PAKISTAN EARTHQUAKE CASE STUDY

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INTRODUCTION

As part of SAS-065, a number of case studies were examined to determine the validity of the NATO NEC C2 Maturity Model (N2C2M2). A group decided to example the earthquake that occurred in Pakistan on 8 Oct 05 to determine if there was a good application of the N2C2M2 to a natural disaster.

BACKGROUND

Figure 1. Location and General Severity of the Pakistan Earthquake

An earthquake measuring 7.6 on the Richter scale hit northern Pakistan on 8 Oct 05. As shown in Figure 1, the earthquake epicentre was located 100km north-northeast of Islamabad, along a fault associated with the Indian subcontinent. Over 1000 aftershocks were recorded; ranging from 5.0 to 6.0 on the Richter scale Most of the affected people lived in mountainous regions with access impeded by landslides that blocked the roads, leaving an estimated 3.3 million homeless in Pakistan alone. The total area affected was 30,000 km^2, included a range of unprecedented damage and destruction, such as: Houses: 500,000 (56%), Medical facilities: 365 (65%), Telecommunications: Exchanges (86 - 34%); Power lines (33,225 - 13%), Schools/colleges: 6083 (50%) and over 1000 hospitals. Due to the earthquake, there was a significant loss to Pakistan's infrastructure. There were collapsed and blocked roads, a total loss of clean water supply, partial loss of telecommunications infrastructure, partial loss of UN VHF system, and in some cases hospitals were non-functional.
[3] [6] [23] [37] [38]

Many countries, international organisations and non-governmental organisations offered relief aid to the region, mostly in the form of donations as well as relief supplies including food, medical supplies, tents and blankets.

Rescue and relief workers were sent to the region from different parts of the world and they brought along rescue, equipment, including helicopters and rescue dogs. Due to the vast extent of the earthquake, the Pakistan military forces were put in charge of coordinating the emergency response for the government. Since the basic infrastructure was severely damaged allowing

limited access by road, the government used a fleet of donated helicopters to transport emergency supplies and evacuate the wounded.

The impact on the government was staggering. Most government officials were unavailable, some were dead, some were attending to their deceased and injured relatives and some were in shock and confused. Therefore, there was a total dependency on the military to organise relief efforts and to create a response structure. As a result, there was no truly functioning civil administration in the region; and, the Army generals were placed in charge of the operation. **[38]**

Many police stations were in rubble. Policemen deserted their posts to check on families. The security assets that[1] remained were negligible to support relief workers. The police communication lines were severely affected. **[38]**

PURPOSE OF CASE STUDY

This case study analysed the Pakistan Earthquake in relation to the NATO NEC C2 Maturity Model (N2C2M2). To verify the completeness of the considered features, this study also readdressed the list of Command and Control variables in the NATO C2 Conceptual Reference Model (C2CRM).[2]

The case study was subdivided into three distinct phases to correspond to relief activities during the aftermath of the earthquake:

  a. Phase I: Search and Rescue (8 Oct - 11 Oct);
  b. Phase II: Provide relief and stabilisation (12 Oct – 7 Nov);
  c. Phase III: Reconstruction and Rebounding (8 Nov - 31 Dec—continues).

For each phase, the analysis was in two parts:

  a. Looking at the C2 Approaches across levels of analysis and entities;
  b. Equating to the C2 Maturity Model in terms of: (1) Variables Defining C2 Approach; (2) Expected Patterns of Interaction; (3) Expected Values of C2 Effectiveness; (4) Indicants of a C2 Approach; and, (5) Measures of Mission Effectiveness.

This case study is subdivided into six major areas

  a. Infostructure
  b. Data-Information
  c. Shared Information
  d. Shared Awareness / Understanding
  e. Shared Intent
  f. Decision-Making.

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1 Available reports, from Phase I of the recovery, when available primarily covered the death toll and property loses. [38]
2 These variables were developed under a previous NATO SAS effort (SAS-050).

2

The five C2 Approaches are as follows:

    a.   Conflicted C2
    b.   De-Conflicted C2
    c.   Coordinated C2
    d.   Collaborative C2
    e.   Edge C2

DISCUSSION OF THE AREAS OF ANALYSIS

INFOSTRUCTURE

Network Usage: During all phases of the recovery, the network usage was high. Voice and data communications were excellent in Islamabad. In the earthquake zone, the landline network was re-established in some towns (including Mansehra) within two or three days of the quake, making dial-up connectivity possible for new offices; the cell network was extended immediately after the earthquake, providing reasonable voice coverage in the main operational area. There have been villages which have been wiped out. Some of the worst-hit areas are still cut off and the relief authorities have no communications. Staff in Pakistan possessed the necessary skills to manage their information technology (IT), but not always to manage their telecommunications; they clearly felt that this was a weakness, and they wanted to develop their capacity, for example to manage Voice over Satellite (VSATs). Police communication lines were severely affected. There was a partial loss of the telecommunications infrastructure as well as a partial loss of the United Nation's (UN's) very-high-frequency (VHF) system within the region. **Islamabad, 10 October 2005**: Donor nations Islamabad. Shortly after the earthquake, military planes started dropping supplies to some of the cut off areas, while the government starting setting up satellite telephones at 200 locations so that people in devastated areas could contact their families elsewhere in the country. Within days, the use of telecommunications, satellite communications, and cellular services became a must for disaster relief in a country having varied topography. Lack of a robust communications system and absence of operative satellite telephones created many problems in the quake-hit mountainous regions. Within the government itself, the emergency centre established in the PM Secretariat or PM House had only one telephone line. It took one day to announce a three-day national mourning**. [1] [3] [4] [9]**

