NPS-LM-13-094

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Analysis of United States Marine Corps Operations in Support of Humanitarian Assistance and Disaster Relief

17 November 2013

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The research presented in this report was supported by the Acquisition Research Program of the Graduate School of Business & Public Policy at the Naval Postgraduate School.

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Abstract

In order to improve the effectiveness of the United States Marine Corps (USMC) response to future international humanitarian assistance/disaster relief (HA/DR) missions, an analysis of the demands created by such disasters as well as the capabilities of the USMC is necessary. This research focuses on the primary response organization within the USMC: the Marine expeditionary unit (MEU) and those resources available to the MEU to conduct HA/DR operations. Recent HA/DR events are examined to determine how common demands were met by the USMC as well as any gaps that may exist that should be addressed to improve future effectiveness.

In this research, we explore the capabilities of the USMC MEU that satisfy demands arising from natural disasters. We follow the humanitarian and military core competencies framework for studying the USMC capabilities to match the supply with the demand from certain past disasters. After compiling and analyzing data from multiple USMC publications, historical records of disasters, and the USMC response to those disasters, we identify those capabilities provided by the USMC that are the most critical and unique with respect to the conduct of HA/DR missions. We collected data for the 2007 cyclone on the southwest coast of Bangladesh, the 2010 Haiti earthquake, and the 2011 Japan earthquake and tsunami. We selected these disasters due to their impact and the level of involvement of the USMC in relief operations.

Keywords: Humanitarian assistance and disaster relief, HADR, Marine expeditionary unit, Bangladesh Cyclone Sidr, Operation Sea Angel II, Haiti earthquake 2010, Operation Unified Response, Great East Japan earthquake and tsunami, Operation Tomodachi

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Acknowledgments

We would like to thank our wives, Laura and Samantha, for maintaining our sanity and keeping our families happy as we completed our research. Thank you for putting up with us during this process and for your unwavering support no matter what our mission. We extend our humble gratitude to our beloved advisors, Dr. Aruna Apte and Dr. Keenan Yoho; thank you both for providing us with the guidance, encouragement, and flexibility that allowed us to complete our thesis. Aruna, your mentorship and art have truly been an inspiration. Finally, we would like to acknowledge the tremendous help that we received from the Acquisition Research Program and its staff. Thank you, RADM James Greene (USN, Ret.), Karey L. Shaffer, and Tera Yoder, for your assistance and sponsorship.

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List of Acronyms and Abbreviations

3/2	3rd Battalion, 2nd Marine Division
AAV	Amphibious Assault Vehicle
ACE	Air Combat Element
AOR	Area of Responsibility
APS-10	African Partnership Station 10
ARG	Amphibious Ready Group
B2C2WG	Board, Bureaus, Centers, Cells, and Working Groups
BATARG	Bataan Amphibious Ready Group
BCT	Brigade Combat Team
BLT	Battalion Landing Team
CARE	Cooperative for Assistance and Relief Everywhere
CAT	Crisis Action Team
CBRN	Chemical, Biological, Radiological, Nuclear
CE	Command Element
CO	Commanding Officer
CRED	Center for Research on the Epidemiology of Disasters
ESG	Expeditionary Strike Group
FCE	Forward Command Element
GCC	Geographic Combatant Commander
GCE	Ground Combat Element
GoB	Government of Bangladesh
HA/DR	Humanitarian Assistance/Disaster Relief
HACC	Humanitarian Assistance Coordination Cell
HAST	Humanitarian Assistance Survey Team
HCOP	Humanitarian Assistance Common Operational Picture
HLZ	Helicopter Landing Zone
HMMWV	High-Mobility Multipurpose Wheeled Vehicle
IFRC	International Federation of Red Cross and Red Crescent Societies

ISR	Intelligence, Surveillance, Reconnaissance
JFCOM	Joint Forces Command
JOA	Joint Operations Area
JSDF	Japanese Self-Defense Forces
JTF	Joint Task Force
JTF–H	Joint Task Force–Haiti
LCAC	Landing Craft, Air Cushion
LCE	Logistics Combat Element
MAG	Marine Aircraft Group
MAGTF	Marine Air-Ground Task Force
MAW	Marine Aircraft Wing
MCCLL	Marine Corps Center for Lessons Learned
MEB	Marine Expeditionary Brigade
MEF	Marine Expeditionary Force
MEU	Marine Expeditionary Unit
MINUSTAH	United Nations Stabilization Mission in Haiti
MOOTW	Military Operations Other Than War
NGO	Nongovernmental Organization
PACOM	U.S. Pacific Command
R2P2	Rapid Response Planning Process
RAS	Replenishment at Sea
SCMAGTF	Security Cooperation Marine Air-Ground Task Force
SPMAGTF	Special Purpose Marine Air-Ground Task Force
THF	The Heritage Foundation
USAID	United States Agency for International Development
USCENTCOM	United States Central Command
USMC	United States Marine Corps
USSOCOM	United States Southern Command

I. INTRODUCTION

An analysis of past Marine Corps humanitarian assistance/disaster relief (HA/DR) operations can help assess relief demand and supply capabilities. Given the current operational climate of U.S. military forces around the world, it is imperative that the Marine Corps Marine expeditionary unit (MEU) is properly implemented while performing foreign disaster relief operations.

A. MOTIVATION

As the U.S. military exits Afghanistan and prepares for a likely period of peacetime, non-combat operations provide a means for combatant commanders to engage in theater shaping. The Marine Corps provides critical assets for these missions through its MEUs, which are flexible and adaptable to accomplish a wide range of operations, including non-combat missions. These natural disasters create a demand for the relief capabilities inherent to the MEUs. By seeking to reduce redundancy and focus on capabilities that are unique and provide an unfilled demand, the MEUs will provide more effective relief and reduce the effects of a disaster. Although the MEU response will undoubtedly provide levels of aid and relief, it is critical that the Marine Corps allocate its assets effectively to accurately match its supply of relief with the demand created by the disaster.

B. BACKGROUND

As identified in Figure 1, as the world population has risen, the occurrence of disasters has impacted an increasing number of people, presenting greater challenges to humanitarian aid responders. Given this rising trend, it is likely that the MEU and Marine forces will face an increasing demand for HA/DR capabilities and response.

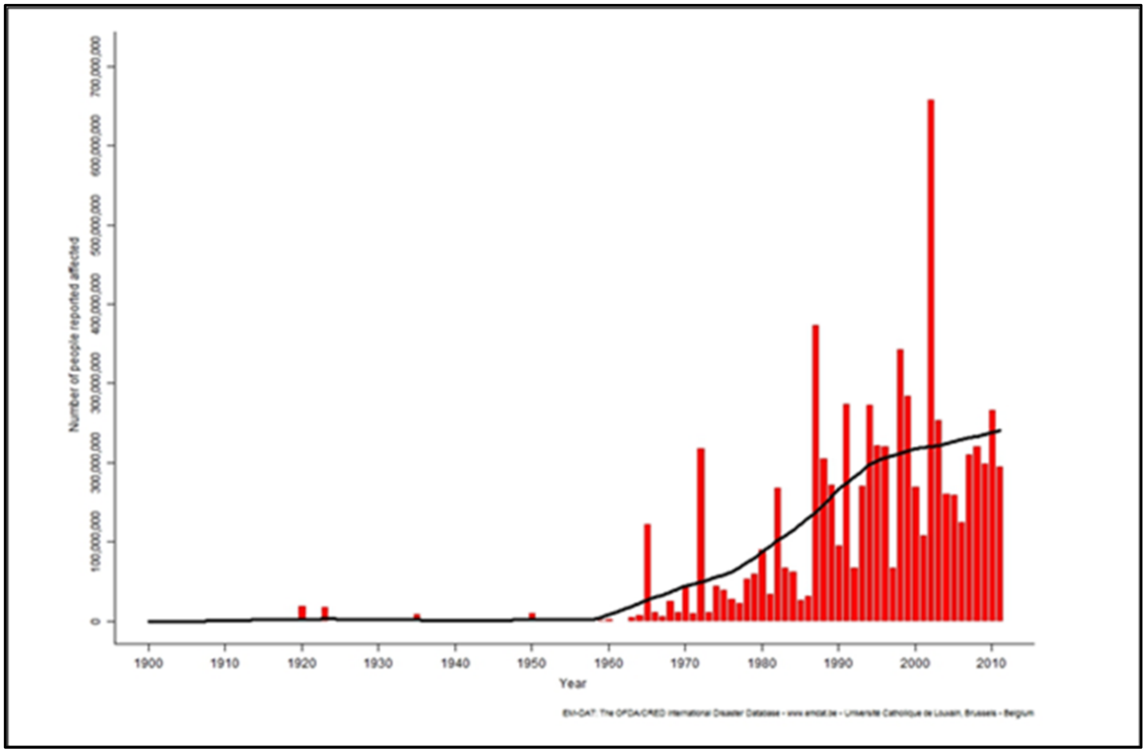

Figure 1. Number of People Reported Affected by Natural Disasters, 1900–2011
(Centre for Research on the Epidemiology of Disasters [CRED], 2011)

C. OPERATIONAL VALUE OF HUMANITARIAN ASSISTANCE/DISASTER RELIEF

HA/DR operations also provide a means for military leaders to shape areas of responsibility (AORs) by providing aid and enhancing global perception of the U.S. military while exerting influence through the socioeconomic and geopolitical factors and infrastructure of affected nations (Office of the Assistant Secretary of Defense [OASD], 2011). *Marine Corps Vision and Strategy 2025* listed preventing and responding to disasters in the top five priorities under the National Strategic Planning Guidance (Office of Naval Research [ONR], 2008). Based on this strategy, the Navy, Marine Corps, and Coast Guard collectively issued maritime strategic imperatives for creating and developing international partnerships to prevent and limit the effects of global disruptions (ONR, 2008). HA/DR operations will undoubtedly be utilized to accomplish the goals of the Marine Corps' strategy for future operations in support of the national strategy.

D. MILITARY

In the event of a large-scale foreign disaster, the U.S. military is uniquely capable of providing extensive logistics, strategic lift, engineering, and medical support to austere and complex devastated environments within aggressive time lines. Although these events are sporadic and relatively low in frequency, their severity creates a demand for assistance that is most readily supplied by the U.S. military (OASD, 2011). Furthermore, due to its structure, the U.S. military is able to provide a wide range of support, including security, transportation and logistics, construction and repair, command and control communications, medical care, subject matter experts, and civil support (Pettit & Beresford, 2005). The military is well suited to respond immediately and operate in all areas, even where infrastructure and stability may be completely lacking.

E. NONGOVERNMENTAL ORGANIZATIONS

Nongovernmental organizations (NGOs) provide similar capabilities as military actors but are generally limited to specific missions, such as the provision of meals or medical care. Accordingly, NGOs often provide greater quantities of aid within their specific competencies but lack the range of operations, which leads to NGO reliance on military assets to provide logistical support for supply movement (Apte & Yoho, 2012).

F. NAVY AND MARINE EXPEDITIONARY UNITS

MEUs combine equipment and personnel from the Unites States Marine Corps (USMC) aboard U.S. Navy vessels, creating an amphibious ready group (ARG). The capabilities of the MEU are enhanced by naval support, but when disembarked, MEU capabilities consist only of organic personnel and equipment.

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II. METHODOLOGY

A. SCOPE

Our analysis of the USMC MEU responses to HA/DR events focuses on significant, foreign disaster relief operations requiring the employment of an entire MEU or larger Marine air-ground task force within the last 10 years. The three events analyzed are Operations Sea Angel II, Unified Response, and Tomodachi. During these operations, USMC MEUs responded to the 2007 cyclone in Bangladesh, the 2010 Haiti earthquake, and the 2011 Japanese earthquake and subsequent tsunami, respectively. These operations are the most recent examples of how a USMC MEU was utilized to conduct aid and relief operations. We selected the disasters on the basis of presenting a representation of recent disasters. These disasters affected nations ranging from an underdeveloped third world nation to a well-organized and modern first world nation, and present an acceptable level of sources of data collected from relief operations. We did not examine responses to domestic disasters, due to legal and logistical considerations, which significantly separate international American military responses from domestic operations.

