LIAISON

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PROGRESS

2004 2007 2010 2013 2016 2019 2022

Advances in Disaster Management that are Shaping the Future

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On the cover: There have been countless advances in disaster management in the last decade. This collage of photos highlights just a few that are represented within the issue.

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Dr. Pamela Milligan

Welcome to the latest edition of Liaison, the Center for Excellence in Disaster Management and Humanitarian Assistance (CFE) publication highlighting recent trends and accomplishments in international disaster preparedness and response. This publication provides a forum for international disaster managers to present articles aimed toward the practitioner to share important new findings, technologies, programs and success stories, and to highlight lessons learned and best practices in the field.

As CFE transforms itself to be the Department of Defense's premier organization focused on building international humanitarian assistance and disaster management capability, this publication will also transform to remain relevant and useful to civil disaster managers, military organizations, humanitarian and nongovernmental organizations. It is our goal to make this publication an extension of our partnership and collaboration with the disaster management community and a forum for important information sharing.

This edition focuses on advances in disaster management practices over the past decade. From water solutions in Sri Lanka to improvements in disaster response in both Nepal and Bangladesh, this edition highlights both technological and programmatic advancements. It is through these advances that both disaster management capability and capacity within many countries has increased significantly, ensuring better response mechanisms and preparedness.

By all indications, we are going to need these advanced capabilities. Report after report indicates there has been a significant rise in the frequency of natural disasters over the past two decades and even with improved national capabilities throughout the Asia-Pacific region the disaster management community will increasingly depend on a collaborative civil-military relationship to achieve optimum results.

Military involvement in disaster response has grown with the increase in frequency and intensity of disasters. Strengthening this response through improved civil-military relations is the primary mission and focus of CFE. In future editions, we will be emphasizing this relationship and providing insight into new research, programs and opportunities to build stronger civil-military disaster response programs.

We welcome your recommendations, participation and contributions to this journal. The next edition will focus specifically on partnerships and collaborations in building disaster resiliency. I encourage you to share your stories and programs with us and our community. It is an exciting time at CFE and in the field of international disaster response—it is our pleasure to share this time with you and to be a resource for you.

Please visit our new website at www.cfe-dmha.org to learn more about CFE.

Warmest Aloha,

LIAISON

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LIAISON is a publication of the Center for Excellence in Disaster Management and Humanitarian Assistance (CFE-DMHA) and serves to inform its diverse audience of current and emerging issues related to civil-military relations across the broadspectrum of disaster relief in order to enhance understanding among civilian and military practitioners and policy makers. Content is prepared in accordance with the *Associated Press Style Guide*. Contributions are welcomed and highly encouraged. The editor reserves the right to make editorial changes to any material submitted as deemed necessary.

The authors in this issue of LIAISON are entirely responsible for opinions expressed in their articles. These opinions are not to be construed as official views of, or endorsed by, CFE-DMHA, any of its partners, the Department of Defense, or the U.S. Government.

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LIAISON provides an open forum for stimulating discussion, exchange of ideas and lessons learned – both academic and pragmatic– and invites active participation from its readers. If you would like to address issues relevant to the disaster management and humanitarian assistance community, or share a comment or thought on articles from past issues, please submit them to editor@cfe-dmha.org. Please specify which article, author and issue to which you are referring. LIAISON reserves the right to edit letters to the editor for clarity, language and accuracy.

LIAISON welcomes article submissions

LIAISON is a journal of civil-military disaster management and humanitarian relief collaborations and aims to engage and inform readers on the most current research, collaborations and lessons learned available. If you are interested in submitting an article for consideration, please email your story idea to editor@cfe-dmha.org.

•**Format.** All submissions should be emailed to the editor as an unformatted Microsoft Word file. Footnotes are the preferred method of citation, if applicable, and please attach any images within the document as separate files as well.

•**Provide original research or reporting.** LIAISON prefers original submissions, but if your article or paper is being considered for publication elsewhere, please note that with the submission. Previously published articles or papers will be considered if they are relevant to the issue topic.

•**Clarity and scope.** Please avoid technical acronyms and language. The majority of LIAISON readers are from Asia-Pacific nations and articles should be addressed to an international audience. Articles should also be applicable to partners in organizations or nations beyond that of the author. The aim is for successful cases to aid other partners of the DMHA community.

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•**Supporting imagery.** Original imagery supporting any and all articles is welcome. Please ensure the images are high-resolution and can be credited to the photographer without license infringement. Images should be attached to the submission separately, not embedded within the Microsoft Word document.

•**Biography and photo.** When submitting an article, please include a short biography and high-resolution photo of yourself for the contributors' section.

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Mass Communication Specialist 2nd Class Eric C. Tretter/ U.S. Navy

Haitian fishermen look toward the Military Sealift Command hopitial ship USNS Comfort

Comfort makes better doctors

Lessons learned during the Haiti medical response that can enable other organizations

By Navy Capt. Miguel Cubano, M.D., Medical Director for Tricare Area Office Pacific

In the last two decades it seems that every time we turn on our TVs, or look at news online, there is another disaster developing somewhere in the world. Who can forget the terrorist attacks of September 11, 2001, or the 2004 earthquake and tsunami in the Indian Ocean that killed 230,000 people, or Hurricane Katrina, Haiti's earthquake, the tornados in Joplin, Mo., Chile's earthquake, the Boston bombing, Typhoon Haiyan in the Philippines, and Japan's earthquake that triggered a tsunami responsible for the Fukushima nuclear reactor meltdown?

As we can see, all disasters are different, they can strike anywhere, anytime and overwhelm the capacity of any country to prepare for, protect against, respond to, recover from, and mitigate all hazards. By definition, a disaster is a sudden event that can disrupt a community or an entire country by causing human, material, economic and environmental losses that exceed the region or country ability to cope using its own resources. The unique nature of a disaster does not preclude an appropriate response that could save lives, decrease suffering and accelerate the recovery of the affected areas.

My goal in this article is to highlight five medical lessons learned during my response to the 2010 Haiti earthquake that may apply to all types of disasters, and the steps we need to take now in order to improve our global disaster response. My experience comes from a lifelong interest in disaster response and disaster training, and my direct involvement in the coordination of the largest medical disaster response after the earthquakes in Haiti and Chile while serving as command surgeon of United States Southern Command (USSOUTHCOM).

After the January 2010 earthquake in Haiti, the United States military conducted Operation Unified Response (OUR), the longest and largest U.S. military relief effort in

a foreign disaster operation to date. At the peak of the relief efforts, the Department of Defense had deployed more than 22,000 personnel, with 8,000 on the ground, and the remainder on 58 aircraft and 23 vessels.

The USNS Comfort (T-AH 20) hospital ship departed from Baltimore within 72-hours of the disaster and received the first Haitian casualties by air Jan. 19. A day later, the ship had dropped anchor off the coast of Port-au-Prince. The total number of patients treated by U.S. military personnel was 9,758, of which 1,025 had some type of surgical procedure. At the peak of operations, the military medical personnel numbered 1,110.

The 7.0-magnitude quake killed an estimated 223,000 people and injured more than 300,000. Approximately 1.5 million people were left homeless and displaced by the quake. The cost of the disaster was approximately $8 to 14 billion (which is more than Haiti's GDP).[1] In comparison, the earthquake in Chile was an 8.8-magnitude but killed only 507 people; the majority of the deaths were secondary to the tsunami.

Our medical military involvement in Chile (as requested by the government) was a U.S. Air Force Expeditionary Medical Support (EMEDS) unit manned for one month by U.S. personnel and eventually donated to the Chilean Ministry of Health. The total cost to U.S. Agency for International Development (USAID) was approximately $8.6 million, which included transportation and the month-long management of the unit.

The medical involvement of U.S. military personnel in Haiti was much more extensive. In the following sections I will describe five lessons learned that I consider important in any type of disaster response.

Lesson One: Have a Disaster Response Plan

Disaster response starts with a local, regional, and national plan, but depending on the magnitude of the disaster, the country in question may request assistance from the international community. The earthquake in Haiti was unprecedented in our hemisphere and exceeded the capacity of the island to appropriately respond to the needs of its citizens. The functioning government in Haiti immediately after the disaster was extremely limited, in contrast to the other disasters describe in the introduction where a government was still coordinating the international assistance. For example, in the Philippines, the government has a disaster response plan; their request did not included U.S. military medical assets, so the medical assets available were strictly for the care of the military personnel deployed to the disaster. As a result, my involvement as medical director of Tricare Pacific was limited.

Haiti's disaster response was not the first time USSOUTHCOM was involved in a disaster response in the region, but it was the first time we had to develop a complete disaster plan for the country assisted. Once Haitian President René Preval made an official request for help from the United States and the international community, a plan was drafted within hours to include search and rescue, water, food, medical assistance, security and a command and control element. The plan also had to incorporate force health protection against malaria, dehydration, diarrheal diseases, psychological issues and the need of protective gear for potential exposure to asbestos and silica dust during rubble clearing operations.

One of the initial challenges in our plan was the incorporation of non-governmental organizations (NGOs), interagency and United Nations health clusters. In order to establish


Astrid Riecken/ ProjectHOPE

A child is treated in the critical care unit onboard the USNS Comfort.

1 Pascal Fletcher, "Haiti reconstruction cost may." *Reuters, 16 Feb 2010, www.reuters.com.*

command and control of the large military forces expected to assist in the disaster response, USSOUTHCOM established Joint Task Force - Haiti (JTF-H) on Jan. 14 to conduct humanitarian assistance and disaster relief in support of the lead agency, USAID.[2]

According to Rachel Donlon, author of *Haiti Earthquake and Response*[3], the plan had significant challenges, due to lack of communications within the country, loss of electric power and damage to the infrastructure.

The medical response plan included the USNS Comfort, a 32-member Disaster Assistance Response Team (DART), Air Force EMEDS, multiple medical elements from the combat ships first on the scene, and eventually medical personnel from all branches of the military. One of the most significant elements of the medical plan was to designate the individuals in charge of triaging the casualties prior to arriving on the USNS Comfort to ease processing to the appropriate medical departments. During the first two to three days, those individuals were not able to appropriately triage patients on the ground because large numbers of patients were simply flown onboard for care; however, once onboard the USNS Comfort the patients were triage appropriately and those requiring laboratories, radiology or surgery were routed accordingly.

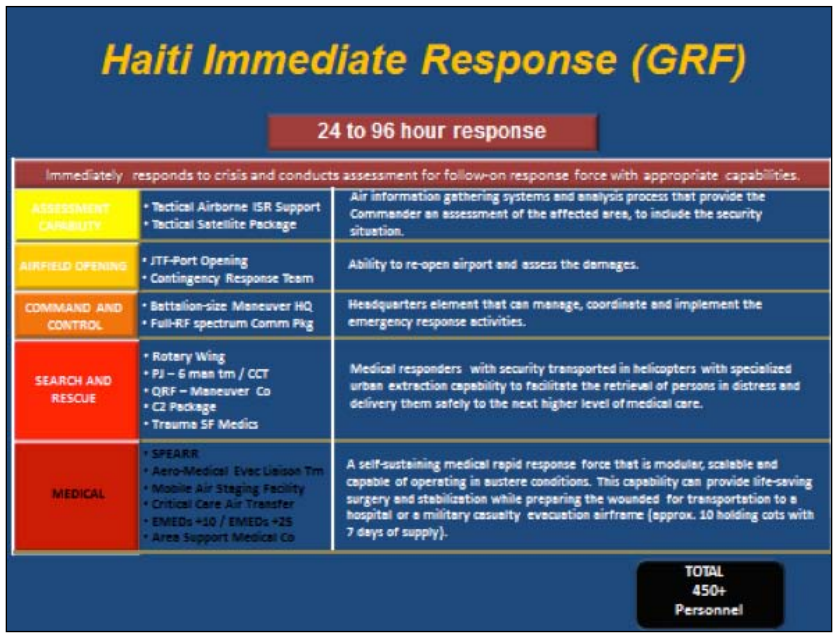


Figure 1

A good example of a medical plan combatant commands should include in their region is included in a larger plan developed by USSOUTHCOM in preparation for the 2010 rain and hurricane season. Figure 1 shows the elements required in the first 24- to 96-hours in Haiti if a hurricane or severe rain moved toward the island after the earthquake. The plan is a guide that includes what assets are needed to protect approximately 1.2 million displaced citizens.[4]

One of my recommendations to build our partners medical planning capabilities is to incorporate disaster response plans to the multinational exercises we do every year around the globe (e.g. exercises Cobra Gold and Panamax). The other suggestion to improve medical disaster responses globally is to incorporate a disaster plan component to the medical readiness training exercises (MEDRETE) and medical civil action programs (MEDCAP) done around the world by our military, in order to increase capacity building of the local community during a regional disaster. Combatant commands need a plan that incorporates NGOs, interagency and civilians when responding to humanitarian assistance and disaster relief operations in their area of responsibility.

Lesson Two: Logistics, Logistics, Logistics

One of the most important elements in a disaster response is logistics. The main contribution of the military during a disaster response is the vast logistical capability not found in the civilian sector - the ability to move goods and personnel from point of origin to the final destination. According to Van Wassenhove, a Henry Ford professor of manufacturing, "disaster relief is 80 percent logistics," so the proper execution of the logistical element in a disaster response can be the difference between success and failure.[5]

Opening the airport, clearing roads and utilizing helicopters to transport water, food and medical supplies to the affected population within the first 24 to 48 hours, was one of the logistic success stories during OUR. During the early hours, the lack of situational awareness made it difficult for us to know the requirements and priorities regarding medical care.

The third day after the disaster, the Argentinian hospital medical director called me and asked me to help him get supplies. The Argentinian hospital was part of United Nations Stabilization Mission in Haiti and was the only operational hospital immediately after the earthquake. The field hospital had used a month worth of medical

2 P. Ken Keen, "Foreign Disaster Response; Joint Task Force-Haiti Observations." *Military Review*, 2010: 85-96
3 Rachel Donlon, "Haiti Earthquake: Crisis and Response." In *Haiti Earthquake and Response*, New York: Nova Science Publisher, Inc, 2011, 1-67.
4 U.S. Southern Command, *Operation Unified Response: Support to Haiti Earthquake Relief 2010.* May 1, 2010.

5 Van Wassenhove, "Humanitarian aid Logistics: Supply chain management in high gear." *Journal of the Operational Research Society*, 2006: 475-489.

supplies in just three days. I ask them to fax me a list with the medical supplies needed which I forwarded to the Veterans Affairs in Puerto Rico. The Puerto Rico National Guard was able to deliver 80 percent of the supplies requested within a day of the original call. We eventually did the same thing with the Cuban, Haitian and other hospitals that needed consumables to continue taking care of the injured. The movement of medical supplies from our warehouses to the different hospitals outside Port-au-Prince accelerated Haiti's capacity to care for its own patients, setting the stage for the conclusion of OUR.

In my opinion, this is the model to mimic in the future. During the acute phase of a disaster response, we should be asking the leadership of the country what hospitals outside the disaster area are capable of receiving patients and should be able to supply them with fuel, generators, medical supplies and temporary personnel (in Haiti's case this meant orthopedic surgeons for the large number of crush injuries) until they are capable of sustaining themselves. Focusing our efforts on fulfilling the medical supply needs of already existing hospitals provides citizens with faster, more effective care in locations they are already familiar with. Supplementing medical care with specialty personnel should also accompany supplies to bridge any gaps in capabilities.

Lesson Three: Communication

If you read any after action report from a disaster response, you will see that the number one complaint are issues with communication. The day after the USNS Comfort arrived, I instituted a telephone conference that included 22 different medical individuals representing the White House, interagency and different branches of the military. One of my requirements was that individuals representing a particular agency had to have the authority to make decisions. This telephone conference was used the entire time our forces were deployed in the disaster zone. The benefit of this type of communication is that many problems with transportation, equipment, supplies, authorities and personnel were solved by one of the individuals at the other end of the phone. After the first month, some units were excused if their involvement was no longer needed.

Other important sources of communication were our connection to USAID as our lead agency and the United Nations clusters. We were able to communicate with many of the NGOs on the island via direct communications or during the U.N. cluster meetings. In particular, we worked very closely with the University of Miami's Project Hope, which has participated in the military humanitarian operations aboard the USNS Mercy during Pacific Partnership and aboard USNS Comfort during Continued Promise. The association with Project Hope was important because the physicians they bring aboard are credentialed and ready to work.


Mass Communication Specialist 2nd Class Chelsea Kennedy/U.S. Navy

Military doctors work to place a skin graft on a Haitian patient's leg during surgery aboard USNS Comfort at anchor off the coast of Haiti Feb. 15, 2010.

We also had a daily internal medical brief that included the Center for Disease Control (CDC), all branches of the military, intelligence units, NGOs, a public health representative and a medical evacuation representative. The brief included information about each agency's status. For example, the CDC would report any cases of malaria, cholera or any infectious disease trends; my deputy would report the overall patient status onboard the USNS Comfort and any other platform or ground medical unit; the blood bank officer reported available or utilize units of blood and their expiration dates. A report was produced daily for the Chief of Staff to review and report at the daily commanders' meeting.

One of the issues we confronted early on was the lack of a clear common operating picture (COP) and multiple command and control (C2) structures. In a way, it was understandable due to the magnitude of the disaster, the number of forces, NGOs, interagency and private citizens that wanted to help. One of the lessons learned was to have a clear COP and a single C2 structure before the deployment of forces.

A contribution of the Special Forces teams during OUR was the distribution of 73,000 hand-crank radios to the Haitian population in order to keep them informed of the location of medical services, food and water distribution sites, and other pertinent information. There was a radio station broadcasting information to the population on a regular basis.[6] Also, the USSOUTHCOM Commander, Gen. Douglas Fraser, instructed officers to declassify as much information as possible and share it through blogs,

6 Donlon, ""Haiti Earthquake," 2011.

social media and websites for the benefit of all involved in the disaster response.[7]

During the early days of the disaster I was making many of the decisions in coordination with one of the medical planners in Haiti, Navy Capt. Michele Hancock, but it became obvious that we needed a joint task force surgeon to provide better care to the people of Haiti; Rear Adm. Alton Stocks was selected as the JTF-Haiti surgeon in order to have a strong advocate to represent medical capabilities during the everyday operations in country.

One last suggestion to finish this section on communication - please make sure that you have only *one* person from the medical sector talking to the media at the same time each morning to report the number of patients treated and deceased. This will prevent confusion of numbers and information that may erode your creditability with the media and possibly your command. I spent hours explaining comments made by medical personnel on different casualty numbers to my leadership; comments that were well intentioned but caused more confusion and in the end wasted time and money.

Lesson Four: Use of Technology

The use of technology was crucial during the entire evolution. The U.S. Navy surveillance and the Air Force unmanned aerial vehicles were instrumental in evaluating the damage of the buildings around Port-au-Prince. The unmanned aircrafts help us detect early on the location of internally displaced citizens. The information was also use to set up the distribution centers of food and water. The unmanned aircraft was also instrumental in selecting the locations during the early stages of the operation for aerial drops of food and water. We needed to reach the population that was isolated due to damaged roads and debris, but we didn't want to injure anyone on the ground.

Other vital information gathered by looking at the aerial pictures of the buildings was the ability to see the condition of the hospitals. In many of the views, we observed a large number of beds with patients in the hospital's parking lot. We used that information to calculate the number of patients, beds available and the location of those hospitals.

One more technological tool you need during disaster response is a satellite phone. In a disaster, cell phones and landlines may not work due to damage to the infrastructure. Satellite phones may be the only way for medical personnel to communicate with one another in order to coordinate medical supply needs and shipments. If you are going to use radios, you need the same type of radio and to coordinate the frequency during the planning stage.

In the months after the disaster, our information technology department used computer simulation software for weather forecasting to predict the cholera outbreak before it happened. Their estimate was short by only 5,000 cases. We also use Google Earth, Facebook and Twitter to communicate with the populace, but a word of caution – I recommend that the use of social media be limited to sharing valuable information on location and supplies for the public. I've seen good medical personnel become unwanted during disaster response as a result of harmless posts that were interpreted negatively.

Lesson Five: DoD & NGO Cooperation

Department of Defense and NGO cooperation during OUR has been described by many on both sides as unprecedented. The most significant cooperation was aboard the USNS Comfort where translators, physicians, nurses and support staff worked together under one roof to care for patients. The Red Cross and Project Hope provided the majority of civilian personnel during the evolution. Even though the cooperation was unprecedented, there is opportunity to improve the collaboration by having NGOs participate in military humanitarian operations like Continue Promise and Pacific Partnership. In order to grow our partnership, designated officers should spend time with our NGOs partners so both organizations can understand each other better during the next disaster.[8] One of the most accepted suggestions is to develop an international disaster response network that will help nations deploy civilians and military personnel cohesively in response to disasters on foreign soil.[9]

It would also be wise for academic institutions preparing the next generation of doctors, nurses and military personnel to include a comprehensive guide in their curriculum on how to plan and execute a disaster response in conjunction with interagency and NGO participation. This type of civil-military cooperation will save lives and money in the next disaster response by providing a seamless, synergistic cooperation.[10]

Working with the NGOs will also provide a good foundation to deal with the issue of an internally displaced population. Military medical involvement should be in support of the NGOs in the form of logistical support. The reality is that the internally displaced population poses a challenge that must be addressed as soon as possible in order to provide suitable solutions to the needs of large numbers of people.[11]

Conclusion

The military's medical community has a definite role in the initial phase of disaster response, whether the

7 Keen, "Foreign Disaster Response," 2010.

8 James Terbush and Miguel Cubano, "DoD and NGOs in Haiti: A Successfull Partnership." *World Medical and Health Policy*, 2012: 1-6.
9 Keen, "Foreign Disaster Response," 2010.
10 Terbush and Cubano, "DoD and NGOs," 2012.
11 Keen, "Foreign Disaster Response," 2010.

Petty Officer 3rd Class Christopher Lussier/ U.S. Navy

disaster is within your own nation or you are responding to another country's cry for help. The plan has to include a disaster assessment team that can quickly make recommendations regarding the immediate needs on the ground. The military medical response should be fast and modular, augmenting the existing platforms in the region or even augmenting host country medical assets. Plan on providing medical supplies to the local hospitals capable of treating patients and supplementing personnel as needed. The surgical teams should be presented like a Forward Resuscitative Surgical System (FRSS) or EMEDS; early surgical units are the key to saving lives within the first four days of a disaster, especially after an earthquake. If available, an amphibious assault ship is an ideal platform for a rapid medical response, because of the large flight deck capable of receiving multiple helicopters with casualties simultaneously and the robust surgical assets as part of the crew.

Establish channels of communication within your organization and with outside medical assets. We need to improve our cooperation, communication and understanding of the NGO's and civilian personnel involved in a disaster response if we want to be successful. If we take advantage of each other strengths, we will shorten the acute phase of the disaster, saving lives and money in the process.

The humanitarian missions in the Pacific and Caribbean provide a unique platform for what I call a humanitarian "unitas." Unitas is a multinational naval exercise to enhance security cooperation and understanding between participating navies. The concept of humanitarian unitas is to invite nations within the respective region to participate in a regional humanitarian medical operation. Nations like China, which has a brand new hospital ship, could work alongside the USNS Mercy during port visits in Pacific Partnership. In the Caribbean, the Mexican hospital ship ARM Huasteco can do port visits with the USNS Comfort during Continued Promise. This type of cooperation with representatives from all countries of the region, as well as NGOs, can develop relationships and refine common processes needed for a successful global disaster response.

There is no such thing as a "perfect" disaster response, but every day that we work together we are getting closer to that goal of saving lives, mitigating suffering, and providing those affected by the disaster the best opportunity to rebuild.

Petty Officer 3rd Class George Sherer, a steelworker assigned to Amphibious Construction Battalion Two installs fencing material around the perimeter of the relief camp. ACB 2 is conducting construction operations as part of the humanitarian and disaster relief to Haiti, Operation Unified Response.


Indian Ocean

One drop at a time

Sri Lankan hospitals find life-saving water solution

By Kusum Athukorala, Chair of NetWwater and the Sri Lanka Water Partnership

Water problems have plagued Sri Lanka for more than a decade. Extensive droughts, industrial pollution and poor water management have all contributed to the issue, and third and fourth-order affects are being seen in the rural regions. In particular, the rural hospitals in Sri Lanka are fed by nearby water sources through gravity schemes and ground water, but during the dry periods many water resources dry up dramatically. To exacerbate the problem, runoff due to heavy rains can cause silt blockages in water systems that are in place.

This lack of a reliable water supply degrades the capability of rural hospitals to provide the highest level of health services and can potentially cause the hospitals to shut down completely. As a way to mitigate the challenge, rainwater harvesting systems providing supplementary water for health and hygienic purposes can help hospitals reduce their monthly water bills and reduce service interruptions due to an inadequate water supply.

Rainwater harvesting tanks address water challenges in rural Sri Lankan hospitals.

The Network of Women Water Professionals Sri Lanka, or NetWwater, a founding member of the Women for Water Partnership, with support of the Soroptimist Club – Wassenaar and Retourschip Foundation, both of the Netherlands, has implemented a rainwater harvesting project to address the water problems in rural hospitals. The first system, a 8500-liter (2,245 gallons) Ferro Cement Rainwater Harvesting (RWH) tank, was set up in Henawala District Hospital, Kadugannawa, Kandy, Central Province.

The Henawala hospital reflects the average target hospital due to its high water consumption needs of daily admissions, patients and staff. The monthly water bill is 25,000 rupees (approximately $400 USD) and the hospital's monthly consumption of water averages 260,000 liters (69,000 gallons), of which 120,000 liters are obtained from the National Water Supply and Drainage Board (NWSDB). During the rainy season an additional 140,000 liters are pumped from a nearby well every three or four days to a separate water tank.