Network Availability: Initially the network availability was very low and throughout the recovery it was raised to a medium level. The main issue for the field staffs was not bandwidth limitation, but consistency of the connection. The staff generally expected to wait for download or replication, but consistent breaks in the connection were found to be extremely disruptive. Although they were aware of its limited extent in remote areas, staff consistently overestimated the reliability of cell/mobile coverage. It has been demonstrated repeatedly that cell/mobile phones are not adequate for emergency telecommunications, as networks are seldom resilient enough to cope with large surges in usage during emergencies. Had there been a serious aftershock, it is doubtful that the network would have remained stable. It is also worth noting that, until the earthquake, the Pakistani government limited cell/mobile phone coverage in the area due to political sensitivity, and there is no guarantee that this control would not be exerted again. **[1]**

Interoperability: One of the key aspects that worked throughout the recovery was interoperability, which was high. One factor that contributed to national staff success was cross-fertilisation of skills. In the context of Pakistan this meant two things. Firstly, many Information and Communications Technology (ICT) staff had worked for more than one Non-Governmental Organisation (NGO), and had contacts with their counterparts in other organisations as a result. Secondly, some national staff were returned from international positions in order to support the response, bringing with them new skills and experiences. These opportunities for skills transfer are generally valuable, not just during an emergency. Although NGO staff may be happy with the use of cell phones, this illustrates a growing split between the NGO community and the UN and Red Cross families (and some emergency NGOs, such as the Monetary Service Fund-MSF). The latter group still views radio communications as security communications – radio coverage is part of the UN Minimum Operating Security Standards – and invests in it according to this priority. NGOs, however, now see radio communications as an extra, and have replaced radios with cell phones significantly in many locations. This growing divide in communication technology use has two detrimental effects on the response. Firstly, it undermines co-ordination, since there is no central monitoring of communications and contact information is harder to acquire. Secondly, it erodes security in the operating environment. The UN and Red Cross will have more reliable communications that will support better security management, while NGOs will not have consistent access to this level of support (see the discussion on co-ordination with the UN, below). The WFP did express their desire to support the NGO community through specific services such as frequency allocation and provision of radio repeaters dedicated for NGO use, but since few of the NGOs were planning to deploy radios, this did not warrant much discussion. **[1]**

DATA-INFORMATION

Information Accuracy: Throughout the recovery, the accuracy of the information collected continued to be a problem and was evaluated as low. One of the key deficiencies was situation reports. It was determined that they had little or no use in the field by the staff. Most (although not all) staff tasked with situation reporting either circulated it internally or made it available through shared drives. However, when asked, the same staffs were unanimous that their colleagues did not generally refer to the sitrep for information. Those situation reports, once received by headquarters were felt to contain insufficient information for needs such as donor reporting, fundraising and advocacy. This often led to multiple queries from headquarters to the field staff for additional information, with corresponding duplication of effort. This is demonstrated by the deployment of staff to the field specifically to write fundraising proposals, as some IWG members have done previously in Pakistan. Shortly after the earthquake, there was only a trickle of information. What information did make it through was confused and contradictory. Information available was grossly insufficient for UN agency planning. Humanitarian assessments are near to impossible without accurate and detailed information. As a result, the world was largely unaware of the catastrophic impact of the disaster in the first 24 hours. The information was partially transferred from the paper-based forms to excel sheets and word files on the computers. The district officials in Mansehra did a good job of setting up a data cell with the help of local volunteers and the rate at which this data was entered is impressive. There were initial plans for using this data as the basis for the compensation phase, and a field for cheque number was introduced in the excel database with the intention of matching it with later arriving records of checques and cash distribution to households. However, these plans were abandoned since a unique identifier was absent from the

personal data, practically making the matching and updating exercise of various data fields impossible. The candidate for a unique identifier was the National Identity Card (NIC) or Computerised NIC (CNIC) numbers, but many people had lost their identity cards in the rubble. Amongst the initial chaos and confusion the need for recording a unique identifier was not stressed and surveyors often choose to ignore the NIC field, even when it was available. Furthermore, the cash disbursement started when PS data was still being entered. As particular forms were filled these were given priority over older forms that had not been computerised. A preliminary survey, during Phase I of the recovery, only showed counts for deaths and damages, even though more information was captured in this survey. But this information was ignored due to some issues with the data integrity. [1] [3] [12]

Information Distribution: Another key shortfall during the recovery dealt with information distribution. This improved to medium towards the end. The lack of communication with the UN automatically put the supporting NGOs at a disadvantage, not knowing what plans or problems the UN had might also affect their own work. It also removed the possibility for the sort of peer collaboration that produces new synergies, broaden C2 approaches, and makes mutual support more likely. The UN, and particularly the World Food Program (WFP), was not seeking to exclude NGOs, but without regular contact there could be no mutual understanding of needs and capacities. Most of the significant information sharing in the field was verbal. Management staff in particular expressed concern that essential knowledge was lost by not being recorded, particularly in handovers, and they wondered aloud how the IWG might address this, while noting that a solution was likely to be expensive. It was also determined that the UN established cluster groups (Shelter, Water/Sanitation, Food, Health, and Education) were hampered by problems of communication between field staff and decision-makers based in Islamabad. **[1] [11]**