B. DATA COLLECTION

We analyzed the operations using both USMC reports and government and organizational reviews of response in order to identify strengths and weaknesses of the MEU response. Additionally, we evaluated the overall response of all responders to identify the strengths, shortages, and gaps in the response. We sought to identify demand and responses by the USMC in these disasters. In the research, we attempted to match the hard and soft assets of the USMC MEU to the demand for HA/DR created by the previously mentioned disasters.

C. LITERATURE REVIEW

Previous research in the field of HA/DR identified classifications for disasters as well as categories for military HA/DR response; evaluating these sources in an objective format enhances the understanding of disasters. This research, when matched with the current composition of the MEU, provides a firm foundation for evaluating the MEU's response to foreign disasters.

1. Humanitarian Assistance/Disaster Relief

Disasters have historically been classified as either natural or manmade, but recent models seek to classify disasters based on the size of the affected location and the tempo of the disaster (Apte, 2009). This classification system provides insight into the complexity of the disaster and the difficulty of the response efforts, based on inherent characteristics of the disaster. Disasters that are widespread are more challenging to respond to than those that are localized, and disasters that strike without warning cause more destruction when preparation and evacuation are lacking (Apte, 2009). Figure 2 indicates the level of difficulty as a product of location and time.

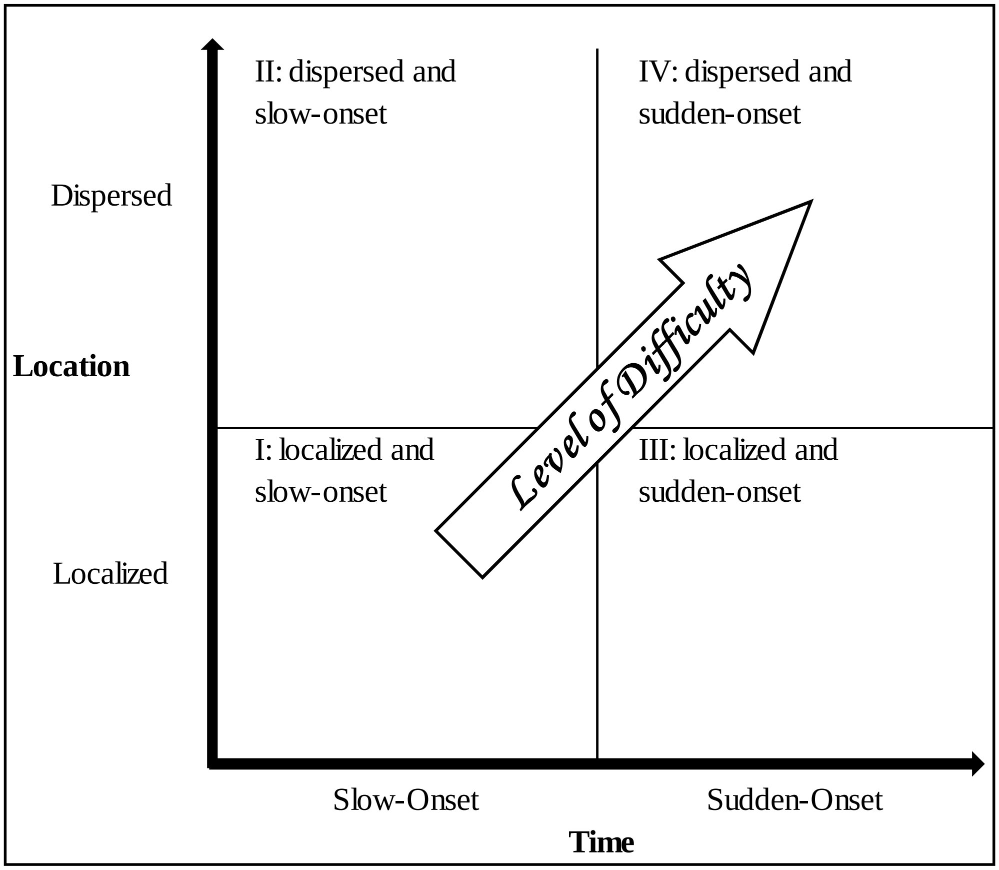

Figure 2. Classification of Disasters
(Apte, 2009, p. 14)

Response to any level of disaster must accomplish several capabilities to meet a wide range of demand for HA/DR. These necessary response deliverables include information and knowledge management, needs assessment, supply, deployment and distribution, health service support, and collaboration/governance (Apte, 2009). Without understanding the current situation, it is impossible to properly respond. The generation and dissemination of information is the first step in preparing an appropriate plan to provide relief in the wake of a disaster. This capability provides the responder with the critical information it needs to get the right support to the right place and the right people. Information gathering and data collection serve to develop the responder's overall situational awareness and serve a critical role in leadership's decision-making process (Apte, 2009).

A needs assessment seeks to determine what demand exists for relief and aid. This can be achieved using a variety of metrics, which can be tailored to individual cases. The needs assessment is a product of the intelligence-gathering phase and fuses the data collected from a variety of sources into a developed awareness of what is required to accomplish a given mission while operating within the scope and guidelines established. Needs assessments are critical for matching the appropriate resources to the right demand; in the event of a disconnect, inefficiencies are introduced, and capabilities are lost (Apte & Yoho, 2012).

A supply system is a major enabler to response and extends further than just what the responder is equipped with. Supply includes the processes of procurement, positioning, storing, and inventory maintenance of a responder's assets (Apte & Yoho, 2012). The supply chain of response is also a critical factor in determining overall capability. Organic assets, as well as the capability for resupply, greatly influence the scope and duration of relief operations, ultimately determining the flexibility of response (Apte & Yoho, 2012).

Transporting supplies to the end user is the overall goal of deployment and distribution. This capability is generally referred to as *lift*, or the ability to transport personnel, goods, and equipment from staging areas to the disaster area and distribution locations (Apte & Yoho, 2012). Significantly, naval services utilize the ocean as a maneuver area to establish sea basing capability on ships and then employ sealift and airlift platforms to deliver aid to the end user, with rotary-wing airlift assets providing the most flexibility (Apte & Yoho, 2012).

Virtually all disasters cause loss of life and casualties, as well as displaced persons. Accordingly, health services support must be provided to prevent further loss of life and relieve pain and suffering (Apte & Yoho, 2012). Large-scale medical operations involve naval hospital ships but are extremely cost intensive. Less costly but effective options include field hospitals and medical personnel embedded with ground units to provide individual care (Apte & Yoho, 2012).

Finally, collaboration and governance provide responders with a means to coordinate efforts and increase efficiency. HA/DR operations are likely to include numerous nations, agencies, and NGOs as well as host-nation governments. Additionally, these players are operating in a chaotic and constantly changing environment. Without deliberate collaboration and coordination, relief efforts are unlikely to achieve the highest effectiveness possible (Apte & Yoho, 2012). Furthermore, a well-defined command structure working with local governments, authorities, and community members facilitates the successful completion of HA/DR operations (Apte & Yoho, 2012). Figure 3 shows the relationship between military and non-military capabilities and how they fulfill the required capabilities in support of a disaster.

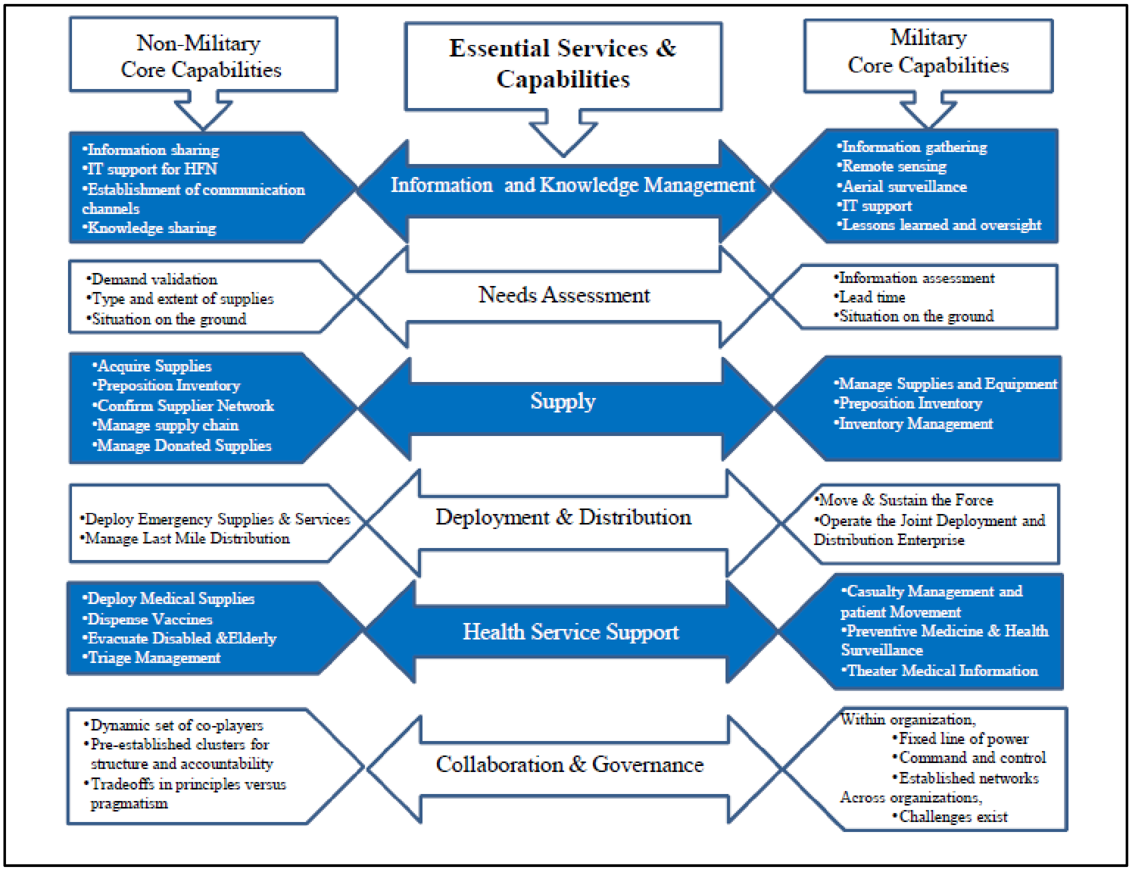

Figure 3. Humanitarian and Military Core Competencies
(Apte & Yoho, 2012, p. 15)
Note. This figure was adapted from Joint Publication 4-0.

2. United States Marine Corps

Known for its expeditionary capabilities, the Marine Corps organizes its forces in a specific structure to facilitate rapid deployment and self-sustainability. Across the range of military operations, the Marine Corps tailors its personnel and equipment to adapt to the response required.

a. Marine Air-Ground Task Force

The USMC's primary fighting organization is the Marine air-ground task force (MAGTF; OASD, 2011). This structure combines the main warfighting components of the Marine Corps and enables the self-sufficiency and sustainability that distinguishes it from the other branches of service. Each MAGTF consists of a command element (CE), ground combat element (GCE), logistics combat element (LCE), and air combat element (ACE; United States Marine Corps [USMC], 2011). Each MAGTF consists of these four elements, which provide the Marines the ability to be utilized across the range of military operations.

There are four types of MAGTFs, three of which are differentiated by size. The largest is the Marine expeditionary force (MEF), consisting mainly of an infantry division, combat logistics group, and Marine aircraft wing. Next, the Marine expeditionary brigade (MEB) is composed of an infantry regiment, combat logistics regiment, and Marine aircraft group (USMC, 2011). The fourth category of MAGTFs is the special purpose MAGTF (SPMAGTF), which is created and structured for a specific requirement and can range in size according to mission objectives (USMC, 2011). The smallest traditional MAGTF is the Marine expeditionary unit (MEU), consisting of an infantry battalion, combat logistics battalion, and Marine aircraft squadron.

b. Marine Expeditionary Unit

At any given time, the Marine Corps has a minimum of three MEUs deployed throughout the world. The 31st MEU is stationary in Okinawa, Japan. The other two are sourced from three MEUs on the East and West Coasts of the continental United States. The 22d, 24th, and 26th MEUs are located in Camp Lejeune, NC, and the 11th, 13th, and 15th MEUs are based out of Camp Pendleton, CA (USMC, 2011).

