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STRENGTHENING FLOOD MANAGEMENT
THROUGH US-DUTCH COOPERATION:
LEARNING FROM A LARGE SCALE
FLOOD EXERCISE IN THE NETHERLANDS
PART II: FINDINGS

Uri Rosenthal
Karen Engel
Marco Zannoni
Sue McNeil
Joseph Trainor
John R. Harrald
Greg Shaw

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Strengthening flood management through US – Dutch cooperation
Learning from a Large Scale Flood Exercise in the Netherlands

Part II: Findings

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COT Institute for Safety, Security and Crisis Management

Uri Rosenthal, Karen Engel en Marco Zannoni

Disaster Research Center (University of Delaware)

Sue McNeil and Joseph Trainor

**Institute for Crisis, Disaster and Risk Management (George
Washington University)**

John R. Harrald and Greg Shaw

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1 Introduction

In the light of increasing cooperation between the United States (US) and the Netherlands, particularly between knowledge institutes, the Ministry of Public Works, Transport and Water Management in the Netherlands requested COT Institute for Safety, Security, and Crisis Management (COT), to initiate research with a number of US disaster research institutes. COT took this challenge and developed the research project *Learning from a large scale flood exercise in the Netherlands*. The primary objective of this research project is to enhance knowledge in the Netherlands of strategies to effectively deal with (possible) floods by exchanging knowledge regarding key processes, best practices, and complexities of flood disaster management and identify areas, within this field, that necessitate additional research.

Against this background representatives from two US institutions, Disaster Research Center (DRC) at University of Delaware and the Institute for Crisis, Disaster and Risk Management at George Washington University, provided a US perspective. The objective of the exploratory project was to develop background knowledge for, participate as observers in, and derive lessons learned from the Dutch flood-exercise week "Waterproef", organized by the Flood Management Taskforce (TMO, Taskforce Management Overstromingen) in November 2008.

In this report we present the findings of the project. First, we briefly present the project trajectory. During this project the researchers involved documented their progress. In the course of the project we have written:

- four working papers on relevant literature and US experience
- a white paper on crisis management and water management in The Netherlands
- a observation report on Waterproef
- a paper on the findings form additional Dutch interviews with Waterproef key players
- a report on the results from a expert meeting in Rotterdam

The report begins with a brief description of the project trajectory, and then we discuss our findings. We have identified various topics that are – from our point of view – of interest in light of our objective to exchange knowledge and experience. The topics are:

- Doctrine and structure
- Capacity
- Situational Awareness
- Information and Communication Technology (ICT) support
- Coordination and Communication
- Human Factors
- Large-scale exercise
- Public communication
- Regionalization

- Warnings and warning response
- Search and Rescue
- Leadership

The last paragraph we have dedicated to translating the findings to the Dutch context. Throughout the paragraph COT reflects on the findings from their knowledge and expertise, particularly from the Dutch perspective and context, in order to position interesting opportunities for future learning throughout the Netherlands.

Project trajectory

The project was divided into three phases, namely a preparatory, an observation and a reflection phase. Throughout the preparatory phase four working papers were developed. These papers served to review experiences and literature relevant to the exercise. The titles of the papers are as follows:

- Best Practices in Incident Management, John R. Harrald, Ph.D. and Dilek Ozceylan, George Washington University, Institute for Crisis, Disaster, and Risk Management
- Best Practices in Using Information Technology in Disaster Management, by Dilek Ozceylan and John R. Harrald, Ph.D, Institute for Crisis, Disaster, and Risk Management, The George Washington University
- A Brief Summary of Search and Rescue Literature, Joseph Trainor, Disaster Research Center, University of Delaware
- A Brief Summary of Social Science Warning and Response Literature, Joseph Trainor, Disaster Research Center, University of Delaware

In addition COT developed a working paper “The Netherlands: Crisis Management and Water Management” that served as a resource for the US team and provided background material.

The observation phase was dedicated to deriving substantial observations from the large scale flood exercise Waterproef. This phase subsequently included observing various elements and participants of the exercise, writing up the ‘preliminary observations’ report:

- “Learning from a Large Scale Flood “Waterproef” Exercise in the Netherlands- Preliminary Observations”, Joseph Trainor and Sue McNeil, Disaster Research Center, University of Delaware; John Harrald, and Greg Shaw, Institute for Crisis, Disaster, and Risk Management, The George Washington University.

To complement the US observations with a number of Dutch observations, COT held in depth interviews with a number of participants of the exercise week and developed an additional working paper on the findings: “Additional interviews: findings”.

The project design ensured reflection moments, particularly with Dutch scholars. The last phase, however, was solely dedicated to reflection; to the exchange of ideas and the generation of discussions based on the US observations and

additional interview finding. Central to this phase was an expert session in which scholars, practitioners and decision-makers of the Netherlands came together to reflect on the results of the project and take first steps towards defining a future research agenda directed at facilitating flood preparedness in the Netherlands.

This report brings together the outcome of all three phases with the objective of providing an overview of 'issues identified' not merely throughout academic literature or US experience, but also through observing the large scale flood exercise in the Netherlands, Waterproef.

Topics: findings

In discussing our findings and the final remarks we use the papers that were prepared before Waterproef and the papers that were produced after Waterproef. In some cases we only have information from the Waterproef exercise without additional information from US literature, because the specific topic was not originally addressed in the papers but came up during Waterproef and related discussions.

2 Doctrine and structure

The interviews confirmed that throughout the Dutch context the issue of 'doctrine and structure', particularly with respect to large-scale events such as a possible flood at the national scale, continues to be a pit fall for the responders.

The observations and documentation seen by the US researchers did demonstrate that the Netherlands is developing a workable system. The interviews however highlighted various challenges that remain. Interviewees, for example, disclosed that the great array of parties involved has led to a system characterized by diversity, especially with respect to structure, procedures, methods and cultures. All actors have organized themselves independently and national harmonization is limited while, as the exercise week demonstrated, floods require a system that transcends borders, i.e. a system typified by national consistency. Throughout the exercise participants experienced a complex system that made cooperation on different levels and between geographical areas difficult as systematic procedures were missing. In addition to difficulties regarding cooperation, limited uniformity also resulted in organizational confusion particularly regarding the command and control structures.

Throughout the US it appears that it has taken three Presidential directives and hurricane Katrina to begin to address the issue of 'doctrine and structure' and attain the national system characterized by a common structure and doctrine applicable to all hazards that is in place today¹.

This common structure and doctrine is established in the National Incident Management System (NIMS) and the National Response Plan (NRP). The National Response Plan was revised and renamed as the National Response Framework (NRF) following Hurricane Katrina. These developments have led to the establishment of a single, comprehensive approach to domestic incident management to be established.² The NIMS ensures that consistent command and control structure and systematic procedures are used during the response to all incidents, minimizing organizational confusion and enhancing the ability to develop training programs and mobilization protocols. The National Response Framework establishes national policy and doctrine for preparedness, response and recovery and assigns responsibilities to federal agencies and non government organizations. The NRF is intended to ensure that the government approaches all hazards and threats in a consistent manner and to provide the basis for developing the capability and capacity to do so.

The national system established by the NRP and NIMS received its first major test when Hurricane Katrina struck the Gulf Coast in August 2005. The federal government and state government response was a failure and significant effort has been directed to correct some serious deficiencies. One of the primary deficiencies

¹ Doctrine and structure are established in the National Incident Management System (NIMS) and the National Response Plan (NRP).

² Homeland Security Presidential Directive Five (HSPD5) declared that: "To prevent, prepare for, respond to, and recover from terrorist attacks, major disasters, and other emergencies, the United States Government shall establish a single, comprehensive approach to domestic incident management".

concerned the issue of 'doctrine and structure', namely the "lack of agility and creativity" as a result of fixed 'doctrine and structure'. The development of doctrine and structure designed to enhance command, rather than to ensure collaboration and coordination made the federal response more bureaucratic and less agile (see Harrald, 2006; Harrald, 2007, Buck, Trainer and Aguirre 2006). During the response to an extreme event, managers must deal with the unexpected and must have the ability to improvise and adapt. Up till now FEMA is attempting to deal with this issue but it is not yet clear whether or not the current efforts will achieve their desired objective.

3 Capacity (for campaign operations)

Throughout the Waterproef exercise it became apparent to the observers that the rhetoric of 'special needs populations' has become so dominant in emergency management that it has become a must attend to issue. It is important for responders to remember however that the label special needs is simply meant to provide a column that sensitizes us to those groups of people that will need more help than the 'normal person'. There seemed to be little awareness of what precisely special needs meant, the complexities involved in assisting these populations, and what might be done to provide additional assistance. Although the social disparity in the Netherlands is not of the same scale as in the USA, it is important to remember that the Netherlands does have some level of cultural, educational, and experiential diversity that must be taken into account when planning social services during disasters.

