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The Impacts of Climate Change on Humanitarian Assistance and Disaster Relief Naval Missions

June 2023

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ABSTRACT

This thesis conducts a qualitative analysis of utilizing unmanned aerial and surface vehicles to support the United States Navy humanitarian and disaster relief (HADR) missions. As climate change continues to increase the likelihood of natural disasters globally, it can be anticipated that the USN will be required to conduct a greater number of HADR missions. Additionally, traditional HADR missions incur large monetary costs and divert naval assets from potential missions that are vital for national security. This thesis analyzes the current naval assets, doctrine, processes and civilian capabilities that could be better utilized for executing HADR missions as global climate change continues to impact distressed nations.

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LIST OF ACRONYMS AND ABBREVIATIONS

AOR	Area of Responsibility
ARG	Amphibious Readiness Group
CG	Guided Missile Cruisers
CLF	Combat Logistics Force
CNO	Chief of Naval Operations
CONUS	Continental United States
CRADA	Cooperative Research and Development Agreement
CVN	Aircraft Carrier
DAU	Defense Acquisition University
DDG	Guided Missile Destroyer
DMO	Disbursed Maritime Operations
DOD	Department of Defense
EKU	Eastern Kentucky University
FFG	Guided Missile Frigates
FHA	Foreign Humanitarian Assistance
FY	Fiscal Year
GCC	Geographic Combatant Commander
HADR	Humanitarian Assistance and Disaster Response
INDOPACOM	Indio-Pacific Command
IPCC	Intergovernmental Panel on Climate Change
JCS	Joint Chiefs of Staff
JP	Joint Publication
JTF	Joint Task Force
LAW	Light Amphibious Warship
LHA/LHD	Amphibious Assault Ships
LPD	Landing Platform Dock
LSD	Dock Landing Ship

LUSV	Large Unmanned Surface Vehicles
MCA	Major Capability Acquisition
MITAM	Military Tasking Matrix
MSC	Military Sealift Command
MTA	Middle Tier Acquisition
MUSV	Medium Unmanned Surface Vehicles
NASA	National Aeronautics and Space Administration
NGLS	Next Generation Logistics Ship
NGO	Non-Governmental Organization
NOAA	National Oceanic and Atmospheric Administration
NPS	Naval Postgraduate School
NSS	National Security Strategy
OFDA	US Foreign Disaster Assistance
ONR	Office of Naval Research
OPORD	Operational Order
PM1/T-AO	Fleet Oilers
PM6/T-AKE	Fleet Ordinance and Dry Cargo
PM8/T-EPF/JHSV	Expeditionary Fast Support
PPBE	Planning, Programming, Budget, and Execution
SECNAV	Secretary of the Navy
T-AOE	Fast Combat Support
UAV	Unmanned Aerial Vehicle
UJTL	Universal Joint Task List
UMV	Unmanned Marine Vehicle
UNEP	United Nations Environment Programme
USAID	US Agency for International Development
USMC	United States Marine Corps
USN	United States Navy
UUV	Unmanned Undersea Vehicles

VTOL	Vertical Takeoff and Landing
WARNORD	Warning Order
XLUUV	Extra-Large Unmanned Undersea Vehicles

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I.   INTRODUCTION

Global warming can have a wide range of negative effects on humanitarian efforts in the Asia-Pacific region, including more frequent and extreme severe weather events such as hurricanes, floods, droughts, and heatwaves (Environment Defense Fund, 2022). These incidents have unfortunately led to food and water shortages, displacement of people, and the destruction of infrastructure of homes. Additionally, rising sea levels can lead to loss of land and displacement of coastal communities. This research evaluates the United States Navy's (USN) incorporation of unmanned vehicles for humanitarian assistance and disaster relief (HADR) missions specifically in the Asia-Pacific (INDOPACOM) Area of Responsibility (AOR). Although climate change affects Earth on a global scale, we will focus on the INDOPACOM AOR, which according to McGeehan (2017) has been the most historically impacted region.

The purpose of this qualitative study is to examine the current capabilities, policies and procedures of the United States Government and Navy for executing HADR missions in the INDOPACOM AOR. Specifically, we will examine how the USN needs to adapt new strategies and incorporate modern technologies, such as unmanned aerial and underwater vehicles, to combat the increasing demand for relief from natural disasters while providing flexibility in the decision making process for the USN's key leadership.

As President Biden addresses in the 2022 *National Security Strategy* (NSS), climate change is the largest and most existential of the problems that we face as a global community. In the NSS, President Biden outlines his concerns that without immediate and drastic action the humanitarian emergencies will only continue to worsen. In President Biden's Executive Order 14008, "Tackling the Climate Crisis Home and Abroad," President Biden began his formal policy of prioritizing climate changes as an essential element of our national security (White House, 2021). The Honorable Carlos Del Toro, the Secretary of the Navy (SECNAV), echoes these same concerns in his Climate Action Press Release in 2022 (United States Navy [USN], 2022b) where he discusses how climate change will impact our national security. The SECNAV describes how our naval forces, specifically the United States amphibious forces are going to be the main effort when it

comes to combating the impending crisis. Climate change and its impacts to the United States, its allies, and its effect on global security are valued at the highest levels and substantial changes need to be addressed to minimize the destruction of key infrastructure around the world as well as to reduce human suffering or the loss of life.

The USN has a vision of a hybrid fleet that consists of over 350 crewed vessels, nearly 150 large, unmanned surface and subsurface platforms, and about 3,000 aircraft, to fulfill its mission (Katz, 2022). The USN aims to prepare its envisioned fleet with the necessary manpower, training, and equipment to operate effectively under the expected future climate conditions, and to be ready to provide aid in times of humanitarian crises. unmanned air vehicles (UAVs) or unmanned marine vehicles (UMVs) have the potential to support humanitarian relief by providing efficient means of assessing damage, delivering supplies, and conducting search and rescue operations in difficult to access areas. They also reduce risk to human lives by operating in these hazardous locations. However, UAV/ UMV HADR support is still relatively new and, as such, it is imperative that this field of study continue to be developed.

In this thesis our scope will be to review the current administration and its militaries' policies and procedures, as well as its ability to utilize unmanned vehicles for HADR missions in the INDOPACOM AOR. We recognize that climate change is a global problem, but we wanted to focus on the region that has historically been most impacted by natural disasters, and where the USN has a substantial military footprint to provide support.

Our research will not include any legal considerations for the utilization of unmanned aerial or underwater vehicles for the movement and distribution of aid to effected locations. We will assume that the Department of State has secured permission for U.S. naval assets to operate in the local and territorial waters and airspace above the impacted nations.

We will also only focus on the USN's ability to transport and deliver humanitarian aid to specific areas and will not include any research into providing medical or technical assistance, or any capability to provide expertise in the repair of damaged local infrastructure. We chose not to include these factors in our thesis because our focus is on

the utilization of unmanned vehicles to meet transportation needs and not the current naval assets which can address these additional requirements.

