ISCRAM 2006 @ NJIT
Information Systems for Crisis Response and Management
Program Summary

Welcome message from the ISCRAM2006
Conference and Program Chairs

Dear ISCRAM2006 participant,

It is our pleasure to welcome you here at the New Jersey Institute of Technology to the third International Conference on Information Systems for Crisis Response and Management, ISCRAM2006.

First of all, we would like to thank a great many of you for your efforts in making this conference an outstanding collection of contributions with interesting and, we hope, engrossing sessions. Without those of you who took the responsibility for creating sessions, soliciting papers, and facilitating the review process, we could not have realized this meeting. We are also grateful for the continued support from our primary sponsoring organizations Tilburg University and the New Jersey Institute of Technology (NJIT). Last, but not least, we would like to acknowledge the appreciated financial support of our other Sponsors.

Once again this ISCRAM meeting has grown significantly in comparison to the previous edition, both in numbers (a strong increase in the number of special sessions, the number and variety of papers accepted, and the number of registered participants) and in quality as very relevant topics and concerns are included in this meeting that were not present before. We are truly in this meeting able to explore the concept of Emergency Information Systems from a context of general systems that includes all the human aspects of the total system as well as the underlying computer technology.

We have sought to be inclusive in this meeting and we believe the result will be considerable interaction among the participants. We think everyone will discover some new and interesting viewpoints and findings to consider. In the spirit of the prior ISCRAMs, we have left ample time for interaction in sessions and significant break times for meeting with one another. In addition, you will find forms to create topic-oriented dinner groups Sunday and Monday night based upon your own suggestions via a set of bulletin board signup sheets to propose topics for dinner groups of up to 10 participants and then sign up for them.

Those of us who have been involved in the formation of ISCRAM and the meetings to date sincerely believe in the need for a community that brings together those working in this very challenging and serious application of Information and Communications technology. Too often, this discipline area is treated in a rather fragmented manner. We have, at this meeting, managed to bring together a small but significant number of practitioners to provide a unique perspective for the rest of us that are in the R&D community in both industry and academia. Our hope is that the next meeting will go even farther in this direction.

At ISCRAM2004, we also started the ISCRAM Community with a home on the web (http://iscram.org) with currently over 950 registered members. At this year's meeting, in an open panel we will discuss how we can better manage this growing community. It is, at this stage, far exceeding our original expectations and we need your help to build the ISCRAM Community and provide it with the foundations of a vibrant and active organization. We hope many of you who are new will join in helping to make the next meeting a success as well. Calls for session proposals will be on the ISCRAM.org website shortly after this meeting. We certainly welcome the repeat of any of the current session themes and organizers. It is our current expectation that we will try to rotate ISCRAM between Europe and the U.S. each year. Also, some other activities are currently underway in addition to this Conference: a Summer School for PhD students who work in this area which will be held in the Netherlands next June, and a first 'ISCRAM-China' Workshop in Harbin, China, in September 2006.

Your primary hosts for this meeting at NJIT are the Office of the Provost, the NJIT Research Office, and the Department of Information Systems. You will find many of NJIT faculty and Ph.D. students wearing some special additions to their badges indicating they are there to help answer any questions you have at any time. We certainly are indebted to the many people at NJIT whose hard work made this a meeting a success, with a special recognition of Mariann Pappagallo, Linda Plotnick, Ellen Schreihofer, and Kenneth Ronkowitz.

We hope ISCRAM2006 will match the expectations that were set at last year's meeting, and we wish your participation in the third International Conference on Information Systems for Crisis Response and Management to be an enjoyable and fruitful one.

Murray Turoff
ISCRAM2006 Program Chair
(Virtually signed in spirit!)

Bartel Van de Walle
ISCRAM2006 Conference Chair
(Virtually signed in spirit!)

ISCRAM 2006 @ NJIT
Information Systems for Crisis Response and Management Program Summary

Symposium

Sunday May 14, 2006

Registration: 12:00am to 5:30pm

Sessions 1:00pm to 3:00pm and 3:30am to 5:30pm

Coffee 3:00pm to 3:30pm

Informal Reception: 5:30pm to 6:30pm (Find dinner partners or group formation signups for topic dinner tables posted in morning near registration desk)

Session 1: 1:00pm to 3:00pm

Track 1: Symposium Position and Research in Progress Papers – Starr Roxanne Hiltz, NJIT, New Jersey, USA

1. *Crisis Detection in Enterprises Based on AHP with Clustering,* Yan Song, Harbin Institute of Technology, China

Crisis detection can help enterprises to make full preparation to respond real crisis, so it is an important field to promote enterprises' competition and keep them develop continuously. Crisis in enterprises may be caused by many factors and most of them are very common and necessary parts in normal operating procedure. This paper takes these parts as crisis signals indicated in many managing books. Group decision-making strategy is put forward to help enterprises to analyze crisis signals based on the characteristics of the decision-making procedure. To get a meaningful and credible result, AHP is used to support the whole procedure. To exhibit the role of managers, system cluster is used to classify experts involved in decision-making procedure. An example to analyze a key engineer's dismissing is given to illustrate the decision-making procedure and to prove the efficiency of this idea and AHP method.

2. *SIGAME: Web-based System for Resources Management on Emergencies*, Laura Montells, Susana Montero, Paloma Diaz, and Ignacio Aedo, Universidad Carlos III de Madrid; Spain, Jorge de Castro, Dirección General de Protección Civil y Emergencias

This paper describes SIGAME, a web-based application for national cooperation in case of disaster. The main motivation of SIGAME is to provide a quick, flexible, reliable, many-to-many, updated communication channel for improving and coordinating the response of assistance suppliers (located at several territories) when an emergency occurs. In order to make communication as efficient as possible and taking into account the organizational diversities of the suppliers, the political implication and the characteristics of the future users, a user centered design method for web-based interactive systems seems to be the best solution for attending the designer through the different phases and products of the design process. In particular, we will focus on the techniques used both to involve stakeholders in the design and to collect requirements.

3. *Developing Adaptive User Interfaces Using a Game-Based Simulation Environment*, Guido te Brake, Tjerk de Greef, Jasper Lindenberg, Jouke Rypkema, and Nanja Smets, TNO Human Factors, The Netherlands

In dynamic settings, user interfaces can provide more optimal support if they adapt to the context of use. Providing adaptive user interfaces to first responders may therefore be fruitful. A cognitive engineering method that incorporates development iterations in both a simulated and a real-world environment is used to develop new adaptive concepts. In a simulated 3D-world, created with the Unreal Tournament game-engine, a team of emergency personnel have to rescue people and develop an understanding of the situation. We believe a game-based simulation environment can provide an effective platform for experiments in which crisis management situations can be created under controlled circumstances. Using this simulation, support concepts based on adaptive user interfaces can be developed and evaluated before they are implemented in a real-world setting. This paper describes the work that has been done, and presents the design of the planned experiments.

4. *VISTA - A Visualization Analysis Tool for Humanitarian Situational Awareness*, Dennis King, US Department of State, Humanitarian Information Unit, USA

The US Department of State's Humanitarian Information Unit (HIU) is developing a new product and web-based visualization analysis tool, known as VISTA (Visualized Information & Synthesized Temporal Analysis). VISTA displays geo-spatial, temporal, numerical/graphic data and textual information, all in one product or via a web interface. VISTA is primarily intended for use by decision-makers, analysts, desk/project officers, and others to provide up-to-date common operating picture ie "a vista" about an emergency, issue or project.

5. *The Moving Digital Earth (MDE) for Monitoring of Forthcoming Disasters*, Valeriy Klenov, Russia

Disasters in Earth Nature Systems (in river basins and in coastal zone) are generated the systems by influence under pressure and impacts of external systems. The water related disasters include the most of hazardous processes on land and sea as follows: floods, avalanches, droughts, landslides, debris-flows, erosion, abrasion, and others. The external systems are not yet able to let know about the Time, Place, and Power of future disasters all together. However, Earth systems allow doing it because of their property to delay on exterior power. The proposed and discussed is the Moving Digital Earth (MDE) technology for outstripping estimation of the Earth Nature Systems response on exterior pressure and impacts. The MDE uses only the knowledge of current System's state and methods of the Digital Systems Analysis (DSA) by high-speed computing.

Track 2: Workshop on Future Communication Requirements for Emergency Response – B.S. Manoj and Alexandra Hubenko Baker, University of California, San Diego, USA

1. *Challenges in Using Distributed Wireless Mesh Networks in Emergency Response*, Brian Braunstein, T. Trimble, R. Mishra, B.S. Manoj, L. Lenert, and R.R. Rao, University of California, San Diego, USA

Wireless Mesh Networks (WMNs) are formed by self-organized wireless nodes that use multi-hop wireless relaying. These networks are useable in a variety of situations ranging from fixed residential broadband networking based on rooftop wireless mesh nodes to emergency response networks for handling large scale disasters. Quick deployability, minimal configuration, broadband communication, and easiness of reconfigurability are the major characteristics that make WMNs a suitable choice for emergency applications. There exist several open research issues in using such WMNs for emergency response applications. We, in this paper, present a hybrid distributed wireless networking architecture, Extreme Networking System (ENS), and present large set of performance observations collected from a real distributed hybrid wireless mesh network used for supporting a medical emergency response application. We present the traffic behavior observed in our network when a client server medical emergency response application is employed. The performance observations on real-traffic scenarios for emergency response application underlines the need for focusing further research on topology control, reliability, service availability, and distributed management. We observed that though there are several challenges that need to be solved, a WMN is a favorable choice for emergency response networking.

2. *Observation of Katrina/Rita Groove Deployment: Addressing Social and Communication Challenges of Ephemeral Groups*, Shelly Farnham, Farnham Research; Elin R. Pedersen and Robert Kirkpatrick, Microsoft

In order to better understand the challenges specific to the deployment of collaboration technologies in crisis situations, we conducted an informal observational study of the deployment of Groove Virtual Office to various civil and military groups at the heart of the disaster zone over the course of ten days. We summarize both general lessons learned from observations of social and communication challenges in crisis situations that impact technology adoption, and make specific recommendations for improving the deployment process of Groove to enable cross group collaboration. We generally found that dynamic, informal social networks and lightweight ephemeral work groups were essential social structures in the relief effort, and we discuss the need to innovate technologies to support these alternative types of organizations. We encourage that current technology centric innovation for ephemeral workgroups is complemented by a usage centric approach to help address emergent behaviors and opportunities.