In addition to understanding the notion of 'special needs populations' it is important to be able to translate disaster caused needs, to required response capacities. Response requires the mobilization of resources of adequate capability and capacity and people with adequate competence. Throughout the exercise it became clear that several components of the Waterproef exercise tested capability and competence—the nursing home evacuation, the wrapping of the dikes, the final day rescue exercise—and the results were impressive. However, while observing in many areas that the Dutch responders have the capability to engage in technical procedures, there were serious reasons to believe that responders grossly underestimated the scale and scope of the events being envisioned. They often made the assumption that resources such as man-power and equipment would simply be in ready supply. There are a number of complex logistics issues that were not addressed sufficiently to suggest that the capability existed to engage in such a large scale operation for a sustained period of time. Overall there was little attention to spatial and temporal connections. Furthermore, these capacities were not part of the strategic decision-making process. It is our perspective that strategic level decisions should be made with a level of awareness of the capability of organizations to successfully complete operations. This level of information allows for more informed decision-making and in the end better results.

The issue of capacity is not unique to the Netherlands. One of the deficiencies that became apparent and needed attention following Katrina was the issue of inadequate capacity. The recognition of this issue has moved FEMA to fund a national catastrophic event preparedness effort designed to increase state capacity and capability in addition to the creation of deployable response teams in key functional areas (search and rescue, medical, communications, etc). The US DOD Northern Command has increased the preparedness of the military to assist in disaster response.

A continuing problem, however, is, also in the US, determining the required response and recovery capability and capacity. The response and recovery capability and capacity required are determined by the needs of the affected population and region. These needs are a function of the physical impact caused by the event, and the social and physical vulnerability of the affected population.

When estimating the required capabilities and capacity a number of issues arise. Firstly one has the problem of understanding social vulnerabilities. Social vulnerability is the product of social inequities. It is defined as the susceptibility of social groups to the impacts of hazards, as well as their resiliency, or ability to adequately recover from them (Cutter and Emrich, 2006). This susceptibility is not only a function of the demographic characteristics of the population (age, gender, wealth, etc.), but also more complex constructs such as health care provision, social, capital, and access to lifelines (e.g. emergency response personnel, goods, services)(Cutter et al, 2003; Cutter et.al, 2000; Cutter, 1996).

Another issue that arises is the problem of determining requirements of special needs populations. Individuals in need of additional response assistance may include those who have disabilities; who live in institutionalized settings; who are elderly; who are children; who are from diverse cultures; who have limited English proficiency; or who are non-English speaking; who are homeless, who are seasonal tourists or who are transportation disadvantaged. Populations whose members may have additional needs before during and after an incident in functional areas, including but not limited to: maintaining independence, communication, transportation, supervision, medical care (FEMA, 2008).

Lastly, problems in translating disaster caused needs to required response capacities is an issue. The concept of vulnerability has been accepted conceptually but is difficult to implement operationally. Managers are looking for simplified indices that will help them estimate needs and deploy resources. The problem is compounded by our poorly understanding of how cascading impacts (e.g. loss of power leading to loss of water and sanitation and health care) increases the needs of vulnerable populations and therefore the requirement for response capacity and capability.

Drawing on current research, however, DHS has developed methods of estimating physical and social vulnerability and development of models that will identify areas where high vulnerability and development of models that will identify areas where high vulnerability coincide with areas of high impact.

Estimating disaster caused needs requires not only the estimation of economic and biophysical vulnerabilities but also the evaluation of social vulnerability. To understand who the most socially vulnerable people are within a population and where those less resilient reside is needed before response decisions can be made. (Cutter and Emrich, 2006)

Since vulnerability manifests itself geographically in the form of hazardous places (floodplains, remnant waste sites); spatial solutions are required, especially when comparing the relative levels of vulnerability between places or between different groups of people who live or work in those places (Cutter, 2003).

Knowledge of physical and social vulnerability is used by FEMA during its planning process through the use of its loss estimation modeling tool HAZARD_US Multi Hazards (HAZUS-MH), or through the use of storm surge models.

Aside from estimating the required capabilities and capacity, hurricane Katrina demonstrated the importance of rapid and extensive mobilization of response

resources. While, due to the nature of any exercise, the issue of mobilization of resources was not prominent, it is an issue that literature and experiences in the US presented as another difficulty when discussing the issue of 'capacity'. As an area of interests with respect to the response to large scale events, throughout the US three major initiatives have occurred in the United States that significantly improve the ability to identify and mobilize essential response resources, namely national special teams, state mutual aid and regional mutual aid.

While these efforts throughout those areas facilitate the mobilization of resources, difficulties with respect to this issue remain. It continues to be difficult to anticipate requirements for extreme events that have not yet occurred. Subsequently, there is often the problem of unexpected requirements. Another issue relates to communication difficulties through chaos. It is difficult for an impacted area to know what resources are needed immediately after an event. It is even more difficult to communicate these needs to organizations that are capable of providing resources.

Lastly, the issue of political leadership becomes prevalent throughout the mobilization of resources as well. The failure to estimate needs before an event or to the failure to adequately assess post event impacts can result in failure to act or a failure to request needed assistance, as was seen during the Katrina response. At the other extreme, there is a temptation to request everything and anything, resulting in an expensive and counter productive commitment of resources. This tendency can be exacerbated by an overly aggressive federal response.

4 Situational Awareness

While 'situational awareness' was originally an aviation term, it is now broadly used in military and civilian operational contexts to describe congruence between the operational perception of a situation and reality. Both throughout the literature and the observations situational awareness is presented as essential for an adequate response to an extreme event. However, it remains a topic of discussion as in practice the ability to adequately attain situational awareness remains limited. Situational awareness has an information component, a perception component, and a meaning component.

The difficult nature of situational awareness was observed during the exercise in a number of locations. Information for this case was obtained from three sources: the exercise script, operations center databases and displays, and external communications. This component is necessarily artificial in an exercise, but participants must determine what additional information is required beyond that provided in the exercise script and where and how to get it. Although there was impressive access and display of pre-disaster data, there was delay and difficulty in identifying and obtaining information critical to key decisions. In one example, the Strategic Team wanted to know how many special needs people would require assistance evacuating and their pre-evacuation location. They also needed to know how many people had self evacuated. It did not appear that the management team was ready to respond to this type of question. It did not appear that the management team was ready to respond to this type of question. The concept that the needs of the people impacted by the disaster would dictate response requirements and capacity did not appear to be well understood. The Management Team and Strategic Teams, located only meters from each other, had different perceptions of what was occurring and opinions on what was significant. The process of providing periodic situational reports and briefings to the Strategic team by the incident leader (the Fire Chief) did not seem to be an effective way of ensuring both teams were on the same page. For example, in one instance the occurrence of fatalities was recognized as important by both teams but the Management team saw this as an operational issues and focused on body recovery and identification while the Strategic team saw this as a major issue affecting the morale of the population and the interests of the national government and was concerned with media announcements, notification of next of kin, reporting to the national government, and the potential for additional casualties. The information provided by the Management Team did not meet their needs.

The interviewees concurred that attaining and maintaining a consistent and complete situational awareness was limited throughout the exercise. It was difficult to get the right information to the right partners and to embrace unique characteristics of the different geographical areas, i.e. respect national diversity. Also it was difficult to change and regularly update the situational awareness.

Another difficult, regarding situational awareness, was accommodating the large number of local and regional area characteristics, such as distinctive geographical qualities, cultural features and risk. Several interviewees particularly felt that the national level did not acquire the necessary information regarding regional realities and needs in case of a (possible) flood. They perceived that insufficient knowledge regarding regional risk profiles, realities, and regional demand in times of a

(possible) flood at the national level might prevent them from sharing situational awareness with the regional levels. Particularly when it comes to floods, the reality of a flood is defined by a specific area's specificities, and is therefore different everywhere.

Throughout the US, particularly the Department of Homeland Security and FEMA have invested heavily in the first component of situational awareness—the collection, filtering, analysis, and distribution of information. Thousands of lives may have been saved by effectively using accurate situational information during the preparation and initial response to Hurricanes Gustav and Ike in the summer of 2008. Situational awareness allowed decision makers in states, Federal regions, and at FEMA and DHS headquarters in Washington, D.C. to manage the allocation of people needing public shelters to shelters opened in 9 states and 3 federal regions.

While efforts are directed at improving the component of situational awareness, the focus continues to be on the first element of situational awareness; on information. As a result, a number of issues regarding situational awareness continue to be problematic. The first issue is the problem of shared perception. Providing accurate, relevant, and consistent information to decision makers in the multiple operations centers in multiple locations that are required to manage the response to an extreme event is technologically and organizationally complex. Even if these operations centers receive approximately the same information, however, their perception of reality may differ significantly due to differences in experience, organizational culture, or organizational objectives. Unless collaboration mechanisms exist to share perceptions as well as information, shared situational awareness will not be achieved. Shared information does not necessarily produce a shared perception of reality.

Another problem is the problem of shared meaning. Meaning requires an understanding of the implications of information, both for the present and for the future. The imputation of meaning to information is a function of one's experience, knowledge, and culture. Simply put, information means different things to different people. In military organizations, uniform training and extensive shared experiences minimize differences in perception and understanding of meaning of information. In a response to a catastrophic event, however, responders and responder organizations are extremely diverse. Organizations range from military and professional first responders (fire, police) to organizations of spontaneous volunteers. At present, our ability to network and to share information exceeds our ability to promote shared perception and shared meaning.

5 Information and Communication Technology (ICT)

While observing the exercise, but also throughout the interviews, it became clear that responders throughout the Netherlands are aware of the possibilities of adequate ICT support throughout flood response. When it comes to implementation, however, problems remain and the full potential of ICT has not yet been realized.

