-emergency management personnel and professionals alike do not understand the pre-established framework, when they consciously ignore it, or when they deliberately take steps to circumvent standard operating procedures (Schneider, 1995, p. 37). It follows that all who are directly involved in the emergency management process at the LA level must understand the structure and operation of the entire governmental response system and abide by it.

Information Flow

Beginning at the LA, where the responsibility for emergency response is maintained from the initial threat of disaster to the final stages of recovery, information is generated and consumed by emergency responders, emergency management officials, elected and appointed public officials, and the local media. To reduce confusion and redundancy, it is vital that the information flow be tailored to meet the requirements of those involved, according to their specific and unique functions *vis-a-vis* the situation. Destination users are concerned only with the information that relates to their functional involvement and correspond to their particular expertise. Those individuals involved in coordinating activity and resources are not likely to find public affairs information very useful. Likewise, the officer in charge of public works should not be answering health and welfare inquiries. Misdirected information must be rerouted to the intended destination user as quickly as practicable. Nevertheless, a complete record of all information received, dispatched, or rerouted must be maintained (*i.e.*, compiled, analysed, and prepared for use by decision-makers) in order that information can be readily shared and made available to the local coordinator and/or senior decision-makers, and in order that it can be found and retrieved

at a later time for auditing, accounting, and learning purposes.

When provincial/territorial support is formally brought to bear on the response effort, the information requirements are increased and the information system expands, becomes more entangled, and demands integration. Information not only continues to flow horizontally on the local plane but must now travel vertically to the provincial or territorial EOCC and from there horizontally again to the departments involved. Vertical communications should follow functional lines. As mentioned earlier, destination users are best equipped to deal with the information that relates to their functional involvement and correspond to their particular expertise. Whether travelling horizontally or vertically, the information must flow in an orderly way between its sources and its destinations, with four basic objectives in mind:

    ❑   decision areas, decision criteria, and decision rules must be identified,

    ❑   information requirements must be specified,

    ❑   time to refer to a data bank for detailed information must be identified, and

    ❑   those who are engaged in the decision-making must be allowed to retrieve and to process information easily and to put it to use (Hirsch, 1969, p.13).

Information flows are further complicated by the fact that staff and resources belonging to various departments, agencies, NGOs, and the private sector may already be supporting the emergency and vital decision-making information may already be travelling directly to their parent operations centres in addition to, or to the exclusion of, the local EOC and the provincial or territorial EOCC.

Emergency management officials from every organization, department, and agency at every level of government are theoretically supposed to mobilize and organize available

resources within their respective jurisdictions. However, it becomes increasingly difficult to coordinate the actions of all the supporting agencies and departments particularly because each has its own set rules, regulations, policies, and information network.

When resources and personnel from these multiple agencies and across many jurisdictions are deployed, existing channels from the provincial/territorial and federal agents to their parent departments must remain open. However, there must now be additional and complementary communications links established from those parent departments to the provincial EOCC, which is in a better position to grasp the total provincial effort being expended, to centrally coordinate the total resources being allocated at the disaster site, to watch for other crises that may arise within the province, and to monitor the existing situation for signs of escalations. Allowing the provincial EOCC to carry out its mandate of providing central coordination to the crisis, and thereby providing a single point of contact for public inquiry, reduces the potential for transferring conflicting information to the public, to the other departments and agencies involved, as well as to the media.

Once the federal government and its resources become involved and another layer of coordination is appended to the already complex communication network, information requirements are increased dramatically. This does not mean that everything about the situation can or must be known. Information requirements must be assessed wisely and information flows must be guided properly. "Without effective and responsible information management[9], the flood tide of information can become a menance rather than an asset" (Graber, 1992, p. 4).

Depending on the scope of the crisis, information requirements will vary. For example, additional information requirements are imposed when the situation demands

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[9]   See Glossary.

specialist or technical knowledge of the hazard (*i.e.*, chemical, biological, nuclear disasters), experts may be required to analyse technical information, to interpret and clarify ambiguous information, or to cross-reference complex information with relevant databases. A representative sample of the provincial/territorial and federal information requirements is at Appendix E.

Information Requirements and Flow in the Context of "Who's in Charge"

In light of the overwhelming information and coordination requirements associated with emergency management, it is possible to lose sight of where the ultimate responsibility for response lies. Officials at both provincial/territorial and federal levels must appreciate and accept their role as supporting in nature and, in keeping with Canadian emergency management guidelines, not usurp the LA's responsibility and authority in disaster response activities. Responders, including the Canadian Forces, must be knowledgeable about their own roles and responsibilities, as well as how their actions relate to those others involved in the emergency management process (Schneider, 1995, p. 36). When perceptions differ across governmental levels about where the authority and responsibility are vested, there are likely to be complications, confusion, and even breakdowns in the management of the situation (Ibid., p. 38). An effective disaster response can be mounted only when everyone understands the overall framework presented by a cross-jurisdictional and multi-agency environment (McLoughlin, 1985).

CHAPTER 4 - A CROSS-JURISDICTIONAL, MULTI-AGENCY INFORMATION MODEL

Introduction

The effectiveness of emergency management, in a large degree, depends on how well decisions are made. How well these are made, how sound judgement is actualized, and how objectives are achieved in turn depends on the presence and effectiveness of framework or model within which information and crisis decision-making are wholly integrated (Erickson, 1999. p. 44). A well-designed information system is "the most important tool of crisis management" (Heath, 1998, p. 114). This chapter builds a model upon which subsequent design and implementation of such a system may be undertaken.

Structured Systems Design Analysis Methodology (SSADM) provides the basis for the construction of the model. In broad terms, SSADM demands that three types of questions be addressed successively, namely: questions of definition, functionality, and physical organization. The first, addresses the problem to be solved rather than the solution. The second addresses the solution, and the third addresses the technical aspects of the solution (DMR, 1984, pp. 25-26). To satisfy the aim of the study, i.e., to propose a simple and effective cross-jurisdictional and multi-agency information model in support of emergency management, the SSADM process was abbreviated. Because the proposed model serves as a platform for further study, discussion, and testing, the technical aspects of the model must be reserved for subsequent study.

Construction

The model's construction process is divided into two corresponding phases. In the conceptual phase the informational problems related to the Red River Basin flood of 1997 at Chapter one, the general informational problems related to decision-making at Chapter two, and the information requirements at Chapter three are analysed, interpreted and strategically defined, i.e., independent from the way the follow-on system would actually

function and the technology that would be used. In the functional phase, which represents the way the information system could function, the processes, their interactions with each other, and the paths they use to access the information are defined.

The development of the model in this study is conducted from the highest level and presents a general and conceptual view of the information system. The model is conceptualized as a construct that operates within a larger integrated environment. which includes personnel; facilities; standard operating procedures; regulations; financial, administrative and logistic support; organizational management functions; and other emergency response systems. It depicts internal and external "entities[1]" and "information flows[2]" giving an overview of the system without elaborating on "relationships[3]," "attributes[4]," "information stores[5]," or processes which must be decided later in the design phases of systems development.

Objectives

The information model supporting crisis decision-making and the achievement of common emergency management goals is designed to increase the shared understanding of the situation and to facilitate appropriate, coordinated, multi-agency action across jurisdictions, according to Comfort's suggestions (1989). In keeping with Garigue and Romet's recommendations, its interfaces are minimal and simple and its information flow is restricted to essentials (1996, p. 33). Based on the the guidelines set out by the U.S. Joint Chiefs of Staff (1995), which are in agreement with the findings of this study, the

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[1]   See Glossary.

[2]   See Glossary.

[3]   See Glossary.

[4]   See Glossary.

[5]   See Glossary.

model is established on the requirement for continuous information and serves the following objectives:

- □   help public officials and practitioners of emergency management combine the thoughts and impressions of multiple responding agencies, across multiple jurisdictions to allow the views of many experts to be brought to bear on any given task,

- □   help public officials and practitioners of emergency management formulate accurate perceptions and make effective action decisions,

- □   respond quickly to requests for information, and places and maintains that information, in a usable form, where it is needed, and

- □   fuse[6] information to produce a factual picture of the disaster area and situation that meets the needs of responders and decision-makers alike (p. viii).

In short, the information model is meant to promote the uninterrupted and timely transfer of meaningful information to the intended destinations in a form that will be useable upon receipt.

Establishing Parameters for An Integrated Framework

<u>Coordination Tiers</u>. Emergency response encompasses the assessment of incident priorities, the determination of operational objectives, the development and implementation of an action plan, the management of incident resources, and the coordination of overall emergency activities including those of outside agencies. In a small scale emergency, these tasks may be managed solely by the first responders (*i.e.*, public works, police, fire, or ambulance personnel). However, when the circumstances approach crisis proportions and raise public concern and media attention, there may be a requirement to establish a

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[6]   See *Information Fusion* at Glosary.

local focal point of response operations. Likewise, as each higher level of government becomes involved, there may be a requirement for corresponding focal points of coordination.

First Tier - The LA Emergency Operations Centre (EOC). As mentioned at Chapter one, the LA EOC serves as the single location where local emergency services department heads, municipal government officials (both elected and appointed), and other selected personnel gather to oversee, to direct, and to coordinate the on-site response to a crisis. Its establishment, however, does not preclude other organizations who are providing assistance or resources to the emergency from establishing separate EOCs to track the allocation and status of their own resources. The important consideration is to provide working interfaces between the LA EOC, other EOCs, and the emergency responders at the crisis scene to permit the rapid transfer of information and to facilitate decision-making.

