Introduction to the HFN Puzzle

NPS's ongoing research in HFNs for Humanitarian Assistance/Disaster Relief (HA/DR), particularly their work for the Southeast Asian tsunami and Hurricane Katrina, is being leveraged by OASD-NII as a model for using inexpensive, commercial-off-the-shelf (COTS), integrated wireless technologies to rapidly provide basic, urgently needed communications to disaster zones—both domestic and international.

In this presentation Brian Steckler introduces the HFN Puzzle as a model representing and describing the different components and issues that must be addressed by emergency responders who will be setting up hastily formed networks in both natural and man-made disasters.

Slide 2 – HFN defined
This is the first of a few slides I will use to define hastily formed networks from both technical or social aspects. When we think of disasters we think of emergency responders and how they need to communicate both locally and on a larger scale with other emergency responders. Without communication there is difficulty in getting situational awareness, coordinating getting resources in to disaster zones, knowing the needs of the victims/volunteers/law enforcement and others on the ground and ultimately reaching the final goal, saving lives and reducing the misery of the victims. Disaster responders must communicate. They must pool their knowledge and interpretations of the situation, understand what resources are available, assess options, plan responses, then decide, commit, act, and coordinate.

Without communications, none of these things can happen; the responders cannot respond. Thus the heart of the network is the communication system all parties use and the ways they interact within the system. We call this the "**conversation space**" of the HFN.

An HFN can be defined by five interrelated elements:
1. A network of people established rapidly….
2. from different communities….
3. working together in a shared conversation space….
4. in which they plan, commit to, and execute actions….
5. to fulfill a large, urgent mission !

People need to use this conversation space to plan, commit to, and execute actions that allow everyone to meet their overall mission objectives, whether they are official government objectives, the objectives or needs of the local community or volunteers, or any other people who are responding to a disaster. They need to have these five interrelated elements.

Slide 3 HFN defined – part 2
An HFN is thus much more than a set of organizations using advanced networking technologies. We believe that the technologies themselves are mature enough and proven enough out in the field that they are part of the solution to responding to needs of survivors in disaster areas.

To be effective in action, HFN participants must be skilled at

1. Setting up mobile communication and sensor systems to maintain situational awareness so they know, again, what roads have survived, where refugee or displaced victim camps are, where the early responders are, and how you can find them…..that sort of thing.
2. Conducting interagency operations is sometimes called working at the "civil-military boundary". Sometimes we define the civ-mil boundary as non-government organizations working together with government or military organizations. Historically there have been a lot of challenges with NGO's working with military and military working with NGO's. There are a host of reasons for these challenges, including things such as having different missions/goals/objectives, different mindsets of the people working the organizations, and different languages and terminologies. For example the NGO may like to use the

term “Collaboration and Coordination”, where in the military we use two different words, “Command and Control”. The term “Command and Control” can sound like an aggressive military type action which can make NGO’s cringe. So we need to be sensitive to each other’s language, in addition to having an understanding and sensitivity of the differences in cultures and how we operate.

3. Collaborating on action plans and coordinating their execution,
4. Leading a social network, where communication and decision-making are decentralized, and there is no hierarchical chain of command or ex officio leader. For example, in Southeast Asia in December 2004 nine countries were hit by a tsunami with zero to two hours of warning. The locals first on the scene had no experience with a disaster of this magnitude so they had to try to create some order out of the chaos, sometimes without having any official capacity because the local military or government were wiped out or otherwise engaged.

Most participants do not have a need for these skills in their individual organizations. When they come together, therefore, they find it hard to accomplish these tasks. When combined with the overwhelming nature of the urgent event, these inherent difficulties can lead to a breakdown in the conversation space.

Slide 4

Another way to look at hastily formed networks is by these three levels of abstraction, from very high level to very detailed level.

First, you need to have **power**, you need to have **air-lift**, and you need to have **communications**. Power is probably the most important thing because you cannot have the other things if you do not have power. If you don’t have electricity you can’t run communications equipment, emergency operations equipment, can’t use cell phones and satellite phones because you can’t charge the batteries of any of those devices. This makes it very difficult to communicate both locally within the disaster area and outside of the disaster areas. Therefore you can’t get information about what is happening on the ground out to those who are on their way or trying to get there, so they know what to bring and what to do when they get there.

A second way to look at this is what we call the “Conversation Space”, and we will talk about that in more detail later in this presentation.

Finally, a third way is a representation of all the key elements that need to happen in a disaster from the hastily formed network perspective and we have put this into a nine piece puzzle. Those elements are located in both text format and as an interactive media piece, accessed by a link below on the page of this section of the website.