3. Workshop Discussion Part 1

Track 3: Ph.D. students' workshop – David Mendonça, NJIT, USA and Jiri Trnka, Linkoping University, Sweden

The purpose of this session is to network Ph.D. students working in this field, and to obtain advice about - current research efforts from fellow students and a small panel of faculty that will be present.

Coffee 3:00pm to 3:30pm

Session 2: 3:30pm to 5:30pm

Track 2: Workshop on Future Communication Requirements for Emergency Response – B.S. Manoj and Alexandra Hubenko Baker, University of California, San Diego, USA

1. *Community based cost effective Early Warning Dissemination Network (EWDN)*, S.H.M. Fakhruddin, ADPC, Thailand

Natural disasters are frequent in Bengladesh. Because Bengladesh has a fragile economy that is mostly dependent on agriculture, these events can be disastrous to the economy and people of the country. Adequate warnings to the community and institutions can mitigate the deleterious effects. This paper presents a model for an effective disaster warning and dissemination system (EWDN) that can provide timely and accurate alerts of natural disasters thus reducing loss of life, property and other risks.

2. Invited Panel

3. Workshop Discussion Part 2

Track 3: Ph.D. students' workshop – David Mendonça, NJIT, USA and Jiri Trnka, Linkoping University, Sweden

The purpose of this session is to network Ph.D. students working in this field, and to obtain advice about -current research efforts from fellow students and a small panel of faculty that will be present.

Informal Reception: 5:30pm to 6:30pm

ISCRAM 2006 Conference May 14 to 17

Monday May 15, 2006

Registration: 8:00am-5:30pm

Exhibits: 10:30am to 5:30pm

Coffee and Snack: 8:00am to 8:30am

Refreshment Break: 10:30am to 11:00am

LUNCH: 12:30pm to 1:30pm

Refreshment Break: 3:30pm to 4:00pm:

Three track Paper Sessions: 11:00pm to 12:30pm and 1:30pm to 3:30pm

Katrina Panel: 4:00pm to 5:30pm

Meeting Reception: 5:30pm to 7:00pm (Group formation signups for topic dinner tables posted in morning near registration desk)

Keynote Session 8:30am to-10:30am

8:30-9:00: Welcome by Priscilla Nelson, Provost of NJIT

9:00-10:30: Citywide IT Preparedness for Critical Events: Accomplishments and Challenges, Gino Menchini, Chief Information Officer (CIO) and Commissioner Department of Information Technology and Telecommunications, City of New York

9/11 and Voice/Data Communications

One of the most important lessons of the September 11, 2001 attacks was the need for an improved means of communicating with key personnel. In addition to ensuring radio interoperability among its first responders, New York City is currently facilitating construction of a citywide mobile wireless network for public safety, which will utilize City buildings, light poles, and traffic lights for antennas, transmitters, and receivers, while also utilizing the City's existing fiber infrastructure. When completed, this citywide network will provide a wireless backbone for applications running on mobile and fixed devices.

Role of 3-1-1 in Citywide Events

On August 14, 2003 New York City was affected by a blackout that covered much of the Northeast United States; from December 20-22, 2005, the City was affected by a strike by its subway and bus operators, who transport more than 7 million people daily. In each instance, our 311 Citizen Service Center, established in March 2003, used technology to handle a significant influx of calls (more than 175,000 calls over the course of the power outage, and over one-half million during the strike—including a record 241,000 in the first day alone). Throughout these events callers to 3-1-1 were routed into a messaging system to provide basic information about the event, which was updated continuously. Furthermore, at all information focal points, 3-1-1 staff maintained updated content in Siebel (the City's CRM application) to ensure it reflected the most current information. As a result, 3-1-1 helped to alleviate the burden 911 would have been faced with if callers did not have anywhere else to call, ensured consistent information was shared with the public by coordinating 3-1-1's messages and content with other channels, and created a clear channel of communication between the public, the City, and agencies responsible for services relating to the events.

Gino P. Menchini was appointed on December 28, 2001 by Mayor Michael R. Bloomberg as Commissioner of the New York City Department of Information Technology and Telecommunications (DoITT) and New York City's Chief Information Officer (CIO). As the City's CIO and DoITT Commissioner, Menchini has helped to establish

and build upon what has been a cornerstone of the Bloomberg Administration—the use of technology to support agency missions and make government more accessible, responsive, and accountable.

Mr. Menchini began his civic career at the Board of Education, at which he spent 14 years. Following his time there, he served as the Director of Citywide Information Technology for the Mayor's Office of Operations. Mr. Menchini left the public sector in 1997, holding jobs with St. Francis College and then Cisco Systems prior to assuming his current position as DoITT Commissioner and New York City CIO.

Mr. Menchini holds a Bachelor in Business Administration degree from Pace University and attended Pace University's Graduate School of Business.

Refreshment Break: 10:30am to 11:00am

Session 1: 11:00am to 12:30pm

Track 1: Requirements for Emergency Management Systems – Paul Burghardt, DECIS, Netherlands

1. *Exploring Protocols for Multidisciplinary Disaster Response Using Adaptive Workflow Simulations,* Guido Bruinsma and Robert de Hoog, University of Twente, The Netherlands

The unique and dynamic changing nature in which a disaster unfolds forces emergency personnel involved with the mitigation process to be greatly flexible in their implementation of protocols. In past disasters the incapability of the disaster organization to swiftly adjust the workflow to the changing circumstances, has resulted in unnecessary delays and errors in mitigation.
Addressing this issue, we propose and demonstrate a method for simulating disasters for work and protocol optimization in disasters response (TAID), based on the BRAHMS multi-agent modeling and simulation language. Our hypothesis is that this low fidelity simulation environment can effectively simulate work practice in dynamic environments to rearrange workflow and protocols. The results from an initial test simulation of the Hercules disaster at Eindhoven airport in the Netherlands look promising for future and broader application of our disaster simulation method

2. *Availability of Technologies verses Capabilities of Users*, Hans Zimmermann, The International Emergency Management Society

The regulatory environment is no longer the primary hindrance to the full application of telecommunications technology in the service of emergency response, disaster prevention and relief, and crisis management. Nowadays the restricting factor is the lack of knowledge about the capabilities, but also the limitations, of the multitude of specialized and of public communication systems. This paper will analyze the situation with the help of some practical examples and will recommend an interdisciplinary multi-stakeholder based approach to an educational concept for emergency and disaster telecommunications.

3. *Foundations for Designing Global Emergency Response Systems,* Tung Bui and Siva Sankaran, University of Hawaii, USA

Works on Emergency Response Systems (ERS) tend to set aside – or discuss peripherally – the global nature of catastrophes and the unique conditions under which these systems have to operate. Major disasters either affect more than one country or require the help of more than one nation. Designing ERS to manage global crisis situations pose great challenges due to incompatible technologies, language and cultural differences, variations in knowledge-level and management styles of decision makers, and resource limitations in individual countries. In this paper, we outline theoretical foundations for designing global ERS. We develop a path model that identifies the elements and their interactions needed to ensure quality of outcomes and processes of emergency response. We also prescribe a Global Information Network (GIN) architecture to provide decision-makers with timely response to crises involving global intervention.

Track 2: Communication Challenges in Emergency Response – B.S. Manoj and Alexandra Hubenko Baker, UC San Diego, USA

1. *Emotion Detection from the Speech Signal and its Applications in Supporting Enhanced QoS in Emergency Response*, Rajesh Hegde, B.S. Manoj, B.D. Rao, and R.R. Rao, UC San Diego, California, USA

Networking in the event of disasters requires new hybrid wireless architectures such as Wireless Mesh Networks (WMNs). Provisioning Quality of Service (QoS) in such networks which are quickly deployed during emergencies demand radical solutions. In this paper, we provide a new QoS approach for voice calls over a wireless mesh networks during emergency situations. According to our scheme, the contention and back-off parameters are modified based on the emotion content in the voice streams. This paper also looks at methods for detecting emotion from an incoming voice call using the speech signal. The issues of interest in such situations are whether the caller is in a state of extreme panic, moderate panic, or in a normal state of behavior. The communication network behavior should be modified to provide differentiated QoS for calls based on the degree of emotion. We use several features extracted from the speech signal like the range of pitch variation, energy in the critical bark band, range of the first three formant variations, and speaking rate among others to discriminate between the three emotional states. At the back end the Gaussian mixture modeling techniques is used to model the three emotional states of the speaker. Since a large number of features increase the computational complexity and time, a feature selection technique is employed based on the Bhattacharya distance, to select the set of features that give maximum discrimination between the classes. These set of features are employed to simulate an emotion recognition system. The results indicate a promising emotion detection rate for the three emotions. We also present the early results on detecting the emotion content in the speech and using this in the MAC layer differentiated QoS provisioning scheme. Our scheme provides an end-to-end delay performance improvement for panicked calls as high as 60% compared to normal calls.

2. *MIKoBOS – A Mobile Information and Communication System for Emergency Response*, Andreas Meissner, Zhou Wang, and Wolfgang Putz, Fraunhofer IPSI; Jan Grimmer, Technical University of Darmstadt, Germany

The role of communication and information provision in coping with natural and man-made disasters and emergency situations is becoming increasingly important. In this paper we present an integrated mobile information and communication system, MIKoBOS, for emergency response operations that enables reliable data communication within the emergency site as well as between the site and the headquarters. It provides the responsible personnel involved in the emergency operation at different levels with anytime-anywhere access to relevant information. Compared to traditional voice-dominated approaches, the proposed system can greatly improve the effectiveness and efficiency of communication and coordination during disaster relief operations. Promising experimental performance results are provided for use with a number of terrestrial and satellite networks.

3. *An Enhanced VoIP Emergency Services Prototype*, Jong Yul Kim, Wonsang Song, and Henning Schulzrinne, Columbia University, USA

In this document we describe enhancements made to the prototype for emergency services in VoIP originally proposed and implemented in (Mintz-Habib, Rawat, Schulzrinne and Wu, 2005). In particular, we describe alternative methods of acquiring the physical location of an emergency caller and a novel way of using location information to determine call destination. We also introduce psapd, an enhanced third party call controller at the public safety answering point (PSAP), and discuss new features made possible by psapd. Preparations are underway in Texas and Virginia to install and test the enhanced prototype.