The supplemental RWH tank is filled by rainwater conveyed from the gutters of the ward building for use during the dry periods when the well is too low to supply the water required. The rainwa-

Hospital	Admissions	Patients Treated	Patients Treated in Clinic	Monthly Cost of Water *(LKR)*	Monthly Cost of Water *(USD)*
1. Henawela	12600	72034	45008	25200	$217
2. Wattappola	4320	34200	25200	15000	$130
3. Dodamwela	No wards	45456	18673	8000	$70
4. Hakgala	7200	34200	23400	10600	$92
5. Ududumbura	14500	57356	38320	12350	$107
6. Muruthawala	4320	39600	21600	8600	$75
7. Yakgahapitiya	5200	41800	26345	12560	$109
8. Pamunuwa	3456	23450	27340	14000	$122
9. Mampitiya	5231	36741	39425	14500	$126
10. Balana	No wards	21600	41235	54960	$479
Total	***57332***	***327537***	***422439***	***175570***	***$1527***

Phase 1. Patient coverage of target hospitals (August 2009)

ter runs through the tank's upper filter and is connected to the hospitals main water system through a discharge pipe. The water is then used for toilet flushing, hand washing, ward washing and gardening purposes.

Rainwater harvesting has become an appropriate alternative solution for scarcity of water in most areas in Sri Lanka. During the last decade more than 10,000 rainwater tanks have been set up to grapple with the periodic drought-related water problems in many parts of the country. State support has been forthcoming with the formulation of a rain water harvesting policy, and as a result, RWH tanks have covered half the rural hospitals in Central Province to date.

Crucial in the set-up of the RWH systems is the direct involvement of staff and doctors of the target hospitals and the close cooperation with the district authorities. NetWWater and the Department of Health have set now in motion the steps needed to ensure that the tanks will be included in the official departmental monitoring format. This means the use and status of the tanks will be covered in all monitoring visits by the provincial authorities. This is essential as a recent study of Sri Lankan RWH systems carried out by the Lanka Rain Water Harvesting Forum shows that 20 percent of the tanks studied are not being used due to poor awareness, lack of follow-up and poor maintenance. The Department will also monitor decreases of water and electricity costs as reflected in monthly bills due to the RWH tanks coming into use. So far, the Henawala hospital reports that they have a 10 percent saving on electricity and water.

"Not even a single raindrop should be allowed to flow into the sea without having made use of it for the benefit of the people."

- Sri Lankan King Parakramabahu the Great (1153-1186 AD)

AP Photo/ Kyodo News

From the Ashes

The city of Higashi Matsushima, Japan rebuilds after tsunami

By Shuya Takahashi, Chief of the Reconstruction Policy Section and Environmental Future City Promotion Office for the city of Higashi Matsushima, Miyagi Prefecture, Japan

On March 11, 2011 the Great East Japan Earthquake caused a massive tsunami that resulted in unprecedented damage. In the city of Higashi Matsushima, Miyagi Prefecture, 1,109 people lost their lives and 25 people are still missing.

In addition to the massive loss of life and thorough destruction of the city's housing, the disaster also destroyed the urban infrastructure and industrial base. Many victims remain homeless and lack the livelihood they relied upon prior to the earthquake and tsunami. However, the lessons learned from the earthquake challenge the traditional idea of "reconstruction." Together, the city's residents are not merely restoring Higashi Matsushima, but creating a town development plan that establishes a standard for disaster recovery.

Higashi Matsushima Before and After

Higashi Matsushima is located between the cities of Ishinomaki and Sendai, slightly northeast of the Matsushima Bay. It has a population of approximately 43,000 and was growing prior to the earthquake. Many of the newer Higashi Matsushima residents took advantage of the convenient public transportation and commuted to Ishinomaki and Sendai through the city's eight rail system stations.

Tourism was also a significant draw for the city and represented the city's main industry. Overlooking the Pacific Ocean, Higashi Matsushima was known as one of Japan's three most beautiful sites. The other major industries were seaweed and oyster aquaculture, and agriculture with a focus on rice.

When the tsunami hit there were nearly five centimeters of snow covering the ground. The temperature was very cold for the middle of March and as a result, many of the victims suffered hypothermia and had to be rushed to the hospital. Requests for food, blankets and heaters were received in the days following the disaster and supplies had to be transported to each site in an efficient manner.

Flooding affected 65 percent of the city's acreage, the largest percentage in the country. At one point after the tsunami, the number of evacuees surpassed 20,000, nearly half the city's population. Refugees were evacuated to 454 locations. Although the city's 350 officials were mobilized and working to find more permanent solutions, many evacuees were forced to remain at evacuation sites for more than a month.

Transportation of the victim's remains was performed concurrently with rescue operations. Initially a municipal gymnasium was prepared as a morgue, but with the high number of casualties, the school gymnasium was also used. By the end of the recovery effort, four morgues were required.

For me the event was a personal matter – I lost my daughter in the disaster, but I had to work soon after viewing my daughter's remains. Many of my colleagues also lost family members and even more lost their homes, but we had to keep working to respond to the disaster and aid in the recovery. As a result, everyone within the city staff was reaching their limits physically and mentally.

The Power of Community

The local community and an inland municipal council played a major role in the emergency period immediately after the earthquake, and continue to provide support during the recovery period. A Higashi Matsushima Town Planning Council was created, which is unique to Higashi Matsushima. It is a self-governing council of city residents organized into eight municipal councils by school district. Through this council, a City Reconstruction Plan

was developed to address solutions for regional issues. Each of the eight councils began working toward solutions for local concerns, and additionally contributed to the overall plan.

Each of the councils are located in their local civic centers and employs residents as the personnel to deploy various programs including a city planning event, continuing studies and sport activities.

After the catastrophe, the local community showed significant strength. Each area developed their municipal councils in cooperation with one another along three phases: self-help, mutual assistance and public-help. In the emergency phase, these councils deployed groups to each area in order to help victims, distribute boiled rice and run soup kitchens, provide a change of clothes to those in need, and provide instructions from the government to the populace.

The city of Higashi Matsushima was devastated by the 2011 earthquake and tsunami. This residental area in Nobiru district was washed away by the tsunami.

In the operation of the community emergency shelters, there were also community organization officers that played a strong role. Each local officer aided the council meetings on discussion and development of restoration plans by obtaining the cooperation of the citizens staying in the shelters.

The City's Efforts for Recovery

One month after the earthquake, the goal was to raise optimism in affected areas and begin the recovery as soon as possible. The Great East Japan Earthquake Rehabilitation and Reconstruction Guidelines were completed quickly and supported this movement towards achieving progress toward reconstruction.

Next, a working team was organized for a land use adjustment study at the city's disaster response headquarters. The team formulated the Higashi Matsushima collective relocation plan as a part of the overall reconstruction plan. The city government and its citizens agreed that a town meeting was needed to determine whether residents would rebuild where they lived prior to the earthquake and tsunami, or whether they would be relocated further inland.

At the discussions of the reconstruction plan, citizens met face to face to exchange information directly. These discussions met at each of the eight municipal council locations. The councils adopted a workshop method instead of a briefing system, dividing citizens into small groups which included farmers, fishermen, evacuation center residents and junior high school students. Each group exchanged ideas and summarized their opinions.

As a result, more than 2,000 people participated in the reconstruction plan workshops and a consensus was attained relatively quickly. An agreement was established which defined the new border for the tsunami disaster prevention zone area. Just over 80 percent of the votes were in favor of relocation, 10 percent favored local rebuilding, and approximately 10 percent were undetermined.

Additionally, advice and guidance from an expert study was incorporated into the final Higashi Matsushima Reconstruction Plan. The expert committee attended the workshops and community meetings, allowing for inclusion of professional recommendations at any time.

During this one to three month period after the disaster, the city government focused on administrative functions, but was also responsible for missing persons searches, emergency shelter management, food security, debris removal, construction of temporary housing, certification issuance for home construction, death certificates, grants for relief, and all other affairs pertaining to the earthquake aftermath. Due to the earthquake and tsunami, about 30 new city representative "help" windows had to be constructed.

Without the support of other local government officials and private sector volunteers, the success of our city staff would not have been possible. The outpouring of support created unbreakable national ties for which the citizens would like to express their sincere gratitude.

Outline of the Recovery Plan

In the recovery plan, the top priority must be to build a defense system that can protect life. For Higashi Matsushima, this defense system must address a coastline extending more than 20 kilometers, and regional characteristics of a low-lying city at sea level, climbing to only three meters above sea level, with Japan's longest canal running through the town. As a result, we decided to develop a defense system that can protect citizens from a once-in-a-1,000-years disaster and property from a once-in-a-100-years disaster by layering defense facilities such as a coastal levee and an inland high-banking structure.

In the area that suffered crushing damage, the planning is based on the experience of the disaster and

More than 2,000 citizens participated in the reconstruction and relocation decisions.

emphasizes community evacuation. Evacuation and fire drills, and upgrades of the disaster prevention administrative radio and other systems, are all improvements to the Higashi Matsushima disaster plan.

Currently, construction is in progress for seven residential complexes in the city. The locations are inland and upland from the pre-disaster areas, representing the commitment to protect human life and in order to rebuild where sustainable development is possible. The city is putting every effort into early completion of the complexes for the approximately 3,000 households destroyed by the tsunami.

Processing Earthquake Waste with the "Higashi Matsushima Method"

Since the regional characteristics of the area consist of lowlands spread along the coast, about 65 percent of the city was submerged by the tsunami. The tsunami, in combination with the earthquake, created a huge amount of rubble, about 1.5 million tons in a single day (approximately 150 years' worth under normal circumstances).

If the standard method of waste disposal (incineration) was used, the debris would have a processing cost of about 60 billion yen. But, in Higashi Matsushima, through the cooperation of the construction business community and the citizens, much of the debris was recycled, reducing the cost of disposal by about 20 billion yen. Further, incineration of less than three percent of the total was needed to complete the cleanup.

Most disaster recovery efforts involve transfer of debris to other municipalities. Higashi Matsushima achieved a high rate of recycling, while securing employment for residents who lost their livelihoods by providing jobs sorting recycling material. Furthermore, use of city-owned portable general-purpose heavy construction equipment dramatically lowered processing costs. This reduction of costs has earned the popular name, "the Higashi Matsushima Method," as an expression of efficient earthquake waste management.

Growing interest in energy and the environment

When the Great East Japan Earthquake hit there was a shortage of kerosene and gasoline that prolonged the power failure within the city. Higashi Matsushima citi-

Higashi Matsushima dramatically reduced cleanup costs by recycling the majority of the debris from the March 2011 earthquake and tsunami. Citizens painstakingly separate the rubble into 19 categories.

Courtesy Photo

zens also experienced a prolonged blackout as a result of difficulty in securing energy in the days and weeks following the earthquake. It is for these reasons that the above-mentioned citizen workshops and a civic questionnaire showed a clear trend in the direction the city should take during the recovery – as a city, a decision was made to focus future energy production on methods that allowed energy independence. By implementing renewable energy and environmental protection plans, the Japanese government certified Higashi Matsushima as the "Environmental Future City Concept" in 2011.

The Future of Reconstruction

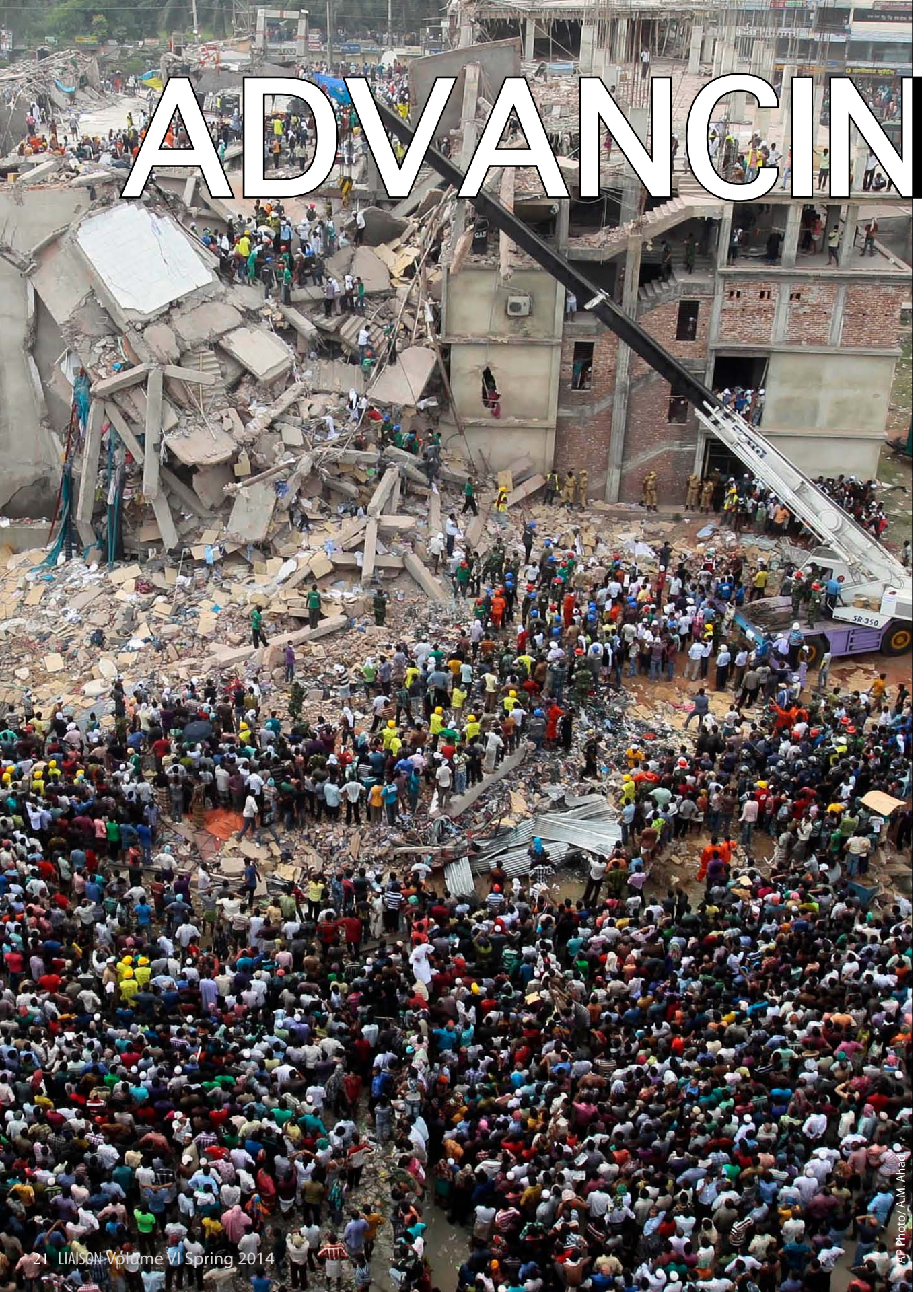
In June 2014, five of the seven housing complexes are scheduled to be complete. Of the 1,010 units, 254 units were finished in March 2014 and families began occupying them in April.

Our city began the recovery effort at a relatively early stage post-disaster, and rebuilding infrastructure such as sewers and roads, and constructing public facilities such as nursery schools, fishing and agricultural facilities will continue after the initial five-year "recovery" period. The time between 2016 and 2020 will be the "development" phase where the beauty of Higashi Matsushima can be further enhanced once again and people can lead a spiritually rich life while the reconstruction is completed.

This time has been filled with support, both physically and spiritually, from home and abroad. Numbers of volunteers and others wishing to aid the city continue to grow, creating new opportunities to build lasting relationships. The circle of support has motivated me to achieve a recovery plan that matches the power of the assistance. But for the city of Higashi Matsushima, it is our hope that others will not only see the city as it recovers from the devastating disaster, but also see it as the model for disaster recovery.

After the March 11, 2011 earthquake and tsunami in Higashi Matsushima, and the progress toward reconstuction.

ADVANCING



More than 1,100 people were killed in the Rana Plaza tragedy forcing Bangladesh to examine the safety of its buildings.

AP Photo/ A.M. Ahad

THE AGENDA

Urban Risk Reduction In Bangladesh

By Mohammad Sifayet Ullah,
Disaster Management Portfolio Manager for the Comprehensive Disaster Management Program – II,
United Nations Development Programme

Our journey towards an 'urban world' has reached a dramatic point in the history of humankind. Since 2008, at least 3.3 billion people, nearly half the world's population, are living in urban areas and not surprisingly more than a third in the urban slums.

Rapid population growth is taking place in cities, be it metropolises, medium-sized cities or small towns. By 2050, it is assumed that approximately 70 to 80 percent of the world's nine billion people will live in cities, a complex trajectory for decision makers responsible for providing quality goods and services to city dwellers. Trends indicate medium urban centers are continuing to inflate sharply despite having resource deficiency. Simultaneously, larger cities are also overstrained due to substantial demands of their booming inhabitants causing resource poor conditions, compounding risks and increasing vulnerabilities to disaster. While the urban life may seem appealing to many, the shocking reality is that the urban context in Asia is currently grim and Bangladesh is unfortunately not an exception. Effective urban governance, driven toward poverty alleviation and disaster risk management, is now a great concern and poses a paramount challenge for national authorities across the globe.

Bangladesh is an extremely populous and poverty challenged country in South Asia. Looking from a disaster risk management viewpoint, Bangladesh is a global leader, a laboratory where 'resilience' is showcased. Yet, acknowledging that 40 percent of the nation's population will become urban residents by 2020, the government is broadening its vision and preparing the urban centers where risks are being accumulated and transferred from the rural areas. The United Nations Development Programme (UNDP) is committed to continuing support of the people and their government to reduce urban risks and 'Making Cities Resilient.'

The disaster management vision of the Government of Bangladesh (GoB) is to reduce the risk of its citizens, particularly the poor and the disadvantaged, and UNDP continues to be a proud partner that supports this undertaking. This long-standing partnership with GoB is unique for at least three major reasons- development of national policies, responsive institutions and empowerment of communities. Effective central policies, stronger institutions and smarter resource and knowledge management, coupled with active community participation, means Bangladesh is not only planning better to minimize the impact of natural disasters, but also accelerating recovery and rebuilding stronger in the aftermath.

In disaster risk management, UNDP continues to be a partner in which the government harbors its trust. Since 2004, the redoubled push of the multi-donor Comprehensive Disaster Management Programme (CDMP) has catapulted a paradigm shift away from reactive relief toward proactive risk reduction on a national scale. The CDMP II (2010-14), a vertical and horizontal expansion of Phase I, deepened the culture of risk reduction through mainstreaming it across the government. This programme has played an important role problematizing the risk and developing the risk profile of the country. It also influences the political will in favor of proactive risk management and in devising agile policy instruments to enable transformational change.

Risk awareness and policy response

CDMP II conducted the seismic microzonation mapping of Dhaka, Chittagong and Sylhet city areas to determine the vulnerability factor for all infrastructure, building, communication networks and lifelines (e.g. gas, electricity and water). The programme is now scaling up the seismic microzonation to Dinajpur, Rangpur, Tangail, Mymensingh and Rajshahi township areas. Results from a set of technical and multi-disciplinary studies (seismic fault-lines, geological and structural vulnerability) commissioned by CDMP create a strong basis to

develop key policy instruments and works as an incentive for its urgent implementation. This study defined seismic vulnerability characteristics of existing building structures, essential and lifeline facilities in the metropolitan areas under the City Corporations of Dhaka, Chittagong and Sylhet.

Modeled on international best practice initiatives in some of the high-risk countries of earthquake disasters, including Japan, Iran, Turkey and the United States, this study was conducted by a team of top-notch experts, both international and local, from Asian Disaster Preparedness Centre, Bangkok, OYO International Cooperation, and Japan in partnership with three abovementioned City Corporations. It revealed that Bangladesh faces a massive threat from a plethora of buildings that do not meet minimum safety standards against earthquake and fire hazards. The threat is seriously compounded by high population density, congestion, lack of enforcement on building codes and limited capacities in response, including the availability of critical equipment. Thus, this study provided critical inputs to develop scenario-based response planning for key national response agencies and offered processes for contingency planning for 13 response agencies including three City Corporations, Fire Service, Armed Forces Division (AFD), Department of Disaster Management, Directorate of Health and Utility Services (WASA, gas, and electricity) and telecommunications.

Mainstreaming Disaster Risk Reduction (DRR) in Urban Governance

Poor urban governance, informal settlements on unsafe lands, declining ecosystems and vulnerable rural livelihoods are main underlying risk drivers, which need to be addressed to build safer urban centers. Against such backdrops, CDMP II approaches the urban risk reduction through the execution of an integrated set of actions to adopt an all-urban hazard approach. CDMP II also propels mainstreaming of disaster risk management and strengthening community institutional mechanisms. CDMP II continues to work with key national institutions and enhance their capacity to address urban risks from earthquake, landslide, flooding, fire and others. CDMP II is deeply engaged with Municipal Association of Bangladesh to realize the 'Safer City' campaign and provides technical support for capacity strengthening of 140 municipality mayors from all over the country, who signed the 'My City is Getting Ready Global Campaign' of UNISDR. In addition to supporting the Ministry of Disaster Management and Reliefs (MoDMR), the Armed Forces Division at the Prime Minister's Office, CDMP II is strengthening the Fire Service and Civil Defence (FSCD) with cutting-edge training for officials, providing response equipment and most importantly connecting with communities to promote disaster volunteerism.

Community Volunteerism for Urban Disasters

CDMP II is the key vehicle to develop and realize the national vision of developing 62,000 urban community volunteers, of which 32,000 are in the process of being trained on search and rescue (SAR), equipped with safety gear and standing by to serve the country when needed. These community volunteers proved their worth during the Rana Plaza tragedy, where the building containing six garment factories, numerous commercial shops and a bank collapsed, killing more than 1,100 people. Around 200 CDMP trained firefighters and rescue experts engaged in rescue operations with overall coordination conducted by the Bangladesh Army. Approximately 800 urban volunteers, trained through CDMP support, joined the rescue operation on a rotational basis - 200 in each shift - and helped save more than 2,400 lives.

Enhancing Response Capacities: Equipment to address Urban Hazards

Continuing the support of CDMP Phase I, light and heavy equipment (cranes, pilot transporters, bulldozers, excavators, forklifts, emergency lights, search cameras, thermal imaging cameras, airlift bags, rescue jacks and wheeler water mist systems) was provided to Bangladesh Fire Service and Civil Defence. Drawing lessons from the Rana Plaza tragedy, targeted fire stations located within or near commercial hubs have been strengthened. Professionals and community volunteers attached to these stations are now being provided with additional support.

Piloting innovations: Connecting Urban Poverty with Urban Risk

To make communities more resilient, an innovative financing mechanism (Local Disaster Risk Reduction Fund- LDRRF) was developed to enhance risk assessment, planning and implementation capacities of urban authorities, ranging from small municipalities to megacity corporations. The LDRRF is being utilized to showcase community-based infrastructure, and mechanisms to mitigate impacts of urban hazards like landslides, water-logging, flooding, fires and earthquakes. Taking a step further, CDMP II also broadens the horizon to synergize with urban poverty issues. A pilot disaster resilient resettlement for evicted slum dwellers has been built in partnership with urban authorities aimed at demonstrating how disaster reduction considerations need to be imbedded in poverty reduction interventions for development of sustainment.

Considering the potential rainfall-induced landslide hazard in Bangladesh, CDMP-II developed the landslide risk reduction interventions that include Rainfall Triggered Landslide Hazard Zonation in selected municipalities. This intervention has introduced the Community-Based Landslide Early Warning System that has the component of community-based facilitators and volunteers skill development. The training of volunteers, linking them to the local administrations and providing simple tools and technologies were put into practice during the 2012 rainy season. While other localities experienced huge damage and casualties due to landslides, there were no reported casualties in the pilot areas.

Earthquake Contingency Plan

A national earthquake contingency plan has been developed highlighting nine operational clusters: command and coordination operations; search, rescue and evacuation operations; health services; relief services; shelter; water supply; sanitation and hygiene; restoration of urban services; transportion; and security and welfare services. With support from CDMP II, a three-tiered (agency, city and national-level) earthquake contingency plan has been developed to identify the key resources needed to respond to an emergency, build and train the emergency response team, and to restore the urban services for meeting immediate needs.

Bangladesh faces a massive threat from a plethora of buildings that do not meet minimum safety standards against earthquake and fire hazards.

Disaster Management Education: Institutionalizing Earthquake Safety Drills at Schools

To promote preparedness and awareness development, CDMP conducts school safety and evacuation drills throughout the country, with particular emphasis in the earthquake-prone cities. Since 2012, CDMP II continues to provide training to schoolteachers and instructors on earthquake safety. Earthquake drills were conducted in 42,000 secondary and primary schools across the country jointly with the Ministry of Primary and Mass Education (MoPME) and advocacy is continuing to insert drills into the school curriculum. A guidebook for school drills and corresponding information, education and communication materials was developed and distributed to earthquake-prone districts. Between the third and twelfth grades, more than 15 million students now have direct access to disaster and climate risk related information through 39 textbooks. CDMP II is also partnering with the key public and private universities and training institutes to advance the professionalization of disaster management by supporting higher education.

Promoting Risk Integrated Development Plan

Institutional partnership with Urban Development Directorate (UDD) was developed to showcase risk integrated development plans and subsequent training modules. The scope of this collaboration covers structure planning, urban area planning and disaster management plans, and subsequent training modules for targeted urban authorities to reshape their area-based planning process. So far, more than 1,300 construction professionals (bar binders, masons and day laborers) have been trained and received certification.