The interviewees put forward that the use of technology to improve the management of disaster response, i.e. Decision Support Systems, would be an advantage but only when implemented adequately. Participants of the exercise acknowledge that through the use of technology effective and efficient communication could for example be realized.

The interviews however, put forward that the primary problems arise throughout the implementation process. The diversity of systems used and unfamiliarity with the different system primarily hampered the process of decision-making, communication and coordination throughout the exercise. As a result interviewees underlined the importance of technology, but also the importance of uniform systems that are understood by all relevant partners at different levels and areas of expertise.

Furthermore, participants of the exercise warned that one should be aware that the use of technology, particularly Decision Support Systems, does not take into account the emotional reality of a disaster. To complement technology it is therefore important to be in touch with the reality outside control rooms; the reality throughout disaster areas. It became clear throughout a variety of interviews that technology has an added value when perceived as support of human activities.

As also presented throughout US experience and academic literature, the rapid evolution of information technology is providing capabilities that are dramatically changing our ability to prepare for, respond to, and recover from extreme events (Harrald, 2005).

According to Pine (2007) technology has had major effects on all organizations, allowing emergency managers to predict hazards more quickly, respond more effectively, communicate quickly, develop a better understanding of hazards, improve response, increase coordination, improve efficiency, improve training and risk communication programs. It provides more robust, interoperable, and priority-sensitive communication; better situational awareness and a common operating picture; improved decision support and resource tracking and allocation; greater organizational agility for disaster management; better engagement of the public; and enhanced infrastructure survivability and continuity of societal functions (NRC, 2007).

Four areas of information technology best practice identified are:

1. Warning Systems
2. Decision Support Systems
3. Interoperable Communications

4. Geospatial Technologies

One area of information technology best practice identified is the area of 'Warning Systems'. Early warning is the provision of timely and effective information, through identifying institutions, that allow individuals exposed to hazard to take action to avoid or reduce their risk and prepare for effective response (GDACS, 2008). With increasing damage caused by natural disasters in last decade, the implementation of effective Early Warning Systems (EWS) has become a major issue on the agenda of international, national, and local authorities (Meissen and Voisard, 2008). Early warning has been recognized as an effective tool to reduce vulnerabilities and to improve mitigation, preparedness and response to natural hazards (Pattie and Dannenmann, 2008; Meissen and Voisard, 2008). It is important that warnings are disseminated effectively and efficiently in a timely way and targeted to people at risk (Hui et al, 2008; Meissen and Voisard, 2008).

A number of issues, however, continue to hamper the effective implementation of early warning systems. The information technology needed to create an all hazards warning system exists. But one important challenge in the successful implementation or improvement of an EWS is evaluating and monitoring its efficiency (Meissen and Voisard, 2008). Fragmented responsibility and lack of coordination leads to inconsistent messages and/or overly broad messages instead of the desired authoritative and targeted warnings (NRC, 2005) and these situations cause inefficiency (UN/ISDR, 2006).

Warning messages must be received and understood to be effective. Warning systems must consider people's perception, interpretation, and reaction to the warnings. It requires significant knowledge of the population, in terms of their demographics, societal culture, and past events that have occurred in the location (Pattie and Dannenmann, 2008).

Besides these, lack of legal frameworks, insufficient investment, lack of participatory approaches and inadequate identification and sharing of methodologies and good practices are also seen as a barrier to being effective (UN/ISDR, 2006).

Another best practice identified is the use of technology to improve the management of disaster response. Disaster managers face unexpected situations, must act during periods of great chaos, and must make critical decisions based on incomplete and inconsistent information. Using information technology to support key decision makers and the making of critical decisions has been a major priority for the US Federal Emergency Management Agency since Hurricane Katrina.

The best practice related to this specific issue regards Decision Support Systems. Decision support is needed to help frame crucial decisions, to structure the analysis of alternatives, and in monitoring results after decisions are made. For example, the decision to "evacuate those at risk" must be supported with how many are at risk, where should they be evacuated to, and address the "how can we do this" part of the task. Where are shelters? Which hospitals have beds? How will casualties be transported, and how can the process be managed, and who needs to know? (Carver and Turoff, 2007)

Also with respect to the implementation of DSS a number of issues remain problematic:

- First the pre-event identification of critical decisions. Disaster managers are often faced with unexpected conditions that have not been anticipated during planning and exercises. Decision support systems must be robust and flexible enough to support unexpected critical decisions.
- Second, erroneous identification of decision makers. Decision support is only useful if it is available to the appropriate decision makers. If systems are developed to support national headquarters, for example, and decision are actually made by decentralized regional and local officials, the technology will be of limited use.
- Lastly, inability to get the right information to the right place at the right time. Decision support systems depend upon information. Information gathering, analysis, and distribution capabilities must support the decision support technology.

Another ICT best practice concerns the ability of response organization to communicate with each other during the response to complex, extreme events. The response to a complex, extreme event can involve hundreds of organizations and thousands of trained responders. These organizations and individuals must be able to communicate critical information without overwhelming their technology of themselves. The tragic loss of lives among responders when the World Trade Center towers collapsed after the attacks of 9/11 dramatically demonstrated the critical importance of effective emergency responder communication systems. After that interoperability has widely recognized as a vital to effective emergency response by the United States Department of Homeland Security.

The last best practice relates to gathering, analyzing and displaying information to enhance the understanding of complex, dynamic events, particularly Geospatial Technologies. Geospatial technologies include, but are not limited to, geographic information systems (GIS), global positioning systems (GPS), remote sensing, and location-based systems (LBS) (Sui, 2008). These technologies can play a vital role in helping us cope with our uncertain world (Bednarz and Bednarz, 2008).

A GIS is an organized collection of computer hardware and software designed to create, manipulate, analyze, and display all types of geographic data. A GIS can assist in emergency rescue operations by identifying where help is needed and helping to direct resources in an efficient manner. It is easy to determine the potential damage from a flood and see who will be affected. A GIS allows the user to select features in a layer (e.g. special needs populations) that intersects with another layer (a flood zone). You could communicate directly with residents in the flood zone in a pending flood. You could see the interstates and plan evacuation routes. You can also attain a list of critical facilities from looking at this map, and you could make special arrangements to evacuate residents in those facilities (Pine, 2007).

A global positioning system (GPS) is a system to identify and record a geospatial reference point on the Earth's surface using a set of satellites orbiting Earth. GPS technology has many applications. These applications can be broken down into five broad categories which are determine the location, navigation, tracking, mapping and timing (Pine, 2007). Following Hurricanes Katrina and Rita, survey teams were dispatched to New Orleans to use GPS to record the extent of flooding

at street intersections or in open areas. In addition, the precise locations of residential and commercial buildings in New Orleans were identified using GPS units. High water marks were then measured on these structures in order to verify water depths throughout the city. GPS technology was essential in accurately recording the extent of flooding and the location of high water marks (Pine, 2007).

Remote sensing has most commonly been employed as a method for the detection, identification, mapping, and monitoring of hazards and effects of disasters (Showalter, 2001).

A pit fall, however, is that too often when using Geospatial technologies maps and other products are produced without adequate knowledge of their potential use (what functions and decisions they will support). Inversely, manager use geospatial displays without an adequate knowledge of limitations created by incomplete or inaccurate data incorporated in the display. Such issues impede the adequate use of these technologies.

6 Coordination and Communication

Observations Waterproof week

As is often the case in operations that span political and bureaucratic boundaries, through the observations during Waterproof week, a number of difficulties arose in the coordination of activities and decision-making. The relationship between the municipal/ regional groups and the relationship to National Operations Centers appeared to be less well understood. In multiple locations we observed, the Management Team struggled to understand what the Strategic Team needed in order to support their strategic decisions. It was also not clear what the division of role and responsibilities was between the local and regional operations centers. It was also not clear that the responsibilities and authority of the National Operations Center at Driebergen were clearly defined and shared with the safety regions. This ambiguity will definitely impact multi region coordination during future exercises and actual disaster management. It is interesting to note that the word experiment versus exercise was widely used by personnel at the National Operations Center, which may imply that the responsibilities and authority were still being defined and that Waterproof was an initial step in that process. Reconciling these types of issues and developing a common operating picture is a vital task that should be given top priority. It is not sufficient for higher level decision-makers to simply disregard less influential or powerful actors. In order for these structures to operate trust and mutual understanding need to be established. We observed many tensions in this interactions at a number of levels including 'Super Mayor' to other mayors, safety region to national, safety region to safety region, safety region to waterboard, and policy head to operational heads. While the structure of the system is sound, it appears that the mechanisms for integrating these units are underdeveloped.

The interviews also revealed existing difficulties regarding coordination and communication. Throughout the different operational and bureaucratic structures communication and coordination appeared difficult. Roles seem to still be ill defined and command structures are unclear.

Particularly the role of the national level seems to be ill-defined to most of the interviewees. There continues to be uncertainties regarding their role, legal mandate, capacities and responsibilities. Thus, while the preparation of the exercise and the exercise itself underlined the importance of the national level throughout the response, the role and responsibilities of the national level remain unclear and particularly hampered communication, coordination and decision-making processes.