In theory, all EOCs are structured to accomplish the same objectives. Therefore, the first tier's entities apply equally well to any EOC. Based on Chapter one's Statement of the Problem, confirmatory information acquired in the course of the interviews conducted, and Chapter three's Information Requirements, the common entities include Executive, Coordination, Planning and Advice, Public Affairs, and Triage. Although these common entities are wholly integrated from an informational perspective, they should, as much as practicable, be physically isolated from each other, i.e., compartmentalized. This compartmentalization is not to be confused with the concept of "stovepiping." All that is meant here is that decision-makers be afforded space away from the noise of the coordination centre. Likewise, the planners and the public affairs personnel, and those responsible for triage, should all be afforded their separate space.

Executive. This entity represents the decision-making that impacts on the overall management of the emergency response. Executive decision-making can only be

undertaken by those with the requisite legal authority, *i.e.*, the "executive." For example, in the case of the LA, the executive is restricted to the chief elected official and other legally delegated officers or officials as appointed by the chief elected official. In other EOCs executive authority may rest with the senior officer in charge of the organization to which the EOC belongs, or with other legally delegated officers as nominated by the senior officer in charge. In any case, the Executive entity is publicly accountable for the decisions it makes. The local emergency coordinator should be invited to attend the entity's decision-making meetings as its advisor.

Planning and Advice. The Planning entity represents the analysis of information[7] about the development of the crisis, the determination of future requirements and the conduct of short and long-term planning, the issuance of plans, the assignment of priorities to tasks, the provision of technical and planning advice to the Executive entity, and the dissemination of the Executive entity's goals and objectives. The Planning and Advice entity is staffed by local emergency management practitioners who are qualified in the conduct of planning activities and/or by technical specialists as required by the emergency situation. The head of the planning entity should be appointed by the local emergency coordinator.

Coordination. This entity represents the implementation of the emergency response plan issued by Planning. Its information processing[8] functions include directing and coordinating the response activities prescribed by the Planning entity; requesting and/or releasing resources; tracking resource allocation and status; ensuring continuity of communications within the EOC, as well as to and from the emergency site; and keeping

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[7]   See *Information Analysis* at the Glossary.

[8]   See Glossary.

current of all operations activities surrounding the immediate situation. This entity may be staffed by local emergency management practitioners, but is usually staffed by local department heads or officials who have been trained in EOC operations. The head of the Coordination entity is the local emergency coordinator. Personnel who are staffing the Coordination entity should, as much as practicable, have specific and unique responsibilities *vis-a-vis* the situation and should be discouraged from flitting about in areas where they have no experience or business.

Public Affairs. The Public Affairs entity represents the formulation and release of information about the incident to news reporters and broadcast stations, on approval from the Executive entity or its delegated representative entity, *e.g.*, Planning and Advice. The Public Affairs entity's information processing functions include monitoring, as completely as practicable, all relevant broadcasts on all networks and on all communications means (*i.e.*, radio, TV, Internet); correcting errors in fact or in misrepresented stories; and providing advice to the Executive Decision-Making entity with respect to misrepresented coverage. This entity should, as much as practicable, be staffed by personnel who have experience in dealing with the media. The head of the Public Affairs entity should be appointed by the Executive entity.

Triage. The *Triage* entity represents the collection[9] of information (*e.g.*, answering incoming calls) and the vetting and routing of information. It includes the immediate sorting and transfer of information[10] according to its significance to the disaster circumstance and the redirection of public inquiry calls to a location or entity within the larger integrated environment outside the EOC framework. It can be staffed by anyone provided they have

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[9]   See Glossary.

[10]   See Glossary.

the proper indoctrination, operator-manuals, and directories. The head of the *Triage* entity should be appointed by the local emergency coordinator with input from the Executive entity.

Second Tier - The Provincial/Territorial Emergency Operations Coordination Centre (EOCC). The EOCC is established within provincial or territorial jurisdiction to coordinate the allocation of resources provided by the province or territory on request from, and in support of, the LA during a disaster event, until such time as the LA can resume its routine operations unassisted. Unlike the LA or any other EOCs, the EOCC has no direct control of resources, *i.e.*, it does not own any. Moreover, the provincial/territorial departmental and agency participation necessitates a larger Executive entity comprised of many more public officials than at the local EOC. Therefore, there are minor adjustments to the descriptions of the second tier's entities required. However, with those exceptions, the structure is identical. Once more, although the second tier entities are wholly integrated from an informational perspective, they should, as much as practicable, be physically isolated from each other, *i.e.*, compartmentalized.

Executive. This entity represents the decision-making that impacts on the overall coordination of the emergency response. Executive decision-making can only be undertaken by those with the requisite legal authority. For example, in the case of the provincial or territorial government, the executive is restricted to departmental deputy ministers and/or assistant deputy ministers, Special Operating Agency Chief Executive Officers, and other senior officials whose organizations are, or are likely to be involved in responding to the crisis. The head of the Executive entity at the provincial/territorial tier is

the minister responsible for the *Emergency Measures Act* or equivalent legal arrangement[11]. The Executive entity is publicly accountable for the decisions they make. The provincial/territorial EMO Director should be invited to attend the Executive entity's decision-making meetings as its advisor.

Planning and Advice. The Planning entity represents the analysis of information about the development of the crisis, the determination of future requirements and the conduct of short and long-term planning, the issuance of plans, assignment of priorities to tasks, the provision of technical and planning advice to the Executive entity, and the dissemination of the Executive entity's goals and objectives. The Planning and Advice entity is staffed by provincial/territorial emergency management practitioners who are qualified in the conduct of planning activities and/or by technical specialists as required by the emergency situation. The head of the planning entity should be appointed by the provincial/territorial EMO Director.

Coordination. This entity represents the implementation of the emergency response coordination plan issued by the Planning and Advice entity. Its information processing functions include coordinating the response activities prescribed by the Planning and Advice entity; requesting and/or releasing resources from provincial/territorial departments or agencies; tracking resource allocation and status; ensuring continuity of communications within the EOCC, as well as to and from all external entities; and keeping current of all operations activities surrounding the immediate situation. This entity may be staffed by

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[11] At the time of this writing, the ministers responsible for the *Emergency Measures Act* or equivalent legal arrangement vary from province to province, *e.g.*, Minster of Government Services (Manitoba), Solicitor General (Ontario), Minister of Municipal Affairs (Alberta). Although beyond the scope of this study, there appears to be difficulty with these arrangements in that other departmental ministers may not be as responsive to another minister as they would be to a higher level of authority. It could not be determined with certainty, however, there is a likelihood that the "political barriers" mentioned at Chapter one might relate to this potential difficulty. Further study in the area of "where" provincial/territorial EMOs should fit within their governmental organizational structure is recommended.

provincial/territorial emergency management practitioners, but is usually staffed by departmental or agency representatives who have been trained in EOC operations. The head of the Coordination entity is the EMO Director. Personnel who are staffing the Coordination entity should, as much as practicable, have specific and unique responsibilities *vis-a-vis* the situation and should be discouraged from flitting about in areas where they have no experience or business.

Public Affairs. The Public Affairs entity represents the formulation and release of information about the provincial/territorial coordinated response to news reporters and broadcast stations, on approval from the Executive entity or its delegated representative entity, *e.g.*, Planning and Advice. The Public Affairs entity's information processing functions include monitoring, as completely as practicable, all relevant broadcasts on all networks and on all communications means (*i.e.*, radio, TV, Internet); correcting errors in fact or misrepresented stories; and providing advice to the Executive entity with respect to misrepresented coverage. This entity should, as much as practicable, be staffed by provincial/territorial public affairs specialists. The head of the Public Affairs entity should be the Director of provincial/territorial public affairs.

Triage. The *Triage* entity represents the collection of information, *e.g.*, answering incoming calls, and the vetting and routing of information. It includes the immediate sorting and transfer of information according to its significance to the disaster circumstance and redirecting public inquiry calls to a location or entity within the larger integrated environment outside the EOCC framework. It can be staffed by anyone provided they have the proper indoctrination, operator-manuals, and directories. The head of the *Triage* entity should be appointed by the EMO Director with input from the Executive entity.

Third Tier - The Federal EOCC. The federal EOCC is established to coordinate the allocation of resources provided by the federal government on request from, and in support

of, the province or territory during a disaster event until such time as it can resume its routine operations unassisted. The federal EOCC has no direct control of resources and, therefore, is restricted to coordinating the movement and allocation of federal resources. In the same way the provincial/territorial Executive entity is larger than the LA's, the federal Executive entity is larger than the province's or territory's. However, the structure remains identical to that at the first and second tiers, and the adjustments to the descriptions of the third tier's entities comprise changes in players' names only. The entities remain wholly integrated and the suggestion that they otherwise be compartmentalized stands.

Executive. The head of the federal Executive entity is the minister responsible for the Emergency Act[12]. The Executive entity is publicly accountable for the decisions they make. The federal Director of Emergency Preparedness Canada should be invited to attend the Executive entity's decision-making meetings in an advisory capacity.