While some concrete steps have been taken to advance the urban risk management agenda through mainstreaming disaster risk reduction into governance, a lot more needs to be done. It is grossly inadequate and all areas need to be scaled up to correspond to the level of disaster risk Bangladesh currently faces. Lessons from the Rana Plaza collapse offer little confidence that Bangladesh would be able to respond effectively after a major earthquake. While Disaster Management Act (2012) provides a good foundation for legal and institutional framework for earthquake response, the implementation of agile policies, regulations and instruments such as the National Building Code (1993), Building Construction Regulations (2008), Fire Prevention Act (2003) and specific laws for industries remains at a critical juncture.

Bangladesh has proved the capacity to reverse its profile from a 'bottomless basket' to a 'global leader of disaster management.' The performance of the Bangladesh disaster management system has a proven track record that can be shown through the response to the recent storm Mahasen. The GoB successfully evacuated 1.1 million coastal residents within 24-hours to shelters, indicating the robustness of the disaster systems and structures; however, the same level of institutional readiness for urban disasters, especially earthquakes, is yet to be secured. Commitment from the international community in supporting Bangladesh to prepare for urban disasters is a major precondition. Urban risk reduction, therefore, needs to be at the center of policy and political processes and the synergy of the problem, policy and politics is the key to advance the urban risk management agenda.

Interview with Richard Hough, Senior Development Advisor to U.S. Pacific Command, U.S. Agency for International Development

LIAISON Staff

Richard Hough is a career Foreign Service Officer with the U.S. Agency for International Development (USAID). As the USAID senior development advisor to the U.S. Pacific Command (USPACOM), he works to maximize interagency cooperation and develop "whole of government" solutions to developmental challenges faced by both civilian and military agencies. His international career has spanned thirty years, with assignments in Africa, Eastern Europe, Southeast Asia and the Middle East. While in Indonesia, Hough managed the development of a new, post-9/11 strategy for USAID programs and following the devastating Indian Ocean tsunami of 2004, he produced a $400 million recovery and reconstruction plan for the province of Aceh. Hough has been assigned to USPACOM since September 2011.

(Since this interview, Hough has retired from service.)

LIAISON: What have been the most significant advances in disaster management over the last 10 years?

Richard Hough: We have learned through hard experience we need to understand and be constantly engaged in disaster management – we need to put the time and effort into doing it well. While we still haven't fully captured the need to change our resourcing and planning processing in light of this acknowledgment, we've made a lot of progress.

L: Can you give specific examples of that progress?

RH: The U.S. military, as a result of steady involvement in disaster management support, has fully internalized a robust understanding of their role within the U.S. government response to foreign disasters.

I was stationed in Indonesia from 2001 to 2007. When the tsunami struck I managed the USAID component of the post-tsunami recovery program. During the actual event we followed a somewhat informal process – we identified the need, validated it, the request then went up through the ambassador, to the Secretary of State, across to the Secretary of Defense and then down to the component commanders. In this case the ambassador got on the phone with the USPACOM commander, asked for help, and got it. The (USS Abraham) Lincoln carrier battle group that happened to be in the area got turned around on the high seas to figure out what they could do to help. They basically made it up as they went along, including the potentially contentious engagement with the Indonesian military, with which the U.S. had had very little interaction. Banda Aceh, one of the most devastated regions, was suffering from a civil war at the time. The military came into that situation, attended the meetings at the airport staging area with the other actors and people got together every evening and the coordination just occurred – no one was following a neat, concise rulebook. They were simply asking "what do we need to do," "who has the assets to do it, to meet the needs" and various organizations, including the U.S. military would answer. The military was a key provider of the "wholesale" heavy lift, mostly with helicopters since the port facilities were in many cases destroyed, and the host nation and NGOs took care of the "retail" delivery of supplies.

Now, this sort of interaction is articulated in policy, but it wasn't then and everyone did their best to be as efficient and effective as possible without overstepping organizational boundaries. The existence of (Office of the Secretary of Defense) policy directives today, clearly articulating the roles and responsibilities of military actors in disaster management in an interagency context, serve as evidence that this is not just a lesson identified, but an actual lesson learned – practical changes have been made and these changes have been reflected in policy, doctrine and training. It's a great lesson learned.

L: Is there progress outside of new policy and doctrine?

RH: The second major advance that comes to mind is the impetuous the response gave to enhanced efforts by the U.S. military to get to know the neighborhood. For example, during the tsunami response the navy didn't seem to have sufficient knowledge of the coastal waters to be perfectly comfortable with a lot of the movements they were doing. How deep is the water? What facilities were available? Thus USPACOM's Pacific Partnership started as an outgrowth of the tsunami response.

The first visit was a mess – I got a call, and the gist of it was "there is a ship coming in and what don't know what to do with it, any ideas?" In response, USAID tweaked some NGO grants, talked to local government partners and helped put a program together.

Now, almost 10 years later, the process has changed dramatically. Pacific Partnership is intensively collaborative, with deep planning, involving pre-event site surveys to determine local needs, engagement with local government, civil society actors and non-governmental organizations.

To know your area, know your partners, and practice is key to success in disaster response – the only way to do it well is to get out there and do it, before the crisis. This emphasis on the importance of and utility of resource expenditure, getting to know each other before a crisis, is an important outcome of the hard (humanitarian assistance/disaster management) experiences of the past. Learning from those experiences is continuing, and will continue, to better inform our approach to disasters.

L: How does the military fit into the local picture?

RH: As we look at the recent past and to the future, local disaster management capability is growing. In round numbers, out of 100 disasters 10 require international assistance from the U.N., USAID, NGOs, et cetera, but only one out of 100 has a requirement for the unique capabilities DoD assets provide.

However, 70 percent of militaries in the Asia-Pacific area are first responders, often with support from the local Red Cross, Red Crescent and other local actors. We still need to work with our partners to articulate which slice of that reality we are addressing to increase conceptual clarity given our different policy postures on the use of military capabilities in disaster response activities.

L: Are there other advances that don't involve disaster management?

RH: Another major advance, in its early stages, consists of enriching our threat definition. I was absolutely

floored when Admiral Locklear identified climate change as a threat from a security perspective.

For example, two countries most at risk from a rise in sea levels are the Republic of Kiribati and the Maldives, which are in USPACOMs neighborhood. What does inundation of these countries mean? We already have a good understanding of the ramifications when viewed from the humanitarian, economic and social perspectives; however, what happens when there is no more dry land from which to measure the exclusive economic zone? What happens to the ocean bed minerals, the fishing, who owns that stuff, under the U.N. Convention on the Law of the Sea? More importantly from the USPACOM perspective, who will start competing for it and when does that competition turn to fighting? Looking a few years into the future at this issue from a security perspective is an example of redefining the threat.

Another way of enriching our threat definition concerns the whole issue of pandemic and emerging diseases. USAID has looked at pandemics from the human impact and developmental perspectives; it is a health sector issue, but impacts the economy and other elements – we've been working on it for decades.

The military is increasingly recognizing the importance of pandemics as well. For example, USAID gave USPACOM and USAFRICOM money to work with us on planning for national civil-military preparedness in response to a pandemic influenza. It did some good - it is just planning, but planning that wasn't there before. More importantly, the project helped build a foundation of awareness by military personnel for the potential threat that those disasters represent. The military may look at pandemics as a force protection issue, for both host nations and U.S. militaries. But when you take it a step further, pandemics have potential impacts on the ability to perform the core military mission of defending the homeland. Now these issues are included not just in planning, but as a result of the threat definition having been expanded actual programming is being placed against these issues. USPACOM's use of the term "all hazards" in its strategy is a reflection of this broader definition of threat. "All hazards" are a big source of the threat in the future.

L: How does USPACOM prepare for 'all hazard' threats?

RH: Identify the risk, threat, and prepare to deal with it. We need to do the analysis, understand the threat, identify where you can intervene in advance to lessen the impact when, not if, it occurs so what can you do now to diminish the threat to our interests, threats to homeland. An area that deserves more emphasis is thinking through and then executing ways that we can use our ongoing engagements to enhance local preparedness.

> "The terms are all in the paperwork, but it is still hard to find them in the programs that are implementing the ideas."

Military to military training is important on this, but it typically stops analyzing issues like "how many trucks do you have available?" or "what is your supply situation?" It is almost exclusively a logistical conversation. We need to push the envelope, go to the left of the event, get deeper into disaster preparedness issues and answer the question: "are we developing the capabilities we need to respond?"

Resiliency and disaster risk reduction are being absorbed into military speak, which is very good. We need to make sure that we are looking at the underlying causes, and asking if there is there anything we can do through our engagements to address the issues posed by that underlying condition. The resiliency words have crept in; however, they haven't transitioned all the way down into plans and actual event execution as much as they need to. The terms are all in the paperwork, but it is still hard to find them in the programs that are implementing the ideas.

Interview conducted by
Michael Hallett, July 31, 2013.

Military-Military Cooperation on HA/DR in the Indo-Pacific Region: JSDF's Perspective

By Col. Nozomu Yoshitomi, Ground Research & Development Command
Japan Ground Self-Defense Force

Mass Communication Specialist Seaman Kyle D. Gahlau/ U.S. Navy

The Indo-Pacific is the most disaster prone region in the world, yet the stability of this region is critical due to its developing economy and global security influence. As a result, maximizing humanitarian assistance and disaster relief (HA/DR) in this region is not only a humanitarian necessity but also required for stability of the economic and security environments.

Traditionally, the military is the first responder in many cases because of its unique capability to deploy substantial search and rescue, humanitarian aid and recovery assets; however, the Oslo Guidelines of 1994[1] state that the military should be the last resort for HA/DR. Even so, international cooperation among militaries (mil-mil cooperation) in this region would be a significant step toward mitigating the damage caused by large-scale humanitarian catastrophes. It becomes essential that the Japan Self-Defense Forces (JSDF) and other militaries in this region work together in overseas HA/DR events, and hopefully the mil-mil cooperation would also lessen the challenges between the civilian and military sectors of HA/DR.

JSDF's overseas HA/DR

The JSDF's role and mission for overseas HA/DR is stipulated by Japanese law, which allows medical support, providing a clean water supply, local helicopter airlifts, and strategic sealifts and airlifts from Japan to the affected area. To fulfill immediate requests for overseas HA/DR support, the JSDF maintains designated units through the Ground Self-Defense Force (GSDF), the Maritime Self-Defense Force (MSDF) and the Air Self-Defense Force (ASDF), and depending on need, can provide medical units, transportation vessels and aviation capabilities.

The JSDF's first overseas HA/DR operation was the disaster relief in Honduras in 1998. Since then, the JSDF has conducted 17 overseas HA/DR operations to date. Of the 17 operations, nine were in the Indo-Pacific, five in the Near and Middle East, two in Central America and one in Africa. The JSDF's responses for HA/DR in Indo-Pacific region since 2001 are shown in Figure 1.[2]

The first JSDF's HA/DR in the Indo-Pacific was in India after the Gujarat earthquake in January 2001. The ASDF carried relief materials from Japan to India and the GSDF supported the construction of tent sites for survivors in the affected areas. The next operation was in response to the Indian Ocean tsunami in December 2004. The JSDF conducted search and rescue missions, provided local airlifts, medical support and strategic sea and air lifts in cooperation with U.S. forces and other militaries. After the 2010 floods in Pakistan, the JSDF's aviation unit cooperated with the Australian Defense Force (ADF) medical teams to provide medical support for the affected people.[3] Most recently, the JSDF cooperated with U.S. forces and other militaries during the 2013 disaster relief efforts in the Philippines. In all of the cases the JSDF received support requests from the militaries and civil authorities of the host nations.

The JSDF continuously prepares for HA/DR by participating in exercises to develop and maintain the skill sets and overall capabilities necessary. In 2011, the JSDF joined the Association of Southeast Asian Nations (ASEAN) Regional Forum Disaster Relief Exercise in Indonesia[4] and has participated in the multinational exercise Cobra Gold in Thailand since 2005. During the Cobra Gold exercise the JSDF cooperated with U.S. forces, Royal Thai forces, and other militaries on HA/DR scenarios and continues the collaboration whenever possible.

Since 2010, the JSDF has par-

Year	Country	Type of Disaster
2001	India	Earthquake
2004	Thailand	Tsunami
2004	Indonesia	Tsunami
2005	Russia	Submarine Accident
2006	Indonesia	Earthquake
2009	Indonesia	Earthquake
2010	Pakistan	Flood
2011	New Zealand	Earthquake
2013	Philippine	Typhoon

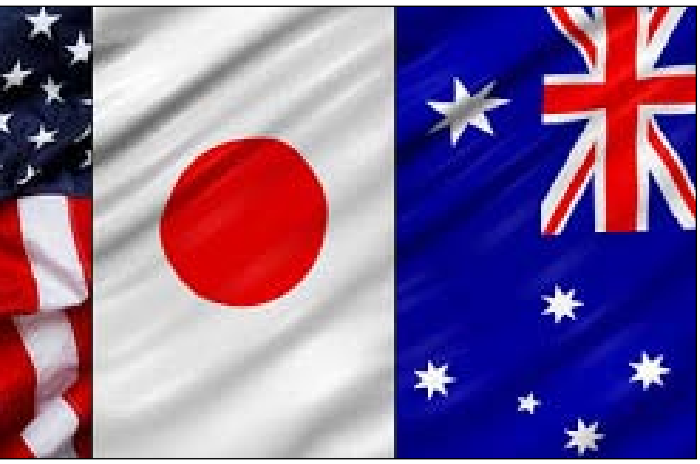
Figure 1: JSDF's previous responses for HA/DR in Indo-Pacific

1 The "Oslo Guidelines" were originally prepared over a period of two years beginning in 1992. They were the result of a collaborative effort that culminated in an international conference in Oslo, Norway, in January 1994 and were released in May 1994.

2 Japan Ministry of Defense, Defense of Japan 2013, August 2013, pp. 386-387.

3 Joint Staff Official Website, http://www.mod.go.jp/js/Activity/Past/pdf/pakistan_kinkyuenjo/paki20100930.pdf accessed on 16 February, 2014.

4 Defense of Japan 2013, p. 231.



ticipated in Pacific Partnership in cooperation with Japanese nongovernmental organizations (NGOs). Sponsored by U.S. Pacific Fleet, Pacific Partnership is the largest annual disaster response preparedness and civic assistance mission in the Indo-Pacific region. During the mission, the JSDF has provided medical treatment and public health education in Vietnam, Cambodia, the Philippines, East Timor, Micronesia, Tonga and Papua New Guinea.[5] In addition, the JSDF has been conducting capacity building support since 2012. JSDF personnel also spent approximately three months providing education to members of the East Timor Army to develop skills related to HA/DR.[6]

2011 Earthquake Response by JSDF

On March 11, 2011 Japan was struck by a 9.0-magnitude earthquake and follow-on tsunami. The JSDF deployed approximately 107,000 personnel immediately after the event as a disaster relief operation that consequently lasted more than nine months. The operation was the largest in JSDF history and American and Australian forces came to assist. The Americans launched a large-scale disaster relief named Operation Tomodachi and deployed 24,000 military personnel to Japan. Their primary mission was transportation, reconstruction and civil support. JSDF's cooperation with U.S. forces was successful due to the close alliance between the two nations. The ADF conducted a strategic airlift operation named Operation Pacific Assist.[7] The JSDF's cooperation with the ADF went relatively smoothly as both forces have been developing a cooperative posture.[8]

Lessons learned from JSDF's overseas HA/DR and 2011 Response

Three perspectives can be useful to evaluate lessons learned from the HA/DR cooperation: the first is *framework*, the second is *capability* and the third is *acceptability by host nations*.

Regarding framework, establishing a legal agreement in advance is critical for effective and rapid mil-mil cooperation. As seen between Japan and the U.S., the alliance-based approach is the best method for cooperation because many necessary agreements for HA/DR are already in effect – logistics and information sharing are two good examples. On the other hand, the shared experience of staff talks and exercises without pre-existing legal agreements can produce a de facto framework nearly as easily, as the basis of the framework could be the mutual confidence between the nations and militaries.

The unique military capabilities are the raison d'etre in HA/DR events. Intelligence, communications, coordination, transportation, and interoperability are essential components of mil-mil cooperation.

Acceptability by the host nation is always an indisputable factor for foreign military activities in sovereign countries. In order to establish broader friendly relations, communication not only with the host military, but also with relevant civilian entities is necessary. Moreover, a foreign military needs to have cultural awareness of the affected people in the case of overseas HA/DR operations. As a result of a framework and capability plan laid out in advance between JSDF and U.S. forces, acceptability resulted easily during the 2011 response.

Improving JSDF's mil-mil cooperation in HA/DR

Through the lessons learned from Japan's overseas and the 2011 HA/DR operations, improvements can be made to the JSDF's mil-mil cooperation from the perspective of framework, capabilities and acceptability by host nations:

Framework

From the perspective of framework, the JSDF's mil-mil cooperation partners can be categorized into four tiers as shown in Figure 2.[9]

Tier-1 partners are allied nations. The United States is Japan's sole allied nation and both forces have close legal and institutional connections and a rich history of cooperation.

Tier-2 partners are not allied forces but have legal agreements with JSDF. The ADF is the only military, except for the U.S., that has agree-

5 Ibid, p. 230, p. 375.
6 Ibid, pp. 227-229.

7 Operation Pacific Assist was the joint effort between the ADF and Emergency Management Australia (EMA). http://www.defence.gov.au/op/pacificassist/ accessed on November 21, 2013.
8 Defense of Japan 2013, pp. 233-234.

9 The similar type of partnering framework from U.S. perspective is seen in the following paper. Jeffrey W. Hornung, "Drawing Lessons from Operation Tomodachi for Trilateral HA/DR Operations: A U.S. Perspective", Enhancing Trilateral Disaster Preparedness and Relief Cooperation between Japan, U.S. and Australia; Approaches from Various Civil-Military Perspectives, Joint Research Project by ACJUA, APCSS and QUT, July 2013, pp.104-117.http://www.apcss.org/wp-content/uploads/2013/08/HADR-PROJECT-for-publication-0822.pdf Accessed on November 21, 2013.

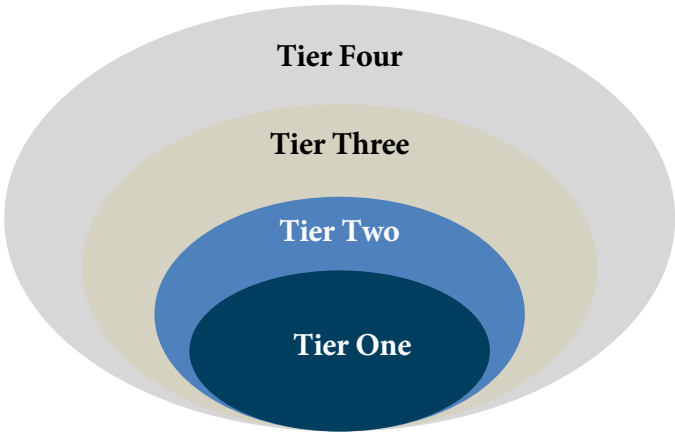


Figure 2: Partners of JSDF's mil-mil cooperation

ments with JSDF covering logistics and intelligence.[10] Additionally, the JSDF and ADF have been developing cooperative relations through a series of exercises and real-world operations.[11]

Tier-3 militaries do not have legal agreements but have some experience of cooperation with the JSDF either in exercises or operations. For example, the Armed Forces of the Philippines, Thailand, India, Russia, and the Republic of Korea (ROK) are in Tier-3.

Tier-4 militaries have no legal agreement and no experience of cooperation with JSDF. The Armed Forces of China, Myanmar and Taiwan would be in Tier-4. However, militaries in Tier-3 and Tier-4 have the potential to be close partners by increasing mil-mil cooperation with the JSDF.

Capabilities

Regarding the capabilities of mil-mil cooperation, the JSDF should enhance its capabilities with respect to intelligence, communications, coordination, transportation and interoperability.

Gathering detailed information on humanitarian catastrophes and sharing it with other partners is the most important activity related to HA/DR. Therefore, the JSDF should enhance its information gathering capabilities from space, air and ground. At the same time, the capability to plug into the civil-military information network in a timely manner is also necessary. Developing a better communications capability is a central issue for mil-mil cooperation due to the necessity of sharing information and for coordination. Additionally, foreign language capability should also be improved.

Regarding coordination, the JSDF has depended upon ad-hoc coordination with other militaries in previous HA/DR operations. This ad-hoc process was time-consuming and insufficient. Therefore, establishing an agreement on the mechanisms and procedures for coordination in advance would be helpful. Moreover, the standing coordination body would maximize the coordination capability.

Transportation is another indispensable military capability. Strategic and heavy airlift capabilities are essential to deploy personnel, materials and equipment to the affected area. The JSDF is now developing a strategic airlift capability[12] but cooperation with the U.S. Air Force and Royal Australian Air Force would have a synergistic effect in establishing a strategic airlift network in this region.

In addition to strategic airlift, sea-basing capabilities needs to be considered for HA/DR operations in the Indo-Pacific region that covers a vast maritime domain. Sea-basing can become an off-shore platform for HA/DR activities. It should be composed of aircraft carriers, helicopter carriers, amphibious ships and replenishment ships. Helicopters and landing craft are the connectors from sea-bases to affected areas. During disaster relief operations after the Indian Ocean tsunami (2004), Japanese earthquake and tsunami (2011) and the typhoon in the Philippines (2013), sea-basing by Japanese, American and British naval ships

10 Japan and Australia signed the Acquisition and Cross-servicing Agreement [ACSA] on May 19, 2010 and the General Security of Military Information Agreement [GSOMIA] on May 17, 2012.
11 During the JSDF's operation in Southern Iraq from 2003 to 2009, the ADF supported the JSDF for its force protection. From 2012 the JSDF and ADF has been cooperating in the United Nations Mission in South Sudan (UNMISS).
12 Japan Air Self-Defense Force will deploy new strategic transportation aircraft named C-2 in 2014. The maximum payload of C-2 will be 30 tons.

Figure 3: The overall structure for the acceptability by host nations

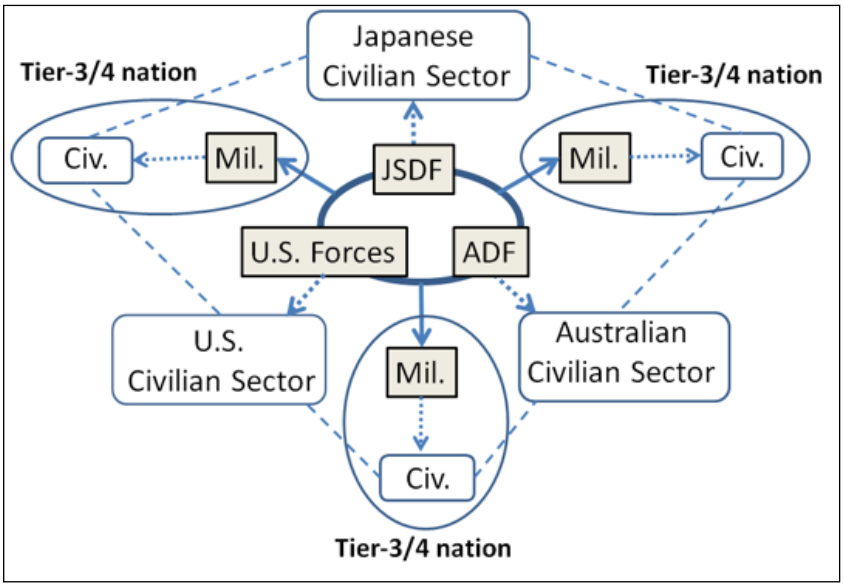


Figure 4: The image of civil-military coordination network

played a vital role as hubs for relief operations.[13] Additionally, the Royal Australian Navy will possess two large amphibious ships in the near future[14] and their capacity as a sea-base would be important for HA/DR operations in the Indo-Pacific.

The most basic capability for mil-mil cooperation is interoperability. Generally speaking, interoperability needs common equipment, procedures, doctrines and mindsets. The JSDF has prioritized interoperability with U.S. forces; however, the JSDF's equipment, procedures, doctrines, and mindsets need to reflect possible cooperation with militaries in the region other than the United States.

Acceptability by Host Nations

The overall structure for the acceptability by host nations is shown in Figure 3.[15]

The basis of acceptability by a host nation is its military and civilian authorities having confidence in the JSDF. The JSDF should develop its confidence building efforts through personal interaction and operations in the Indo-Pacific. This confidence building would be realized as a sort of "framework building" in Tier-3 and Tier-4 host nations.

Concurrently, to elevate the acceptability by a potential host nation's military, capacity building support for HA/DR related skills of military personnel would be helpful to deepen relations with regional militaries as potential responders and recipients. Multinational exercises are also necessary to develop the interoperability of equipment and procedures between countries and could potentially elevate the acceptability by host nation militaries and civilian authorities. The JSDF has participated in a few regional multilateral exercises with potential host nations but should participate in this type of exercise more frequently. Moreover, civil support activities such as the Pacific Partnership exercise are helpful for the JSDF to elevate acceptability by potential host nation militaries and civilian authorities including local governments and NGOs. The JSDF should join this type of activity continuously and proactively with other regional civil-military entities.