Track 3: Incident Command Systems Workflow Management – Allen Milewski, Jiacun Wang, Monmouth University, NJ

1. *Precise Yet Flexible Specification of Emergency Resolution Procedures,* Manuel Llavador, Patricio Letelier, Mª Carmen Penandés, José H. Canós, Technical University of Valencia, Spain; Marcos Borges, Universidade Federal do Rio de Janeiro, Brasil; and Carlo Solis, Technical University of Valencia, Spain

Emergency Managers face a number of critical problems related to the compilation, validation, and use of Emergency Procedures. Traditional approaches do not provide enough expressiveness to accurately specify emergency procedures covering each possible scenario. As a result of this situation, Emergency Procedures are not as useful as they should be, neither in prevention nor during resolution of an emergency. In this work, we present an approach that merges two techniques to provide the broad expressiveness required when specifying Emergency Procedures. To represent sequences on actions performed by different participants we use workflow techniques. On the other hand, we use rules to represent available or mandatory actions according to the state of the system during the emergency. These rules are expressed in dynamic logic as the underlying formalism. Our approach provides more expressiveness and precision for the specification of Emergency Procedures, offering better conditions for their verification and validation. As a case study we have used part of a city subway Emergency Procedure.

2. *m-ARCE: Designing a Ubiquitous Mobile Office for Disaster Mitigation, Services and Configuration*, Patricia Gomez Bello, Ignacio Aedo, Fausto Sainz, and Paloma Diaz, DEI Laboratory, Carlos III University of Madrid; Jorge de Castro, Dirección General de Protección Civil y Ermergencias, Ministry of Interior, Spain

Cooperation and mutual assistance in emergency situations is one of the main objectives of the Latin-American Association of Governmental Organisms of Civil Defense and Protection. To promote such collaboration m-ARCE has been developed; an ubiquitous mobile office for disaster mitigation where users can send and receive information anywhere and anytime. When a catastrophe happens in a country, and almost all infrastructure is destroyed, mobile technology, such as mobile devices and wireless networks, offers the user resources to ask for help and to manage it. Latin-American Countries often suffer catastrophes that provoke numerous human losses and major economic and social problems. International assistance and collaboration with the affected country is necessary to help in its recovery. The Web, like Internet, offers static office services to users who can access information using an infrastructure in indoor environments. On the other hand, mobile computing and networking use the Internet, together with mobile physical devices linked to it, and software platforms built upon it, to design and coordinate systems across countries. In the ubiquitous mobile office design, we describe how services, such as chat, email and wireless communication, should be configured for emergency situation. We make use of ubiquitous hypermedia -linked nodes in ubiquitous spaces- to ensure mobility and accessibility to the mobile device interface, such as PDAs and smartphones.

3. *Incident Command System Workflow Modeling and Analysis: A Case Study*, Jiacun Wang, Monmouth University, NJ

The dynamics and volunteer-based workforce characteristics of incident command systems have raised significant challenges to workflow management systems. Incident command systems must be able to adapt to ever changing surroundings and tasks during an incident. These changes need to be known by all responsible parties, since people work in shifts, get tired or sick during the management of an incident. In order to create this awareness, job action sheets and forms have been created. We propose a paperless system that can dynamically take care of these aspects, and formally verify the correctness of the workflows. Furthermore, during an incident, the majority of workers are volunteers that vary in their knowledge of computers, or workflows. To address these challenges, we developed an intuitive, yet formal approach to workflow modeling, modification, enactment and validation. In this paper, we show how to apply this approach to address the needs of a typical incident command system workflow.

LUNCH: 12:30pm to 1:30pm

Track 1: Public Warning Systems, Art Botterell, Ronja Addams-Moring and Mikko Sarela, Helsinki University of Technology, Finland

1. *Challenges for Warning Populations with Sensory Disabilities*, Marcia Brooks, WGBH National Center for Accessible Media, USA

People with sensory disabilities, like anyone else, need access to timely emergency and weather warnings information. Primary information sources, radio and television broadcasts, do not consistently serve the needs of the 28 million people who are deaf or hard-of-hearing, or the 11 million people who are blind or have low vision. Alert systems, services and products are developing text and audio alert capabilities to serve these populations but many inconsistently support appropriate modalities and accessible interfaces.
Funded by the US Department of Commerce, WGBH is uniting emergency alert providers, local information resources, telecommunications industry and public broadcasting representatives, and consumers to research and disseminate replicable approaches to make emergency warnings and community-based information accessible. Through research with consumers and the public warning community, and delivery and device testing, an information model is being developed with recommended accessibility extensions to emergency system protocols, technologies and services for cross-platform delivery.

2. *An Internet Public Alerting System: A Canadian Experience*, Nabil Seddigh, Biswajit Nandy, Solana Networks; John Lambadaris, Carleton University, Canada

Public officials have the responsibility of giving public directions and issuing warnings in the event of an emergency. Traditionally, siren systems, radio and television have been used as the primary means for issuing public alerts. Recently, there has been increased interest in evaluating the Internet's suitability for issuing public alerts during times of emergency. This paper presents a Canadian experience with the design and trials of an Internet-based emergency public alerting system (IPAS). We discuss a proposed set of requirements and system architecture. We also include a discussion of the challenges to be overcome in developing such systems and report on experiments and field trials using the IPAS system developed during this project. Our objective is to provide motivation for future research and industry work in this area.

3. *Comparing Cell Broadcast and Text Messaging for Citizen Warning*, Simone Sillem and Erik Wiersma, Delft University of Technology, The Netherlands

In life-threatening emergencies, citizens need to be warned. The currently used method for citizens warning in The Netherlands is a siren. AT this moment, research is being carried out into using new technologies as an addition to this siren for citizens warning. Modern telecommunication technologies have great potential for informing the public. Especially the use of text-based features of mobile phones is considered for this function. Advantages of such a system are that these technologies overcome problems of hearing the siren and that text-based messages provide possibilities for giving more and more detailed information. In a number of pilot studies, Delft University of Technology has gained experience with the possibilities of these technologies for citizens warning services. This paper compares two text-based mobile phone technologies that can be used for citizens warning as an addition to the siren.

4. *Design Criteria for Public Emergency Warning Systems*, Maurice McGinley, Ovis Pty Ltd.;Andrew Turk and David Bennett, Murdoch University, Australia

This paper describes the development of a public emergency messaging system in Western Australia. A set of design criteria were identified by a review of relevant published literature, a survey of current practice in Australia, and consultation with local stakeholders. The system should support: Multiple Recipients, Multiple Channels, Multiple Hazards, Multiple Stakeholders, Multiple Senders, Multiple Platforms, and Write Once Message Composition. A prototype system was built according to these design criteria, based on the Common Alerting Protocol version 1.0. The design was validated in trials simulating messages sent during a tropical cyclone and a bushfire. A total of 56 trial participants from identified stakeholder groups were surveyed with regard to their experience of the prototype system. Overall, the prototype system functioned successfully and participants reported high levels of satisfaction. The paper describes this research project and the initial stages of the subsequent development of a production system, called APECS.

5. *Mobile Emergency Announcements with Really Simple Syndication (RSS 2.0)*, Yrjo Raivio and Ronja Addams-Moring, Helsinki University of Technology, Finland

Broadcasting methods, such as the radio, the television and sirens, have been the main choices for delivering emergency announcements (EA) – also called public warnings, emergency alerts or citizens warnings – during the last 60 odd years. Unfortunately, broadcast EAs do not reach all people, and the reason for the EA and the actions required can remain unclear. Today, the high penetration of personal mobile phones offers new options to authorities. As a result, a new research and implementation area, Mobile Emergency Announcement (MEA), has emerged. The GSM Short Message System (SMS) is already deployed for MEA delivery. Simultaneously, in the World Wide Web (WWW) a novel news delivery technology, called Really Simple Syndication 2.0 (RSS) is spreading. This paper describes a concept for how RSS can be harnessed for MEA use. First, MEA requirements are briefly reviewed. Second, the eXtended Markup Language (XML) based Common Alerting Protocol (CAP) and the syndication protocol RSS 2.0 are presented. Third, the central implementation issues are presented. Finally, the proposed solution is critically reviewed.

Track 2: Communication Challenges in Emergency Response – B.S. Manoj and Alexandra Hubenko Baker, UC San Diego, USA

1. *Emergency Communication Challenges and Privacy*, Raheleh B. Dilmaghani, B.S. Manoj, and R.R. Rao, UC San Diego, USA

Communication and interoperability between different organizations of first responders has been a problem for a long time. There have been examples of failure in communication between different organizations at World Trade Center on 9/11, for example some of the police warnings were not heard by fire fighters that resulted in several lives lost. In most cases, network unavailability or incapability of coordination among networks causes much damage. Therefore, we present a highly reliable communication infrastructure that is suitable at ground zero where the existing communication network is damaged or unavailable. We used Hybrid Wireless Mesh Network (HWMN) as a candidate for communication infrastructure with the capability of working in a heterogeneous environment with different available backhaul technologies. In addition to the use of WMNs, we also present some special requirements for a cellular networks generated by simulation models investigating different scenarios that occur at ground zero. For example, when hurricane Katrina hit New Orleans, people outside the ground zero area could place a call, but were not able to receive phone calls. This happened because the cellular network elsewhere was not able to contact the Home Location Register (HLR), located at New Orleans. We, in this paper, propose a solution in which the important user or network information databases such as HLR and VLR (Visitor Location Register) are replicated to provide a sufficient amount of fault tolerance.

2. *Issues in the Development of a Mobile Based Communications Platform for the Swedish Police Force and Appointed Security Guards*, Bo Andersson and Jonas Hedman, Lund University, Sweden

This paper presents the learning experiences from the development of a mobile-based communication platform, called OrdningsVaktsCentralen (OVC). OVC can be translated to Security Guard Central. OVC is designed to enable the Swedish Police Force (SPF) to comply with new legal requirements and enhance their collaboration with Appointed Security Guards (ASG). The focus of this paper is on the early phases of development; in particular on the specific technical issues such as interoperability and standards used in the development of mobile based systems. The learning experiences are as follows: firstly, when developing mobile based systems we suggest and recommend that the analysis phase should be enhanced and it should address the interoperability between mobile phones on one hand and operators on the other hand. Secondly, global and national standards, such as the MMS7 for sending multi-media messages, are not always standardized. It seems that operators and mobile phone manufacturers make minor alterations and interpretations of the standard and thereby some of the benefits found in standards disappear. Thirdly, mobile based communication platforms have a large potential for contributing to the field of emergency management information systems since they can be based on open and nationally accepted standards.

