BIOGRAPHICAL INFORMATION

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Specific Responsibilities:

Mr. Francica is the editor-in-chief and vice-publisher of Directions Media, the world's top-ranked publisher of location intelligence, geographic information systems (GIS), and wireless location-based technology with over 450,000 visitors each month to its internet-based media. Now comprising three publications and two conferences, he is directly responsible for Directions Media's 40% growth in readership in each of the past two years. He is also the chief operating officer for the company's day-to-day operations and has increased advertising revenue sixteen fold since joining the firm in 2001. He is the conference chairman for two events: the Location Intelligence Conference, now in its fifth year planned for Santa Clara, California April 28-30, 2008, and the Rocket City Geospatial Conference.

Past Experience: Personally, Mr. Francica has authored over 250 articles and editorials on topics ranging from market research, wireless location-based services, retail trade area analysis, and the use of geographic information system (GIS) technology for business applications. During the past year, because of the tremendous group in the location technology market, has been sought out for his market guidance by the national media, venture capitalists, and market research groups. He has contributed to three books, "Profiting from a GIS" (published in 1993; edited by G. Castle), "Geographic Information Systems in Business (published in 2005; edited by J. Pick), and the soon to be published "Encyclopedia of GIS."

Education:

BA, Rutgers University (New Brunswick, New Jersey) in Geology in 1978

MA, Dartmouth College (Hanover, New Hampshire) Earth Science in 1980

MBA, Edwin L. Cox School of Business at Southern Methodist University (Dallas, Texas) in 1989

Other:

Mr. Francica is also the CEO of BidConnexion Software Inc., which has developed BidEngine™, a solution to support the communication and management of online project bidding for government agencies and businesses that need to disseminate request for proposals.

Mr. Francica is a national class, Masters runner having earned the distinction of "All American" according to USA Track and Field and is a member of Huntsville's Fleet Feet Sports Racing Team.

Using Geospatial Technology to Communicate with the Public When Disasters Strike

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ABSTRACT

The U.S. Government has spent billions of dollars preparing for the next major terrorist attack, hurricane and any other human or natural disaster. Based upon both research and personal experiences, this paper will discuss how we are woefully unprepared to assist those affected in the next major incident. In order to mitigate some of the potential problems much will be dependent on the availability of the right geospatial data. Much of these data are readily available to the general public. The problem is that this information may never reach the affected individuals if government agencies and telecommunications companies do not offer certain services in the very near future.

This paper is not meant to be an indictment of any federal, state or local agency. It offers a first-hand account from the Hawaiian earthquakes of October 15, 2006 and illustrates how communication with the public during a disaster situation can be improved. As many will understand, the technological feasibility of solving a problem is often well ahead of other more difficult political challenges. Despite the investments we have made in disaster planning and response, this paper will illustrate that in this incident, there was no clear understanding of who was in charge of informing the public and how it would be done.

INTRODUCTION

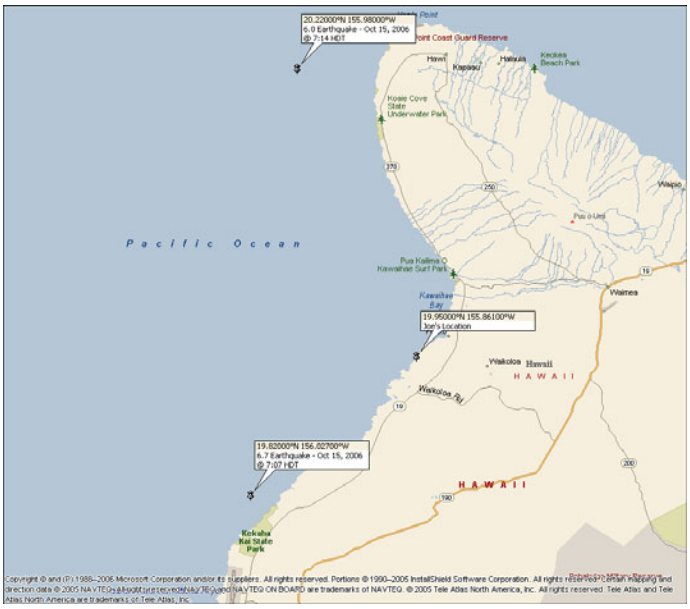
How will the public be notified about the next natural disaster or terrorist attack? Though we are spending billions of taxpayer dollars on supporting the first responders, the public seems to be left on its own to learn about potentially life-threatening situations and to plan an appropriate escape. The public was caught in the middle of political gridlock in the response to Hurricanes Katrina and Rita, and we were simply unprepared for the attacks of 9/11. However, during the southern California fires in the fall of 2007, the government used a reverse 911 system to help alert the public and to inform citizens that escape was necessary. But is this enough, and can we find a more effective means of disseminating vital information to warn of impending threats? Using mobile location-aware devices and solutions to geospatially model the extents of areas affected by devastation, coupled with the ability to "alert by geography," government and private industry are indeed making progress.