U.S. forces and the ADF are also improving military capacity building in many countries in the Indo-Pacific. The Defense Ministers of Japan and Australia and the United States Secretary of Defense have already agreed to foster capacity building with other nations and regional forums.[16] The cooperation by the three militaries and regional actors could be critical to developing the acceptability for a trilateral commitment in potential host nations, especially since JSDF is the only Asian military in the trilateral framework and its cultural awareness of people in this region would be helpful to elevate acceptability by host nations.

Political precaution for better mil-mil cooperation in HA/DR

Regarding mil-mil cooperation in the Indo-Pacific region, political precautions are necessary even in HA/DR. From the JSDF's perspective, U.S. forces and the ADF are the best partners for cooperation, but this trilateral framework consists of primarily military responders. Therefore, potential host nations may be doubtful whether three militaries can respect their national policies and sovereignty. Additionally, this trilateral framework consists of allied countries of the U.S. Countries like China may raise political and security concerns as a result.[17]

Even with the potential for alarm, multinational HA/DR is a humanitarian activity and should not be constrained by political concerns. The JSDF should strive for a framework that includes not only U.S. forces and the ADF but also Tier-3 and Tier-4 militaries of countries like India, Southeast Asian nations, ROK,

13 Typhoon Haiyan hit the Philippines on November 8, 2013. The Japan Maritime Self-Defense Force, U.S. Navy and Royal Navy deployed two aircraft carriers (USS George Washington and HMS Illustrious), a helicopter carrier (JS Ise) and three amphibious ships (JS Ohsumi, USS Ashland, and USS Germantown).
14 The first ship, named HMAS Canberra, is due to be commissioned in the first quarter of 2014 and the second one, HMAS Adelaide, is planned to commission in 2015. http://www.navy.gov.au/fleet/ships-boats-craft/lhd accessed on 31 January, 2014.
15 Figure-3 is written by the author.
16 Japan–Australia–United States Defense Leaders' Joint Statement (2 June, 2012) http://www.au.emb-japan.go.jp/pdf/Japan_Australia_US_Defense_Leaders_Joint%20Statement_02062012_eng.pdf accessed on 31 January 2014.
17 Chinese Foreign Ministry spokeswoman Hua Chunying said on October 7, 2013 "The United States, Japan and Australia are allies but this should not become an excuse to interfere in territorial disputes, otherwise it will only make the problems more complicated and harm the interests of all parties."http://www.reuters.com/article/2013/10/07/us-asia-southchinasea-china-idUSBRE99602220131007 accessed on November 24, 2013.

China, and international organizations such as the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) and United Nations High Commissioner for Refugees (UNHCR). This broader framework, in addition to the trilateral militaries as the core responders, would be helpful to develop acceptability by many potential host nations, relieve political concerns and can be a means to contribute not only to the humanitarian cause but to the stability of the India-Pacific region.

Mil-mil cooperation aiding civil-military coordination in HA/DR

As seen in the Japanese tsunami and Typhoon Haiyan examples, mil-mil cooperation cannot be replaced in effective and rapid HA/DR operations, yet per the Oslo Guidelines the military is supposed to represent a last resort. This means that the civilian sector should be the main body to respond to HA/DR and the role of military is to support the civilian sector. Therefore, civil-military coordination should be more significant than mil-mil cooperation, but varying cultures can create challenges even within a single country. Moreover, the Indo-Pacific region includes dozens of countries with various races, cultures, religions and languages. This means civil-military coordination could potentially be a serious challenge to HA/DR in the region.

On the other hand, most militaries, even in Tier-3 and Tier-4, share a common military culture with JSDF, U.S. forces and the ADF. Moreover, a lot of militaries in this region have already established mutual understandings and cooperative postures through personnel exchange, conferences and exercises. In this context, the trilateral framework should be developed as the core of mil-mil cooperation and used as the catalyst to broaden the civil-military coordination network in the Indo-Pacific region. The image of this network is shown in Figure 4.[18]

Japanese Lt. Gen. Masayuki Hironaka, U.S. Pacific Air Forces commander Gen. Herbert Carlisle and Royal Australian Air Force Air Commodore Anthony Grady work together to strenghten the tri-lateral relationship.

Conclusion

On November 2013, Typhoon Haiyan hit the Philippines and caused devastating damage. Militaries inside and out of the Indo-Pacific region, including Japan, the U.S., Australia, India, the U.K., Canada and China joined the large-scale and complex relief operation. Mil-mil cooperation was the key to increasing the effectiveness of multinational relief activities as militaries from countries worked together to aid the people of the Philippines.

JSDF is now developing its capability for overseas HA/DR, making efforts to elevate the acceptability by host nations, and enhancing the cooperation with U.S. forces and the ADF. Through a trilateral commitment capabilities would increase, acceptability of host nations would grow and future HA/DR operations will become even more efficient. The only possible concerns of a strengthened trilateral commitment are political and security unease from other nations, which can be mitigated by inviting Tier-3 and Tier-4 militaries into the process. An additional goal of the process is that increasing mil-mil cooperation challenges between the civilian and military sector would lessen, and ultimately the cooperation would lead to, a network that represents the most powerful HA/DR tool for Indo-Pacific nations when another disaster occurs.

18 Figure 4 was created by the author.

A volunteer for International Medical Relief depends on medical supplies reaching remote locations.

Pushing Humanitarian Logistics to the Edge:

The Purple Shovel Story

LIAISON Staff

An earthquake rocks Japan and the tsunami that follows submerges towns. A typhoon devastates the Philippines leaving mountains of debris in its wake. Tens of thousands of people are homeless and lacking food, water or shelter while they rebuild their lives and mourn those they have lost. The worldwide humanitarian community rushes to help those in need and ordinary people, wanting to help, fill shipping containers with food, clothing and other necessities, only to have the aid stuck on a seaside dock. Purple Shovel, a service-disabled veteran-owned transportation company, is working to stop aid from being needlessly wasted as a result of transportation challenges and delays.

In 2009, Benjamin Worrell, the founder and chief executive officer of Purple Shovel, saw first-hand the frustration and confusion that accompanies these types of transportation requests and sought a solution to the challenge. He wanted to prevent developmental and faith-based organizations, which had spent quality time, money and resources to do great things for others, from having their ability to affect positive change negated as a result of the improper filing of the required paperwork. Purple Shovel was the result of his efforts.

Worrell describes Purple Shovel as a "global logistics company with a thriving humanitarian business line" and states it was created to provide services to an underserved group of humanitarian entities composed of small organizations, community groups, churches, and business associations. These groups engage in humanitarian enterprises to help meet the needs of the world's most

exposed communities.

He discovered that many freight forwarders providing service to the humanitarian industry had become disillusioned by the highly complicated set of hurdles that defines humanitarian aid, hurdles he knew could be overcome. Worrell set out to close the gap that existed in the methodology used to provide logistical services to the humanitarian arena and the effort that was needed to facilitate a successful outcome for donors. What was standing in the way was the uniqueness of these types of transportation requests – usually one-time events, serving small numbers of people in remote areas, with additional factors that can influence regional interventions like economic conditions, social dynamics, changing political climates, sanctions and media influences.

Worrell was not intimidated. He began thinking about ways he could structure a business model that would help unify the humanitarians and the logisticians in a mutually beneficial way.

"Purple Shovel's main objective is to effectively maximize the success rate associated with the execution and distribution of products to the end destination," said Worrell. "By knowing local rules, we make it possible to get useable products to remote locations."

"It's so hard to move small things," said Karen Walsh, chief executive officer of Blue Glass Development. "Many shipping companies want bulk movements and have no support once they get to the country. (Purple Shovel's) network on the ground makes it possible, and are there to help us and support us if something goes wrong."

From the start, Purple Shovel strived to understand the logistical environment in which humanitarian aid exists. Maximizing value and minimizing losses demands extensive preparation, in the form of researching legal policies and regulations, cultural awareness and relationship building. That's why before starting the business, Worrell insisted employees of the company spend 18 months obtaining the operating authorities, building forwarding capabilities and learning about the regulations governing the import and export of humanitarian goods.

"Most people just want to take the path of least resistance," said Jim Brech, vice president of operations, Purple Shovel. "They move shipments from point A to point B, usually a port or airport near a major population center. We don't stop until the goods are delivered directly to the end user."

Brech says that the key to making complex deliveries possible is cultivating relationships through communication and respect. Early engagement with key personnel including customs officials can help alleviate many of the security challenges that are present when making deliveries to regions in crisis, as well as misun-

Purple Shovel

(Left) Purple Shovel uses shipping containers modified with doors and windows that can be used by receipt communities after the aid is gone.

(Above right) Purple Shovel often travels with heavy equipment, like the crane shown here, in order to offload shipping containers of aid.

derstandings about duties and taxes, which continue to be a complicated matter worldwide. By focusing on the relationships, the strengths of each partner in the network are maximized to bring the aspirations of donors and specific-need populations together.

"With Purple Shovel there's no such thing as 'stuck in customs,'" said Walsh, who has used the company to ship humanitarian goods from medical equipment to vehicles. "They find inventive solutions. It makes a difference."

The company also realizes that interventions have the potential to cause more harm than good through unintended consequences. Worrell says that it's important to determine what the specific needs are regionally and to listen carefully to the local consumers.

"Before we move anything, a team is assembled to analyze and assess the situation. Care is taken not to impose our values or ethics on the indigenous population. We make every effort to meet recipients where they actually are before helping them get where they want to go."

Diligence has resulted in the awareness that there are many aspects of providing aid to be considered. First, knowledge and appreciation of diverse cultures promotes capacity building without unduly increasing the invasive footprint of the relief itself. Also, extreme caution is taken to prevent harm from occurring either directly or indirectly to the local population by the goods brought in to provide relief. For example, if unsuitable food is brought into an area, there could be detrimental side effects that can lead to illness and cause the user's body to reject the product.

Worrell explains, "due to celiac disease among children in a North African country we had to source and deliver gluten free products for a donor, because the wheat that many other organizations were providing was making this critical population sick."

Harm can also result indirectly, like when there are individuals or groups that do not want the recipients to accept the goods and have the inclination to withdrawal the aid by threats or violence. In addition, forethought should be given to ensuring that recipients actually consider themselves beneficiaries and are not further victimized by the intended goodwill.

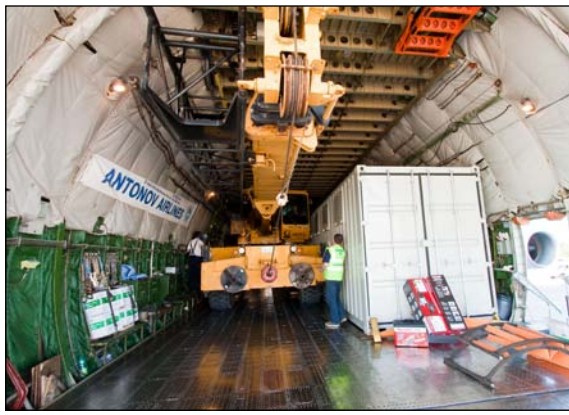
"The end user needs to be an integral part of the logistics sequence," said Worrell. "It might cost a little more money and time in the beginning, but in the long run if you don't get that local involvement, the pain caused by flaws in the process through which the aid is delivered can actually outweigh the value of the aid itself."

As a result, a great deal of emphasis is placed on the importance of communication between all parties involved from the customer to the beneficiary in order to determine the best course of action in achieving the goal.

Once the company determines the best course of action, the logistics of getting the goods to the end user begins; however, when moving goods through foreign countries, the process isn't cut-and-dry.

"It is the laws and regulations of a country that make a product moving through a supply chain 'humanitarian' versus 'commercial,'" said Worrell.

He explains that the regulations differ in each country, and many supply chain inefficiencies result from a lack of knowledge of the differences, so understanding the subtle nuances is essential. For example, a problem with a single item can hold up a 40-foot container of goods, or a change in the coding of a medical product's label can ultimately prevent the import of much needed medical kits. Easily made mistakes arise from a failure to understand the regulations governing the importation of humanitarian material and can have real costs.



In another effort to save money for their customers, the growing company is also providing opportunities to bring the manufacturing of products closer to the end recipient. In 2013, the company utilized its worldwide partners to manufacture 19 products in 14 countries. Goods like chira (pressed rice), blankets and gluten-free products can be processed locally to enrich the lives of people by minimizing the cost of production for the donor while providing high-quality health benefits to the beneficiary.

In another avenue of long-term development, while most logistics companies want to lease containers and keep them moving, Purple Shovel sees bigger potential. When possible, Purple Shovel helps small humanitarian organizations add value to their recipient communities by using containers that are modified with doors, dividers and windows so they can be converted after the delivery into functional spaces like shops or schools. The dual purpose reduces costs and is a creative way to improve the quality of life at the receiving end of aid.

"Over the last 20 years, the reach of globalization has brought so many people out of poverty; we are just trying to help small humanitarian organizations to reach those still suffering," said Worrell.

technology & di

Technology Integration for Performance Measurement in Training for

sasters

Disaster Management

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Advances in mobile computing (e.g., sensor technology, context aware computing and cloud computing) allow for the design of a tool that goes beyond the traditional methods of data gathering. In time-critical scenarios, such as disaster management, pararescuers are focused on completing the task using their tactical and strategic skills. They train and are tested on the different aspects of the mission - locate, stabilize and exfiltrate. In order to effectively evaluate their performance there is a need to capture the measures of effectiveness in real-time and present it to the team during the after action review. In their day-to-day activities, first responders focus on time-critical tasks that are very hectic and can be cognitively demanding. Hence, the focus of this article is on developing a framework to capture the measurement of effectiveness with the integration of mobile technologies.

During disaster response, emergency operators need to make critical effectual decisions within short time constraints undeterred by grave uncertainties to cut down on causalities, reduce the resulting financial losses and to restrain the situation from causing any secondary disasters. In crisis situations, transmission of precise information rapidly can positively affect the crisis response operations, preserving human life and property. In the aftermath of a disaster, the existing infrastructure including the communication networks that are used by safety radios are overwhelmed by the increase in network traffic. Most of these networks are operated by specific providers and use proprietary technology. Interoperability bridges can be utilized to reduce the stress on these networks and redirect traffic to reduced bandwidth networks.[1]

According to Naveen et al.,[2] crisis response operations consist of four integral phases:

a) Damage assessment – in this phase, the resulting losses are ascertained. The problems, which require immediate attention and time needed to restore normalcy of affected systems, are determined. These issues may include identifying locations, which have been seriously affected, and places where preliminary damage may result in secondary accidents if not contained quickly;

b) Needs assessment – events that may need help of emergency operators for rescue operations at any scale are identified and are ranked on a priority scale established on whether there is an immediate threat to human life;

c) Prioritization of response measures – in this phase, resources are paired with events which necessitate response and in cases where demand for resources is greater than the capability of the disaster response units (as in an massive calamities), the resources are prioritized and applied depending on the judgment of the decision-makers;

d) Organizational response – during this phase, decision support systems are employed for efficient use of existing resources to monitor important movements and to be updated about the movements of emergency units. All emergency units are utilized and organizational decisions are promulgated to emergency workers and the general population.

The process listed above is a continuous one, in which decisions made at one phase directly influence the subsequent phases. For this process to be effective, the different actors involved need to interact swiftly and this in turn depends on making timely and precise information available to these individuals. Software solutions can record specific event data during crisis response activities and this data can be transmitted to emergency operation centers (EOC) in real-time for event analysis and augmentation of the decision-making capabilities of the crisis responders. The event data can be retrieved from multiple simultaneous sources including satellite images, video feed from cameras planted at different locations, sensor information from different devices and observations made by first responders who can be communicated wirelessly to EOCs. Other vital information can be retrieved by analyzing the fleecing patterns of people around the incident site, which may provide information regarding the location of the incident. All this information must be transferred across the existing mobile framework that may fail or be susceptible to external attacks. It is important that existing information systems are used efficiently so as to "turn the available information into actionable information for people and systems."[3] To achieve this objective, the available information needs to be analyzed and the areas that have been affected needs to be identified. The infrastructure needs to made reliable and have distributed networking that can switch between different nodes based on geography, load, type of message, and so on. A system with robust architecture should be developed that can integrate data from different sources such as different information streams (audio, video, images) during a disaster and enable automated continuous sharing of this information and minimize manual intervention.

In distributed mobile applications, where information has to be transmitted over limited bandwidth networks, information transmitted should be prioritized or should be set to minimal so that cost of transmission delay does not have a significant effect on actions being performed. The communicated content has to be configured and controlled to enable timely, quality decisions despite time constraints.[4,5] Due to the limitations of human information processing and cognitive abilities, human decision-making capabilities including quality of decisions being made decreases in cases where a large block of information needs to be reviewed while the time window for making the decision is very small.[6] According to Simon,[7] the information processing by humans is generally sequential. Studies have shown that human performance degrades as the information being presented increases and performance can be increased by showing only the relevant information by filtering out information not relevant to the task being performed. Research by Miller[8] in human cognition has shown that when making decisions, humans generally can consider only five to nine

1 James R. Gruenberg, "Managing the Complexities of Incident Command" in L. R. Adedeji B. Badiru, *Handbook of Emergency Response: A Human Factors and Systems Engineering Approach* (CRC Press, 2013) pp. 554-555.
2 Naveen Ashish et al., "Situational awareness technologies for disaster response" in *Terrorism Informatics*. (Springer, 2008).
3 Ibid.
4 Eric Horvitz, "Transmission and Display of Information for Time Critical Decisions," *Microsoft Research*, 1995.
5 Eric Horvitz and Matthew Berry, "Display of Information for Time-Critical Decision Making," *Microsoft Research*.
6 Horvitz, "Transmission," 1995.
7 Herbert A. Simon, "Theory of Problem Solving," *Information Processing*, 1972.
8 George Miller, "The Magical number seven plus or minus two: some limits on our capacity for processing information," *Psychological Review*, 63:81-97, 1956.

The Joint Command Operations Research Environment (J-CORE) at the National Center for Medical Readiness

National Center for Medical Readiness

chunks of information at a time and this may reduce even further in crisis situations that need swift response. It is important that the interface integrates relevant information and presents it to the user in a format that captures their attention without information overload.

This article provides an overview of the mobile computing application that can capture performance measures to provide aid to training. The performance measurement tool facilitates improved communication and training of users in time critical situations. The data collector uses the tool to measure the objective performance measurements – time taken to complete the task and quality of decision-making for pararescuers that map to the learning objectives. This provides quick access to a chart that can list the different decision-making points and the associated data. This study also developed tools for performance measurement to aid after action reviews in live, virtual and constructive (LVC) sensor integration for data fusion in operations and training (SIDFOT). LVC SIDFOT is focused on developing architecture that allows the integration of LVC sensor data through ad-hoc sensor networks, enabling data fusion for innovative operations, first responder operations and training research.

LVC SIDFOT

Live, virtual and constructive training research and development under the SIDFOT effort is aimed at enhancing the ability of military and civilian first responders to make time-critical, life-saving decisions under uncertainty. The SIDFOT LVC technology integrates the live environment into a virtual world through the use of game engine technology. Engineers have developed an open architecture to allow the LVC sensor data through ad-hoc sensor networks enabling data fusion for innovative operations and training research. Live exercise participants, vehicles and buildings are represented, in real-time, as entities in the game engine. On scene, as well as distributed, EOC commanders can manipulate the virtual environment to see different views of personnel in the field using different sensor technology. Decision-makers can track their team member locations via mobile technologies as well as employ deployable sensor technologies providing critical real-time data to decision-makers in both training and operational environments. Leveraging advances made under recent LVC research efforts, the current effort is applying best-value technologies to enable a LVC enterprise for supporting critical first responder training. Research focus areas include improved measurement and tracking of responder position and status, tools for managing LVC exercise data and providing useful feedback to trainees, developing the architecture to support integrated training events across the region, and researching the ability to secure the deployable networks to ensure the safety and generalizability of LVC architectures. Deployable decision-aiding technologies and solutions evolved in the context of supporting cost-effective LVC training environments are also in development to enhance operational decision-making in the field. Also, the team has integrated initial bio-harnesses to capture patient physiological data to be sent back to the command center and displayed for monitoring purposes. All sensor data, audio and video, along with objective and subjective performance based data is synchronized and archived for debrief and training use as the organizations see fit. The primary focus of this system is to improve training resources for Air Force first-responder security and medical personnel while facilitating skill-building, streamlining performance tracking, reducing costs, increasing safety and providing expanded access to unique learning events and advanced technology.

The National Center for Medical Readiness

The test bed used for training is the National Center for Medical Readiness (NCMR) at Calamityville in Fairborn, Ohio. NCMR provides medically oriented education, training, product testing and research opportunities for medical and non-medical civilian and military personnel. It is a 52-acre austere training environment that equips and empowers America's medical responders and non-medical personnel with the experience and knowledge necessary to prepare them for disaster management.

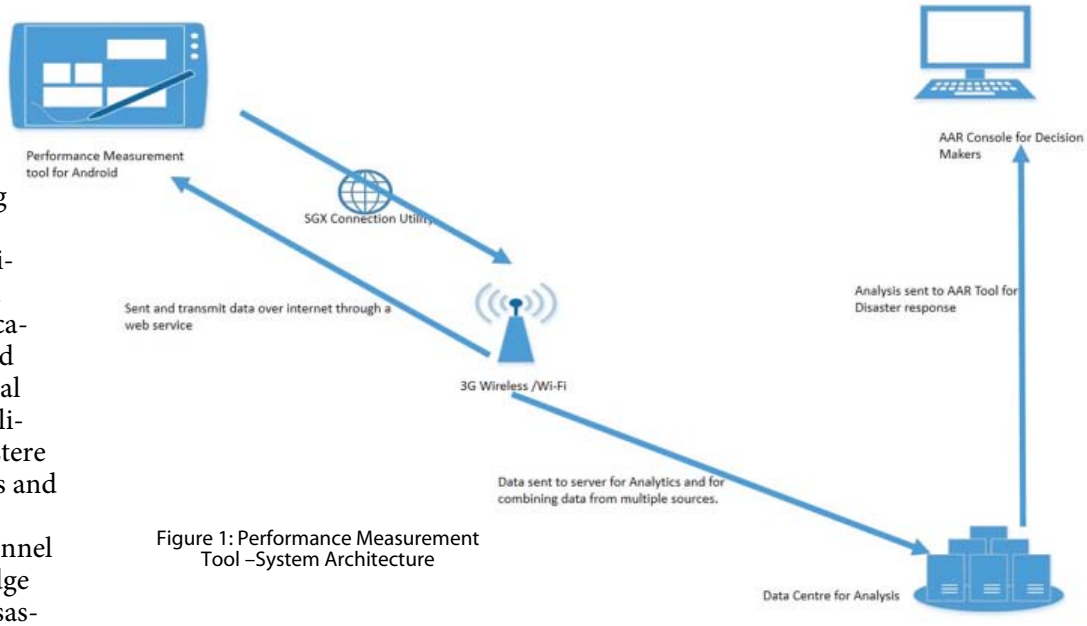


Figure 1: Performance Measurement Tool –System Architecture

Role of NCMR in Disaster Management

NCMR provides medically oriented education, training, product testing and research opportunities for medical and non-medical civilian and military personnel. NCMR's training courses equip medical responders and non-medical personnel with the experience and knowledge necessary to prepare them not only for their day-to-day challenges, but also for disaster management scenarios. Calamityville's technical training zones (TTZs) are the focal point of NCMR's training vision. These functionally oriented one- to two-acre areas house props that provide controlled, high-fidelity opportunities for scenario-driven, physically challenging training and rehearsals. TTZs include complex vehicles, confined spaces and hazardous materials. Other TTZs in development include a collapsed village simulating a destruction zone after a natural or man-made event; an aircraft mishap with elevated and ground-based crashed small-engine planes; and a standing/moving water zone.

Calamityville has three traditional and one non-traditional classroom, each outfitted with computer and multimedia support equipment accommodating up to 40 students. The non-traditional classroom is designed as a mock emergency operations center that can be used for traditional classes, but also support command and control and/or decision-training and research.

The site also includes several indoor spaces that can be configured for various hands-on labs or student breakout areas within the classroom building and a high-bay warehouse space. The high-bay accommodates large props for hands-on learning protected from adverse weather, and also enables modulating conditions to create sensory experiences such as darkness, wind, noises and smells. Several technology-based structures augment the training provided at the facility to further expand training capability, appropriately improve the fidelity of training and exercise operations and to allow for training review and after-action activities.

Technology infrastructure includes:

- A 10-camera (including HD and IR) array that can film activities.
- A radio frequency identification (RFID) grid with multiple readers to track and record the movements of people and objects.
- Isolated Wi-Fi system.
- The Joint Command Operations and Research Environment (J-CORE), a collaborative civilian and military working laboratory facilitating the investigation of operational command and control (C2) methods.

Performance Measure Tool

The performance measurement (PM) tool is an "event–centric" application that attempts to increase situational awareness of disaster response teams by correlating the existing raw information from multiple events. This system is based on the belief that disaster management challenges are inherently problems of resource management and by breaking down the information into events at different levels the challenges can be more easily addressed. The event information is used to analyze the situation and make decisions in high-stakes situations, like when to dispatch emergency responders and when to start the rescue operations. The PM tool was designed for an Android mobile platform and integrates with an after action report (AAR) tool. The AAR tool is a console that aggregates all the data from different sources including data from video

feeds located at multiple strategic locations, event data from PM tools and other data from different organizations taking part in the training exercise. The AAR tool provides a holistic view of the current developments on field to the decision-makers so that they can make timely and efficient decisions based on information available at that instant. The goal of the application is to be simple, easy to navigate, easy to maneuver and carefully constructed to ease the learning of complex tasks. The problems should be well defined and use minimal possible text. The environment has to mimic reality as closely as possible and participants must be immersed in the application so that the responder can face the same situations as in the real world.

