Research and Experimentation for Local & International Emergency First-Responders

RELIEF 11-02

Report on the RELIEF 11-02
Experiments at NPS/Virginia Tech Advanced Research Institute in Arlington, VA

*Humanitarian Technologies for
Domestic and International HADR Operations*

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# Background

From 22-25 February 2011, RELIEF convened its seventh session of field experiments for humanitarian information management and crisis mapping at the Virginia Tech/NPS Advanced Research Institute in Arlington, VA. The RELIEF experiments occurred within a partnership of the National Defense University’s Center for Technology and National Security Policy and the Naval Postgraduate School.

Problem domain: RELIEF 11-02 focused on three problems:

1. **How to create a protocol by which volunteer and technical communities (e.g., OpenStreetMap and Crisis Mappers) can request imagery from lead US federal agencies**. Volunteer and technical communities (V&TCs) generally lack access to the imagery that sparked the crowdsourcing activity seen after the Haiti earthquake. This experiment focused on building a protocol for the USG to publish imagery and other geospatial data to V&TCs in the event of a domestic or international emergency response operation.
2. **How to quickly identify health facilities in a country after a sudden onset emergency***.* After the Haiti quake, one of the most pressing problems for SOUTHCOM and the United Nations was identifying the locations and status of health facilities. This experiment focused on techniques for aggregating and conflating existing data sets, with secondary focus on building methods for validating information and ensuring minimal duplicates in the data set.
3. **How to enable field-deployed military units to support social media during crisis operations.** With operations like Haiti and Libya, social media is a key method of interacting with the affected population. However, the military is poorly tooled to support social media; it cannot open communications channels to enable flows of SMS messages nor can it analyze the data for actionable information. This experiment explored how to build out a pre-alpha version of QuickNets, a Joint Staff project to support social media during HADR operations.

Approach. Unlike the hackathons and code sprints which have become common among other crisis organizations (like Crisis Camps and the Random Hacks of Kindness) which generally invite technologists to invent new software platforms to solve a range of problems), the experiments at RELIEF extend existing applications. The intent is to gather the inventors of the open source software commonly used by responders and the large organizations that deploy to humanitarian emergencies. In this case, RELIEF convened a panel of top humanitarian technologists from industry and the open-source domain. This team included the following software developers and engineers:

* **David Bitner**, SAHANA
* **Kate Chapman**, OpenStreetMap
* **George Chamales**, system administrator for Ushahidi’s Crowdmap and core collaborator on other Ushahidi tools.
* **Victor Cid**, NLM - Disaster InfoMngmt Research Center
* **Mary Fraley**, ESRI - Technical
* **George Gallop**, U.S. NAVY
* **Dominic Konig**, SAHANA
* **Carlunle** **Moyet-Bruno**, U.S. NAVY
* **James Mwangi**, U. of South Alabama CSHI
* **Joram Mwangi**, U. of South Alabama CSHI
* **Glen Pearson**, National Library of Medicine
* **Jason Ricksillius**, Hosted Labs
* **Kevin Sigwart**, ESRI - Technical
* **Stan VanDruff**, U.S. NAVY
* **Rob Baker**, Konpa Group

The RELIEF team also convened SMEs who focused on the social and policy problems around the use of open-source software in the field, including:

* **Rosa Akbari**, NPS RELIEF
* **Tristan Allen**, NPS RELIEF
* **Katie Baucom**, NGA
* **Samuel Bendett**, NDU - TIDES
* **Heather Blanchard**, CrisisCommons
* **Mark Bradshaw**, U.S. NAVY
* **Jeannenne Brooks**, NGA
* **Kevin Cole**, NGA
* **John Crowley**, experimentation lead and crisis mapping coordinator at both the Harvard Humanitarian Initiative and National Defense University Center for Technology and National Security Policy.
* **Nora Darcher**, Booz | Allen | Hamilton - PEAK
* **LouElin Dwyer**, NDU - TIDES
* **Catherine Graham**, HumanityRoad
* **Jessica Heinzelman**, Konpa Group
* **Christina Higgins**, NGA
* **Eric James**, American Rescue Committee
* **Theresa Jefferson**, Virginia Polytechnic Institute and State University
* **Bess K(utseris), NGA Support Team @ State HIU**
* **Matt Mattigan**, FortiusOne
* **Jon Nystrom**, ESRI - Crisis Mapping - FEMA
* **Mark Prutsalis**, Sahana
* **Eric Rasmussen**, AccessAgility
* **Collin Roach**, PEAK
* **Dori Sewell**, U.S. NAVY
* **Nelly Turley**, NPS RELIEF
* **Linton Wells II**, NDU - TIDES
* **Benson Wilder**, Department of State - HIU
* **Michael Willingham**, VT
* **Mary Willmon**, NGA
* **Richard Williams**, NGA
* **Nathaniel Wolpert**, NGA

