Command And Control in Disaster Management

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Abstract

Like war, the disasters are also much unstructured in scope. The national disaster system may employ *detailed Command and Control (C2)* which is poorly equipped to deal with *uncertainty, complexity and variability*. The first response to uncertainty is to try to minimize it by creating a powerful, highly efficient command and control apparatus (Command Structure) able to process huge amounts of information and intended to reduce nearly all unknowns. Detailed command and control emphasizes vertical, linear information flow: in general, information flows up the chain of command and orders flow down. Discipline and coordination are imposed from above. The proposed C2 model accepts the turbulence and uncertainty of disaster. Rather than increase the level of certainty that C2 seeks, this approach of command and control reduces the degree of uncertainty that we need. This C2 for disaster management decentralizes decision-making authority and grants subordinates significant freedom of action which increases tempo and improves the ability to deal with fluid and disorderly situations.

Keywords: *C2 (command and control), disaster management, Wi-max Technology, PDA*

1. Introduction

Command and control (C2)"[1] has been getting a lot of attention in recent years. It was a hot topic for United State's Congress during discussions leading up to the Goldwater-Nichols Defense Reorganization Act, of USA of 1986. Command and control involves the complex collection of functions and systems an executive draws on to arrive at decisions and to see they are carried out, thus, the acronym C2 may be used to refer to anything from information to sophisticated communications and computer equipment, to the executive's own mind-the last involving education, training, experience, native intelligence, and other aspects of cognition. This broad view enables us to deal better with communication technology and its often confusing terminology. This chapter helps us to understand why C2 has grown by steps to what many now call "C3I2"- Command, Control, Communications, Intelligence, and Information [7].

2. Necessity of C2 in disaster management

Like war, the disasters are also much unstructured in scope. No one can predict at what exact time and how a disaster will strike. In democratic country like India, only the government is the solo organization who will act and take necessary actions to disaster. Thus any model for disaster management must follow the government rules and regulations. The governmental structure itself is a hierarchical one, where there is a central or root position and below, its branches or sub-levels are spread [10]. The central authority will take decision depending on the discussion with its subordinates, and that decision will be treated as a command to all other leafs. Whenever there is a disaster, the command or actions to be taken is released by the government authority and pass to its lower levels and different other organizations for implementation. The command is issued after collecting relevant information from them and its lower levels. The national disaster system may employ detailed command and control. Unfortunately, detailed C2 is poorly equipped to deal with uncertainty, complexity and variability.

3. Proposed C2 system for disaster management

This proposed C2 model for disaster management is just an approach of C2 strategy but not the detailed C2 system. This approach accepts the turbulence and uncertainty of disaster. Rather than increase the level of certainty that C2 seeks, this approach of command and control reduces the degree of uncertainty that we need [2].

This command and control for disaster management can be described as spontaneous [3]. Subordinates are guided not by detailed instructions and control measures but by their knowledge of the requirements of the overall mission. This C2 for disaster management decentralizes decision-making authority and grants subordinates significant freedom of action. It is much more informal and flexible than detailed C2. It increases tempo and improves the ability to deal with fluid and disorderly situations. This approach of C2 for disaster management allows for both horizontal and broadcast information. Horizontal information saves time and increases situational awareness by moving information directly among agents in the field. Broadcast information from the commanders presents information to the field agents that they can process and act on autonomously. The proposed C2 system for disaster management can precisely be elaborated diagrammatically [4].

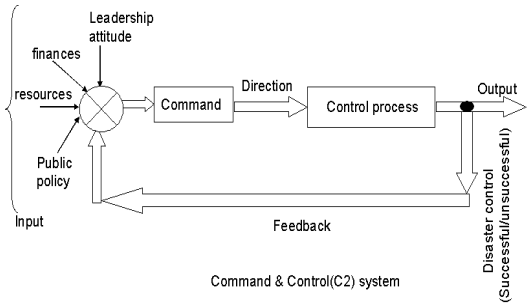

Fig. 1 Command & Control (c2) system

During the race against the clock high-level commanders must be able to delegate decision making due to the sheer volume of information. Using some automated software, the tempo of the local group is much faster as a result. Variability requires adaptability. Field agents must respond quickly to changes in the environment. Applications will be bandwidth-aware and change their mode of transmission accordingly to accommodate a volatile network. The goal is to enable mutual understanding with limited exchanges of data.