According to Marine Corps policy, MCO 3120.9C describes the MEU as a rapid response force whose mission is to

> provide a forward deployed, flexible, sea-based Marine Air Ground Task Force (MAGTF) capable of conducting Amphibious Operations, Crisis Response and limited contingency operations, to include enabling the introduction of follow on forces, and designated special operations, in order to support the theatre requirements of Geographic Combatant Commanders (GCC). (USMC, 2009, p. 4)

Marine Corps policy dictates that the MEU must possess five characteristics to ensure mission readiness. First, the MEU must accomplish a sea-based forward presence. Regardless of the geographic location of the mission, the MEU must be able to operate within the designated AOR independent of support from other nations. This is accomplished through the MEU’s use of naval platforms and naval ARG to provide mobile basing for global operations (USMC, 2009).

As the title of the MEU suggests, it must be expeditionary in nature. This includes a high level of training and proficiency in areas spanning the range of military operations so that when called upon, the MEU can deploy a flexible and adept force into austere environments while meeting urgent time lines (USMC, 2009).

Next, every MEU must possess the capability of crisis action planning and response (USMC, 2012). Threats and situations often develop rapidly and require commanders to complete the Rapid Response Planning Process (R2P2) in a matter of hours, with the target time being fewer than six hours. The MEU command must be able to use limited and incomplete information to generate an executable plan, the 80% solution. This requires command continuity through all levels and elements as well as a force capable of a flexible and immediate response (USMC, 2009).

A requirement for any MAGTF, the MEU must function with combined arms integration. Achieving synergy and unity of effort through the employment of fires and maneuver from units internal to the MEU, as well as external supporters such as naval gunfire, is critical to mission success and confronts the enemy with a combined arms dilemma that is direct and indirect fires combined with the tactical maneuver of forces that overwhelm the enemy (USMC, 2009).

Finally, an MEU must implement the concept of interoperability into its operational capabilities. Training and operating under a joint command environment, to include special forces, enhances the flexibility and effectiveness of the MEU by increasing proficiencies and maximizing the utility of strategic assets (USMC, 2009).

When forward deployed, the MEU is expected to be able to complete four core missions: amphibious operations, special operations, crisis response/limited contingency operations, and expeditionary support to other operations (USMC, 2009). Projecting naval power ashore is the key tenet of amphibious operations and consists of amphibious assaults, amphibious raids, maritime interceptions, and advance force operations. Providing high levels of both skill and flexibility, special operations include direct action operations, special reconnaissance, and foreign internal defense operations. Meeting America's emergency diplomatic and kinetic action requirements, crisis response/limited contingency operations, as well as expeditionary support to other operations encompasses the following: noncombatant evacuation operations, humanitarian assistance, stability operations, tactical recovery of aircraft and personnel, joint and combined operations, aviation operations from expeditionary shore-based sites, theater security cooperation, and airfield/port seizure (USMC, 2009).

c. MEU Structure

Table 1 identifies a sample structure for an MEU. Its composition provides the MEU commander with the capability and resources of air, ground, and logistics assets, including attachments and detachments of specialized skills such as chemical biological radiological nuclear (CBRN) and others. This allows the MEU to operate independently in a host of environments and missions depending on the needs of the combatant commander.

Table 1. Notional MEU/MEU (SOC) Structure and Organization
(Based on USMC, 2009, p. 11)

Element	COMMAND ELEMENT (CE)	GROUND COMBAT ELEMENT (GCE)	AVIATION COMBAT ELEMENT (ACE)	LOGISTICS COMBAT ELEMENT (LCE)	MARINE SPECIAL OPERATIONS COMPANY (MSOC)
	MEU/MEU (SOC) command and control is provided by the Command Element	The GCE is structured around a reinforced infantry battalion	The ACE is a composite/reinforced squadron structured around Medium Lift or Tilt-Rotor Squadron	The LCE is structured around Combat Logistic Battalion (CLB) provides the following	The MSOC is a special operations force partnered with the MEU/ARG for training and deployment
Personnel	Approximately 169 personnel: USMC: 25 OFF and 140 ENL, USN: 1 OFF and 3 ENL	Approximately 1200 personnel: USMC: 59 OFF and 1086 ENL, USN: 3 OFF and 50 ENL	Approximately 417 personnel: USMC: 75 OFF and 337 ENL, USN: 1 OFF and 4 ENL	Approximately 273 personnel: USMC: 14 OFF and 232 ENL, USN: 6 OFF and 21 ENL	Approximately 84 personnel: USMC: 8 OFF and 69 ENL, USN: 7 ENL
Composed of	MEU/MEU (SOC) commander and staff	H&S Company	Medium Lift or Tilt-Rotor Squadron	Headquarters and Service Platoon	Company HQ
	Imagery Interpretation Det	Rifle Company x 3	Heavy Helicopter Squadron Det	Communications Platoon	Marine Special Operations Teams (MSOT) x 3
	Human Exploitation Team	Weapons Company	Light/Attack Helicopter Squadron Det	Maintenance Platoon	Enablers: Admin, EOD, Riggers, Maintenance, Supply, Ammo Techs, Fire Control Team, Embark
	Ground Sensor Det	Tank Platoon	Marine Attack Squadron Det	Supply Platoon	
	Topographic Det	Artillery Battery	Marine Fighter / Attack Squadron Det (Tethered)	Transportation Support Platoon (Includes Landing Support & Motor Transportation)	
	Radio Battalion Det	LAR Platoon/Company	Marine Aerial Refueler / Transport Squadron Det	Health Services Platoon	
	Communications Battalion Det	Shore Fire Control Party	Marine Air Control Group Det	Engineer Platoon	
	Force Reconnaissance Platoon	Combat Engineer Platoon	Marine Wing Support Squadron Det		
	Military Police Squad	Division Reconnaissance Platoon	Marine Aviation Logistics Squadron Det		
		Assault Amphibian Vehicle Platoon			

d. Equipment

For military operations other than war (MOOTW), including HA/DR, the MEU can be equipped with a host of assets. The following is a sample composition of key equipment:

- (105 ea.) high-mobility multipurpose wheeled vehicle (HMMWV) trucks
- (15 ea.) assault amphibious vehicles
- (31 ea.) 7-ton trucks
- (1 ea.) excavator
- (2 ea.) TRAM forklifts
- (12 ea.) MV-22B Ospreys
- (2 ea.) tactical water purification systems

- (1 ea.) 5,000 lb. forklift
- (1 ea.) extended boom forklift
- (1 ea.) D7 bulldozer
- (4 ea.) CH-53E Super Stallions
- (3 ea.) UH-1N Hueys
- (2 ea.) KC-130 Hercules

  (USMC, 2009)

As seen in Table 2, carrying this assortment of heavy equipment enables the MEU to provide a wide range of support, including supply delivery and personnel transport that could be applied during a humanitarian crisis or disaster mission.

Table 2. Sample MEU Baseline Equipment
(Based on USMC, 2009, p. 12)

CE		BLT		ACE		LCE		MSOC	
(1)	MEWSS LAV	(7)	LAVs	(12)	CH-46E/MV-22B	(2)	TWPS	(16)	HMMWVs
(18)	HMMWVs	(15)	AAVs/EFVs	(4)	CH-53E	(5)	Refuelers	(4)	Trailers
(1)	JTF Enabler	(4)	Tanks ***	(4)	AH-1W	(1)	M88A1		
(6)	CRRCs*	(6)	M777A2	(3)	UH-1N/Y	(15)	MTVRs		
		(20)	CRRCs**	(6)	AV-8B	(18)	HMMWVs		
		(2)	ACEs	(5)	A-MANPADS	(1)	AAVR7		
		(16)	MTVRs	(5)	HMMWVs	(1)	5k Forklift		
		(8)	81 MMs	(2)	KC-130	(1)	EBFL Forklift		
		(8)	TOW Launchers	(6)	F/A-18 *****	(1)	D-7		
		(64)	HMMWVs			(1)	Excavator		
		(7)	IFAVs			(2)	TRAM Forklift		
		(6)	M327 (EFSS) ****						

Note
CE Command Element
BLT Battalion Landing Team
ACE Air Command Element
LCE Logistics Combat Element
MSOC Marine Special Operations Company
* CONUS deploying MEUs embark (6) CRRCs.
** 31st MEU embark (20) CRRCs.
*** 31st MEU does not embark.
**** The EFSS (120mm mortar) may be employed in place of the M777, in conjunction with the M777 (reduced numbers for both), or not at all.
***** An F/A-18 Det could potentially be tethered to a MEU deployment.

III. THE DISASTERS

The disasters discussed in the following sections were selected due to their recent occurrence as well as the availability of data and information of the response of the USMC MEU and other organizations.

A. SEA ANGEL II

On November 15, 2007, the southwest coast of Bangladesh was ravaged by Cyclone Sidr, which caused high winds and flooding. As a result, more than 3,200 people were killed, an estimated 40,000 people were injured, over 1.6 million acres of farmland were devastated, and 350,000 head of livestock were killed (Command Element, 3rd Marine Aircraft Wing [CE 3D MAW], 2008). The day after the cyclone struck, U.S. Pacific Command (PACOM) released Tasking Order P-137, ultimately resulting in the assignment of the Kearsage Expeditionary Strike Group (ESG) and the 31st MEU (CE 3D MAW, 2008). Additionally, a humanitarian assistance survey team (HAST) sourced from III MEF was authorized to be deployed to the disaster area (CE 3D MAW, 2008).

The HAST was tasked with liaising with the Bangladesh government, the United States Agency for International Development (USAID), and response team leadership as well as assessing the situation and developing plans for HA/DR actions to be executed by follow-on responders. Finally, the HAST was ordered to inform the government of Bangladesh of the assistance currently en route to the country while seeking approval to provide the aid (CE 3D MAW, 2008). Six days after the disaster, the government of Bangladesh accepted America's offer for aid, and two days later, on November 23, III MEF received its executive order to provide relief (CE 3D MAW, 2008).

When tasked to provide relief to the Bangladesh disaster, III MEF tasked 3d MEB to

> conduct HA/DR operations in partnership with the Government of Bangladesh and Host Nation agencies in order to reduce further loss of life, mitigate suffering, reduce the scope of the disaster and set conditions for transition of sustainable efforts to the Government of Bangladesh and Non-Governmental Organizations. On order, the MEB will transition operations to appropriate government agencies and redeploy forces to home station. (CE 3D MAW, 2008, p. 3)

From the onset of the operation, the Marine Corps' policy of creating short-term relief solutions was evident. Brigadier General Bailey, 3d MEB commanding general, affirmed the short duration of operations when he stated, "We are here until the major critical items associated with the disaster relief are delivered" (CE 3D MAW, 2008, p. 6).

As a direct result of the HAST's evaluation, 3d MEB set to develop a plan to first liaise with the local government and develop a plan of action. Then, the MEB began supply distribution operations, using sea, air, and land assets. Finally, the Marines began to transition operations to the local government and NGOs as U.S. personnel redeployed (CE 3D MAW, 2008). Once on the ground, 3d MEB began providing aid with the following priorities: (a) water distribution and storage, (b) distribution and lift, and (c) preventive and primary medical care. These priorities were supported by the HAST assessment and the Bangladesh government's requests. Notably, the Marine leadership proposed establishing a secondary logistics distribution center along the southeast coast of Bangladesh in order to provide increased support. However, because the government of Bangladesh opposed the notion, only one primary debarkation point was utilized during the relief operation (CE 3D MAW, 2008).

