

UNIVERSITY OF
DELAWARE

DRC

Disaster Research Center



2010 ANNUAL REPORT

DISASTER RESEARCH CENTER

RESEARCH OFFICE

UNIVERSITY OF DELAWARE

2010 ANNUAL REPORT

Sue McNeil, Director
Tricia Wachtendorf, Associate Director

Benigno Aguirre, Core Faculty
Rachel Davidson, Core Faculty
Earl (Rusty) Lee, Core Faculty
Joanne M. Nigg, Core Faculty
Havidán Rodríguez, Core Faculty
Joseph Trainor, Core Faculty

Russell R. Dynes, Founding Director, Professor Emeritus
E. L. Quarantelli, Founding Director, Professor Emeritus

Deb Alvarez, Affiliated Faculty
Rick Sylves, Affiliated Faculty

Telephone: (302) 831-6618
FAX: (302) 831-2091
Email: drc-mail@udel.edu
DRC website: www.udel.edu/DRC

DRC Staff

Vicky Becker, Assistant to the Director

Gail Kracyla, Staff Assistant

Pat Young, Resource Collection Coordinator

Rick Jarnagin, Resource Collection Undergraduate Assistant

Leslie Quispe, Resource Collection Undergraduate Assistant

Ivan Learmont, Information Technician

Pruttipong Apivatanagul, Post Doctoral Researcher

Graduate Research Assistants

Lauren Barsky

Eric Best

Laura Black

Susan Brink

Rochelle Brittingham

Melody Cotterill

Amy Crabill

Silvana Croope

Kimberly Gill

Alex Greer

Ziqiang Han

Ben Johnson

Sizheng Li

Laura Monico

Danielle Nagele

Sekine Rahimian

Yvonne Rademacher

Dana Rathfon

Shawn Reynolds

Jenniffer Santos-Hernández

Brittany Scott

Richard Stansfield

Manuel Torres

Lucia Velotti

Ben Walker

Gabriela Wasileski

Eva Wilson

Undergraduate Research Assistants

Alicia Badoff

Austin Barlow

Sarah Dalton

Sophia Elliott

Andrea Fendt

Zephi Francis

Josh Kelly

Paige Mikstas

Precious Morris

Samantha Penta

Shawn Reynolds

Yesenia Rodríguez

Shazida Sarwar

Spencer Schargorodski

Kathleen Shea

Sarah Welde

Brad Wright

DRC Annual Report Editorial Staff

Pat Young

Sue McNeil

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Disaster Research Center (DRC)

Established at Ohio State University in 1963 by Professors E. L. Quarantelli, Russell Dynes, and Eugene Haas, and moved to its current location at the University of Delaware (UD) in 1985, DRC was the first research center in the world devoted to the social scientific study of disasters. Historically, the Center has conducted field interviews and extended research projects on group, organizational, and community preparation for, response to, and recovery from natural and technological disasters and other community-wide crises for both academic and practical development of the field of disaster research and mitigation.

Recognizing the broader research interests in disasters across the campus and the interdisciplinary nature of the research, the Center moved from the Department of Sociology and Criminal Justice to the College of Arts and Sciences in the summer of 2006 and in June 2007 the Center moved again to come under the oversight of the UD Research Office. While much of the research at DRC has been interdisciplinary, UD researchers from disciplines other than Sociology are now actively engaged with the Center. Research at the Center continues to build on the foundation in the social sciences while broadening activities to more explicitly embrace interdisciplinary, multidisciplinary and cross-disciplinary research.

Graduate and undergraduate training has been an integral component of DRC's mission. Faculty members from the University of Delaware's Department of Sociology and Criminal Justice and the Department of Civil and Environmental Engineering oversee DRC projects. Classes are taught in the Department of Sociology and Criminal Justice's graduate concentration in Collective Behavior, Social Movements, and Disasters as well as the undergraduate concentration in Emergency and Environmental Management. Classes on Risk Analysis, Civil Infrastructure Systems, and Modeling Systems are also taught in the graduate program in Civil and Environmental Engineering in the concentration on Infrastructure Systems. In Fall 2010, the University of Delaware launched a new interdisciplinary graduate program in Disaster Science and Management that is administered through the School of Urban Affairs and Public Policy (renamed the School of Public Policy and Administration). DRC core and affiliated faculty are actively involved in the program as advisors and instructors, as well as the administration of the program. The program offers Master of Science and Doctor of Philosophy degrees. Graduate researchers from DRC have gone on to careers at leading universities, prominent research centers, key disaster-oriented government agencies, and private sector organizations that deal with disaster and risk issues.

Researchers at DRC have conducted over 695 field studies since the Center's inception, traveling to communities throughout the United States and to a number of foreign countries. DRC researchers have carried out systematic studies on a broad range of disaster types, including but not limited to hurricanes, floods, earthquakes, tornadoes, hazardous chemical incidents, plane crashes, and civil disturbances. Past DRC studies have focused on such topics as emergency medical and mental health service delivery in disasters, community responses to acute chemical hazards, mass evacuation and sheltering, preparations for and responses to major community disasters by lifeline organizations, and community earthquake mitigation and emergency preparedness in the U.S. to name just a few. This current report provides detailed information regarding DRC's current studies and projects.

Since its founding over four decades ago, DRC's activities have been supported by diverse sources, including the National Institute of Mental Health, the Federal Emergency Management Agency (FEMA) and its preceding agencies, the NOAA Sea Grant Program, and the U.S. Geological Survey. Major research funding is currently provided by grants from the National Science Foundation (NSF), FEMA, the Department of Homeland Security (DHS), the National Institute of Standards and Technology (NIST), and the United States Department of Transportation through the UD University Transportation Center.

In addition to maintaining its own databases, DRC serves as a repository for materials collected by other agencies and researchers. DRC's specialized library, the E. L. Quarantelli Resource Collection, contains the world's most complete collection on the social and behavioral aspects of disasters — now numbering more than 57,000 items. It is open to both interested scholars and agencies involved in emergency management.

The Center has its own book, monograph, and report series with nearly 1,400 publications including preliminary papers and published articles. The DRC maintains ongoing contact with scholars from throughout the United States, Asia, Europe, and Mexico, some of whom have been visiting research associates at the Center for periods of up to a year. Many of these contacts have led to ongoing research collaboration.

For more information, consult DRC's home page at www.udel.edu/DRC



Relief supplies are being unloaded at Hospital Buen Samaritano (Good Samaritan) in Jimani, Dominican Republic, in preparation for transport to Haiti to aid the earthquake impacted areas.

(photo by DRC staff)

Director's Message

The Disaster Research Center (DRC) at the University of Delaware is pleased to present our 2010 Annual Report. This report documents our ongoing activities and achievements, both individually and collectively. Several important milestones were achieved in 2010 as well as some significant transitions and changes.

This 2010 Annual Report documents the accomplishments of our faculty, staff, graduate students and undergraduate students this past year. Highlights include continued active engagement of our students in our research. The publications, projects and activities listed reflect this involvement.

Specifically:

- 28 graduate and 19 undergraduate students worked at DRC throughout 2010 as research assistants. The graduate students are enrolled in degree programs in four different colleges. These students contribute to both the research and outreach activities supported by the Center. Financial support for these students has been possible through a number of externally funded research projects.
- The Research Experience for Undergraduates (REU) Program funded by the National Science Foundation completed its final year. Once again the 10 undergraduate social science researchers were joined by two civil engineers, both juniors, one visiting scholar from Graduate School of Human Sciences, Osaka University (Japan) and one visiting faculty member from Universidad de Antioqui in Columbia. Professor Walter Díaz from University of Puerto Rico, Mayaguez again assisted with the program. The diversity of disciplines and cultures again added to the richness of the experience. The individual projects are documented in this report. It was a pleasure to work with these 14 talented, motivated and energetic young researchers.

DRC Core Faculty member, Professor Tricia Wachtendorf was promoted to Associate Professor with tenure. Congratulations Tricia! While Tricia may have taken a moment to celebrate, she also has clearly demonstrated that she has much more disaster related research she wants to do!

Tricia spent much of the summer of 2010 in Sweden working with scholars at CRISMART, located at the National Defence College in Stockholm, and participating in the International Research Committee on Disasters meeting in Gothenburg. She began a one-year sabbatical in Fall 2010, during which time she is working on two book manuscripts, returned to Sweden to work with collaborators at Mid Sweden University, and continues ongoing research including that on humanitarian assistance following the 2010 Haiti earthquake.

In Fall 2010 the long awaited interdisciplinary graduate program in Disaster Science and Management (DISA) welcomed our first cohort of MS and PhD students. A profile of the entering class is included in this annual report. Everyone teaching, advising and supervising the research of these students has appreciated the diverse backgrounds and interests of this entering class while also observing that they have become cohesive as a class. I have been teaching the graduate seminar course and have enjoyed my interactions with the DISA (pronounced \dis\ as **dis** in **dis**aster, and \a\ as **a** in **a**bout) students.

In December we said farewell to former DRC Director, Havidán Rodríguez, who accepted the position of provost and vice president of academic affairs at the University of Texas-Pan American (UTPA) in Edinburg, Texas. Since 2007 Havidán served as Vice Provost at the University of Delaware but remained actively engaged with the Center. While we will miss Havidán's presence on campus, we wish him well in his new position.

On December 31, 2010, I stepped down as director of DRC. I feel extremely honored to have served in this role and appreciated the opportunity to work with a group of outstanding researchers and wonderful people. I will continue as a DRC core faculty member and an active participant in the new graduate program.

On January 1, 2011 we will welcome Professor James Kendra as the new DRC director. Jim's faculty appointment is in the School of Public Policy and Administration (the new name for the School of Urban Affairs and Public Policy effective January 1, 2011).

Also in 2010, DRC hosted the presentation of the Charles E. Fritz Award by the International Research Committee on Disasters to Bill Anderson. The Charles E. Fritz Award, named after one of the earliest pioneers in social science disaster studies, is given for significant and numerous contributions to the disaster area such as the conducting of research, publications, policy development, as well as providing input into the professional development of the field. It recognizes major and notable career achievements over a lifetime. Dr. Anderson is a graduate of DRC from Ohio State.

We were also fortunate to have three visiting scholars spending a year at DRC. Takumi Miyamoto is a PhD candidate in the Graduate School of Human Sciences at Osaka University. He is also a Research Fellow at the Japan Society for the Promotion of Science. Takumi also participated in the REU program. Tao Peng is a PhD candidate in the School of Government at Nanjing University. Zhengyi (Stone) Shi is a PhD candidate at Minzu University in Beijing. Both Tao and Stone arrived in September.

Finally, Professor Russ Dynes was honored by the Research Committee on Sociology of Disasters at the XVII International Sociological Association World Congress on Disasters in Gothenburg, Sweden in July.

I personally am looking forward to 2011 under the leadership of Jim Kendra and the opportunity to contribute to DRC and continue to steer our graduate program. I am sure Jim would join with me in saying please come and visit, use the Resource Collection, or attend one of our seminars. We look forward to a productive 2011 and welcome your comments and suggestions.

Sue McNeil, Ph.D., P.E.
smcneil@udel.edu
Director, 2010

Feature Article:

Changes at the DRC Helm

by Pat Young

In June, 2007, Professor Sue McNeil assumed the role of Director at DRC. This was a bit of a stretch for Sue, not because she was unfamiliar with leadership roles (in fact, quite the opposite was true), nor because she lacked the enthusiasm for the task or the interest in DRC (also far from the truth). Rather, it was because she was not what one might term a “seasoned disaster researcher.” This turned out to be quite serendipitous for both Sue and DRC. None of us could have predicted the tremendous impact that she had during her brief tenure in the Director’s chair.

Although Sue’s accomplishments as DRC Director are numerous, two achievements truly mark her time at the helm. First, she was instrumental in redirecting the course of DRC toward a more interdisciplinary and integrated research center. Her ability to preserve the core history of DRC as well established in the social sciences and, specifically, in sociology combined with her vision to broaden the scope of DRC’s perspective to incorporate such diverse fields as engineering, political science, and public health enhanced DRC’s ability to approach disaster research from a more holistic and thorough framework.