Planning and Advice. The head of the Planning entity should be appointed by the Director of Emergency Preparedness Canada.

Coordination. The head of the operations entity is the Director of Emergency Preparedness Canada.

Public Affairs. The Public Affairs entity represents the formulation and release of information about the federal coordinated response to news reporters and broadcast stations, on approval from the Executive entity or its delegated representative entity, *e.g.*, Planning and Advice. The head of this entity should be the Director of federal public affairs.

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[12]   At the time of this writing, the Minister of National Defence is responsible for the *Emergency Act*. Although beyond the scope of this study, there appears to be difficulties with this arrangement in that other departmental ministers are not be as responsive to another minister as they would be to a higher level of authority; the Minister of National Defence's mandate concerning the employment of the Canadian Forces may, one day, place the minister in a tenuous situation; and the mitigation and recovery aspects of emergency management do not dovetail well with the mission of the Canadian Forces. Further study in the area of "where" Emergency Preparedness Canada should fit within the federal governmental organizational structure is recommended.

Triage. The head of the _Triage_ entity should be appointed by the Director of Emergency Preparedness Canada.

Representing the Framework in Diagrammatic Form. Figure 4 depicts the three tiers and the entities within them.

ThirdTier
Federal
Government
EOCC

Second Tier
Provincial or
Territorial
Government
EOCC

First Tier
Local Authority
EOC
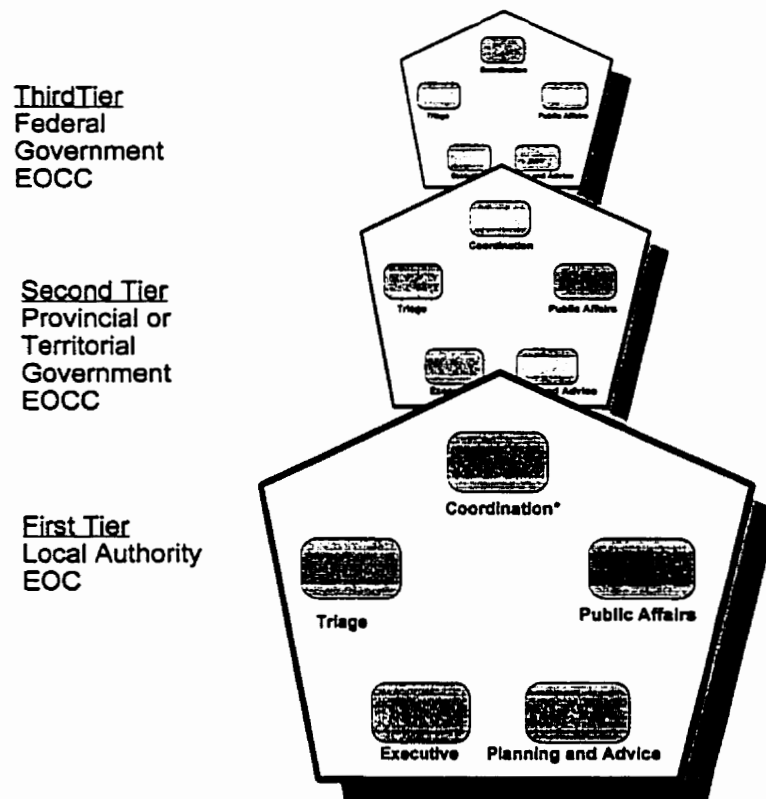
Figure 4 - **Information Model Framework**

*Note that the Coordination entity at the First Tier could be entitled "Operations"

Fourth Tier? In theory, because all of the tiers are identically structured, it should be possible to add a fourth, International or Joint Coordination tier. There may be value in conducting research into the international aspects of emergency management to confirm whether the framework established in this study would apply at the United Nations, for example.

Establishing the Information Flows

Based on the discussion at Chapter three, Figure 5 represents the possible internal and external information flows irrespective of the tier.
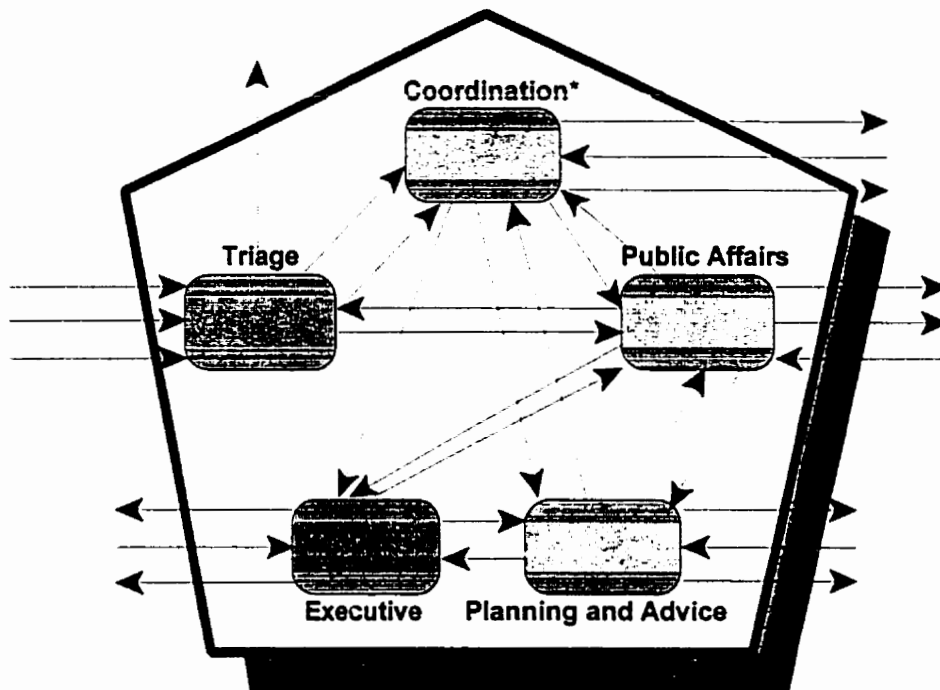
Figure 5 - Internal and External Information Flow at Tier Level

The framework established, the next step in the construction of the information model is to overlay the information requirements and flows determined at Chapter three in order to determine, as closely as possible, the information flows associated with each entity; to name them, and to describe the information they may carry.

In order to better understand the movement of information in and out of the emergency management system and the movement of information within the framework just established, diagrams serve a useful purpose. A series of them will be used to successively and progressively demonstrate the building of the model.

SSADM symbology conventions provide the basis used in the following information flow diagrams. For example, a rectangle divided into three parts represents an internal entity. It is given a number in order that further breakdowns, *i.e.*, siblings of that entity can be numerically related to the parent. For example, if the Executive entity is numbered "1," the first breakdown or sub-entity would be numbered "1.1," the second "1.2," and so on. Additional process information can be placed in the space provided above the entity name. An external entity is represented by an oval containing that entity's nominal description. The cut-line in the left-hand corner signifies plurality.

Information flows are depicted by an arrow whose arrowhead points to the destination entity. They are nominally labelled in order to better represent the information being transferred from one entity to another.

Triage. The *Triage* entity is the main point of information entry into the emergency management system. The information flows associated with the *Triage* entity mainly stem from external sources as well as from the entity itself. In the majority, the input flows are generated from the general public and become output flows once they are transferred to other external or internal entities. For example, a citizen may generate a request for emergency transportation. This request is received, prioritized, and transferred to the appropriate destination. In this case, the request should have been made directly to the LA EOC and is redirected there without entering any other internal entities. See Figure 6.

Coordination. In the majority, the external incoming information flows are generated as requests from the lower tier Coordination entity and as status reports from collateral departments and agencies. The internal incoming information flows originate from the *Triage* and Plans and Advice entities. The information is processed and returned as outflow. For a more complete list of the types of information that would be carried on incoming information flows see Appendix E, under the headings of "Coordination," "Support

Resources," "Human Resources," and "Communications." The information flow diagram is below at Figure 7.

Planning and Advice. This entity's input and output flows are represented at Figure 8. For a more complete list of the types of information that would be carried on incoming information flows see Appendix F, under the heading "Plans."

Executive. Although the Executive entity receives and sends information internally and externally throughout the emergency management system, in theory, it should only communicate its goals and/or objectives to the Coordination entity through the Planning and Advice entity. The information flow diagram relating to the Executive entity as at Figure 9.

Public Affairs. The Public Affairs entity is interconnected to each internal entity and to many external entities, as depicted at Figure 10. Its incoming information flows would carry information such as that listed at Appendix E, under the heading "Public Affairs."