System Architecture

The PM tool is installed on an Android 7-inch tablet and transmits the event data in real-time to datacenters through available Wi-Fi connectivity or using a 3G service. Figure 1 presents the system architecture for the performance measure tool. Data transmission takes place through a web service called SGX Connection utility. The SGX Connection utility transmits event data and sends the confirmation back to the tablet after successful transmission. The data center combines data from multiple sources, analyses the data using existing disaster response models and sends the processed data to the AAR tool, which will be used by decision makers to aid their decision-making processes. By using a web service for data transmission between the mobile tablet and data center, the transmission data is set to minimal so that important event information is transmitted even when the network communications may be unreliable.

The performance measure tool includes capturing measurements based on the scenario tested and will also include contextual information such as voice recordings and image capture. Experts from whom design guidelines were created conducted heuristic evaluation of the wireframes. Figure 2 shows an example of a wireframe.

The mobile application includes features related to preparing, planning, executing and adapting to the time-critical scenario. Figures 3a, 3b, and 3c show example screenshots of the mobile system. Figure 3a presents the screen for "time required to plan" event. The application records the time (in minutes) required to plan once the TOC is alerted. The Start Time is recorded when a "go" command is issued to the disaster responders and duration between the start and end time is recorded for analysis. Event includes actions pertaining to planning and prepar-

Figure 2: Wireframe Development

(3a)

(3b)

(3c)

Figure 3: Screenshots of the Performance Measurement Tool

ing for missions and coordinating with other assets regarding the roles and responsibilities during the operation. Figure 3b indicates "time to identify injuries after identifying victims" event that records the time when the injuries on the victims have been identified and before the victims are stabilized. The victim identification and injury ID are recorded for further analysis. Figure 3c shows a screenshot of an "ad-hoc" event used to record any ad-hoc or any event that the responders may feel is important for analysis. They can record the start time of the event and name the event to identify it during analysis.

Pilot Testing

The system was tested using a Special Weapons and Tactics team (SWAT) scenario at the National Center for Medical Readiness at Calamityville. The SWAT training consisted of an all-day event split into several scenarios: two scenarios focused on emergency medical care in a hostile fire situation and two scenarios focused on tactical response to an active shooter hostage situation. Prior to beginning the day's events, SWAT team members completed a pre-test measure (expectation and objectives) that assessed their expectations about the types of experiences and instruction they would receive. Surveys were also administered to assess the impact of SIDFOT-technology on mission execution and augmentation of training experiences, such as the inclusion of a simulated RPA intelligence feed, GPS tracking of SWAT personnel, video and audio recording of scenario activities, virtual and constructive representations of the training environment and scenario personnel (both friendly and hostile entities), objective performance tracking (Performance Measurement Tool – PMT), subjective performance tracking and advanced after action review capabilities (time and event-synched video, audio, chat and performance metrics). Three training experiences and the usefulness and user acceptance of technologies assessment were administered at the end of the training day to capture SWAT participants' impressions of the impact of the technology upon training effectiveness. Table 1 presents an overview of the participant rating (N = 21) of the utility of the performance measurement tool and the after action report capability.

All comments were very positive and indicated that the use of technology vastly improved the human performance and training.

Conclusion

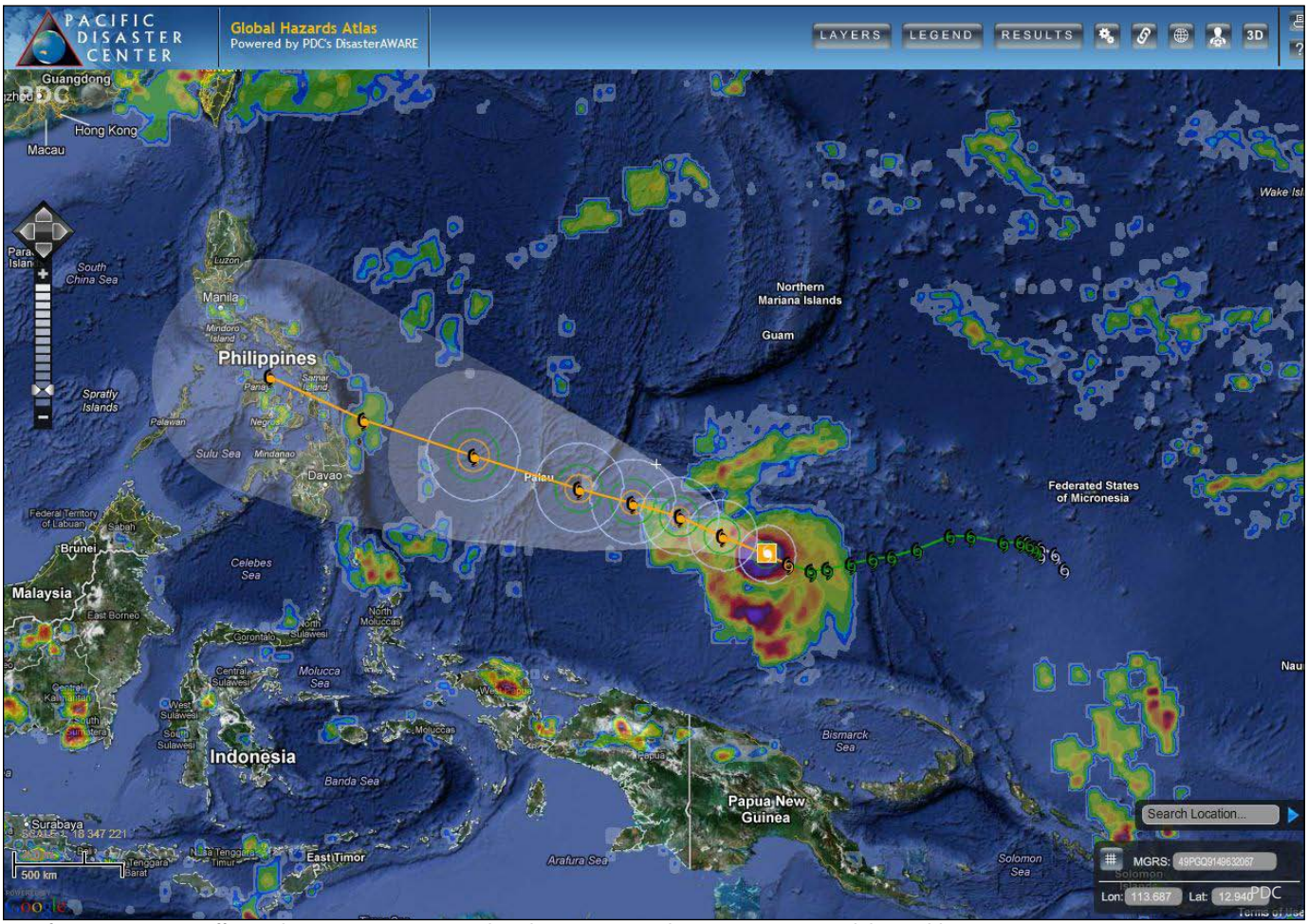
Mobile applications are powerful tools for learning. They can assess skills like response time and decision-making. The mobile application will be designed in such a way that when a poor decision is made the application will train the participant or make the participant realize the value of the mistake and evaluate them later, the result of which could be that the occurrence of the same mistake in a real scenario is reduced.

Question	Mean	Std Dev
a. The ability to record video of training exercise events and replay multiple video feeds is useful in supporting training/learning.	4.57	.93
b. The ability to record radio communications and replay multiple audio channels is useful in supporting training/learning.	4.30	1.03
c. The ability to record trainee and role-player positions using GPS tracking and virtual/constructive representations is useful in supporting training/learning.	4.48	.93
d. The event/time marker capability of the Performance Measurement Tool captures critical training exercise events useful in supporting performance assessment for learning/training.	4.29	.96
e. The Scenario-based Performance Observation Tool for Learning in Team Environments (SPOTLITE) application was useful in supporting performance assessment for learning/training.	4.33	1.02
Section 3 Overall	**4.39**	**.96**

Table 1: Utility of After Action Review and Performance Measurement Capabilities for Training. Note: N = 21. Scale: 5-Strongly Agree, 4-Agree, 3-Neutral, 2-Disagree, 1-Strongly Disagree

Advantages of using mobile devices for performance evaluations include a) reducing human resources required to train and evaluate, and b) reducing the use of space required for training, both of which would eventually reduce the cost of operations. Empirical measurements and findings from the study provide a solid starting point for additional development of more complex metrics through modeling and evaluation of mobile computing's ability to provide continuous education and evaluation in disaster management. The support system can be extended as a training module for users on expeditionary operations, where units need to set up processes quickly. The operation unit needs to adapt rapidly to changes in the scenario with minimum deployment support. Expert decision-making may not be available at all times for such operations, but the domain knowledge of the expert decision maker could be captured to develop a knowledge-based agent to enable novice decision-makers with decision-aiding mechanism and train them adequately for expeditionary operations. Future work will focus on providing support for other training scenarios and increasing preparedness in susceptible populations.

To watch a video on sensor integration at Calamityville, scan this QR code



Pacific Disaster Center offers early warning programs and applications to at-risk communities around the world.

Building Disaster Resilient Communities using Science and Technology

By Jamie Swan, Pacific Disaster Center

The Pacific Disaster Center (PDC) envisions a safer, more secure world—where populations live in more disaster-resilient communities informed by science and technology, and are equipped with the right tools and information for decision-making.

To make this vision a reality, PDC actively partners with like-minded international, regional and national organizations and agencies to provide information access, management, analysis and exchange throughout the disaster management cycle.

Providing early warning and multi-hazard monitoring, PDC developed DisasterAWARE, an integrated platform for hazard situational awareness, decision support and information exchange that forms the basis for customizable applications – including a mobile app known as Disaster Alert. The

platform is designed to strengthen disaster management capabilities by identifying and closing critical information gaps during times of crisis. Over 1.5 million people around the world are currently using the integrated geospatial platform.

The ever-evolving technology incorporates best practices for data acquisition, hazard modeling, risk and vulnerability assessment, mapping, visualization, information sharing, and much more. DisasterAWARE powers a variety of systems—including both open source and secure environments. The adaptability of DisasterAWARE allows the general public to access the same core disaster information and functionality as disaster managers, while also addressing the complex information needs that disaster professionals face. As part of its core, it continually monitors information feeds from reliable meteorological and geological agencies across the globe, ensuring accurate, real-time reporting of potential hazards.

Pacific Disaster Center training at the Kauai County Emergency Operations Center.

Training, Exercising & Event Support

Having a tool is never enough – building capacity and capability is also required to help ensure resilient communities. Those in the disaster management community know that it is critical to train and exercise the same way you would respond during a real disaster. That is why PDC is dedicated to helping partners strengthen resilience through hands-on training, exercises and event simulation. Using the DisasterAWARE platform (as you would in a real event) users can simulate a disaster and test their disaster management plan. PDC involvement in exercises can range from scenario development to exercise facilitation and evaluation, and hazard-specific mapping and modeling.

Headquartered in Hawaii, PDC is integrated with State Civil Defense and actively participates in Makani Pahili, the state's annual hurricane preparedness exercise. Joining government agencies and military operations, PDC helps to rehearse response to a major hurricane that causes significant damages. Participants use DisasterAWARE through all phases of the exercise, providing a common operating picture that supports exercise play.

In May 2013, DisasterAWARE was used in support of a U.S. Pacific Command Multinational Planning Augmentation Team (MPAT) exercise and workshop in Dhaka, Bangladesh. During the scheduled event, a real disaster, Tropical Cyclone Mahasen, approached Bangladesh. Exercise participants quickly began responding, moving DisasterAWARE from exercise to real-world use. Displaying hazard and local-level GIS base data, and supplying real-time storm information, DisasterAWARE provided a common operating picture, and acted as a communication hub, promoting efficient interagency information sharing. At the request of the U.S. Embassy, PDC personnel presented daily situational awareness briefs that were shared with local United Nations representatives, government agencies and local NGOs.

PDC personnel also participated in Balikatan 2013, an annual joint exercise of the Republic of the Philippines and the U.S., aimed at improving civil-military coordination for disaster preparedness. Balikatan also utilized DisasterAWARE as the situational awareness tool for exercise play, and PDC conducted DisasterAWARE training with disaster management agencies and military players.

Public Access to DisasterAWARE

Anyone around the world can access DisasterAWARE by using PDC's Internet-accessible Global Hazards Atlas (www.atlas.pdc.org). The Atlas offers users a way to view current and historical hazards and numerous social and cultural information layers, as well as models of potential impacts.

Another interface providing access to DisasterAWARE is the free mobile application, Disaster Alert. PDC's Disaster Alert is an easy-to-use iOS and Android app with an Atlas-like map optimized for mobile screens. It displays and continually updates active hazards. Disaster Alert provides on-the-go early warning and multi-hazard monitoring on a global scale.

Global Hazards Atlas and Disaster Alert provide a comprehensive solution that can empower individuals and communities to achieve preparedness and resilience goals, both through increased information about risk and

vulnerability and through up-to-the-minute situational awareness.

Professional Access to DisasterAWARE

To ensure that during times of disaster information is always available, PDC provides password-protected versions of DisasterAWARE to disaster management professionals. One such system, known as the emergency operations system (EMOPS), provides users with the additional information and functionality required for critical decision-making. This secure environment offers a common operating picture with enhanced data and information-sharing capabilities. Actionable information, such as situation reports and damage assessments, can be made instantly available to approved users.

Similarly, PDC offers customized versions of DisasterAWARE to support humanitarian assistance and disaster management operations. In early 2013, the Association of Southeast Asian Nations (ASEAN) deployed a Disaster Monitoring and Response System (DMRS) that is operational at the ASEAN Humanitarian Assistance (AHA) Coordinating Centre in Jakarta, Indonesia; the U.S. Department of Defense has deployed a customized system called RAPIDS (Risk Assessment, Planning and Decision Support); and the Vietnam Disaster Management Center deployed VinAWARE to build capacity for tropical storm and flood preparedness and early warning within national and provincial disaster management agencies. VinAWARE is currently undergoing a second phase of development that will add data sources and reinforce institutionalization of the program through interagency memoranda and training programs.

In addition, following the Great Sumatra Earthquake and Indian Ocean tsunami (2004), PDC assisted Thailand in developing their own DisasterAWARE platform that provides earthquake and tsunami early warning and decision support tools for the National Disaster Warning Center (NDWC), which is currently being upgraded and expanded to multi-hazard capabilities. Most recently, PDC commenced a three-year program for its newest deployment – InAWARE – for Indonesia's National Agency of Disaster Management.

Training Solutions

PDC provides a variety of training solutions to support the disaster management and humanitarian assistance community, focused on the use of technology for an enhanced understanding of hazards and their impacts, and for effective, timely decision making and actions during disaster response.

PDC packages training services, such as briefings, multi-day workshops and classroom-based courses in various formats to meet each organization's specific needs. Modalities include lecture, discussions, hands-on training, group activities, case studies, demonstrations and simulated exercise.

Vietnam instructors learn how to present comprehensive disaster management curriculum.

Areas of training expertise cover natural hazards, comprehensive disaster management, damage assessment and needs analysis, DisasterAWARE, data collection and management, risk and vulnerability assessment, and disaster risk reduction. In 2010, PDC created customized course materials and trained more than 100 of Vietnam's national and provincial disaster management professionals as part of the World Bank-funded Natural Disaster Risk Management Project. Additionally, in both 2010 and 2013, PDC produced training sessions on aspects of Hazard Mapping for APEC.

If you are interested in finding out if PDC training is being offered near you or to request training for your organization you can contact them at training@pdc.org.

For nearly two decades, Pacific Disaster Center has been a leader in providing timely and accurate information that can save lives and mitigate potential effects of hazards. DisasterAWARE has played a vital role in capacity building across the globe to help ensure that communities have the training, tools and knowledge required to reduce disaster risk. Continuing its proactive approach, PDC is committed to listening to distinctive and singular needs in order to help identify gaps and assist in crafting proper disaster management solutions.

A construction team builds a house with EarthinBlocks' compressed earth block machine in Tibet.

Building with Compressed Earth Blocks

By Susan Heilig

More than one billion people suffer from inadequate shelter and the need grows exponentially in disaster recovery environments. As a result, numerous new products are attempting to address the need by providing high-quality, low-cost housing solutions to communities around the world; EARTHinBLOCKS (EIB), a company dedicated to constructing quality housing in hard to reach locations, is leading the way.

Prior to founding the company in 2010, EIB Chief Executive Officer Elsie Walker served as president of the Mountain Institute (TMI), a non-profit organization working on development projects in the mountainous regions of the world. TMI launched a program to build earth-block housing in the Tibet Autonomous Region in western China as a way to enhance agricultural facilities and housing in high mountain villages in ways that did not require expensive and time-consuming transport of construction materials. Walker began to investigate compressed earth blocks (CEB) as a suitable construction technology.

Approximately 65 percent of the Earth's sub-soil is suitable for compressing blocks, making it an effective and efficient building technology. The ideal soil is composed of a high percentage of sand, or about 2/3 sand, and the rest a balance of clay and silt. Blocks are manufactured by hydraulically pressing, at high pressure with a stabilizing ingredient and a modicum of water, the soil into a standard block. After curing, these blocks are ready for construction using normal construction techniques.

Walker was initially intrigued by the portability of the CEB machines, which can be hauled behind a truck – or even disassembled and loaded onto the back of yaks – and carried to the most inaccessible mountain villages. She concluded that if a CEB machine could be developed that lived up to its promise, its addition could enable TMI to address local housing and environmental issues and create jobs in the process.

Jim Underwood, a TMI staff member who lived in West Virginia, had studied natural building technologies, including compressed earth blocks. He responded to Walker's request to design a block machine that

improved on existing CEB manufacturing methods by adding tongue and grooves to the bricks, simplified construction and increased the overall structural integrity of the resulting building. When it was ready, the machine was sent from West Virginia to Lhasa, Tibet.

Once there, Underwood and his colleagues were able to train 23 rural construction teams in earth-block construction. These teams were composed of a few experienced builders and many unskilled laborers, who caught on quickly to the laying of tongue and grove blocks. After his second summer of training in Tibet, Underwood returned to the U.S. to discover that he was suffering from advanced pancreatic cancer and died months later; however, enough Tibetans had been trained to build more than 40 structures, including farmhouses, bio-gas greenhouses, a winery, a dairy cooperative and many guesthouses – a fitting and lasting legacy to Underwood's vision.

Walker was initially hoping that the machine could be locally manufactured, thus creating even more jobs, but the undertaking proved to be too complicated. Dan Brundage, a retired naval systems engineer who volunteered his talents, came to TMI's rescue. He joined the project to oversee a variety of design improvements and the manufacturing of the machine by the Agricultural Research Institute in Chengdu, China.

When Walker stepped down as president of TMI in 2010, she decided to promote this home-and-job-creating technology. Susan England, a longtime colleague, joined the effort and together they formed EARTHinBLOCKS with Walker serving as CEO and England as president.

In 2011, they were referred to Tom Kopera, a Chicago-based engineer, who converted the drawings from Chinese to U.S. specifications and produced a prototype of the now twice-upgraded machine. The American prototype was tested and in 2012 EIB looked for a U.S. manufacturer. John Rivera, a businessman and engineer based in Florida, assembled a team of retired NASA engineers, who had worked together on the Saturn program and were looking for a project that would reunite them. They studied Kopera's prototype and drawings in great detail. Together with Rivera, they strengthened the ergonomics of the machine, streamlined it by eliminating several parts and formed it into a rugged, easy-to-use machine. Rivera was so impressed by the machine and the EIB mission that he joined EIB as senior vice president and chief operating officer. The latest iteration of the machine is now being manufactured in Melbourne, Fla., a few miles from Cape Canaveral.

EarthinBlocks' compressed earth block machine can produce two blocks a minute.

Three key features distinguish the EIB machine from other CEB machines: the tongue and groove blocks, the rate of compression and its self-contained portability. The blocks emerge from the EIB machine ready to assemble, without need for mortar as a result of their tongue and groove form. The tongue and groove enables the blocks to interlock with each other, which both simplifies and accelerates the building process and increases the structural integrity of the building.

The machine compresses the soil horizontally up to 2,500 pounds per square inch (psi). This enables teams to form blocks that are consistently identical height and width that exceed the standard building code for compressed earth blocks minimum requirement of 300 psi.

Lastly, the EARTHinBLOCKS machine weighs 2,000 pounds and is built on a rolling trailer that can be hauled by truck, sport utility vehicle or airlifted to the building site. The unit is a self-contained workstation – once on site, the unit needs only to be leveled and stabilized to be ready for block making. The EARTHinBLOCKS machine produces two blocks per minute and can make more than 500,000 blocks before the machine will need a major tune-up.

Ultimately, EIB is using a technology and an approach that can become part of a broad humanitarian solution in regions struck by natural disasters or civil conflict. The companies motto, "building strong communities, one block at a time," captures the goal of empowering people in communities worldwide by providing them with low-cost, low-footprint, quality, sustainable housing – housing they can build themselves, while learning a simple, replicable technology, that creates local jobs as well.

FLYIN

The use of

G HIGH

expendable civil drones after Typhoon Haiyan

By Imes Chiu, Ph.D.
Chief of Applied Research,
Center for Excellence in
Disaster Management &
Humanitarian Assistance

Chuck Devaney,
Ph.D. Candidate,
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Ted Ralston, Drone Developer,
California State University,
Long Beach

Nicolas Asfouri, Armed Forces of the Philippines

In a January 2014 publication, *Lessons From Civil-Military Disaster Management and Humanitarian Response to Typhoon Haiyan (Yolanda),*[1] the interdisciplinary CFE-DMHA team concluded that during the rapid response phase of disaster management, aerial imagery of damaged areas proved more useful than a detailed needs-assessment. Committed to using this emerging technology to save lives and rebuild destroyed areas, drone operators saw civil drones as a means for local empowerment. As a result, various types of civil drones found applications in the Tacloban city relief operations. Most notable were the expendable unmanned aerial vehicles (xUAV) that did not require expert operators, unlike many other civil drones used in Haiyan relief operations.

Chuck Devaney, a doctoral candidate at University of Hawaii's Department of Geography, flew to Tacloban in the aftermath of Haiyan to spend several months working with Ateneo de Manila University capturing aerial images of the damage.

"A lot of things can be interpreted if you just have a snapshot of the ground," said Devaney in an interview.[2]

Imagery provided by civil drones enabled local government units to immediately and accurately assess the extent of the damage in their jurisdictions, even when operating with a significantly reduced staff. As exemplified in the Tacloban experience, many of the first responders became victims themselves and the surviving local government unit faced the daunting task of providing a quick damage and needs-assessment to incoming relief workers.

"What they actually need at this point is to get an accurate understanding and a very detailed picture at the village level, at the camp level, as to what exactly is going on," explained Devaney.[3]

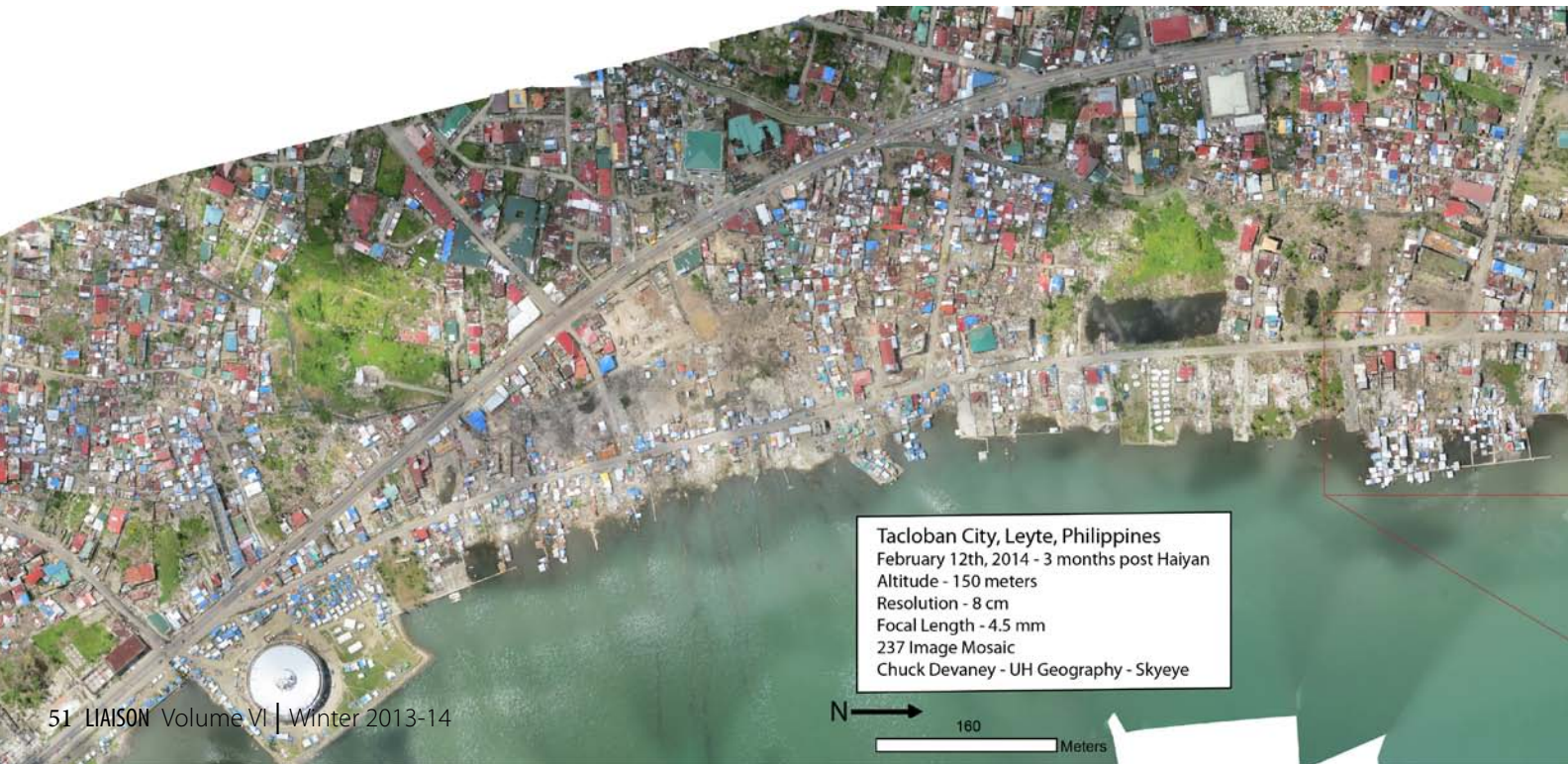
During Haiyan recovery operations, civil drones were quickly adopted as routine operating procedures for many humanitarian groups. Overcoming the logistical challenges posed by massive debris in Tacloban, civil drones provided many nongovernmental organizations (NGOs) much needed situational awareness at a time when needs-assessment teams did not have access to the disaster area.