Second, Sue was instrumental in the establishment of the University’s interdisciplinary Disaster Science and Management Program which is administered by the School of Public Policy and Administration. DRC’s presence at the University of Delaware made this program a natural fit, however as anyone with knowledge of the process involved in creating new academic programs well knows, a natural fit does not mean an easy process. Sue worked through all of the logistics and shared her enthusiasm for this concept with the end result that the first cohort of students was enrolled in the fall of 2010. We look forward to many successful years ahead as she continues her oversight of this new academic program in cooperation with the School of Public Policy and Administration.

Sue met with great success in steering DRC along its continued path to prominence within the disaster research field. We are fortunate that although she stepped down from the role of Director, she will continue her affiliation with DRC as a core faculty member and, as mentioned previously, as overseer of the DISA Program.

Also fortunate is the fact that DRC will not remain without a Director at the helm. We truly look forward to welcoming Dr. James Kendra into the role of Director effective January 1, 2011. Jim is no stranger to DRC. In fact, he spent three years here, first as a post doctoral research fellow in 2000 and then as DRC’s Research Coordinator from 2001 to 2003. During that time, he worked collaboratively with several DRC staff members and continued to do so after leaving DRC. He is also well suited to assume the helm given his background as coordinator of the Emergency Administration and Planning Program in the Department of Public Administration at the University of North Texas and his experience as a former Merchant Mariner.

Jim’s research interests include individual and organizational responses to risk, improvisation and creativity during crisis, post-disaster shelter and housing, and planning for behavioral health services. Projects that he has participated in have included research on the reestablishment of New York City’s emergency

operations center after the 9/11 attacks, a major study of the waterborne evacuation of Manhattan on 9/11, research on the social impacts of the Indian Ocean tsunami, and research on the organization of disaster behavioral health services. We feel that he is well suited to the Director's role and we eagerly anticipate his new vision as he shepherds DRC into its next era toward its 50th year and beyond.



Outgoing Director Prof. Sue McNeil
(photo by Evan Krape)



Incoming Director Prof. James Kendra
(photo by Dr. April N. Kendra)

Research

DRC has a well-established research tradition built on its foundations in the social sciences, a proven capacity for quick response field research, and a culture of collaboration between faculty, staff, graduate students, and undergraduate students. A number of issues, events, and elements have created not only an increased demand for DRC's traditional expertise, but have also provided motivation to go beyond multidisciplinary work to develop a sustainable interdisciplinary program. These include the increase in focus on issues related to disasters, the multidisciplinary funding climate, emerging collaborations between DRC and external agencies, the many unfunded mandates related to disaster planning that have been imposed on governmental agencies, and DRC's University-level administrative location under the Research Office. All have converged to further support and encourage DRC's efforts to establish a strong interdisciplinary research environment. In developing such an environment, DRC draws on the core research areas current DRC faculty engage in, all of which are prime for interdisciplinary collaboration, including:

- The identification of the social, physical and environmental factors/conditions that influence vulnerability and resiliency of social and physical systems
- Individual and collective threat perception and behavior
- Organizational and inter-organizational dynamics
- Development and disasters
- Social and political dynamics that enhance the development of public policy for disaster reduction
- Analysis and management of infrastructure systems

In developing and conducting research projects, DRC aims to act as a catalyst for and serve as the intellectual home for interdisciplinary disaster related research. Our integrated project teams leverage the interests and capacities of other disciplines on campus that balance quantitative and qualitative approaches to research, that demonstrate systems-level thinking, that employ the broadest possible set of methodologies and analytic techniques, and that nurture a culture which values the integration of disciplinary insights and thinking.

Project Descriptions

This section provides short descriptions of active projects involving faculty from the Disaster Research Center at the University of Delaware. Although by no means an exhaustive list of capabilities, these projects demonstrate the Center's expertise and our current agenda.

Active Projects

Collaborative Research Proposal on Improvisation and Sensemaking in Sudden Crisis

Principal Investigators: Tricia Wachtendorf, Disaster Research Center, and James M. Kendra, University of North Texas

Senior Personnel: Jasmin Ruback, Ruback & Associates

Graduate Research Assistant: Brandi Lea, University of North Texas

Undergraduate Research Assistants: Alicia Badoff, Josh Kelly, Samantha Penta

Funding Agencies: National Science Foundation, University of Delaware Research Foundation

The waterborne evacuation project focuses on the unplanned waterborne evacuation of more than 500,000 commuters from Lower Manhattan by an ad hoc flotilla of ferries, tugs, workboats, dinner cruise boats and other assorted harbor craft after the 9/11 attacks on the World Trade Center, and the subsequent improvised boat-lift of supplies and equipment into the city. The goal of this project is to examine organizational improvisation and distributed sensemaking under conditions of rapid change and urgent needs for decision making and action. The focus of this research is on geographically dispersed organizations that are able to coordinate actions and responses by “making sense” of their surroundings and environment during a crisis. The study works to ascertain:

- The cues upon which participants relied in assessing shifting environmental information;

- The existing and developing networks which were significant in coordinating action;
- The processes of gathering, assessing, and disseminating information to support distributed learning; and
- The significance of prior experience and the process by which it was employed in changing circumstances, including the emergence of new norms.

Principal analytical methods include an inductive qualitative approach, a social network analysis of pre- and post-attack relationships among participants and GIS mapping of vessel activity. The study will provide an explanatory framework for how organizations understand rapid change, communicate with others in turbulent and complex environments and develop new strategies and procedures for emergent needs under crisis conditions.

DRU: Contending with Materiel Convergence: Optimal Control, Coordination, and Delivery of Critical Supplies to the Site of Extreme Events

Principal Investigators: Jose Holguin-Veras, Rensselaer Polytechnic Institute, Tricia Wachtendorf, Disaster Research Center, Havidán Rodríguez, Disaster Research Center, Satish V. Ukkusuri, Purdue University, and Didier M. Valdes, University of Puerto Rico-Mayagüez

Undergraduate Research Assistants: Austin Barlow, Zephi Frances, Josh Kelly

Funding Agency: National Science Foundation

The overall goal of this project is to develop methodologies and tools to foster an accelerated convergence between the dynamic needs and supplies of critical resources (e.g., blood, water) to the site of an extreme event. Achieving the overall goal of this project requires a modeling framework that integrates concepts from the social sciences, control theory, and robust and stochastic optimization of supply chains to bridge the gap between dynamic demand and supply of critical resources (i.e., resources available on site, private dona-

tions, resources provided by emergency agencies) after an extreme event, as a system, and in consistency with social science principles. These mathematical procedures would help proactively advise the general public about donation priorities, thus reducing the probability of a repeat of previous extreme events in which a massive influx of non-priority donations hampered the flow of critical resources.

The project seeks to develop novel analytical formulations to:

- Forecast what is needed, providing robust estimates of the dynamic resource requirements following an extreme event (e.g., demand for water or food);
- Estimate what is available, i.e., critical resources available on site and in adjacent areas;
- Estimate the dynamic pattern of unmet needs, i.e., what needs to be transported to the site;
- Establish an optimal strategy of priority allocation among the donations from the general public and emergency agencies;
- Design the most effective ways to deliver, store and distribute critical supplies to the impacted area;
- Identify institutional impediments to coordinating

an effective response to extreme events, and formulate mechanisms to overcome these obstacles; and,

- Identify ways in which tighter integration of the information technology systems can be achieved among the pertinent stakeholders.

The work will lead to scientific contributions in the social sciences, control theory, robust and stochastic optimization, dynamic modeling of supply chains, and to improved national emergency response capabilities. As a part of the effort to promote learning education at all levels, the research team will engage both undergraduates and middle school students in research activities with specific emphasis on members of underrepresented groups.

DRU: Integrated Optimization of Evacuation and Sheltering for Hurricanes

Principal Investigator: Rachel Davidson, Disaster Research Center

Co-PIs: Tricia Wachtendorf, Disaster Research Center, and Linda Nozick, Cornell University

Post-doctoral Research Associate: Pruttipong Apivatanagul

Graduate Research Assistants: Rochelle Brittingham, Richard Stansfield

Undergraduate Research Assistants: Geoffrey Dilg, Samantha Penta

Funding Agency: National Science Foundation-HSD

This project seeks to improve understanding of and decision support for evacuation and mass case sheltering in hurricanes. In the past, math modeling in this application has been limited to estimating the time required to clear a region, assuming many characteristics of the problem are uncontrollable input (e.g., where shelters are located). Instead, we will expand the decision frame and use optimization models to support the full range of strategic and operational evacuation and sheltering decisions, with higher-level objectives such as minimizing life loss, cost, and inequity. These models will be developed through a close interaction between sociologists and engineers to ensure that they are firmly grounded in the reality of people's behavior. For the first time, the models will be based on individual hurricane scenarios instead of conservative aggregations of many

events, and they will be dynamic, accounting for the fact that officials can update their decisions as an event unfolds and information about the situation changes. The project has 5 main steps: (1) determine a suite of hurricane scenarios for use in evacuation and shelter models such that they probabilistically represent the full range of possible events, but are limited in number enough to allow detailed analysis of each; (2) conduct focus groups of key decision makers and stakeholders to identify and characterize key decision making elements; (3) using the focus group input, develop long-term strategic mathematical optimization models for evacuation and sheltering decisions; (4) conduct surveys of affected citizens to test the validity of the optimization model assumptions and results; and (5) demonstrate the models with case study applications in North Carolina.

Infrastructure Security and Emergency Preparedness

Principal Investigators: Sue McNeil, Tricia Wachtendorf, Earl Lee, Rachel Davidson, and Joseph Trainor

Graduate Research Assistants: Sekine Rahimian, Gabriela Wasileski

Funding Agencies: Delaware Department of Transportation and University Transportation Center

The first part of this project (funded by Delaware Department of Transportation) considers the protection of our national infrastructure systems. Of special relevance to this project is the joint responsibility of the Department of Transportation and the Department of Homeland Security to collaborate on all matters pertaining to transportation security and transportation infrastructural protection. Given the many pressing needs for transportation resources in Delaware, assessing the vulnerability and risk of Delaware's critical transportation infrastructure, identifying possible countermeasures, and estimating the capital and operating costs of these improvements is challenging.

The objectives of this research are:

- To provide background and context for addressing risks and vulnerabilities as outlined above, and
- To explore the applicability of one tool, CAPTA, for costing asset protection.

The tool requires knowledge of the hazards faced, the events of concern, the assets of high consequence, appropriate counter measures and preparations. Armed with this information, CAPTA iteratively assists the agency to understand when and where to commit resources.

The research involves a literature review, review of CAPTA and development of a case study.

A second part of this project (funded by the University of Delaware University Transportation Center) recognizes that transportation infrastructure security and emergency preparedness present an enormous challenge for both the State of Delaware and for the major transportation corridors that run through the state. The objective of this part of the project is to review the current practice for Delaware, review external research and apply insights from state-of-the-art social science and engineering, and develop a plan for integrating research insights into practice.

Interaction between Building and Occupant Responses during Collapse (IBORC)

Principal Investigators: Benigno E. Aguirre, Disaster Research Center, and Sherif El-Tawil, University of Michigan

Graduate Research Assistants: Kimberly Gill, Eric Best

Undergraduate Research Assistant: Shawn Reynolds

Funding Agency: National Science Foundation

The aim of this project is to interview survivors of building collapses in order to find out how they evacuated the building and how they received warnings. We anticipate that perception of danger, decision to flee, choice of evacuation route, and the urge to assist victims will strongly depend on signals (such as sounds, sights and smells) that are produced by the building during and after a collapse. Other goals of this project are to investigate the impact of the building's structure on building collapse response and occupant survival rates through computer simulation modeling.

2010 Project accomplishments:

- *Obtained copy of the Oklahoma State Department of Health, Injury Prevention Service Bombing Injury Database for secondary data analysis*

Following the April 19, 1995 bombing of the Alfred P.

Murrah Federal Building in Oklahoma City, the Commissioner of Health of the State of Oklahoma declared injuries and other health conditions related to the bombing to be reportable conditions for special study. As a result, the Injury Prevention Service (IPS) of the Oklahoma State Department of Health (OSDH) conducted an assessment of physical injuries incurred as a direct result of the bombing.