B. UNIFIED RESPONSE

On January 2, 2010, an earthquake struck 14 miles away from the capital city of Port-au-Prince, Haiti, registering a 7.0 on the Richter scale. The earthquake affected 3.9 million people, including 2 million people in the capital city, where more than 60% of the government infrastructure and 14 of the 16 ministry headquarters were destroyed (Joint Center for Operational Analysis, 2010). It was estimated that 230,000 people were killed and 197,000 injured (Command Element, II Marine Expeditionary Force [CE II MEF], 2010). Additionally, areas within a 41-mile radius of the epicenter experienced severe to moderate damage, causing the government of Haiti to declare a state of national emergency and request assistance from the United States (Commanding Officer, Security Cooperation Marine Air Ground Task Force, Africa Partnership Station 10 [CO, SCMAGTF, APS-10], 2010).

Upon verbal order from the joint forces command (JFCOM), II MEF prepared the 22d and 24th MEUs for deployment to Haiti. The MEUs were assigned to two ARGs along with several other U.S. Navy units, as well as African Partnership Station 10 (APS-10). The group, titled Joint Task Force–Haiti (JTF–H), was tasked with providing HA/DR to Haiti, which was named Operation Unified Response (CE II MEF, 2010). The task force focused efforts on establishing sea-based operations from which it could manage a hub-and-spoke–style distribution network of relief supplies. Initial and continuing guidance for the MEU personnel was to provide food, water, and critical medical aid to those affected by the disaster, as evidenced through U.S. Southern Command's (USSOCOM's) mission to "deploy assets to Haiti to conduct search and rescue operations, damage assessments, and transition to sustained humanitarian assistance/disaster relief operations in order to prevent human suffering and additional loss of life" (CE II MEF, 2010, p. 7).

Prior to the earthquake, 300 charities with more than 3,000 workers were operating in Haiti. These charities were striving to improve the third world country standard of living in Haiti. The goal of U.S. involvement was to prevent the loss of life, then facilitate the existing charities' efforts to rebuild the affected area (CE II MEF, 2010).

Four main phases were established during the planning of Operation Unified Response, including crisis relief, life sustainment, infrastructure restoration, and multilateral reconstruction and development. On January 18, the 22d MEU arrived in Haiti, followed by APS-10 on January 18, and the 24th MEU, which arrived on January 24 (Joint Center for Operational Analysis, 2010). During the initial phase, JTF–H was established with a command and control capability that provided liaison opportunity between the U.S. military, diplomatic leadership, USAID, and the United Nations Stabilization Mission in Haiti (MINUSTAH). This command and control organization also established a humanitarian aid coordination center to manage the relief efforts of the government of Haiti, USAID, the United Nations, and NGOs providing relief to the disaster (CE II MEF, 2010). MV-22 Osprey aircraft were used by the 24th MEU to survey the damage of the earthquake, complete an assessment of affected areas, and dispel false reports of damage in northern Haiti. The 24th MEU also completed assessments of infrastructure in the northern area of Haiti and an assessment of relief distribution capabilities in the southern portion of the country (CE II MEF, 2010). Additionally, Marines from the MEUs were deployed into the joint operations area (JOA) to provide immediate lifesaving for critical situations (CE II MEF, 2010).

Next, JTF–H engaged in structure relief. This process began with the arrival of the World Food Program NGO and the large-scale supplies of food. The strategy of distribution was to use the MEUs' rotary-wing assets to distribute food and water supplies using a hub-and-spoke distribution model while providing a steady state of supply (CE II MEF, 2010). The initial part of this phase ended when USAID was capable of meeting the demand for relief supplies and a working structure had been established (CE II MEF, 2010).

After relief operations were saturated by the World Food Program and USAID was meeting residual demand, JTF–H began the transition phase of operations. The phases of infrastructure restoration and multilateral reconstruction and development were canceled, and the task force began relinquishing responsibility to the government of Haiti as well as MINUSTAH. This included transferring seaport and airfield control as well as the transfer of relief operations under the control of the government of Haiti, USAID, and other authorized NGOs (CE II MEF, 2010).

C. OPERATION TOMODACHI

On March 11, 2011, mainland Japan suffered an earthquake that registered 8.9 on the Richter scale and caused a tsunami that struck the north Pacific coast of Japan and measured over 30 feet at its highest point (Command Element, 3d Marine Division [CE 3D MARDIV], 2011). The disaster killed 14,898 people, injured 5,270 more, and left almost 10,000 unaccounted for. In addition, the tsunami caused a catastrophic failure of the cooling system at the Fukushima nuclear power station, which led to the explosive meltdown of the nuclear reactor. It was estimated that all damage combined exceeded $300 billion (Command Element, 3D Marine Expeditionary Brigade [CE 3D MEB], 2011).

Immediately following the earthquake, the Japanese prime minister declared a state of emergency, and Japanese emergency responders as well as the Japanese Self-Defense Forces (JSDF) began operations in the wake of the devastation. On the evening of the disaster, the prime minister formally requested assistance from U.S. forces through the U.S. embassy. Upon being notified of the disaster, III MEF stood up a crisis action team (CAT) and began the planning process and resource assessment in support of generating a response plan to the disaster (CE 3D MEB, 2011).

In the early morning of March 12, the commanding general of U.S. Forces Japan authorized III MEF to deploy the first phase of responders to the disaster area. The force was made up of the forward command element (FCE) of 3d MEB, including four HASTs, and was transported by fixed- and rotary-wing aircraft to Japan (CE 3D MEB, 2011). The HASTs from the FCE assessed that the host nation's response plan was well organized and an effective strategy was in place. However, even with their years of training and preparation, Japanese responders were overwhelmed by the size of the disaster (CE 3D MEB, 2011). Additionally, the FCE based its recommended priority of work upon the U.S. Office of Disaster Assistance priorities, which are airfield management, humanitarian aid airlift/delivery and reception support, communication support, medical aid, search and rescue, and critical infrastructure recovery. During the time that the FCE was operating, the Air Force Special Operation Command's 320th Squadron began clearing and repairing the Sendai Airport but was overwhelmed by the size and complexity of the project (CE 3D MEB, 2011).

The FCE was able to provide assistance by creating Task Force Fuji, which consisted of a logistically focused group sourced from Combat Logistics Regiment 35 from Marine Corps Base, Camp Butler, Okinawa, Japan, among other contributors (CE 3D MEB, 2011). The task force assumed the heavy lift and equipment requirements of the airport recovery, allowing the 320th Squadron members to focus on other vital reconstruction areas. This facilitated the rapid completion of the project, and the airport was reopened in a matter of days. The airport enabled the delivery of over 872 tons of supplies, including water, food, hygiene kits, and food (CE 3D MEB, 2011). As a continuation of infrastructure recovery, the FCE engaged and facilitated the delivery of critically needed fuel; clearing of debris from schools for use as shelters, as well as from the Kesenumma-Oshima seaport; clearing of debris from the Sendai-Tohoku Shinkansen railroad station; and the restoration of power to the Oshima Islands (CE 3D MEB, 2011).

On March 15, U.S. Forces Japan was tasked with providing the following end state:

> HA/DR assistance to the Government of Japan/JSDF has been effective in alleviating suffering of the Japanese populous. U.S. Assistance is no longer requested by the Government of Japan. Temporary operating locations have been returned to the Government of Japan in good condition. The U.S./Japan alliance is strengthened. (Marine Corps Center for Lessons Learned [MCCLL], 2011, p. 16)

The commander's intent was to ensure that the HA/DR operations would be completed using interagency cooperation and coordinated with other key players (CE 3D MEB, 2011).

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IV. ANALYSIS/DISCUSSION

In the following sections, the actions completed in support of the disasters are evaluated on the basis of efficiency in meeting demand of the competencies and capabilities of the MEU.

A. SEA ANGEL II (BANGLADESH CYCLONE)

1. Information and Knowledge Management

Information managers, successfully implemented by the Cooperative for Assistance and Relief Everywhere (CARE), were able to liaise between local governance, other responders, media, and other groups and increased the flow of information and improved the organization's decision-making (Tod, Alam, Wahra, Hoque, & Begum, 2008). Furthermore, prepositioned and prepared assessment teams that were immediately deployed proved critical to the success of CARE relief operations. The NGO noted that data were readily available and were compiled into useful information through collection and management teams that were able to quickly identify needs as well as the extent and location of damage (Tod et al., 2008). Interpreters and other mediums of communication were required for interacting with victims of the cyclone since a large portion of the population in Bangladesh was illiterate. Audio transmissions were noted as the most effective means for communicating to affected populations in order to distribute information (Tatham, Spens, & Oloruntoba, 2009).

Communication also became a learning point during USMC relief operations. Plaintext high-frequency radios provided the best capability for communications from ship to shore. Liaisons, command cells, agency leadership, and NGO leadership must be able to complete crosstalk among tactical, operational, and strategic communications, creating the need for a robust communication infrastructure (CE 3D MAW, 2008). Furthermore, HA/DR operations require extensive public affairs efforts that educate the host and international population on the status goals of operations (CE 3D MAW, 2008).

2. Needs Assessment

Following the cyclone, the government of Bangladesh began evaluating the effects of the disaster as well as assessing the needs of affected populations. Completing these assessments led the government to prioritize the following responses: food aid, nutrition, water, sanitation, and shelter and disease surveillance. Through coordination with the United Nations as well as NGOs such as the Red Crescent, the government of Bangladesh was able to identify demand for relief through their assessments and coordinate the appropriate responses

(Government of Bangladesh [GoB], 2008). With winter approaching, blankets and cold-weather clothing was determined an urgent need for survivors of the cyclone. Unlike other HA/DR operations, it was determined that community involvement in the initial needs assessment was not necessary due to the homogenous demand of food, water, shelter, and sanitation across the entire impacted area (Tod et al., 2008).

After the operation concluded on December 6, one main takeaway was the critical role that the HAST played in identifying both the severity and the scope of disaster and requesting the appropriate response and capabilities (supply) to match the needs identified (demand). This initial survey provided invaluable information for the planning and preparation of large-scale relief efforts. The success of the HAST relies on the proper staffing of the team that represents all major warfighting functions, including the ability to conduct an airfield survey (CE 3D MAW, 2008). Another key to the success of the HAST was the use of commercial aircraft and diplomatic and tourist passports. This allowed the team to operate as non-intrusively as possible and avoid some of the administrative friction that is tied to the movement of military forces on the host nation's soil (Command Element, 3D Marine Expeditionary Brigade [CE 3D MEB], 2008).

Red Crescent conducted four immediate assessments utilizing aircraft, which allowed the organization to identify areas of damage, the urgent need for potable water, the demand for clothing and shelter as well as infrastructure restoration, and health service requirements and finally determine the necessity of emergency logistics control centers. Air assets allowed the assessment teams to cover the vast areas devastated by the storm without needing to use the severely damaged roads and waterways (International Federation of Red Cross and Red Crescent Societies [IFRC], 2010). Unfortunately, while attempting to formulate a standard needs assessment, the United Nations lost momentum in its relief operations and fell behind the tempo of other responders. The United Nations completed its assessment report on November 22, when numerous other organizations had already begun aid distribution and relief operations (Tod et al., 2008).

3. Supply

Search and rescue operations commenced immediately after the storm passed and lasted for several days. Since the affected regions were largely impoverished, most homes and structures were poorly constructed and, as a result, were mostly destroyed by the storm surge and winds (GoB, 2008). The debris created by destroyed buildings and infrastructure created a high demand for search and rescue operations, which reached their peak on November 17, two days after the cyclone. As the likelihood of finding survivors diminished after several days, search and rescue operations appropriately transitioned to recovery and debris-removal operations (GoB, 2008). The immediate commencement of search and rescue operations was well executed and proved critical to preventing further loss of life. In addition to loss of life, infrastructure was severely damaged in the districts affected by the cyclone, causing losses of electricity and communication lines (GoB, 2008). Most devastated areas immediately lost electricity after the cyclone, but due to prepositioning of power company supplies and personnel, power was restored to most areas within five days. Because of the mass destruction to housing and infrastructure, demand for electricity immediately following the disaster dropped. Within the affected districts, hard-lined telecommunications were severely degraded as a result of destroyed physical lines of communication. However, the survival of most communication towers ensured that wireless communications were minimally impacted (GoB, 2008).