Information Shareability: A shortfall here was another key aspect that affected the recovery effort. At best it could be rated as medium. Since the agencies remained far apart from each other, the issue became one of communications data standards. In the crucial arena of gathering field data for programming purposes, requirements were generally ill-defined, few processes were in place to ensure that data from different sources were correctly reconciled, and limited attention was paid to definitively placing this data at the centre of project planning and management. All the managers interviewed believed that this information existed, but that the challenge was to extract and organise the information. Rather than information overload, the problem for these managers was information fragmentation. None of the managers felt that reporting and other requests for information were a burden, although they did continually seek ways to deal with them more easily. To an outside observer, however, it did appear that staff spent unnecessarily large amounts of time in collecting and reconciling information from within the organisation in order to build up an overall picture. This came into sharp relief when agencies were asked for information by senior managers or external coordinators, when simple requests—such as the number of camps an agency was serving—required staff to make a range of phone calls, review documents and prepare entirely new documents to share the recovered data. While there were public, private and international partnerships to support the Pakistan government's data collection efforts on the needs and requirements, there was no standardisation of data collection and reporting. The Pakistan operation marked only the second time the UN Humanitarian Information Centre had been deployed in support of a rapid-onset natural disaster. Systems were incompatible, like the FalconView software used by the US military and ArcView, the software used by the United States Agency for

International Development (USAID). Likewise, Pakistan was heavily reliant on fax communication while others relied mostly on e-mail. Cell phones and commercial e-mail systems were the primary means of communication. Due to firewalls, Pakistan personnel had difficulty accessing ".pk" sites, which is where much civilian information was being posted. Chance encounters and personal initiatives between civilian and military actors led to valuable exchanges of information that could have happened much earlier in the operation if such contact had been institutionalised rather than being ad hoc. The national media found themselves in uncharted water, but adapted strategies of balancing objective reporting with responsibilities to provide the public with important relevant information. Clusters were credited with providing an opportunity for information-sharing and coordination. International NGOs and donors reported that having a named agency responsible for coordinating efforts in a particular area was helpful. Adequate attempts were not made to involve local NGOs and governmental structures. Local NGOs complained that cluster meetings – always held in English – did not pay sufficient attention to the ideas and issues they raised. Others regarded the meetings as talking shops and preferred to spend their time in the field. The UN made very limited efforts to involve local democratic structures, which were sidelined in the humanitarian response. Our analysis demonstrates that data collection and computerisation were done in an ad-hoc manner and were affected by issues such as: lack of protocols for data entry; lack of personal training; inconsistent use of certain terms such as household; loss of information, and incorrect or partially recorded information; difficulty in determining what percentage of the eligible population had been covered; inconsistencies in file formats and fields resulting in complexities of merging and aggregating of various data files. However, it must be pointed out that Mansehra district government was working in extremely difficult circumstances and were given no technical support from any agency or the federal and provincial government. **[1] [8] [11] [12]**

SHARED INFORMATION

Role of Pakistan Military: During the first phase of operations, the Pakistan Army was the main coordinating activity. They used a system based on grids and sectors, making it near impossible to share information with the various NGOs. However, within days district governments initiated "preliminary survey" forms to improve the sharing of information. However, the data collection was ad hoc, there was a lack of training, as well as an inconsistent use of terms and file formats; causing problems in merging the data in a comprehensive manner. The district administration did not have a lot of confidence in the data. They felt the survey was designed early on in the disaster relief and no standard methodology was maintained. **[39] [40] [41] [42]**

Establishments of NGO Groups: Within days of the earthquake, Pakistan established Federal Relief Commission (FRC) and Earthquake Rehabilitation and Reconstruction Authority (ERRA). The United Nations Disaster Management Team (UNDMT) met on 8 Oct 05, attended by the UN Agencies and most of the International and national NGOs working in the field of humanitarian assistance. UNDMT constituted three UN Interagency rapid assessment teams; the first was led by the United Nations Children's Fund (UNICEF) to be fielded to the North-West Functional Province (NWFP), the second by the United Nations Population Fund (UNFPA) to Azad Jammu Kashmir (AJK) and the third by International Non-Governmental Organisations (INGOs) Forum to the Northern Areas. The teams left on 9 October. The Acting UN Red Cross (UNRC) with few agency

4

heads met government officials on 9 Oct 05 to discuss further needs and modalities of cooperation in managing this emergency. [39] [40] [41]