Initially used to pinpoint potential base camp locations for aid workers, many NGOs began adapted the use of civil drones to inform their relief, rescue and recovery operations from aerial views of infrastructure devastation, road and power line damages, emergency areas and relief distribution networks. Civil drones also helped ensure the safety of aid workers through regular information feeds of their movements in the affected areas.[4]

Two Men On a Truck - Tacloban, Leyte, Philippines

The simple low maintenance set-up of civil drones makes it an attractive alternative over expensive satellites. It just requires two men and a form of transport. In Tacloban, it was "two men on a truck" – Chuck Devaney and drone developer Ted Ralston. The biggest challenge the team faced was determining a launch and recovery site sufficient for a fixed-wing xUAV, so the team used a multi-rotor helicopter drone that is vertically launched and recovered. Imagery from both video and still photography

1 Center for Excellence in Disaster Management and Humanitarian Assistance, cfe-dmha.org
2 Lara Yamada, "Drone operators work to help Philippines' Typhoon Haiyan survivors," KITV News. Retrieved from: http://www.kitv.com/news/hawaii/drone-operators-work-to-help-philippines-typhoon-haiyan-survivors/24008774
3 Yamada, "Drone operators."
4 Paige Dearing, "Civil drone helps NetHope Haiyan relief efforts in the Philippines," NetHope. Retrieved from: http://nethope.org/blog/2013/12/civil-drone-helps-nethope-haiyan-relief-efforts-in-the-philippines/



informed the acquisition team where to launch and recover the larger fixed-wing unit.

Even though this UAV subclass is termed 'expendable,' it does not mean the team intentionally or willingly 'expends' them, rather it means that the cost is so low and accessibility so high that the drones can be readily replace in case of loss – therefore users are not inhibited by the cost and loss factors. Nevertheless, while the low cost allows the systems to work even in high risk-of-loss conditions, it is essential for data acquisition that the units be recovered. Once a suitable launch and recovery zone had been selected, the team began their task.

The team's first effort started from a fixed-wing xUAV that covered an area of approximately 1.5 square kilometers at an altitude of 150 meters. The total flight time was approximately 30 minutes. The imagery acquired rendered a final mosaic at eight centimeter per pixel (see below). The current xUAV configuration can fly and capture imagery for approximately an hour.

The xUAV platform used to generate the Tacloban mosaic imagery consisted of widely available parts that can be purchased for approximately $1,000. This is significantly cheaper than the more expensive commercial "turnkey" systems. The piloting skills required to launch and recover the aircraft, as well as conducting minor repairs, are readily learned due to the recent exceptional developments in miniaturized electronic and optical systems from the model airplane and cellular phone industry. It is reasonable to assume that the consumer-driven evolution in reliable, multi-functional 'pocket systems' will continue to drive down prices and increase the capability of the 'expendable' subclass of UAVs built upon this technology. In a loose parallel, it might be said that the UAV subclass of systems is actually 'crowd sourced' – from a selected, motivated, skilled crowd.

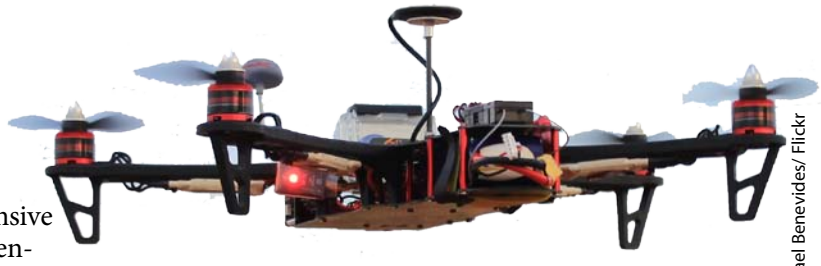
Eventually, a quadricopter, or a drone using four propellers, flew over wrecked buildings in Tacloban to provide decision-makers and logistical planners an overall damage assessment estimate. From this estimate, planners determined the resources and relief equipment needed on the ground. Many articles coming from various perspectives espoused the use of civil drones for search and rescue.[5,6] For example, civil drones have the potential of additional life-saving applications in disasters such as earthquakes, where they could produce thermal images of survivors buried beneath rubble.

Locally focused analytics

A significant benefit of the xUAV is as an asset that could be locally employed and managed. They do not require a centralized command system; they are 'locally modifiable' so changes to the system can easily be done to meet community needs. These expendable systems by nature are small, inexpensive and not transportation limited. Unlike larger systems, xUAV could easily be hand carried to remote locations. The components are derived from everyday consumer technology backed by a large network of web-based support systems, often set-up by the academic community.

5 Daniela Spath, "'Friendly' drones in emergency response," *Deutsche Welle. Retrieved from: http://www.dw.de/friendly-drones-in-emergency-response/a-17344041*
6 "Civilian drones search and rescue documentary released on YouTube," *ICARUS: unmanned search and rescue. Retrieved from: http://www.fp7-icarus.eu/news/civilian-drones-search-and-rescue-documentary-released-youtube*

Future potential for xUAVs



Rafael Benevides/ Flickr

In addition to the relief and response phase, aid workers on the ground continue to rely on civil drones to plan and track recovery operations until a comprehensive damage assessment is complete. The Humanitarian OpenStreetMap Team (HOT) described the Philippine environment as "an unprecedented" use of UAVs in the collection of Haiyan imageries and suggest that various analytical products on relief and recovery operations be produced from organizing and analyzing imagery feeds of debris removal and reconstruction projects at various phases of the recovery operations.[7] Many relief workers on the ground predict that civil drones will eventually become an integral part of disaster risk reduction efforts in the future.[8]

The concept of xUAV has not been widely diffused as a common tool in civil-military operations. The authors will next embark on looking at the disruptive effects of xUAV in the current top-down flow of relief operations among foreign military responders. All factors brought about by xUAVs that favor 'localization' could potentially have the same disruptive effects to national response mechanisms, much like the way cellular phones and social media have changed the daily lives of many vulnerable areas. A new opportunity space for the development of sensors, microelectronics, creative new flight management and flight safety tools, including the analytic software systems used to make sense of the emerging sensor-defined imagery, provide an interesting study in the dynamic applications of Geographic Information Services (GIS) in geospatial awareness-based risk-mitigation concepts.

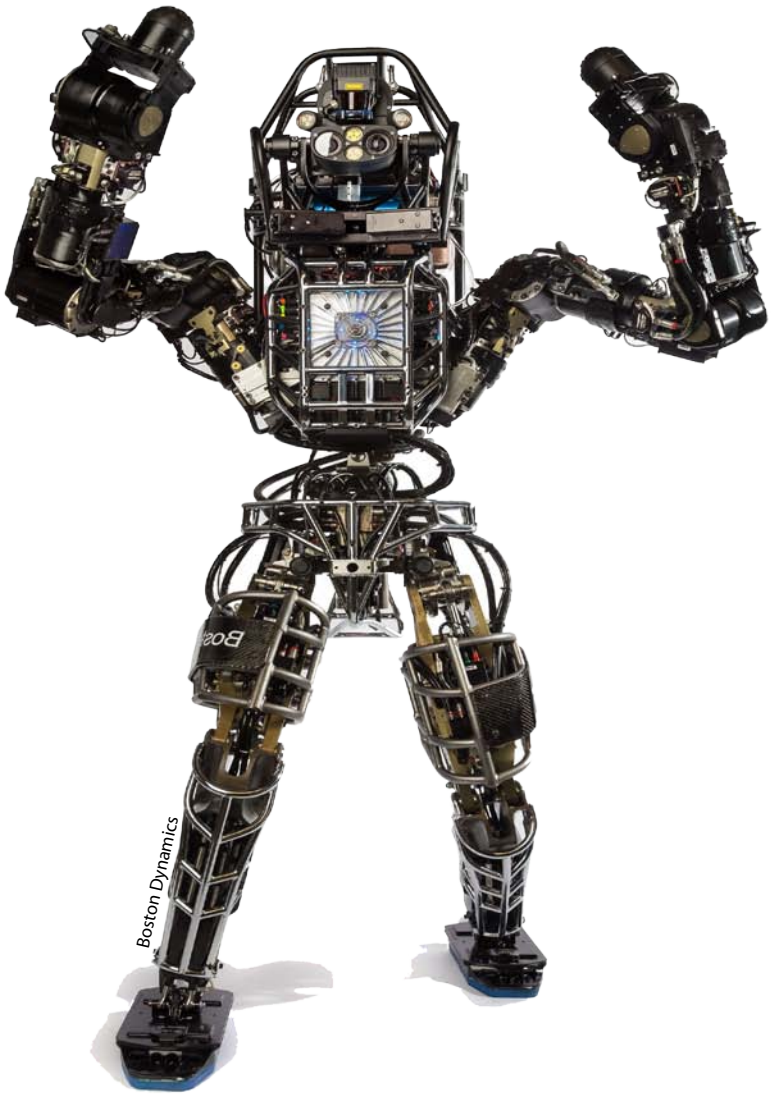
7 "Support Haiyan/Yolanda reconstruction: contribute public use UaV (Drone) imagery," *Humanitarian OpenStreetMap Team. Retrieved from: http://hot.openstreetmap.org/updates/uav_imagery_haiyan*
8 Lean Alfred Santos, "In the Philippines, drones provide humanitarian relief," *Devex. Retrieved from: https://www.devex.com/news/in-the-philippines-drones-provide-humanitarian-relief-82512*

Staff from Aklan State University, University of Ateneo de Manila and University of Hawaii collaborate to produce aerial imagery for use during Typhoon Haiyan disaster response.

Courtesy photo

Disaster relief architect wins prestigious award

After spending more than two decades building structures for victims of natural disasters, Japanese architect Shigeru Ban became the 2014 Pritzker Prize winner in March. His low-cost structures have helped thousands of people in Japan, Haiti, New Zealand and the Philippines after earthquakes, tsunamis and other natural disasters devastated large areas. He is best known for the creation of paper partitions in emergency shelters and construction of structures using unique building materials like cardboard tubes (see photo) and shipping containers.



First responder robot competition

The Department of Defense's strategic plan calls for the armed forces to conduct humanitarian, disaster relief and related operations. The plan identifies requirements to extend aid to victims of natural or man-made disasters and conduct evacuation operations. Some disasters, however, due to grave risks to the health and well-being of rescue and aid workers, prove too great in scale or scope for timely and effective human response. The Defense Advanced Research Projects Agency (DARPA) Robotics Challenge will attempt to address this capability gap by promoting innovation in robotic technology for disaster-response operations.

The primary technical goal of the challenge is to develop ground robots capable of executing complex tasks in dangerous, degraded, human-engineered environments. Competitors in the challenge are expected to focus on robots that can use standard tools and equipment commonly available in human environments, ranging from hand tools to vehicles, with an emphasis on adaptability to tools with diverse specifications.

The 2014 finals will be held between December 2014 and June 2015.

NEPAL'S

Approach to Risk Resilient Development

By Sudhir Kumar, Disaster Risk Reduction Specialist, United Nations Development Programme

Countries and individuals across the globe aspire for sustainable development and it takes measures from policy to planning and from implementation to monitoring of developmental interventions to make it possible. However, in many countries the 'development gains' of years and decades can be wiped out in several minutes due to a disaster. Hence, it is important that the development is informed of disaster risk.

Climate change is reconfiguring the existing hazards and thus reconfiguring risk. The linkages among disaster, climate change and development have been well established and hence developmental interventions require a disaster and climate risk management inclusive approach.

Countries and development partners have been working on disaster and climate risk management issues using various approaches, however the risk sensitive development, i.e. disaster and climate risk management, embedded within the development framework approach has been widely accepted as the 'way ahead.' This article aims to highlight the key principles and approaches for disaster and climate risk management inclusive development from Nepal. It also covers the framework and interventions taken and draws out practical lessons, which can be replicated.

Introduction

In the recent past, the world has witnessed some of the worst disasters, including Typhoon Haiyan of 2013 in the Philippines, the Great East Japan Earthquake of 2011, the earthquake of 2010 in Haiti, the Sichuan earthquake of 2008 in China, Cyclone Nargis of 2008 in Myanmar, the Pakistan earthquake of 2005, Hurricane Katrina of 2005 in the United States and the Indian Ocean tsunami of 2004. These disasters not only claim precious lives and destroy livelihoods but also impact the long-term growth of the countries and have trans-boundary impacts. For example, in Japan after the Great East Japan Earthquake of 2011, 337 private companies went bankrupt within six months of the disaster and out of these only 46 companies were located in the earthquake-tsunami affected region.[1] Similarly, the Thailand floods of 2011 led the Bank of Thailand to revise its GDP forecast for 2011 to no more than 2.6 percent, down from 4.1 percent.

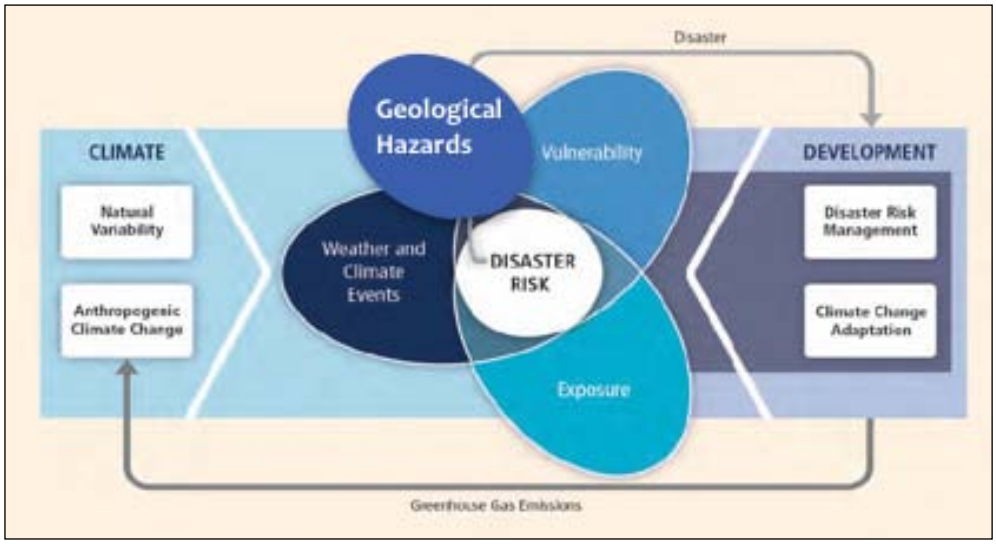
In order to meet the challenge of disaster, countries and development partners have taken a number of steps for risk management and the United

1 Asian Disaster Reduction Center, Japan, ISDR Asia Partnership Meeting, April 2012, Bali, Indonesia


UNDP Nepal

Nations Office for Disaster Risk Reduction (UNISDR) report[2] has observed that there has been significant progress in achieving effective disaster response and preparedness. However, risk reduction has a long way to go and it continues to challenge countries and development partners.

This context calls for a comprehensive and systematic approach to risk management, which ranges from deconstruction of disaster risk into its three elements, namely hazard, vulnerability and exposure to resilient development. The risk-informed development intervention is very important, as development is not risk neutral - it either reduces or increases risk. Unfortunately, the choices made, intentionally or unintentionally, by government, private sector and society have contributed to increasing risk.



Modified and Adapted from IPCC SREX, 2012

Figure 1: Disaster, Development and Climate: Inter-linkages

1. Approach to risk resilient development

The comprehensive and systematic approach to risk reduction should be embedded within the development framework aimed towards risk (disaster and climate) sensitive development and thus contributing to sustainable development. It should aim to reduce risk through reduced vulnerability, exposure and hydro-meteorological hazards (limited intervention) and through development interventions.

A number of agencies, including Asian Disaster Preparedness Center (ADPC), are working on this issue using various models and approaches, which are mainly based on the following principles:

1.1 Development, Disaster and Climate Risk inter-linkages

The inter-linkages between disaster, climate and development have been well established and the Inter-Governmental Panel on Climate Change (Figure 1) has documented the link in its special report on *Managing the Risks of Extreme Events*. The risk management approach analyses risk from disaster as well as climate change and identifies measures to address the risk. And, apart from weather and climate events, geological hazards are also considered.

1.2 Holistic Approach to Risk Management

The risk management framework is holistic, which includes a three-step approach (Figure 2):

Identifying disaster and climate risk;

Taking measures to reduce risk through reduction of hydro-met hazards, vulnerability and exposure. The identification of risk is the basis for other two measures i.e. reduction of risk as well as management of residual risk;

Managing the residual risk.

1.3 Targeting Public and Private Investments

It is important to highlight that risk reduction is proactive and has economic benefits in general. Also, huge development investments can be leveraged for risk reduction and have long-term gains. The approach to resilient development should target both public investment and private investment, as both are equally important.

The public investment is typically 3-15 percent of GDP in low- and middle-income countries (UNFCCC, 2007) but these investments are critical for risk reduction. For example, a study on public investment in India for 2011-12 found that the development programs where risk

2 Global Assessment Report on Disaster Risk Reduction, UNISDR *(2013)*

Figure 2: Risk Management Frameworks

reduction can be included amounts to approximately $80 billon as compared to exclusive risk reduction programs in 2011-12 were approximately $2.3 billon. In terms of percentage of GDP allocation, the former is approximately 3.4 percent while the latter is 0.1 percent.[3]

Global Foreign Direct Investment (FDI) is projected to reach $1.8 trillion in 2013 and $1.9 trillion in 2014. In 2011, almost half of the FDI flowed into low- and middle-income countries (GAR 2013) and it is important that these investments are not in hazard exposed areas but support risk resilient development. Considering the scale of investments and geographical focus of the investments, it is important that these investments are informed of risk so that the 'development gains' are protected and need not to be reinvested after the impact of disaster to recreate the same assets.

1.4 Partnership

The risk management measures are long-term as well as complex; therefore, it requires partnership between all key development actors, which include planning ministries, line agencies, disaster management organizations, technical institutions, private sector and development partners. It also requires process-oriented approach for long-term sustainability.

1.5 Capacity Building and Knowledge Management

Governments are regarded as the lead development entities, which are supported by non-governmental actors, for implementing long-term development agendas. To ensure risk resilient development in long-term planning, it is important to setup the system for local capacity building. The range of actors involved in development is very large and local capacity building mechanism is the most feasible one.

Also, disaster risk management and climate risk management is a relatively new theme and creation of a knowledge management mechanism on this theme is very important. The approaches, examples and use of disaster and climate risk management in development needs to be catalogued and made available to the public for reference.

1.6 Multi-layered as well as Coordinated Approach

Development interventions evolve from policy to plan, from an initial project to monitoring and evaluation, which is undertaken by a range of actors at various levels. For example, the Planning Commission in Nepal is the primary agency that steers the development agenda in the country while specific development plans are formulated by the local government as well as at the line ministries. Line ministries, local bodies and other actors then implement those plans and projects. This multi-layered and coordinated approach signifies the importance of various key stakeholders and actors from planning down to implementation stages of development initiatives for attaining the objective of a resilience society.

1.7 Build on Existing Platform

The 'development' interventions are primarily planned and implemented through formal development instruments such as development policy, national, sectorial and local development plans, projects and monitoring and evaluation systems. These mechanisms are well established and it is important that the resilience approach build on these existing instruments.

2. Key interventions

Mainstreaming disaster risk management into development has been a key goal of the agenda in the last decade and it is gaining momentum. The post-2015 Development Agenda discussion as well as Hyogo Framework for Action-2 discussion has highlighted its importance.

Though mainstreaming disaster risk management into development has been taking place for several years, a comprehensive and systematic approach began around 2009 and focused work started in 2011 when the Comprehensive Disaster Risk Management Programme of the United Nations Development Programme (UNDP), with Asian Disaster Preparedness Center (ADPC) as a technical partner, supported the Government of Nepal on risk resilient development over 2011-2013.

The ADPC has been working on this theme across different sectors of development since 2004-05 in several countries within Asia, including Nepal, but the intervention of the UNDP benefited and built upon them.

By area or country, some of the broader key interventions include:

Guideline on mainstreaming disaster risk reduction in the education sector (Philippines)

Guideline on mainstreaming disaster risk reduction into housing sector (Asia)

Guidance on promoting use of disaster risk information in land-use planning (Asia)

Guidelines for mainstreaming disaster risk reduction into public investment programming (Sayaboury Province, Lao People's Democratic Republic)

Technical assistance on implementation of DRR/CCA inclusive environmental impact assessment guideline (Philippines)

3 Chakrabarti D, Understanding existing methodologies for allocating and tracking resources, 2012

Disaster risk reduction inclusion into housing sector (Sri Lanka)
Mainstreaming DRR into local development planning (Maldives)

Capacity building and technical assistance on risk considerations into irrigation sector (Pakistan)

In Nepal, the following interventions were undertaken for contributing towards risk resilient development:

2.1 Incorporation of Disaster and Climate Risk Management Considerations into Development

The overall framework for disaster and climate risk management intervention in Nepal has been captured in Figure 3. The process started with understanding disaster and climate risks in Nepal, which is followed by risk reduction and management of residual risk. The capacity building, knowledge management and partnership remained the underpinning pillars in the entire process.

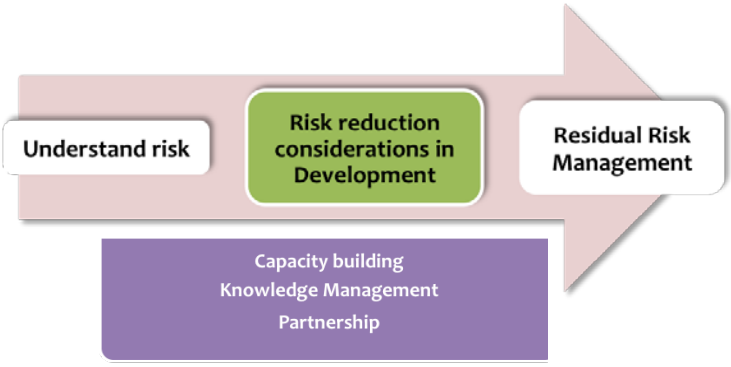


Figure 3: Disaster and Climate risk management in Nepal

2.1.1 Understanding risk

In order to understand disaster and climate risks in Nepal a two-pronged approach was adopted, which included the development of new systems of studies and the usage of existing systems of studies. This assessment was undertaken at district level, which is an important administrative unit.

Multi-hazard risk assessment:

Nepal is prone to multiple hazards and in order to understand disaster risk, a multi-hazard risk assessment was undertaken to determine the potential future impact of the following hazards:

Earthquakes for the next 500 years, 250 years, 100 years and 50 years return period, or the type and size of earthquakes expected in next 50 to 500 years

Floods or inundation for 500 years, 100 years, 50 years, 25 years and 10 years return period

Landslides induced due to precipitation and earthquakes

Droughts in pre-, during, post-monsoon and winter

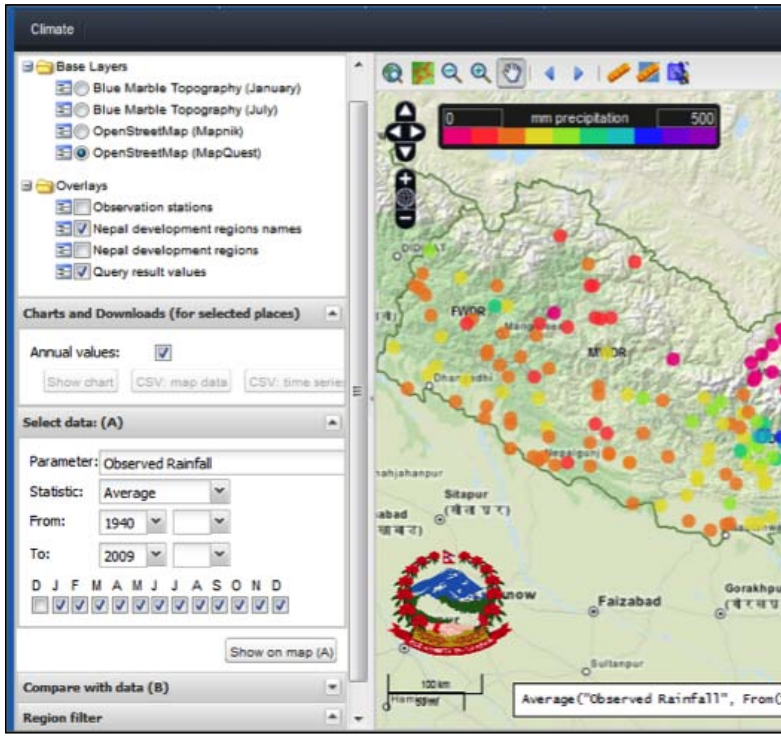
Epidemics

This information helps the policy makers and officers make a decision on the level of risk mitigated and/or retained in a development intervention or in prioritization of risk reduction measures.