The most important initial supply was clean drinking water, which was provided from ships and transported using rotary-wing assets and landing craft, air cushion (LCACs). Reverse osmosis equipment was not utilized due to the potential dependency that it would create, but four water purification units provided by USAID were delivered by the MEB to local distribution centers (CE 3D MAW, 2008). Clean drinking water supplies fell short of demand and proved critical after the storm since most water sources (wells and ponds) were contaminated by sea water and waste resulting from the storm surge (GoB, 2008). The MEU was criticized for a lack of organic relief supplies, and appropriately, responders recommended that MEUs work with USAID to provide daily family-portioned meals for distribution (CE 3D MAW, 2008). Since a majority of supplies were delivered from USAID directly to inland airports, the sealift capability of the MEB was degraded. The MEB's lift assets and main forces were stationed on ships, so an additional step was added for rotary-wing assets delivering supplies to land airports. If USAID would complete replenishments at sea (RASs), the MEB could embark the goods directly from the ships and deliver them more efficiently via helicopter or LCAC (CE 3D MEB, 2008).

Additionally, roughly half of all damage created by the cyclone was attributed to housing structures (Tod et al., 2008). Since housing was significantly impacted by the storm, a high demand for shelter was generated in the early phases of response. The government of Bangladesh provided reconstruction support as well as financial aid for rebuilding homes, which provided a long-term solution but did not provide immediate relief (GoB, 2008). Mosquito nets and soaps were demanded because of the destruction of household items and were utilized to prevent the spread of diseases and sickness (Tod et al., 2008).

4. Deployment and Distribution

Over 8,000 km of roadways and over 2,000 km of waterways were destroyed by the cyclone, severely crippling transportation in the affected districts. Due to the reduced traffic ability of road- and waterways, a high demand for rotary-wing assets was created for the immediate distribution of relief (GoB, 2008). The damaged road conditions and destroyed distribution routes, combined with a shortage of trucks, created a severe challenge for delivering supplies. As a result, many remote locations were inaccessible for responders, thus increasing tensions and friction among the survivor population (IFRC, 2010). These tensions could lead to instability and a lack of order, especially at distribution points, which would severely interfere with relief operations.

Distribution also presented a challenge for U.S. Marines since lift capabilities were limited. It was discovered that tactical sites should be established for distribution of relief supplies, which should be conducted by local authorities (CE 3D MAW, 2008). Using local Bangladesh military as formal authority figures to govern the tactical distribution of supplies allowed for a coordinated and decentralized distribution plan (CE 3D MEB, 2008). It was recommended that mobile medical teams be implemented for HA/DR operations, with an interpreter assigned to each care provider while using the interagency emergency health kits (CE 3D MAW, 2008).

Fixed- and rotary-wing aircraft served a crucial role in assessing the disaster as well as distributing supplies. Overall, the large-scale Marine Corps response took fewer than two weeks and made significant accomplishments in facilitating the international response to the crisis (CE 3D MAW, 2008).

5. Health Service Support

With hundreds of thousands of heads of livestock killed, as well as thousands of people, the military of Bangladesh was tasked with burying the dead in order to prevent the spread of disease. This response was executed within two days of the cyclone impacting Bangladesh and was expedited by prepositioning responders due to early warning of the storm (GoB, 2008).

During early relief operations, medical care facilities were overwhelmed by demand. More facilities for medical treatment were needed to care for the victims of the disaster. Mobile health teams used by the Red Crescent during early response operations were effective in reaching remote locations to distribute care as well as medical and hygiene supplies. Although these mobile health operations were ended prematurely due to funding, the teams proved effective in reaching over 80,000 victims (IFRC, 2010).

Prior to the cyclone, pit latrines were the common form of sanitation in Bangladesh. The flooding from the storm combined with the destruction of 70% of these latrines in rural areas created large-scale contamination of drinking water and the spread of waterborne diseases (GoB, 2008). This created the need for large-scale disease monitoring and control, especially in rural areas with little infrastructure even prior to the disaster. In only 20 days (from December 27, 2007, to January 15, 2008), the spread of these diseases resulted in the requirement to treat over 3,500 cases of diarrhea, over 7,500 cases of skin disease, over 3,200 respiratory tract infections, over 2,300 eye infections, and over 10,000 cases of typhoid fever. Additionally 1,787 injuries were treated by medical responders during this time (GoB, 2008). The absence of an epidemic of diarrhea and other illnesses proved a testimony to the effectiveness of rapid response of basic aid such as clean drinking water, food, and temporary shelter (Tod et al., 2008).

6. Collaboration and Governance

Bangladesh utilized established organizations for disaster warning as well as disaster relief. Immediately following the cyclone, the government remained operational and began providing aid to affected areas. Notably, the Cyclone Preparedness Programme and Comprehensive Disaster Management Programme, both under the Ministry of Disaster Management, had established relief procedures and capabilities (Sarkar, 2009). Coordinating with these agencies would have likely alleviated much of the friction between responders and the host nation’s authorities. Clearly defined authority, as well as established geographic boundaries of responsibilities, were not created among international responders, which created a lack of unity of effort and collaboration among organizations providing aid (Sarkar, 2009).

Marine after-action analysis also concluded that measures of effectiveness need to be defined and established early as a means of setting clear and attainable goals to limit the scope and duration of operations and developing transition criteria. Additionally, the relief efforts highlighted the importance of clearly stating and ensuring mutual understanding of transition criteria for USMC responders. These measurable set criteria should be developed and announced as early as possible to prevent the Marine Corps from becoming entangled in operations, as well as the possibility of overextending their welcome from the host nation’s government (CE 3D MAW, 2008).

The Red Crescent noted successes in long-term response coordination by participating in joint assessment teams with the government of Bangladesh to evaluate four of the most severely damaged districts (IFRC, 2010). The sharing of inventories of aid supplies with the government of Bangladesh Ministry of Disaster through the use of the Disaster Management Information Center also improved collaboration between NGOs and host-nation recovery efforts. This database of inventory facilitated information sharing and improved overall HA/DR operations (Tatham et al., 2009).

The United Nations experienced delays in completing initial needs assessments as well as implementing relief through the cluster system due to weak collaboration between the local government and NGOs. Early setbacks in the evaluation of the disaster caused the United Nations relief operations to fall behind the tempo achieved by other more autonomous responding organizations such as CARE. Furthermore, the United Nations's cluster approach was not adequately coordinated with the government of Bangladesh, which led to the host nation's reluctance to implement the United Nations's relief operations (Tod et al., 2008).

The Marine Corps noted that Bangladesh created helicopter landing zones (HLZs) prior to the cyclone in the event of a disaster, but information on the locations and details provided to the MEB were often incorrect. Prior to engaging in HA/DR operations within a country, HLZs should be discussed, and standard reporting information, including a 10-digit grid location, should be validated. Ensuring that a Bangladeshi liaison officer accompanied each HLZ delivery alleviated confusion in reference to the correct drop zone and avoided further delay of support (CE 3D MEB, 2008).

Finally, the arming of Marines proved to be a point of friction. It was recommended that the Department of State accept the requirement for Marines to carry weapons and acknowledge the commander's authority and responsibility to protect their forces. The location of command headquarters was described as a critical enabler for establishing control over an area as well as coordinating with all responders. Furthermore, the inclusion of NGOs and other agencies in planning and communications was vital in achieving a coordinated response. The lead agency should be used as a representative for all similar groups (agencies, NGOs, militaries), which is likely to limit congestion and enhance organization (CE 3D MAW, 2008).

Table 3 summarizes the HA/DR operations of the MEU and identifies demand that remained unmet by the entire relief efforts of Cyclone Sidr in 2007. Furthermore, Table 3 identifies capabilities organic to the MEU, which could be matched to this demand.

Table 3. Sea Angel II Demand and Supply
(Based on Apte & Yoho, 2012, p. 15)

	Sea Angel II: USMC Provided	Sea Angel II: Unmet Demand	MEU capabilities to Satisfy Unmet Demand
Information and Knowledge Management	-Unclassified and plain text communications -Public Affairs liaisons	-Means of mass communication to public	**-S2 Intelligence Section** **-S6 Communications Section** **-(19) Rotary wing aircraft for mass distribution of info materials** **-Civil Affairs section** **-Public Affairs section**
Needs Assessment	-Initial HAST		
Supply	-Potable water	-Drinking water during initial relief	**-(2) Tactical water purifiers**
Deployment and Distribution	-Delivery of water purifiers and supplies from USAID via rotary wing aircraft and LCACs	-Tactical distribution sites with security -Distribution to isolated locations -Trucks	**-(19) Rotary wing aircraft, (2) C-130** **-(31) MTVR Trucks, (105) HMMWV, (15) AAV, (4) Forklifts** **-Infantry Battalion of Marines** **-Military Police Detachment**
Health Service Support		-Mobile medical teams -Interpreters -Immediate care facilities -Disease monitoring in remote areas	**-Embedded Navy Corpsmen**
Collaboration and Governance	-HAST coordination -Establishment of joint HLZs -Inclusion of host nation and NGOs in planning process	-Accurate information from host nation -Clear procedures from DOS -Clear areas of responsibility -Collaboration between host nation and NGOs	**-Civil Affairs section** **-Public Affairs section**

B. OPERATION UNIFIED RESPONSE (HAITI EARTHQUAKE)

1. Information and Knowledge Management

Throughout the initial relief efforts by both civilian and military organizations, Blackberry and cellular devices provided a simple and effective means of distributing information and coordinating efforts among responders (Webster, 2010). The use of unclassified and plaintext communications was a necessity to facilitate the sharing of information among agencies. This capability required a significant up-front investment in the communication equipment but presented an easy-to-use and necessary enabler of command and control as well as information dissemination (Webster, 2010).

The overall requirement for detailed information about needs for relief services was significant, especially during the emergency response phase of operations. The need from NGOs and responders for up-to-date information about the situation on the ground in Port-au-Prince was required in order to provide the appropriate type of aid in the right locations (DiOrio, 2010).

USAID and high-level U.S. military units were burdened by policy-makers and strategic leaders with a constant stream of information requests about the operational picture of Haiti. These requests were time consuming and exhaustive and forced commanders to allocate manpower from relief operations to fact-finding missions, which provided minimal value to overall operations (DiOrio, 2010).

The decision to use unclassified networks was made early by USSOCOM and greatly increased the ease of information sharing and transfer. The use of civilian software programs such as Google Maps and Google Earth was widespread to map activities and locations (DiOrio, 2010). Military intelligence, surveillance, and reconnaissance (ISR) capabilities such as aerial drones and satellite imagery were used by the military to augment the information gathered from civilian programs. By deciding to use unclassified communications, the U.S. military was able to take advantage of both open-source as well as military information gathering and management resources (DiOrio, 2010).
The detailed information and intelligence gathered by troops on the ground was invaluable for developing the operational picture of the relief effort (DiOrio, 2010). Specifically, Marines from the 22d MEU and soldiers from the 82nd Airborne Division provided timely and detailed updates to infrastructure as well as human terrain. Troops were able to identify demand requirements by interfacing with local leadership and personnel in order to evaluate and report support requirements (DiOrio, 2010).

2. Needs Assessment

During the first 72 hours of planning, USSOCOM based relief operations on educated guesses of what relief was demanded as a result of the earthquake (DiOrio, 2010). After initial operations commenced, the demand assessment was further refined as the operational picture was developed. The push approach to relief response facilitated an aggressive time line of deployment and adequately fit the situation due to the massive scale of demand. Furthermore, delaying response time would likely be more detrimental than slight inefficiencies in response supply (DiOrio, 2010).