Following this investigation, an OSDH registry was compiled and developed into a database that included information for 1,259 injured and uninjured persons who were directly exposed to the bombing. Persons involved in search and rescue efforts were excluded. The IPS collected bombing injury data from medical records, surveys, and medical examiner reports. Additionally, in October 1996, the IPS began a follow-up

study of Oklahoma City bombing survivors to collect further information about the causes of bombing injuries, long-term health problems, and medical costs associated with the bombing.

We obtained permission to receive a copy of this database, with identifying information removed. The data is provided through a Memorandum of Agreement established between approved qualified research investigators and the OSDH. The data may be used only for research, characterizing health conditions, and developing prevention strategies. All of the forms that were used for data collection can be found on the OSDH website at:

http://www.ok.gov/health/Disease_Prevention_Preparedness/Injury_Prevention_Service/Injury_Surveillance_Toolbox/index.html

We are now using this data set to study people who were trapped by the explosion, and intend to use the dataset to expand the ongoing effort to build a computer based Agent Based Model of building evacuation that would apply to multi-floor buildings like the Murrah Building.

- *Obtained copy of interviews conducted by The Oklahoma Historical Society Oral History Program for secondary data analysis*

The OHS conducted interviews with survivors, first responders and experts following the 1995 terrorist bombing of the Alfred P. Murrah building. We worked with the Historical Society to determine which of their

interviews would be relevant to the goals of our project and we obtained copies of 12 CDs and 5 DVDs that contain interviews with survivors, FEMA task force teams and other first responders, terrorism and bomb experts, and documentation of damage to the buildings. A sample of the interviews that are available through the Oklahoma Historical Society's Oral History Program can be found on their website at:

<http://www.okhistory.org/research/collections/oh/bombing.html>

- *Disaster Research Center interviews with Oklahoma City Bombing survivors*

We continued use of IRB approved in-person/telephone interview guide and web-based questionnaire for use in conducting interviews with survivors of the 1995 Oklahoma City bombing or with survivors of other building collapses. Web-based questionnaire is available at: https://delaware.qualtrics.com/SE/?SID=SV_0ICxLeiLCIAFrEw&SVID=Prod

Nine telephone interviews have been conducted with survivors and six web-based surveys have been completed.

Our recruitment notice was circulated to survivors by the Executive Director of the Oklahoma City National Memorial and Museum through their newsletter. Recruitment efforts also included a direct mailing to approximately 300 survivors of the bombing for whom addresses could be determined.

International Research Network

Principle Investigators: Joseph Trainor, Disaster Research Center, and Erna Danielsson, Mid Sweden University, Anna Olofsson, Mid Sweden University, Kurt Petersen, Lund University, Ann Enander, Karlstad University, and Tricia Wachtendorf, Disaster Research Center

Graduate Research Assistants: Rochelle Brittingham, Susan Brink

Funding Agency: Swedish Central Bank Tricentenary Fund

The goal of this project is the development of a national and international "knowledge network" with the requisite skills necessary to support the growing interest in risk, crisis, and disaster research. New technologies and new approaches to research have made it possible to create 21st century solutions to coordinating and integrating researchers. These activities will create synergy among participants, will aid in the production of innovative activities, and will have great potential to produce ideas, solutions, and approaches that would not come into being without this grant's assistance.

The level of sustained research interaction this funding can provide will help us to overcome the barriers that distance and disciplinary training have created. By continuing to work together, our interactions will facilitate the creation of permanent relationships that can serve as the basis for future projects which will expand our proposed work in directions that other groups will simply not be equipped to handle. In particular we are focused on empowering graduate students and providing them with collaboration opportunities.

Investment Planning for Regional Natural Disaster Mitigation

Principal Investigator: Rachel Davidson

Co-PI: Linda Nozick, Cornell University

Graduate Research Assistants: Meredith Legg, Cornell University, Pantea Vaziri, Cornell University

Funding Agency: National Science Foundation

In this project, we are developing a set of mathematical models to help guide an optimal expenditure of regional natural disaster mitigation funds, and to provide insight into the many factors that interact to determine the best mix of mitigation strategies. Focusing on earthquakes and hurricanes, the regional natural disaster mitigation analysis models will help an at-risk region with a limited budget decide how much to spend on pre-event mitigation that aims to reduce future losses versus post-event recovery, and which of the many possible pre-event mitigation activities to fund so as to meet the region's objectives. The proposed set of models will advance knowl-

edge about natural disaster risk management and the simultaneous planning for multiple hazards. While it is widely thought that pre-disaster mitigation is desirable, and much has been done to develop structural and other techniques for disaster mitigation, the circumstances in which it is desirable to implement different mitigation measures are not well understood. This project will merge optimization and loss estimation modeling to provide new insights into resource allocation decisions for mitigation. The findings may be generalizable to other hazards and to risk managers in other contexts.

Modeling Natural Disaster Risk Management: A Stakeholder Perspective

Principal Investigator: Rachel Davidson

Co-PIs: Linda Nozick, Cornell University, Jamie Kruse, East Carolina University, Thomas D. O'Rourke, Jr., Cornell University

Graduate Research Assistants: Jiazhen Peng

Funding Agency: National Institute of Standards and Technology

Natural disasters are a significant and growing national challenge. This project involves developing risk and game theoretic optimization models to support design of a regional natural disaster risk management system that is effective, efficient, sustainable, equitable, and that is appealing to each of the key stakeholders so that it will be implementable. The modeling will be novel in: (1) using sophisticated large-scale game theory optimization to model regional natural disaster risk management; (2) incorporating realistic representations of regional risk and mitigation options; (3) explicitly considering the differing objectives, constraints, and

alternatives of each of the key stakeholders (e.g., building owners, insurers, government); (4) recognizing the biases people and organizations have in making disaster risk decisions; (5) allowing decisions and investments to be made over time; and (6) representing the large uncertainty in disaster losses. The new models will be demonstrated through case studies focusing on earthquake risk in Los Angeles and hurricane risk in North Carolina. Successful completion of the project will provide tools to help address the increasingly severe problem of natural disaster risk, a topic of major national concern.

Modeling Post-earthquake Fire Spread

Principal Investigator: Rachel Davidson

Graduate Research Assistants: Selina Lee, Cornell University, Sizheng Li, Disaster Research Center

Funding Agency: MCEER

In the aftermath of an earthquake, many fires may ignite simultaneously, and at the same time that a region's

suppression capabilities are severely diminished due to damaged water supply, transportation, and communi-

cation systems, and increased demands on fire service personnel. The result can be conflagrations that cause losses exceeding those caused by ground shaking. In this project, we are developing a new simulation model of post-earthquake fire spread and applying it to a case study area in Los Angeles. The model is designed to have several desirable features: (1) to be physics-based, representing the various modes of fire spread separately (e.g., radiation, branding); (2) to be computationally tractable so that it can be applied to an entire urban area; (3) to provide many types of detailed results, including for example, total area burned, spatial description of spread,

and relative importance of different modes of spread, so that it can provide insight into the relative importance of different contributors to fire spread; (4) to quantify uncertainty in the results, and (5) to be flexible to allow for easy modification. The new post-earthquake fire spread model is designed to be used to improve estimation of fire damage for a specified earthquake scenario and to provide new insight into the relative importance of factors that contribute to post-earthquake fire spread. It will also help with future evaluation of potential long- and short-term post-earthquake fire risk reduction strategies.

Modeling the Interactions between Development and Regional Disaster Risk

Principal Investigator: Rachel Davidson

Graduate Research Assistant: Susan Brink

Funding Agency: National Science Foundation Graduate Research Fellowship (Susan Brink)

In order to understand the root causes of risk and the full implications of mitigation and recovery decisions on a city's development trajectory, a broad decision frame is needed that considers disasters in a long time framework and fully captures the many interactions between normal development processes and the ongoing cycle of mitigation preparedness, response and recovery. This

research aims to understand the interactions between a city's disaster risk and its development trajectory by (1) developing a system dynamics model capable of describing vulnerability and development; (2) applying the model to Port-au-Prince, Haiti and Padang, Indonesia; and (3) using the model to answer questions about development and disaster risk.

Multi-organizational Collaborative Leadership and Interaction

Principal Investigators: Tricia Wachtendorf, Disaster Research Center, and William Waugh, Georgia State University

Funding Agency: Department of Homeland Security: Center of Excellence for the Study of Natural Disasters, Coastal Infrastructure, and Emergency Management

The goal of this project is to help officials do a better job of coordinating incidents that are multiorganizational and/or multi-jurisdictional. Consideration is given to traditional formal responders as well as other community-based involvement and the integration of public and private sector efforts, social and human factor elements, and political and cultural facilitators/barriers to response participation. This project will: (1) assess the effectiveness of current organizational structures and incident management systems in building and maintaining collaboration among stakeholders involved in man-

aging hazards and disasters; (2) identify best practices, major issues, and the skill-set (individual and organizational) necessary to build and maintain collaborative relationships; (3) identify skills, cultural features, and social relationships that can foster effective improvised action when a multi-organizational response is necessary; and (4) design and test a training program in collaborative management and leadership for community and state officials involved in managing hazards and disasters. Research methodology includes focus groups, in-depth interviews, and test-bed application.

NEES-SG. NEESWood: Development of a Performance-based Seismic Design Philosophy for Mid-rise Woodframe Construction

Principal Investigator: John van de Lindt, Colorado State University

Co-PIs: Rachel Davidson, Disaster Research Center, Andre Filiatrault, University of Buffalo, David Rosowsky, Texas A&M University, and Michael Symans, Rensselaer Polytechnic Institute

Graduate Research Assistant: Greg Black

Funding Agency: National Science Foundation, Network for Earthquake Engineering Simulation (NEES) Program

The objective of this project is to develop and experimentally validate a performance-based seismic design (PBSD) procedure that would make construction of mid-rise wood-frame construction possible in regions of moderate to high seismicity in the U.S. While wood-frame structures have historically performed well in earthquakes with regard to life safety, they have sustained significant structural and non-structural damage in recent events. Further, the height of wood-frame construction has been limited to approximately four stories, and current building code requirements for engineered wood construction are not based on a global

seismic design philosophy but rather wood elements are designed independently of each other. In this project, we seek to provide the necessary mechanisms to take advantage of the engineering characteristics that make wood-frame construction perform well with regard to life safety, while safely increasing the height of wood-frame structures in seismically active areas and mitigating damage to low-rise wood-frame structures. The UD portion of the project is to develop a regional earthquake loss model for woodframe buildings to help guide the specification of appropriate performance objectives.

Netherlands US Water Crisis Research Network (NEUWCRN)

Principle Investigators: Joseph Trainor, Disaster Research Center, Sue McNeil, Disaster Research Center, Karen Engle, COT, Jack Harald, Virginia Tech, Liesel Ritchie, Natural Hazards Center, University of Colorado, Boulder, Harold Bousche (TNO), and Georg Frerks, Wageningen University

Graduate Research Assistants: Manuel Torres, Lucia Velotti

Undergraduate Research Assistant: Brittany Scott

Funding Agency: The Ministry of Public Works, Transport, and Water Management, The Netherlands

The purpose of NEUWCRN is to develop a sustainable network of Dutch and U.S. knowledge institutes that can facilitate the advancement of the Netherlands' preparedness with respect to possible floods. In addition to distributing existing knowledge, we also aim to develop

scientific knowledge and assess operational practices for flood disaster management. The ultimate goal is to institutionalize a collaborative international network that can generate approaches to policy in the Netherlands and/or the United States.

New Methods for Measuring, Monitoring, and Evaluating Post-disaster Recovery

Principal Investigator: Ronald Eguchi, Imagecat, Inc.

Co-PIs: Rachel Davidson, Disaster Research Center, Stephanie Chang, University of British Columbia, Arleen Hill, University of Memphis, and Beverley Adams, Imagecat, Inc.