Nepal Climate Data Portal:

This Portal was created to facilitate the analysis of climatological / meteorological, geographical and projection data using a publicly accessible web-based interface. It helps the viewer to easily access historical station data, historical gridded data and project future climate change scenarios for:

(Above) multi-hazard risk assessment is used at the district level to understand disaster and climate risks. (Below) The Nepal Climate Data Portal allows the user to access historical risk data for analysis.



Assessing impacts and vulnerability in climate sensitive sectors such as agriculture, water resources, energy and health.

Developing adaptation strategies for vulnerable sectors

Infrastructure planning as adaptation measures

Contingency planning

Other sources for risk information:

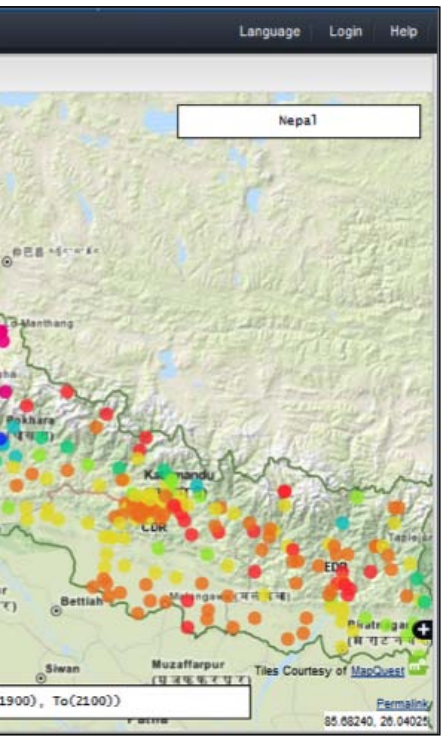
Nepal has prepared National Adaptation Programme of Action (NAPA), which provides valuable information for climate change impact projections. Also, the Disaster Management Plans provide important disaster risk information.

2.1.2 Risk considerations into development process

In order to include risk considerations into development processes in Nepal, the horizontal as well as vertical approach were taken which included disaster and climate risk management considerations into the development planning processes of line ministries at the national level as well as at the district and sub-district level. At the national level it included the National Planning Commission, Ministry of Home Affairs, Ministry of Federal Affairs and Local Development, Ministry of Urban Development, Ministry of Irrigation, Ministry of Forest and Soil Conservation, Ministry of Science, Technology and Environment and Ministry of Education.

Overall approach for Disaster and Climate Risk Management (DRM/CRM) inclusion into development:

The disaster and climate risk management considerations were included in the overall development planning framework of the country and the ministries i.e. it built upon the existing system. The schematic diagram is at Figure 4.



Disaster and Climate Risk Management Considerations into Irrigation: Within the above-mentioned schematic diagram, disaster and climate risk considerations were identified in consultative process and used in the development functions for each key ministry. For example, Nepal's Ministry of Irrigation identified a number of considerations. A sample is provided in Figure 5.

Disaster and Climate Risk Management Considerations into local development planning:

Nepal has a well-established 14-step development planning process, which includes local development planning at district and sub-district level. Integration of DRM/CRM considerations into all 14-steps were identified and a guideline has been prepared.

Also, Nepal has a detailed monitoring and evaluation system, the Minimum Condition and Performance Measures (MCPM) for local development funding. It includes:

Local bodies must meet minimum conditions to be entitled to receive the unconditional capital grants. It has 15 indicators within three functional areas namely *Planning and Management; Financial Management and Transparency.*

Performance measures are designed to create incentive for local bodies to improve their performance. It has 62 indicators: *Planning & Program Management; Financial Management; Fiscal Capacity; Program execution; etc.*

Within the MCPM, indicators and sub-indicators have been identified for disaster and climate risk management considerations.

2.1.3 Residual risk management

Risk reduction measures can be very costly and their financial viability is very low. For example, residential buildings are mostly constructed as earthquake resistant but not earthquake proof, while the nuclear reactors are earthquake proof due to their critical nature. This means that residential buildings can withstand earthquakes up to a specific magnitude. Therefore, it is important to implement a system for managing the residual risk, i.e. the risks which have not been mitigated due to various factors such as limited budget and unavailability of technical designs.

To manage the residual risks, Nepal has been undertaking several measures which includes the preparation of the Disaster Preparedness and Response Plan, awareness generation on "do's and don'ts" of a disaster and mock drills. These measures will help in managing the leftover or residual risk.

2.1.4 Underpinning pillars

Capacity building, knowledge management and partnership have been the three underpinning pillars in ADPC's intervention.

Partnership:

Partnership has been key in disaster and climate risk management intervention, which includes partnership among Government of Nepal, U.N. agencies, technical institutions and universities and NGOs. ADPC works in partnership to implement mainstreaming disaster and climate risk management into development.

Capacity building:

In order to ensure long-term sustainability and also to

reach scale, the capacity building of national institutions has been the center of attention since the beginning. The process started with a study of capacity assessment, which analyzed the existing as well as future desired-capacity needs based on legislations, strategies and mandate of relevant ministries. The analysis helped to identify the gaps, which was followed by the analysis of technical capacity of national training institutions vis-à-vis the needs of ministry and thus the capacity building needs of national training institutes for long-term support to Nepal were identified. This has been captured in Figure 6.

Knowledge management:

Disaster and Climate Risk Management is a cross-cutting agenda as well as relatively new theme, hence it is important to have one-stop shop for all DRM/CRM related information for reference for stakeholders. A knowledge management portal on DRR namely 'Nepal DRR Portal' has been developed which has sections on DRR Landscape of Nepal, Disaster Profile, Online Resources and Learning, DRR Projects in Nepal, DRR Resources Mapping and Online Discussion Forum. The Ministry of Home Affairs, the nodal Ministry for Disaster Management in Nepal, has hosted it.

Conclusion

The cases of Nepal highlight the complexities involved in the inclusion of disaster and climate risk management into development. Like many other countries, this theme is still in its nascent stage in Nepal; however, there is growing awareness of the need to bring the issue to the forefront. Also, the post-2015 development agenda as well as Hyogo Framework for Action-2 process have highlighted the need and importance of this agenda as sustainable development that is not possible without risk reduction considerations. It can be concluded that the future of disaster and climate risk management will depend on governments and political leaders, which is becoming more successful at combining the promotion of local and national economic growth with effective disaster and climate risk management on the ground.[4] The approach used in Nepal for mainstreaming disaster and climate risk management into development for risk resiliency can be replicated and modified by other nations in need of a template for success.

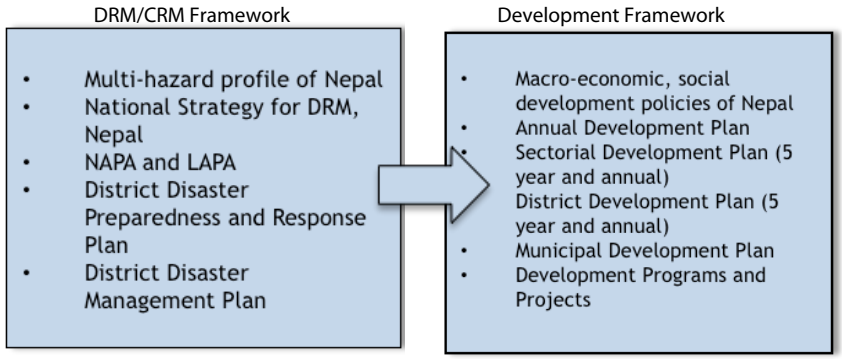


Figure 4: Schematic Diagram of Disaster and Climate Risk Management considerations into development in Nepal

Functions/ Activities	DRM/CRM entry points	Document/ Administrative Order to be referred	M&E Indicator	Time Line
Organizational Setup	Link CRM/DRM in each division /sub-division	CRM /DRM Action Plan	Action Plan Prepared	6 months
Updating of policies, directives and circulars	Incorporate DRM/CRM in policies, directives and circulars	NAPA, LAPA, Periodic Plan HFA, MDG	DRM/CRM incorporate	1 year
Redefining of Job Descriptions	Include DRM/ CRM in job descriptions	Working Procedures of DOI	DRM/CRM included in Job descriptions	6 months

Figure 5 : Disaster and Climate Risk Management considerations into functions of Ministry of Irrigation, Nepal (draft)

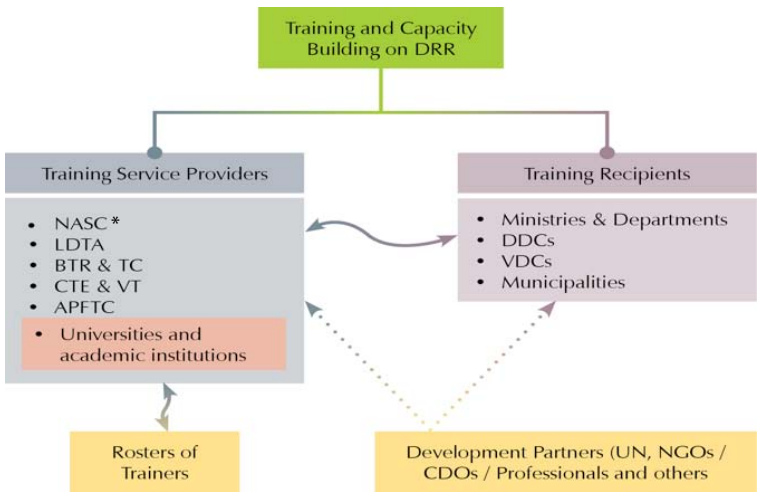


Figure 6: Framework for capacity building on DRM/CRM in Nepal

*NASC: National Administrative Staff College; LDTA: Local Development Training Academy; BTR&TC: Building Technology Research and Training Center; CTE&VT: Council for Technical Education and Vocational Training; APFTC: Armed Police Force Training Center

4 Global Assessment Report on Disaster Risk Reduction, UNISDR *(2013).*


Bas Bouman/ International Rice Research Institute

Protecting Cultural Heritage During Disasters

Prevention, Mitigation and Response

By Elizabeth Varner, Executive Director of the National Art Museum of Sport

Natural and human-induced disasters have damaged and destroyed cultural heritage spurring advances to protect cultural heritage through prevention, mitigation, and response. Awareness, resources, training and the number of organizations dedicated to safeguarding cultural heritage has increased. Multiple organizations have taken up the charge to protect cultural heritage and help entities prevent and mitigate harm to cultural heritage, as well as fostering a dialogue between cultural heritage organizations and emergency responders to enable a better response to disasters that threaten cultural heritage.

This article defines cultural heritage, analyzes why cultural heritage is important and briefly discusses the different considerations for moveable and immoveable cultural heritage. The article reviews the key parties involved, risks implicated in disasters affecting cultural heritage, and the differences between preventing, mitigating and responding to disasters. Then the article explores advances and resources in preventing, mitigating, and responding to disasters. Finally, this article distills this information into key points to prevent, mitigate and respond to disasters that affect cultural heritage.

A. Definition of Cultural Heritage, Cultural Property and Cultural Resources

The term "cultural heritage" can be subdivided into "tangible cultural heritage," the physical manifestation of cultural heritage such as a painting or sculpture, and "intangible cultural heritage," the non-physical manifestation of cultural heritage such as oral stories or dancing.[1,2] Within the context of disasters, I will focus primarily on tangible cultural heritage. My intent is to offer cultural heritage sites worldwide a starting point and basis for a disaster mitigation plan that includes prevention, mitigation, and response.

In government documents, tangible cultural heritage is frequently called "cultural property," which is a limiting and antiquated term, but was used in the 1954 Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict and is still used in U.S. military documents. Article 1 of the 1954 Hague Convention defines cultural property as "movable or immovable property of great importance to the cultural heritage of every people."[3]

Tangible cultural heritage is also referred to as "cultural resources or assets" in disaster management resources and amongst disaster management professionals.[4]

For purposes of clarity, tangible cultural heritage will be denoted hereinafter solely as "cultural heritage."

B. Importance of Cultural Heritage

Protecting and safeguarding cultural heritage from disaster is important to the local, national, and global community. Corine Wegener, Preservation Specialist for Cultural Heritage at the Smithsonian Institution, has repeatedly found when responding to disasters that cultural heritage is an integral part of a community's identity and is a motivational force in people staying to rebuild a community after a disaster instead of leaving to start afresh.[5]

C. Moveable vs. Immovable Tangible Cultural Heritage

Considerations in preventing, mitigating and responding to a disaster sometimes differ if the cultural heritage is moveable rather than if it is immoveable. For example, sometimes facility issues in immoveable cultural heritage can be the source of the disaster, such as broken pipes or

1 P. Gerstenblith, personal communication, May 13, 2012.
2 Elizabeth Varner, Cultural property and heritage, In the *Encyclopedia of Military Science*. K Piehler (Ed.). Thousand Oaks, CA: SAGE Publications, Inc., 2013.
3 Convention for the Protection of Cultural Property in the Event of Armed Conflict, May 14, 1954, 249 U.N.T.S. 240.
4 Lori Foley, (Vice President of Emergency Programs at Heritage Preservation), interview by Elizabeth Varner, Record, August 22, 2013.
5 Corine Wegener, (Preservation Specialist for Cultural Heritage, Smithsonian Institute), interview by Elizabeth Varner, Record, July 02, 2013.

The Convento Da Ordem do Carmo in Lisbon, Portugal was destroyed in the 1755 Lisbon Earthquake.

Anna Hallett

fire from faulty wiring in a historic house.[6] Sometimes moveable cultural heritage, such as a painting or document, can more readily be evacuated or moved to a safe location than immoveable cultural heritage such as a monument, museum, or historic site.[7] Different requirements for salvage can also exist such as Section 106 responsibilities for properties on or eligible for the National Register of Historic Places.[8]

I. Threshold Issues in Preventing, Mitigating, and Responding to Disasters Involving Tangible Cultural Heritage

A. Key Parties for Preventing, Mitigating and Responding to Cultural Heritage Disasters

Key parties for preventing, mitigating, and responding to cultural heritage disasters include the cultural entity possessing the cultural heritage, emergency responders, and cultural heritage and emergency response networks and partners. In the United States of America cultural heritage and emergency response networks and partners can include the American Institute for Conservation, Federal Emergency Management Agency (FEMA), Heritage Emergency National Task Force, Northeast Document Conservation Center and other regional centers, Smithsonian Institution, U.S. Committee of the Blue Shield, and the U.S. National Park Service (see *infra*).

B. Natural vs. Human-Induced Disasters

Natural. Natural disasters include earthquakes, floods, hurricanes, severe storms, tornadoes, tsunamis, volcanoes, and wild fires.[9]

Human-induced. Human-induced disasters include armed conflict, arson, chemical spills or leaks, civil disorder, facility failures such as broken pipes and faulty wiring, terrorism, and vandalism.[10]

Overlap. Lori Foley, Vice President of Emergency Programs at Heritage Preservation, observed that sometimes the resulting harm from natural or human-induced disasters is similar: "whether an arsonist sets a fire or a bolt of lightning starts a fire, the cultural object is still burned. Whether a water pipe bursts or a storm surge floods the structure, cultural objects become wet. Whether a bomb explodes or a tornado hits, cultural objects are torn apart. Recognizing some of these overlaps and typical types of damage in disasters, such as water and fire damage, can help entities prepare for cultural heritage disasters and make the parade of horribles less daunting."[11]

C. Difference between Preventing, Mitigating and Responding to Cultural Heritage Disasters

While organizations have different ways of addressing stages of emergency management, such as FEMA, which divides emergency management into five areas including prevention, mitigation, preparedness, response, and recovery,[12] for purposes of this article stages of emergency management will be consolidated into three areas: prevention, mitigation, which will include preparedness, and response, which will include recovery. These various stages have overlap.

Preventing. "Prevention", according to FEMA, includes "[a]ctions to avoid an incident or to intervene to stop an incident from occurring."[13]

Mitigating. "Mitigation" means "[a]ctivities providing a critical foundation in the effort to reduce the loss of life and property from natural and/or human-caused disasters by avoiding or lessening the impact of a disaster and providing value to the public by creating safer communities."[14] The term "mitigate" is necessary because it is not always possible to prevent, or stop, all disasters.

For purposes of this paper, "preparedness" is included under "mitigation". "Preparedness" is defined as "[a]ctions that involve a combination of planning, resources, training, exercising, and organizing to build, sustain, and improve operational capabilities."[15]

Responding. "Response" is defined as "[i]mmediate actions to save and sustain lives, protect property and the environment, and meet basic human needs."[16] Response can encompass the time between notification, if any, of the approaching disaster and when it occurs, such as during a storm watch; stopping the disaster, such as putting out a fire, or trying to save cultural heritage and people during the disaster.[17,18]

For purposes of this article, "recovery" is included under "response". "Recovery" is defined as the "development, coordination, and execution of service and site restoration plans… evaluation of the incident to identify lessons learned; post-incident reporting; and development of initiatives to mitigate the effects of future incidents."[19] Recovery includes salvaging, rebuilding, and conserving cultural heritage in the aftermath of the disaster.[20]

Disconnect. A gap in understanding can exist about who has control over response to affected cultural heritage and what that response should be.[21] Not all cultural heritage professionals have developed a written disaster plan for their collections and understand what happens

6 National Park Service (2000, 2001). Emergency planning. In *Museum Handbook* (10). http://www.nps.gov/museum/publications/MHI/mushbkI.html
7 National Park Service (2000, 2001).
8 Advisory Council on Historic Preservation, *Role of Section 106 in disaster response - Frequently asked questions, 2011.* http://www.achp.gov/sec106_disaster-responseFAQ.html
9 National Park Service (2000, 2001).
10 National Park Service (2000, 2001).
11 Lori Foley, (Vice President of Emergency Programs at Heritage Preservation), interview by Elizabeth Varner, Record, August 6, 2013.
12 Lori Foley, August 22, 2013.
13 Federal Emergency Management Agency, *Developing and maintaining emergency operations plans: Comprehensive preparedness guide 101, 2010.* http://www.fema.gov/pdf/about/divisions/npd/CPG_101_V2.pdf
14 FEMA, 2010.
15 Ibid.
16 Ibid.
17 Lori Foley, August 6, 2013
18 National Park Service (2000, 2001).
19 FEMA, 2010.
20 National Park Service (2000, 2001).
21 Lori Foley, August 6, 2013.

during the disaster.[22] Not all first responders understand the importance of cultural heritage, how cultural heritage should be handled, and cultural heritage professionals' concerns about the protection of cultural heritage.[23]

"If a major disaster such as a fire occurs at a cultural heritage institution, the cultural stewards are not in charge of the response; the museum director will not be telling the fire chief what to do," said Foley. As a result of the passing of the baton during a disaster, it behooves cultural heritage professionals to work with emergency responders on a local and national level to make sure their concerns are understood before a disaster takes place.[24]

Wegener added that many cultural heritage professionals might also not consider the time lapse before cultural heritage is addressed in a disaster, especially a large-scale disaster, as people come first and must be protected or rescued before cultural heritage.[25] Nonetheless, the overall climate of responding to cultural heritage disasters has improved.

II. Advances in Preventing, Mitigating and Responding to Cultural Heritage Disasters

A. Advances in Awareness, Resources, Knowledge, and Training in Disaster Prevention, Mitigation and Response

Advances. While advances in technical aspects of cultural heritage disasters continue, such as in the field of conservation and forecasting natural disasters,[26] this article will not focus on the technical advances, but rather how the overall climate of responding to cultural heritage disasters has advanced.

Motivation. The great devastation wrought in natural and human-induced disasters such as Hurricane Katrina and Sandy, the earthquake in Haiti, and ongoing armed conflicts as well as the ratification of cultural heritage agreements like the 1954 Hague Convention have spurred advances in awareness, resources, knowledge, and training to protect and save cultural heritage from disasters.[27]

Awareness, resources, knowledge, and training. As each new disaster occurs, cultural heritage entities and those that help them respond and recover from those disasters learn how to better respond to the next disaster.[28] Many resources have been created to educate cultural entities on how to prevent, mitigate, and respond to disasters impacting cultural heritage and can be downloaded for free on websites of the American Library Association,[29] Connecting to Collections, Heritage Emergency National Task Force, National Center for Preservation Technology and Training, National Trust for Historic Preservation and Smithsonian Institution Archives, among many others. These sites have articles and guides that address key issues such as creating a disaster plan, training internal responders such as cultural entities' staff and volunteers, training external responders such as firefighters, evaluating hazards the cultural entity could encounter, and preparing for standard types of damage caused by water and fire.[30,31]

Disaster networks and partnerships. State resources, conservator groups, collection management groups, registrar groups, and disaster networks, such as the Alliance for Response, are available to promote awareness of disaster response, to train cultural entities, and to help respond to disasters.[32] Additionally, cultural heritage entities have been forming partnerships with emergency responders. At Heritage Preservation, Foley connects the emergency responder community with the cultural heritage community to create relationships, to share the value of cultural heritage, and the language and concerns of emergency management professionals.[33]

B. Resources

1. Resources for prevention

Evaluating and addressing risk. One of the first steps cultural entities should take in preventing and preparing for disasters is an evaluation of potential risks. Libraries, long-time staff at the cultural heritage entity, local historians, emergency responders, cultural heritage networks, and a variety of entities that specialize in certain disasters are helpful to consult to determine past disasters that might manifest in the future, which should be included in the disaster plan.[34] For example, FEMA's "Declared Disasters by Year and State" is useful for evaluating what kind of risks a cultural entity could face within the United States of America.[35] Typical facility risks, such as water pipes and wiring, should also be addressed and hopefully prevented.[36]

The National Park Service has a model Emergency Risk Assessment Worksheet.[37] Heritage Preservation also has a risk prioritization worksheet and a walk-through checklist in its Risk Evaluation and Planning Program.[38]

Creating a disaster plan. A disaster plan is a critical resource that helps an entity prevent, mitigate, and respond to a disaster.[39] The American Alliance for Museums

22 Ibid.
23 Ibid.
24 Lori Foley, August 6, 2013.
25 Corine Wegener, July 02, 2013.
26 Corine Wegener, July 02, 2013.
27 Corine Wegener, July 02, 2013.
28 Lori Foley, August 6, 2013.
29 American Library Association (n.d.). *Disaster response: A selected annotated bibliography.* www.ala.org/Template.cfm?Section=libraryfactsheet&Template=/ContentManagement/ContentDisplay.cfm&ContentID=25420
30 Heritage Preservation (n.d.e). *Risk evaluation and planning program.* http://www.heritagepreservation.org/REPP/
31 Heritage Preservation (n.d.f). *Working with emergency responders.* http://www.heritagepreservation.org/lessons/HPR_Emergency_Poster8.5x11.pdf
32 Heritage Preservation (n.d.a). *Alliance for response.* http://www.heritagepreservation.org/AfR/index.html
33 Lori Foley, August 6, 2013.
34 National Park Service (2000, 2001).
35 Federal Emergency Management Agency, *Disaster declarations by state/tribal government, 2012* http://www.fema.gov/disasters/grid/state-tribal-government
36 National Park Service (2000). Risk assessment worksheet. In *Museum Handbook*. http://www.nps.gov/museum/publications/MHI/Fillable_Risk_Assessment_Worksheet.pdf
37 National Park Service (2000, 2001).
38 Heritage Preservation (n.d.e).
39 American Alliance for Museums (2012). *Developing a disaster preparedness/Emergency*

considers it important enough to have made a disaster plan one of its five core documents for museums (2012).

The following are highlights of the many resources that explain how to create a disaster plan and can be utilized by museums or other cultural heritage sites as a starting point. The United Nations Educational, Scientific and Cultural Organization has a useful outline for understanding key issues in disaster prevention, preparedness, response, and recovery.[40] The Northeast Document Conservation Center has a worksheet that cultural entities can fill in to create its own disaster plan that is helpful.[41] An online program, dPlan,[42] created by the Northeast Document Conservation Center in partnership with Massachusetts Board of Library Commissioners will enable a cultural entity to tailor its disaster plan.[43] The Getty Conservation Institute's *Building an Emergency Plan: A Guide for Museums and Other Cultural Organizations* and the National Park Service's *Museum Handbook* are comprehensive guides for considerations for disaster management and creating a disaster plan.[44,45]

The Council of State Archivists also offers a downloadable template, called the Pocket Response Plan, for key, customizable disaster plan information that is designed to be easily carried on the responder (n.d.). While the organization notes that it is not to be used in lieu of a full disaster plan, it is a great resource that staff can carry on them to "ensure that all the appropriate personnel are contacted and all the appropriate response steps are taken."[46,47]

2. Resources for mitigation

Preparing for foreseeable risks. Many foreseeable risks that cannot be prevented can be addressed and mitigated.[48] For example, flooding, whether from nearby water features, rain or even a burst pipe within a structure, is a foreseeable risk for most entities such that it is advisable not to place or store cultural heritage on or near the floor.[49] Fire is also another foreseeable risk. The National Park Service has a checklist on steps to take to prevent fires[50] while the Northeast Document Conservation Center has an article on fire detection and suppression.[51]

The flooding in Ravena, Italy threatens hundreds of artifacts and cultural heritage sites.