UN Established "Clusters": During the second phase, the UN created, for the first time, a "Cluster Approach." Within the first 4 weeks it had positive effects for joint analysis, common approaches and programming. Some actors on the ground however did not participate in cluster groups (Shelter, Water/Sanitation, Food, Health, and Education). There was early recognition that coordination mechanisms established during the emergency phase must be maintained and improved during the recovery phase. The establishment of the District Relief and Recovery Committees within four weeks improved coordination at the local level, and there was constant fine tuning at the military, NGO, and civil authorities. The Pakistan Federal Relief Commission (FRC) had two wings; one was the military wing which was responsible for the execution of the relief—in other words, the blue collar workers. Then there was the civilian wing full of civil servants who acted as the go-betweens with the line-ministries, the international organisations, the foreign agencies and the NGOs. So they were coordinating at strategic level with these elements. The international NGOs and the plethora of local agencies were not alone in developing partnerships with the Pakistani military as they responded to the earthquake. In the days and weeks following 8 October, hundreds of military personnel and resources poured in from a wide variety of countries. Our research found that performance varied widely from cluster to cluster. One international NGO commented that clusters got 'so bogged down with the mechanics.' We also found that clusters were hampered by problems of communication between field staff and decision-makers based in Islamabad. High staff turnover inhibited the development of institutional memory and made it difficult to develop relationships with stakeholders. There was a lack of back-up support for cluster leads, who were essentially taking on two full-time roles, an agency role and a separate role as cluster lead**. [3] [11] [41] [42]**

Enhanced Coordination For Disaster Relief: During the third phase, there were key mechanisms established for coordinating various aspects of the response, including but not limited to: the Strategic Planning Group within the Pakistan Federal Relief Commission (FRC) for longer-range planning; the Clusters, for coordinating among *sectors* or *functions*; and the Air Operations Centre (AOC) for aviation tasking coordination. Though there was clearly frustration over the speed at which these mechanisms became functional, their formation had the input of a large number of actors and led to greater fidelity in planning and improved task division among civilian and military actors. **[43]**

SHARED AWARENESS/UNDERSTANDING

Building Situational Awareness: In Pakistan, there were visible and familiar problems in building a situational awareness of the earthquake. The size of the area affected by the disaster and the creation of coordination "hubs" on a location basis meant that "stovepipes" were quickly created. Agency contact was reported to be fairly constructive at the field locations, but at higher levels some staff reported that they had little contact with other agencies. The "Clusters" (Shelter, Water/Sanitation, Food, Health, and Education) played a key role in building and maintaining situational awareness throughout the three phases analysed. Additionally, these clusters significantly assisted in ensuring that each organisation had a "shared awareness/understanding" of the relief operations. **[3]**

Information Management: Staff working in informational roles in Pakistan recognised that information management was very poor within their agencies. This was a significant factor that limited shared awareness and understanding. To an outside observer it did appear that the staff spent unnecessarily large amounts of time in collecting and reconciling information from within the organisation in order to build up an overall picture. **[3]**

Map Accuracy: Another key area that limited the ability to have shared awareness/understanding was the use of outdated maps. Maps are critical to planning and implementation across the whole range of relief and recovery activities. Topographic maps were commercially available in Pakistan; in addition, the NGO MapAction began producing thematic maps for the humanitarian community less than a week after the earthquake. Despite this, agencies felt a lack of useful maps, although this may have been a lack of awareness of the full range available particularly in the field. **[3]**

SHARED INTENT

Common Intent: All entities shared the end goal, recovery and stabilisation following the earthquake. However, they differed in the execution. In some of the high level meetings in Islamabad, not all organisations were present to coordinate their activities. Notably, NGOs were not there so it made it very difficult to coordinate and de-conflict activities. **[3]**

Communications Infrastructure: Although agencies claimed to subscribe to the principle of "communications first," none of them successfully achieved this in Pakistan[3]. The staff in Pakistan possessed the necessary skills to manage their IT, but not always to manage telecommunications.

Use of "Clusters": Pakistan was the first emergency response in which the UN implemented the "cluster" approach, with implications for information sharing. These clusters significantly assisted in ensuring that each cluster group had a "shared intent.**" [3] [11] [41] [42]**

DECISION-MAKING

The last variable considered in this case study was to assess the decision-making processes across all agencies involved in the operational environment. Various definitions and models have been proposed for decision-making. Examples of definitions include: (a) the cognitive process of reaching a decision; (b) choosing between alternative courses of action using cognitive processes—memory, thinking, evaluation, etc.; (c) the process of mapping the likely consequences of decisions, working out the importance of individual factors, and choosing the best course of action to take. Common to all these definitions is the view that decision-making is a process based on inputs and leading to a decision.

Completeness and Clarity: Some features focused on the inputs used (or more precisely the interpretation of the inputs) for the decision: the completeness and clarity of the inputs (including the understanding of all options available) and the processes used to manage the associated uncertainty. Other features concern the importance of the decision: the level (strategic, operational or tactical) of the decision, the degree of authority of the decision as well as the degree of responsibility shown by the decision-makers towards the possible consequences of the decision

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3 The basic definition of communications is that secure and stable communications must be established first in a crisis.

made. In addition, some features include external pressure: time pressure, perceived expectation, and perceived default options (it is well-known that the decision-making process is influenced by the perceived status-quo or default option). The decision-making process is also characterised by features such as the decision criteria used (benefits, risk, etc.), the rationality of the decision (optimal, threshold-based, risk avoidance), and the cognitive awareness of the individuals (sometimes a deliberate process is used, corresponding to high awareness, while at other times decision-making is based on intuition and consideration of previous similar situations). Finally, group decision-making is also characterised by features such as the degree of consensus required and the process used to develop agreements among the group. There are two main types of approach for developing agreement: advocating and inquiring approaches. While in the advocating approach, each party strives to persuade others and defend its position, an inquiry approach required presenting balanced arguments and remaining open to alternatives. The various features considered in such an approach are not all independent. For example, the degree of cognitive awareness tends to be higher for a decision made at a strategic level than one at the tactical level where time pressure is more important. **[28] [29] [30] [31] [32]**