Graduate Research Assistant: Dana Rathfon

Funding Agency: National Science Foundation

Post-disaster recovery—one of the phases of the disaster management cycle—is a complex physical, social, economic, environmental, and political process. It lasts

years, requires enormous financial and other resources, and can define the character of the affected communities for years to come. The literature includes theoretic-

cal frameworks of recovery and empirical case studies of historic events. The empirical studies have often focused on a single dimension of recovery, such as housing, and have typically relied on interviews, focus groups, and one-time surveys for data gathering. This literature offers rich cross-sectional insights into recovery at a point in time, but limited systematic, quantitative, empirical descriptions of regional recovery over time. Using newly available high-resolution satellite imagery, previously underutilized statistical data, and advanced field survey techniques that capture a detailed geographically-referenced record of recovery through photographs, video, and observations, this study will develop innovative methods for systematically and quantitatively measuring and monitoring post-disaster recovery. Utilizing a single recent hurricane as a case study, in this project we are: (1) developing methods to process and interpret

remote-sensing data to describe the physical and socioeconomic manifestations of post-disaster recovery; (2) obtaining and compiling quantitative and qualitative recovery data from remote-sensing, field reconnaissance surveys, secondary statistical sources, interviews, and surveys; (3) developing methods to analyze and synthesize the recovery data to comprehensively measure and monitor recovery; and (4) demonstrating application of the new methods within the case study area. Improved tracking of recovery will serve as a critical first step for future efforts to better explain and evaluate recovery by addressing questions such as: (1) For a disaster that has just occurred, over what timeframes and in what ways is recovery likely to unfold?; (2) Why is recovery proceeding in a particular way?; and (3) How are recovery speed and character correlated with various pre- and post-disaster decisions and actions?

Post-earthquake Water Supply Restoration

Principal Investigator: Rachel Davidson

Graduate Research Assistant: Susan Brink

This project entails developing a discrete event simulation model of post-earthquake restoration for the Los Angeles Department of Water and Power water supply system, and using it to provide insight into the factors that govern restoration efficiency and ways to improve the process. The model mimics the real-life process in detail, simulating the movement of different types of crews as they inspect, reroute around, isolate, and repair system damage. For any given earthquake, it pro-

vides restoration curves with uncertainty bounds, maps showing the spatial distribution of outages over time, and crew and repair material usage information. Results for the 1994 Northridge earthquake suggest the model is capable of accurately estimating the time and spatial sequence of the restoration. This is the first application of discrete event simulation to post-disaster water supply restoration, and one of the first for any infrastructure system.

RAPID: Assessing Community-scale Disruption and Restoration of Basic Needs in Post-earthquake Haiti

Principal Investigator: Ronald T. Eguchi, Imagecat, Inc.

Senior Personnel: Rachel Davidson, Disaster Research Center, Beverley Adams, Imagecat, Inc.,

Stephanie Chang, University of British Columbia, and Arleen Hill, University of Memphis

Graduate Research Assistant: Susan Brink

Funding Agency: National Science Foundation RAPID Program

In this RAPID project, we are conducting fieldwork and analysis aimed at better understanding the nature of the relationship between physical damage in disasters and socio-economic disruption at the community scale. Specifically, we sought to examine how building damage can be used to predict the severity of disruption

to a community's social fabric and economy. What is the relationship between physical damage and community disruption? Is there a damage threshold beyond which an event becomes a catastrophe? How does the damage-disruption relationship change over time during the response and restoration phases? The project

includes two specific objectives: (1) gather perishable data describing physical damage and disruption at the community level following the Haiti earthquake. This includes satellite and aerial imagery, Pictometry data, GPS-referenced street-view video and photographs (VIEWS data), and responses from semi-structured interviews with knowledgeable NGO staff; (2) analyze the relationship between community-scale physical damage and disruption over space and time. The

project will be undertaken through three main tasks: (1) collecting remote sensing imagery and Pictometry data; (2) collecting field data through a deployment of the VIEWS system and a series of semi-structured interviews with NGO personnel; and (3) using the data collected in this study and previously to develop estimates of community-scale damage and disruption and examine their relationship.

RAPID/Collaborative Research: The Forgotten Aspects of Evacuation: Mass Evacuee Processing and Care by Host Communities Following the Haiti Earthquake

Principal Investigators: Joanne Nigg, University of Delaware, and James Kendra, University of North Texas

Senior Personnel: Sudha Arlikatti, University of North Texas

Graduate Research Assistant: Manuel Torres

Funding Agency: National Science Foundation

This project researches the hosting of evacuees in the Miami area from the January, 2010 earthquake in Haiti. The field team interviewed public and non-profit decision makers and is analyzing agency reports and news media accounts. In May of 2010, James Kendra, Sudha Arlikatti, and Manuel Torres traveled to the Miami area for interviews and site visits.

Principal research questions included:

- What procedures were used to identify airlift passengers from Haiti or the Dominican Republic bound for the US?
- What organizations/agencies are providing processing and services in the cities receiving an influx of displaced Haitian earthquake victims? What specific services are needed?
- Are these organizations and agencies adopting new roles or expanding their normal activities in the processes of receiving and providing services for evacuees?
- What are the key issues surrounding inter-organizational or inter-governmental coordination in

the processes of evacuation and invacuation?

- Has improvisation occurred among these agencies/organizations when solving expected and/or emerging needs?

Preliminary findings include:

- Organizations reported the importance of prior experience and (for the most part) familiarity with each other;
- Organizations reported the utility of the Incident Command System;
- Organizations reported lack of a federal lead agency as introducing ambiguity. Our document search suggests there were multiple “leads”;
- Congruence of Florida and FEMA ESF structures likely assisted in multiorganizational coordination;
- Local NGOs reported local challenges in assisting non-citizen evacuees;
- Economic conditions in Florida negatively affected the ability of families to assist evacuees and to send money to Haiti.

RAPID: San Bruno CA Sept. 9, 2010 Gas Pipeline Explosion and Fire

Principal Investigator: Rachel Davidson

Co-PIs: James Kendra, University of North Texas, and David McEntire, University of North Texas

Graduate Research Assistant: Sizheng Li

Funding Agency: National Science Foundation RAPID Program

On September 9, 2010, in San Bruno, California, a suburb of San Francisco, a 30-inch steel natural gas pipeline exploded in flames, igniting a fire that ultimately killed seven residents and damaged or destroyed dozens of houses. This RAPID project studies the San Bruno explosion and fire with the aims of (1) improving understanding of how urban fires spread and are suppressed, (2) supporting development and validation of next-generation urban fire simulation models, and (3)

advancing theories of resilience. An interdisciplinary field team is gathering data that is providing a holistic account of the event across the engineering and social sciences. In particular, the team will examine the composition and distribution of structures, rate and means of fire spread, local topography and weather conditions, and elements of multi-organizational coordination and decision making.

Reporting for Duty: Selected Workforce Issues in Disasters

Principal Investigator: Joseph Trainor

Senior Personnel: Lauren Barsky

Graduate Research Assistants: Ziqiang Han, Yvonne Rademacher, Ben Walker, Eva Wilson

Undergraduate Research Assistant: Andrea Fendt

Funding Agencies: Virginia Department of Emergency Management, University of Virginia

This project is a small portion of a larger study entitled *Behavioral Aspects of Sheltering and Evacuation Planning for the National Capital Region* being conducted by University of Virginia on behalf of the Virginia Department of Emergency Management. As part of this effort, researchers at DRC have been reviewing published reports and study findings related to workforce during disasters. In particular we are focusing on summarizing the state of knowledge related to role conflict and role abandonment and convergence. Our intent is to pro-

vide a report that uses plain language to explain what social scientists have learned about these issues and to provide emergency managers with recommendations on how they might adjust their plans and policies based on the findings.

To date DRC personnel have collected, catalogued, and reviewed approximately 200 articles and papers related to this topic and are in the process of writing the final report. We expect to use the results to develop an academic review and presentations of the material.

Research Experience for Undergraduates (REU) Program: Training the New Generation of Disaster Researchers

Principal Investigators: Havidán Rodríguez and Joanne Nigg

Faculty Mentors: Tricia Wachtendorf, Benigno Aguirre, Sue McNeil, Joseph Trainor, Rachel Davidson, and Earl Lee II, Disaster Research Center, and Walter Díaz, University of Puerto Rico-Mayagüez (UPRM)

Graduate Research Assistant: Lauren Barsky

Undergraduate Research Assistants: Brittany Scott, Kathleen Shea

Funding Agencies: National Science Foundation, U.S. Department of Defense and University of Delaware

The National Science Foundation originally funded DRC to establish a Research Experience for Undergraduates (REU) site for three years beginning in the summer of 2005 to engage ten (10) undergraduate students in hands-on research training to enhance their understanding of the social science aspects of disasters. A renewal of this funding was received in 2008 to continue the program for an additional three years through 2011. Each summer during the funding period, a nine-week research training institute is held at DRC to provide students with the necessary academic background, training, and relevant research experiences to prepare them to function as relatively independent research scholars. Course models focus on research methodology, social science approaches to understand-

ing the causes and consequences of disasters, and ethical implications of the research process. Students work with leading scholars and researchers on state-of-the-art research projects that focus on issues such as disaster mitigation, preparedness, response, recovery, vulnerability, and resilience. A multi-disciplinary group of leading disaster researchers and practitioners participates in the Invited Speaker Series in order to emphasize the contributions that other disciplines bring to this field. A series of professional development and social-cultural activities complement the trainees' overall education and training. Recently, the REU added students from engineering, as well as from India and Sweden, making the REU an interdisciplinary program with an international component.

Resilience of Transportation Corridors during Disasters

Principal Investigator: Tricia Wachtendorf

Senior Personnel: Joseph Trainor

Graduate Research Assistant: Ben Johnson

Undergraduate Research Assistants: Austin Barlow, Joshua Kelly, Samantha Penta

Funding Agency: University Transportation Center, University of Delaware

Transportation corridors are vital in allowing for public and commercial mobility. When these corridors are compromised during a disaster, the way in which emergency response networks function is critical to ensuring continuity or resumption of the transportation flow. Inter-organizational coordination is central to an effective disaster response and may require interaction across jurisdiction, timely exchange of information, and provision of personnel or material resources. This study examines how multi-organizational actors/agencies expect and are expected to interact during a transportation corridor disaster. Using social network analysis, researchers will examine the codified and actor-anticipated inter-

action in maintaining the continuity of transportation flows along the I-95 corridor in Delaware.

The study works to:

- Provide information to facilitate planning and management of response in Delaware and the surrounding states;
- Increase our understanding of social response networks in place during corridor disasters which may have applicability in other geographic areas;
- Generate results useful in the development of socio-technical systems to improve communication and coordination during corridor disasters.

Resiliency of Transportation Corridors Before, During, and After Catastrophic Natural Hazards

Principal Investigators: Sue McNeil, Disaster Research Center, Joanne Nigg, Disaster Research Center, and Tracy DeLiberty, Geography Department, University of Delaware

Graduate Research Assistant: Silvana Croope

Funding Agency: University of Delaware University Transportation Center with funding from U.S. Department of Transportation

The objective of this project is to develop a framework to evaluate the resiliency of transportation corridors before, during, and after a catastrophic event. The project addresses the challenge of working with diverse sets of data that present several problems such as incomplete data, lack of data, data that are too dense for real-time analysis, and data not made available due to homeland security policies. Given these data challenges, we are developing the framework using a specific example and then attempting to generalize our findings. We are using U.S. 13 in Sussex County, Delaware as the example. U.S. 13 is subject to flooding, and we have access to much of the data DELDOT has available. The evaluation will use

real-time emergency event management utilizing data generated from the Transportation Management Center integrated with data from other DELDOT sections and other institutions.

The research serves to develop a preliminary framework for a suite of tools to assist agencies to be better prepared for, better able to respond to and better able to recover from catastrophic events due to natural hazards. The research uses existing data, GIS tools and concepts of resiliency to assist in this important area. A technical report and presentation will document the research results and provide direction for further research, development and implementation.