The final limitation to the thesis is that we only analyzed the capabilities of the USN to provide a supportive role to the impacted nation, and that the host nation and non-government organizations would function as the lead for the disaster response. This viewpoint is already in line with how the USN currently conducts its HADR missions, and how the Navy collaborates with various nations each year to ensure that they have the capability and capacity to respond when needed. The Office of Naval Research (ONR) has disclosed that the USN has worked in partnership with Vietnamese scientists to investigate the effects of climate change on the Mekong Delta. The research aims to gain a deeper understanding of how rising sea levels, alterations to the mangrove habitats, and reduced water flow from upstream will impact the region (USN, 2022b). The article highlights another instance of the USN's efforts to support its allies in adapting to the effects of climate change. Specifically, the Navy Entomology Center of Excellence collaborated with multiple agencies in Ghana to address the potential increase of combat vector-borne diseases such as malaria that are worsened by climate change. The goal for these partnerships is to help the host nation be prepared to respond to the disaster or outbreak and not rely on American military units to stabilize the situation. This will allow for the U.S. deployed military units to continue to execute the already assigned missions and remain combat effective (USN, 2022b).

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II.   BACKGROUND

A.   USN BACKGROUND

"The USN performed major HADR operations more than 20 times and numerous minor HADR missions from 2000 to 2018. But due to many reasons the countries may not be able to depend on USN and will need to be, at least partially, self-sufficient" (Lopez, 2021). Due to climate change, the USN has encountered notable hindrances in its ability to deliver aid, particularly in response to the surge of natural disasters. The upsurge of sea levels, amplified occurrences of natural calamities, and shifts in weather patterns have introduced new obstacles that impede the USN's capacity to supply timely and effective aid. In response, the Navy must develop new strategies and procedures for the increased frequency of HADR response and invest in infrastructure and equipment that is more resilient to the impacts of climate change.

In the continental United States (CONUS), the USN and DOD have implemented measures to tackle the issues caused by climate change, such as the escalation of sea levels and surge in occurrence of extreme weather events. These challenges have emerged as a mounting concern for the military (Lopez, 2021). The Navy is working to improve the resiliency of our facilities and infrastructure and create new contingency plans (USN, 2022b) to address the challenges posed by climate change and secure a sustainable future within CONUS, but also to take lessons learned from our own home front and bring our best practices in support of our allies and countries in need of our support.

B.   CLIMATE CHANGE BACKGROUND

Climate change is among the most pressing concerns that humanity faces today. Over the years, the humanitarian response system has increasingly prioritized mitigating these impacts of climate change and global warming. In addressing the effects of natural disasters, the United States has traditionally led the way through collaborative response by federal, state, and local governments, alongside non-governmental organizations and volunteer groups. Over time, climate change has caused a spectrum of natural disasters that

have, in turn, increased in frequency and intensity. Notable examples of distinct types of natural disasters include hurricanes, droughts, flooding, and wildfires.

For example, according to the National Oceanic and Atmospheric Administration (NOAA), the frequency of North Atlantic hurricanes has increased since the 1980s (NOAA, 2021). The article states that between 1980 and 2020, there was an average of 6.2 hurricanes per year, in comparison, between 1950 and 1979 the North Atlantic average was 4.4 hurricanes per year. Also, a study by Kossin et al. (2020) found that average hurricane strength or intensity, especially the global proportion of Category 4 and Category 5 hurricanes, has increased over the past four decades, which was attributed to climate change. The outcomes of the study are likely to enhance the credibility of forecasts that indicate a rise in hurricane intensity in the future due to persistent impact of global warming (Kossin et al., 2020). A study by Villarini et al. (2018) found that the amount of rainfall associated with hurricanes has increased over the past century and that the most noteworthy rises in rainfall have occurred in the most recent few decades, which is credited to the warming oceans and warmer atmosphere associated to climate change.

The Intergovernmental Panel on Climate Change (IPCC) (2018) states that the frequency and severity of droughts have escalated, especially in regions such as the Mediterranean, western United States, and Southern Africa due to climate change. These areas are experiencing longer and more severe droughts with direct impacts to agriculture, resources for water, and human health in these impacted areas (IPCC, 2018). These increases can be attributed to a mixture of natural and human generated climate change, such as the emission of greenhouse gases from industrial processes, deforestation, and the burning of fossil fuels. According to the United Nations Environment Programme (UNEP), the severity of these droughts will progressively increase due to climate change, particularly in the areas that are already water-stressed (UNEP, 2018).

To better rely on their own disaster preparedness and capabilities, countries' governments have begun developing their own infrastructure to better withstand weather and their own early warning systems. Pakistan, for instance, has more glaciers than any country outside of the polar regions (Fox, 2022). In September 2022 glacier outbursts in the northern regions of Pakistan caused flooding resulting in property damage,

displacement of thousands of people, and the loss of thousands of lives. These glacier outbursts averaged five or six each year, but at least 16 occurred in 2022 (Fox, 2022). Rising temperatures in the region due to climate change have caused the glaciers to melt at an accelerated rate, which highlights the need for increased attention to climate change to prevent such disasters from becoming more severe in the future. Not only does the United States have a leadership role in international efforts to provide humanitarian assistance to countries like Pakistan, but they also play a critical role in infrastructure development and signaling its commitment to global change to combating the future risks and effects posed by climate change.

The rise in occurrences and severity of natural calamities, which have impacted nations worldwide, is being attributed to climate change and the repercussions of global warming. These events not only cause immediate damage but also have enduring impacts on communities and subsequently their economies. It is vital for the DOD to continue its efforts to prepare, research, develop, and support countries to better mitigate and respond to these natural disasters. By investing in strategies to reduce carbon emissions, improve infrastructure, and enhance disaster response capabilities the DOD can help communities worldwide to better adapt to the challenges posed by climate change and ensure the safety and well-being of all.

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III. LITERATURE REVIEW

A. CLIMATE CHANGE

According to a UN report published in 2023, climate change is characterized by prolonged changes in temperature and weather patterns. While natural factors like variations in the solar cycle can play a role, since the 1800s, human activities such as burning fuels (coal, oil, and gas) have been the primary driver of climate change. (UN, 2023). The topic of climate change has been heavily studied because of the direct impacts that these changes are having on severe weather conditions and in turn the increased monetary and human cost of having to live in unstable regions.

According to the National Aeronautics and Space Administration (NASA) article titled "The Effects of Climate Change" in 2023 the impacts of climate change to the globe include having the sea rise between one to eight feet by 2100 displacing millions of people who live near the shoreline. Hurricanes will continue to increase in strength, longer and more intense droughts, as well as rising temperature levels and the subsequent melting of the polar ice caps. Each of these changes will fundamentally alter how humans and animals interact with the environment as we try to adapt to these changes. While climate change will not have any impact on seismic activity or the natural disasters that can accompany large tectonic shifts such as earthquakes and tsunamis, having to respond to multiple natural disasters simultaneously can stretch already thin resources to the breaking point.