Interactions with NGOs: Although information was shared for NGOs to use common decision criteria and prioritise the same options, it is unknown if these inputs were used. Finally, there is no information available with regard to the compatibility of decisions made, the similarity over the expectations and there is no evidence of decisions made based on wide optimisation considering various agency resources. There was as well no evidence of collaboration with regards to uncertainty management. To summarise the observations made most decision-making support was in sharing inputs with regard to the decisions that needed to be made. Very little is known about the agencies respective use of these inputs within their decision-making process. It is therefore nearly impossible to estimate the similarity of the inputs used within the decision-making process, or the similarity of the criteria used. For this reason, the proposed assessment tool for the NATO NEC C2 maturity level based on the decision-making processes along cannot be produced with confidence. A different case study for this assessment should be considered.

De-Confliction vs Coordination: There are indications that levels of De-Conflicted and Coordinated C2 decisions were reached. Some relevant evidence was noted to demonstrate De-Conflicted and Coordinated C2 approaches, namely some agencies:

- Used the NetHope Software application that can support collaborative decision-making;
- Provided recommendations about approaches or inputs to consider within the decision-making processes. This indicated a tentativeness to develop coordination of the decision-making. However, it is unknown if these recommendations have been followed. Specific examples of recommendations include:
    – World Health Organisation (WHO) strongly recommended the implementation of the standards of the Sphere Handbook.
    – Office for the Coordination of Humanitarian Affairs (OCHA) recommended contingency planning based on scenarios of projected population movements to lower ground;

- Provided recommendations about options that should be prioritised (see OCHA list of Immediate Needs and Emergency Requirements. However, it is unknown if these recommendations have been followed. If so then a Coordinated C2 would have resulted through development of common objectives and understanding of priorities;

- Conducted meetings between decision-makers from various agencies. For example, there was a Geneva meeting in October 2005 and later an executive committee consisting of key decision-makers from the humanitarian community and the Pakistan military was established. If the meeting was mostly to exchange information with the various parties advocating for their own objectives than the meeting would lead to a De-Conflicted approach for the decisions made. If an inquiry approach was used than the meeting would have lead to a Coordinated C2 approach between the parties involved; and,

- Conducted De-Conflicted C2 approach of the Search and Rescue (SAR) teams with the different international SAR teams being allocated a different search area.

Based on those observations, there is evidence that some decision-making inputs were shared and group decisions were made. However, it is unknown what type of consensus was used for the group decisions and what approach was used for developing the consensus (advocated or inquiry). The NNEC C2 maturity levels were assessed based on the above discussion. These features are used rather than variables like the decision speed since it is uncertain how these variables correlate with the NNEC C2 maturity levels. For instance, it is likely that the decision speed increases as one moves from Conflicted C2 to De-Conflicted C2 and then to Coordinated C2; and, then decreases back as the Edge level is approached. Therefore, there would not be a one-to-one relation between the C2 approaches adopted and the decision speed, which makes this variable unsuited to determine without ambiguity the maturity level. From a sheer decision-making point of view, it is difficult to assess the degree of NNEC C2 maturity level since most reports available do not specify the approach used by the agencies for their decision-making process. **[1] [15] [16] [17] [19] [35]**

CRITICAL FINDINGS

Taking the information and observations from the six areas in the first section, an analysis was conducted to extract any critical findings during each of the three phases. For each of the three phases, an analysis was conducted and grouped into three main areas, namely: Government, NGOs, and Information.

PHASE I: SEARCH AND RESCUE

Government:

Government officials were unavailable: Due to the earthquake, some were dead; some were attending to their deceased relatives; some were in shock and confused; consequently, there was a total dependency on the military to organise relief efforts and to create a response structure. However, the Pakistan government reacted quickly and rushed to provide relief and restore basic services. Within a few days of the earthquake the Pakistan President established: (a) a Relief Fund to mobilise resources for relief efforts; and, (b) an Earthquake Reconstruction and Rehabilitation Authority. The Pakistan Prime Minister (PM) appointed a Federal Relief Commission and Relief Coordinator for: shelters, food, clean water, and medical care. Additionally, the government set up a Steering Committee for Recovery and Reconstruction consisting of the Ministries of Finance, Economic Affairs, Planning and Foreign Affairs, as well as representatives from UN, World Bank and the Asian Development Bank (ADB). It's interesting to note that the Pakistan government stated that one of the reasons for lack of an "initial response" was that they had no detailed plan for a disaster response. Due to the magnitude of the earthquake, political tensions between India and Pakistan over the Kashmir region were temporarily put aside with the Indian PM offering assistance. **[1] [38]**
RESULT: During this phase the Pakistan government exhibited both Conflicted C2 and a De-Conflicted C2 approaches.