Consolidating Information Flow with Framework

Consolidating the information flow diagrams into the previously established framework yields a model which more adequately serves the cross-jurisdictional and multi-agency effort usually associated with emergency response, irrespective of the nature of the disaster or its location. See Figure 11.
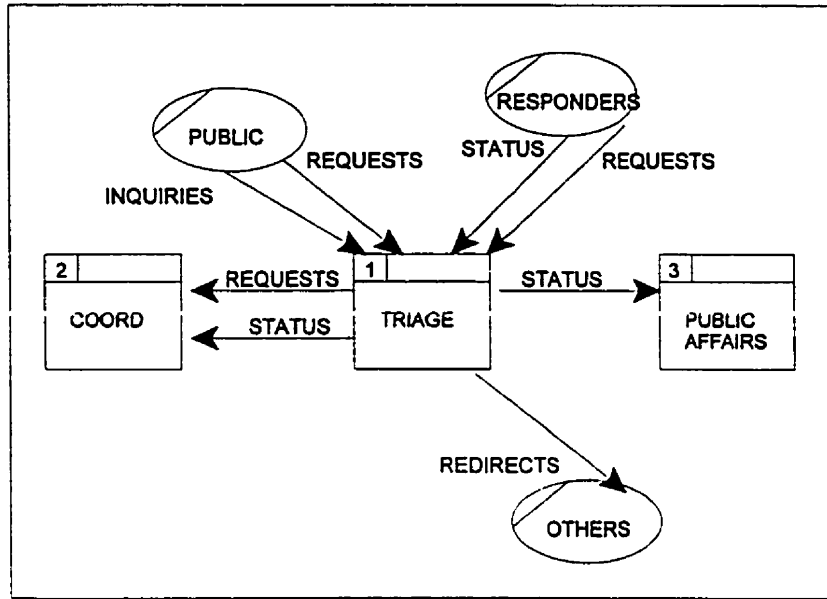
Figure 6 - *Triage* Information Flow Diagram
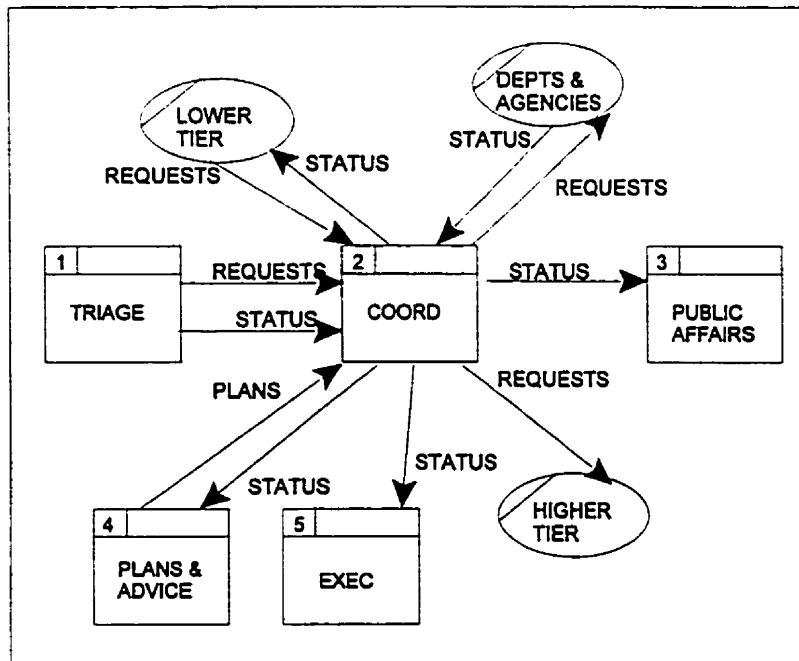
Figure 7 - Coordination Information Flow Diagram

Page 4-15
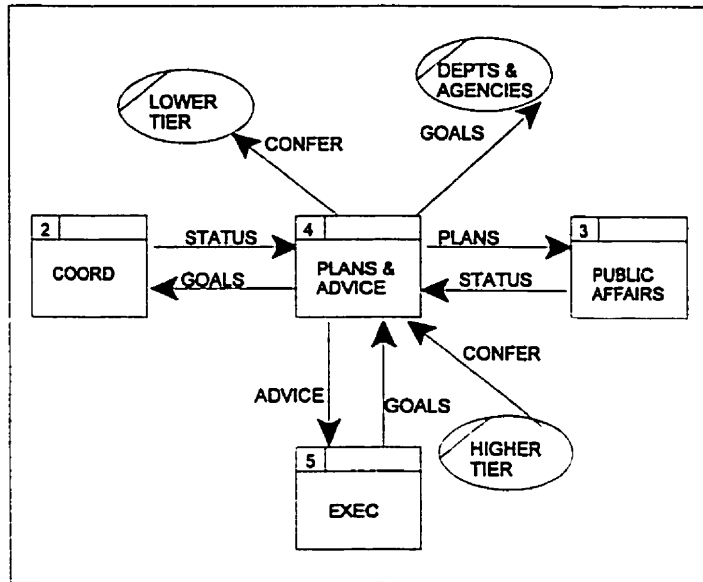
Figure 8 - Planning and Advice Information Flow Diagram
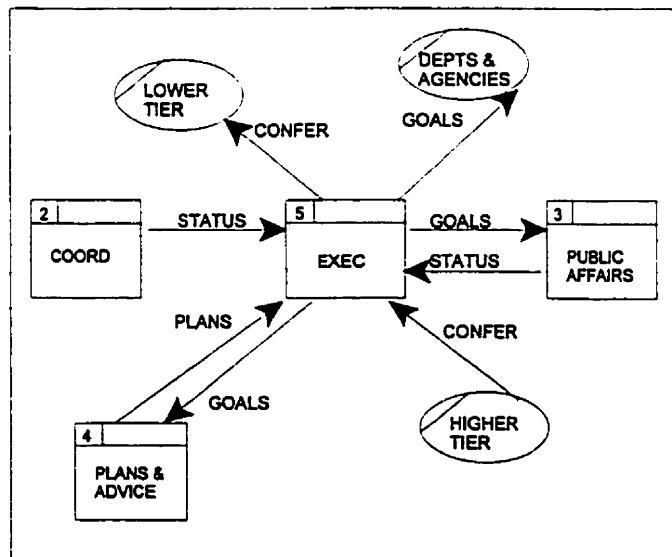
Figure 9 - Executive Information Flow Diagram
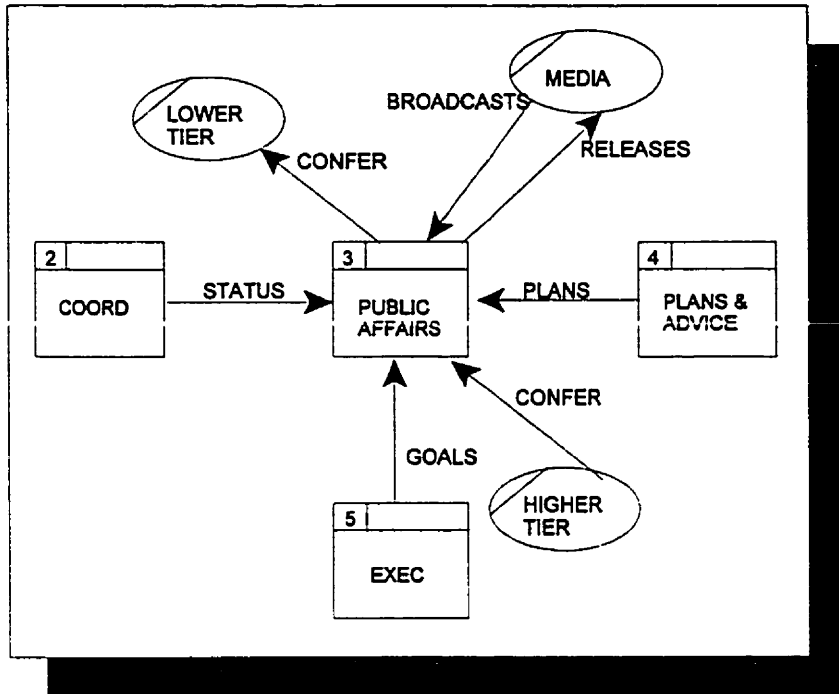
Figure 10 - **Public Affairs Information Flow Diagram**