Nowhere is this change more impactful than in the INDOPACOM Area of Operation (AOR). According to McGeehan (2017), between 1970 and 2014, natural disasters in the Asia-Pacific accounted for more than two million deaths, approximately 57% of the global total. The article continues by describing the shift of the wealthier residents of these countries away from more rural areas to urban areas and cities. McGeehan states that in 1970 approximately 26% of the Asia-Pacific population lived in cities, but in 2014 that concentration shifted to almost 48%, many of which are located along the coastlines which are more susceptible to typhoons. The article continues by stating that another outcome of this migration is that the most impoverished individuals are

compelled to reside in areas that are more susceptible to flooding, which increases the likelihood of immediate humanitarian emergencies.

The increasing vulnerabilities of the INDOPACOM AOR have a direct impact on security of the United States because of the potential not only for disruption in trade routes that would limit the U.S.'s ability to transport goods without interruption but also for mitigating the chances of infectious diseases. Hiebert and Fallin in 2021 best describe this threat saying, "Health security is another critical issue for the United States. Southeast Asia, a frequent origin of infectious diseases, will experience substantial outbreaks as the environmental impact of natural disasters is exacerbated by climate change." Sanitation after a natural disaster occurs can often be one of the direst areas in need of support, with the potential for a displaced population having to combat disease as well as a lack of food, water, and shelter. The potential for infectious diseases to be spread is not localized only when a natural disaster strikes, but the threat of contagion grows significantly when clean living environments are an impossibility.

Another impact is the potential weakening of economic and political U.S. partners in the INDOPACOM AOR, with the Philippines having a heightened risk of being impacted by climate change. On average the Philippines is hit by 20 typhoons every year (Amnesty International UK, 2019). According to NASA (2023), the strength of these storms has significantly risen in recent times. This is caused by elevated ocean temperatures resulting from global warming, which leads to typhoons becoming more potent (Amnesty, 2019). Five of the deadliest storms to have hit the Philippines have occurred since 2006 (Amnesty, 2019). According to Hiebert and Fallin (2021), the Philippines are situated in a region prone to cyclones and are expected to experience a higher frequency of storms making landfall each year. Not only will the Philippines expect to see a larger number of cyclones and typhoons land on their shores as climate change continues to warm the oceans, but the severity of the storms is expected to increase as well.

Approximately 70% of the 150 million people in the Southeast Asia region, to include the Philippines, currently live in areas that are likely to be submerged by 2050 (Amnesty, 2019). This problem is clearly not limited to only the Philippines, but to other U.S. partners and allies in the INDOPACOM AOR. Destabilization in the region from

having to respond to national emergencies from natural disasters is a threat to the United States and global security, and the U.S. will need to address these existential threats (Hiebert and Fallin, 2021). The potential for detrimental effects to global security, the free flow of commerce, or the increased potential for infectious diseases to spread increases as climate change worsens. These natural disasters will necessitate responses from the U.S. to use their instruments of national power, to include military action in the form of humanitarian assistance and disaster response (HADR) missions as necessitated by requests from the State Department. From 2000 through 2018, the United States Navy performed more than 20 major HADR, as well as numerous minor missions in response to natural disasters (Apte, 2022). As climate change continues to worsen, it is expected that the number of missions that U.S. naval assets will be called upon to alleviate human suffering will increase proportionately.

The DOD understands that as the climate changes they will need to adapt to more severe and more common HADR missions. Climate change is viewed as a factor that amplifies existing problems and adds to conflicts within and between countries (McGeehan, 2017). These are complex issues that will require advances on multiple fronts to combat the changes effectively. The Department of the Navy conducted a tabletop exercise in 2022 that summarized the future needs as a requirement for force flexibility and redundancy, as well as the efficiency to build resilience to climate impacts and avoid single points of failure (USN, 2022a). Now that we understand climate change and why the U.S. Navy will need to plan on an increased response to supporting our allies, partners, and other countries to alleviate human suffering, we will need to understand what the current policies and procedures are for requesting naval assets to execute HADR missions.

B.   STATE DEPARTMENT HUMANITARIAN ASSISTANCE AND DISASTER RELIEF POLICY AND PROCEDURE

Joint Publication 3-29 (JP 3-29), which was released by the Joint Chiefs of Staff in 2019, is the United States Joint Doctrine for foreign humanitarian assistance, which provides clear instructions on what the process entails to request military assistance to execute a mission to help alleviate human suffering from another nation. We will be using this publication extensively in this portion of the Literature Review as it is one of the critical

documents that dictates how the process is utilized. According to JP 3-29 the Oslo Guidelines provide that one should only request foreign (meaning foreign to the country who is requesting assistance) military assets when no equivalent civilian alternative exists, and they should only be employed when the use of military assets can address an essential humanitarian requirement. Accordingly, the U.S. military can only be used to support a foreign government's relief effort only when all other options have been exhausted, to include the use of non-governmental organizations (NGO) to meet critical humanitarian need. Examples of NGO's include USAID, Doctors Without Borders, etc.

U.S. military assets are also only able to provide indirect assistance to foreign governments. One example of this could be the provision of logistical support for humanitarian relief efforts, such as transporting supplies or aid workers, which may not directly involve interacting with affected populations (JP 3-29). While the U.S. military has significant capabilities and can aid a vast range of humanitarian disaster relief missions, the primary organization responsible for executing the disaster response is civilian, either through the government of the afflicted country or an NGO.

According to JP 3-29 (JCS, 2019) the procedure usually works in the following fashion. After a disaster strikes the affected state normally requests assistance from the international community. The UN consults national authorities/counterparts and relevant interagency standing committees to determine which areas need assistance, the leads for each sector and what is needed from the United Nations Office for the Coordination of Humanitarian Affairs. For a USG response the cognizant U.S. embassy determines if the state will be able to manage the disaster on its own, a formal request for U.S. assistance has been submitted, and if it is in the strategic interest of the U.S. to respond. If so, then the chief of mission coordinates with the operations office in the Executive Secretariat of the State Department via a disaster declaration cable. U.S. Foreign Disaster Assistance (OFDA) is the office within U.S. Agency for International Development (USAID) for coordinating assistance overseas. OFDA is responsible for assessing the level of aid needed in a crisis, including the possibility of requesting military assistance. For military aid to be considered, three criteria must be met: the response capacity of the affected state and international community is overwhelmed, all other commercial options have been

exhausted, and there is no comparable civilian alternative available. If military assistance is deemed necessary, OFDA will formally request it through the State Department, who will then forward the request to the DOD's Executive Secretariat. A Military Tasking Matrix (MITAM) will be submitted via the State Department to the requested service which is the formal tasking for conducting Disaster Response missions. Once in receipt of the MITAM the Navy Commander will begin the Navy Planning Process to address the request.