Technology, Weather Forecasts, and Warnings: Integrating the End-user Community

Principal Investigators: Joseph Trainor, Disaster Research Center, Havidán Rodríguez, Disaster Research Center, and Walter Díaz, University of Puerto Rico-Mayagüez (UPRM)

Graduate Research Assistants: Danielle Nagele, Brittany Scott

Undergraduate Research Assistants: Sophia Elliott, Zephi Francis, Paige Mikstas, Precious Morris, Spencer Schargorodski, Kathleen Shea, Sarah Welde

Funding Agencies: National Science Foundation (NSF), Engineering Research Center for the Collaborative Adaptive Sensing of the Atmosphere (ERC-CASA)

Scientists at the Disaster Research Center are contributing through research to the end user integration efforts of the Center for Collaborative Adaptive Sensing of the Atmosphere (CASA) by exploring the social and human dimensions of severe weather forecasts and warnings. CASA is an Engineering Research Center (ERC) within NSF's Directorate for Engineering that focuses on the development of revolutionary sensing technology that will enable earlier and more accurate forecasts of severe weather events. The aim of CASA is to design the necessary infrastructure to sense, analyze, and predict lower atmospheric events and to respond to potentially hazardous phenomena in order to significantly reduce their impact on society. More accurate and reliable weather forecasts and warning systems (based on the technology proposed by CASA researchers) may lead to improved disaster mitigation,

preparedness, and response initiatives. Social scientists in the CASA project are focusing their research efforts on examining how improved forecasting can reduce the exposure and vulnerability of individuals and property to everyday and extreme weather events. Specifically, through the use of survey methodology, focus groups, face-to-face in-depth interviews, and phone interviews using the recently acquired CATI system (Computer Assisted Telephone Interviewing), we are examining how end-user community members access, utilize, and respond to weather forecasts. We also seek to explore their knowledge and interests concerning weather forecasting issues, attitudes towards climatological information, and their needs and interests in relation to the use of meteorological information. We aim to answer a variety of questions, including; (1) What are the primary sources of weather information used by emergency

management agencies?; (2) How much confidence do these end-users have in this type of information?; (3) According to the end-users, how reliable are weather forecasts and warnings?; (4) How does climatological information affect the decision-making processes of this community of end-users?; and finally, (5) How does the

public respond to and interpret warnings? To collect data on the public, we launched a CATI survey in June 2008 and continued collecting data during the 2009 and 2010 tornado seasons. During 2011 DRC will be focused on cleaning and analyzing that data as well as contributing to new programs evolving in CASA.

DRC Field Studies

In addition to our regular projects, researchers at DRC have conducted over 695 field studies since the Center's inception, traveling to communities throughout the United States and to a number of foreign countries in the immediate aftermath of disaster events. Our work has encompassed a broad range of disaster types. Recent field studies have focused on a number of topics including organization, multi-organizational coordination, social behavioral response to disasters, warning and evacuation, and vulnerability.

This section offers a brief list of the field research conducted by DRC faculty and graduate students during the past calendar year.

Location: Punta Gorda, Florida
Dates: January 5–8, 2010
Researcher: Dana Rathfon
Funding Agency: National Science Foundation
Project Title: New Methods for Measuring, Monitoring, and Evaluating Post-disaster Recovery
Purpose: Data was collected on the recovery of the City of Punta Gorda and Charlotte County from Hurricane Charley, including meetings with community leaders and video data on building recovery.

Location: Dominican Republic
Dates: January 20–25, 2010
Researcher: Jenniffer Santos-Hernández
Funding Agency: National Science Foundation
Project Titles: DRU: Contending with Materiel Convergence: Optimal Control, Coordination, and Delivery of Critical Supplies to the Site of Extreme Events; RAPID/Collaborative Research: Field Investigation on the Comparative Performance of Alternative Humanitarian Logistic Structures
Purpose: This research effort was focused on collecting perishable data and field observations related to the response of the Dominican Republic and its coordination efforts to channel aid into neighboring Haiti. In addition, this project sought to generate a better understanding of the relationship between the two countries that comprise the island of Hispaniola, particularly to explore pre- and post-disaster migration from Haiti to the Dominican Republic.

Location: Homestead, Ft. Lauderdale, and Miami, Florida
Dates: January 20–27, 2010
Researcher: Tricia Wachtendorf
Funding Agency: National Science Foundation
Project Titles: DRU: Contending with Materiel Convergence: Optimal Control, Coordination, and Delivery of Critical Supplies to the Site of Extreme Events; RAPID/Collaborative Research: Field Investigation on the Comparative Performance of Alternative Humanitarian Logistic Structures
Purpose: To collect perishable data on the relief effort underway in Florida to assist earthquake stricken Haiti. Time was spent observing activities at warehouses, donation drives, Homestead Air Reserve Base, and planning meetings. The reception process of incoming evacuees from Haiti was also observed at Miami International Airport. Informal interviews were conducted with participants involved in these activities.

Location: Haiti
Dates: February 28 – March 7, 2010
Researcher: Susan Brink
Funding Agencies: Earthquake Engineering Research Institute, National Science Foundation
Project Title: RAPID: Assessing Community-scale Disruption and Restoration of Basic Needs in Post-earthquake Haiti
Purpose: This was an initial field visit to gather perishable data following the January 2010 earthquake.

Location: Haiti
Dates: May 10–16, 2010
Researchers: Rachel Davidson, Susan Brink
Funding Agency: National Science Foundation
Project Title: RAPID: Assessing Community-scale Disruption and Restoration of Basic Needs in Post-earthquake Haiti
Purpose: The visit was undertaken to collect perishable data from the January 2010 earthquake. Community meetings were held, interviews with NGOs and community leaders were conducted, and video data on building damage was collected.

Location: Port-au-Prince and Leogane, Haiti
Dates: March 20–27, 2010
Researcher: Lucia Velotti
Funding Agency: National Science Foundation
Project Titles: DRU: Contending with Materiel Convergence: Optimal Control, Coordination, and Delivery of Critical Supplies to the Site of Extreme Events; RAPID/Collaborative Research: Field Investigation on the Comparative Performance of Alternative Humanitarian Logistic Structures

Purpose:	Research was conducted to attempt to understand the causes of the initial delay in the international relief as blamed on a shortage of trucks and warehouses, and the organization of this effort from the logistical viewpoint once started. The study consisted of 25 qualitative interviews with key informants from the United Nations agencies, the Red Cross, the representatives of grassroots organizations and the citizenry.
Location:	Port-au-Prince and Jacmel, Haiti
Dates:	October 7–10, 2010
Researchers:	Yvonne Rademacher
Team Members:	Haiti Delaware Alliance (HDA), Yvonne Rademacher
Funding Agency:	Delaware-Haiti Development Corporation
Project Title:	Haiti Delaware Alliance (HDA) Assessment Trip
Purpose:	HDA made a presentation to the Jacmel Town Council on their recovery project proposal in the wake of the Haiti earthquake. A DRC representative was invited to join as advisor to the group.



DRC graduate student Susan Brink stands in front of the destroyed Presidential Palace in Port-au-Prince.

(photo by DRC staff)

Education/Mentoring

Students, staff, and faculty affiliated with DRC all play an important role in graduate and undergraduate education at the University. Faculty offer related classes, advise students (as academic advisors and advisors for independent studies and research), and serve on comprehensive exam and dissertation committees; faculty and staff offer professional training sessions for graduate and undergraduate students; and graduate students mentor undergraduates, serve as teaching assistants, and in some cases, such as in the REU program, teach classes. The Disaster Research Center has a history of engaging graduate and undergraduate students in research. Although DRC does not admit students, offer classes, or award degrees, faculty teach classes as part of their responsibilities in their home departments, influence academic programs, and also provide instruction through the interdisciplinary M.S. and Ph.D. program in Disaster Science and Management.

This section provides information and examples regarding DRC's efforts to manifest its vision of education and mentoring in a concrete way.

Doctoral Dissertations

John Barnshaw

"Lessons Learned from Lehman: Crisis, Financial Instability and Social Change."
Department of Sociology and Criminal Justice and Disaster Research Center, University of Delaware, Newark, Delaware.

Silvana Croope

"Managing Critical Civil Infrastructure Systems: Improving Resilience to Disasters."
Department of Civil and Environmental Engineering and Disaster Research Center, University of Delaware, Newark Delaware.

Manuel R. Torres

"Every Man for Himself? Testing Multiple Conceptual Approaches of Emergency Egress on Building Evacuation during a Fire." Department of Sociology and Criminal Justice and Disaster Research Center, University of Delaware, Newark, Delaware.

Master's Theses

Sekine Rahimian

"Selecting Asset Protection Strategies: A Comparison of Optimization and Ranking."
Department of Civil Engineering and Disaster Research Center, University of Delaware, Newark Delaware.

Dana Loren Rathfon

“Measuring Long-term Post-disaster Community Recovery.” Department of Civil and Environmental Engineering and Disaster Research Center, University of Delaware, Newark, Delaware.

Interdisciplinary Disaster Science and Management Master’s and PhD Programs

Profile of the Fall 2010 Student Cohort

<i>Program</i>	<i>Matriculated</i>
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PhD	6
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MS	5
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Gender

Male	5
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Female	6
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<i>International Students</i>	3
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U.S. Undergraduate Institutions:

- Fordham
- University of Delaware (Leadership, Economics, Sociology)
- East Tennessee State University
- Catholic University of America
- University of Kentucky
- Towson University
- Millersville University

Master’s Institutions:

- University of Delaware (Economics)
- Arizona State University
- Beijing Normal University
- American Military University
- Texas Tech University
- College of William and Mary (JD)

Work Experience:

- Wildland Firefighter, AmeriCorps Emergency Response Team Member
- Citicorp
- Taipei County Fire Department
- Emergency Readiness Manager Cecil County
- United Nations—Early Recovery Advisor to the Humanitarian Coordinator for Pakistan

DRC Sponsored Seminars

“Beautiful but Risky: Housing Market Response to Coastal Hazards.” Presented by Jamie Kruse, East Carolina University, February 19, 2010.

“Looking for a Ship: Maritime Response to Disaster.” Presented by James Kendra, North Texas University, February 26, 2010.

“Disasters and the Media.” Presented by Joseph Scanlon, Emergency Communications Research Unit (ECRU), Carleton University, Ottawa, Ontario, Canada, October 25, 2010.

“Managing the Risk of Cascading Failure in Complex Urban Infrastructures.” Presented by Richard Little, Keston Institute, University of Southern California, November 1, 2010.

“Risk, Crisis and Disaster: An Analytical Framework.” Presented by Tao Peng, School of Government, Nanjing University, November 22, 2010.

“Wenchuan Earthquake and the Development of China’s Emergency Management.” Presented by Shi Zhengyi, Minzu University, November 22, 2010.

“Study of Long-term Revitalization Process after Disaster in Japan.” Presented by Takumi Miyamoto, Graduate School of Human Sciences, Osaka University, November 22, 2010.

“An Engineer’s Perspective on Disasters.” Presented by Michael Paul, Duffield Associates, December 15, 2010. (UTC Brown Bag)

Graduate Student Achievements

DRC graduate students are typically among the more outstanding graduate students at the University of Delaware and frequently excel within their major discipline. The following graduate students were recognized by the University and others for their academic achievements with the awards and recognitions cited.

Susan Brink was awarded the Global Research, Internships and Performances for Graduate Students Award.

Amy Crabill became a Certified Emergency Manager (CEM) through the International Association of Emergency Managers. She was also promoted to Deputy Director of the Department of Emergency Services for Cecil County, Maryland. Additionally, Amy co-wrote and established the Maryland Professional Emergency Managers Program state level certification for the Maryland Emergency Management Association (MEMA) and received the Governor’s Citation from Governor Martin O’Malley, State of Maryland.

Kimberly Gill successfully defended her dissertation proposal, “An Examination of the Role of the Public in Local Public Health Department Emergency Preparedness Planning.” Kimberly was also a Graduate Student Instructor for DRC’s Research Experience for Undergraduates (REU) Program as well as a student member of the International Association of Emergency Managers.

Alex Greer was named to the University of Delaware's Dean's List.

Sizheng Li was awarded a National PERIship, a dissertation fellowship in Hazards, Risk, and Disasters.