ThirdTier
Federal
Government

Second Tier
Provincial or
Territorial
Government

First Tier
Local Authority

Coordination*

Triage

Public Affairs

Executive   Planning and Advice

Coordination

Triage

Public Affairs

Executive   Planning and Advice

Coordination*

Triage

Public Affairs

Executive   Planning and Advice
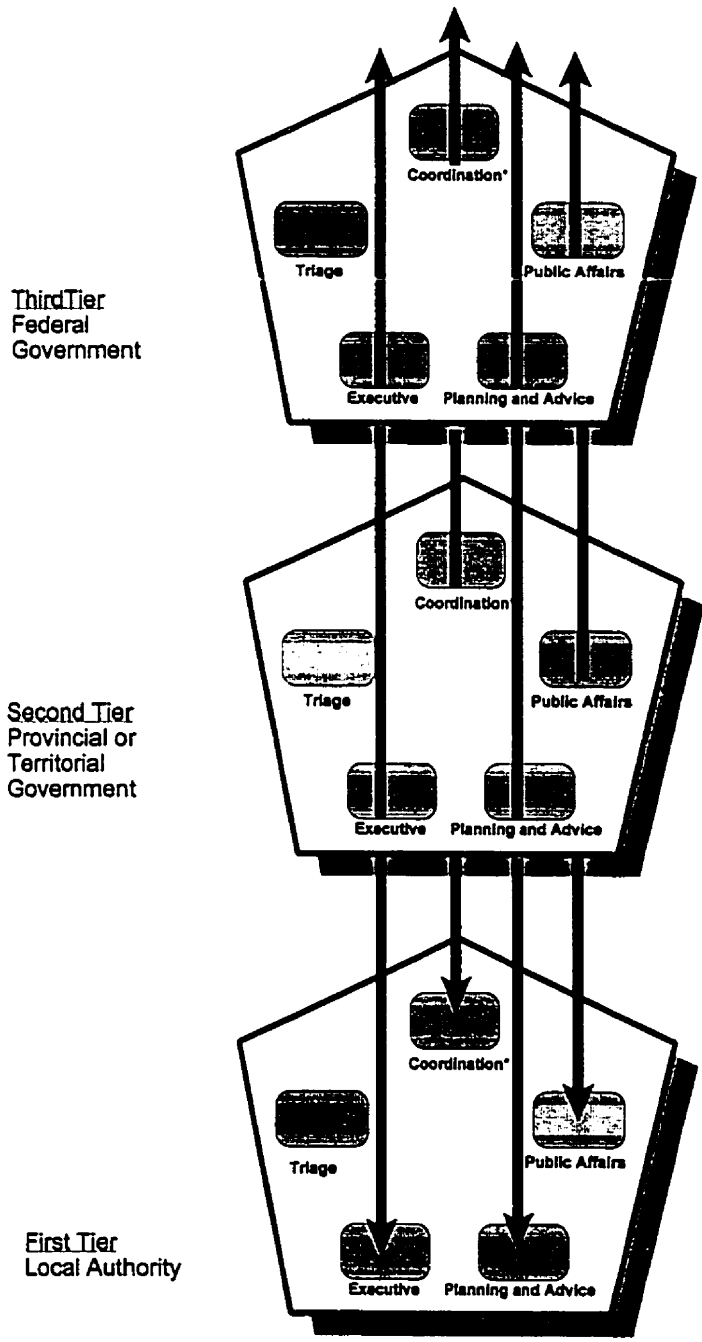
Figure 11 - Cross-Jurisdictional, Multi-Agency Model

CHAPTER 5 - CONCLUDING MATERIAL

Emergency management is a complicated task often demanding extraordinary cross-jurisdictional and multi-agency coordination and cooperation. An example of this complexity was the Canadian portion of the 1997 Red River Basin flood. This disaster, which threatened more than 70 percent of the Province of Manitoba's population and caused the evacuation of approximately 28,000 of its residents, involved the federal government, 8,000 troops of the Canadian Forces, the Manitoba provincial government, seven rural municipalities, the City of Winnipeg, six towns, one Indian Reserve, several NGOs, church groups, the private sector, and several hundred thousand volunteers.

The collective response to the 1997 flood was successful, however. And in the main, the perception of the citizens of Manitoba towards the massive cooperative effort was favourable. Nonetheless, a review of the formal after-action reports and the conduct of interviews with flood plain emergency coordinators revealed certain problems and criticisms, some of which dealt specifically with informational and decision-making issues. Many felt that central coordination across municipal, provincial and federal jurisdictions was lacking and that response activity, in general, was delayed. Others reported difficulties that were related to uncoordinated communications across municipal, provincial and federal jurisdictions; and complications that stemmed from the two models of delegating tasks and resources which coexisted but did not dove-tail well together, *i.e.*, the rigid and hierarchical "command and control" system used by the military, and the loose and flexible "coordination and cooperation" system used by the emergency management structure.

There was a consensus on the ideal that *future responses must be based on better informed decision-making and better coordinated action*. This study was also in agreement. Consequently, it has contributed to the achievement of this ideal by proposing a simple and

effective cross-jurisdictional, multi-agency information model for emergency management.

The study's sequence and structure followed two principles: 1) effective emergency management depends on how well decisions are made, and 2) good decisions depend on how well the supporting information system captures and transfers meaningful information from source to destination.

While the problem, thesis, and methodology, were introduced in the first chapter, the study's second chapter was dedicated to the examination of decision-making. It discussed the subject in detail and showed that on whatever level and in whatever environment, *choosing a course of action relies on gathering and evaluating meaningful information.* At the same time, however, it also provided a clear differentiation between non-crisis and crisis decision-making. The analysis of decision-making theories in both the non-crisis and crisis contexts, for example, revealed that *while some techniques work well in normal, day-to-day operations and management, these would be unsatisfactory in the uncertain, time-pressured, high-stakes environment typical of crisis situations.* The differences that were established by Chapter two are summarized at Table1.

The second chapter also explained that *the effectiveness of decision-making in crisis situations is, typically, directly proportional to the level of experience possessed by decision-makers, i.e.,* the more the experience, the better the decision. However, experience alone is not enough to assure a satisfactory outcome. Decision-makers must be aware of the inhibitors they face in order that they may take steps to guard against them. *Miscommunication,* for example, *may jeopardize the entire decision-making process.* Chapter two concluded that because sound decisions rely so heavily upon the collection and evaluation of information, a more detailed examination of information, as it relates to crisis management, was necessary.

	NON-CRISIS DECISION-MAKING	CRISIS DECISION-MAKING
METHODOLOGY	Methodological, analytical, systematic, scientific.	Pragmatic. Focused on what must be accomplished.
TIME SENSITIVITY	Relatively non-urgent.	Time is critical.
ENVIRONMENT	Stable with established goals, norms and procedures.	Complex, ambiguous, unstable. High intensity. High potential for stress and fatigue. Missing information, time constraints, ill-defined, shifting and/or conflicting goals. Dynamic and continually changing conditions. Ill-structured tasks, high stakes, high emotions.
SOURCES OF POWER	Deductive logical thinking, analysis of probabilities, statistical models.	Intuition, mental simulation, metaphors and analogies.
CONSEQUENCE	Allows for well-deliberated decisions, decision points, corrections and adjustments.	Potential risk to life and property. Delay could mean loss of life or property.
NUMBER OF PARTICIPANTS	In the majority, the literature involves a single, unified actor.	May involve many jurisdictions and many agencies. Team interaction.
RESEARCH FOCUS	In the main, normative and prescriptive.	Cognition-based. Concerned about how decision-makers handle confusion and stress.
INFORMATION RELIANCE	High	High
FRAMEWORK	Institutional structure, procedures, the influence of power, social and cultural attitudes, professional standards, regional or national economic conditions, anticipated political developments, and the need to mobilize public support for outcomes, may restrict innovation and the choice of alternatives.	Uncertain, ambiguous, and unique conditions. Cross-jurisdictional and multi-agency structure, missing or outdated procedures. Reliance on knowledge and experience. Decisions made during crisis are largely irreversible.

Table 1 - Non-Crisis and Crisis Decision Making in Contrast

Chapter three provided an analysis of the information requirements associated with an emergency management system, suggested lists of information requirements for use at local, provincial/territorial and federal levels of government, proposed requirement-driven recommendations in answer to the informational problems set out by Chapter one, and established the framework wherein a cross-jurisdictional, multi-agency emergency management model, upon which to subsequently build an emergency management information system, can be conceptualized.

Although it was hoped that the interview questions posed to the former local emergency coordinators would generate more meaningful data, the interviews were constrained by the time lapsed since the 1997 Red River Basin flood and by strong residual emotion. However, the most surprising constraint experienced was that the majority of respondents had difficulty expressing and/or understanding the fundamentals of EOC/EOCC operations and identifying the information requirement that might have made the task easier to manage had they been in place. The general sentiment recorded during the interviews was that none of the respondents would be eager to act in the capacity of an emergency coordinator again due to the problems experienced.

The interviews did, however, confirm the requirement of this study's aim. The absence of a standard emergency management information system spanning the jurisdictions of government and the boundaries of the many agencies involved in responding to emergencies was acknowledged, as was the ineffectiveness of those existing hierarchical diagrams that are intended to depict communication flow.

Appendix F, which evolved in the course of Chapter three's development, served to clarify Chapter one's Statement of the Problem by concisely listing each criticism found at the various 1997 Red River Basin flood after-action reports, along with its corresponding possible causes. As the analysis of the problems and their potential causes progressed,

it was determined that the causal factors of one problem could themselves be translated into problems.

When a potential cause could be considered as a problem, it was copied to the "problem" column and analysed in turn. The process continued until a problem's cause finally revealed itself as a "lack" of some function or capability. The result of this analysis concluded that the informational and decision-making problems experienced during the Red River Basin flood of 1997 could be attributed to a lack of liaison personnel, a lack of training, education, and procedures, and, more germane to this study, a lack of an integrated emergency management information system or framework. Of the 34 problems associated to the management of the 199 Red River Basin flood response, 24 of them were shown to be directly related to the absence of a cross-jurisdictional, multi-agency emergency management information system.

Independent from the way the follow-on system would actually function and the technology that would actually be used, the model is established at Chapter four. Based on the commonality of functions at each level of involvement, Chapter four builds a platform or tier which, in theory, should apply equally well to any level of government. Each tier includes five functional components or entities, namely: Executive, Coordination, Planning and Advice, Public Affairs, and *Triage*.

Overlaying the information requirements of Chapter three onto a tier offers a representation of internal and external information flows. However, the study's objective of proposing a simple and effective cross-jurisdictional and multi-agency information model in support of decision-making is not met by this diagram (see Figure 5). The nature of information flow in an emergency management information system is 3-dimensional. It encompasses internal and external inputs and outputs, as well as horizontal and vertical ones.