A visual representation of the path that a request must follow, along with the different criteria that exist for a Department of Defense response, is in Figure 1.
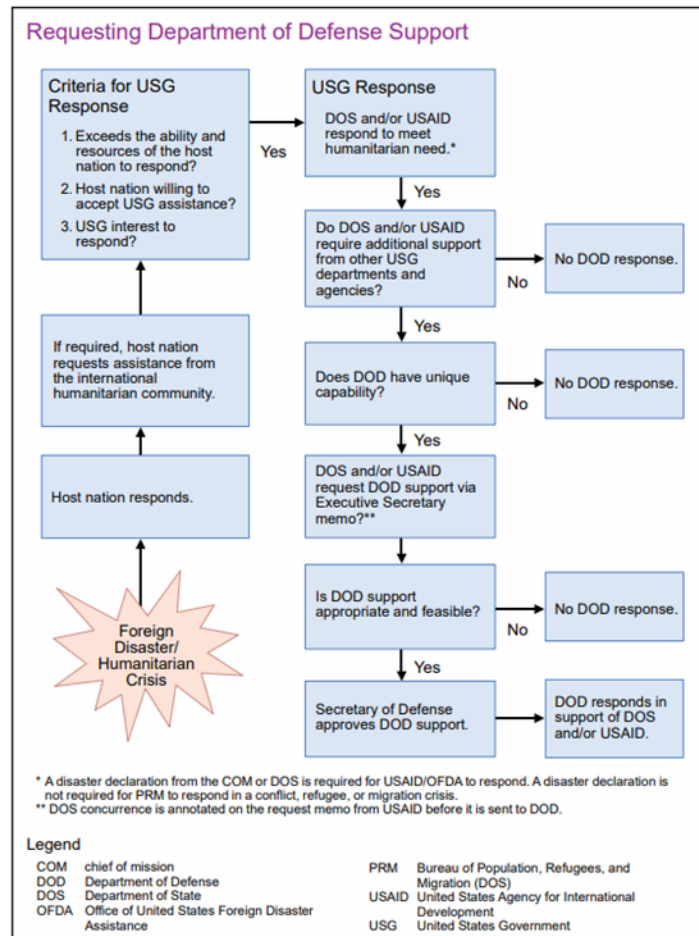

Figure 1.   Requesting Department of Defense Support. Source: JCS (2019, Figure II-3).

Joint Publication 3-29 states that although the OFDA is responsible for coordinating most U.S. government disaster responses, in the case of specific or extensive disasters, the USAID Administrator may collaborate with the National Security Council to hold interagency meetings when a humanitarian crisis arises (JCS, 2019). These interagency meetings are typically tied to disasters that directly impact the U.S. or global security and may or may not have been coordinated through USAID.

Because of the multitude of different organizations that participate in a HADR mission, the proper flow of information, as well as proper interagency coordination is vital. Ensuring that the host nation government, the United States Embassy, the Department of State, USAID and the Bureau of Democracy, Conflict and Humanitarian Assistance/Office of United States Foreign Disaster Assistance, The DOD, the Disaster Response Team and the Response Management Team are all synchronizing their efforts to provide the most effective and efficient response is a daunting task. See Figure 2 for a flow chart of interagency coordination.
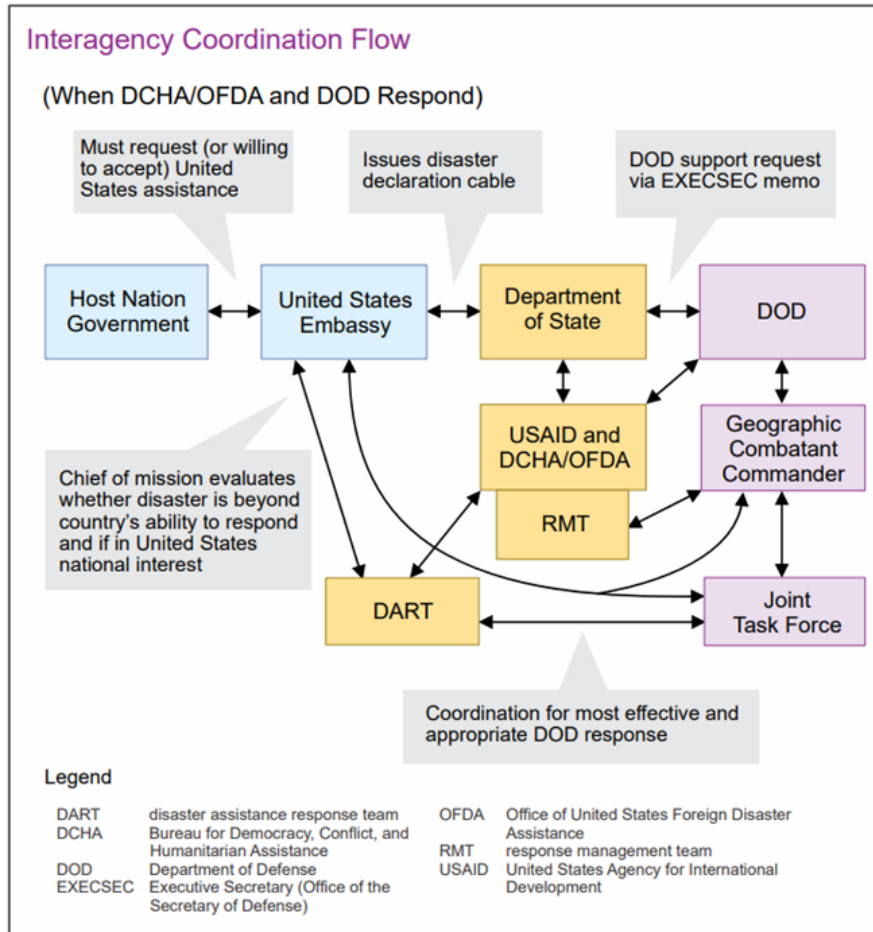
Figure II-4. Interagency Coordination Flow

Figure 2.   Interagency Coordination Flow. Source: JCS (2019, Figure II-4).

JP 329 (JCS, 2019) continues by illustrating that once the State Department has requested support from the DOD, the task will then fall on the specific Geographic Combatant Commander (GCC) to assign the appropriate forces to aid where required. The GCC will either call upon an existing Joint Task Force (JTF) to provide relief or designate a new Task Force for mission tasking. The JTF will then coordinate with the Disaster Assistance Response Team to provide the requested capabilities until a designated end state has been achieved, at which point the JTF will return to its next assigned mission.

C.   DOD/USN POLICY AND DOCTRINE

The Biden Administration has prioritized addressing Climate Change and names it one of his top concerns and priorities in the *National Security Strategy* (White House,

2022). This formal policy directly influences how each of the different organizations that fall under the Executive Branch (to include the Department of Defense) prioritize their efforts. The Secretary of Defense, the Honorable Lloyd Austin, has been consistent when administering policy regarding climate change and the role the U.S. will play in response to how it will impact our operating environment. He is quoted as saying "the department will immediately take appropriate policy actions to prioritize climate change considerations in our activities and risk assessments in order to mitigate this driver of insecurity" (Lopez, 2021). Lloyd follows the direction of President Biden and lists climate change as one of his top priorities in the National Defense Strategy, and in General Milley's National Military Strategy. Each of these leaders formalize climate change through their strategic level policy tools to ensure that the forces are taking action to minimize their forces impact on the environment, but to take active steps to aid those who are the victims of natural disasters.