The MEU reconnaissance platoon was implemented to conduct an assessment of remote and austere areas. Using organic skills and resources, the platoon was successful in establishing HLZs while directing follow-on aircraft to deliver relief support including the transport of medical teams. Carrying only essential gear, the reconnaissance teams were able to conduct longer missions and achieve high levels of maneuverability, enhancing the effectiveness of their assessments and ultimately resulting in required relief being provided where it was needed (Battalion Landing Team 3rd Battalion 2nd Marines, 22nd Marine Expeditionary Unit [BLT 3/2, 22d MEU], 2010). Significantly, the MEU discovered that in permissive environments where the locals welcome the assistance, reconnaissance units are capable of being used for evaluations and assessments outside of kinetic operational environments.

3. Supply

Immediately after the earthquake struck, the local population was focused on immediate search and rescue operations and basic recovery. However, after the initial shock of the incident dissipated, civil unrest became an apparent issue (DiOrio, 2010). Without the arrival of basic aid, the affected areas were left without fuel, power, communications, food, or water and soon began to experience turmoil and instability. Since Haiti's infrastructure was extremely limited before the earthquake struck, the destruction of virtually all government capabilities created a chaotic environment (DiOrio, 2010). This issue was compounded by the destruction of the Prison Civile in Port-au-Prince, which subsequently enabled the release of over 4,000 inmates into the city. With convicted criminals running free combined with a devastated population with severe shortages in basic services and virtually no governing authority, the stability of Port-au-Prince quickly deteriorated into an insecure and anarchical state (DiOrio, 2010).

Since the local population predominantly spoke only Creole, a language barrier was established between victims and U.S. military members. NGOs provided translators, which allowed for the collaboration between responders and victims. The translators were especially useful for medical relief and non-transactional relief projects (DiOrio, 2010).

At three days after the earthquake, security in Port-au-Prince became a major concern. Stemming from the shortage of food and water supplies delivered by relief efforts, violence first erupted from gang activity against aid distribution trucks. The instability soon spread to mob violence against aid workers and especially supply trucks (DiOrio, 2010). Crowds at distribution points turned violent and resorted to throwing stones at aid workers. As a result, United Nations peacekeepers were forced to use rubber bullets, tear gas, batons, and pepper spray to control crowds at distribution points. World Food Organization convoys were also experiencing looting and attacks from bandits along supply routes, which caused them to request United Nations escorts (DiOrio, 2010). In an effort to reduce the insecurity, the United Nations requested and received over 300 military policemen from European countries to restore order in Port-au-Prince. Meanwhile, the U.S. military continued to provide local security at the seaport and airport AoRs (DiOrio, 2010).

Power generators were particularly useful for command centers, and fuel support became an issue. Because of a lack of military generators, many commands relied upon contractor generators, which required MoGas. The fuel for the MEUs was provided by the ARG, which provided only JP-5 and JP-8 fuel types. By ensuring that each company level unit is equipped with a military power generator, the friction caused by non-compatible fuels could be eliminated and bolster self-sustainability (BLT 3/2, 22d MEU, 2010).

Over the course of the main relief operations in Haiti, responders provided a total of 4.9 million meals, 17 million pounds of food, and 2.6 million bottles of water (Joint Center for Operational Analysis, 2010). Over one million people were provided shelter, the streets over 80 city blocks were cleared of debris, and 40,000 buildings were evaluated by engineers (DiOrio, 2010).

Overall, the ARG and MEUs were able to deliver 950 gallons of fuel, 163,523 gallons of drinking water, 4.48 million pounds of rations, 19,000 pounds of medical supplies, and 10,600 pounds of non-food supplies (Bataan Amphibious Ready Group, 22d Marine Expeditionary Unit [BATARG/22d MEU], 2010).

Several deficiencies in equipment were noted by the responding MEUs as well. Most importantly, concertina wire and engineer stakes were in high demand and out of supply (BLT 3/2, 22d MEU, 2010). This shortfall presented a serious problem since a key tenet of distributing relief is ensuring that order is preserved at the distribution site. Concertina wire, when reinforced by engineer stakes, is an excellent personnel barrier and can facilitate an environment of peace and order while providing protection and security. Additionally, hanging shower bags, hygiene kits, sunscreen, and hand sanitizer were in short supply (BLT 3/2, 22d MEU, 2010). A lack of hygiene in a third world country can lead to medical issues and attrite a force of responders, reducing their ability to conduct HA/DR operations.

4. Deployment and Distribution

When evaluating the relief operations conducted, it is clear that the Marine Corps was challenged to assemble the required forces due to the operational engagements. The 22d MEU was extended from a recent deployment, the 24th MEU was temporarily reassigned from a U.S. Central Command (USCENTCOM) mission, and APS-10 was routed from a mission to the Horn of Africa. Ultimately, the 22d MEU formed the main effort of the Marine response, since the 24th MEU and APS-10 were not assigned to the JTF throughout the duration of the task force’s operation (CE II MEF, 2010).

The use of MV-22 aircraft, seven-ton MTVR trucks with extended beds, and high-back HMMWV trucks emerged as a critical asset for distributing relief supplies and executing the logistics strategy. The high-back HMMWVs were particularly useful in reaching remote or densely populated areas due to their relatively small frame and maneuverability (BLT 3/2, 22d MEU, 2010). It also became apparent that in order to effectively distribute supplies, distribution sites need to be prepared prior to the arrival of supplies, including perimeter control, lines, entry points, crowd segregation, and so on. Marines were best utilized for outer cordon security, while local authorities were best implemented as an inner cordon where they could best handle the individual situations due to their cultural knowledge and ability to speak the local language (CE II MEF, 2010).

The U.S. Army's 2nd Brigade Combat Team (BCT), 82nd Airborne Division was tasked to mediate between the demand for relief and the supply of relief provided by a multitude of responders. The BCT noted that the most effective means of matching the demand and supply was the eBay Effect, wherein the BCT served most critically as an intermediary by identifying demand and matching it to suppliers (Webster, 2010). This was accomplished through an Excel database that classified locations of demand such as medical and food distribution facilities. These demand points were then supplied by coordinating with relief organizations to provide required goods and services. The database was termed the humanitarian assistance common operational picture (HCOP) and was used to organize the plethora of information used to enhance the efficiency of relief supply distribution (Webster, 2010).

Once the airport was repaired and functional, it became a major means for supplies to arrive in Haiti. As supplies began to flow into the airport, a logjam was created at the edge of the Port-au-Prince airport (DiOrio, 2010). Since the local response area was established at the airport but did not expand into the adjacent city, supplies and logistics ended at the edge of the airport area. The resulting congestion and lack of stability in the city adversely impacted the distribution of medical supplies and care as well as other aid to the affected area (DiOrio, 2010).

Since the roads and infrastructure in the city were largely destroyed and distribution accordingly degraded, clusters of relief facilities were established immediately surrounding the airport since supplies were available in that area (DiOrio, 2010). This logistics cluster hampered the distribution of relief into the city of Port-au-Prince by preventing the flow and dissemination of materials. Within the first week of relief operations, virtually all distribution of relief aid beyond the airport area was accomplished through the U.S. military since NGOs lacked adequate means of lift or transportation (DiOrio, 2010).

The U.S. military was criticized by USAID for its distribution of life-sustaining supplies during the first days of relief when search and rescue operations were the priority. USAID concluded that the military is more proficient at search and rescue operations than aid distributions and should be utilized accordingly (DiOrio, 2010).

5. Health Service Support

By the second day after the quake, the existing mortuary facilities were over capacity and the tens of thousands of casualties created by the disaster created a significant health concern (DiOrio, 2010). Bodies were piled in the streets and quickly rotting due to the hot, tropical conditions of the Caribbean nation, which threatened the sanitation and health of survivors throughout the city. Without sufficient mortuary services, bodies were hastily moved by whatever means available to shallow, mass graves created just north of the city (DiOrio, 2010). These graves were nothing more than massive trenches dug into the countryside by excavation equipment, into which massive numbers of corpses were dumped and buried. In some cases, bodies were simply dumped in the open at the grave sites by dump trucks, giving rise to millions of flies and the spread of disease (Ghosh, 2010).

At three days after the earthquake, any remaining medical facilities were inundated by casualties and medical supplies and personnel were in severe shortage. Furthermore, as victims migrated from the Port-au-Prince region to the border of the Dominican Republic to seek refuge, all medical facilities along the way quickly became overwhelmed by the masses of victims in need of medical care (DiOrio, 2010).

Navy corpsmen were also an invaluable asset during Marine patrolling operations, since corpsmen were able to treat minor injuries on the spot, which improved community relations immediately. Once food and water distribution was established, corpsmen provided tangible relief to individuals throughout the devastated area. Corpsmen have the capability to provide medical aid relief while gaining the trust of local nationals; therefore, we can improve the effectiveness of operations by ensuring that corpsmen are located within units on the ground (BLT 3/2, 22d MEU, 2010).

Field sanitation and latrine facilities for American military forces were lacking during the operation. Contracted sanitation companies were not available, which created a gap between the requirements of the approximately 400 U.S. personnel aboard the base camp. Burn barrels were ordered but took an additional four days to arrive. This could have been avoided by equipping personnel with waste bags and sanitation equipment prior to debarkation from the ships (CO, SCMAGTF, APS-10, 2010).

As a result of airfield congestion, medical facilities and supplies clustered around the airport in order to access the medical supplies being delivered to the airport (DiOrio, 2010). With a lack of distribution of supplies to field hospitals located in the city, those facilities operated with diminished levels of care, often performing surgeries and amputations without anesthesia and reusing latex gloves. With the bulk of medical care facilities located around the airport, casualties were forced to utilize any means necessary, including trucks, carts, and walking, to travel to the airport medical clusters in order to receive care (DiOrio, 2010). The ARG administered 8,001 immunizations while providing medical treatment to 2,789 patients (BATARG/22d MEU, 2010).

6. Collaboration and Governance

Since the majority of the Haitian government infrastructure was destroyed, the president and his cabinet staff met with international responders on a daily basis, but turmoil soon surfaced. Questions of authority as well as a lack of decisive action and tasking by the government of Haiti by the fourth day after the earthquake resulted in a lack of direction and focus for responders from the Haitian government (DiOrio, 2010).

With a multitude of nations as well as organizations responding to the earthquake, the United Nations assumed authority of aid efforts, and USAID was authorized to lead the interagency Haiti task force (DiOrio, 2010). Additionally, the United Nations authorized the United States to use military forces to provide relief to the nation. Specifically, the U.S. military was tasked with restoring and maintaining the seaports as well as the airport of Port-au-Prince and roads to distribute humanitarian aid. The United Nations assumed responsibility for establishing law and order in the country (DiOrio, 2010).

A civil affairs officer was noted as a particularly useful staff officer during the MEU’s response in Haiti (CE II MEF, 2010). Working with local governments and infrastructure greatly amplified the efforts of Marine responders, and the civil affairs officer served as a vital link between responders and local leaders.

The Office of Disaster Assistance, a subset of USAID, created the NGO coordination cell within four days after the disaster. Unfortunately, limited resources such as personnel, as well as bureaucratic and political friction, limited the effectiveness of the office to liaise and collaborate with NGOs (DiOrio, 2010). This office, however, provided a link between military and NGO responders in order to improve the overall humanitarian response. Liaison officers assigned to key organizations allowed cross-level communication to occur with USAID and NGOs and helped to increase levels of unity of effort, as well as collaboration of response (DiOrio, 2010).

The decision to allow such a large number of U.S. troops to respond to the disaster garnered disapproval from France and several South American nations, which resented the commanding role that the U.S. took in providing relief (DiOrio, 2010).

Collaboration was initially established at the U.S. embassy in Port-au-Prince and accomplished high levels of coordination between state actors and organizations. However, as additional entities continued to flow into Haiti, the complexity of the collaboration quickly outgrew the facilities at the embassy (DiOrio, 2010). Ultimately, the JTF headquarters, consisting of tents and temporary structures, was constructed in a lot beside the embassy. This location was beside the United Nations headquarters, which provided increased international collaboration throughout relief operations. However, challenges to collaboration with NGOs persisted due to the sheer number of organizations operating within Haiti (DiOrio, 2010). The close proximity of headquarters emerged as a critical factor in the success of collaboration since planning must be accomplished in environments with limited communication and information infrastructure (DiOrio, 2010). The humanitarian assistance coordination cell (HACC) further exemplified this tenet while integrating military support into USAID operations. A majority of the HACC members were sourced from military units, which provided a link between key military assets and USAID personnel while operating in one central area (DiOrio, 2010).