In order to simplify the model and to provide a standard upon which to build an emergency management information system, SSADM was chosen to provide the model building blocks and the basis for the terminology used as well as for the textual and diagrammatic representations of the discussion. Information flows associated with each entity were determined and named to show the information each flow carries. Finally, the cross-jurisdictional, multi-agency model was presented as Figure 11.

Its development was conducted from the highest level in order that a general and conceptual view of the intended information framework could be fully realised. The model's interfaces were kept minimal and simple and information flows were restricted to essentials. The main objective was that the model must allow the uninterrupted and timely transfer of meaningful information to the intended destinations in a form useable upon receipt.

In establishing the parameters for an integrated framework, it was determined that the model should reflect the Canadian emergency planning guidelines, which suggest an escalated emergency response starting with the Local Authority and moving progressively through the provincial/territorial emergency response structure to the federal emergency response structure. Accordingly, the model was depicted using three tiers, each structured identically, based on the observation that all tiers are intended to accomplish the same objectives.

In the course of this work's production, a number of areas requiring more attention came to light, but were outside the scope of this study. They were, therefore, not discussed in any detail but are offered here as potential for further examination or study:

❑ Emergency management training and education are lacking. Specifically, attention is required in the areas of Emergency Management Structure, the Importance of Liaison, EOC and EOCC Operations, Exercising and Simulation, the Use of Technology, the

Requirement for and Maintenance of Written Records, and Media Relations and Interviewing Techniques.

❑ Professional and standard qualifications are lacking for practitioners at all levels of government emergency management involvement.

❑ Standard emergency operations procedures for use across the country are lacking. Each province/territory and the federal government has its own way of conducting emergency management business.

❑ The use of technology, e.g., GIS, Digital Mapping, Automated Emergency Management Support Systems, Logging and Tracking Programs, is not standardized across the country. Technologically, there is no vertical or horizontal interoperability between the three levels of government.

❑ The provincial/territorial EMOs are each located under different departments. There appears to be difficulty with these arrangements in that other departmental ministers may not be as responsive to another minister as they would be to a higher level of authority. Attention should be given to an organizational arrangement that would elevate the profile of emergency management while affording it more "enforceability."

❑ There appears to be a similar difficulty at the federal level, where EPC reports to the Minister of National Defence. Federal ministers do not willingly report laterally to another departmental minister. Other problems related to the location of EPC under DND relate to the difficulty in "dovetailing" C^2 and Cooperation and Coordination systems and to the difficulty of providing equal attention to the mitigation and recovery aspects of emergency management, which are not normally DND priorities.

❏ More focussed attention on correcting the existing inadequacies of the information system supporting all crisis decision-making and emergency management activities is required, including an evaluation of this study's proposed cross-jurisdictional, multi-agency information model.

❏ A better understanding of the decision-making differences in crisis situations is required. It could be achieved through training and exercising decision-making units, conducting simulations, open-ended contingency planning, using psychological advisors in crisis decision-making staffs, and encouraging senior public officials to participate in training and preparatory exercises.

❏ There is no provision for emergency management specialization in the field of Public Administration. The provision of emergency management curriclae is recommended.

❏ Does the proposed model apply to the study of more global emergency management information requirements?.

A standard emergency management information system is recognized as being vital to practitioners and decision-makers alike. However, one does not exist. Where there are emergency management information systems, they are modelled against structural arrangements, which vary from location to location, and are deemed inadequate.

This study's proposed model, upon which an emergency management information system may eventually be built, is a starting point towards achieving a standard which can be used across the country. However, before launching onto the design and implementation of the system, the model must be fully tested against various scenarios (including worst-case ones), and practitioners and decision-makers that are usually involved in local EOC, provincial/territorial and federal EOCCs must be involved in the testing process.

APPENDIX A - GLOSSARY

Those communications terms and definitions cited below that are based on the DOD Joint Staff Publication No. 1-02, 1994, *Department of Defense Dictionary of Military and Associated Terms*, are identified by the adjacent marking: [DODJS].

Those emergency management terms and definitions cited below that are based on the FEMA Emergency Management Institute Independent Study Course, "The Emergency Program Manager," are identified by the adjacent marking: [FEMAISC].

Attribute
An information element used in the design phase of information systems to describe entities or relationships.

Channel
In a communications system, the part that connects a data source to a data sink.

Command and Control
1. The process by which commanders plan, direct, control, and monitor any operation for which they are responsible (D Force C3, 1995). 2. The establishment of common intent and the transformation of common intent into coordinated action (Pigeau and McCann, 1998).

Command and Control System
Military system used to support an action in response to a crisis. NATO defines this coordinating structure by combining the definitions of each term.

Communications [DODJS]
The transfer of Information among users or processes, according to agreed conventions.

Communications System [DODJS]
A collection of individual communications networks, transmission systems, relay stations, tributary stations, and data terminal equipment usually capable of interconnection and interoperation to form an integrated whole. *Note:* The components of a communications system serve a common purpose, are technically compatible, use common procedures, respond to controls, and operate in unison.

Data
Representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or by automatic means. Any representations such as characters or analog quantities to which meaning is or might be assigned.

Destination User
In an information transfer transaction, the user that receives information from the source, *i.e.*, from the originating user.

Emergency Operations Centre
The single location where local emergency services department heads, municipal government officers and officials, and volunteer agenices gather to oversee and to coordinate the on-site response to an emergency event. External organizations providing emergency services, assistance or resources to an emergency may also establish individual command or operation centres to track the allocation and status of their own resources.

Emergency Operations Coordination Centre

The EOCC is established within provincial or territorial jurisdiction to coordinate the allocation of resources provided by the province or territory on request from, and in support of, the LA during a disaster event until such time as the LA can resume its routine operations unassisted. Likewise, an EOCC is established within federal jurisdiction to coordinate the allocation of federal resources on request from, and in support of, provinces or territories.

Entity

1. An element of a conceptual information model representing a function, person, organization, department, computer system or anything else that sends or receives information. See User. 2. A class of objects, all of which can be described by the same attributes. *Synonym*: Source User.

Emergency Site Management

A coordinating structure used in Canada as the approximate equivalent to the Incident Command System. It is based on a multi-tiered framework for communications, joint (or coordinated) decision-making, and the coordination of activities or resources. It does not intend to undermine, usurp or interfere with the C^2 or ICS coordinating structures of the various response agencies. It intends instead to facilitate the interaction among the various crisis response organizations.

Feedback

A condition bearing information about the effect produced by the message and the consequences attributable to it (Graber, 1992).

Incident Command System [FEMAISC]

The coordinating structure of choice of the US Federal Emergency Management Agency. It represents a model for responding and providing a means to coordinate the efforts of individual agencies as they work toward the common goal of stabilizing a crisis, protecting life, property, and the environment.

Information

The meaning assigned to data by means of the known conventions used in their representation. Information consists of symbols (numbers, letters, words, graphics, etc.) that provide visualization or convey thought. It is generated from the collection, research, analysis, and arrangement of data to evaluate the underlying relationships between variables to draw new insights, to answer a question, to direct an activity, or to describe what has happened (Lindquist, 1998; Graber, 1992). A given piece of information may be meaningless by itself; however, combining pieces of information produces ideas or provides knowledge.

Information Analysis

A function of the information system in which information is subjected to review in order to identify significant facts for subsequent interpretation.

Information Collection (Acquisition) [DODJS]

The obtaining of information in any manner, including direct observation, liaison with official agencies, or solicitation from official, unofficial, or public sources.

Information Flow

A route by which information travels from one element of an information flow diagram to another. Information flows are represented by arrows which begin at the source entity and points to the destination entity.

Information Flow Diagram
A representation defining the passage of information through a system or model.

Information Fusion
Reducing information to the minimum essentials and putting it in a form upon which decision-makers can act.

Information Management
The careful planning and controlled steps necessary to achieve the purpose for which information is generated (Graber, 1992).

Information Processing [DODJS]
The systematic performance of operations upon information such as handling, merging, sorting, and computing. *Note:* The semantic content of the original data should not be changed. The semantic content of the processed data may be changed.

Information Store
An element of a conceptual of a conceptual information model representing a repository for information within the information system being modelled.

Information System [DODJS]
1. An interdependent collection of functions through which information is acquired, analyzed, processed, transferred, managed, and made available to decision-makers for action. It is conceptualized as a construct that operates, either manually or automatically, within an environment (personnel, facilities, standard operating procedures, regulations, etc.), and in relation to other systems in use during the crisis circumstance. Although the outcome of the system's activity is decision-making, the decisions cannot be determined precisely. 2. Any communications and/or computer related equipment or interconnected system or subsystems of equipment that is used in the acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of voice and/or data, and includes software, firmware, and hardware.

Information System Management [DODJS]
Network management functions extended to include user end instruments.

Information Transfer [DODJS]
The process of moving information from from a source to a sink or to a destination user.

Interconnection [DODJS]
1. The linking together of interoperable systems. 2. The linkage used to join two or more communications units, such as systems, networks, links, nodes, equipment, circuits, and devices.

Language
A set of characters, conventions, and rules that is used for conveying information.

Liaison
The contact or communications maintained between elements of the emergency response structure that ensure mutual understanding and unity of purpose and action.