3. *Coordinating Shared Perspectives in Robot Assisted Search and Rescue*, Martin Voshell, The Ohio State University, USA; Augustine H.J. Oomes, Delft University of Technology, The Netherlands

From high fidelity field exercises to disaster response deployments, search and rescue robots are being readily integrated into rescue operations. Previous research has proposed that for such new technology to be successful in an operation the organization architecture needs to support the coordination of shared perspectives between the human team members and the robotic platforms. For this, the robot platforms need to be effective team players in the field of practice. Based on this conceptual model, this paper introduces a novel software interface utilizing virtual position and orientation indicators to alleviate perceptual ambiguities and navigation problems experienced by robot handlers and problem holders. By actively orchestrating and sharing these indicators between handler and operator displays, the interface caters to user expertise and to the natural competency of the human perceptual system. These probes provide a basic tool for aiding robot navigation and way-finding fundamental to effective team coordination and communication in urban search and rescue missions.

4. *Development and Assessment of the STATPack Emergency Response System*, Noel Johnson and Ann Fruhling, University of Nebraska at Omaha, USA

The STATPack^{TM} is a telemedicine consultation and emergency response system which was developed to increase statewide laboratory responsiveness to public health emergencies. Although several emergency response management information systems have been created for diagnostic laboratories at the national level, most states in the U.S. do not have the capability to share critical public health microbiology laboratory information at local levels, especially in rural communities. This paper offers a description and preliminary assessment of the STATPack as it is being deployed by the Nebraska Public Health Laboratory and should be recognized as research in-progress. Initial experiences with this emergency response system have been encouraging.

Track 3: Command and Control, Michael Chumer, NJIT, USA

1. *Effective and Efficient Coordination Strategies for Agile Crisis Response Organizations*, J.B. van Veelen, Decis Lab, The Netherlands; P.P.A. Storms and C.J. van Aart, Y'All, The Netherlands

Agile crisis response organizations can be seen as actor-agent communities, where artificial coordination strategies are applied to manage activities. This paper provides a classification of artificial coordination strategies, specified in terms of the Rasmussen's three-level model for supervisory control: skill, rule and knowledge based. Three distinct strategies to artificial coordination based on Rasmussen's levels are described. These approaches are applied in a small case study related to the problem of medic-casualty allocation in the crisis response domain. In terms of effectiveness and efficiency, the knowledge-level coordination strategies seem to be the most effective, where the skill-level strategies are the most efficient. Concerning flexibility there is a reverse trade-off with efficiency. Opposed to skill-level strategies, knowledge-level strategies easily adjust to changing operational requirements. On all aspects, the performance of rule-level strategies is in-between knowledge-level and skill-level strategies.

The results of this work can be used to improve the performance and effectiveness of actor-agent communities for mission critical applications.

2. *Personalized Situation Aware Information Retrieval and Access for Crisis Response*, Nong Chen and Ajantha Dahanayake, Delft University of Technology, The Netherlands

Crisis response is an information intensive process, which produces or consumes large quantities of information from different relief organizations. Although personalized information retrieval and access has been realized as an efficient means to accelerate information acquisitions, most IT enabled applications in the fields can only provide uniform information to all the involved relief organizations. The traditional centralized design principle dominantly used to address the inter-organizational information accesses over boundaries is no longer feasible due to its lack of flexibility and adaptability to deal with dynamically changing information needs caused by the unpredictable nature of the crises. In this paper we present our ongoing research regarding a plug and play service architecture for personalized, situation aware information retrieval and access services, which offers a new way of thinking about the retrieval of personalized information in the context of crisis response.

3. *A Critical Thinking Environment for Crisis Response*, Josine G.M. van de Ven and Martijn Neef, TNO, The Netherlands

Building up a proper understanding of a large-scale incident is an important and difficult process. We envision a working environment for decision makers in crisis management situations that allows them to work with information in various ways. That will stimulate them to think critically in processing the information they receive – all in support of rapid sensemaking and decision making. To realize this ambition, we combine various technologies into an integrated support concept called the Critical Thinking Environment (CTE), aimed at tackling critical issues in sensemaking.

4. *Automated Support for Dynamic Information Distribution in Incident Management*, Neils Netten and Maarten van Someren, University of Amsterdam, The Netherlands

For all emergency response personnel involved in crisis situations it is essential to timely acquire all information critical to their task performance. However, in practice errors occur in the distribution of information between these collaborating actors leading to mistakes and subsequently more damage to the situation.

In this paper we present a prototype system for dynamic information distribution able to support the information flow between collaborating crisis actors. The system has been evaluated by means of simulated experiments that use data from a real incident scenario. The results indicate that automated support by means of Machine Learning method works well. Especially, when actor work context features are included, then the performance on selecting and distributing relevant information is high. Furthermore, actors acquire relevant information much faster making group communication much more efficient.

Refreshment Break: 3:30pm to 4:00pm:

<u>Session 3: 4:00pm to 5:30pm</u> Panel on the Katrina Experience

Hurricane Katrina caused catastrophic impacts on the city of New Orleans and the Gulf Coast of Louisiana and Mississippi. The response to this catastrophe was the first test of the National Response System crafted by the Department of Homeland Security during the last three years. Information management problems and information technology failures were significant factors in the failed response. This panel will address the impacts of the hurricane and flooding on the city of New Orleans (Prof. Steinberg), information management problems encountered by FEMA/DHS (Mr. Pawlowski), IT (Mendonça) issues in response, and the implications for emergency management, impacts on universities in the area, (Chen), and the National Response System (Harrald)

Laura Steinberg, Associate Professor of Civil and Environmental Engineering, Tulane University; **Michel Pawlowski**, Incident Response Section Chief, FEMA, Department of Homeland Security; **David Mendonca**, Assistant Professor of Information Systems, NJIT; **Peter Chen**, Distinguished Professor and Director of the Homeland Security and Intelligent Data Analysis Laboratory, Louisiana State University; and **John Harrald**, Director, Institute for Crisis, Disaster and Risk Management, The George Washington University

<u>Meeting Reception:</u> 5:30pm to 7:00pm (Group formation signups for dinners posted in morning near registration desk)

Tuesday May 16, 2006

Registration: 8:00am to 5:30pm

Exhibits: 9:00am to 5:30pm

Coffee and Snack: 8:00am to 8:30am

Refreshment Break: 10:30am to 11:00am

LUNCH: 12:30pm to 1:30pm

Refreshment Break: 3:00m to 3:30pm:

Three track Paper Sessions: 11:00pm to 12:30pm, 1:30pm to 3:00pm, 3:30pm to 5:30pm

Dinner: 7:00pm to 10:00pm, Don Peppe Restaurant, Newark

Keynote Session: 9:00am to 10:30am

A tale of two cities: Banda Aceh, New Orleans, and Humanitarian Operations, Paul Currion, Humanitarian.Info

The international community provides humanitarian assistance through a complex web of agreements and institutions that simultaneously support and obstruct each other in their work. While most support during a disaster is provided by local actors, international organizations often provide the framework for funding and co-ordination of responses in those countries where national or local institutions are unable to cope – whether because of the scale of a disaster (such as the Pakistan earthquake) or because of issues around government capacity (such as in the Democratic Republic of Congo).

In recent years, the humanitarian community has undergone a massive transformation – one that is still going on today. Partly those changes relate to the political environment in which we operate now, particularly the 'war on terror'; partly, they are shaped by the increasing frequency and severity of natural disasters, although many conflict-related emergencies that dominated the 1990s and early 2000s continue. Partly, however, they relate to the way that technology has changed both the response and the context in which that response is made.

While domestic emergency management practice relies on certain assumptions – the establishment of clear lines of communication and command, centralized and coordinated decision-making, specialized agencies providing critical public services, continuity of presence (particularly of government) – humanitarian actors proceed on directly opposite assumptions. As a result there are critical differences in the design and implementation of information systems for relief and peace operations, compared with the requirements of emergency management.

Comparing the responses to the Indian Ocean tsunami and Hurricane Katrina exposes many of these differences, and raises questions about how compatible the two approaches might be. While there may be lessons for the humanitarian community to learn from the emergency management discipline, what is more important is to build a common language to enable these two sets of actors to co-operate more effectively – something that will become increasingly critical as they interact more in future.

Paul Currion runs a consultancy specializing in information management for humanitarian operations. He is currently carrying out an assessment for the Interagency Working Group (CARE, Catholic Relief Services, International Rescue Committee, Mercy Corps, Oxfam, Save the Children and World Vision) on NGO use of ICT to respond to emergencies. He is working on a range of other projects including research into the use of ICT for peace, developing open source software for disaster response, a GIS data model for humanitarian work, and humanitarian data standards. Previously, Paul was Regional Information Manager for the tsunami response with the World Food Program, and developed the Humanitarian Information Centre (HICs) concept for the United Nations, working on HICs in Kosovo, Afghanistan, Iraq and Liberia.

Refreshment Break 10:30 to 11:00

Session 1: 11:00am to 12:30pm

Track 1: System Dynamics Modeling for Emergency Management – Peter Otto, Dowling College, USA

1. *Modeling Risk Dynamics in e-Operations Transitions*, Eliot Rich, University at Albany, USA

Migrations to new modes of operation are perilous times for most organizations. For firms that routinely work in high-threat, high-reward situations, the risks of innovation are particularly challenging. This paper presents a systems-based approach to understanding these risks, drawing examples from one firm migrating to e-Operations for offshore oil platforms to increase profitability. The firm recently participated in two facilitated group model building exercises to examine the effects of the migration on the organization and resources needed to safely implement multiple changes over time. Based on these exercises, a simulation model of the timing and relative levels of risk, was developed. The results of the workshop and simulation demonstrate the effect of a combined qualitative and quantitative modeling approach to understanding complex problems.

2. *IS Capability for Incident Management and the DERMIS Design Premises*, Gerd Van Den Eede, Vlekho Business School, Belgium; Willem Muhren, Raphaël Smals, and Bartel Van de Walle, Tilburg University, The Netherlands

In this paper we present a dynamic model of the performance of an organization's Incident Management process as determined by the capability of its supporting emergency response information system. Our work is based on the Capability Trap model by Repenning & Sterman (2001) and draws from the many insights on emergency response information systems design as described in the DERMIS (Dynamic Emergency Response Management Information System) framework established by Turoff *et al*. 2004. Whereas the latter describes the premises that underlie an Information System (IS) that is capable of ensuring a reliable and flexible emergency response, the present paper contributes to the research field by looking at the interrelations of the aforementioned premises. We take a System Dynamics approach and gain insights in the key determinants of IS Capability by highlighting the mutual interdependences grouped around the concepts of adaptability, control, implicit knowledge and explicit knowledge.