Thus, as floods are often national matters it is of utmost importance that all levels of government are adequately positioned within the flood management structures. With respect to communication, difficulties varied from communication to the citizenry and communication from the national to regional/ local levels and vice versa.

Real and Experienced Distance between the National, Regional and Local level

The distance between the central government, regions and local communities is generally intensified by an experienced distance based on previous interactions and perceived relationships. Whether real or experienced, such an amplified distance is rarely beneficial to crisis management. Especially in case of disasters such as floods, adequate cooperation between national, regional and local levels is required.

7 Human factors

Observations Waterproof week

Although the extent to which US based findings on human behavioral response to disasters can be generalized to the Dutch context is unclear, the level of confirmatory findings from other European countries suggests that many of the assumptions regarding human behavioral reactions to crisis and disasters that were observed were unfounded. There have been extensive studies on issues such as: role abandonment, factors that affect evacuation, 'panic', and looting that should be used to inform decision-making or at a minimum should be tested in the Dutch context.

8 Large-scale exercise

Observations Waterproof week

The design of the exercise seemed to have been both too complex and too simplistic. The overall scenario in many ways seemed to be interpreted as implausible by many responders. Even those that bought into the scenario had a difficult time getting themselves to think about all of the complexities of a 1 in 100 000 year event, nor did we have anything other than anecdotal evidence of the impacts other than flooding of a 1 in 100 000 storm (for example, wind and wave damage). It would have probably been more productive to do a smaller scale event and exercise the system than to have the first national exercise also be of enormous proportions. It is likely that a smaller event would have manifested many of the same issues, but would not have been so overwhelming as to allow responders to disregard the scenario.

Furthermore, the choice to run simultaneous scenarios over several days was felt to be questionable. We believe it would have been more beneficial to have run one scenario through the course of several days. While everyone would not have been in an impact zone it is likely that there could have been important lessons learned about campaign operations and about how to better organize those areas operating in a supporting role. The exercise component terminated at the evacuation decision, leaving critical situational issues not clearly identified: 1) where would people be evacuated to and was there capacity there to support them? 2) How many people would remain in the city and vertically evacuate and how would they be supported? 3) How long would the city be without power and water? This was also an issue in other areas where the exercise dealt with the issues involved in evacuating most of the Province, but did not address issues of supporting the evacuees at their destination.

In addition to these questions, the additional interviews reveal that participants did appreciate the exercise, particularly the preparative phase. Throughout the preparative phase participants attained additional awareness, knowledge and insights into the effects of a (possible) flood in addition to stakeholder appreciation, i.e. for stakeholders to become aware of and acquaint relevant partners whom, in case of (possible) floods they do not generally encounter.

More knowledge regarding the specific characteristics of floods in the Netherlands, where thankfully floods do not occur often, is desirable because it continues to be one of the major risks at hand. Due to great preventive measures such knowledge must be generated through education and exercises as real life experience is limited.

A primary lesson that is shared by many of the interviewees is the importance of balancing planning and networking. Making plans in the light of a (possible) flood pertains to the preparative phase of crisis management and, as exercises, enables the generation of knowledge regarding the risk for which one plans and increasing stakeholder appreciation. Planning, however, is not sufficient. Exercises demonstrate that plans are often left in cupboards when in actuality they should be utilized to facilitate crisis management. Within this light it is important to invest in capacity building of teams and networks. The resilience of any adequate crisis management organization relies eventually on plans, networks and capacity. While with respect to the topic of floods in the Netherlands, theorizing is one of the

primary Dutch undertakings, over-theorizing is undesirable as it often diminishes flexibility and the capacity for improvisation. Therefore plans need to be complemented by adequate and extended networks of people from various levels, fields and areas of expertise and capacity building efforts.

The primary question that was discussed with interviewees is whether an issue will continue on agendas after the exercise. Many reacted rather skeptically

9 Public communication

Observations Waterproef week

Although we did not observe any direct public communication strategies of the responders, the issue of public communication was conspicuous in its absence. At no point was a serious discussion about public awareness about communication or the like heard. This is potentially a very dangerous situation. These types of situations often generate a great deal of uncertainty in the public and it will be of great importance that public officials engage in open and honest communication with the public. The absence of information often leads to rumor transmission that can become very difficult to control. Furthermore, open communication will also facilitate trust that can be vital when attempting to get public compliance with governmental requests.

10 Regionalization

Observations Waterproef week

The regional focus seems to be quite appropriate as do the developing efforts to better integrate national level actors into the disaster process when necessary. Balancing the integration of national capacity with local knowledge is an admirable goal.

Regionalization seems appropriate as do the developing efforts to better integrate national level actors into the disaster processes when necessary. Balancing the integration of national capacity with local knowledge is an admirable goal.

Differentiation Organizational and cultural

Relevant parties in the light of water safety are often from a great array of levels, disciplines and geographical locations. As a result, parties tend to be characterized by organizational and cultural differences. Many parties are not aware of these differences. However, exercises and acquainting relevant partners allow for differences to be acknowledged by the different parties involved. Awareness of organizational and cultural differences between cooperating parties is important as it allows for interactions to be improved.

International and national learning

To not reinvent the wheel and prevent deficiencies throughout flood management, it is important to look beyond one's borders and learn from other's experiences and approaches in flood management.

In addition to international learning, it is important to also recognize knowledge, experience and expertise present throughout one's nation. Regions characterized by different realities allows for great bodies of knowledge regarding various issues, such as risk communication. A nation should increasingly tap into these available bodies of knowledge and also nationally exchange knowledge.

National bodies of knowledge: local communities and governments

Tap into national sources of knowledge.

The diversity between regions in the Netherlands results in the existence of various bodies of knowledge in which different actors can tap. Exchange knowledge, also concerning practical issues, and learn from others within the nation.

Do not underestimate local knowledge and expertise

Increasingly use civil society; organized civilians. How can the knowledge and capacity of civilian organizations be embedded into crisis management structures. Local governments knows the local reality they are dealing and has experience dealing with it, use such knowledge and expertise.

Collective memory

Collective memory of floods improves risk awareness and societal preparedness.

11 Warnings and warning response in the disaster context

The nature of the exercise did not allow for warnings and warning response in disaster contexts to be observed. However, throughout the expert meetings, reflection meeting and the interviews it was considered a point of interests; an issue that interests both academics and professionals in the field of disaster management. Throughout the working papers the issue of warnings and warning response was presented and a number of interesting features and lessons can be drawn from it.

Risk awareness and self-reliance

Experience has demonstrated that increasing risk awareness and self-reliance can be effectively increased by including such issues throughout educational routines.

For more than five decades, researchers have explored the dynamics of warnings and warning response in the disaster context. This report is intended to briefly summarize findings related to this topic. The ultimate goal is to provide a basic understanding of how social science research related to warnings and evacuations might inform policy makers and emergency managers.

Before we begin discussing the details of warning messages, the first and most important issue for readers to note is that the decision making processes of most evacuees and even non-evacuees are rational and calculated. Contrary to media depictions and other's perceptions of the public that suggest animal-like, irrational, or antisocial behavior it is important that we begin this discussion knowing that people typically "rise to the occasion" during disasters. Although it would be wrong to suggest that people *never* make irrational decisions it is important that we begin this summary by recognizing that when we look at the broad patterns of human behavior documented through scientific/empirical studies, people who are experiencing a disaster far more often than not act in very rational and predictable ways. This finding above all others holds true in social science research. It is important to recognize this truth because it allows policy makers and emergency managers to move beyond the notion that the problem with warning and response is "getting people to be rational and do what we say" and instead allows us to move towards understanding "how can we change our approach so that it takes into account how people process warning information. While the difference may seem subtle, in practice it is quite important. The first sees overcoming irrationality as the problem while the second sees the institutional/organizational approach to warning as the problem.

This report attempts to provide information that can help policy makers understand the factors that affect warning response in the US context. In so doing, this report addresses two important pieces of information. First, it outlines the stages of information processing that people move through when deciding to take or not take protective actions. Second, it summarizes findings from research on how social structural factors and patterns of human behavioral response influence people at each phase. The goal is to help readers better understand warning message processing.

12 The Warning Process

Within warning and response research there are literally hundreds of social science studies. Among these four major works (Donner 2007; Lindell and Perry 1992; Mileti and Sorensen 1990; Mileti 1999) have been instrumental in developing an understanding of the phases of information processing that must be taken into account when designing a “warning system.” These works have outlined the following eight stage process of warning.

1. Stage One-Receive the Warning-People must physically receive a warning.
2. Stage Two- Understand the Warning-Once people receive a warning they must be able to process the message and understand what it means.
3. Step Three- Believe the warning is credible-People must believe that the source of the warning is reliable.
4. Step Four- Confirm the threat-People must take steps in order to verify that the threat described in the warning is real.
5. Step Five- Personalize the threat-People must believe that the threat is something that can potentially effect them.
6. Step Six-Determine whether or not protective action is needed-People need to decide if they need to take action.
7. Step Seven-Determine whether protective action is feasible-People need to decide if they are able to take action.
8. Step Eight- Take Protective Action- Finally people need to have the resources to actually do what is required

Below we address the relationship between these stages and present a very simplistic review of the main issues that affect people’s interpretations at each stage.