Inability of Local Security forces: Since the local security forces were unable to perform basic functions, the Pakistan military was charged with coordinating the emergency response for the government; however, in many cases the Pakistan Army waited for top-down orders that never came. The Pakistan Army had to rely on survivors fit enough to walk down to their bases and inform them where aid was most needed. A key issue was that the Pakistan military was trained for war, not disaster relief, coupled with the fact that Gen Musharraf's military mindset blocked humanitarian aid from reaching the needy. **[38]**
RESULT: During this phase the Pakistan's local security forces exhibited both Conflicted C2 and De-Conflicted C2 approaches.

Lack of Timely Information: Initially there was a lack of information regarding the earthquake that caused confusion and what information that did get through was confused and contradictory. Consequently, the information available was grossly insufficient for UN agency planning. As a result the world was largely unaware of the catastrophic impact of the disaster in the first 24-hours. At the local level, the community themselves were the first responders. Initially the early information was spontaneous and sporadic, but after a few days, both local and NGOs as well as the Pakistani Army became involved in more organised relief efforts. A key finding was that although

the PM Secretariat and PM House established an emergency centre, they only had one telephone line. This caused an extreme communications issue. For example, it took one day to announce a three-day national mourning. **[38]**

RESULT: During this phase, due to the lack of clear information the Pakistan government exhibited both Conflicted C2 and De-Conflicted C2 approaches.

NGOs:

Strain of Logistics and Resources: The terrain and sheer scale of the disaster required unprecedented logistics and resources. Since practically all the land communications was destroyed, and there was a lack of Satellite cell/mobile-phones these were the contributing factors towards the initial lack of coordination. Preparedness for population movements required increased focus. They found that affected communities preferred to remain in their villages. The first responders were "Jihadis" who provided much needed support before anybody. Winterisation of tents remained a challenge, as it was difficult to track the type and location of tents that had been distributed. One item that significantly assisted in bringing resources into the area was the Pakistan International Airlines (PIA), who offered free delivery of goods from anywhere in the world.

RESULT: During this phase the non-governmental organisations exhibited a De-Conflicted C2 approach.

UN Use of "Clusters": This was the first time the UN used the "cluster" approach. There were five clusters formed (Shelter, Water/Sanitation, Food, Health, and Education). In Islamabad they thought this was positive and they used this approach to build an overall situation picture. In Marsehra, it was mixed and they used the "clusters" for information sharing only. However, the use of these "clusters" allowed for more efficient coordination between all the relief groups. **[3] [11] [41] [42]**

RESULT: During this phase the use of clusters exhibited a De-Conflicted C2 approach.

Lack of Updated Maps: Many staffs identified problems with maps. They used Global Positioning System (GPS) for locations and the maps were found to be inaccurate. This was compensated by stronger links between the Health Information Centre (HIC) and Federal Records Centre (FRC) data management structures. With regular data and information exchange, shared assessments and sharing of geographic data helped build a more comprehensive picture. The HIC also helped to build FRC mapping capacity. **[3]**

RESULT: During this phase, due to lack of accurate maps, the Pakistan government exhibited a Conflicted C2 approach.

Information:

Disrupted Communications: Since the infrastructure was massively damaged, to provide communication capabilities non-organic assets were shared between locals and NGOs, creating signs of interdependence on technical assets. (Coordination: Strategy by Office of the Prime Minister; Search and Rescue by Ministry of Interior; International Assistance by Ministry of Foreign Affairs).

RESULT: During this phase the Pakistan government exhibited Conflicted and De-Conflicted approaches.

10

Lack of Information Sharing: Information sharing consisted of only organic information. Initially there was only a trickle of information. The information that did make it through was confusing and contradictory. The available information was grossly insufficient for UN agency planning. After action reports indicated that data collection and computerisation were done in an ad-hoc manner and were affected by issues such as: lack of protocols for data entry; lack of personal training; inconsistent use of certain terms such as household; loss of information, and incorrect or partially recorded information; difficulty in determining what percentage of the eligible population had been covered.
RESULT: During this phase the Pakistan government as well as NGOs exhibited Conflicted and De-Conflicted approaches.

Lack of Common Data Standards among the NGOs: Within the various NGOs, there was a lack of common data standards. It seemed that some agencies gave data collection and analysis more attention; therefore, they were more productive during the early phases. During Phase I, the primary vehicle for transmitting information was via "situation reports." These reports were neither continuous nor inclusive; consequently, they were of little value, but tied up a lot of resources. The main issue for the NGO field staffs was not bandwidth limitations, but consistency of the connection. Although they were aware of its limited extent in remote areas, staff consistently overestimated the reliability of cell coverage. However, damages of over-reliance on the cell network would have been minimised if redundant communications were available – but in most cases they were not. There was a growing divide in communications technology use between and among the NGOs, which had two detrimental effects on response: under minded coordination and eroded security. Within the emergency response, there was lots of concern about vertical information flow, but little focus was done on improving horizontal information flow. For example, there were coordinating "hubs" on a location, but little horizontal coordination. Rather than information overload, the problem was information fragmentation. Information regarding priority areas above 5,000 ft was provided by the Pakistani military. What they did was manually match their information with information from the agencies/NGOs to determine areas that have been partially/fully covered, and areas that have not been covered; which, took a lot of resources and time. All these shortcomings plus the extremely large area added up to a significant problem in trying to build a comprehensive situational awareness.
RESULT: During this phase, due to the lack of interoperability between NGOs, they exhibited Conflicted and De-Conflicted approaches.