3. *A Theoretical Evaluation of the Information Processing Resources During Organizational Crisis*, Peter Otto, Dowling College, USA; and Salvatore Belardo, University of Albany, USA

The purpose of this paper is to present a model for testing different organizational learning characteristics and their effects on performance rate in times of an unexpected temporary increase in workload. Drawing on the theoretical frameworks of Yerkes-Dodson law, the stress-buffering effect of coping resources, and established crisis management models, the authors examine the hypotheses of curvilinear and interactional influence of single and double-loop learning on stress levels during crises. Using a simulation model, we identify thresholds in single and double-loop learning environments, where increases in workload lead to dysfunctional effects of stress. The findings indicate support for the hypothesis that an organization that employs double-loop learning is less susceptible to negative stress in times of a crisis. Overall, the study highlights the characteristics of different learning types and its effects on stress. It is suggested that experiments with a simulation model lead to a better understanding of how information processing resources that people have access to in stress events, buffers or protects them from negative effects.

Track 2: Multiagent Systems for Emergency Management – Frank Fiedrich, George Washington University, USA

1. *Using I-X Process Panels as Intelligent To-Do Lists for Agent Coordination in Emergency Response*, Stephen Potter, Austin Tate, and Gerhard Wickler, University of Edinburgh, UK

The aim of this paper is to describe the I-X system with its principal user interface, the I-X Process Panel, its underlying ontology, <I-N-C-A>, and how this panel can be used as an intelligent to-do list that assists emergency responders in applying pre-defined standard operating procedures in different types of emergencies. In particular, multiple instances of I-X Process Panels can be used as a distributed system to coordinate the efforts of independent emergency responders as well as responders within the same organization. Furthermore, it can be used as an agent wrapper for other software systems such as web services to integrate these into the emergency response team as virtual members. The heart of the I-X system is an automated planner that can be used to synthesize courses of action or explore alternative options manually.

2. *WIPER: A Multi-Agent System for Emergency Response*, Timothy Schoenharl, Greg Madey, Gábor Szabó, and Albert-László Barabási, University of Notre Dame, USA

This paper describes the proposed WIPER system. WIPER is intended to provide emergency planners and responders with an integrated system that will help to detect possible emergencies, as well as to suggest and evaluate possible courses of action to deal with the emergency. The system is designed as a multi-agent system using web services and the service oriented architecture. Components of the system for detecting and mitigating emergency situations can be added and removed from the system as the need arises. WIPER is designed to evaluate potential plans of action using a series of GIS enabled Agent-Based simulations that are grounded on realtime data from cell phone network providers. The system relies on the DDDAS concept, the interactive use of partial aggregate and detailed realtime data to continuously update the system and allow emergency planners to stay updated on the situation. The interaction with the system is done using a web-based interface and is composed of several overlaid layers of information, allowing users rich detail and flexibility.

3. *Intelligent Systems for Exploring Dynamic Crisis Environments*, Bogdan Tatomir, Leon Rothkrantz, and Mirela Popa, Delft University of Technology, The Netherlands

The routing in complex buildings is provided by information systems. But during a crisis situation, these systems may collapse due to certain incidents like an explosion, a fire or sabotage. The task of guiding people in this situation has to be handled in some way. In this paper we present a possible solution to this problem. We use a multi-agent system in a mobile ad-hoc network, without the need of any infrastructure. The main idea of the paper is that just by exploring the damaged building, the data of the changing environment becomes available and the challenge is how to fuse this data from different observers. We focused on the way of building, sharing and merging topological maps, using observations from individuals present in this infrastructure-less network. Besides a more efficient exploration of the building, the system presented in this paper can provide the rescue teams with additional services like finding the nearest exit. Some results of the tests we run with our system are also presented.

Track 3: Human Factors in Multi-Agency Crisis Management – Elizabeth Carver, BAE Systems, UK

1. *Emergency Services Enterprise Framework: A Service Oriented Approach*, Sukumar Dwarkanath, COMCARE; and Michael Daconta, Oberon Associates

The current *Emergency Services* landscape is characterized by a number of systems and networks that are isolated in nature, thus making information sharing impractical, if not impossible. Such an environment does not promote ease of information sharing, and each incident highlights the need for efficient collaboration and coordination, and the need for a holistic *internetwork* – a series of virtual interconnected networks - approach. In other words, it requires an overall framework that looks at *safety as an overall enterprise,* (albeit one with thousands of independent agency owners)*,* with the strategic goal to facilitate greater collaboration and effectiveness of operations, and to ensure a streamlined and efficient prevention of, response to, and recovery from all-hazards. Adopting a Service-Oriented enterprise approach is extremely useful and has number of advantages in such an environment. This paper defines a framework – in the context of an *enterprise* – an envisioned Emergency Services Enterprise Framework, and identifies the key elements of this framework.

2. *Disaster Forensics: Leveraging Crisis Information Systems for Social Science*, Mitchell Moss and Anthony Townsend, New York University, USA

This paper contributes to the literature on information systems in crisis management by providing an overview of emerging technologies for sensing and recording sociological data about disasters. These technologies are transforming our capacity to gather data about what happens during disasters, and our ability to reconstruct the social dynamics of affected communities. Our approach takes a broad review of disaster research literature, current research efforts and new reports from recent disasters, especially Hurricane Katrina and the Indian Ocean Tsunami. We forecast that sensor networks will revolutionize conceptual and empiricial approaches to research in the social sciences, by providing unprecedented volumes of high-quality data on movements, communication and response activities by both formal and informal actors. We conclude with a set of recommendations to designers of crisis management information systems to design systems that can support social science research, and argue for the inclusion of post-disaster social research as a design consideration in such systems.

3. *Mobile communications support for first responders*, Elizabeth Carver, Jeremy Hinton, Huseyin Dogan, and Ben Dawson, BAE Systems, UK

This invited paper presents very recent evaluation data on an R&D effort to develop a helmet for first responders that provides a full range of communication capabilities and for hands free operation.

LUNCH: 12:30am to 1:30pm

Session 2: 1:30pm to 3:00pm

Track 1: Panel and Discussion on the Future of ISCRAM

This is a session to present and discuss various alternative future options for the evolution of ISCRAM and to get feedback from those at this meeting interested in this topic. Should we rotate each year between Europe and the US? Do we establish relationships with appropriate professional societies and/or Universities? What other activities should we undertake? etc.   A small number of individuals who have been involved with ISCRAM since its inception will make up the panel but the primary purpose is to engage the audience.

Track 2: Multiagent Systems for Emergency Management – Frank Fiedrich

1. *Situation-Aware Multi-Agent System for Disaster Relief Operations Management*, Gabriel Jakobson, Altusys Co.; N. Parameswaran, The University of New South Wales; John Buford, Altsys Corp.; Lundy Lewis, Southern New Hampshire University; and Pradeep Ray, The University of New South Wales

Natural and human-made disasters create unparalleled challenges to Disaster Situation Management (DSM). One of the major weaknesses of the current DSM solutions is the lack of comprehensive understanding of the overall disaster operational situation, and very often making decisions based on a single event. Such weakness is clearly exhibited by the solutions based on the widely used Belief-Desire-Intention (BDI) models for building the Muiti-Agent Systems (MAS). In this work we present the adaptation of the AESOP situation management architecture to address the requirements of disaster relief operations. In particular, we extend the existing BDI model with the capability of situation awareness. We describe how the key functions of event collection, situation identification, and situation assessment are implemented in MAS architecture suitable to the characteristics of large-scale disaster recovery. We present the details of a BDI agent in this architecture including a skeleton ontology, and the distributed service architecture of the AESOP platform.

2. *Data Integration Potentiometer in DERMIS*, Eli Rohn, NJIT, USA

Dynamic Emergency Response Management Information Systems must integrate data from heterogeneous and autonomous resources. We propose a mathematically based approach for evaluating and quantifying the potential of a successful automatic integration between pairs of data resources. The integration potential, expressed as a percent, should influence assumptions and procedures of emergency response planners.

3. *Authors Panel (topic to be chosen at meeting)*

Track 3: Visualization in Emergency Management – Erika Darling, MITRE Corporation, USA

1. *Emergency Data Analysis via Semantic Lensing*, Aaron Burgman, Nikhil Kalghatgi, Erika Darling, Chris Newbern, Kristine Recktenwald, Shawn Chin, and Howard Kong, The MITRE Corp., USA

Emergency situations often play out over extended geographic regions and can present response personnel with numerous types of data at various level of detail. Such data may be displayed in mapping software tools that organize the data into layers. Sufficiently complex scenarios can result in dense, occluded, and cluttered map displays. We investigated a localized, "detail-on-demand" filtering strategy called semantic lensing that in certain situations provides a more efficient and desirable approach than filtering global layers for mitigating clutter and occlusion.
An initial formal user study with these semantic lenses has shown their value in aiding decision makers during tasks that might occur during detection of and response to emergency situations. Completion times are significantly faster when using lenses, and workloads are significantly lower. Future work will evaluate additional features and task-specific applicability, and may support the distribution of such a lens tool to emergency preparedness and response personnel.