12.1 Relationships between Phases

Although these stages were initially thought to operate in a linear fashion where a person must move through phase one in order to reach phase two and so on, it is now thought that later stages for one person or community often act on earlier stages for others. This is important because it highlights that the warning process is a matter of collective behavior, involving, among other things, cooperation, coordination, and interaction among people.(Donner 2007) In other words, these messages are processed by groups not by individuals alone. In addition, individuals’ movement from phase to phase is affected by:

1. Interdependence- in other words decision made in one phase effect the range of responses people see as feasible or rational in other phases.
2. Movement through stages is based on interaction- this means that as people make choices at each phase they influence and are simultaneously influenced by other people’s decision making process.
3. Social variables have complex effects on the process - In other words we need to recognize that characteristics such as age, gender, race, etc will have different levels and different types of influence at different phase (Donner 2007)
4. Resources matter- in other words regardless of if people want to act their ability to do so is limited by the resources they possess.
5. The process of responding to warnings is characterized by a complex process of information seeking, keynoting, and, most of all, interaction.

Thus, contrary to the beliefs of officials, warning response is not simply an “individual” decision that determines whether someone will seek shelter when faced with the possibility of tornadoes. Such a view is simplistic, poorly conceptualized, and ignores years of research. It is important to know that groups and families should be targeted rather than individuals. Messages should be tailored to specific sub-populations interests.

12.2 Social Factors that affect the Warning Process

As discussed above, many of the forces that drive the warning process are social and involve interaction, communication, and collective definition. Research strongly suggests, moreover, that pre-existing social structures and emergent behaviors (Turner and Killian 1987; Aguirre, Wenger, and Vigo 1998) also play a role in shaping warning response and evacuation behavior. In this section we discuss a few of the more salient factors. Empirical studies in the fields of sociology, political science, and anthropology continue frequently and consistently corroborate these ideas. As noted previously, there are a variety of factors including age, language and culture which might inhibit actors from understanding and successfully interpreting a warning message (Aguirre 1998; Bausell 1986; Belloc and Breslow 1972; Levanthal and Prohaska 1986; Linsk 1994; 2000; Nichols et al. 2002; Puleo 1996). The dynamics behind warning understanding are well documented as a result the following list presents an overview of these findings :

1. Social Power
 - a. The more freedom a person has to leave their place of employment, the more likely they are to respond to a warning message
 - b. Spousal control plays an important dynamic in warning decision making
2. Resources
 - a. Having resources increases the likelihood of a person responding to a warning message. Both Balluz et al. (2000) and Baker (1979) show the presence of resources increases the likelihood of response.
 - b. The perceived availability of resources shapes evacuation decision making. (Duval and Mulilis 1999) find clear evidence supporting the mere perception of resources as sufficient to motivate evacuation.
 - c. A person is more likely to respond to a warning message if their livelihood will be unaffected by their decision.
 - d. The experiences of Hurricane Katrina evacuees within the larger context of socio-structural limitations and builds upon previous research by Barnshaw (2006b) and Trainor, Donner and Torres (forthcoming 2007) which both demonstrated how the “choice” to evacuate was constrained by structured inequality, and a lack of social resources. The level of economic resources cannot be overstated as significantly influencing how evacuation from the impacted area was experienced. Frequently, individuals with greater resources in the form of economic capital were able to locate a place to stay and could move on to the other tasks which were competing for the time and attention of less affluent “underclass” evacuees’ who were most often found in the shelters.

3. Culture

- a. Culture is a salient feature of warning response. In particular, Perry and Hirota (1991) offer an instructive analysis of values and their influence on sheltering behavior among U.S. and Japanese evacuees. The researchers found the greater likelihood of sheltering among the Japanese chiefly attributable to a “collectivist culture in which citizens have higher expectations that authorities will provide care in the event of disasters or other disruptions in social life.” (112).
- b. Others (Aguirre 1988) find language a cultural artifact inseparable from the process of receiving tornado warnings, a finding suitably extended to slow-onset events, for there is little reason to believe that communication barriers play any less a role in the process of understanding, belief, and personalization.

4. Gender

- a. Women are more likely than men to respond to warning messages.

5. Characteristics of the Warning Message

- a. The probability of warning receipt and comprehension tends to increase with the dissemination of multiple warnings (Turner et al. 1979).
- b. When it comes to warning systems, accuracy beyond a limited threshold would therefore hold diminishing returns for marginalized social groups, who, in the face of disaster, often experience obstacles to understanding, personalizing, and reducing risk.
- c. Also of great importance are characteristics of message and sender. Such findings would, however, appear to conflict with well-supported observations that warnings of greater specificity elicit greater levels of understanding (Perry 1983).
- d. Evidence from research presents mixed findings regarding whether potential victims share a greater likelihood to believe warnings from official sources and media reports (Drabek 1994; Baker 1987) or “significant others” (Nigg 1987; Sorenson 1982).
- e. Including local information and/or televised maps in a warning message to the public assists the public in understanding the warning message.
- f. The more specific the warning message, the more likely the public is to respond to it.
- g. The more specific a warning message is, the more likely the receiver is to confirm the warning.
- h. Emergency managers should avoid generic approaches to using the media--different hazard agents and different disaster settings require custom-made warnings from the media.
- i. The more consistent a warning message is, the more likely the public is to respond to it.
- j. Officials must make every effort to provide warning messages in formats that are tailored for those midlife and older who have diminished auditory, cognitive and visual acuity and may require larger print messages, greater amplification, frequent summarization and restatement of prevention messages and/or messages in actors native language.

- k. Access to more and more complicated technological info such as weather forecasts may complicate ability to process (Donner 2007) simply receiving more of what one only vaguely—or, not at all—understood in the first place. Thus, while improvements in *reception* are potentially accrued through technological development, there is arguably a concurrent deficit in *understanding* produced from this explosion of information.
6. Characteristics of the Hazard
 - a. Threat proximity, for example, is consistently acknowledged as a mechanism behind public response (Sorenson 1982): the likelihood of belief within warned communities located near a disaster is greater, which, of course, may be linked to the reality of greater response rates among those encountering environmental cues (Hammer and Schmidlin 2002; Mileti and O'Brien 1993; Tierney 1987).
 - b. The more environmental cues the public observes, the more likely they are to respond to warning messages.
 - c. Having confirmation of the disaster/hazard increases the likelihood of a person responding to it
 7. Behavioral Response Patterns
 - a. "People have a tendency to err on the side of normalcy," McLuckie (1973). "Conditions are evaluated as all right until proven otherwise. Therefore," he concludes, "the burden of proof is on the warning system." In the absence of nearby environmental cues, this "normalcy bias," described by Okabe and Makami (1981), triggers immediate *denial* on the part of potential victims.
 - b. Defining a situation is necessary for action (Turner and Killian 1987) and such consensus is often produced through interaction. To be sure, there is strong evidence to suggest that the perception of immediate danger is a necessary factor in the decision to evacuate (Hammer and Schmidlin 2002).
 - c. Similarly, as suggested by Aguirre, Wenger, and Vigo (1998) in the case of building evacuation, people often made the decision to evacuate or stay based on a collective emerging definition of the situation and appropriate lines of action.
 - d. Risk personalization—or the perception that one is indeed under threat—is no less contingent upon social, psychological, and environmental factors.
 - e. Researchers have noted a fundamental difference between the belief of a threat or warning and the personalization of the threat (Donner 2007; Lindell and Perry 1983). Perry, Lindell and Greene (1980) found that actors are more likely to respond to a threat if they personally believe to be a stakeholder in danger.
 - f. Warnings need to take into account social time. For example take the example provide by donner : interviewee hesitant to inform her family of tornado warnings: arriving at the risk personalization stage, she nevertheless felt it unwarranted to contact her daughter about the tornado warning. Doing so, she believed, would have violated norms regulating when, how, and under what conditions the waking of another person is permitted. The reader may at this point be puzzled: are tornado warnings not grounds for violating

- f. If a person has had experiences with the cancellation of warnings, they are less likely to believe and respond to warning messages.
10. Credibility of person/agency Issuing the Warning
- a. If warning information comes from an official source, the public is more likely to respond to the warning message
 - b. The public is more likely to respond to a warning message if it comes from an official source.
 - c. Citizens tend to use social networks to relay and receive warnings
 - d. Citizens make use of the mass media when attempting to manage information about hazards
 - e. The public is more likely to hear a warning from the mass media. When the media reports on the hazard/disaster with adequate information, the public is more likely to understand the warning message.
11. Knowledge and Ability to take Action
- a. The more knowledge a person has about protective responses, the more likely they are to respond to warning messages.
 - b. The more knowledge a person has about protective responses, the more likely they are to respond to warning messages.
 - c. The more knowledge a person has about protective responses, the more likely they are to respond to warning messages.
 - d. People are more likely to respond to a warning message if it includes informative guidance and/or if there is a lack of response alternatives.
 - e. although an actor may personalize the threat, the decision on what action an actor should undertake is a subjective decision open to a variety of interpretations, actions or a lack thereof. For example, Donner (2007) noted that some actors may believe that if institutional actors and organizations, such as public health officials and organizations are attempting to handle the crisis, no additional action is necessary.