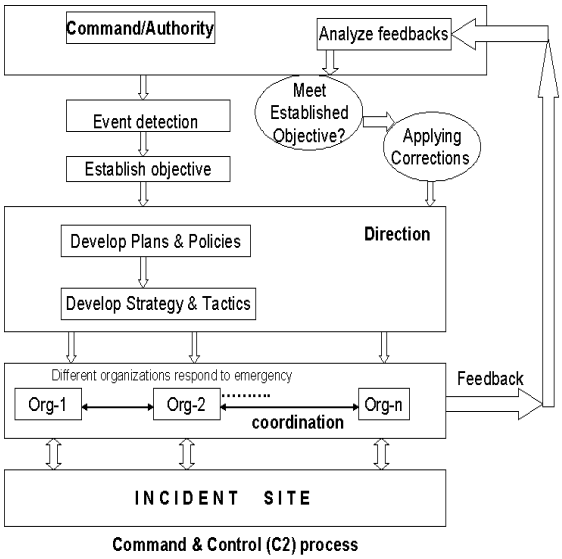

Fig. 2 Command & Control (C2) process

4. Role of communication in C2 system

Communication system plays the central role in C2 system for disaster management. When a disaster strikes, it may damage the existing communication system even across the terrestrial border. The proper flow of information from the incident site to authority and simultaneously command or response direction from authority to incident site must be well communicated [5]. However for this we need a communication system, which may be damaged due to disaster. There are two alternative methods possible for that purpose. First one is one need to restore the existing communication network which may take some hour or even some days or even months also. During those days communication from authority to operational stuff is not possible and one can easily guess what will the result of response and relief operation? Alternate method is after disaster breaks the existing network, if we are able to deploy a network rapidly (may be of Wi-Fi or wi-max) up to position where we have available network for communication, one can send information from the core incidental site to the authority. The information then flow from there to some higher authority and finally reaches an emergency operation center by any means. The more and more information from the incident site reaches to the authority; the authority can visualize the situation more accurately, and then analyzes those information or

feedbacks so that authority can take the better decision immediately for more accurate response work. The less the amount of information gathered by the commanding authority, the more difficulties he/she will face while taking decision.

5. Proposed N/W architecture

In case the existing communication system breaks by disaster, for continuity of response and relief operation, one needs a rapidly deployable network system. That means one need to establish any sort of communication method which may includes various technologies like Wi-Fi or Wi-max etc. and extends this rapidly deployable communication network's range to the existing network reach-ability area. Keeping all the services and the constraint in the mind the architecture of the proposed system has been developed as the following. In this proposed network architecture is divided into five layers namely *Frontier*, *Access*, *Backbone*, *Backhaul and Backend* layer.

The proposed-system should reach all the possible locations under disaster-siege for data collection; *nomadic approach* and the inclusion of *mobile handheld devices* will add flexibility in the process. Mobile handheld devices can collect and transmit data. They are also called Personal Digital Assistant (PDA). Network of such devices is named as *FRONTIER Network*.

For the 1st case, we need a device that connects PDA (s) together to form a Wireless network; this device is called a *Wireless Access Point* (WAP). A mesh network of such devices is required for the full coverage of the area under disaster siege, since, coverage of a single WAP may not be adequate, and it should be called *ACCESS Network*.

For the 2nd case, a long range communication is required and the ACCESS Network should be a connected to a Customer Premises Equipment (CPE) of the Long Range Communication Device. CPE will in turn communicate to a Base Tran receiver Station (BTS) or to a series of BTS (s) for further traveling of the data; we named this arrangement as *BACKHAUL Network*. Backhaul network will later merge to an existing *BACKBONE Network* wireless (GSM/CDMA) or wired network.
After the travel via existing Backbone network, data will be deposited to CENTRAL DATA REPOSITORY, which will be connected to different departmental Network via Internet for further distribution and processing of the said data, which we termed as *BACKEND Network*.

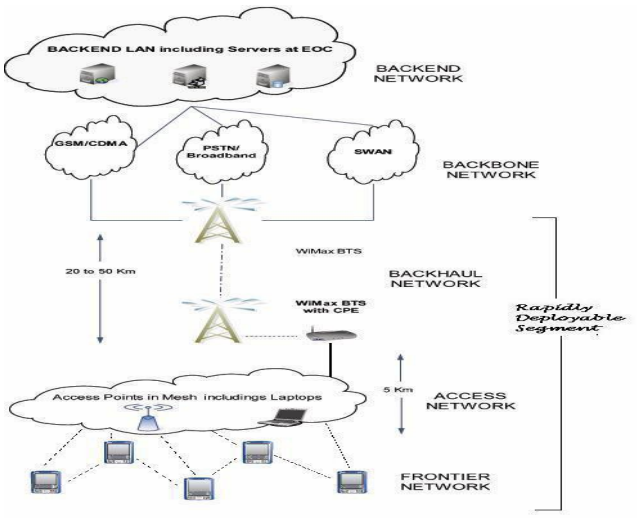

Fig.3: Proposed architecture for rapidly deployable network

6. Conclusion

Since disaster is just like war and much unstructured in scope, we may adapt the Command and control system for disaster management which is the main aspect of the first part of the work. The strict C2 system may not be best suited to disaster scenario; rather proposed C2 architecture which follows the C2 methodology with some autonomy at the lower functionality divisions may gives a success as an output for proper disaster management work. To design this disaster management model, I follow the NFPA 1600, 2007 edition standards. Among the different functional areas as identified by this standard, the two areas, Incident Management and Facility are highlighted, which is the second part of the work. The last part is the maximum extent of ICT implementation of the above two functional activities.

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