PHASE II: PROVIDE RELIEF AND STABILISATION

Government:

Strain of Logistics and Resources: The coordinated planning of logistics remained a critical issue throughout Phase II. Towards the end of Phase II, the Pakistan government presented a National Plan of Action to all the agencies involved. This plan identified gaps and provided a framework for further response. **[34]**
RESULT: During this phase the Pakistan government exhibited both a De-Conflicted C2 and Coordinated C2 approaches.

Patterns of Interaction improved with Establishment of "Clusters": This was the first time the UN used "clusters" for relief (Shelter, Water/Sanitation, Food, Health, and Education) Regular cluster meetings were used with an emphasis on developing a "strategic" oversight role of the cluster groups in Islamabad and a "tactical" implementing role of the sub-clusters located in the field. This significantly enhanced the coordination and collaboration of the relief efforts. Agencies were able to reassign existing resources to provide surge capacity for response, and to procure new equipment for their expanded staff. Existing ICT staff were familiar with organisational procedures, with local markets and (to some extent) with legal requirements, enabling procurement to be carried out quickly. Collective objectives, patterns of interaction, and allocation of authority and responsibility approaches were improved via the use of clusters. **[35]**

RESULT: During this phase the use of Clusters enabled improvement from Conflicted C2 to Coordinated C2 approaches.

Smooth Transition from Military to Civil Control: The Pakistan military started the process of a phased handover of control to civil authorities for directing relief work. This was key as the military realised that they were not trained for relief operations and were willing to transfer control. **[43]**

RESULT: During this phase the Pakistan government exhibited a Coordinated C2 approach in moving the military to a support role in relief operations.

Hesitation of Local Populace to Move: One issue that came up that was unforeseen was that the local people were reluctant to move from their village to a relocation center. The reasons being: (a) awaiting compensation payments; (b) uncertainty regarding available services/assistance at new locations; (c) majority were poor and feared that they would lose their land if they left; and (d) reluctance to leave their main source of income—livestock.

RESULT: During this phase the Pakistan people exhibited both Conflicted C2 and De-Conflicted C2 approaches.

NGOs:

Creation of Planning Cells: Humanitarian planning cells were manned by both military and civil organisations using a single government priority list of at-risk villages. The first cells to be established were in Muzaffarabad, Mansehra and Bagh. The Army's coordination liaison officers were interested in strengthening cooperation with the international humanitarian community. In some instances, they chaired the daily coordination meeting with the humanitarian organisations. These planning cells enhanced the coordination of efforts. **[34]**

RESULT: During this phase the relief operations exhibited both De-Conflicted C2 and Coordinated C2 approaches.

Information:

Rebuilding Infrastructure: Infrastructure (satellite lines, radios, phone lines, GSM coverage) was reconstructed with limited collective planning in place. Sharing of equipment, data formats and communication channels later extended to organic and non-organic means; subsequently affecting interdependence between state, military and NGO structures. Actions and effectiveness related to infrastructure increased during this Phase of operation.

RESULT: During this phase the Pakistan government exhibited the transfer from De-Conflicted C2 to Coordinated C2 approaches.

12

Information Fragmentation: All the field managers interviewed believed that pertinent information existed, but that their major challenge was to extract and organise that information. This was not a problem of information overload, but rather information fragmentation. Accurate information on movement of population remained very limited. Who/What/Where maps were becoming key to the overall relief operation. Pakistan MOH and WHO established an emergency Early Warning and Response Surveillance system in the affected areas, starting in Muzaffarabad. This was a key item in reducing the fragmentation and enhancing coordination among the various groups. **[13] [35]**

RESULT: During this phase the relief operations exhibited both De-Conflicted C2 and Coordinated C2 approaches.

Lack of a Comprehensive Information Management Structure: Voice and data networks were operational with local and independent management; consequently, there was an active effort to strengthen information management, both within and between the clusters and the government. One method was to have regular formal meetings with relevant counterparts in the Federal Relief Commission on Security and on Information Management.

RESULT: During this phase the relief operations exhibited both De-Conflicted C2 and Coordinated C2 approaches.

PHASE III: RECONSTRUCTION AND REBOUNDING

Government:

Focus Shift to Long Term Projects: During this phase the focus was on long term projects and further development to increase effectiveness and efficiency of infrastructure related activities. For example, the Pakistan President established an Earthquake Reconstruction and Rehabilitation Authority (ERRA) to facilitate the rebuilding and repair of damaged infrastructure. Resource sharing decreased due to the fact that some organisations left the territory and others had sufficient amount of own / leased infrastructure components.

RESULT: During this phase the relief operations exhibited the range from De-Conflicted C2 to Coordinated C2 approaches.

NGOs:

Lack of Long Term Support: The national media found themselves in uncharted water, but adapted strategies of balancing objective reporting with responsibilities to provide the public with important relevant information. However, once the media left so did the NGOs.

RESULT: During this phase the relief operations exhibited the range from De-Conflicted C2 to Coordinated C2 approaches.

Information:

Increased Availability of Data and Information: During this phase of the operation, data became more available; however, the most problematic was the structure of the data and processing of information.