13 Search and Rescue (SAR)

Due to the nature of the exercise actual search and rescue could not be observed. Throughout expert sessions and the interviews however, it became apparent that responders are interested in the issue, particularly lessons learned which could facilitate them in case of a flood to be as effective as possible and limit consequences, particularly regarding human loss and suffering.

Throughout the working papers SAR, particularly lessons learned, were put forward.

US experience and literature

The accumulated of research on search and rescue (SAR) allows us to identify repeating patterns that should be considered in the development of an effective plan for national emergency response: (1) SAR is not simply an organizational activity, it necessarily includes the social and collective behavior of volunteers; (2) Preexisting and emergent organizations, social statuses and social identities, such as neighborhood and work place relationships and family and neighborhood social identities, serve as a basis for the emergence of new SAR groups and constitute the fundamental concepts and categories that are needed to understand and improve SAR activities; (3) SAR activities do not emerge from a vacuum; as an example of the principle of continuity advocated by Quarantelli and Dynes (1977), there are always elements of the traditional social structure embedded within collective behavior entities, and their emergent division of labor, role structure, and activities are also dependent on prior social relationships and forms of social organization in the community or region; (4) Breakdown models of social organizational patterns in disaster are not useful to understand SAR. Television reports and misinformed reporters often misinterpret throngs of people moving seemingly at random at the sites destroyed by various hazards, and assume that the people were disoriented immediately after impact and had lost their ability to enact social roles. Despite these reports, scientific research shows the absence of widespread confusion, lack of coordination, and panic (Aguirre, 2005). The seeming disorganization and aimless movement of people is the result of their individual and collective acts as they try to accomplish multiple individual and collective goals under severe time constraints (c.f. Fritz & Mathewson, 1957). In short search and rescue (SAR) activities are part of the complex emergency response system that emerges in response to disasters.

A number of researchers in the USA have conducted systematic studies in order to understand what accounts for successes and failures of SAR activities. These works have chosen to explore everything from patterns of collapse to the effects of human use on the likelihood of being caught in a void space. They came to the following conclusions:

- (1) Volunteer and emergent group response is of critical importance.
- (2) Volunteers and emergent groups accomplish most initial SAR activities.
- (3) Since most survivors are rescued within the first 2 days, this emergent and volunteer activity is critically important to the rescue effort, especially because buried and entrapped victims are likely to suffer from injuries that require rapid life-sustaining intervention including

compromised access to air, severe loss of blood and body fluid, crushing injury, and internal damage to essential organ systems.

- (4) Despite the attention they usually receive from the mass media (Quarantelli, 1991), most of the time urban search and heavy rescue (US&R) teams arrive too late to rescue anyone; instead, they undertake highly specialized recovery activities requiring sophisticated skills and equipment. This is due in large part to the particular nature of the social geography of disasters in which US&R teams are hampered by problems of timely access.
- (5) The integration of volunteer and established organizational activities is seldom efficiently achieved; many official responding organizations, particularly those from national governments, usually do not appreciate the work of the volunteers in SAR operations since they are often perceived as lacking sufficient credentialing, specialized training, and tools. In turn, the absence of disaster planning about how to use volunteers creates problems of its own as large number of volunteers converges on disaster sites (Quarantelli, 1996c). Problems of management of rescue activities are serious and include difficulties in coordinating activities across independent, autonomous organizations, disagreement over rescue strategy, and ambiguous authority relationships.

The most extensive study of SAR activity was undertaken during the late 1970s by Drabek, Tamminga, Kilijanek, and Adams (1981.) These researches conceptually recast search and rescue not only as a professional activity, but also as an emergent, inter-organizational activity. Their study highlighted the inter-organizational and managerial difficulties inherent in SAR. They found four common operational problems: (1) difficulties in interagency communications, (2) ambiguity of authority, (3) poor utilization of special resources, and (4) unplanned media relations. Quarantelli (1983) analyzed the problem of locating victims and managing their entrance into the emergency medical system.

Glass et al. (1977, 1979) provided epidemiological evidence on the etiology of injuries and deaths that had obvious implications for SAR behavior. The contrasting effectiveness of local SAR voluntary organizations and formal organizations such as fire departments in locating and rescuing victims is in part a result of the interaction of ecological characteristics of the site of the disaster with other factors such as the (1) the social, cultural, and behavioral patterns and social relationships between victims and responders; (2) behavior of victims during entrapment; and (3) nature of the buildings and other structures and their collapse configuration.

Search and rescue activities are undertaken by a number of different types of actors including unaffiliated volunteers, organizational volunteers, and formal organizations. Measures should be taken to most effectively utilize all of these resources.

It is important to note that while formal organizations are the most technically proficient they are often hampered by their geographical distance from disaster sites.

Search and Rescue and Death and Injury

A great percentage of the majority of deaths as a result of a disaster could be avoided if warnings and evacuation plans would be better and more effectively disseminated.

Furthermore, physical injuries are the primary cause of nonfatal casualties after all disasters; the majority is soft tissue injuries and fractures, generally to the arms and legs. When electrical service is disrupted, the use of generators and other sources of light and heat lead to increased incidents of carbon monoxide poisoning and burns. After every disaster, certain myths emerge about how disasters affect the health of populations. Prominent among them are the misconceptions that dead bodies cause disease, epidemics and plagues follow every disaster, local populations are in shock and unable to function, and outsiders are needed to search for bodies and bring supplies. In particular, our review did not find any evidence to support the popular belief about disasters and the occurrence of infectious disease outbreaks. Jean Luc Poncelet, Claude de Ville de Goyet, and Eric Noji have been among the most persistent in trying to address these misconceptions (e.g., de Ville de Goyet, 2004; Noji, 2005, n.d.; Poncelet, 2000). Other issues that are related to effective SAR and should be taken into account are: culture, time, victim age and behavior of victims.

Culture

It is important to recognize the importance of local cultural knowledge in helping to predict locations of victims and to assist in searches. Cultural and social arrangements are often of primary importance (Pomonis, Sakai, Coburn, & Spence, 1991). Reflecting cultural practices, occupancy of buildings by time of day and season is significant in determining occupant exposure to specific hazards (Durkin et al., 1987; Tiedemann, 1989).

Another issue is the increased vulnerability to disasters of minority group members and residents of low-income households. These categories of people have lower ability to protect themselves from disaster. Income is positively related to access to better and safer housing and location.

Religious and ethnic minorities are often impacted by a number of erroneous assumptions about the management of the dead in the aftermath of major disasters which are often used to guide SAR activities.

Time

Several studies examine the relationship between changes in response time and the saving of trapped victims (Coburn & Hughes, 1987; Kunkle, 1989; Pomonis et al., 1991; Quon & Laube, 1991). Kunkle claims that 80% to 90% of entrapped victims who survive are recovered in the first 48 hours after the disaster impact, and that many more entrapped victims could survive with timely delivery of appropriate medical care. Comfort (1996, p. 134) reports that in the 1995 Kobe, Japan earthquake the percentage of those rescued who survived was 80.5% for the first day after the earthquake, 28.5% for the second day, 21.8% for the third, 5.9% for the fourth, and 5.8% for the fifth day. Similarly other research have developed predictive models and done studies to this issue. Essentially, time is of the essence when it comes to effective SAR. Subsequently, it is important to take steps to empower local organizations and build local capacity.

Victim Age

Certain age groups are more vulnerable and have an increased risk for death and injury in disasters and others. People older than 60 years of age have a death rate that can be five times higher than that of the rest of the population during earthquakes. Children between 5 and 9 years of age, women, and the chronically ill also have an elevated risk for injury and death (Glass et al., 1977). As Noji (2003) points out, limited mobility to flee from collapsing structures, inability to withstand trauma, and exacerbation of underlying disease are factors that may contribute to the vulnerability of these groups. He also stressed the effect that certain social attitudes and habits of different communities may have on mortality distribution by age. For example, in some societies young children sleep close to their mothers and may be more easily protected by them.

Behavior of victims

Scientific studies of the behavior of victims in disasters are infrequent. While in need of replication, the few studies that have examined issues ranging from general behavioral patterns of communities during disasters to what building occupants did during the actual period of a disaster and experiences of trapped victims during SAR operations show that the much-feared social disorganization during the disaster periods is extremely rare (Aguirre, 2005; Durkin, 1989; Dynes, 1970), although conditions under which panic does occur have been identified in the literature (Dynes, 1970; Johnson, 1988). An atmosphere of human solidarity and cooperation characterizes the behavioral processes during and in the aftermath of a disaster. Residents of disaster-stricken areas are proactive and willing to assist one another. Research findings show that volunteer activity increases at the time of disaster impact and remains widespread during the emergency period (Dynes, Quarantelli, & Wenger, 1990).

Family is a very powerful unifying factor for disaster victims, and, as Alexander points out, its influence could immediately dissolve other groupings such as friends. Family members are the first to be rescued by their kin. As soon as the nuclear family is reunited they concern themselves with other relatives. Second in importance is the concern for immediate neighbors and other nearby residents, and then other people farther removed from the spheres of everyday interactions (Aguirre et al., 1995). While in need of replication, a research finding is that the chances of people surviving the Guadalajara explosion were directly proportional to the presence among the searchers of a person or persons who acted as proxies for the victims, reminding the searchers that the family member was missing, and supplying information about their possible location.