Table 4 shows the response operations completed by the USMC, as well as gaps in the overall HA/DR operations in support of the Haitian earthquake in 2010.

Table 4. Unified Response Demand and Supply
(Based on Apte & Yoho, 2012, p. 15)

	Unified Response: USMC Provided	Unified Response: Unmet Demand	MEU capabilities to Satisfy Unmet Demand
Information and Knowledge Management	-Unclassified and plain text communications	-Cell phones and personal communication	**-S6 Communications Section -Civil Affairs section -Public Affairs section**
Needs Assessment	-Troop contact and info gathering with victims -Recon teams for remote assessments/HLZ ID -Rotary aircraft assessment -Infrastructure assessment	-Remote location assessment	**-Reconnaissance Platoon -Force Reconnaissance Platoon -Infantry Battalion of Marines**
Supply	-Fuel, drinking water, food, medical supplies -Manpower for sea and air port security	-Generators and fuel -Hygiene supplies -Security of distribution routes and points -Civil order/governance -Safety at refugee camps -Debris clearance -Trucks, ambulances, heavy equipment	**-(2) Tactical water purifiers -Infantry Battalion of Marines -Military Police Detachment -(4) Forklifts, (1) Bulldozer, (1) Excavator -(31) MTVR Trucks, (105) HMMWV, (15) AAV**
Deployment and Distribution	-Air and ground delivery of supplies	-Dissemination of relief facilities -Distribution lift capabilities -Landing capacity for fixed wing aircraft	**-(19) Rotary wing aircraft, (2) C-130 -(31) MTVR Trucks, (105) HMMWV, (15) AAV, (4) Forklifts**
Health Service Support	-Basic aid to remote populations	-Latrines and sanitation facilities -Mortuary services -Medical supplies and personnel	**-Embedded Navy Corpsmen**
Collaboration and Governance	-Civil Affairs officer as liaison -Collaboration with JTF-H, NGOs and USAID	-Functioning government -Personnel at NGO coordination cell -Large scale response collaboration	**-Civil Affairs section -Public Affairs section**

C. OPERATION TOMODACHI (JAPAN EARTHQUAKE AND TSUNAMI)

1. Information and Knowledge Management

Upon arriving off the coast of Japan, U.S. Navy aircraft successfully employed fixed- and rotary-wing aircraft to gather reconnaissance imagery of over 2,000 square miles of ocean and coastal areas. This information was critical for planning a response and identifying areas of demand and was used by both American and Japanese responders (Zielonka, 2012). Unmanned aircraft additionally provided high-resolution imagery that was used in the development of the U.S. response plan (Wilson, 2012).

These unmanned aerial drones also successfully provided information and monitoring of radiological levels around Fukushima and collected imagery of impacted regions to assist search and rescue efforts (Zielonka, 2012). A specialized assessment team sourced from U.S. Northern Command conducted a ground assessment of the area surrounding the power plant in order to determine the extent of the fallout from the power plant meltdown. Also, U.S. Navy Radiological Assistance Team members monitored crew members aboard naval vessels for radiation and contamination (Zielonka, 2012). Mapping the levels of radiation surrounding Fukushima using rotary-wing aircraft and then disseminating the information through a combined Japanese and American team facilitated the placement of relief personnel and reduced fears. This was critical since an initial lack of knowledge of the extent of the nuclear disaster at Fukushima limited response measures and promulgated anxiety among local populations and responders (Wilson, 2012).

Social networking, unclassified information, and media further assisted response efforts by educating the population about current situations while increasing legitimacy of the host nation (Carafano, 2011). Although social media provided easy-to-use information sharing that achieved widespread communication between individuals, information was not validated, often resulting in the spreading of rumors and anxieties (Wilson, 2012). Furthermore, a lack of information assurance and trust slowed response due to the unreliability of many intelligence sources. The large scale of destruction and damage to communication infrastructure crippled the response effort. Accurate, timely, and disseminated information emerged as a necessity for effective relief efforts (Carafano, 2011).

In addition to dissemination, information about radiation levels from the nuclear power plant was difficult to convey to the public since the population lacked specific knowledge to accurately interpret the information. This stressed the need for easily understandable means for conveying complex information to the public (Carafano, 2011).

Finally, the Japanese government discovered that withholding disaster information, specifically regarding nuclear radiation, from media sources caused the local population to lose trust and, in some cases, express animosity toward the government (The Heritage Foundation [THF], 2012). In countries with less functioning infrastructure and societal order, this animosity could lead to instability and limit relief operations.

2. Needs Assessment

Since the sheer size and severity of the disaster overwhelmed primary and backup local response measures, local organizations were unable to accurately evaluate and measure levels of damage and needs. Accordingly, satellite imagery was requested early by the Japanese government in order to measure the scale of the destruction caused by the tsunami (Norio, Ye, Kajitani, Shi, & Tatano, 2011). American aerial assets conducted numerous aerial reconnaissance missions, which further identified remote groups of stranded victims as well as damage to infrastructure within impacted regions. The U.S. Army Corps of Engineers also provided critical assistance in assessing the damage to the Japanese infrastructure within devastated regions after the tsunami (Zielonka, 2012).

It was observed that initial inaccurate assessments of the radiation levels from Fukushima caused more problems than assistance by causing panic among the population (Carafano, 2011). This emphasizes the sensitivity of nuclear disasters as well as the need for accurate measures of the disaster.

3. Supply

The debris and destruction caused by the tsunami created a requirement to identify and clear underwater obstacles in ports and waterways on the Japanese coasts. The U.S. Navy sourced salvage teams to detect and classify underwater obstacles and debris in key ports with specialized divers and equipment (Zielonka, 2012). Specifically, side-scanning sonar devices were successfully implemented on LCACs and small vessels from the ARG and naval units to scan the Uranohama harbor for underwater obstructions. Furthermore, Navy divers assisted in the reconstruction of a natural gas pier, allowing the delivery of natural gas fuel into the region (Zielonka, 2012).

The seaport at Uranohama was inundated by debris caused by the tsunami, rendering the logistics hub non-capable. By using the manpower of Marines from the 31st MEU, the port was restored in order to allow the flow of logistics into the local area (Zielonka, 2012).

Many areas impacted by the tsunami were heavily populated and accordingly consisted of extensive civil infrastructure. After the disaster, most of the infrastructure and personal possessions were reduced to mass amounts of debris, which cluttered streets and existing structures (Zielonka, 2012). This devastation created a need for extensive search and rescue operations and later debris clearance and removal. Responders noted high levels of gratitude from victims when removing debris and, if possible, returning personal possessions (Zielonka, 2012).

Specifically, over 190,000 buildings were damaged, including over 45,000 that were completely destroyed, creating over 250,000,000 tons of debris (Norio et al., 2011). This led to the high demand for clearing operations, which were critical to restoring Japan's infrastructure. Furthermore, impacted areas suffered widespread power outages, leaving roughly 4.4 million families without electricity during inclement winter weather (Norio et al., 2011). With large-scale power outages, energy generators were essential for reestablishing critical infrastructure such as airports and emergency facilities. Accordingly, fresh water, blankets, and shelter were needed by survivors due to the destruction of infrastructure combined with inclement winter weather (Zielonka, 2012).

The nuclear disaster at Fukushima created demand for specific goods and services for responding to such events. Among these, radiological detection assets aboard naval vessels and aircraft were used to monitor the levels of nuclear fallout surrounding the power plant in order to ensure the safety of nearby populations and responding organizations (Zielonka, 2012). U.S. Navy barges delivered hundreds of thousands of gallons of fresh water to cool the plant's nuclear reactors (Zielonka, 2012). Additionally, radiation detectors and protection as well as emergency lanterns proved useful for victims in areas surrounding Fukushima (Norio et al., 2011). Populations within the danger radius of contamination required immediate evacuation and relocation shelter at a safe distance from the plant (Carafano, 2011). This created large, dislocated populations with no possessions or sustainment capabilities and in need of shelter and sustenance (THF, 2012).

Regardless of the extent of existing infrastructure and governance, basic relief services such as search and rescue and debris clearance are always greatly demanded during the emergency response (Carafano, 2011). Rice and bread was provided for victims as basic sustenance since most food stores were destroyed by the tsunami. The refueling of aircraft on naval vessels, especially rotary-wing platforms, was required to support the extensive airlift operations while delivering aid and conducting information gathering (Zielonka, 2012). The U.S. Army's use of small teams consisting of translators, communications experts, and medical personnel were effective in providing a small but immediate supply of communications and information as well as medical care (Feickert & Chanlett-Avery, 2011).

Challenges in matching supply to demand arose due to the disparity between delivery of relief and real-time need. For example, within the first week of the disaster, blankets, clothing, and drinking water were in high demand; however, after that week, the response supply of these items overwhelmed the demand and became a nuisance to the supply chain of aid (Holguín-Veras et al., 2011). Since the JSDF was operating over capacity, in some areas without a large JSDF presence, looting and a bank robbery were reported (Holguín-Veras et al., 2011).

4. Deployment and Distribution

The use of rotary-wing platforms played a monumental role in the distribution of supplies. Helicopters provided critical lift capabilities to deliver a variety of relief supplies from naval vessels to distribution points (Zielonka, 2012). They were also successful in completing ship-to-shore and follow-on movement of supplies, even when seaports and coastlines were devastated. Rotary-wing aircraft were vital in providing last-mile distribution of relief to the impacted areas, especially those in remote and isolated locations (Zielonka, 2012). American rotary-wing aircraft even enhanced JSDF operations by transporting both supplies and personnel from JSDF ships to the disaster area (Wilson, 2012). This capability was essential since in areas struck by the tsunami, the majority of all roads, railways, and other lines of transportation were destroyed and rendered impassable, severely limiting distribution of relief (Norio et al., 2011). Seventy-six percent of highways and 600 miles of high-speed rail network in affected areas were closed immediately following the flood (THF, 2012). Since emergency supplies such as food, water, and medical aid generally must arrive within 72 hours of a disaster to prevent further loss of life (Carafano, 2011), rotary-wing lift capability was employed immediately to distribute aid throughout the region since other means were likely to be inadequate.

U.S. helicopters, fixed-wing aircraft, and surface vessels were successfully used to search hundreds of miles of coastline for survivors and bodies among the debris after the flooding receded (Zielonka, 2012). On land, HMMWVs, dump trucks, and water and fuel trucks successfully expedited seaport debris clearance operations since almost all local ground and water transportation assets were destroyed by the flood (Zielonka, 2012). Clearing debris from all highways and restoring use within two weeks of the disaster increased distribution of aid and transportation of personnel during continued relief operations (THF, 2012). Private local trucking companies even volunteered their services in an attempt to meet the demand for distribution assets for relief supplies due to the lack of operable trucks once roadways were restored (Holguín-Veras et al., 2011).

The Sendai Airport, as well as numerous seaports, was littered with large amounts of debris and left inoperable after the tsunami floodwaters receded, which prevented the delivery of international aid (Norio et al., 2011). By clearing debris from the airport and restoring its 5,000-foot runway and control capabilities, a vital logistics base was established within the disaster area, which enabled large-scale local delivery of aid from military and civilian aircraft (Wilson, 2012). Additionally, using the functional airports outside of the disaster area as hubs for logistics distribution proved effective when combined with last-mile distribution assets such as rotary-wing aircraft (Norio et al., 2011). External staging areas as far away as military air bases on Iwakuni and Okinawa were used effectively to avoid congestion and prepare supplies for the last stage of distribution (Wilson, 2012). A major success of Operation Tomodachi was the scale of air support operations achieved. The 3d Marine Division air officer tracked over 800 sorties transporting over 3,000 passengers and over 1,000 short tons of humanitarian supplies to the disaster area, including water, fuel, food, and blankets, which were critical to preventing loss of life (CE 3D MARDIV, 2011).