Slide 5 – Continuing on defining HFN
One way to look at an HFN is that it is a network formed quickly to respond to a crisis, emergency, or urgency, and is disbanded when the job is done. This definition encompasses three kinds of networking:
- **Physical** we understand and use it everyday. This includes telecommunications systems, distribution systems, email and web, cell phone, telephones, etc.
- **Socia**l **networking**, such as our circle of friends, our rolodexes, our online databases of key people and key organizations or resources that we can use in case of a disaster to get help from the outside to where it is needed inside the disaster zone.
- **Information flow**, things like web searches, pushing information out via the web or FM radio, email, online chat and other collaboration tools; these are some examples of tools that facilitate information flow.

There are several skills that we need to learn or have taught to us on the fly, in the middle of the disaster. As we know, a lot of people who are thrown into a disaster are not used to being in that

mode; they are not used to responding to emergency situations. So the other skills that need to be learned and/or taught are:

1. How to work at the civ-mil boundary that we mentioned earlier, which can be one of the hardest and most important jobs to achieve. There can be security, political and economic concerns that hamper this process.
2. What is and how do you use a collaborative coordination tool set? There are technologies out there that enable us to coordinate or collaborate. Some are very high-tech. Some only richer nations or more technology advanced nations have and/or know how to use these tools. Sometimes they bring tools in to a disaster zone in a less developed country and they expect the people to suddenly be able to use these high-tech tools. You don't just jump in and try to use all of these technologies…..sometimes you need to understand the culture and perhaps the resistance that some people may have to using these tools.
3. You must also learn to have the capacity to improvise. You may have to improvise ways to get things done that are different than the way you usually do things.
4. Another skill is just the plain skill of leadership in a network. Sometimes it can be pre-planned who the leaders are, and sometimes it just happens that people on the ground have to come up with creating leadership and order out of the chaos, as in the case of Hurricane Katrina.
5. And finally, people need to be able to overcome conditioned tendencies, such as expecting the responders to show up and be there. Emergency response people and resources my be required to be at other emergencies, so in the local emergency the people on the ground, though they have not ever thought they would be in this situation, may have to jump in and do what they can to help out.

Slide 6 – Power, Lift and Comms
At the very highest level of abstraction any response to a disaster (natural or man-made) must require three elements:

Power - Required to run all aspects of any human activity in a disaster zone; including medical, emergency services (stabilization), security, search/rescue, infrastructure repair, and most importantly, communications.

Lift - There must be multiple forms of transportation for people, equipment of all types (power, rescue, medical, people, communications, etc).

Communications - In order to coordinate all aspects of a relief effort there must be multiple redundant methods of communicating within the disaster zone, from inside the disaster zone to the outside, and from the outside back into the disaster zone.

In a military sense, communications capability is known commonly as "Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance, and Observations" (C4ISRO) – an acronym normally associated with tactical military operations, but also relevant in Humanitarian Assistance/Disaster Relief Operations.

NOTE: All of these must be available and deployed simultaneously in any disaster response. They are 100% interdependent and of equal importance.

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I want to take a look now at how HFNs relate conceptually. There is always some kind of medium in which all communications take place, whether it is on a conference call, a group of people in a room, a stadium with a loud speaker, these are all types of mediums for facilitating communication. And there is usually a set of interaction rules for effective coordination among all participants. This is the "Conversation Space".

Slide 8

Typical manmade or natural disaster scenarios have the following environmental conditions to consider for common medium and rules:

- No pre-positioned communications infrastructure
- No pre-negotiated communications support contracts (DHS/FEMA)
- No power
- No fiber/copper infrastructure
- No push-to-talk communications to speak of (radio towers out)
- Cellular services jammed (overloaded and cell sites out)
- Satellite phone service jammed (overwhelmed)
- Not enough satellite communications (voice/data) equipment available
- No Internet access (web, email, VOIP)
- Command & Control chaos
- Maslow's Hierarchy needs are unavailable (food, water, shelter)

Slide 9 – Three aspects of the conversation space
The three aspects of the conversation space are:

1. **Physical** - Consists of communication systems, meeting places and distribution systems

2. **Community** - Are the players and organizations

3. **Practices** - Are the rules of interaction and coordination

Let's look at these a little closer.

Slide 10
First we will look at the physical aspects. These are things we see and use every day, things like:

- mobile networks
- telephony
- Internet
- satellite
- power
- fast configurability
- meeting places
- pre-positioning essential equipment
- distribution systems

Slide 11
Let's look at community aspects. First you need to include all of the people involved. It is essential that you include the city, state and local government, the local organizations, the non-government organizations, and the victims of the disaster. **You need to include all the players** to provide effective response**.**

Another challenge is that you need to transcend turf issues. Often times in the U.S. it is unclear who is in charge of the disaster in a local area. Sometimes those in charge have competing priorities. We need to understand that first there are turf issues, and then we need to work through the bickering and chaos that comes with those turfs.

As we said before, another aspect is working at the civ-mil boundary. Militaries and governments working with the non-government organizations, international organizations; and for international disasters the UN agencies are all key responders and often times the legitimate organizing agency, if the host nation wants them in there.