The formal Department of Defense (DOD) doctrine regarding mission assignment is distributed through written Operational Orders (OPORD), which are written by staff at the various levels of command utilizing the Universal Joint Task List (UJTL) (JCS, 2023). The UJTL, which for the purpose of this thesis was reviewed using the latest update in 2023, has pre-defined missions sets that the staff can utilize to provide effective guidance to lower commands for mission execution. These standardized missions provide clarity to both the order writers and the recipients who will be tasked with executing the formal orders.

The UJTL (JCS, 2023) has HADR specific commands that indicate the various levels of involvement the State Department (DoS) or the DOD will commit to (JCS 2023). For example, in the UJTL SN 8.1 the mission is to assist foreign nations or groups and lists humanitarian assistance as a function of the order. Next the staff can choose to direct stabilization efforts (SN 8.1.3) or direct foreign humanitarian assistance (FHA) (SN 8.1.5). The staff can also utilize SN 8.1.9 which is the mission to cooperate with NGO's, SN 8.2.3 which is to coordinate foreign humanitarian assistance or ST 8.6 which is to coordinate stabilization effort. Each of these dictates how each of the JTF's will provide aid. Whether it is to assist, coordinate, or to direct the recovery effort. The U.S. Navy has a similar

document called the Universal Naval Task List, which has the same mission sets, but uses more force specific terms to provide detailed tasking to the tactical level commands for execution. Of note, we found no formal policy for the DOD or USN that mentions the usage of unmanned or autonomous aerial or waterborne vehicles.

Like the JP 3-29, which directs the Joint Forces in supporting foreign governments and Non-Governmental Organizations (NGOs) with alleviating human suffering from natural disasters, Naval Warfare Publication 3-29 (NWP 3-29) (CNO, 2011) is the naval doctrine for foreign humanitarian assistance. In it, it lists what considerations Navy planners need to account for when creating disaster response plans. The NWP 3-29 lists five planning considerations which include: Air space control plan, helicopter landing zone security, method to track Navy personnel who are ashore (who and where), boat lanes (the path that the ships will follow to prevent collision), and beach landing zone security (CNO, 2011). These factors are used to give guidance on force deployment and protection, not on the methods or techniques of aid delivery. Those details would need to be coordinated through the DART or respective NGOs and government agencies, and not through formal doctrine.

D. U.S. NAVAL CURRENT AND FUTURE CAPABILITIES

The United States Navy (USN) has a large array of available forces that have varying capabilities that could be utilized when supporting foreign governments or NGOs in their response to a natural disaster. When formal operational orders (OPORDs) are sent to respond to major humanitarian assistance missions, often dozens of naval assets are sent to support. Apte et al. in 2013 gathered the types and numbers of ships that had previously been sent, which is annotated in Figure 3.

Category	Unified Assistance	JTF Katrina	Unified Response
CG/DDG/FFG	6	0	4
LPD/LSD	3	3	5
LHA/LHD	2	2	3
CV/CVN	1	2	1
T-AH	1	1	1
MSC/Misc (w/o T-AH)	14	17	17
SSN	2	0	0
MCM/MHC	0	9	0
TOTAL SHIPS	29	34	31

Figure 3.   Naval Asset Examples for HADR Missions. Source: Apte (2013).

Apte (2013) provides a detailed breakdown for specific missions as examples, as seen above. Operation Unified Assistance was the mission to provide aid to the survivors of the Indian Ocean tsunami in 2004, where 29 assets were deployed for 81 days. JTF Katrina was in response to Hurricane Katrina which had thirty-four ships utilized for 42 days, and in 2010 the Haiti earthquake was lent assistance by operation Unified Response which deployed 31 ships for 72 days (Apte et al. 2013). These are just three examples of mission sets that the Navy Commander sent to aid in alleviating human suffering from these natural disasters. Each had an Amphibious Readiness Group (ARG) which typically consists of one LHA/LHD (Amphibious Assault Ships), an LPD (Landing Platform Dock) and an LSD (Dock Landing Ship), as well as a Carrier Strike Group which includes one CVN (Aircraft Carrier) and can include CG's (Guided Missile Cruisers), DDG's (Guided Missile Destroyers) and FFG's (Guided Missile Frigates), before they were decommissioned. Multiple Military Sealift Command (MSC) ships were also utilized in each of these responses. MSC ships provide excellent logistical support to the fleets to support maritime operations, including the delivery of aid ashore.

These responses to natural disasters include large numbers of warships that are not designed to provide humanitarian assistance but do contain substantial movement capacity for the delivery of aid or personnel. According to Seck in 2021 the Navy has the following assets (excluding submarines because of the negligible support that they provide to disaster relief):

- CVN: 11

- Surface Combatants: 115

- Amphibious Warfare Ships: 31

- Combat Logistics Ships: 29

- Fleet Support: 33

- Auxiliary Support: 1

Each of these naval assets bring capabilities with varying degrees of applicability to conducting HADR missions and will be analyzed for their effectiveness in responding to the United States State Department's tasking in the Qualitative Analysis chapter.

As the technology to utilize unmanned or autonomous delivery systems to support military HADR missions is still in its infancy, how effective these assets would be to supporting the execution of these missions is still unknown. It is evident that the Navy's intention is to create and acquire three specific classifications of large, unmanned vehicles (O'Rourke, 2022a). The Navy has requested $549.3 million in research and development funding for Large unmanned surface vehicles (LUSVs), $60.7 million for medium unmanned surface vehicles (MUSVs), and extra-large unmanned undersea vehicles (XLUUVs), and other U.S. Navy UUVs (O'Rourke, 2022a). The integration of unmanned surface and undersea vehicles presents opportunities for their use in supporting HADR missions and familiarizing with modern technology for future integration as capabilities advance.

As this innovative technology advances, the usage of unmanned and autonomous vehicles will become an integral part of how the USN conducts its missions. According to Katz (2022) in the 2040s and beyond, the Navy's plan is to have a mixed fleet consisting of over 350 crewed ships, 150 unmanned surface and subsurface platforms, and around 3,000 aircraft. This fleet is designed to operate in future climate conditions, and it is prepared to respond to conflicts and humanitarian crises that are induced by climate change (USN, 2022b).

Unmanned aerial vehicles (UAVs) are already incorporated into civilian HADR operations and are proving to be vital in supporting the relief efforts. Drones are currently being utilized to survey areas for damage and critical infrastructure in need of repair, as well as identifying trapped civilians, and any gas or chemical leaks, and extinguishing wildfires. Additionally, they are already delivering medical and aid supplies to affected areas (Leetaru 2015, Issuelab 2015, EKU 2020). These are an example of the capabilities that were available for commercial use in 2015, as UAV technology matures, new capabilities, capacity limitations, and usages may be developed or discovered. If a UAV is developed that is tailored to military application, then its integration and utilization could become a part of every HADR mission set. The research and development of a new UAV can be cost prohibitive though and have extensive lead times prior to its deployment.