2. *Modeling Multi-Hazard Disaster Reduction Strategies with Computer-Aided Morphological Analysis*, Tom Ritchey, Swedish Defense Research Agency, Sweden

Disaster Risk Management (DRM) is a multi-dimensional problem complex requiring knowledge and experience from a wide range of disciplines. It also requires a methodology which can collate and organize this knowledge in an effective, transparent manner. Towards this end, seven specialists from the social, natural and engineering sciences collaborated in a facilitated workshop in order to develop a prototype multi-hazard disaster reduction model. The model, developed with computer-aided morphological analysis (MA), makes it possible to identify and compare risk reduction strategies, and preparedness and mitigation measures, for different types of hazards. Due to time constraints, the model is neither complete nor accurate – but only represents a proof-of-principle. The workshop was sponsored by the Earthquake Disaster Mitigation Research Center (EDM) in Kobe, in January, 2005

3. *A Distributed Spatiotemporal Cognition Approach to Visualization in Support of Coordinated Group Activity*, Brian Tomaszewski and Alan M. MacEachren, The Pennsylvania State University, USA

Technological advances in both distributed cooperative work and web-map services have the potential to support distributed and collaborative time-critical decision-making for crisis response. We address this potential through the theoretical perspective of distributed cognition and apply this perspective to development of a geocollaboration-enabled web application that supports coordinated crisis management activities. An underlying goal of our overall research program is to understand how distributed cognition operates across groups working to develop both awareness of the geographic situation within which events unfold, and insights about the processes that have lead to that geographic situation over time. In this paper, we present our preliminary research on a web application that addresses these issues. Specifically, the application (key parts of which are implemented) enables online, asynchronous, map-based interaction between actors, thus supporting distributed spatial and temporal cognition, and, more specifically, situational awareness and subsequent action in the context of humanitarian disaster relief efforts.

Refreshment Break 3:00pm to 3:30pm

Session 3: 3:30pm to 5:30pm

Track 1: Research Methods in Crisis Decision Making – David Mendonça, NJIT, USA

1. *A Service Elicitation Process for Crisis Management Technologies*, J.H. Appleman, E.A.M. van de Kar, M. Hengst-Bruggleing, Delft University of Technology; J. van de Ven, TNO & DECIS-lab; and P. Burghardt, DECIS-lab, The Netherlands

New information technological applications, that aim to support better professional responses to incidents and crises' are being developed at an increasing rate. We observe in almost any disaster that actions by civilians also contribute substantially to alleviation of the effects of a crisis. We are largely unaware what crisis management services would be of use to civilians under these particular circumstances; just as it is difficult for users to specify requirements for services based on novel technologies. These insights guided the design of a service elicitation approach that can be repeatedly used for different user groups. In this paper we introduce a design methodology and discuss outcomes of a first test-session. We reflect in the conclusions on improvements to the design.

2. *Developing Performance Measures as Part of an Integrated Approach to Conservation Management of Cultural Heritage Assets*, Jeremy Hutchings, Oslo University, Norway

For sustainable care of cultural heritage it is essential to set accurate goals. However, the difficulty involved in establishing what is "accurate" in any given circumstance is often highly underestimated. Unbalanced decision making based on partial consideration of the situation surrounding a cultural heritage asset can at best result in inefficient use of resources and at worst will lead to its rapid loss. But the balance of risk against benefit is not straightforward, the impact of certain activities are far easier to quantify than others. Consequently, the adoption of a well balanced approach that considers all activities equally within the same framework is the key to providing appropriate and sustainable levels of protection. The development of an appropriate and systematic methodology offers a resolution to this problem. The outcome will be a suite of performance indicators assigned to each activity within a multivariate management framework. This paper describes the development and validation of such a methodology and the current status of the author's research.

3. *Distributed Perception Networks for Crisis Management*, Marinus Maris and Gregor Pavlin, University of Amsterdam, The Netherlands

Situation assessment in crisis management applications can be supported by automated information fusion systems, such as Distributed Perception Networks. DPNs are self-organizing fusion systems that can infer hidden events through interpretation of huge amounts of heterogeneous and noisy observations. DPNs are a logical layer on top of existing communication, sensing, processing and data storage infrastructure. They can reliably and efficiently process information of various quality obtained from humans and sensors through the existing communication systems, such as mobile phone networks or internet. In addition, modularity of DPNs supports efficient design and maintenance of very complex fusion systems. In this paper, a fully functional prototype of a DPN system is presented that fuses information from gas sensors and human observations. The task of the system is to compute probability values for the hypothesis that a particular gas is present in the environment. It is discussed how such a system could be used for crisis management.

4. *Information Technology (IT) and Critical Infrastructure Interdependencies for Emergency Response*, Rae Zimmerman and Carlos Restrepo, New York University, USA

Information technologies and other critical infrastructures are interconnected in ways that can lead to vulnerabilities in the ability of these infrastructures to perform during natural disasters and acts of terrorism either to reduce adverse consequences or provide needed emergency response services. This research applies and adapts a number of indicators of infrastructure interdependency based on the authors' earlier research to determine where weak points and strengths occur in the interconnections between infrastructure technology and other infrastructure support services such as electric power and transportation, and where weak points create vulnerability that can be improved for more effective response in emergencies.

5. *Emergency Scenario User Perspective in Public Safety Communication Systems*, Delia Berrouard, Krisztina Cziner, and Adrian Boukalov, Helsinki University of Technology, Finland

In the area of emergency response communication technologies, consideration of organization structure is critical in order to begin the understanding of user needs and optimize the development of effective technologies. User studies were carried out during the Wireless Deployable Network System European project – WIDENS. This paper discusses the information flow and spatial distribution of different European organizations involved in emergency response for various large-scale scenarios. The paper presents the operational view of emergency situation and related communication flows in several countries. Key results revealed that similarities exist in organizational roles, holding specific responsibilities in terms of location and task. Hierarchical arrangements and information flow may also be similar. However, difficulties lie in the efficient transmission of information due to slow information flow. Spatial distribution of personnel varies for scenarios. Future European studies are recommended for the advancement of our understanding of these newly addressed issues in public safety communication technologies and the needs of users in Europe.

Track 2: Real-Time Alerts for Earthquakes and Tsunami – Max Wyss, World Agency of Planetary Monitoring and Earthquake Risk Reduction, Switzerland

1. *Early Warning in Case of Potential Tsunami*, Jochen Zschau

The mega-tsunami of Dec. 26th, 2004, in the Indian Ocean has made clear to the world that there is a need for reliable tsunami early warning not only in case of the Pacific where early warning is already in place since a few decades, but also in case of other major oceans, such as the India, the Atlantic, the Caribbean and the Mediterranean, where nothing comparable exists.
Guided by the german-indonesian activities towards an early warning system for the Indian Ocean, the presentation will attempt to answer the questions,

- which technological components are essential and presently available for tsunami early warning,
- which new scientific challenges can be identified in this field and
- what are the technologies we should further develop for more effective systems in the future.

Besides this, the presentation will also point out that a scientific-technological system alone will not be sufficient for reliable early warning, but that bridging the "last mile", i.e. bringing a warning message to the people and making them understand and react properly, is an absolutely necessary, though still the weakest link in the early warning chain.

2. *The Kashmir M7.6 Shock of 8 October 2005 Calibrates Estimates of Losses in Future Himalayan Earthquakes* , Max Wyss, World Agency of Planetary Monitoring and Earthquake Risk Reduction, Switzerland

In an article published in March 2005, we estimated the number of fatalities to be expected in future large earthquakes in the Himalaya (Wyss, 2005). For the scenario called "Kashmir", we estimated that 67,000 to 137,000 fatalities should be expected. The M7.6 Kashmir earthquake of 8 October 2005 caused approximately 85,000 fatalities. Thus, one may argue that we forecast this disaster well. However, we assumed M8.1, a depth of 25 km and an epicenter located about 200 km to the SE from the October epicenter. Using the moment tensor solution for the October earthquake with a depth of 12 km for the energy release, we estimate the number of fatalities between 29,000 and 56,000. Thus, a factor of 2 must be applied to obtain the observed number, and the depth of the energy release in the scenario earthquakes should be placed at 12 km, which results in on over-all correction factor of 2.4. Therefore, we correct our estimates for numbers of fatalities in future Himalayan earthquake to range from 100,000 to 500,000, as specified for the locations given in Table 2.

3. *Rapid Post-Earthquake Information and Assessment Tools from the US Geological Survey's National Earthquake Information Center*, Paul Earle and David J. Wald, US Geological Survey, USA

A suite of post-earthquake information products and assessment tools are produced and distributed by the U.S. Geological Survey (USGS) National Earthquake Information Center (NEIC). These products range from the rapid determination of earthquake magnitude and location to tools that provide situational awareness following earthquake catastrophes. The NEIC distributes earthquake location, magnitude, and supporting information through many sources including, text message, pager, and the Internet (e-mail, web-pages and RSS feeds). To aid in the rapid determination of an earthquake's impact, the NEIC has developed tools to 1) map the observed shaking intensity reported from the region affected by the earthquake (Community Internet Intensity Maps), and 2) quantify the number of people exposed to severe shaking (Prompt Assessment of Global Earthquakes for Response).

4. *Modelling Disaster Impact for the Global Disaster Alert and Coordination System*, Tom De Groeve, Luca Vernaccini, and Alessandro Annunziato, European Commission Joint Research Centre, Institute for the Protection and Security of the Citizen

The Global Disaster Alert and Coordination System, jointly developed by the European Commission and the United Nations, combines existing web-based disaster information management systems with the aim to alert the international community in case of major sudden-onset disasters and to facilitate the coordination of international response during the relief phase of the disaster. The disaster alerts are based on automatic hazard information retrieval and real-time running of impact models. This paper describes impact models for earthquakes, tsunamis and tropical cyclones.

5. *A Region-Specific Prognostic Model of Post-Earthquake International Attention*, Daniel Eriksson, Coventry University

This project evaluates the feasibility of a prognostic model for international attention following earthquakes. The degree of international attention is defined as the number of situation reports issued by the United Nations. Ordinal regression is applied to a set of 58 case study events that occurred in Central Asia between 1992 and 2005. The context of the model is promising. Patterns were identified among the misclassified events. The patterns can prove helpful in understanding the irregular behavior of the international community and to improve future models by identifying subjects, such as bilateral relations and willingness to request external aid, for which additional indicators are needed. Eriksson, Coventry University

Track 3: Communities in Emergency Management – Wendy Schafer, Penn State University, USA

1. *Modeling Emergency Response Communities Using RBAC Principles*, Ignacio Aedo, Daniel Sanz, and Paloma Diaz, Universidad Carlos III de Madrid; Jorge de Castro, Dirección General de Protección Civil, Ministero del Interior, Spain

One of the main design challenges of any Emergency Management System (EMS) is the diversity of users and responsibilities that must be considered. Modelling the access capabilities of different communities of users is a relevant concern for which the RBAC (Role-Based Access Control) paradigm provides flexible and powerful constructs. In this paper we describe how we used an RBAC meta-model to specify at different levels of abstraction the access policy of a specific EMS called ARCE ("*Aplicación en Red para Casos de Emergencia*"). This approach has made it possible to face access modelling at earlier development stages, so that stakeholders got involved in analytical and empirical evaluations to test the correctness and effectiveness of the access policy. Moreover, since the RBAC meta-model is embedded into a web engineering method, we put into practice a holistic process which addresses different design perspectives (structure, navigation, presentation, interaction and access) in an integrated way.