14 Leadership

The experience with hurricane Katrina put light on the issue of 'Leadership'; an issue enables any emergency system to succeed or fail and which appeared a major deficiency leading to federal and state failure to respond effectively. A primary effort to counter the deficiency regarding Leadership in the US was the development of the Homeland Security Presidential Directive Five (HSPD5) that designates the Secretary of the new Department of Homeland Security as the Principle Federal Official for domestic incident management and directed the DHS Secretary to develop the National Incident Management System (NIMS) and the National Response Plan (NRP). Also the Post Katrina Reform Act that requires the Director of FEMA to be an experienced Emergency Manager is directed at countering the deficiency of poor leadership. Various efforts have been directed at significantly increasing the competence level of the federal and state governments to The Federal and state governments have significantly increased the competence level of their senior emergency management leadership.

A number of interviewees mentioned that the Netherlands should separate the role of a civilian leader from the role of an operational leader.

15 Concluding remarks: opportunities for future learning

In the previous chapters we have presented the observations and findings of the project. This includes relevant literature, observations by the US experts, observations by Dutch interviewees, observations by Dutch experts and observations by COT. We have presented these observations in a systematic way per topic.

In this chapter we want to take it one step further and focus on opportunities for future learning, both from a Dutch and US point of view. These opportunities may – in some cases – already be used as discussion points for practitioners. Some of these opportunities require further research, for example within the NUWCREN³ project or in other international projects.

We would like to underline that the topics identified in this report are not intended to criticize the Waterproof exercise but to stimulate the exchange of knowledge and experiences. Throughout the exercise, we encountered individuals who were aware of many of these issues. The challenge is translating the knowledge, information and lessons learned into formats that will be useful to the diverse groups involved in crisis preparedness, response and recover.

15.1 National Response Framework

- While the Netherlands has a workable system, in which the regional focus seems to be appropriate as do the developing efforts to increasingly integrate national level actors into the disaster process, it lacks a National Response Framework that could facilitate interregional and national response efforts.

There are various documents in which the crisis management structure in the Netherlands is outlined, but no single framework in which all responsibilities, particularly the role of national actors, are included. The current system also lacks increasing insights about the practical implications of the system (how does it really work, what does it mean for national, regional and local actors in terms of activities, time line, etc.), especially when confronting interregional and national events. While the main responsibilities and structures are established, primarily by law, such practical implications are not.

A National Response Framework is desirable, particularly to clarify Dutch doctrine and structure and the integration of lessons learned coming from Waterproof, like the National Operational Staff.

³ NUWCREN is an initiative by the Ministry of Transport, Public Works and Water Management to develop a sustainable network of Dutch and US knowledge institutes that can facilitate the advancement of the Netherlands' preparedness with respect to floods. The participating parties are: George Washington University, Institute for Crisis, Disaster, and Risk Management, University of Delaware, Disaster Research Center, University of Colorado at Boulder, Natural Hazards Center, COT Institute for Safety, Security and Crisis Management, TNO, Wageningen University and Research Center, Chair Disaster Studies.

While the organizational design and structure of crisis management is clearly defined and well positioned, the design seems to lack mechanisms that enable relationships through which people can connect with other people and institutions.

The National Response Framework establishes national policy and doctrine for preparedness, response and recovery and assigns responsibilities to federal agencies and non government organizations. The NRF is intended to ensure that the government approaches all hazards and threats in a consistent manner and to provide the basis for developing the capability and capacity to do so.

15.2 Planning

- Disaster plans should not be limited to describing structures and roles, but should also include and elaborate on operational mechanisms. The plans should not merely elaborate on who does what, but also on *how* things should be done (interaction mechanisms, means of communication, timeframes, et cetera).
- Furthermore, the value of planning lies in more than attaining adequate plans. Through planning processes, especially joint planning efforts, risk awareness can be increased, knowledge is generated and stakeholder appreciation is enabled. Subsequently, the process of planning should not be discontinued when plans have been developed.
- Realities change and plans should always reflect the reality at hand. Subsequently, plans are never finished and should be living, ever changing documents.
- The past two years, regional planning efforts with respect to floods have been significant. On the national level, however, plans continue to be limited and should be further developed. Planning is preparation and symbolizes to some extent that risks are being taken seriously. Visible planning efforts, especially at a national level, enable increased risk awareness, the development of a national response framework and regional confidence that responsibilities can be entrusted on national actors.

15.3 Safety paradox

- Dutch safety standards are high as the Netherlands has primarily focused on limiting external risks. While this approach has allowed the Netherlands to prevent large scale incidents, it has also resulted in the possibility of catastrophic events when safety mechanisms are breached and limited disaster response experience. The Dutch emergency system primarily deals with small scale incidents and has, thankfully, hardly any experience with events that approximate catastrophic dimensions. The Dutch situation regarding a sea flood response, could be compared with a high-school team playing their first soccer game at the world cup. One of the questions this reality rises is: "is it possible to equip and enable an organization to deal with catastrophic events if the organization never experiences incidents characterized by catastrophic dimensions?"

15.4 Human factors

- The safety paradox the Netherlands experiences makes planning, and particularly the planning process, an essential learning and capacity building mechanism. Learning throughout these processes, particularly regarding large scale events that are not often experienced, demands looking abroad and learning from other country's experiences. As such, the Netherlands has learned a lot from New Orleans and introduced various lessons from New Orleans into their system. While international learning is of great importance two issues should be taken into account by Dutch practitioners:
 1. The Dutch reality (history, culture, language, demography, et cetera) is different from other countries' realities. As a result, lessons should be translated into Dutch reality before including them into the Dutch system.
 2. Learning through planning can lead to the bureaucratization of human factors during a disaster response. When responding one should reach out to the factual reality outside and not to facts and number taken from books or reports.
- Lastly it is important to note that in actuality, in times of catastrophes and crises, crisis management organizations become social service organization.

15.5 Special Needs

- Throughout the Waterproef exercise it became apparent to the observers that the rhetoric of 'special needs populations' has become so dominant in emergency management that it has become a must attend to issue. It is important for responders to remember that the label 'special needs' is simply meant to provide a column that sensitizes us to those groups of people that will need more help than the 'normal person' . There seemed to be little awareness of what precisely special need meant, the complexities of these populations, and what might be done to provide additional assistance. Although the social disparity is not of the same scale as in the USA it is important to remember that the Netherlands does have some level of cultural, educational, and experiential diversity that must be taken into account when planning social services during disasters.
- In addition to understanding the notion of 'special needs populations' it is important to be able to translate disaster caused needs, to required response capacities. Response requires the mobilization of resources of adequate capability and capacity and people with adequate competence. It seems that often responders grossly underestimate the scale and scope of the events being envisioned. US experience could be interesting for Dutch professionals, nationally and regionally. This concerns methods of estimating physical and social vulnerability and development of models that will identify areas where high vulnerability and development of models that will identify areas where high vulnerability coincide with areas of high impact.

15.6 Emergency Managers

- In the US there is a professional emergency management organization: Emergency Management Agency. This means that experts form that office

will have an important managing role, like the Operational Leader in the Dutch situation. In various Safety Regions there is a discussion going on, on how to staff the Operational Leader role. Traditionally this is the role of the fire department. But with the development from disaster management to crisis management, this could change. The mayor can appoint someone else from another agency, for example the police department, to fulfill the role of operational leader. Some regions are working on a 'grey' operational leader: it is not the organization that counts, but the specific skills. In the discussion on the role of operational leader, the concept of emergency professionals with a full time job in preparing for and in networking with partner organization could be interesting.

15.7 Situational awareness

- Situational awareness is crucial for adequate decision making during crisis. Situational awareness has an information component, a perception component, and a meaning component. 'Information management' is an important topic in strengthening crisis management in the Netherlands. Most safety regions are establishing a information system (developed on a national level) and are appointing so called information managers. This will cover at least the information component. Each user will have his or her own perception of the situation. It is up to the information manager to come to a coherent set of facts and forecasts/analyses. This will influence the perception. There are however lessons to be learned concerning the 'meaning' component. This requires that decision makers and their advisors/operational staff understand what the other party wants and needs concerning information and the type of advice. Both in the US and in The Netherlands, the ability to network and to share information exceeds the ability to promote shared perception and shared meaning. In implementing the new systems and establishing the information managers, does practitioners should take into account the other important factors: perception and meaning.
- During the exercise it appeared very difficult for participants to attain an adequate situational awareness, particularly with respect to a 1 in the 100 000 year storm. There was no real understanding of the consequences, particularly physical effects, of such a storm and decision making individuals were subsequently hardly concerned with important questions that will arise as a result of such a great storm. The scalability in time and space of a crisis is a challenge in the Netherlands.
- A response to a catastrophic event that spans political and bureaucratic boundaries will entail difficulties regarding coordination of activities and decision-making that need to be overcome. One of the issues to be overcome relates to situational awareness. In the Netherlands, a major issue is information management and situational awareness especially between different levels of government. A gap between national and regional situational awareness will lead to two levels of government operating with different data and different interpretations of information. Reconciling these types of issues and developing a common operating picture is a vital task that should be given top priority within the Dutch context. All actors of all levels and status should be taken into account by key decision-makers.