Distribution of these new unmanned or autonomous vehicles could be applied to the Navy's current maritime assets, but with the development of the new Light Amphibious Warship (LAW) or the Next Generation Logistics Ship (NGLS), the integration could be a designed feature to ease implementation (Moffat, 2014). Both the Military Sealift Command (MSC) would own ships, with the LAW being leased to the United States Marine Corps (USMC) for its usage while the NGLS would remain in the service of MSC.

The LAW stems from a USMC shift in their deployment strategy to one of disbursed maritime operations (DMO), where the Marines would island hope to provide support for naval maritime operations (O'Rourke, 2022b). The Navy's LAW program from the Congressional Research Service states that the primary responsibility of the LAW would be to transport small USMC units and facilitate their landing and re-embarkation. To achieve this objective, the LAW would need to have a shallow draft and be capable of beaching to enable the efficient deployment of essential capabilities to critical maritime locations (O'Rourke, 2022b). The underlining strategy behind DMO, is that in a hostile environment, having to defend against a force that is capable, but well distributed makes the adversary's surveillance much more difficult. This can prove to have less operational risk to the deployed Marines and increase their element of surprise and lethality against enemy maritime assets if undetected. These assets would be able to hold repositories of HADR aid and utilize the unmanned vehicles for distribution in areas that may not have a

working port or reachable beaches. With the shallow water keep, they would be able to stay close to land and provide support from the water, but only with limited amounts of aid that could be delivered without refilling their stores from another asset.

The NGLS is another future MSC asset that could be developed into supporting HADR missions by utilizing unmanned vehicles. A separate Congressional Research Service article by O'Rourke in 2022c that is titled the *Navy Next-Generation Logistics Ship* provides additional information on the procurement schedule and capabilities of the NGLS, which is slated to be procured in Fiscal Year (FY) 2026. The author details to sustain operations of both naval and land forces, NGLS will serve as a responsive and adaptable platform for the transportation of equipment, personnel, supplies, and fuel across the dispersed nodes, ports, advanced bases, and ships (O'Rourke, 2022c). Like the LAW, the NGLS will also support DMO and will be much smaller than the current MSC ships. The Navy could order up to a couple of dozen NGLS' ships, but estimates have the USN ordering up to twice that number have been reported (O'Rourke, 2022c). The first NGLS is expected to be procured in FY26 for an approximate cost of $150 million, with the second costing approximately $156 million. While this may seem steep, especially when considering that the USN intends to buy dozens of the NGLS, a current MSC ship, the TAO-205, currently costs $700 million. The NGLS are intended to be a replenishment ship that can be operated in hostile environments and would not cripple the entire operation if one were to be lost or broken off for a separate mission, such as to complete a HADR mission.

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IV. METHODOLOGY AND QUALITATIVE ANALYSIS

In this chapter we will analyze the usage of unmanned and autonomous vehicles for the purpose of executing Humanitarian Assistance and Disaster Relief (HADR) missions, specifically in the INDOPACOM Area of Responsibility (AOR). We will conduct this analysis by utilizing the SWOT model, or reviewing the Strengths, Weaknesses, Opportunities, and Threats associated with this innovative technology.

A. STRENGTHS

The USN has a year of experience responding to HADR operations to include the effects of climate change (Apte, 2022). One of the key strengths is the ability for the U.S. military to mobilize their resources quickly, which can be critical in emergency situations such as HADR relief (Apte et al., 2013). They have large fleets of aircraft, ships, and other vehicles in which we can use to transport personnel and equipment to relief zones in which the ability to deploy these resources is crucial in situations where the need is dire.

Another key strength is the U.S. military's logistical support capabilities. The DOD has well established supply chains and communications channels that can help coordinate HADR efforts, which is vital during disaster relief scenarios in which the infrastructure has been damaged or destroyed. Additionally, the U.S. military has a robust experience with the use of satellites to help aid in search and rescue missions (Apte et al. 2013).

The United States military's close partnership with NGOs is a key strength to help respond to natural disasters. Established NGOs have a global network of personnel with broad backgrounds and resources that can respond to disasters rapidly. The broad backgrounds of personnel in the large NGOs also have specialized skills and expertise in terms of disaster response, such as medical care or coordination, which can be combined with our military to help bolster the overall response to the mission.

B. WEAKNESSES

According to Apte et al., one major weakness to our military in a disaster response is the potential lack of knowledge of the local culture and language (Apte et al., 2013).

Without an understanding of the local culture and language, the effectiveness of communication with the local communities can inevitably create misunderstandings that delay relief efforts. Additionally, the military's involvement is sometimes viewed as aggressive particularly in politically complex countries where the United States is not considered a trusted partner nation.

Apte et al. states that while the military's personnel are trained to operate in high stress locations, the training itself does not necessarily prepare U.S. service members for unique challenges such as HADR relief. This point also applies to the U.S. military's equipment, which is geared towards combat, which often does not translate well in support of HADR missions (Apte et al., 2013).

Moffat in 2017 describes the capacity for the USN to respond to the increasing amounts of natural disasters for the future will spread our Navy thin. Throughout the research, data on the amount of naval assets deployed in response to HADR missions and the number of ships or aircraft remaining on standby to assist other missions was scarce. The limited focus on the Navy's resources dedicated to HADR response can lead to future instances of unpreparedness to respond adequately due to inadequate planning. While the military can provide valuable assistance in the immediate aftermath of a disaster, it is not well suited for long-term reconstruction efforts (Moffat, 2017).

The cost of deploying Navy assets for HADR missions is significant and must be weighed against other operational requirements and available resources (Moffat, 2017). Limited funding could create significant challenges to humanitarian response efforts. Without funding, the DOD and Navy would be unable to ramp up production for drones and training to assist with future technologies with limited capacity.

C.   OPPORTUNITIES

Within the context of examining the usage of unmanned or autonomous vehicles, we will define an opportunity as a set of circumstances that will allow the drones to provide potential capabilities and tactics to accomplish the HADR mission. In this section of the Qualitative Analysis Chapter, we will review what unmanned vehicles can provide to the USN and how this could impact how the USN provides support to ailing nations.

The USN is currently in the acquisition process of developing new types of unmanned vehicles, the large unmanned surface vehicle (LUSV), medium unmanned surface vehicles (MUSV) and extra-large unmanned undersea vehicles (XLUUV) (O'Rourke, 2021a). These new unmanned vehicles are a pivot point in how the USN conducts its operations and could take the technologies that are being developed in both the public and private sectors to begin utilizing drones to aid in the intelligence gather and execution of HADR missions. Leetaru in 2015 states that drones are already being utilized in this manner, by surveying areas for damage and to identify critical infrastructure in need of repair. Additional uses include the ability to conduct reconnaissance for injured civilians, gas, or chemical leaks. Issuelab in 2015 states that civilian Non-Government Organizations (NGO) are already utilizing unmanned aircraft to deliver aid such as medicine, food, and equipment. These skillsets that are being utilized in the commercial sector are easily transferable to the Department of Defense to increase their capabilities and effectiveness in alleviating the suffering of impacted people.