Meaning
The representation of both, the concept of language, i.e., semantics, agreed understanding, common terminology, and intent.

Medium [DODJS]
In communications, the transmission path along which a signal propagates, such as a wire pair, coaxial cable, waveguide, optical fibre, or radio path.

Message [DODJS]
1. Any thought or idea expressed briefly, using language, prepared in a form

suitable for transmission by any means of communication. *Note:* A message may be a one-unit message or a multi-unit message. 2. In communications, record information expressed using language and prepared in a format specified for intended transmission by a communications system. 3. An arbitrary amount of information whose beginning and end are defined or implied.

Mitigation [FEMAISC]
A phase of emergency management. Any activities which actually eliminate or reduce the chance of occurrence of the effects of a disaster. Also includes long-term activities which reduce the effects of unavoidable disasters.

Preparedness [FEMAISC]
A phase of emergency management. Preparedness activities are necessary to the extent that mitigation measures have not, or cannot, prevent disasters. In the preparedness phase, governments, organizations, and individuals develop response plans and work to increase available resources, before the onset of a disaster. Preparedness activity is designed to save lives and minimize damage to property by preparing people to respond appropriately. The necessary components of an appropriate response are a response plan, trained personnel, and necessary resources. Preparedness measures also seek to enhance disaster response operations.

Recovery [FEMAISC]
A phase of emergency management. Any activities undertaken to return vital life support systems to minimum operating standards, in the near term; in the longer term, recovery activities continue until all systems return to normal or near normal, *i.e.*, until the entire disaster area is completely redeveloped, either as it was in the past or for entirely new purposes that are less disaster-prone.

Relationship
A descriptive element of the conceptual information model, representing an association of two or more entities.

Response [FEMAISC]
A phase of emergency management. Any activities designed to provide emergency assistance to victims of a disaster, as immediately as practicable, to reduce the likelihood of secondary damage, and to speed recovery operations.

Sink [DODJS]
In communications, a device that receives information, control, or other signals from a source.

Source User [DODJS]
The user providing the information to be transferred to a destination user during a particular information transfer transaction.

System [DODJS]
Any organized assembly of resources (including personnel and equipment) and procedures united and regulated by interaction or interdependence to accomplish a set of specific functions.

System Analysis
A systematic investigation of a real or planned system to determine the functions of the system and how they relate to each other and to any other system.

Telecommunication [DODJS]
1. Any transmission, emission, or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems. 2. Any transmission, emission, or reception of signs, signals, writings, images, sounds, or information of any nature by wire, radio, visual, or other electromagnetic systems.

Transmission [DODJS]
1. The dispatching, for reception elsewhere, of a signal, message, or other form of information. 2. The propagation of a signal, message, or other form of information by any means, such as by telegraph, telephone, radio, television, or facsimile via any medium, such as wire, coaxial cable, microwave, optical fibre, or radio frequency. 3. In communications systems, a series of data units, such as blocks, messages, or frames.

Transmission Medium [DODJS]
Any material substance, such as fiber-optic cable, twisted-wire pair, coaxial cable, dielectric-slab waveguide, water, and air, that can be used for the propagation of signals, usually in the form of modulated radio, light, or acoustic waves, from one point to another. *Note:* By extension, free space can also be considered a transmission medium for electromagnetic waves, although it is not a material medium.

User
A person, organization, or other entity (including a computer or computer system), that employs the information transfer services provided by an information system. *Note:* A user functions as a source or final destination of information, or both.

APPENDIX B - QUESTIONNAIRE INTENDED FOR THE LOCAL AUTHORITY

Rural Municipality (Internal Communication)

1   How was the RM's emergency response to the Red River Basin flood of 1997 controlled and/or coordinated?

2   Who staffed the RM EOC?

3   Which RM agencies were involved in responding to the event?

4   What were the communication links from the EOC to the RM agencies involved?

5   How did the EOC communicate to the RM agencies involved?

6   What were the communication requirements at the EOC from the RM agencies involved?

7   Which communities within the RM were involved in responding to the event?

8   How were their emergency responses controlled and/or coordinated?

9   Who staffed their EOCs?

10   What were the communication links from the RM EOC to the community EOCs?

11   How did the RM EOC communicate to the community EOCs?

12   What situational information did the EOC demand? How and by whom were these communicated to the EOC?

Private Sector Communication

13   Which private sector organizations were involved in responding to the event at the RM level?

14   What were the communication links from the EOC to the private sector organizations?

15   How did the EOC communicate to the private sector organizations involved?

Neighbouring RM Communication

16   How did the neighbouring RMs assist you in your response to the event?

17   What were the communication links from the EOC to the neighbouring RMs?

18   How did the EOC communicate to the neighbouring RMs?

19   What were the channels of communicationa between the RM and the media?

20   Which were the provincial agencies/departments involved prior to a request being made to the province for assistance?

Provincial Communication (before request)

21   What were the communication links from the EOC to the provincial agencies/departments involved?

22   How did the EOC communicate to the provincial agencies/departments involved?

23   What were the communication requirements at the EOC from the provincial agencies/departments involved?

Volunteer Agency/NGO Communication

24   Which were the volunteer agencies/NGOs involved within the RM?

25   What were the communication links from the EOC to the volunteer agencies/NGOs involved?

26   How did the EOC communicate to the volunteer agencies/NGOs involved?

27   What were the communication requirements at the EOC from the volunteer agencies/NGOs involved?

Federal Communication (before official provincial involvement)

28   Which were the federal agencies/departments involved prior to a request being made by the province for assistance?

29   What were the communication links from the EOC to the federal agencies/departments involved?

30   How did the EOC communicate to the federal agencies/departments involved?

31   What were the communication requirements at the EOC from the federal agencies/departments involved?

Other Communications

32   What other external information requirement did the EOC demand? How and by whom were these communicated to the EOC?

33   How was all the information required by the EOC stored?

Communication (after official provincial involvement)

34   Once the province's support was requested and in place, what constituted the information pipeline between the EOC and the EOCC?

35   Once the province's support was requested and in place, what changes were there in communication channels between the RM and the private sector?

36   Between the RM and previously established links with neighbouring RMs or others?

37   Between the RM and the media?

38   Between the RM and previously established communication links with provincial agencies/departments?

39   Between the RM and previously established communication links with volunteer agencies/NGOs?

40   Between the RM and previously established communication links with federal agencies/departments?

APPENDIX C - LETTER OF INTRODUCTION TO POTENTIAL INTERVIEW CANDIDATES

UNIVERSITY OF MANITOBA

Master of Public Administration

DEPARTMENT OF POLITICAL STUDIES
532 Fletcher Argue
Winnipeg, Manitoba R3T 2V5
Canada
Telephone (204) 474 9733
Fax (204) 474-7585

UNIVERSITY WINNIPEG

DEPARTMENT OF POLITICAL SCIENCE
6L20 Lockhart Hall
515 Portage Avenue
Winnipeg, Manitoba R3B 2E9
Canada
Telephone (204) 786-9340
Fax (204) 774-4134

To whom it may concern,

This letter serves to introduce Captain (ret) Guy Corriveau, who is presently completing his Master of Public Administration degree (conferred jointly by the universities of Manitoba and Winnipeg) In partial fulfilment of the academic requirements of this program, Capt Corriveau has undertaken to complete a thesis which proposes:

> a detailed examination of the information system framework in support of the Red River Basin flood of 1997 In light of the available theories of information handling in crisis decision-making situations, a number of complications and deficiencies in the information handling and decision-making process will be identified. On the basis of the literature reviewed, interviews, and the study of the Red River Basin flood of 1997, the thesis will develop a simple and effective information model for transversal use across municipal, NGO, private sector, provincial (state), and federal emergency management lines in disaster situations

Capt Corriveau's research necessitates the conduct of interviews with senior officials in the field of emergency management As such, you have been identified as a potential interview candidate and you will soon be contacted by Capt Corriveau for assistance in this regard It is important you be aware that the research and scholarly work conducted by Capt Corriveau will be carried out to the highest ethical and scientific standards of academic integrity With your permission the interview will be recorded on tape for later transcription However, the tape will be subsequently destroyed None of the information gathered will be for attribution, that is, you will not be identified, and the information imported by you will be used only in the context of the academic work

The interview, which should last no more than one hour, will be conducted at a mutually agreeable time as determined between you and Capt Corriveau Your participation is voluntary and you retain the right to withdraw from the study at any time and/or refrain from answering whatever questions you prefer to omit without prejudice or consequence.

We thank you in advance for your cooperation in this matter, and invite you to call either one of us if you have any questions in this regard.