BACKGROUND

Personal Experience – The Hawaiian Earthquakes of October 2006

At approximately 7:07 a.m. on Sunday, October 15, 2006, a 6.7 magnitude earthquake struck the Big Island of Hawaii about six miles north of the Keahole-Kona Airport (refer to map below). Eight minutes later, a second, entirely separate earthquake of magnitude 6.0 jolted the same area, its epicenter located approximately 27 miles north of the first quake. Both were considered "strong" earthquakes but no fatalities resulted from either episode. Power outages affected the

Big Island, Maui and Oahu. I happened to be on the Big Island at the time, approximately 15 miles from the epicenter of both quakes, and I found myself literally "in the dark" about what was going on and how much danger I was in. Were these quakes on or offshore? How big were these quakes? Were they big enough to generate a tsunami? And if a tsunami was possible, what evacuation route should I take? In short, I wanted to know what I didn't know. I wanted to know what the local authorities knew and how to evacuate from my current position. Specifically, I wanted to know if I was still in harm's way. Based on my experience and my subsequent research for this paper, the information I wanted was very much dependent on the availability of the right geospatial data. Actually, the information was readily available, but it had no way of reaching me.



Considerations of Geography, Population

These quakes occurred very early on a Sunday morning on an island in the Pacific that has a low population density; it was not in a major metropolitan area in the middle of rush hour. Consider the consequences if this occurred in San Francisco. Consider also if the more recent, powerful 8.3 magnitude earthquake off the Kuril Islands had impacted Hawaii or the west coast of the U.S. These kinds of events have happened before. Recall the 1989 Loma Prieta quake that measured 6.9. Supposedly, government agencies have been preparing to mitigate communication problems during disasters. It appears that still more needs to be done to communicate with those who are actually experiencing the disaster as it occurs and those who may be affected by its aftermath.

Safe Assumptions?

The safest assumption in my case was to assume that a tsunami was imminent, but there was no way to verify the threat. I made my way to my rental car and turned on the car radio expecting to hear the Emergency Broadcast System (now known as the Emergency Alert System - EAS). A strong earthquake seemed like a real emergency to me, but there was no broadcast to be heard. According to the Federal Communications Commission (FCC), "The EAS is designed to provide the President with a means to address the American people in the event of a national emergency." As such, this did not really qualify as a national emergency, but it was indeed a

"local" emergency. So, who is supposed to communicate that information? What agency is charged with informing the public about a local emergency? Reports from a local Oahu radio station which had managed to remain on air eventually provided only the basics: The earthquake registered 6.6 (later upgraded to 6.7), and no tsunami threat existed. This information, while helpful, was still not the "official announcement" I wanted to hear.

INFORMATION FLOW

Where Does the Information Flow Start?

Seismic recording stations at the U.S. Geological Survey's (USGS) Hawaiian Volcanic Observatory (HVO) on the Big Island captured the earthquake from its many recording stations. HVO geologists contacted for this report said that the observatory's mission is to provide initial position and magnitude information when earthquakes occur. They usually have a position of the earthquake within five minutes of the event and will send this information to local civil defense authorities. But HVO and the USGS are not responsible for alerting the public; they merely communicate the geospatial and intensity information to other agencies.