An analysis was completed by Moffat in 2014, where the current capabilities of the different classes of ships were assigned numerical values to assess either utility in support of a HADR mission. Larger emphasis was placed on helicopters because of their unique position to be so effective at responding to the varying nuances of these mission sets. The Figure below was taken from the paper that Moffat in 2014 wrote and demonstrates the stark difference that Landing Helicopter Dock (LHD) and Landing Helicopter Assault (LHA) had when compared to the other ships in the USN's arsenal, to include the US's aircraft carriers (CVN). If the USN were to invest in unmanned vehicles, specifically aerial delivery, and reconnaissance drones, then the Total Capability Chart that is listed below would need to be reviewed based on the radical changes that these unmanned vehicles would provide. If they were to be stationed on ships such as the Light Amphibious Warship (LAW) or the Next Generation Logistics Ship (NGLS), then the organic capability would then tilt much more heavily to Maritime Sealift Command assets instead of the LHD/LHA.
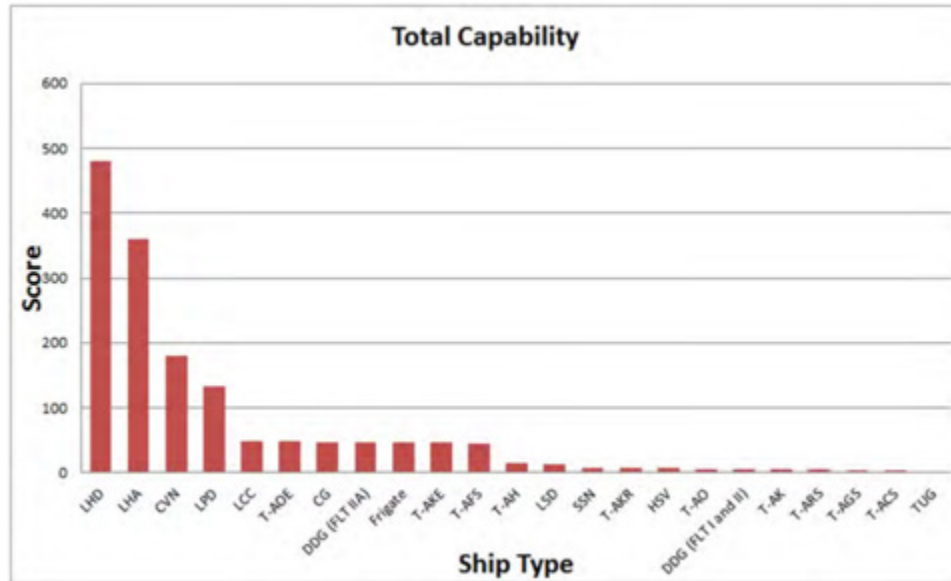
Figure 4.   Capability Scores by Ship Type. Source: Moffat (2014).

D.   THREATS

There are two primary threats that will need to be addressed to effectively utilize unmanned or autonomous vehicles in alleviating the suffering of a population recovering from a natural disaster. The first is operating in contested environments that have been compromised because of climate change. The second is providing the operational commander with enough flexibility in their orders promulgation procedures to be able to execute the HADR mission to the State Department's specifications.

The Biden Administration has focused policies addressing and combating climate change. In Executive Order 14008 (White House, 2021), titled Tackling the Climate Change Crisis at Home and Abroad, he details exactly the impacts that are predicted if drastic change does not occur quickly, and outlines his plan to mitigate these risks (USN, 2022b). President Biden is right to address these challenges directly. The Sea Level has risen 18 inches over the last 100 years and is expected to rise between one to three feet by 2050 (Lopez 2021). These rising water levels will directly impact cities and citizens that live near the ocean and lead to displaced citizens and damaged infrastructure.

Nowhere is the threat of climate change more prevalent than in the INDOPACOM AOR. From 1970 to 2014, natural disasters in the Asia-Pacific were responsible for over

two million fatalities, accounting for 57% of the worldwide total (McGeehan, 2017). This is particularly concerning for maintaining U.S. relations in the AOR, considering that one of the US's strongest allies, the Philippines is continually devastated yearly by the onslaught of typhoons. The Philippines experiences an annual average of 20 typhoons making landfall, with five of the seventh most deadly striking since 2006 (Amnesty, 2019). Because of the increase of the frequency and intensity of natural disasters in Southeast Asia, the number of infectious diseases is being exacerbated because of climate change (Hiebert and Fallin, 2021). All these factors coupled together demonstrate a tremendous threat in the increasing number, diversity, and strength of the natural disasters in the AOR and the need for new capabilities to be developed and deployed quickly.

The other competing threat to the utilization of unmanned and autonomous vehicles is the doctrine currently does not contain any verbiage on its utilization of them. In the Literature Review chapter, we detail all the different potential mission sets that can be executed using the Universal Joint Task List (UJTL) (JCS, 2023), and how those standardized missions can provide guidance to lower echelon commanders in their execution of the orders. In the publications and doctrine, we could find no mention of the usage of autonomous or unmanned vehicles. Others would argue that this is intentional, that we should not hamper lower echelon commanders in their ability to execute a mission, and that by providing specific verbiage in the orders from a strategic level commander that would tie the hands of the operators. While this is a valid concern, we believe that this viewpoint is shortsighted by not having the full scope of political implications of having the U.S. Navy or Marine Corps provide aid in another country. By allowing the commander to have more direct feedback into whether unmanned vehicles are used, we may be able to provide aid to countries that would have normally declined because of the stigma associated with the United States military, or they could have mandatory requirements that have been promulgated by the State Department to only provide aid remotely. Incorporating unmanned verbiage does not necessitate that all mission sets become more specific or limit a tactical command in their ability to use the appropriate means for executing a successful mission, but if the verbiage is included then it can provide more direct guidance from the strategic level leadership to arrive at the correct desired end state.

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V. RECOMMENDATIONS AND CONCLUSION

A. RECOMMENDATIONS

The use of unmanned vehicles in delivering aid to areas impacted by natural disasters is a new capability. Although this new utility has only been available for a few years, there are limitations that we have discovered that could lead the Navy to better utilization to support foreign governments in their disaster relief. The four recommendations that are outlined below include: to incorporate unmanned vehicles into the Navy's arsenal of tools that can be utilized to distribute aid, procure these drones from already existing civilian technologies, the Military Sealift Command (MSC) be the lead for the deployment of the unmanned vehicles for aid distribution, and that we develop unmanned specific language in our policies, procedures and doctrine to provide senior leadership flexibility in their ability to promulgate orders. We believe that each of these recommendations could provide tangible benefits to the Navy for its implementation of this modern technology and help to service those who are in need.

(1) Incorporate remotely piloted or autonomous drones for delivering humanitarian aid.

Our first recommendation is the naval implementation of remotely piloted aircraft or autonomous surface drones to provide humanitarian aid. Usage of unmanned aircraft has proven effective in response to a HADR setting for many reasons. Response speed plays a pivotal role concerning HADR, and unmanned aircraft can drastically decrease response times. For example, by not requiring large surface areas to deploy the aircraft, smaller boats or ships can potentially get closer to the affected areas to lend support and, in turn, be able to resupply the drone quicker to deliver another aid package.