Unfortunately, distribution operations were hindered by the government of Japan and the JSDF's staunch position and national pride. Instead of using local authorities for inner cordon security and end user distribution, the Japanese authorities demanded that supplies be brought to them and then they would distribute from central locations to local distribution points (CE 3D MEB, 2011). This model reduced the transportation and distribution site creation requirements for the Marines of the 3D MEB. Ultimately, the responders concluded that requirements need to be established for relief operations based on the strength of the infrastructure. Specifically, missions, response measures, and capabilities for third world nations need to differ significantly from those of first world nations.

5. Health Service Support

As in most disasters, it was discovered that small children, elderly, sick, and poor victims were more susceptible to suffering (THF, 2012). The highest casualty rates were experienced in the Fukushima prefect and consisted mostly of elderly citizens due to their lack of mobility, resiliency, and self-sustainability (Japanese Red Cross Society, 2013).

6. Collaboration and Governance

Collaboration through treaties and policies between the U.S. military and the JSDF ensured high-level coordination between American and host-nation responders (Zielonka, 2012). The JSDF quickly established its position of leadership and directed international responders to operate in specific areas in order to distribute relief. An exchange of embedded liaison teams between the U.S. Navy and JSDF increased overall communication and cooperation between the U.S. military and host-nation organizations. The 31st MEU sourced a three-man team in exchange for a three-man Japanese team, each of which functioned within the operation planning sections of their counterpart's organization (Zielonka, 2012).

With a high concentration of both host and international agencies and relief organizations, achieving unity of effort and coordination was an arduous task. A method for solving the problem known as Board, Bureaus, Centers, Cells, and Working Groups (B2C2WG) was implemented by the JTF. This concept focused on the scheduled meetings and conferences with key players in the relief effort to streamline coordination, improve synergy, and coordinate response (CE 3D MARDIV, 2011). Early coordination between the U.S. embassy, USAID, and the Japanese government via the U.S. Bilateral Assistance Coordination Cell streamlined and directly enabled the success of the American response during immediate and subsequent relief operations. Although successful, clear policies and procedures understood and implemented by both parties would have increased effectiveness (Wilson, 2012).

By working together with the Japanese forces, American military units achieved several joint objectives and functioned in roles complementary to one another. During seaport restorations, once U.S. Navy salvage teams located underwater obstacles in ports, the coordinates and information were relayed to local officials in Kessenuma and Oshima for clearance operations (Zielonka, 2012). While searching for human remains swept out to sea, U.S. responders maintained cultural sensitivity by reporting the location of remains to local forces to allow appropriate customary procedures to be conducted during the recovery operations and handling of human remains. Naval medical teams partnered with local Japanese teams also successfully provided a combined and effective assessment and location of service centers in response to the victims' need for medical care (Zielonka, 2012).

The nuclear disaster at Fukushima led to the involvement of numerous host-nation and international nuclear organizations, which increased the demand for organization and coordination (Norio et al., 2011). Further friction was added by the lack of continuity between the private Tokyo Electric Power Company, who owned the power plant, and host-nation government agencies. These internal issues further challenged unity of effort with international organizations and reemphasized the requirement for well-executed coordination between all involved parties (Norio et al., 2011).

A major factor influencing the scope of Operation Tomodachi was Japan's infrastructure and standing as a first world nation. Because Japan had well-developed and well-executed emergency response plans, as well as resources and capabilities, aid was not as welcomed as it had been in past disasters where impoverished countries with incapable governments were affected. Not all relief supplies were demanded, and the JSDF was often hesitant to relinquish control and authority over relief operations (CE 3D MEB, 2011). For example, the HASTs' movement, although arriving in Japan within 24 hours, was delayed by seven days by Japanese civil authorities, which is most likely due to their reluctance to be viewed as needy (CE 3D MEB, 2011). As a result, the relief effort was very straightforward and attempted to match demand with excess resources held by the government of Japan in other parts of the country. The distribution modeling and matching of needed resources while operating under the control of the government of Japan and exerting significant effort in order to determine the actual needs of the host nation became a real challenge (CE 3D MEB, 2011). The Japanese government later admitted that by not fully considering the capabilities of international organizations, they limited their overall resources and level of response. Overall, a JTF was useful in allocating resources and managing personnel, but establishing clear chains of command and authority to reduce redundancy of effort proved difficult (Wilson, 2012). These inflexible emergency management procedures caused delays in the integration of foreign aid organizations and subsequently hampered the speed of response operations (Carafano, 2011).

Table 5 depicts the relief supplied by the MEU as well as the total shortages in overall HA/DR operations in support of the Japanese earthquake and tsunami of 2011.

Table 5. Tomodachi Demand and Supply
(Based on Apte & Yoho, 2012, p. 15)

	Tomodachi: USMC Provided	Tomodachi: Unmet Demand	MEU capabilities to Satisfy Unmet Demand
Information and Knowledge Management	-Social media -Unclassified and plain text communication -Rotary wing imagery -Creation of crisis action planning team	-Validated and accurate information -Accurate, timely and understandable radiation reports	**-S2 Intelligence Section** **-S6 Communications Section** **-Civil Affairs section** **-Public Affairs section**
Needs Assessment	-Initial HAST -Rotary wing aerial surveys	-Accurate radiation measurements	**-CBRN Detachment**
Supply	-Manpower and equipment for debris clearance -Fuel	-Manpower and equipment for search and rescue and debris clearance -Restoration of electricity -Initial, food, water, clothing, shelter -Radiological detection -Civil order	**-(2) Tactical water purifiers** **-Infantry Battalion of Marines** **-Military Police Detachment** **-(4) Forklifts, (1) Bulldozer, (1) Excavator** **-(31) MTVR Trucks, (105) HMMWV, (15) AAV**
Deployment and Distribution	-Helicopter lift of supplies and personnel to JSDF -Trucks	-Trucks	**-(31) MTVR Trucks, (105) HMMWV, (15) AAV, (4) Forklifts**
Health Service Support		-Care for children, elderly, sick and poor	**-Embedded Navy Corpsmen**
Collaboration and Governance	-Exchange of embedded liaison teams with JSDF	-Large scale coordination of government and NGOs -Timely acceptance of aid -Unity of effort between Japanese Gov., TEPCO and foreign aid.	**-Civil Affairs section** **-Public Affairs section**

Even with the large-scale relief operations and tremendous levels of support provided by a host of multinational organizations and state actors, it is apparent that gaps in response persisted. To supply this unmet demand created by the disasters, USMC MEUs could potentially use the following organic resources:

- (1) S2 intelligence section
- (1) civil affairs section
- (1) CBRN detachment
- (1) S6 communications section
- (1) public affairs section
- (1) reconnaissance platoon

- (1) force reconnaissance platoon
- (1) infantry battalion of Marines
- (4) forklifts
- (1) excavator
- (105) HMMWVs
- (19) rotary-wing aircraft
- embedded Navy corpsmen
- (1) military police detachment
- (1) bulldozer
- (31) MTVR trucks
- (15) AAVs
- (2) tactical water purification systems

V. CONCLUSIONS

After examining the previous cases, it is apparent that regardless of the disaster, there will likely be a high demand for life-sustaining relief such as food, water, and medical aid immediately following the event. Since the MEU is specifically structured to enable rapid deployment anywhere in the world, immediate push-based logistics operations delivering food and water will likely provide high levels of utility to victims if delivered rapidly. In order to provide further utility and enhance overall relief operations, the MEU is capable of employing capabilities in all categories of the Apte and Yoho model. Matching the capabilities of the MEU with shortfalls in combined response is likely to increase the effectiveness of operations while ensuring that MEU resources are implemented efficiently. Furthermore, by providing capabilities when other agencies cannot, the Marine Corps will establish its competitive advantage and function in foreign aid operations.

Potential capabilities that the MEU can best employ to achieve this competitive advantage have been identified by determining the unmet demands from the three studied disasters. Information and knowledge management capabilities lacked a method of mass communication to local populations, sufficient supply of cell phones and personal communication devices, validated information reports, and accurately disseminated reports of radiation. The MEU’s S2 intelligence section is capable of providing validated information products, while the S6 communication section can facilitate communication and information dissemination operations. Organic public and civil affairs officers along with their staff specialize in managing and communicating information between the MEU chain of command and external organizations. Furthermore, the MEU’s rotary-wing assets, including MV-22 Ospreys and CH-53 and UH-1 helicopters, could distribute mass notifications. Shortfalls in demand for needs assessment included the completion of assessments in remote and isolated areas as well as accurate detection of radiation levels surrounding the Fukushima power plant during Operation Tomodachi. Reconnaissance platoons as well as the infantry battalion from the MEU are capable of reaching isolated and austere areas and identifying the needs of victims through interaction. For radiation detection, the MEU’s CBRN section would not have been able to meet this demand due to the scale of the disaster, but it would be able to provide detection in certain areas.

The initial lack of drinking water caused by disasters could be alleviated in part by the use of the MEU’s two tactical water purifiers until other relief agencies arrive. When stability is compromised and relief distribution is hampered by looting, violence, and unrest, the Marine Corps’ manpower resources provide an ample solution. The infantry battalion of Marines and especially the military police platoon are capable of restoring order and providing security spanning across the force continuum. Furthermore, the presence of Marines is likely to maintain order at relief camps and prevent crimes against at-risk populations such as women, children, the sick, and the elderly. The manpower of the MEU combined with equipment assets could also be effectively used in search and rescue as well as debris clearance operations. The battalion landing team as well as four forklifts, one bulldozer, one excavator, 31 seven-ton trucks, 105 HMMWVs, and 15 amphibious assault vehicles (AAVs) could provide significant capabilities, search a significant area, and clear large amounts of debris and rubble to restore critical infrastructure and facilitate additional relief distribution.

The distribution of relief was shown to be particularly challenging to most aid organizations due to the devastated environments they were operating in. The distribution to locations beyond logistics hubs plagued most responders due to their lack of lift capabilities. Most significantly, the MEU's 19 rotary-wing aircraft have been proven capable of accomplishing the critical task of delivering supplies and personnel to areas inaccessible by land transportation. By providing last-mile distribution in future operations, the MEU's aircraft can serve as a critical enabler to organizations such as USAID, the World Food Organization, and the Red Cross. In areas where ground transportation is possible, the 31 seven-ton trucks, 105 HMMWVs, and 15 AAVs can transport large quantities of relief supplies and personnel over strenuous terrain. The four forklifts possessed by the MEU can also be used at logistics hubs for the loading and unloading of cargo since local equipment is often inoperable or lost after a disaster. Additionally, due to the nature of relief operations, the creation and maintenance of order at distribution sites is paramount, but also difficult to achieve. The Marines of the MEU, working with host nations or autonomously, can establish secured and orderly distribution sites to ensure the safe and effective flow of aid.

The shortage of mobile medical teams could be partially met by the use of embedded Navy corpsmen with Marine ground troops. As noted in Haiti, embedded corpsmen were able to reach victims in remote locations who were unable to travel to medical facilities. Although care is limited to basic aid, the services provide immediate assistance and contribute to needs assessments for follow-on relief. Finally, the lack of unity of effort, overall response collaboration, and clear AoRs can be improved through the use of the MEU's civil affairs and public affairs sections. Although the MEU will likely only be able to improve levels of collaboration between itself and other large organizations who are willing to cooperate, improving combined response will lead to improved levels of relief being provided to victims. Improving collaboration will also allow the MEU to better match its capabilities and supplies with the needs of victims while reducing redundancy and inefficiency.

A. FOLLOW-ON RESEARCH

- Conduct a cost analysis using the previously mentioned metric to determine cost effectiveness within the scope of meeting demand shortages, as opposed to assuming that all aid provided was necessary. Determine waste/excess and cost of superfluous and redundant aid.
- Conduct an analysis of HA/DR-specific tasking statements versus broad statements with specific mission requirements and focus areas.
- Develop specific MEU command/staff training exercises and playbooks that focus on HA/DR competencies.

  Conduct an analysis of the maximum utility of an MEU response time line and identification of diminishing returns based on the duration of operations.

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