Over the course of four days, the team of approximately 45 engaged in deep policy discussions with NGA, State HIU, and several V&TCS. They also engaged in collaborative mashups and extensions of several pieces of code, focused on the Python variant of Sahana (Sahana-Eden) with PeopleFinder work on the PHP-version of Sahana (Sahana-Agasti). The accomplishments appear below for each initiative under each of the three problems outlined above.

# Problem 1: Health Facility Crisis Mapping

### Background

After a sudden onset emergency, one of the most critical questions is: *where are the health facilities?* No global database of hospitals, clinics, and smaller facilities currently exists, nor is there a global standard for reporting the current status of each facility and its current supply and staffing needs. To complicate matters, responding organizations deploy (and redeploy) field hospitals and ships with health facilities at a rapid tempo. For physicians in the field who need supplies or wish to transfer patients with acute conditions, the dynamic state of health facilities is almost impossible to track. For those working on DoD operations, supporting the physicians is difficult without having an accurate picture of the state of play.

This situation is complicated by the current state of health facility data that can obtained from the host government and other organizations with operations in the affected area. Collating multiple datasets is time-consuming and error prone. In Haiti, the national ministry of health had a dataset from 2004-05. Hospitals lacked unique identifiers at the national level; they also appeared in the dataset in English, French, and Creole. Some larger facilities housed other items in the dataset (and by extension, their duplicates). Apothecaries—drug dispensing facilities with no beds—were mixed in with large hospitals and small outpatient clinics; some clinics had beds for inpatient work and others did not. Many had been damaged or destroyed, or were lacking staff within key specialties, such as orthopaedic surgery and anesthesia. Making sense of what capabilities existed within a single location, and what each of those locations needed proved to an extreme challenge for responding organizations, including the Command Surgeon at SOUTHCOM.

### Problem Statement

In the event of a sudden onset emergency, it is critical to be able to collate existing datasets of health facilities and quickly derive a list of locations with associated capabilities and needs. This list will provide the basis for comparison against rapid assessments in the first days of the response operation.

### Work Performed

A team from Sahana, the National Library of Medicine Person Finder initiative, Humanity Road and the AIMS service from the University of Southern Alabama developed an approach to mapping health facilities in countries where sudden disasters have changed known conditions. Based on their experience with the Haiti earthquake from 2010, the team assumed that they would need to build a concordance from multiple outdated lists of health facilities, while also adding temporary facilities such as field hospitals and hospital ships.

Their work focused on several key steps in the data munging process:

1. To develop a minimal essential schema for health facilities, including a method to develop unique identifiers for each facility.
2. To develop a process for determining duplicates based on geocodes, names, translated names, and several other attributes of the facility.
3. To develop software code for merging lists of health facilities from multiple data sources, based on the schema in (1) and the process designed in (2) above.

To provide a framing scenario, the team worked with data from a country that is expected to suffer from severe floods in mid 2011: Colombia. The ESRI team brought a list of 1100 hospitals from its distributor in Colombia. This list was compared with two other lists: one from OpenStreetMap and one from Humanity Road. Over four days, the team derived unique identifiers for each facility, identified unions in the datasets as well as hospitals which appeared only 1 or 2 of the three lists. The team then automated the process in Python code, creating tools for a) deriving unique identifiers, b) deriving a list of unique facilities, and c) tracking a small core schema for each health facility. The team integrated the resulting code into Sahana-Eden, the Python-based variant of the Sahana Disaster Management System.