HVO does not operate 24/7, but an earthquake of this magnitude brought geologists to the observatory within an hour of the first event. HVO primarily monitors events associated with the island volcanoes, which do not usually produce earthquakes of this magnitude. Accordingly, HVO's recording stations are tuned to measure quakes of a maximum magnitude of only 4.9. The October 15th quake sent its seismographs off scale. In fact, HVO originally reported this quake at only 4.4. Earthquake assessments of this size are also referred to the USGS's center in Golden, Colorado.

The information from HVO was also immediately provided to the National Oceanographic and Atmospheric Administration's (NOAA) Pacific Tsunami Warning Center (PTWC) on Oahu and to local civil defense. PTWC may make its own assessment and in this case it issued a bulletin four minutes after the HVO report, with its own estimation of location and a different and more precise estimate of the quake's magnitude.

Who is responsible for gathering geospatial data before, during and after a disaster?

The PTWC is responsible for communicating the information to other public authorities. The PTWC continuously monitors data across the state, mostly from the Big Island since that is where the majority of seismic activity occurs. The PTWC coordinates closely with HVO and within 20 seconds of an earthquake it has a preliminary location. Alarm signals notify PTWC staff. In the case of this earthquake, signals went off before the PTWC building on Oahu began to shake.

Some background information is necessary to explain NOAA's mission. In general, NOAA will inform the public about severe weather, including the potential for tsunami. But some communication is a function of the local agencies. Primary responsibility for informing the public about emergency situations (weather, etc.) lies with civil defense (CD) which controls the EAS. Multiple communication systems exist between the PTWC and CD; phone lines are backed up with satellite and radio systems. PTWC has a dedicated phone line supported by the Federal Emergency Management Agency (FEMA). They also communicate via text bulletins through

normal weather channels, such as the World Meteorological Organization (WMO), an agency of the United Nations (worldwide), and Advanced Weather Interactive Processing System (AWIPS), a National Weather Service (NWS) program. Therefore, if an emergency exists, redundant systems are in place to alert other public entities, but not the general public. This seems to be a gross oversight given that the surest way to reduce panic is to get the right information into the hands of those people most affected by the situation.

Public Information Availability – Where and how does the information start to flow to the public?

The PTWC made a preliminary tsunami threat assessment of the situation within three to four minutes of the October 15th earthquake and issued a bulletin via NOAA weather radio. It also alerted local civil defense authorities that this particular quake was not "tsunami-genic." Once or twice a month a magnitude four, or above, tremor occurs on the Big Island and bulletins are regularly issued. In the aftermath of the October 15th quake, the PTWC assured state civil defense that no tsunami threat was evident.

Significantly, PTWC does not issue any bulletin if there will NOT be a tsunami; only if a tsunami event is likely will they issue an alert. In this case there was no warning because there was no threat. While this method may be functional, it certainly does not meet the "need to know" for the general public, who were caught in an information void on that Sunday morning. People were thinking "tsunami." There was a heightened sensitivity to that threat following the widely publicized Indonesian tsunami of December 2004. Also, no quake of this magnitude had occurred on the Big Island for 13 years.

Sources for this report indicated that it was Hawaii County Civil Defense (HCCD) that had the responsibility for informing the public. In searching for information about what civil defense authorities advise the public to do in the case of an emergency, the following information was found on the Oahu CD website: "A local earthquake, i.e., one that causes you to fall or hold on to something to keep from falling, is a natural tsunami warning…(For) An Earthquake in Hawaiian Waters: If a significant earthquake occurs in the vicinity of the Hawaiian Islands, the Pacific Tsunami Warning Center (PTWC) will issue an URGENT TSUNAMI WARNING for those islands which could be affected by tsunami. The warning will be announced over radio through the Emergency Broadcast System in conjunction with the sounding of Civil Defense sirens. If an URGENT TSUNAMI WARNING specifically identifies Oahu, leave all evacuation zones immediately." However, two of my sources said that HCCD's system had a "glitch" due to the power outage. If HCCD had tried to issue a warning, they would have been prevented from doing so by an easily predictable power interruption. Calls to HCCD to confirm this were not returned. In this case, the October 15th temblor was a strong earthquake, one which caused me to seek a handhold. Therefore, by the warning advice above, I might assume that a tsunami was imminent. It's a gray area. Though no sirens sounded, was I to presume that everything was okay? And with the power out, could I presume that the sirens would sound anyway? I did not have a NOAA Weather radio in my rental car, nor would I expect to find one in my hotel room. Is this a sufficient means by which to communicate impending disasters? If so, it is a very poor assumption on the part of government authorities.