Sincerely,

Professor Paul Thomas
Department of Political Studies
University of Manitoba
Thesis Advisor
(204) 474-8116

Professor Robert Tait
Director, Disaster Research Institute
University of Manitoba
Thesis Second Reader
(204) 474-8777

APPENDIX D - RESOURCE INFORMATION REQUIRED AT THE LOCAL LEVEL[1]

EMERGENCY SERVICES
Fire
Police
Ambulance
Public Utilities
Public Works

MEDICAL
Hospitals
Clinics
Doctors
Dentists
Nurses
Nursing Homes
Veterinarians
Medical Associations

ASSEMBLY AREAS
Parks
Parking Lots
Shopping Centres
Schools
Churches
Government Buildings
Warehouses
Community Centres

TRANSPORTATION
Buses
Trucks
Vans
4 Wheel Drive Vehicles
Tractor Trailors
Taxis
Power Boats
Airplanes
Snowmobiles
Swamp Buggies
Helicopters

SUPPLIES
Food
Clothing
Sand

MEDIA
Newspapers
Radio Stations
Television Stations
News Services

INDIVIDUALS
Clergy
Local Officials
Pilots
Amateur Radio Operators
Building Contractors

EQUIPMENT
Farm Tractors
Construction Equipment
Excavation Equipment
Chain Saws
Portable Power Plants (Generators)
Oxygen Tanks

SERVICE AGENCIES
Red Cross
Salvation Army
St. John's Ambulance

COMMUNITY GROUPS
PTA
Chamber of Commerce
Boy Scouts
Girl Guides
Kiwanis
Lions Club
Churches

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[1] Based on FEMA, n.d., p. 4-39.

APPENDIX E - INFORMATION REQUIREMENTS AT PROVINCIAL/TERRITORIAL AND FEDERAL LEVELS OF GOVERNMENT [1]

PLANS

❑   What are the applicable policies, procedures, regulations, legislation

❑   How can the planners at the other levels of government be contacted

❑   What are the overall priorities for response activities

❑   What is the status of upcoming activities

❑   What are the task-related restrictions and constraints

❑   What is the status of the systems providing power and potable water to the affected area

❑   What are the estimates of the potential impact of the crisis

❑   What are the needs and damage assessments

❑   What are the disaster area boundaries

❑   What are the social, economic, and political impacts

❑   What are the jurisdictional boundaries

❑   What is the status of transportation systems and critical transportation facilities

❑   What is the status of communication systems

❑   What are the access points, access roads, and entries to the disaster site

❑   What is are the hazard-specific scientific and/or technical considerations (*i.e.*, modes of exposure, chronic and acute effects, signs and symptoms of exposure, rehabilitation requirements, emergency and follow-up medical treatment and surveillance)

❑   What are the health and safety considerations (*e.g.*, protective equipment, decontamination and waste disposal requirements, emergency medical treatment)

❑   What are the evacuation procedures and temporary shelter needs

❑   What are the current and predicted weather forecasts

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[1]   Note: This list is not all-inclusive. Rather, it is only intended to represent the type of information that may be required at provincial/territorial and federal governments.

- ❑ What are the area's geographic, geophysical, and demographic descriptions

- ❑ What maps, schematics, and diagrams are being used; how can these be obtained and distributed

- ❑ What are the major issues and activities of plans activation

- ❑ What is the status of plans activation

- ❑ What is the status of disaster or emergency declarations

COORDINATION

- ❑ Who are the emergency coordinators at the other levels of government and how can they be contacted (*i.e.*, telephone numbers, e-mail addresses)

- ❑ What is the status of operations

- ❑ What are the operational priorities and requirements

- ❑ What is the status of resources

- ❑ What are the jurisdictions involved and who are the agencies, departments, NGOs, and public sector organizations involved

- ❑ Who are the representatives of the agencies, departments, NGOs, and public sector organizations involved

SUPPORT RESOURCES

- ❑ What are the resource requirements

- ❑ What resources are available

- ❑ Who controls the necessary resources (*i.e.*, LA, neighbouring community, public sector, department, agency, NGO); how are these control authorities contacted (*l.e.*, telephone numbers, e-mail address, address)

- ❑ What are the procedures for obtaining necessary resources

- ❑ What is the status of critical resources

- ❑ What are the additional sources of support resources (*i.e.*, consultants, contractors); how can these be contacted (*i.e.*, telephone numbers, fax numbers, e-mail addresses, addresses)

HUMAN RESOURCES

- ❑ Who are trained as Liaison Officers and how can they be contacted (*i.e.*, telephone numbers, e-mail addresses, addresses)

- ❑ Who are the departmental emergency coordinators and how can they be contacted (*i.e.*, telephone numbers, e-mail addresses, addresses)

- ❑ What is the status of key personnel

- ❑ Who are the regulatory and other personnel having special knowledge and experience relevant to health and safety and response operations; how can they be contacted (*i.e.*, telephone numbers, e-mail address, address)

COMMUNICATIONS

- ❑ What are the communication requirements (*i.e.*, how many networks, who are the subscribers, how are they interconnected)

- ❑ What are the available communication means (*i.e.*, land-line telephone, radio, cellular telephone, satellite telephone, internet, fax)

- ❑ What are the available communication equipment and systems

- ❑ What are the available radio frequencies and how are they acquired

- ❑ What are the standard communication procedures and protocols for cross-jurisdictional and multi-agency use

- ❑ What communications security measures are required (*i.e.*, protection of information, redundancy of systems)

- ❑ What are the procurement procedures for additional equipment and systems

- ❑ What are the equipment and system environmental and operating requirements

- ❑ What user training is required for communication equipment and system use

PUBLIC AFFAIRS

- ❑ What are the relevant press services, newspapers, TV stations, and radio stations; how can they be contacted (*i.e.*, telephone numbers, fax numbers, e-mail addresses, addresses)

- ❑ What is the available background material and how can it be quickly accessed and disseminated

- ❑ Who are the experts and others with whom the media can consult for technical details and for verification of information; how can they be contacted (*i.e.*, telephone numbers, e-mail addresses, addresses)

- ❑ How can the other Public Affairs coordinators at the other levels of government be contacted

APPENDIX F - INFORMATIONAL PROBLEM ANALYSIS

	REPORTED PROBLEM	POSSIBLE CAUSE
1.	Information was treated as proprietary.	Each provincial department seemed to run independently and had its own internal source of information and relied solely on its own field people to gather intelligence.
		Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
2.	Each provincial department seemed to run independently and had its own internal source of information and relied solely on its own field people to gather intelligence.	Information was not properly shared.
		Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
3.	Information was not properly shared.	Information was treated as proprietary (see 1).
		"Political" barrierrs may have been responsible for "stymied" openness between participants and for the general unwillingness to share information.
		Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
4.	Individual departmental policies being followed vs. those policies and decisions set by the CTT.	Failure to provide central coordination.
		Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.

5	Decision-making was conducted in a disjointed and fragmented manner.	Failure to provide central coordination. Information was not properly shared (see 1). Each provincial department was perceived as wanting to be the expert. Difficulty was encountered obtaining information from provincial departments. Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
6	The province's departmental response was uncoordinated.	Failure to provide central coordination. Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
7	Failure to provide central coordination.	Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
8	Each provincial department was perceived as wanting to be the expert.	Information was treated as proprietary (see 1). Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
9	Difficulty was encountered obtaining information from provincial departments.	Information was treated as proprietary (see 1). Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
10	The province was perceived to have conducted "unilateral" decision-making and "usurped" municipality responsibilities.	Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.

11	"Ownership of the problem" led to differences in the way communications and actions were carried out.	Information was treated as proprietary (see 1). Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
12	Conflicting or contradictory information.	Failure to establish clear authority for the release of information to the media. Each provincial department seemed to run independently and had its own internal source of information and relied solely on its own field people to gather intelligence (see 2). Provincial authorities were not pro-active with the media and media interviews needed to be better planned. Measures to prevent rumours and to quash "informal" information networks were not taken. Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
13	Failure to establish clear authority for the release of information to the media.	Lack of training and education. Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
14	Provincial authorities were not pro-active with the media and media interviews needed to be better planned.	Lack of training and education.
15	Measures to prevent rumours and to quash "informal" information networks were not taken.	Information was treated as proprietary (see 1). Provincial authorities were not pro-active with the media and media interviews needed to be better planned (see 15)

16	Media relations, in general, could have been improved.	Lack of training and education. Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
17	The news media tended to sensationalise information.	Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
18	Reliance of media channels for necessary information	Information was treated as proprietary (see 1).
19	Local knowledge not being incorporated in decision-making and recommendations.	Lack of LO. Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
20	Lack of LO.	Shortage of personnel. Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
21	LAs were all treated as though they all faced the same threat, had the same response capabilities, and faced identical impacts.	Lack of LO (see 20).
22	Knowledge and advice of local experts seemed to have been ignored.	Lack of LO (see 20).
23	Lack of LA representation on EMO committees.	Each provincial department seemed to run independently and had its own internal source of information and relied solely on its own field people to gather intelligence (see 2).
24	Unauthorized calls accepted into the EOCC.	Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.

25	Improperly "packaged" information received at the EOCC.	Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
26	Overwhelming information throughput at the EOCC.	Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
27	Inordinate amount of verbal vs. written information.	Lack of training, education, and procedures.
28	Lack of common terminology.	Lack of training, education, and procedures.
29	Miscommunicated and misunderstood information.	Lack of training, education, and procedures. Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
30	No U.S. flood information communicated to southernmost LAs.	Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
31	Delayed arrival of information.	Lack of procedures. Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
32	Emergency response structure problems.	Lack of a cross-jurisdictional, multi-agency information model and corresponding information system.
33	Too many political committees overseeing the response operations.	Failure to provide central coordination (see 7).
34	Two delegation and tasking structures co-existing but not dove-tail well	Failure to provide central coordination (see 7).

APPENDIX G - BIBLIOGRAPHY

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