2. *Public Health Crisis Management: Community Level Roles and Communication Options*, Elizabeth Avery Gomez, Katia Passerini, and Karen Hare, NJIT, USA

Crisis management efforts in the United States public health sector aim to prepare and protect the life of an individual, family or group against a health-related event. These efforts span governmental, nongovernmental and private sectors. The need for coordination between these organizations has never been more apparent. A solution will depend heavily on standardized communication protocols using information and communication technology (ICT). Numerous initiatives are currently addressing the needs of our nation with respect to homeland security and public health, yet remain in the early stages for the nongovernmental sector. The emphasis of our research is at the local level where the governmental sector extends to the nongovernmental sector (NGO), particularly community outreach. Our analysis of the local community suggests focusing on the management of communication during public health crises to better understand the complexities and variations presented in these communities. Leveraging experiences from media-technology literature findings and emergency-response efforts, we seek to identify a framework and tools to enable effective communication for those public health practitioners who serve as front-line responders to public health crises. The major contributions of this research will be to extend the use of information systems and mobile technology to the local United States public health communities to increase effective communication between organizations, while providing a state of readiness for homeland security related events.

3. *Integrated Criminal Justice System Design: Selecting an Appropriate Governance Structure*, Michael Tyworth and Steve Sawyer, The Pennsylvania State University, USA

In this paper we discuss interim findings from an ongoing comparative case study of the Automated Regional Justice Information System (ARJIS) in San Diego, CA. Significant attention had been given to the need to integrate information systems across organizational boundaries in the criminal justice domain. We employ a social informatics lens in this research that views the technological artifact as embedded in cultural and institutional context. In our examination of ARJIS we have found that the adoption of a Joint Powers Agreement (JPA) as a governance structure has impacted system design and organizational practices significantly. Specifically, the JPA facilitates participation by member agencies and, allows the ARJIS management team autonomy and flexibility in developing and managing the ARJIS information system.

4. *Virtual Emergency Preparedness Gaming: A Follow Up Study*, Art Hendela, Xiang Yao, Murray Turoff, Roxanne Hiltz, and Michael Chumer, NJIT, USA

Planning processes, including simulations and games, can help emergency workers to prepare for the unexpected. Rehearsal using software based gaming techniques not only helps planning, but is also cost effective. Computer-based groupware systems can make experts available regardless of location. A new approach, Virtual Simulation (VS), uses networking to create a flexible learning and planning environment. To date two prototype trials of this approach have been implemented at NJIT with major revamps between each one. This paper gives the results of the latest prototype trial, a simulation of attacks on university computer centers. The insights from this second prototype trial of virtual simulation will help us to improve the design and approach for future offerings.

<u>Dinner: 7:00pm to 10:00pm</u>, Don Peppe Restaurant, Newark

Wednesday May 17, 2006

Registration: 8:00am-1:30pm

Exhibits: 9:00am to 1:30pm

Coffee and Snack: 8:00am to 9:00am

Refreshment Break: 10:30am to 11:00am

LUNCH: 12:30am to 1:30pm

Refreshment Break: 3:30pm to 4:30pm:

Three track Paper Sessions: 11:00pm to 12:30pm and 1:30pm to 3:00pm

Closing Sessions 3:00pm to 3:30pm

Keynote Session: 9:00am to 10:30am

Resolving Resilience: Emergency Management, Risks, and Information Management in New Zealand, Peter Wood, Emergency Management Planner, Ministry of Civil Defence & Emergency Management, New Zealand

Civil Defence Emergency Management (CDEM) is New Zealand's response to the uncertainties of the next "big one". New Zealand's location on the boundary of two or the Earth's tectonic plates makes it vulnerable to earthquake, volcano, and tsunami. As an island nation in the "roaring forties" and surrounded by vast areas of southern ocean, New Zealand is also vulnerable to extreme weather and the related storms, floods, landslides and erosion. Additional are the risks of any developed country including life-line failure (energy, telecommunication, water, and transportation), hazardous materials, biosecurity, and commercial failures. Risks are treated through strategies that address sustainability and combine legislation requirements, such as the Resource Management Act and the Building Act; with regulations; codes; good practice guidelines; and risk management practices such as those of the Australian and New Zealand standard (AS/NZ4360:2004). Information is essential for risk assessment, mitigation, and monitoring; information that represents the natural, built, social, and economic environments to relevant spatial and temporal resolutions.

New Zealand's Civil Defence and Emergency Management Act (2002), promotes risk reduction, readiness, response, and recovery; known locally as the 4Rs; the equivalent of prevention, preparedness, response, and recovery (PPRR). The "4Rs" acknowledge that some hazard risks, as from earthquake, can't be totally prevented. The CDEM Act addresses all hazards and all risks but most are principally addressed through other legislation, as for: Health; Biosecurity; Fire Service; and Hazardous substances and new organisms. CDEM encourages local communities to understand and manage their own risks, supported by agencies of local government and central government. Increasing local resilience is the goal. Risk can be treated by appropriate land use, development, building, and engineering, insurance, business continuity plans, and emergency plans. However, there is always a residual risk.

CDEM developments in New Zealand are to serve local needs but occur in an International context. Increasingly, international best practices are sought; benefits include improved interactions with global emergency management actors, such as United Nations Disaster assessment and Coordination (UNDAC), but also more consistent support to developing Pacific Island neighbors.

Risk management is ongoing, more or less business-as-usual. At times of civil defence emergencies or crises, business-as-usual systems and information are augmented, for the emergency response and recovery, by collecting and analyzing highly variable information that describes the impacts of the emergency. Information is a key to successful emergency or crisis management, but emergency information is but a discrete part of time-continuous business-as-usual information. Information management is evolving in New Zealand, addressing interoperability,

dispersed geospatial data, internet-communities, and associated standards. CDEM is also evolving, including the attributes and systems for CDEM information.

Peter has 35 years experience in research, consulting, and policy development on natural hazard mitigation and emergency management. He has contributed to crustal deformation studies in New Zealand, the systematic mapping of active faulting, seismic hazard assessments for hydroelectric dams, digital data management, emergency management, and the development of national emergency plans.

Peter is an advocate for hazard risk mitigation. He has direct experience of or of the response to hazard events that include: Inangahua earthquake NZ 1968; Hutt Valley Floods NZ 1976; Imperial Valley earthquake California 1979; Edgecumbe earthquake NZ 1987; Spitak earthquake Armenia 1988; Loma Prieta earthquake California 1989; emergency response to flooding 2004 and 2005 NZ. He was co-coordinator of investigation and reporting on the effects of the 1987 Edgecumbe earthquake and compiled the NZ Society for Earthquake Engineering Reconnaissance Team Report on the 1989 Loma Prieta earthquake, from first hand experience. He promotes the integration and maximisation of expertise, data, and information - to improve hazard risk outcomes for projects and communities. Peter is a passionate advocate of collaborative approaches to hazard risk mitigation and emergency management.

Refreshment Break: 10:30am to 11:00 AM

Session 1: 11:00am to 12:30pm

Track 1: Military and Civil Information Systems for Emergency Preparedness – Tim Grant, Netherlands Defense Academy, The Netherlands

1. *Communication and Information System for Disaster Relief Operations*, Karin Mertens and Wim Mees, Royal Military Academy, Belgium

Disaster relief operations are very different from the traditional war operations. In disaster relief operations everything has to go very fast, the relief workers have to leave on very short notice and cooperation with other organizations is needed in order to save as many human lives as possible. The communication and information system of those operations has to be small, flexible, rapidly deployable and mobile. Above that, it has to ensure the information exchange between the coordination center in the home nation and the relief workers in the field in all kinds of situations with changing bandwidths and impermanent connections. In this document the structure and the data warehousing of such an information system are described.

2. *Command and Control (C2): Adapting the Distributed Military Model for Emergency Response and Emergency Management*, Michael Chumer and Murray Turoff, NJIT, USA

The military use of Command and Control (C2) has been refined over centuries of use and developed through years of combat situations. This C2 model is framed as process, function, and organization, suggesting that emergency response organizations and emergency management structure their non military C2 and subsequent response scenarios within the C2 framework established in this paper.

3. *Emergency Planning as a Continuous Game*, Murray Turoff, Michael J. Chumer, and Starr Roxanne Hiltz, NJIT, USA

Currently there are serious problems with organizational abilities to plan the response to emergencies. This paper presents a fundamental premise that the use of a game employing competing human teams operating on a continuous asynchronous basis over long periods of time is the way to develop high confidence emergency plans within a given organization.

Track 2: Design and Standards in Emergency Management Systems – Jane Fedorowicz, Bentley College, USA and Vassilka. Kirova, NJIT, USA

1. *The Role Transferability in Emergency Management Systems*, Haibin Zhu, Nipissing University, Canada; and MengChu Zhou, NJIT, USA

Role Transferability is a basic requirement for emergency management systems. Role specification, relationship expression, and transfer regulations are critical elements of this requirement. This paper discusses the role transferability requirement for emergency management systems; emphasizes that role specification is an underlying mechanism for role transfer; proposes a revised E-CARGO (Environment-Class, Agent, Role, Group, Object) model for role transfer in a group; and presents an algorithm to validate role transfer while maintaining group viability.

2. *The Common Alerting Protocol: An Open Standard for Alerting, Naming, and Notification*, Art Botterell, incident.com

This document describes the OASIS Common Alerting Protocol (CAP) standard, review its history and current status, and propose some directions for its future application and development. This XML content standard specifies a canonical data model for alerting, warning and notification messages. By abstracting the essential elements of effective warning messages from the underlying delivery technologies, CAP simplifies the integration of diverse warning delivery systems and provides a simple template for the creation of alerts and warnings. CAP is being used in a variety of warning systems and applications, but its full potential has yet to be exploited.