TECHNOLOGY AND GEOSPATIAL INFORMATION

What We Should Expect and the Information We Should Receive

The public should expect an emergency status notification if they are located in the affected area. The solution must work a majority of the time to inform the highest number of citizens possible. That is perhaps the 70% solution guideline. In my experience, those who remembered to pick up their cell phones as they evacuated their hotel rooms used them to call someone. With over 250 million cell phones in use in the United States, there's a good chance you'll be standing next to someone with a cell phone in case you left yours behind, which is what happened to me. Most people that I observed were getting through to make a call. We can not necessarily assume that all cellular communications will be functional, but in this case backup generators were functioning at the cell towers. Other solutions might involve two-way pagers or satellite communications, but certainly the majority of the people today are carrying cell phones or some mobile device.

Consider this: As I pulled away from the hotel, I turned on my Garmin i5 StreetPilot GPS-enabled personal navigation device (PND). Though my unit does not receive radio transmissions, Garmin has introduced consumer PNDs integrated with cellular communications, traffic alerts and XM Satellite services, thereby giving consumers more access to better location-aware devices that are more convenient, portable and more likely to be purchased than a NOAA weather radio. These are the devices to which communications should be sent concerning emergency evacuation routes and where to turn for more information. And, there are some cellular carriers that offer the ability to locate family members by "pinging" their cell phones and retrieving their locations.

More importantly, because these devices determine an exact location for the user, emergency communications from civil defense authorities can alert those who are at risk within a specific geographic proximity that they will, or will NOT, be in harm's way. It is technologically feasible to have an alert sent to me at my specific location to tell me if I am in danger. It is equally important to me to know that I am not in danger.

In this case of the Hawaiian quakes, NOAA/PTWC should have been able to communicate to those in Hawaii County (i.e. the affected area) that the 6.7 magnitude quake was NOT tsunami-genic. And, they should have been able to do it with widely used communication tools. This would have alleviated many fears for all concerned. According to PTWC, their algorithms are sufficiently sophisticated to determine the area of a coastline that may expect a tsunami if an earthquake of sufficient magnitude occurs. If so, then the cellular telecommunication carriers who are now offering "geofencing" capabilities with their phone service to locate family members should be communicating with emergency authorities to provide similar alerts (via opt-in request to address privacy concerns) to the affected people during any type of emergency, local or national. It is not acceptable to be left uninformed when the technology is readily available to notify citizens in a very well-defined geographic region whether they are in danger.

In addition, when NOAA sends alerts for flash floods, hurricanes or tornadoes, it is usually a county-wide notification. This proves to be overkill in most cases, especially when we are more technologically equipped in terms of geospatial situational awareness. In short, if I had a GPS-enabled device on which I received a text message alert telling me that I was within ten miles of

a tsunami, I would have the information that I needed to take action. And, if possible, that same alert should tell me the most viable route to take to evacuate the area because it should also be aware that some routes may be experiencing high traffic flow or blockages (see photo below taken 30 minutes after the Hawaiian quakes). Today, we already have adequate real time traffic information services.

GOVERNMENT LEGISLATIVE INITIATIVES

The WARN Act

Quite coincidentally on October 16, 2006, the president of the United States signed into law the Warning, Alert, and Response Network (WARN) Act, which originated in the Senate Commerce Committee. The WARN Act is supposed to encourage communication protocols and standards in a manner consistent with what I suggested above. It states, " The WARN Act will establish a network for the transmission of alerts across a broad variety of communication technologies, including wireless communication devices such as cell phones and Blackberries, the internet, digital, analog, cable, satellite television, and satellite and terrestrial radio, as well as non-traditional media such as sirens and 'radios-on-a-stick.' The legislation would require that alerts provide individuals with instructions about what to do in response to the threat. The National Alert System, created under the WARN Act, will ensure that regardless of where an individual is or what kind of communication technologies they are using, they will receive a life-saving alert. Alerts would be transmitted in response to all threats to public safety, including natural disasters, man-made accidents and terrorist incidents. Alerts would only be allowed for hazards that pose a grave risk to public health and safety."