Yvonne Rademacher was invited to join and is now a member of the Journal Review Board of New Visions for Public Affairs (NVPA), School of Public Policy and Administration.

Lucia Velotti attended "Essex Summer School in Social Science Data Analysis", University of Essex, Colchester, United Kingdom, July through August, 2010.

Eva Wilson was named to the University of Delaware's Dean's List.

Undergraduate Student Achievements

DRC undergraduate students typically achieve high academic standards and participate in various academic and professional organizations as they are relevant to the students' course of study and academic interests. Below is a partial list of undergraduate students along with some of their most recent accomplishments and activities.

Geoffrey Dilg

- Dean's List
- Received University of Delaware University Transportation Center Summer Research funding to participate in DRC's summer REU program

Sophia Elliott

- Dean's List
- Member, National Society of Collegiate Scholars (NSCS)

Andrea Fendt

- Dean's List
- Recipient, General Honors Award

Samantha Penta

- Dean's List
- Summer Scholars Program participant, Social Sciences category, Undergraduate Research Program
- Senior Thesis Winter Session Scholar
- Member, Alpha Kappa Delta Sociology Honor Society
- Recipient, Undergraduate Research Program Grant, University of Delaware
- Recipient, Alumni Enrichment Award, University of Delaware Alumni Association
- Recipient, Special and Student Travel Award, Office of Equity and Inclusion, University of Delaware

Research Experience for Undergraduates (REU) Year Five Activities

The Disaster Research Center's REU program included the following guest speakers:

Anne Bowler, University of Delaware
Dave Carpenter, New Castle County Emergency Management
Erin Daix, University of Delaware
Rusty Lee, University of Delaware
Marcia Nickle, University of Delaware
Walter Gillis Peacock, Texas A&M University
Dorry Ross, University of Delaware
Kathleen Tierney, University of Colorado at Boulder
Daniel Valle, American Red Cross
Dennis Wenger, National Science Foundation
Pat Young, University of Delaware

The following is a list of the 2010 REU participants, their institutional affiliations, and their research topics:

Mark Ahner, Millersville University, Millersville, Pennsylvania

“Seeking the Familiar in a Time of Terror: An Analysis of the Experiences of Those in the Alfred P. Murrah and the Surrounding Buildings during the 1995 Terrorist Attack”

Matthew Binsted, University of Delaware, Newark, Delaware

“‘One Man’s Wisdom is Another’s Folly’: Severe Weather Warnings, Demographics, and Perceived Source Credibility”

Jenna Bucsak, University of Delaware, Newark, Delaware

“Portrayal of International Disaster Aid: The U.S. Media’s Depiction of Aid Following the Haitian Earthquake”

Robin Cassedy, University of Denver, Denver, Colorado

“Taking Care and Taking Charge: Portrayal of Men and Women in the Media Following Disasters”

Geoffrey Dilg, University of Delaware, Newark, Delaware

“Wind Speed Estimates for Hurricane Evacuation: Developing a Method to Determine the Changing Uncertainty in Wind Speed and Track Predictions as a Hurricane Approaches Landfall”

Chelsea Kimble, Texas Tech University, Lubbock, Texas

“Intersectional Vulnerability and the Chemical State”

Elisa Kropat, University of Delaware, Newark, Delaware

“Mapping of Landslides Induced by Earthquakes”

Emmanuel Martínez, University of Puerto Rico – Mayagüez, Mayagüez, Puerto Rico

“Stranger Aid and Helping Behaviors in the Rhode Island Station Nightclub Fire”

Stephen Morgan, University of Florida, Gainesville, Florida

“Who’s in Trouble Now? A Case Study of Place Vulnerability in Delaware”

Tyler Svitek, University of Colorado – Denver, Denver, Colorado

“Chile vs. Haiti: How Did the Media Frame the Earthquakes in Haiti and Chile?”

Colleen Wynn, Western Kentucky University, Bowling Green, Kentucky

“The Shake Felt Round the World: An Examination of Framing of Social Inequality in Local Media in the Wake of the Earthquake in Haiti”

David Garcia, Loyola University, New Orleans, Louisiana

“Normalcy Bias and Cultural Attachment in the Rhode Island Station Night Club Fire”



REU students and DRC staff in attendance at the 35th annual Natural Hazards Research and Applications Workshop in Broomfield, Colorado. Workshop Moderator Kathleen Tierney appears at lower right.

(photo by DRC staff)

Outreach/Dissemination

DRC is well known in the academic community of disaster researchers as a major force for the development of research methods and theory within the field. This section illustrates our activities aimed at applying or distributing the information and knowledge gained from DRC research projects and institutional history.

Peer Reviewed Publications

The following are publications authored or co-authored by DRC faculty, students and staff that are related to disasters and which have undergone the peer review process. The list is divided according to publication type.

Articles

Greg Black, Rachel A. Davidson, Shiling Pei, and John van de Lindt

2010. “Empirical Loss Analysis to Support Definition of Seismic Performance Objectives for Woodframe Buildings.” *Structural Safety*, 32(3): 209–219.

Susan Brink

2010. “The M_w 7.0 Haiti Earthquake of January 12, 2010: Report #2.” *EERI Newsletter*, 44(5): Special Earthquake Report 1–16. (Susan Brink was a partnering organization member of the EERI team that authored this article.)

Susan Brink, Rachel Davidson, and Taronne H. P. Tabucchi

2010. “Strategies to Reduce Durations of Post-earthquake Water Service Interruptions in Los Angeles.” *Structure and Infrastructure Engineering*, 2010, 1–12, iFirst article. Published online at http://pdfserve.informaworld.com/555832_751308105_918800592.pdf

Bethany L. Brown, Pamela J. Jenkins, and Tricia Wachtendorf

2010. “Shelter in the Storm: A Battered Women’s Shelter and Catastrophe.” *International Journal of Mass Emergencies and Disasters*, 28(2): 226–245.

Sherif El-Tawil and Benigno Aguirre

2010. “Search and Rescue in Collapsed Structures: Engineering and Social Science Aspects.” *Disasters*, 34(4): 1084–1101.

Karen Engel, Jack Harrauld, Bas Kolen, Manuel Torres, Joseph E. Trainor, Pauline Veldhuis, Lucia Velotti, and Marco Zannoni

2010. “Is Verticale Evacuatie Haalbaar of Niet?” (In English: “Is Vertical Evacuation Feasible or Not?”) *Nationale Veiligheid en Crisisbeheersing*, 8(5): 34–36. (text in Dutch)

Karen Engel, Manuel Torres, and Joseph E. Trainor

2010. "Wat Nederland Moet Weten over Grootschalige Buitenlandse Bijstand." (In English: "What the Netherlands Should Know about Large-scale Foreign Assistance.") *Nationale Veiligheid en Crisisbeheersing*, 8(5): 24–25. (text in Dutch)

Selina W. Lee and Rachel A. Davidson

2010. "Physics-based Simulation Model of Post-earthquake Fire Spread." *Journal of Earthquake Engineering*, 14(5): 670–687.

2010. "Application of a Physics-based Simulation Model to Examine Post-earthquake Fire Spread." *Journal of Earthquake Engineering*, 14(5): 688–705.

Meredith R. Legg, Linda K. Nozick, and Rachel A. Davidson

2010. "Optimizing the Selection of Hazard-consistent Probabilistic Scenarios for Long-term Regional Hurricane Loss Estimation." *Structural Safety*, 32(1): 90–100.

Havidán Rodríguez, William Donner, Walter Díaz, and Jenniffer Santos-Hernández

2010. "Emergency Managers, Allocation of Radar Resources, and Policy Implications: The Intersection of Weather Hazards, Population, and Technology." *Journal of Emergency Management*, 8(2): 35–44.

Richard Sylves

2010. "The Politics of Disaster: Does Government Regulation Save Lives in Catastrophic Earthquakes?" Guest blog in *Political Bookworm* by Steven Levingston (*Washington Post* online, February 28, 2010) http://voices.washingtonpost.com/political-bookworm/2010/02/the_politics_of_disaster_does.html

Book Chapters

B. E. Aguirre

2010. "Chile's Civil Defense and Lack of Mitigation." Chapter 22 in *Comparative Emergency Management Book Project*. Emmitsburg, MD: FEMA Emergency Management Institute. <http://training.fema.gov/EMIWeb/edu/CompEmMgmtBookProject.asp>

B. E. Aguirre and Joseph E. Trainor

2010. "Emergency Management in Cuba: Disasters Experienced, Lessons Learned, and Recommendations for the Future." Chapter 19 in *Comparative Emergency Management Book Project*. Emmitsburg, MD: FEMA Emergency Management Institute. <http://training.fema.gov/EMIWeb/edu/CompEmMgmtBookProject.asp>

Karen Engel, Joseph E. Trainor, John R. Harrauld, Sue McNeil, Greg Shaw, and Marco Zannoni

2010. "Floods and Disaster Management in the NL: 'God Created the World, but the Dutch Created the NL.'" Chapter 6 in *Comparative Emergency Management Book Project*. Emmitsburg, MD: FEMA Emergency Management Institute. <http://training.fema.gov/EMIWeb/edu/CompEmMgmtBookProject.asp>

Earl E. Lee, John E. Mitchell, and William A. Wallace

2010. "Network Flow Approaches for Analyzing and Managing Disruptions to Interdependent Infrastructure Systems." Pp. 1419–1428 in *Wiley Handbook of Science and Technology for Homeland Security* edited by John G. Voeller. New York: John Wiley & Sons, Inc.

Tricia Wachtendorf

2010. "Logistics." Session 7a in *Catastrophe Readiness and Response Course*. Emmitsburg, MD: FEMA Emergency Management Institute. <http://training.fema.gov/EMIWeb/edu/catastrophe.asp>

2010. "Emergent Organizations and Networks in Catastrophic Environments." Session 11 in *Catastrophe Readiness and Response Course*. Emmitsburg, MD: FEMA Emergency Management Institute. <http://training.fema.gov/EMIWeb/edu/catastrophe.asp>

Tricia Wachtendorf, James M. Kendra, and Brandi Lea

2010. "Community Behavior and Response to Disaster." Pp. 29–39 in *International Disaster Nursing* edited by Robert Powers and Elaine Daily. New York: Cambridge University Press.

DRC Preliminary Paper Series

Tricia Wachtendorf, Bethany Brown, José Holguín-Veras, and Satish Ukkusuri

2010. "Catastrophe Characteristics and Their Impact on Critical Supply Chains: Problematizing Material Convergence and Management Following Hurricane Katrina." Preliminary Paper No. 365.

Other Publications

The following are lists of publications authored by DRC faculty, students, and staff generated by DRC-conducted research projects or represent writings within the recognized area of expertise for the author or authors.

Final Project Reports

Tyler Svitak

2010. "Chile vs. Haiti: How Did the Media Frame the Earthquakes in Haiti and Chile?" Final Project Report No. 55.

Colleen Wynn

2010. "The Shake Felt Round the World: An Examination of Framing of Social Inequality in Local Media in the Wake of the Earthquake in Haiti." Final Project Report No. 54.

Miscellaneous Reports

Beverley Adams, Paul R. Amyx, John S. Bevington, Susan Brink, Stephanie E. Chang, Rachel A. Davidson, Ronald T. Eguchi, Arleen A. Hill, Matthew J. Honey, Robin Mills, Dilnoor Panjwani, and Sarah Pyatt

2010. "Assessing Community-scale Damage, Disruption, and Early Recovery in Post-earthquake Haiti." Miscellaneous Report No. 70.

John Bevington, Sarah Pyatt, Arleen Hill, Matthew Honey, Beverley Adams, Rachel Davidson, Susan Brink, Stephanie Chang, Dilnoor Panjwani, Robin Mills, Paul Amyx, and Ron Eguchi

2010. "Uncovering Community Disruption Using Remote Sensing: An Assessment of Early Recovery in Post-earthquake Haiti." Miscellaneous Report No. 69.

Laura A. Black

2010. "Evacuation of Carless Populations: Emergency Management Registries: Merging of Research into Practice." Miscellaneous Report No. 68.