3. *Topology Based Infrastructure for Crisis Situations*, Paul Klapwijk and Leon Rothkrantz, Man-Machine Interaction Group Faculty of Electrical Engineering, Mathematics and Computer Science, The Netherlands

Recent terrorist attacks and natural disasters have forced humanity to respond to crisis situations effectively as possible. In these situations especially the first hours rescue workers cannot always rely on existing communication infrastructure. Knowledge about the situation is to be gathered to obtain an aggregate world model of the situation. Decisions can be taken based on this world model. The solution we propose consists of using a Mobile Ad-Hoc Network (MANET), in which the nodes are organized in a topology in order to facilitate the necessary functionalities. Communication between the nodes takes place via a distributed blackboard structure. This architecture supports services developed with the purpose of assisting rescue workers. The agents (humans/sensors) in the network provide data as input to the network. Our approach takes care of processing of this input data to provide users with appropriate information and to obtain a shared world model. As a proof of concept we implemented a prototype of our approach on a number of mobile devices and tested the idea in real life.

Track 3: Stakeholder Coordination for Crisis Management – Julie Dugdale

1. *Stakeholder Perceptions and Standards for Information Security Risks: a Case Study at a Dutch Health Care Organization*, Bartel Van de Walle, Ronald Spanjers, and Dirk de Wit, Tilburg University, The Netherlands

With the increased use of electronic patient files in Health Care Organizations (HCOs), addressing the risks related to the storage and use of patient information has become increasingly important to avoid intentional or unintentional disclosure, damage to or abuse of patients' personal health records. This has lead governments from various countries to introduce and impose information security standards for HCOs. The Dutch government introduced the NEN 7510 national information security standard; a standard derived from the international ISO 17799 norm. Preceding the implementation phase of NEN 7510 standard at a Dutch HCO, we conducted a field study to identify the information security risks as perceived by the main stakeholder groups in the HCO. We present the differences in the perceived information security risks and threats by end users, management and suppliers, and the degree to which these identified risks will be addressed by the implementation of the NEN 7510 standard.

2. *StakeS-holder Management and Crisis Resilience. A Case Study in a Public Transportation Company*, Aurélien Acquier, Sébastien Gand, and Mathias Szpirglas, Ecole Nationale Superieure des Mines de Paris, France

Stakeholder perspectives on crisis management provide a useful descriptive framework for analyzing crises and making crisis narratives. However, their "actionability" for crisis management, i.e. possibility to use stakeholder management models into operational crisis management processes, remains an under-investigated question. The purpose of this article is to discuss the operational value of stakeholder frameworks for crisis management. Drawing on a qualitative case study of a successful crisis management process in a public transportation company, we investigate the activities set up by the crisis cell to manage internal and external stakeholders during the crisis. In our case, successful stakeholder management relied on: 1) good diagnosis capabilities for the design of an appropriate corporate positioning; 2) an ability to manage coherently a set of emerging and heterogeneous issues involving stake**S**holders ; 3) the capacity to set up a tightly coupled form of organization, involving both crisis cell members and various *"anchorage points"*, i.e. specific actors involved in the project before the crisis, who were already in contact with key stakeholders as part of their day-to-day activities. We then discuss the practical and theoretical implications of this analysis and the potential value stakeholder perspectives for crisis management.

3. *Improving Resilience of Organization by Increasing Mutual Knowledge of Stakeholders*, Jean-Luc Wybo, Ecole de Mines de Paris, France

Managing accidents and crisis is a complex task, which is achieved by a large number of stakeholders. In order to identify appropriate responses to risk-prone situations, a classification in two categories has been proposed: risks of damage and risks of crisis (Wybo 2004). Risks of damage correspond to emergency management procedures and plans. Risks of crisis correspond to situations that escape from planning because of the overflow of the organization. Resilience of organizations is defined as their ability to resist to chaos and to maintain the situation under control. From the analysis of a large number of emergencies and crises caused by industrial and natural hazards, we try to identify what conditions increase the resilience of organizations. They have in common to increase the mutual knowledge of stakeholders about their strategies and roles and about the development of the situation.

Lunch: 12:30pm to 1:30pm

SESSION 2: 1:30pm to 3:00pm

Track 1: Emergency Response Reachback: Cases, Concepts, Processes, and Tools – Steven R. Haynes, Penn State University, USA

1. *When Experts or Models Disagree*, Simon French, Emma Carter, and Carmen Niculae, Manchester Business School, The University of Manchester, UK

In managing crises, decision makers are confronted with a plethora of uncertainties. Many arise because the world is uncertain, particularly in the context of a crisis. But some arise because analyses based upon different, but seemingly equivalent models lead to different forecasts. Other times expert advisors differ in their explanations and predictions of the evolving situation. We argue that when handled correctly such conflict can alert the decision makers to the inherent complexity and uncertainty of the situation and improve their management of the crisis.

2. *Reachback in Crisis Management: Lessons Learned from the Military Domain*, Jouke Rypkema and Guido te Brake, TNO, The Netherlands

Military and crisis management organizations show many similarities. Within the military domain, a study is being done on the use of reachback concepts for the Royal Netherlands Army (RNLA) brigade staff. This paper shows that the results are applicable to the crisis management domain. However, there are differences between the two domains as well. Therefore, the reachback concepts should be tailored to the crisis management domain. The Interactive Collaborative Information Systems (ICIS) game-based simulation platform offers a suitable environment to develop these concepts and test them.

3. *A Real-Time Role-Playing Exercise as a Methodology to Support Command and Control Research*, Jiri Trnka, Linköping University, Sweden; and Johan Jenvald, VSL Research Labs, Sweden

In this paper, methodological issues in research and training of complex command and control structures in emergency management are addressed. In particular, a methodological approach combining real-time role-playing exercise, after action review and observations is presented. An explorative study – ALFA-05 – utilizing this approach is described. A brief overview of methodological aspects of preparation and execution is given. Further, experience gained and methodological lessons learned are also discussed. Finally, real-time role-playing exercise in combination with other methods is suggested as a feasible method for researchers and exercise managers to tackle present and future command and control in complex settings, where interaction and communication are in focus. In addition, areas for further development of the real-time role-playing exercises as a research method are suggested.

Track 2: Personal Area Networks (PAN) for Emergency Response – Susan McGrath, Dartmouth College, USA

1. *Electronic Disease Reporting & Management*, Thomas J. Terry, NJIT, USA

The New Jersey Institute of Technology (NJIT) developed an Electronic Disease Reporting & Management System (EDRMS) that has the capability for the rapid collection, analysis, and dissemination of suspected outbreaks including Chemical and Bio-Terrorism events. Prior to EDRMS, agencies relied on disjointed phone and fax reporting and rudimentary methods for data collection, dissemination, follow-up, and remuneration. The objective of this system is to allow collaborative recognition across all the hospitals and public health offices in the state of New Jersey to detect as soon as possible an epidemic occurring of a known or unknown type.

2. *Applications for Emergency Medical Services*, Mark Gaynor, Reuven Messer, Boston University School of Management; Dan Myung, 10 Blade, Inc.; and Steve Moulton, BU School of Medicine, USA

Today, despite the obvious need, pre-hospital providers cannot send real-time electronic patient care information from the field to a receiving hospital. This lack of field awareness and inability to plan for the arrival--or anticipate the needs--of seriously ill or injured patients can lead to the misdirection of patients and the loss of valuable time in the early phases of resuscitation. We believe, however, that current technology can address these shortcomings and that is the focus of our research efforts. This paper discusses how several countries, including Israel, Sweden, Britain and the United States, are addressing the need to better triage patients from the field to an appropriate hospital or trauma center. It also introduces a potential solution, called iRevive, which uses emerging technology such as sensors, wireless WAN data transport, web services, artificial intelligence, and mobile devices to meet the dynamic needs of first responders and the hospitals they serve.

3. *ARTEMIS Personal Area Networks for Emergency Remote Triage and Information Management*, Rebecca Carella and Susan McGrath, Dartmouth College, USA

The Automated Remote Triage and Emergency Management Information System (ARTEMIS) project seeks to provide situational awareness to all level of commands in order to increase patient survival rate during emergencies. By moving the burden of triage off of the medic and into an automated system, more time will be able to be spent on casualty care rather than assessment. Continual monitoring of responders and casualties will alert medics of critical changes in a patient's health that might normally have gone undetected after a patient is initially triaged. ARTEMIS employs a network of embedded sensors worn by responders and casualties to gather the data required for greater situational awareness and to relay the data back to appropriate levels of command both on the field and in remote locations.

Track 3: Exploring Knowledge Management in Crisis Response – Murray E. Jennex, San Diego State University, USA

1. *A Case-Based Knowledge Management System for Disaster Management: Fundamental Concepts*, Samuel Otim, Clemson University, USA

Computer-based knowledge management systems are vital for disaster detection, response planning, and management. These systems aid in early warning, and provide decision support for disaster response and recovery management. Managing past knowledge for reuse can expedite the process of disaster response and recovery management. While early warning systems predict some disasters with remarkable accuracy, there is a paucity of knowledge management systems for disaster response and management. This paper outlines a case-based reasoning (CBR) knowledge management system that in effect, is a model of human reasoning since it is based upon the idea that people frequently rely on previous problem-solving experiences when solving new problems. A CBR knowledge management system results in efficient and effective disaster response and management

2. *A Framework to Evaluate How Management Games Improve Knowledge Management Effectiveness*, Martin Smits and Bartell Van de Walle, Tilburg University, The Netherlands

Knowledge-intensive organizations realize that 'knowledge' is a strategic resource that gives them sustainable competitive advantage and helps them achieve long-term organizational goals. These organizations use knowledge management (KM) to encourage the creation and sharing of knowledge resulting in improvements in productivity, innovation, competitiveness, and relationships among people. This paper investigates what role management games play in knowledge-intensive organizations and how they can be used to improve KM effectiveness. We present a theoretical framework that allows answering the following question: *'How can management games be used to improve the effectiveness of KM in knowledge-intensive organizations?'*

3. *Knowledge Management Systems Developed For Hurricane Katrina Response*, Tim Murphy, Murray E. Jennex, San Diego State University, California, USA

This paper explores the use of knowledge management with emergency information systems. Two knowledge management systems that were utilized during Hurricane Katrina response are described and analyzed. The systems specified were developed by both federal agencies as well as grass root efforts without the support or mandate of government programs. These programs, although developed independently, were able to share data and interact in life saving capacities, transcending traditional geo-political boundaries. We conclude that emergency information systems are enhanced by incorporating knowledge management tools and concepts.

Closing Session 3:00pm to 3:30pm in Ballroom

Presentation of Awards, other ISCRAM events and plans for next year

Refreshment Break: 3:30pm-4:30pm

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