I contacted the Senate Commerce Committee concerning the implications of this legislation. My source commented that the bill came up short of its intended purpose. There are no deadlines to enforce the law or to set these recommendations

in motion in private industry. The Act was supposed to push the telecommunications industry to come up with standards. But essentially the legislation has no "teeth." However, a recent Government Accounting Office (GAO) report noted, "As required by the WARN Act, the Commercial Mobile Service Alert Advisory Committee is addressing the technical issues currently affecting the participation of wireless providers in emergency communications." So, there is hope.

The Geo-Targeted Alerting System

FEMA is conducting an initiative called the Geo-Targeted Alerting System. This system uses reverse 911 so that automated calls go out to specific areas through a telecommunications network to alert the public. According to the same GAO report, "the Geo-Targeted Alerting System is a pilot program to integrate near-real-time weather and hazard predictions and provide geo-targeted alerting to homes, buildings, and neighborhoods via cell phones, landline phones, pagers, desktop computers, sirens, and other geo-aware devices. This pilot is planned to conclude in 2007 with the development of a national Geo-Targeted Alerting System deployment plan." The Geo-Targeted Alerting System is part of another program of FEMA and the Department of Homeland security called the Integrated Public Alert and Warning System (IPAWS), which also includes the Association of Public Television Stations (APTS). According to the Library of Congress report, "It is testing digital media —including digital TV — to send emergency alert data over telephone, cable, wireless devices, broadcast media and other networks. If successful, the program will provide the base for a national federal public safety alert and warning system using digital technology."

SUMMARY

Though many millions of dollars in property were destroyed, the Hawaiian earthquakes of October 15, 2006 caused no fatalities and the disruption in power was merely an inconvenience for several hours for a sparsely populated area. But it could have been a very different situation, had the events occurred during a different time of day or in a more densely populated area. In my opinion, none of the potential solutions to warn and inform the public would be difficult to implement. However, as we can see, it will require a number of agencies and telecommunications companies to work together.

In the case of an earthquake or similar point source for an event, it is likely that the geospatial data would be available to pinpoint location and magnitude so that the public residing in the affected geographic region could be notified by some form of communication. And that form of communication should not be solely dependent upon electrical power. Information should not be limited to the NOAA weather radio system. It is not a ubiquitous form of communication, no matter how much NOAA encourages people to buy a weather radio. To be sure, there appears to be a political component to the problem; the necessary "teeth" are needed in the WARN Act or other legislation to compel government and corporations to work on solving this problem.

The WARN act emphasizes that "all" forms of communications be used to inform the public. However, we should begin with the common sense notion that a large majority of people are carrying cell phones and that most of the phones, within five years, will contain location

determination chipsets such as GPS. Again in this specific case, had this been a tsunami-genic event, NOAA would have issued an alert and sirens would have sounded. However, as a tourist destination, how many visitors would have understood that the sirens indicated that a tsunami was imminent? So, there are also certain mitigating circumstances that must be factored. These "gray areas" need to be addressed, but the bottom line is that all available relevant information should be relayed to the public.

Every organization that was mentioned above had some important piece of information, but no single agency seemed to be able to coordinate the information and use the available technology to communicate with the public. And if they had the information, a question exists as to the means they would use to communicate it most effectively. But progress is indeed being made as cited by the reports above by the GOA and the Library of Congress.

However, the next time I confront an emergency situation I hope to be informed by an official source and in the shortest possible time. I'll gladly opt-in to an emergency notification system that can determine my location. We do that today with the 911 service that is already mandated for cellular communications. If I am incapacitated, I want first responders to know my location, as well. This is a geospatial problem and we can solve it today.

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