Presentations at Professional Conferences

DRC personnel regularly participate in conferences and professional meetings that contribute to the field. Below are lists of these activities.

Paper Presentations

John Bevington, Sarah Pyatt, Arleen Hill, Matthew Honey, Beverley Adams, Rachel Davidson, Susan Brink, Stephanie Chang, Dilnoor Panjwani, Robin Mills, Paul Amyx, and Ron Eguchi

“Uncovering Community Disruption Using Remote Sensing: An Assessment of Early Recovery in Post-earthquake Haiti.” Presented at the 8th International Workshop for Remote Sensing for Disaster Management, September 30, 2010, Tokyo, Japan.

Susan Brink

“Strategies to Reduce Durations of Post-earthquake Water Service Interruptions in Los Angeles.” Presented at the 1st International Network on Risk, Crisis and Disaster Conference, November 12, 2010, Umeå, Sweden.

Meredith Legg, Rachel Davidson, and Linda Nozick

“Resource Allocation for Regional Hurricane Risk Mitigation Planning.” Presented at the annual meeting of the Society for Risk Analysis, December 7, 2010, Salt Lake City, Utah.

Sizheng Li, Rachel Davidson, and Selina Lee

“Comparison of a New Physics-based Simulation Model and the Hamada Equations in Determining Post-earthquake Fire Spread.” Presented at the 9th National and 10th Canadian Conference on Earthquake Engineering, July 25–29, 2010, Toronto, Ontario, Canada.

Joseph Trainor

“Myths and Realities Surrounding Public Response.” Presented at the Workshop on Public Response to Alerts and Warnings on Mobile Devices: Current Knowledge and Research Gaps, April 13, 2010, Washington, D.C.

“Emergency Management in the Netherlands.” Presented at the FEMA Higher Education Conference, June 9, 2010, Emmitsburg, Maryland.

Joseph Trainor, Havidán Rodríguez, Walter Díaz, William Donner, and Jenniffer Santos-Hernández

“Predicting the Behavioral Response to Tornado Threats.” Presented at the International Research Committee/Natural Hazards Center Disasters Hazards Researchers Meeting, July 14, 2010, Broomfield, Colorado.

Tricia Wachtendorf

“When Push Comes to Shove: The Framing of Need in Disaster Relief Efforts.” Presented at the XVII World Congress of Sociology meeting of the International Sociological Association, July 16, 2010, Goteborg, Sweden.

Tricia Wachtendorf and Rochelle Brittingham

“Hurricane Preparedness and Strategy Feasibility.” Presented at the International Research Committee on Disasters Workshop, July 14, 2010, Boulder, Colorado.

Tricia Wachtendorf and Samantha Penta

“Masculinity on the Hudson: Gendered Representations of the Flight 1549 Response.” Presented at the Annual Meeting of the Eastern Sociological Society, March 21, 2010, Boston, Massachusetts.

“Masculinity on the Hudson: Gendered Representations of the Flight 1549 Response.” Presented at the International Research Committee/Natural Hazards Center Disasters Hazards Researchers Meeting, July 14, 2010, Broomfield, Colorado.

Invited Presentations

B. E. Aguirre

“Chile’s Emergency Management.” Presented at the FEMA Higher Education Conference, June 9, 2010, Emmitsburg, Maryland.

Eric Best and B. E. Aguirre

“The Incorporation of Group Behavior in Computer Simulation of Building Evacuations.” Presented at Millersville University, Center for Research and Education, June 18, 2010, Millersville, Pennsylvania.

Susan Brink and Rochelle Brittingham

“Fundamental Literature in Risk Analysis.” Presented at the 2nd International Network on Risk, Crisis and Disaster Conference, November 10–13, 2010, Östersund, Sweden.

Sue McNeil

“The State of California’s Infrastructure: the Challenges of Rebuilding America.” Presented at the Transportation – Land Use – Environment Connection Conference, October 17–19, 2010, UCLA, Lake Arrowhead, California.

Tricia Wachtendorf

“Lost in Translation: Contending with the Myths and Realities of Disaster Response.” Presented to the ACELA Regional Volunteers Active in Disasters, April 9, 2010, Baltimore, Maryland.

“Disaster Myths and Realities.” Presented at the Church World Service Forum on Domestic Disaster Ministry, April 19, 2010, New Windsor, Maryland.

“Lost in Translation: Contending with the Myths and Realities of Disaster Response.” Presented at the Eastern Montgomery County Emergency Management Group’s bi-annual disaster training symposium, EDITS 2010, April 21, 2010, Lafayette Hill, Pennsylvania.

“These are the People in your Neighborhood.” Presented at the National Volunteers Active in Disasters (NVOAD) Annual Meeting, May 13, 2010, Miami, Florida.

“Disaster Myths and Realities.” Presented at the Southeastern Pennsylvania Medical Reserve Corps Meeting, May 22, 2010, Chestnut Hill, Pennsylvania.

“Uncharted Waters: Improvising the Boat Evacuation of Lower Manhattan on 9/11.” Presented at CRISMART, Swedish Defence College, June 29, 2010, Stockholm, Sweden.

“Disaster Response and the Art of Improvisation: Development of an Approach for Exercise.” Presented at the International Symposium: Imagining Futures in Crisis and Disaster Management, July 8, 2010, Goteborg, Sweden.

“Disaster Myths and Realities.” Presented to the Delaware Medical Reserve Corps, September 20, 2010, Newark, Delaware.

“Getting Relief or Not: Disaster Humanitarian Assistance Efforts in Haiti, China and after the Indian Ocean Tsunami.” Presented at the University of Delaware Association of Retired Faculty (UDARF) meeting, October 4, 2010, Newark, Delaware.

“These are the People in your Neighborhood: Volunteers, Convergents, and Non-traditional Helpers in Disaster Response.” Presented at the opening conference of the Risk and Crisis Research Center, November 11, 2010, Östersund, Sweden.

William Waugh and Tricia Wachtendorf

“Collaborative Leadership and Improvisation Skills in Emergency Management.” Presented at the annual meeting of the International Association of Emergency Managers (IAEM), November 2, 2010, San Antonio, Texas.

Poster Presentations

Tricia Wachtendorf

“Resiliency of Transportation Corridors during Disasters.” Presented at the PI/PM Showcase, Department of Transportation, May 5, 2010, Dover, Delaware.

Sessions Organized or Moderated

Rachel Davidson

Chair, Program Committee, Society for Risk Analysis Annual Meeting, December 4-7, 2010, Salt Lake City, Utah.

Joseph Trainor

Co-Meeting Organizer, International Research Committee on Disasters and Natural Hazards Center Hazards Researchers Meetings, July 13, 2010, Broomfield, Colorado.

Session Moderator, “Do We Need a Coordinated Disaster Research Agenda?” 35th Annual Natural Hazards Research and Applications Workshop, July 10, 2010, Broomfield, Colorado.

In addition, DRC staff members regularly attend various professional conferences, workshops, etc. and contribute to the collective knowledge of the disaster research field through their attendance. Below is a partial list of events recently attended.

NUWCRen Conference, Wageningen and Delft, The Netherlands, June 3-5, 2010. Attended by Joseph Trainor and Lucia Velotti.

“The History of Oil in America: Before and after the Gulf Spill” Symposium, Princeton University, October 21, 2010. Attended by Alex Greer.

NUWCRen Conference, Washington, D.C., November 4, 2010. Attended by Hsien-Ho Chang, Alex Greer, Ziqiang Han, Sue McNeil, Joseph Trainor, Lucia Velotti, and Eva Wilson.

“From Haiti to Pakistan: A Year of Disasters,” Philadelphia, Pennsylvania, December 4, 2010. Attended by Susan Brink, Ben Walker, and Eva Wilson.

DRC in the News

DRC events and activities were publicized regularly throughout the calendar year by the University's electronic newsletter, *UDaily* and in UD's news magazine, *Research*. The following are the news stories for 2010 along with their Web URLs:

"Civil Engineering Professor Receives Major Grant for Disaster Risk Management"

Rachel Davidson, Associate Professor in UD's Department of Civil and Environmental Engineering and DRC Core Faculty member, received a \$796,255 grant from the National Institute of Standards and Technology (NIST) for research on risk analysis and risk management. Her work was highlighted in this article.

Available online at <http://www.udel.edu/udaily/2010/jan/nist011410.html>

"DRC Faculty, Students Study Humanitarian Response to Quake"

This article describes the research conducted by several DRC staff members in the wake of the Haiti earthquake that occurred in January, 2010.

Available online at <http://www.udel.edu/udaily/2010/feb/drcquake021610.html>

"Disaster Research Center Offers Vibrant Summer Research Experience"

This article highlights the DRC's very successful Research Experience for Undergraduates (REU) Program, held each summer for the past six years.

Available online at <http://www.udel.edu/udaily/2011/jul/drcreu070910.html>

"Disaster Researcher Discusses Relief Strategies at UDARF Meeting"

DRC Associate Director Tricia Wachtendorf discussed the challenges of implementing disaster relief following natural disasters in her presentation, "Getting Relief or Not: Disaster Humanitarian Assistance Efforts in Haiti, China and after the Indian Ocean Tsunami." Her presentation was made at a meeting of the University of Delaware Association of Retired Faculty held in October.

Available online at <http://www.udel.edu/udaily/2011/oct/udarf-disaster-research102010.html>

"Presidential Disaster Declarations on the Rise, National Expert Says"

DRC Affiliate Faculty member Richard Sylves is quoted extensively in this article from the University of Delaware *Research* (Vol. 2, No. 1, 2010).

Available online at http://www.udel.edu/researchmagazine/issue/vol2_no1_enviro/disasterdeclarations.html

In addition to regular inclusion in *UDaily*, DRC staff members were also contacted for expert opinions that appeared in outside public media sources. The following are examples of these DRC appearances.

“After the Aftermath.” Joshua Zaffos, *Miller-McCune*

Long after the benefit concerts are finished, the victims of hurricanes, earthquakes and tsunamis suffer severe emotional aftershocks. Is there a better way to respond to disaster? DRC Associate Director Tricia Wachtendorf was interviewed for this article regarding her work in Sri Lanka following the Indian Ocean earthquake and tsunami of 2004.

Article available online at www.miller-mccune.com/health/after-the-aftermath-1644

“Challenges in the Haiti Relief Effort.” Marty Moss-Coane, *Radio Times*, National Public Radio

In a brief interview with program host Marty Moss-Coane, DRC Associate Director Tricia Wachtendorf spoke about the challenges facing the relief effort in Haiti following the earthquake.

Audio recording available online at <http://whyy.org/cms/radiotimes/2010/01/14/being-racist-vs-talking-about-race-whats-the-difference/>

“Chances of Large Delmarva Quake ‘are Very Remote.’” Beth Miller, *The [Wilmington, Delaware] News Journal*

In the wake of the Haiti and Chile earthquakes early in the year, reporter Beth Miller explores the possibility of earthquakes in the Delmarva region. She discusses the concept of risk analysis as described by DRC Associate Director Tricia Wachtendorf.

Article available online at <http://pqasb.pqarchiver.com/delawareonline/access/1972506521.html?FMT=ABS&date=Feb+28%2C+2010>

“A Country in Search of Hope: Delaware Team Tries to Help Battered Haiti Pick Up the Pieces.” Alison Kepner, *The [Wilmington, Delaware] News Journal*

DRC Core Faculty member Rachel Davidson is quoted in this article regarding the slow progress of removing debris and clearing roadways in Haiti following the January earthquake.

“Delaware Haitians Keep Calling, Praying.” Beth Miller, James Merriweather, and Rachel Kipp, *The [Wilmington, Delaware] News Journal*

Following the deadly earthquake in Haiti in January, 2010, DRC Core Faculty member Joseph Trainor was among those interviewed by the local news media regarding the difficult challenges faced by the country during the disaster response.

Article available online at <http://pqasb.pqarchiver.com/delawareonline/access/1940008881.html?FMT=ABS&date=Jan+14%2C+2010>

“Disaster Planning on the State and National Levels.” David Inge and Celeste Quinn, *Focus 580*, Illinois Public Media

In this news program that explores global affairs and daily life, hosts David Inge and Celeste Quinn interview DRC Affiliate Faculty member Richard Sylves on disaster planning related topics.