Another community aspect is the sharing of information. One of the biggest lessons learned by the U.S. military in the tsunami disaster was that we had a lot of information about damage zones, where resources were, we had the information but we didn't have a good way to disseminate it. A lot of it was on classified networks, even though it was not classified information, and it could have been put out on the internet. So the US military has created websites where people do not need to access the sites with passwords, as one example of resolving this communication barrier. We need to continue considering what kind of information is needed out there and make it easily available for everybody.

The same goes with the next aspect, which is situational awareness. Information needs to be shared about what the weather is, who is in the area, what the roads are like, where the refugee camps are set up, where threats are located, etc.

And of course there is planning. You don't want to set up a refugee camp in dangerous zones, you need to plan where, what, who, and how, doing this before a disaster hits, as well as during a disaster.

Another aspect is coordinating everything. The OODA loop (observe, orient, decide, and act) is one way the military uses to model this coordination.

The last community aspect that we mentioned previously is the idea of building trust. A lot of times there is already no trust between the local population and their own government, and even less trust in another government coming into the disaster zone. So we need to consider all of the aspects of building trust, whether it is internal in your organization, within your country, within the international community, etc.

Slide 12
In addition to the physical and community aspects, the third aspect is practices. One of those is rules of engagement, or it could be called ways to operate (in NGO language) for multiple autonomous organizations. They must be embodied and flexible, not just a step-by-step process. There must be iterations and you learn in a disaster that some things may not work so you need to try other methods to meet the mission.

You also need to get "buy-in" on the rules, or having the rules and regulations known and understood by the members in the conversation space and members must agree, or at least agree to accept them. Otherwise, without structure you will just continue to have the chaos.

Another practices aspect is a decentralized control and decision making mechanism. Often times having centralized control and decision making turns off key players, or makes people who have value to add to the response uncomfortable. Or it can create an air of animosity or non-cooperation among the responders. Again, some of the responders to a disaster are trained to do this and some are not and those on the ground may need to be providing emergency response, though they have no experience. Sometimes you just cannot depend on external resources to come in and be there.

Finally, you must have collaboration without hierarchy, where you are forced to work in organizations with people you do not know, have never met, never practiced with, and often there is no hierarchy. You just have to jump in and get the job done because there are people suffering right next to you.

Slide 13 Instructive Examples

In New York City and the 9/11 terrorist attack a lot of things that I talked about earlier occurred. The cellular towers, the radio communication towers, all those sorts of things that were sitting up on top of the twin towers were obviously out of commission. Cellular repeaters were destroyed, power was out for much of the area, there was soot and smoke around a lot of the streets and

people couldn't move and operate. There were early responders coming in to the disaster zone and everybody else trying to get out of the disaster zone. That completely chaotic situation was further exacerbated because none of the early responders could communicate, even within their own organization.

Another example is the Tsunami of Dec 26, 2004 that hit nine countries throwing a lot of people into disaster relief mode who had no idea that they would ever be involved in something like that. They had to create their own hierarchy and collaborative environment, a lot of times with people speaking different languages and from different cultures as the area had a lot of tourists mingling among the local survivors. Because of these challenges in the first few days after the disaster hit, because it was so hard for responders to get in, everything started happening in an ad hoc basis and there were no common conversation spaces that were structured, so people had to create them on their own.

And finally, the last example is the US Gulf Coast after the Katrina hurricane in Aug 2005. You have probably seen a lot of the reports and the studies done on some of the problems and lessons learned from Hurricane Katrina. Yes the disaster was so widespread and unprecedented in U.S. history that a lot of responses were partitioned. A lot of the areas had good response, and a lot of areas had poor or no response. New Orleans got a lot of attention; there were constant news reports and updates throughout the first week. Just twenty miles away, some communities were completely dark and completely without communications, the communities were completely partitioned off, and the people had to help their neighbors themselves. There was also obviously a lot of turf protection. We saw all kinds of examples of the Governor's getting in arguments with the rest of the government on who was responsible for what, who was to blame, who should provide relief, etc. There was a lot of finger-pointing in all directions and a lot of red tape delayed getting resources into the disaster zone, at all levels of government and responder organizations. One of the biggest observations of Katrina was that we did not fully utilize the local citizens once organization did start to happen. There was no mechanism in place that enables utilizing this tremendous resource, the local citizens.

Slide 14
We will end this section with one claim and three questions. The claim is that doing HFN well means that you have accomplished mastery of the conversation space. The three questions I want to pose to you are:

1. What are the rules of the most productive "game"?

2. What are the skills for successful play?

3. Where does technology fit in (HFN is the key to the kingdom)?

Slide 15
This concludes the introduction to the HFN puzzle. Close this window to exit and return to HFN site and click the link "Networks Defined: HFN interactive puzzle" to learn more about the nine elements that must be includes in a Hastily Formed Network.