RESULT: During this phase the relief operations exhibited the range from De-Conflicted C2 to Coordinated C2 approaches.

Lack of Effective Information Sharing: Considering information sharing, there were two problems that underlied the multiple information requests: a) the lack of co-ordination between organisations in assessing needs, which lead to duplications and gaps; and, b) the unwillingness of many organisations to share their assessment results in forms that can easily be used by others.
RESULT: During this phase the relief operations exhibited the range from De-Conflicted C2 to Coordinated C2 approaches.

CONCLUSIONS

The critical findings for the Pakistan Earthquake Case Study are summarised in Tables 1 and 2.

RELIEF PHASES:

Phase I: Entities in Phase I generally exhibited a *De-Conflicted C2* approach, except in the areas of "Frequency/Continuation of Interaction", "Degree of Shared Awareness", "Degree of Shared Understanding", "Relative Effectiveness", and "Efficiency, Given Effectiveness" where they exhibited a *Conflicted C2* approach. This is as expected due to the large area of destruction, notably the infrastructure. On the positive side, in the areas of "Degree of Inter-cluster connectivity" and "Frequency/Continuity of Interaction" there were some signs of *Coordinated C2* approaches. This can be attributed to the use of "clusters" within relief operations by the UN.

Phase II: Entities in Phase II generally exhibited a *De-Conflicted C2* approach, except in the areas of "Relative Effectiveness", and "Efficiency, Given Effectiveness" where they had a *Conflicted C2* approach. However, there were two areas which they exhibited a *Coordinated C2* approach, namely: "Degree of Inter-cluster Connectivity" and "Frequency/Continuation of Interaction." This can be attributed to the continued use of the "cluster" approach within relief operations.

Phase III: Entities in Phase III generally exhibited a *De-Conflicted C2* approach, except in the area of "Efficiency, Given Effectiveness." However, this was due to the fact that the NGOs, military, as well as the Pakistan government settled on a *De-Conflicted C2* approach to long term relief operations. However, there were two areas which did exhibit a *Coordinated C2* approach, namely: "Degree of Inter-cluster Connectivity" and "Frequency/Continuation of Interaction." As with Phase I and II, this can be attributed to the use of the "cluster" approach within relief operations.

SUMMARY:

A key aspect of the analysis conducted on this particular case study was the ease to which the team was able to determine the utility of the C2 approach categories using the N2C2M2.

Fundamentally, the UN's first time use of *Cluster's* to assist in the recovery effort was a good example of *C2 Agility*. This ability to recognise that the circumstances demanded a broader C2 approach and to rapidly implement this new approach was a good example of transitioning to a higher C2 maturity level. In this case, transitioning from De-Conflicted C2 to Coordinated C2.

In conclusion, analysis indicates that for the Pakistan Earthquake that occurred in Oct of 2005, they rapidly moved from Conflicted C2 to Coordinated C2 over the period of the recovery.

14

Variables Defining Collective C2 Approaches

	Allocation of Decision Rights to the Collective	Inter-entity Information Sharing Behaviours	Distribution of Information (Entity Information Positions)
Edge C2			
Collaborative C2			
Coordinated C2			
De-Conflicted C2	Pakistan 3 / Pakistan 2 / Pakistan 1	Pakistan 3 / Pakistan 2 / Pakistan 1	Pakistan 3 / Pakistan 2 / Pakistan 1
Conflicted C2			
C2 Approach			

Required Patterns of Interaction

	Cluster Attractor	Degree of Inter-cluster Connectivity	Frequency/ Continuity of Interaction
Edge C2			
Collaborative C2			
Coordinated C2		Pakistan 3 / Pakistan 2	Pakistan 3 / Pakistan 2
De-Conflicted C2	Pakistan 3 / Pakistan 2 / Pakistan 1	Pakistan 1	Pakistan 1
Conflicted C2			
C2 Approach			

Pakistan 1 = Search & Rescue   Pakistan 2 = Relief & Stabilisation   Pakistan 3 = Reconstruction

Table 1. N2C2M2: Variables Defining Collective C2 Approaches and Required Patterns of Interaction

Measures of C2 Effectiveness

	Degree of Shared Awareness	Degree of Shared Understanding	Adaptability of the Collective C2 Process
Edge C2			
Collaborative C2			
Coordinated C2			
De-Conflicted C2	Pakistan 3 / Pakistan 2	Pakistan 3 / Pakistan 2	Pakistan 3 / Pakistan 2 / Pakistan 1
Conflicted C2	Pakistan 1	Pakistan 1	
C2 Approach			

Measures of Endeavour Effectiveness

	Relative Effectiveness	Efficiency, Given Effectiveness	Agility of the Collective C2 Process
Edge C2			
Collaborative C2			
Coordinated C2			
De-Conflicted C2	Pakistan 3		PAKISTAN 3 / PAKISTAN 2
Conflicted C2	Pakistan 2 / Pakistan 1	Pakistan 3 / Pakistan 2 / Pakistan 1	PAKISTAN 1
C2 Approach			

Pakistan 1 = Search & Rescue   Pakistan 2 = Relief & Stabilisation   Pakistan 3 = Reconstruction

Table 2. N2C2M2: Measures of C2 Effectiveness and Measures of Endeavour Effectiveness

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