Preparedness. Many institutions, including the Northeast Document Conservation Center, have lists of emergency supplies that cultural entities will need to respond to disasters that should be gathered in advance.[52] Heritage Preservation and Regional Alliance for Preservation offers many training opportunities, as do regional conservation and preservation groups.[53] The Getty Conservation Institution's book, *Building an Emergency Plan*, has a very helpful chapter on how to train cultural entities' staff for emergency response.[54]

Partnerships. Foley says that both cultural heritage professionals and emergency responders have a role in disasters involving cultural heritage and can benefit by understanding the issues involved, preparing for any disasters, and working together.[55] Heritage Preservation lists online courses that cultural heritage professionals can take to better understand the emergency response process and communicate with emergency responders.[56] Cultural heritage professionals and emergency responders alike can better understand issues impacting cultural heritage in disaster situations by reviewing the resources listed in

response plan. http://www.aam-us.org/docs/continuum/developing-a-disaster-plan-final.pdf?sfvsn=2
40 United Nations Education, Science and Cultural Organization (1999). *Disaster planning: Prevention, preparedness, response, recovery.* webworld.unesco.org/safeguarding/en/pdf/txt_sini.pdf
41 Northeast Document Conservation Center (n.d.d). *3.4 Worksheet for outlining a disaster plan.* http://www.nedcc.org/free-resources/preservation-leaflets/3.-emergency-management/3.4-worksheet-for-outlining-a-disaster-plan
42 Northeast Document Conservation Center, Massachusetts Board of Library Commissioners, Institute of Museum and Library Services, & National Center for Preservation Technology and Training (n.d.). *dPlan*. http://www.dplan.org/
43 Funded by the Federal Institute of Museum and Library Services and National Center for Preservation Technology and Training.
44 National Park Service (2000, 2001).
45 V. Dorge & S. Jones, *Building an emergency plan: A guide for museums and other cultural institutions,* 1999. http://www.getty.edu/conservation/publications_resources/pdf_publications/pdf/emergency_plan.pdf.
46 Lori Foley, August 22, 2013.
47 Council of State Archivists (n.d.). *Pocket response plan (PReP).* http://www.statearchivists.org/prepare/framework/prep.htm
48 Northeast Document Conservation Center (n.d.c). *3.1 Protection from loss: Water and fire damage, biological agents, theft, and vandalism.* http://www.nedcc.org/free-resources/preservation-leaflets/3.-emergency-management/3.1-protection-from-loss-water-and-fire-damage,-biological-agents,-theft,-and-vandalism
49 Ibid.
50 National Park Service (2005). Fire safety 101: A fire safety self-inspection checklist. In *Conserve O Gram*. http://www.nps.gov/history/museum/publications/conserveogram/2-23.pdf
51Northeast Document Conservation Center (n.d.b). 3.2 *An introduction to fire detection, alarm, and automatic fire sprinklers.* http://www.nedcc.org/free-resources/preservation-leaflets/3.-emergency-management/3.2-an-introduction-to-fire-detection,-alarm,-and-automatic-fire-sprinklers
52 Northeast Document Conservation Center (n.d.d).
53 Heritage Preservation (n.d.b). *On-line courses in emergency management for cultural heritage responders.* http://www.heritagepreservation.org/lessons/courses.html
54 V. Dorge & S. Jones, *1999.*
55 Lori Foley, August 6, 2013.
56 Heritage Preservation (n.d.b).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this article. Additionally, joining or forming a disaster network and integrating the cultural entity into the community's hazard mitigation plan can help prevent, mitigate, and facilitate response to disasters that impact cultural heritage.[57]

Armed conflict. In regard to preparing for armed conflicts, Article 3 of the 1954 Hague Convention states that parties to the Convention, "undertake to prepare in time of peace for the safeguarding of cultural property situated within their own territory against the foreseeable effects of an armed conflict, by taking such measures as they consider appropriate."[58]

When asked whether each U.S. cultural entity had a duty to prepare their moveable and immoveable cultural heritage for armed conflict as the U.S. has ratified the Convention, Wegener pragmatically responded that each cultural entity needs to individually evaluate this risk as part of its risk assessment:[59] Where are they located? Does the subject matter of their collection or site make it a target?

Wegener believes the military has a duty to understand the requirements to respect cultural heritage and helps train the military in understanding the requirements of the 1954 Hague Convention.[60]

3. Resources for responding to a disaster

Before disaster hits. Wegener suggests cultural heritage entities refer to the checklist in their disaster plans to implement the course of action to best prepare for the oncoming disaster.[61] Given sufficient warning time, such as when a hurricane is being tracked, a cultural heritage entity can prepare before the disaster occurs, such as by evacuating collections,[62] but staff and volunteers must exercise caution and ensure personal safety first.[63]

Response. Cultural heritage entities should refer to the checklist in their disaster plans to enact the appropriate response procedures, including evacuating people, important moveable cultural heritage, and documents. The Getty Conservation Institute's book, *Building an Emergency Plan*, discusses different cultural entity departments' response procedures.[64] The National Park Service's *Museum Handbook* and the *Primer on Disaster Preparedness, Management, & Response* by the Library of Congress, National Archives and Records Administration, National Park Service and Smithsonian Institute lay out cultural heritage entity's response procedures for different types of emergencies such as floods or earthquakes.[6566]

Recovery. After the disaster has passed, the initial response has concluded, and cultural heritage professionals can access the cultural heritage, recovery efforts listed in the disaster response plan should start.[67] The first concern should be human life and all structures and sites should be confirmed to be safe and structurally sound before entering.[68]

Heritage Preservation's Emergency Response & Salvage Wheel is a great tool that consolidates disaster response information for cultural entities into a user-friendly laminated wheel that is also available as a free app in conjunction with the National Center for Preservation Technology and Training so cultural heritage professionals and emergency responders can carry it with them everywhere.[69] The websites of the Conservation Center for Art and Historic Artifacts, LYRASIS, the National Park Service, Northeast Document Conservation Center, Heritage Preservation, the Smithsonian Institution and American Institute for Conservation all have downloadable information on salvaging specific types of cultural heritage such as wet paper and books.

There are also groups and specialists available to help salvage cultural heritage after a disaster including the American Institute for Conservation Collections Emergency Response Team and the Northeast Document Conservation Center that are available twenty-four hours a day, the Federal Emergency Management Agency and, in many regions, Alliance for Response.[70]

C. Next Steps to Further Advance Preventing, Mitigating and Responding to Cultural Heritage Disasters

Consolidation. Wegener suggests the consolidation of an entities' efforts and resources is needed so there is less duplication of resources and disaster preparation, mitigation, and response is more attainable for cultural entities.[71] Currently there is a plethora of resources, the high-

57 Federal Emergency Management Agency, *Integrating historic property & cultural resource considerations into hazard planning, 2005*. www.fema.gov/plan/hp/hp/fma386-6.shm
58 "Convention for the Protection of Cultural Property," 1954.
59 Corine Wegener, July 02, 2013.
60 Ibid.
61 Ibid.
62 Ibid.
63 National Park Service (2000, 2001).
64 V. Dorge & S. Jones, 1999.
65 National Park Service (2000, 2001).
66 Library of Congress, National Archives and Records Administration, National Park Service, & Smithsonian Institute, *Primer on disaster preparedness, management & response, 1993*. http://www.nps.gov/museum/publications/primer/primintro.html
67 National Park Service (2000, 2001).
68 National Park Service (2000, 2001).
69 Heritage Preservation, National Center for Preservation Technology and Training (n.d). *ERS Mobile App.* http://www.heritagepreservation.org/wheel/
70 Corine Wegener, July 02, 2013.
71 Ibid.

lights of which are listed in this article, but the breadth and volume could be daunting for cultural entities, many of which have overstretched resources; however, it remains essential for cultural heritage entities to make, implement, and update disaster management plans.[72]

Disaster networks and partnerships. Cultural entities, emergency responders, and the communities need to create more and stronger networks and partnerships.[73] Networks with cultural heritage professionals and emergency responders in the same region are helpful to share knowledge and responses to similar risks.[74] Cultural entities should invite emergency responders for tours and events, ask their advice for disaster prevention, mitigation, and response, and prepare a packet of information so that the emergency responders are better prepared to respond to a disaster at the site.[75] The citizens surrounding the cultural heritage should be involved with the cultural entity and feel a connection to the cultural entity so that they will respond to disasters, call law enforcement if they see something suspicious, and be a deterrent for looting.[76]

III. Key List of Basic Standards for Preventing, Mitigating, and Responding to Cultural Heritage Disasters

For those who do not have the days (or weeks) to pour through the disaster resources for cultural heritage, some key, starting points to keep in mind:

- Have a person in charge of making and updating the disaster plan, implementing the plan, and being the disaster contact point;[77]
- Cultural heritage professionals should work with emergency responders to make sure the cultural entity is in the disaster plan for the community;[78]
- Have an adequate inventory report and insurance policy and keep copies at the cultural entity and at a location other than the cultural entity;[79]
- Have a list of emergency contacts and their phone numbers and emails in the disaster plan;[80]
- Survey risks including those from nature, humans, and from the structure itself and address those risks;[81]
- Ensure adequate fire and security monitors and fire suppression systems;[82]
- Make sure all staff is familiar with and has easy access to the disaster plan at and away from the cultural entity;[83]
- Make sure human life is the first priority and to evacuate the staff, volunteers, and patrons first if a disaster does occur;[84] and
- Ensure the area is safe before going back in to start the recovery process.[85]

This article should offer cultural heritage entities worldwide a starting point and basis for a disaster mitigation plan. Many risks exist, but fortunately many resources and partners are available to help cultural entities' prevent, mitigate and respond to disasters. While not all disasters can be prevented, by preparing in advance, the damage to cultural heritage can be mitigated.

72 Ibid.
73 Lori Foley, August 6, 2013.
74 Heritage Preservation (n.d.a).
75 Heritage Preservation (n.d.f).
76 Corine Wegener, July 02, 2013.
77 Northeast Document Conservation Center (n.d.a). *3.3 Disaster planning.* http://www.nedcc.org/free-resources/preservation-leaflets/3.-emergency-management/3.3-disaster-planning
78 Corine Wegener, July 02, 2013.
79 Northeast Document Conservation Center (n.d.d).
80 V. Dorge & S. Jones, 1999.
81 National Park Service (2000, 2001). Emergency planning. In *Museum Handbook* (10). http://www.nps.gov/museum/publications/MHI/mushbkl.html
82 Northeast Document Conservation Center (n.d.b).
83 National Park Service (2005). Be prepared: Develop a museum emergency operations plan. In *Conserve O Gram*. http://www.nps.gov/museum/publications/conserveogram/21-09.pdf
84 National Park Service (2000 - 2001). Emergency planning. In *Museum Handbook* (10). http://www.nps.gov/museum/publications/MHI/mushbkl.html
85 Ibid.

Artifacts at Pompeii

'Japan changed everything'

Advances in tsunami modeling and simulation since 2011

LIAISON Staff

In 1960, a 9.5-magnitude earthquake, the largest in recorded history, struck Chile. The resulting tsunami not only killed citizens locally, but nearly a day later took lives in Hawaii, Japan and the Philippines before its waters receded back into the Pacific Ocean. Since the Chilean earthquake, tsunami warning systems have improved dramatically, but the 2011 earthquake and tsunami in Japan changed what scientists thought they knew about underwater seismic activity.

At the forefront of the research is the Pacific Tsunami Warning Center (PTWC) on Oahu, Hawaii. As part of the National Oceanic and Atmospheric Administration, the PTWC collects real-time data from Deep-ocean Assessment and Reporting of Tsunamis (DART) stations placed strategically around the globe. The DART information is collected and processed through a mathematical algorithm to predict the landfall location and strength of the tsunami in time to warn potential impact regions; however, the algorithms and prediction-models are now being reevaluated after the catastrophic 2011 event.

"Since (the Indian Ocean tsunami in) 2004, there have been many big advances," said Gerard Fryer, Ph.D., senior geophysicist at PTWC. Dr. Fryer explains that the three most significant advances in the field are the number of DART systems, which has increased from six in 2001 to more than 50 in 2013; modeling, the numerical estimation of how big the tsunami is going to be; and seismology overall. But, he adds, "Japan changed everything."

Tsunamis are traditionally caused by megathrust earthquakes, or when two tectonic plates meet and one plate slides under the other at subduction zones. The sudden upshift in the earth's crust pushes the water violently in one direction, producing a tsunami.

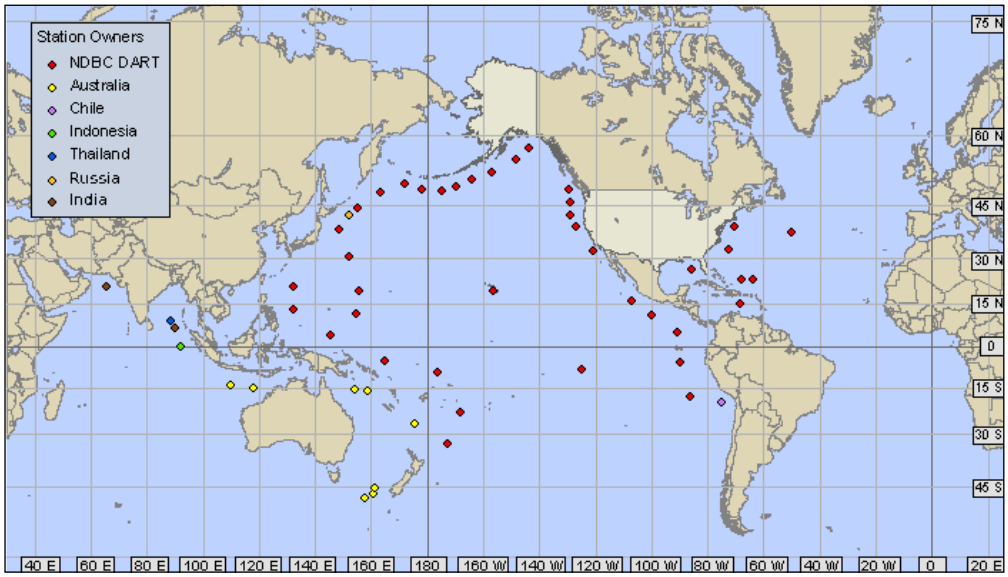
Predicting when and where a tsunami will reach land is a constantly evolving challenge. It requires calculating the location and size of the earthquake, its depth within the earth's crust, how the wave is traveling through the ocean and how significant the shift in land mass is on the ocean floor. The prediction demands solving a massive differential equation that requires significant time and expensive computing power. As a way to reduce the warning generation time, the PTWC uses a modeling and simulation database for tsunamis developed at the Pacific Marine Environmental Lab, which has increased the accuracy of tsunami predictions and increased warning times from minutes to hours.

When an earthquake occurs, the DART system reports the event and the modeling system performs an immediate calculation using the pre-computed database. This enables the development of likely predictions for estimating the size of the tsunami and provides a rough calculation that can serve to indicate the location of landfall.

An additional strength of the modeling and simulation system arises from the ability to modify the input upon

Japanese Self-Defense Force

which the simulation is running to match additional observations from distributed sensors as the data becomes available. When the wave impacts additional DART buoys, or more precise data from the global seismic monitoring system is received, the new information is plugged into the model to increase the prediction precision. This refining process increases the confidence in the prediction and adds flexibility to the system – it can quickly incorporate new data, producing very accurate models of the areas of landfall and color-coded maps with degrees of flooding. The models make it possible to issue very precise warnings so that people in the affected area can be told to evacuate, while those outside the danger area are directed to remain in place.



Deep-ocean Assessment and Reporting of Tsunamis (DART) stations as of 2013

However, whereas the location and direction change with each event, the size of the mass shift in the earth's crust within the calculation was always limited to a previously known distance. The significance of the Japan earthquake was the amount of movement, or 'slippage,' which occurred. All previous models, and therefore the algorithms, are based on the largest amount of slippage known to have occurred – 30 meters during the Chilean earthquake (see insert).

"During the 2011 Japanese earthquake, the slip was around 60 meters – twice that of the worse we have ever seen," said Fryer. "This makes the models from all previous simulations obsolete and the plans for evacuation inadequate."

It is also why, Fryer explains, that even though Japan's tsunami evacuation plan was thorough, the devastation in Japan was so great; the actual water level reached well beyond what was previous thought of as safe zones.

This new data is important for two additional reasons beyond precise modeling. First, time and accuracy are essential. The more accurate the information disseminated to the citizenry, the greater the time people have to prepare for the tsunami. Evacuations can be ordered in a timely manner, reducing possible confusion and preventing injuries that can occur during the evacuation process itself.

"Once everyone starts calling each other, cellular communications often collapse. So the first message people receive on their phones has to be correct," said Fryer. "It is better to take the extra seconds you need to get the required level of accuracy than go out with an inaccurate warning quickly and then have to try to notify everyone again when the communication channels are clogged."

Second, precise predictions reduce the number of false alarms in nations that previously would have received warnings. In the high-risk nation of Fiji, the increased accuracy has reduced an annual average of false tsunami warnings from 12 to one. If people receive numerous false alarms, they tend to decrease the seriousness with which they take future warnings.

According to Fryer, an initial estimate of an earthquake anywhere in the world takes between eight and nine minutes, and a precise estimate approximately 25 minutes. Nonetheless, this modeling and simulation does not provide a complete solution – human expertise is required to extract the most value from the automated modeling and simulation capabilities. This enables them to interpret and generate appropriate warnings but also respond to events outside the normal scope of the models design.

Now, at tsunami warning centers around the world, disaster response planners and scientists like Fryer are recalculating tsunami simulations based on the Japan earthquake slippage and producing new plans for tsunami events. Areas that were once believed to be unreachable by floodwaters are now in danger zones if large shifts in land mass continue in the Pacific.

"The last decade has been one section of astonishing events after another. I wouldn't be surprised if this type of event occurred again," said Fryer. "But as more historical data becomes known, the safer people will be."

Lessons from Japan

By Gerald Fryer, Ph.D., Senior Geophysicist, NOAA Pacific Tsunami Warning Center

After the Indian Ocean disaster of 2004, tsunami warning systems everywhere were enhanced and new ones established. These systems promised useful alerts relating to all tsunamis from sources more than a thousand kilometers away. Warning for nearby sources, however, still left much to be desired – tsunamis in Indonesia, the Solomon Islands, Chile, and Samoa had a combined death toll of over 1,600. Then, (in 2011), the huge Tohoku Earthquake occurred off Japan.

Three minutes after the shaking began, warning sirens in Japan blared and people began to evacuate. Nevertheless, the death toll was immense: 15,429 confirmed dead so far, with an additional seven thousand still missing. Japan's tragedy is all the more sobering, given that it possessed the most sophisticated warning system and the most tsunami-aware public.

The tsunami was simply too large: it overran defenses and flooded farther inland than anyone expected. Stone monuments erected by survivors of great tsunamis in 869 and 1611, however, had documented similar flooding. Those monuments once seemed impossibly far inland. No longer.

The Tohoku earthquake was remarkably compact, rupturing an area only a few hundred kilometers long by less than a hundred kilometers wide. The big surprise was the amount of slip – the distance one side of the fault moves relative to the other. At the shallowest depths of rupture, slip may have reached 60 meters, at least double that inferred for other major earthquakes. Must we now consider the possibility of large slip in all significant quakes? Because the size of a tsunami depends on the amount of sea floor deformation, greater slip means a bigger tsunami. In tsunami-prone regions throughout the world, evacuation maps consider the effects of tsunamis from credible worst-case earthquakes, but 'credible' has never, until now, involved more than 30 meters of slip. Coastal evacuations are already disruptive, expensive, and fraught with their own perils, but at least evacuees could be confident that once out of the hazard zone, they were safe. Tohoku shatters that confidence. With few reliable reports of tsunamis dating beyond a couple of hundred years, we urgently need to push back the record to a few thousand, to discover if the Tohoku earthquake truly was an anomaly. We need more geologists digging trenches in low-lying coastal areas, mapping and dating the sands and other material brought in by ancient flooding waves.

In the meantime, the public needs to be educated about how to respond. Even with Japan's elaborate preparationsv for tsunamis, many were uncertain of what to do. A less-prepared country would fare far worse.

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CALENDAR OF EVENTS

1 **International Federation of the Red Cross and Red Crescent Societies**
Civil and Military Relations Forum
May 4 – 9
Kuala Lumpur, Malaysia

2 **Secretariat of the Pacific Community & United Nations Office for Disaster Risk Reduction (UNISDR)**
2014 Pacific Platform for Disaster Risk Management
June 2 – 4
Suva, Fiji

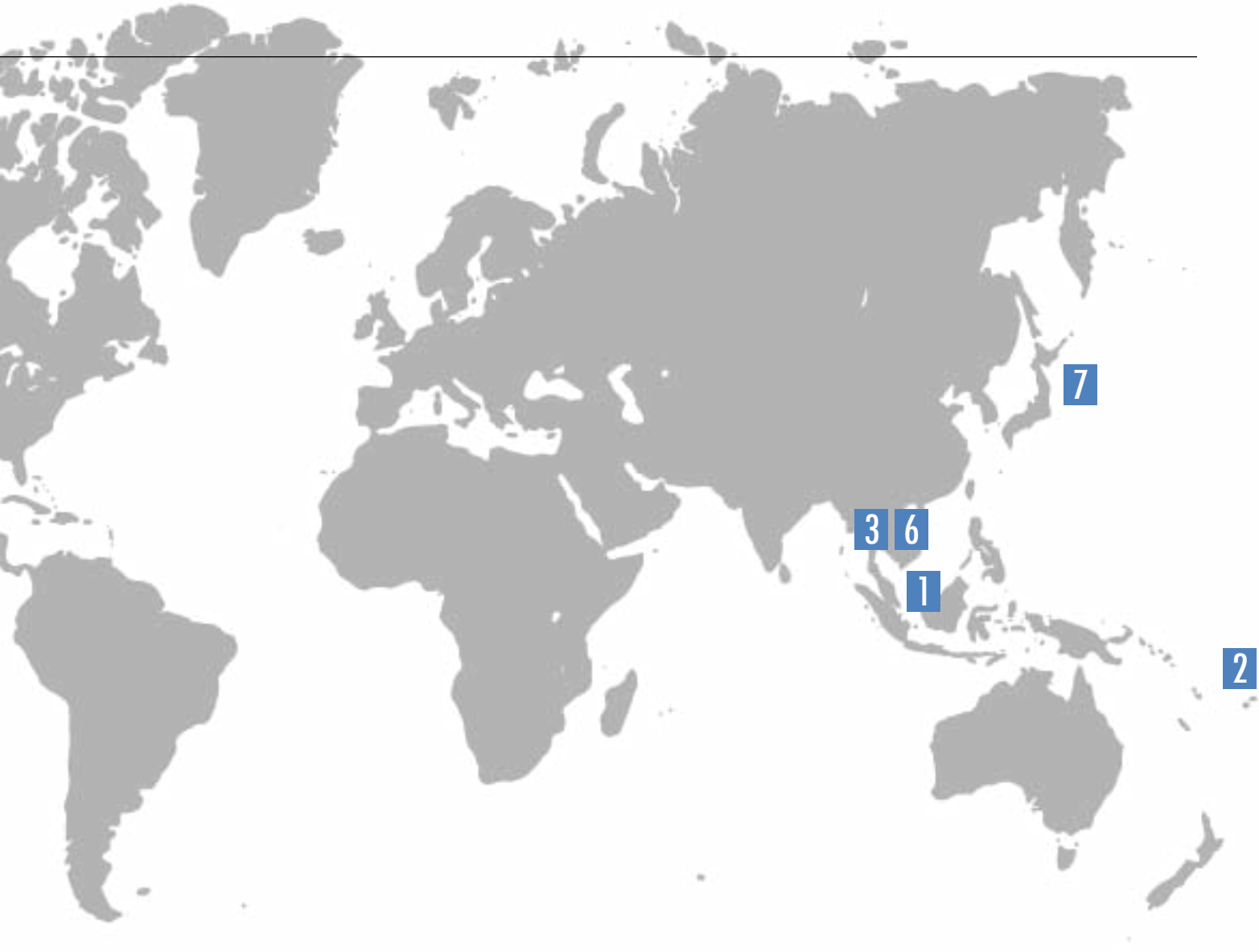
20th Regional Disaster Managers Meeting
June 5 – 6

3 **Royal Thai Government & UNISDR**
Sixth Asian Ministerial Conference on Disaster Risk Reduction
June 22 – 26
Bangkok, Thailand

4 **International Federation of the Red Cross and Red Crescent Societies & CFE-DMHA**
Health Emergencies in Large Populations (HELP) Course
July 21 – Aug. 1
Pearl Harbor, Hawaii, USA

5 **Center for Excellence in Disaster Management & Humanitarian Assistance**
Humanitarian Assistance Response Training (HART) Course
Aug. 12 – 14
Pearl Harbor, Hawaii, USA

November, date TBD
Okinawa, Japan



6 **Asian Disaster Preparedness Center**
Tenth International Training Course on Geographic Information Systems for Disaster Risk Management
Oct. 27 – Nov. 7
Bangkok, Thailand

7 **United Nations Office for Disaster Risk Reduction**
Third World Conference on Disaster Risk Reduction
March 14 – 18, 2015
Sendai, Japan

CENTER FOR EXCELLENCE
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