15.8 Evacuation

- During Waterproof, evacuation was one of the main topics. This was mostly focused on the decision making process, especially the National versus Regional context. As US experience has showed, it is crucial to focus on the implications of a evacuation. What does it require in terms of capacity? Is the capacity available? How long will it take for regional mutual-assistance or national assistance? How time consuming are things? What will be the situation on the roads, trains, etc.? This was not part of the exercise but it was part of some of the planning that has been done on a national and regional level. Decision makers must be aware of what the implications of decisions are, for example if the mayor decides to postpone the evacuation decision for a few hours or days, etc. This requires more awareness and preparation.
- During the exercise, there was talk about vertical versus horizontal evacuation. This is also mentioned in some of the national and regional flood plans. It is important however to address the pros and cons of vertical evacuation. In the Dutch situation, most people will not know what the high points are. People also will not know if these places are safe. Vertical evacuation could mean that people will be stuck in a flooded area. This could put a heavy strain on emergency workers regarding distribution of food, medical care, etc. In some cases vertical evacuation could save lives, especially if there is not enough time to flee the area. Vertical evacuation could be interesting for flood management in the Netherlands, but it needs to be thorough. Practitioners should be careful not to underestimate these evacuation issues, neither in exercises, disaster plans or real life situations.
- Another issue that was insufficiently discussed was the aftermath of a flood. The consequences of evacuation should be analyzed and taken into account throughout preparation efforts. Will evacuation be long or short term? How will capacity for long-term evacuation be ensured? Who will provide long-term shelter and relief? Which funds and capacities will be used for such long-term shelter and relief?

15.9 International cooperation

- The effects of a large-scale event such as a flood are catastrophic. Within the context of a globalization, and more specific for the Netherlands, and Europeanization the Netherlands cannot be seen as separate from the Dutch context. A large scale flood in the Netherlands will entail that other countries will be affected, either by flooding or by the effects of flooding. Measures such as evacuation will necessitate cooperation with other European countries. The Netherlands will need the support of neighboring countries and will have to compete with the demands and interests of other countries afflicted. Furthermore, attaining foreign assistance necessitates a specific logistical endeavor for which we might not be prepared and which could frustrate the effectiveness and potential of the Dutch disaster response.

15.10 Estimating Needed Capacity

- While we observed in many areas that the Dutch responders had the capability to engage in technical procedures, there were very serious reasons to believe that responders grossly underestimated the scale and scope of the events being envisioned. They often made the assumption that resources such as man-power and equipment would simply be in ready supply. There are a number of complex logistics issues that were not addressed sufficiently to suggest that the capability existed to engage in such a large scale operation for a sustained period of time. Some examples include nursing home evacuation, water rescue, and dyke wrapping procedures. For the most part we saw limited focus on the long term and little attention on the complexities of support functions. Overall there was little attention to spatial and temporal connections. Furthermore, these capacities were not part of the strategic decision-making process. It is our perspective that strategic level decisions should be made with a level of awareness of the capability of organizations to successfully complete operations. This level of information allows for more informed decision-making and in the end better results.

15.11 ICT

- ICT support systems could be useful to improve the decision making process. It requires a lot of information that is prepared in order to benefit from these systems. For example, the decision to “evacuate those at risk” must be supported with how many are at risk, where should they be evacuated to, and address the “how can we do this” part of the task. Where are shelters? Which hospitals have beds? How will casualties be transported, and how can the process be managed, and who needs to know? (Carver and Turoff, 2007)
- Also with respect to the implementation of DSS a number of issues remain problematic. Firstly the pre-event identification of critical decisions. Disaster managers are often faced with unexpected conditions that have not been anticipated during planning and exercises. Decision support systems must be robust and flexible enough to support unexpected critical decisions. Secondly, erroneous identification of decision makers. Decision support is only useful if it is available to the appropriate decision makers. If systems are developed to support national headquarters, for example, and decision are actually made by decentralized regional and local officials, the technology will be of limited use. Lastly, Inability to get the right information to the right place at the right time. Decision support systems depend upon information. Information gathering, analysis, and distribution capabilities must support the decision support technology.
- The Dutch interoperability established by the communications network C2000 might be interesting to the US. The current C2000 digital communications network replaces over a hundred different analogue networks that emergency responders used. The analogue networks made interdisciplinary cooperation really difficult. Through C2000 it has become possible for all emergency services in the Netherlands to be integrated into the same network. Here it must be noted that being connected to the same communications network does not solve all communications problems. Communication is more than having a tool to communicate. One obvious issue is to communicate with the tool one has to use it. The process of

changing from the old network to the new has been bumpy from time to time as people like using their old and familiar tools. Furthermore, when using the same network it is important to speak the same language. While interdisciplinary cooperation is increasing, most disciplines continue to have their own language and culture. Especially the utilization of different 'languages' inhibits communication efforts despite having the C2000 tool. While challenges remain, C2000 has enabled more effective interdisciplinary cooperation.

15.12 Regionalization

- The Dutch emergency management system has a regional and local focus. In the US such a level of local awareness is still being developed despite researchers underlying the importance of local input and regional knowledge to successful disaster operations and decision-making. While great steps are being taken to structuralizing and institutionalizing regionalization impediments remain. Various regions are getting to uniform doctrine and structures, but the legal framework and the limited confidence in regional authorities and will to renounce autonomy and certain responsibilities.
The Dutch legal framework establishes responsibility and accountability at a local level: the Mayor. Subsequently, mayors will not simply delegate their responsibility and limit the municipality's autonomy, especially when regional authorities cannot ensure that individual municipality's interests are adequately represented and taken into consideration.
Regionalization is desirable and should be increasingly pursued. In order for regionalization to succeed, however, the regional structures need to enable the accommodation of local realities, characterized by distinctive geographical qualities, cultural features, risks and interests, and local bodies of knowledge.

15.13 Utilizing societal assets

- One of the questions that remains regards the utilization and integration of societal assets in disaster management structures. For example, the public. Disaster management is meant to safeguard and protect people. Discussion regarding public communication strategies and public awareness are therefore important. Lack of strategic and well thought through communication to the public can be very dangerous. These types of situations often generate a great deal of uncertainty in the public and it will be of great importance that public officials engage in open and honest communication with the public. The absence of information often leads to rumor transmission that can become very difficult to control. Furthermore, open communication will also facilitate trust that can be vital when attempting to get public compliance with governmental requests.
- Another issue that should be underlined for the Dutch context, primarily because it does not attain the attention it requires, is the role of societal organizations throughout a response. Volunteer and emergency groups are, for example, of critical importance. They for example accomplish most initial SAR activities. Search and rescue activities are undertaken by a number of different types of actors including unaffiliated volunteers,

organizational volunteers, and formal organizations. Measures should be taken to most effectively utilize all of these resources.

15.14 Large scale exercises

- Large scale exercises are appreciated. Especially the preparation phase is perceived as increasingly valuable because it allows for learning, increased risk awareness and stakeholder appreciation.
- The large scale exercise is developed based on the recognition that there is a real potential for a catastrophic event in the Netherlands. Particularly in a society that has historically placed so much attention on mitigation and the provision of safety, the willingness of high level decision-makers to engage in the process of defining an event and orchestrating a meaningful exercise is an admirable goal. It is often extremely challenging to convince people of the need for catastrophic planning. Having engaged in this process has likely made the Netherlands a safer place. The Dutch should be commended for taking on this serious and important task.
- Designing a large scale exercise is complex. One should take into account that it can become too complex and too simplistic at the same time. Lack of experience with catastrophic events makes it difficult for individuals to envision and understand catastrophic events and makes people interpret the scenario either as implausible, thus simply ignore the realistic nature of the scenario, or too complex and become discouraged.

15.15 Warning processes as social processes

- Contrary to media depictions and other's perceptions of the public that suggest animal-like, irrational, or antisocial behavior it is important that we begin this discussion knowing that people typically "rise to the occasion" during disasters and go through rational decision making processes. Additionally, it's important to realize that contrary to what officials might believe, warning response is not simply an 'individual' decision. Such a view is simplistic, poorly conceptualized, and ignores years of research. Subsequently, warning processes should target groups and families rather than individuals and messages should be tailored to specific sub-populations interests.
- Warning processes are driven by various factors varying from age, language and culture to gender and economical situation. Many of these forces are social and involve interaction, communication, and collective definition. Additionally, pre-existing social structures and emergent behaviors play a role in shaping warning response and evacuation behavior.

The large scale exercise in the Netherlands was a worthwhile effort that has enabled not just a learning process, but also an effective assessment and planning trajectory of the Dutch current disaster management system. As the Flood Management Taskforce ended, however, many fear that the lessons and gains from their effort will disappear into a report and finally into a drawer. This would be a waist. The exercise might not have been perfect, but it generated valuable results that can enable practitioners and scientists to enhance the disaster management system that is currently in place. The will is there, but will the political and administrative arena, necessary for creating the window of opportunity to continue

learning with respect to floods and disaster management be there to support that will and allow for learning trajectories to be continued?

Many issues remain and should be elaborated upon in order for the Dutch system to be enhanced when it comes to floods. Floods are a real threat that hold the potential for catastrophic impacts and we should limit the possibility of flooding becoming a creeping disaster by taking proactive stance and limit 'failures of insight'.

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