Audio recording available online at <http://will.illinois.edu/focus/interview/focus100330a/>

“Haiti Earthquake 2010: When Disasters Hit Third World, Speed Up Your Donations.” Laurent Belsie, *The Christian Science Monitor*

DRC Affiliate Faculty member Richard Sylves was interviewed for this article regarding his perspective on disasters and politics.

Article available online at <http://www.csmonitor.com/Business/2010/0114/Haiti-earthquake-2010-When-disasters-hit-third-world-speed-up-your-donations>

“How the Men Reacted as the *Titanic* and *Lusitania* Went Under.” Sindya Bhanoo, *The New York Times*

DRC Core Faculty member Benigno Aguirre is quoted in this article regarding a study by a professor at Queensland University of Technology that analyzed statistics identifying survival factors in the two historic shipwrecks.

Article available online at <http://www.nytimes.com/2010/03/02/science/02ships.html>

“Mining Destruction for Data to Help Others.” Karen Kaplan, the *Los Angeles Times*

In the aftermath of events such as the Haiti earthquake, teams of disaster researchers travel to the scene to study what happened. It is not “morbid curiosity” but rather their work is intended to alleviate future catastrophes, according to reporter Karen Kaplan. Among those interviewed for this article were DRC Associate Director Tricia Wachtendorf.

Article available online at <http://articles.latimes.com/2010/feb/01/science/la-sci-disaster-research1-2010feb01>

“The Moral Ambiguity of Looting.” Donald G. McNeil, Jr., *The New York Times*

Reporter Donald McNeil explores the occurrence of looting following various natural disasters and civil disturbances. In the process, he cites DRC Associate Director Tricia Wachtendorf, who identifies the distinct difference between what is traditionally considered to be looting and what is viewed as taking essential goods to serve survival-level purposes.

Article available online at <http://www.nytimes.com/2010/03/07/weekinreview/07mcneil.html>

“New Delaware-Haiti Alliance Taking Shape: Group to Link Specialists with Partners in Quake-ravaged Jacmel.” Beth Miller, *The [Wilmington, Delaware] News Journal*

In this article describing the partnering of experts in various fields such as engineering, emergency medical care, and pediatric medicine with those in need following the Haiti earthquake, DRC Associate Director Tricia Wachtendorf describes the process of pairing those with specific needs and those with the skills to address the needs.

Article available online at <http://m.delawareonline.com/news.jsp?key=331724&rc=ts>

“Report: No Crime Wave among Hurricane Katrina Evacuees.” Dan Vergano, *USA Today*

DRC Core Faculty member Joseph Trainor speaks out against the common “disaster myth” held by many that crime waves often occur in the wake of disasters.

Article available online at http://www.usatoday.com/tech/science/columnist/vergano/2010-02-12-hurricane-katrina-crime_N.htm

“Researchers Await Their Turn in Haiti.” Jeff Brady, National Public Radio (NPR)

This news story describes the role that disaster researchers play in the aftermath of disasters, focusing on the research response to the Haiti earthquake. Those interviewed for the story include DRC Associate Director Tricia Wachtendorf.

Story available online at <http://www.npr.org/templates/story/story.php?storyId=123028590>

“Researchers Launch Quick-Response Reconnaissance Trips to Study Humanitarian Response to Haiti Earthquake.” *UnScheduled Events*, Vol. 29, No. 1 (January 2010).

Among those researchers highlighted in this article were DRC Associate Director Tricia Wachtendorf, DRC Core Faculty member Joanne Nigg, and DRC graduate students Manuel Torres and Jenniffer Santos-Hernández, all of whom were engaged in an ongoing National Science Foundation (NSF) funded study on emergency logistics and relief convergence after disasters.

“Snowstorm or ‘Snowpocalypse’? D.C. Abuzz as Weather Hits: Residents of Nation’s Capital Scramble for Staples, Prepare for the Worst.” Devin Dwyer, ABC News

DRC Core Faculty member Joanne Nigg is quoted in this story regarding the reaction of Washington, D.C. residents to an impending storm that had the potential to be a “historic” one. She comments on the residents’ actions to prepare for the possibility of severe weather.

Article available online at <http://abcnews.go.com/Politics/snow-storm-snowpocalypse-capital-residents-abuzz-storm-approaches/story?id=9758972>

“UD Prof Recalls Wreckage of Past Quakes.” Dan Shortridge, *The [Wilmington, Delaware] News Journal*

In this article looking back at Chile’s earthquake history, reporter Dan Shortridge relays the historical facts of past quakes as noted by DRC Core Faculty member Benigno Aguirre.

Article available online at <http://pqasb.pqarchiver.com/delawareonline/access/1972506161.html?FMT=ABS&date=Feb+28%2C+2010>

The DRC Website was also featured as the “Website of the Week” in the January 29, 2010 issue of *The Weekly Homeland Security Newsletter* from the Homeland Security Studies & Analysis Institute. The online issue can be accessed at <http://www.homelandsecurity.org/bulletin/100129.htm>

Visitors to DRC

The DRC hosts numerous national and international visitors throughout the year, many of whom come to work with DRC personnel and to utilize the E. L. Quarantelli Resource Collection. In addition, the DRC also sponsors a speaker series intended to initiate novel and provocative discussion of disaster related topics.

The following is a list of the visitors to the DRC during the past year including their institutional affiliations.

April

Stephen Young, University of Washington, Seattle, Washington, USA

May

Carole Laonde, Université Laval, Québec City, Québec, Canada

June

Bill Donner, Indiana University of Pennsylvania, Indiana, Pennsylvania, USA

Takumi Miyamoto, Graduate School of Human Sciences and Japan Society for the Promotion of Science, Osaka University, Osaka, Japan

August

Patrick Carolan, Michigan State University, East Lansing, Michigan, USA

David Dilworth, Michigan State University, East Lansing, Michigan, USA

Masaki Urano, Waseda University, Tokyo, Japan

September

Kate Brady, Australian Red Cross, North Melbourne, Victoria, Australia

Emily Falone, Office of the Assistant Secretary for Preparedness and Response (ASPR), U. S. Department of Health and Human Services, Philadelphia, Pennsylvania, USA

Tao Peng, School of Government, Nanjing University, Nanjing, China

Zhengyi (Stone) Shi, Minzu University, Beijing, China

October

Joseph Scanlon, Emergency Communications Research Unit, Carleton University, Ottawa, Ontario, Canada

November

Scott Knowles, Drexel University, Philadelphia, Pennsylvania, USA

December

Mark W. Milke, College of Engineering, University of Canterbury, Christchurch, New Zealand

Other Disaster-Related Activities

In addition to the activities listed above, DRC faculty, students and staff also participate in a range of activities pertaining to disasters including affiliations with various Boards, reviewers for disaster related journals, etc.

Below is a brief list of affiliations currently held by DRC personnel.

B. E. Aguirre

- Editorial Board, *Crisis, Communication, and Society*
- Social Science Review Editor, *Natural Hazards Review*
- Editorial Board, *Social Science Quarterly*
- Editorial Board, *International Journal of Business Continuity and Risk Management*
- Editorial Board, *Journal of Flood Engineering*
- Elected member, Editorial and Publication Committee, The Society for the Study of Social Problems

Rachel Davidson

- President, Society for Risk Analysis
- Executive Committee Member, American Society of Civil Engineers (ASCE) Technical Council on Lifeline Earthquake Engineering

Tricia Wachtendorf

- Advisory Board Member, Learning from Earthquakes Program, Earthquake Engineering Research Center (EERC)
- Student Activities Board Member, Earthquake Engineering Research Institute (EERI)

Pat Young

- Vice Chair, Emergency Response Working Group (ERWG), University of Delaware
- Vice Chair, Delaware Disaster Assistance Team (DDAT)



Dr. Bill Anderson (center), recipient of the Charles E. Fritz Award for Career Achievements in the Social Science Disaster Area, delivers his guest lecture to DRC students and staff. Dr. Anderson is flanked by DRC core faculty member Dr. Benigno Aguirre (left) and DRC co-founder and emeritus faculty member Dr. Russ Dynes (right).
(photo by DRC staff)



Dr. and Mrs. Anderson are joined by Fritz Award presenter Dr. Joe Scanlon, founder and emeritus faculty member of the the Emergency Communications Research Unit (ECRU), Carleton University.
(photo by DRC staff)



2010 DRC graduate Dr. Manuel Torres and DRC Director Dr. Sue McNeil share a moment of celebration following UD's spring commencement.
(photo by Melissa Torres)

The E. L. Quarantelli Resource Collection



Pat Young, Resource Collection Coordinator, is seated in the collection space of the E. L. Quarantelli Resource Collection.

(photo by Erna Danielsson, DRC visiting researcher from Mid Sweden University)

Report of Activities

Once again this year, the E. L. Quarantelli Resource Collection has experienced much activity and growth. As one of the key resources at DRC that supports its ongoing missions of Research, Education/Mentoring, and Outreach/Dissemination, the Resource Collection (RC) and its various components continue to enjoy a leading role within the Center as a whole.

This report has two primary focuses this year—the changes within the Resource Collection itself and the activities of the RC staff. Once again there has been regular growth within the collection content through the acquisition of over 1,000 new resources. These range from print resources to electronic information as well as various audio visual items and again encompass the broad range of subject matter currently reflected in the RC. Now numbering approximately 58,000 items, the RC continues to provide vital resources and information to disaster researchers around the globe.

Those utilizing the RC throughout the year included 43 students from the University of Delaware and around the United States along with our eleven visiting researchers from Canada, Japan, Australia, New Zealand, and various locations throughout the U.S.

One of the highlights in terms of collection growth and organization was the creation of the Popkin Red Cross Special Collection—a collection of 974 Red Cross related documents gifted to DRC by former Red Cross staff member Roy Popkin. The collection has been extensively cataloged and organized and is ready for use by researchers with a special interest in the Red Cross or in related areas. We are very grateful to Mr. Popkin and to his family for this wonderful contribution to the E. L. Quarantelli Resource Collection.

In addition to RC staff members establishing the Popkin Red Cross Special Collection, Pat Young, Resource Collection Coordinator, attended the Natural Hazards Research and Applications Workshop hosted by the Natural Hazards Center at the University of Colorado, Boulder, for the first time. Her attendance enabled her to network with various disaster researchers also in attendance and to further establish a collaborative relationship with Wanda Headley, Library Manager for the Natural Hazards Center.

Pat also continued her active involvement in both the Delaware Disaster Assistance Team (DDAT) and in UD's Emergency Response Working Group (ERWG). She continued to serve as Vice Chair of ERWG and this year stepped into the role of Vice Chair of DDAT. She also continued to coordinate membership activities for DDAT and education and training activities for ERWG. Both organizations address the broad spectrum of emergency- and disaster-related topics that pertain to collections. Additional information on both groups can be found on their respective websites (DDAT — www.udel.edu/DDAT; ERWG — www.udel.edu/ERWG).

RC staff members also continued to expand the collection of DRC publications as they were produced by various DRC personnel. This collection includes published articles, peer-reviewed Preliminary Papers, book chapters, miscellaneous reports, and invited commentaries. For a complete list of this year's publications, please refer to the "Peer Reviewed Publications" and "Other Publications" in the Outreach/Dissemination section of this report beginning on page 33. A comprehensive list of all DRC publications may be found at DRC's website — www.udel.edu/DRC — under the tab for the E. L. Quarantelli Resource Collection.

As we look to the future of the E. L. Quarantelli Resource Collection we anticipate completing the migration of the collection catalog database (DISCAT) to the Web during the summer of 2011. We are also developing plans for expansion of the RC museum collection to establish it as a unique collection of artifacts that will enhance teaching and research at DRC and the University of Delaware. We look forward to next year's report when we will once again have the opportunity to share the exciting and vital activities of this very important collection.



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UNIVERSITY OF
DELAWARE

111 Graham Hall, Room 166
Newark, DE 19716-7399
Phone: 302-831-6618
Fax: 302-831-2091