### Remaining Challenges

The team will need to turn rapidly developed software code into production code and document the steps. There will also need to be a process to socialize the solution to the crisis response community.

Process for bringing health facilities is almost there. Resource for tracking health facilities, not static, but dynamic. Available through web services to other applications.

## National Library of Medicine PeopleFinder Project

### Background

The People Finder Interchange Format (PFIF) is a data standard developed for family reunification. Its development is supported by the Google Crisis Response Team. Implementations are deployed by the International Committee for the Red Cross, Google, Sahana, and the National Library of Medicine.

The NLM has extended People Finder for use by federal agencies and hospitals during domestic and international emergencies. The NLM implementation is optimized for hospital staff who are triaging patients from large-scale emergencies.

Glenn Pearson of the NLM team led a group to co-develop two new features in conjunction with Sahana and the health facilities crisis mapping challenge:

* Script to import data from Sahana Eden.
* Continued work on the New Zealand PersonFinder, extending the use of the NLM system as a visualization tool and search engine for the Google data.

### Remaining Challenges

The NLM version of PersonFinder does not yet have mechanism to push data back to Google.

# Problem 2: Imagery Workflow

### Problem Statement:

During crisis response operations, imagery is generally not available for use by crisis mapping organizations. The International Space Charter—an agreement to share imagery several governments, satellite providers, and many UN-affiliated agencies and NGOs—has no provision for voluntary organizations like Crisis Mappers or OpenStreetMap. While the NEXTVIEW license form the US Government provides a mechanism to release commercial imagery purchased by the USG to direct partners to USG operations, releasing data to private volunteer organizations like OpenStreetMap has proved difficult in practice for two reasons:

1. There is no formal mechanism for an entity like OpenStreetMap to request data from the USG, including requests that might generate collections after sudden onset emergencies.
2. The license around was too narrow to accommodate the use of imagery to rebuild a disaster-affected country, including the application of the imagery and derived products to commercial use.

At the second annual International Conference of Crisis Mappers (ICCM) in October 2010, Dick Williams from NGA heard this need and matched it to an internal initiative at NGA to create a “storefront” whereby lead federal agencies can request data from the NGA and retrieve it using OGC-compliant web services. These services—which are loosely called globes—would be available over a public web site and a set of public web services to be supplied by Google.

At RELIEF 11-02, a team from NGA and the State Humanitarian Unit met with members of the volunteer and technical communities (V&TCs) to explore how to connect the VT&Cs to the storefront. Due to laws and regulations, the team started with several design challenges:

1. Because NGA is a supporting agency, V&TCs cannot be a direct customer of NGA. There would need to be process whereby a federal agency would make all decisions about which V&TCS would receive what data over the unclassified infrastructure that NGA is creating.
2. Different federal agencies get the “lead” response role to different types and locations of sudden onset disaster. USAID is lead for many international disasters, but parts of the response may have different lead roles, such as EPA for environmental disasters. There would need to be a mechanism so that each lead federal agency accept requests from the V&TCs, weigh their merits, and request that NGA place certain data onto

### Work Completed

After two days of discussions, the teams created a design that would enable V&TCs to request imagery or other data from the USG; lead federal agencies to weigh the merits of that request; and NGA to place unclassified information on a globe with several layers of access control (from completely public to encumbered). The workflow relies on the creation of a neutral third party ‘broker’ to certify the identity and qualifications of V&TCs and to ensure that all requests made are properly formed and sent to the appropriate lead federal agency. The broker would also ensure that requests are closed, either with the release of data or the release of an explanation of why the data could not be released.

The proposed workflow appears as follows:

1. A V&TC would register with the Broker and undergo some process of certification. This process would ensure that the V&TC understands it responsibilities with the data, has the technical capabilities to pull data from the NGA globes (including proper installation of software).
2. During a sudden onset emergency, the approved VT&C would request data from the broker. The request would be made via a web site that ensures that the V&TC has specified seven elements:
	1. Type of data. The data type, including imagery, vector data, and databases or data sets. In the future, such requests could include radar, multispectral data, and the like.
	2. Geographic boundary: an area of interest with a bounding box.
	3. Temporal boundary: a period of time for the observations.
	4. Operation: the operation that the data would be used to support.
	5. Problem Definition: the problem that the data would be used to solve. This is included because there may be circumstances when release of imagery or other data is not possible, but the USG may have other data types that could meet the request.
	6. License: the licensing needs of the V&TCs, which might include the need to release the data under terms that allow for commercial use.
	7. Partners: the partners with which the V&TC is working on the operation.
3. The Broker would verify the request, validating it against requirements for well-formed requests to the USG. The Broker would then route the V&TC request to the lead federal agency for the current disaster-response operation.
4. The lead federal agency would evaluate the request and determine what data can be released. If data should be released on the NGA storefront, the lead federal agency would make the request to NGA to release the data. This request would either place the data onto a completely public globe or would place it on a globe that is specific to the lead federal agency. The latter type of globe would support encumbered information which the V&TC would be able to use but would have restrictions on redistribution and/or use. The lead federal agency could also release data direct to the V&TC. The lead federal agency would notify the broker and V&TC that the request has been fulfilled or denied.
5. The NGA would evaluate requests from the lead federal agency and would work to release data that solves the problem articulated by the V&TC. For example, if the V&TC requests imagery that would enable volunteers to trace the road and transportation system after the disaster, NGA might also release vector road data that it deems suitable for public release. This would speed up the work of the V&TC, because it would not need to start tracing from scratch. NGA would place data onto the appropriate globe (the public globe or the globe for the requesting lead federal agency) and would notify the lead federal agency, the broker (and if possible, the V&TC) that the request has been fulfilled or denied.
6. The broker would ensure that the V&TC is aware that the data is available for use.

The broker would perform monitoring and evaluation the system, providing reports to the federal government about the areas for improvement and issues that arose during request cycles. The broker would also convene the decision makers at the lead federal agencies for regular, periodic meetings so that these individuals have personal relationships and are implementing the process in similar ways. These meetings would also explore the interface between the USG and V&TCs, recommending continuous adaptation.

### Remaining Challenges:

The protocol needs to be worked into a policy document that can be submitted to the leadership of NGA, lead federal agencies, and V&TCs for further honing and eventual use. The team would like to test the protocol at RELIEF 11-03.

# Problem #3: QuickNets Social Media Support

### Background

Social media is transforming crisis response. Through Twitter, Facebook, YouTube, and SMS-tools like Ushahidi, the affected population are communicating their needs to all who will listen. Unfortunately, neither the DoD nor the UN-led humanitarian response system is tooled to respond to individual requests for assistance. Instead, large players are built to provide aid at a national level. However, when a host nation government cannot respond to requests for assistance from citizens, the question of who has the responsibility to respond to these messages in social media is unresolved.

What is clear is that this communication channel is open and there is a reliable, consistent point of entry for these reports to the DoD. The QuickNets project at Joint Staff is building a backpack-able platform to support social media from the field. The RELIEF experiments were the first public display of the early prototype QuickNet system. The intent of the appearance was to expose the QuickNets team to coders in the V&TCs who could assist them in understanding how the platform could integrate with other social media and mapping applications in use in the field. As a result, the experiment was not one of code building against a challenge, but rather of mentorship and critique.

### Work Completed

**Ushahidi:** members of the Konpa Group led the QuickNets team through the software architecture of Ushahidi and the emerging capabilities for building plugins to support extensions of the Ushahidi platform to tasks like survey data collection. The Konpa Group is a partnership of the software developers and students who deployed the Ushahidi Haiti instance during the earthquake.

**Sahana**: members of the Sahana team helped the QuickNets team understand how to deploy a Sahana instance on their kit, which would have been particularly useful for tracking health facilities in Haiti.

**GeoCommons**: members of the GeoCommons team showed the QuickNets team how to integrate offline version of GeoCommons developed at previous RELIEF events into the QuickNets stack. This capability would give teams web-browser-based GIS analytics that enable teams to upload the most common form of data collection in the field—the excel spreadsheet—into an application that automatically builds shape files and other analytics from georeferenced data.

The QuickNets lead, Mark Bradshaw, believes that the time at RELIEF 11-02 accelerated the development of QuickNets by 4-6 months.

### Remaining Challenges

The QuickNets project would like to test the integration of applications beyond Ushahidi in the next round of RELIEF.