Difficult or inaccessible to reach areas by car or on foot will also be alleviated through drone usage by getting to those areas quickly to provide support and to gain invaluable data which can be used to create maps or plans to get boots on ground to support those dire areas in need of assistance (EKU, 2020 and Leetaru, 2015). Data collection and mapping of the affected areas will also help build the most effective assistance strategy in

which the Navy and other organizations will be able to prioritize the areas that are in most need of help. (EKU, 2020).

According to Apte in 2022, the U.S. Navy performed major HADR missions more than 20 times and many more minor HADR missions from 2000 through 2018. Utilization of remotely piloted aircraft or autonomous drones will decrease the burden of USN assets required to be taken off previous missions to support the new HADR mission. With increased HADR efforts due to climate change, it will eventually become impossible to send our naval assets to aid each humanitarian effort within the INDOPACOM operational theater. By deploying drones to support instead of the limited number of warships, it will give needed agility for our Navy to support other significant missions.

With current heavy emphasis on helicopters and their unique position to be effective at responding to HADR missions, the USN has a heavy inclination towards using LHDs, LHAs, CVNs, and LPD's to respond to HADR missions (Moffat, 2014). Daily operating costs for pulling these vessels into austere ports have exceedingly prohibitive husbanding service costs. For example, the highest USN ship costs, the CVN, daily operating costs in 2013 averaged $1.24M and the lowest cost's, the LPD, daily operating costs in 2013 was $144K (Yoho et al., 2013). Utilizing drones or remotely piloted aircraft will reduce costs associated with mooring pier side during humanitarian missions as the ship's would be better suited to provide support at sea.

(2)   The U.S. Navy should procure commercial unmanned vehicles to provide foreign humanitarian assistance.

As climate change continues to worsen around the world, the Navy needs to be able to aid countries that need aid using assets that are immediately available. Through the Planning, Programming, Budget, and Execution (PPBE) process that the Navy is required to use, there are avenues that can be utilized to speed up the process of procurement and provide additional capability faster (DAU, 2023).

On the Defense Acquisition University website, it details that the PPBE process has two avenues typically used to fulfill a requirement deemed necessary by a branch of service: Middle Tier Acquisition and Major Capability Acquisition. Major Capability

Acquisition (MCA) is the traditional acquisition approach, which has five distinct phases with multiple inspection and decision points that ensure that the procurement will meet the detailed requirements. This process can be time consuming and administratively burdensome. According to the Defense Acquisition University website (2023), the Middle Tier Acquisition (MTA) is a procurement method utilized to swiftly develop prototypes that can be fielded or deployed to demonstrate new capabilities. It is also utilized to produce quantities of systems that utilize proven technologies and require minimal development.

While the MTA still has all the same statutory requirements that the MCA has, many of them are truncated and compressed. They can do this because the technology already exists in the civilian sector and has proven to be mature enough for military application (DAU, 2023). The longest that a program using the MTA can be in service is five years, while there is no mandatory timeline that the MCA must adhere to. The MCA requires a much more structured approach but provides more guarantees that the final product will be able to suffice in meeting mission requirements.

One example of a technology already commercially available is the Chaparral built by Elroy Air. As is stated in the Elroy Air article from 2020, the Chaparral is an electric or hybrid-electric Vertical Takeoff and Landing (VTOL) aircraft that can deliver between 250–300 lbs. of cargo up to 300 miles. The Chaparral is unmanned and can either be operated autonomously or partially remote-piloted to conform with airspace regulations.

According to the Elroy Air website, they have partnered with the U.S. Air Force to begin the procurement process to acquire and utilize the Chaparral for completing humanitarian coordination and disaster relief mission sets. Additionally, they have a Cooperative Research and Development Agreement (CRADA) with the Naval Postgraduate School (NPS) to learn how the military would be able to better utilize these assets (Serpico, 2019). Through this CRADA, NPS would gain a better understanding of these assets, their capabilities, and limitations, and how best to utilize these unmanned vehicles for cargo pickup and delivery. Utilizing these newly formed partnerships would assist in the distribution and implementation of these UAVs to support foreign humanitarian assistance missions faster than if they were to be developed organically by the Navy.

There are other commercial vendors that may be able to meet the requirements for the Navy to procure unmanned vehicles, but by using the middle tier acquisition process to procure ready-made civilian equipment they will be able to execute this primary mission earlier and potentially save lives and ease human suffering.

(3)   MSC (Military Sealift Command) should take lead for drone humanitarian aid distribution.

The Combat Logistics Force (CLF) can also play a critical role in supporting Humanitarian Assistance and HADR missions. The Military Sealift Command (MSC) has substantial logistical knowledge in executing HADR missions, should take the lead for drone humanitarian aid and distribution. Fleet Oilers (PM1/T-AO), Fleet Ordinance and Dry Cargo (PM6/T-AKE), Fast Combat Support (T-AOE), and Expeditionary Fast Transport (PM8/T-EPF/JHSV) with storerooms that can serve to assist in relief scenarios. MSC has mastered the ability to rapidly support naval warships around the world, including INDOPACOM, and with additional training can increase their skillset by learning how to effectively conduct loadouts to drones onboard their ship.

The NGLS (Next Generation Logistics Ships) can supplement the CLF (Combat Logistics Force) by serving as a versatile and adaptable means of transporting fuel, personnel, equipment, and supplies between various locations at sea, including advanced bases, ports, and dispersed nodes of the sea base. This capability enables the support of Surface Action Groups (SAGs) and Expeditionary Advanced Base (ESBs) requirements afloat and ashore (DOD, 2022). Augmenting the MSC's role to include drone distribution will enable U.S. Forces to stay on their current missions. From 1979 to 2000, U.S. Forces have been redirected from their original missions for humanitarian assistance 366 times, compared to only 22 times for combat missions (Apte, Yoko 2018). Although HADR missions have allowed the United States Navy to promote stability and security as well as build and strengthen relationships with allies and partners, the growing number of HADR missions each year will not be attainable for the USN to respond to. Having MSC augment the USN by housing drones and being able to support offshore with their expertise in supply loadouts to active drones to give aid in HADR missions will be substantially reduce the

burden of conventional naval forces to react to each HADR event and provide cost savings by decreased need of husbanding services while in port in each foreign country.

        (4)   The U.S. Navy should include unmanned vehicle specific language in our policies, procedures, and doctrine.

There are many reasons why a Geographic or Component Commander may need added flexibility when assigning forces to conduct a humanitarian mission. Providing the option to utilize unmanned vehicles for aid distribution is one option that we can provide to our executive level leadership, and a necessary administrative requirement. Potential reasons could include not being able to send in military forces to an affected region because of the increased operational risk associated with having service members in the disaster zone. Poor diplomatic relations with the host country could increase hostilities in an already stressed environment if service members were to deploy. Redistributing naval or other national assets to support an FHA mission could mean a delay or annulment of a previously assigned mission, even one that has been previously deemed vital for national security. This is illustrated from Apte and Yoho (2018) where they found that U.S. forces had been diverted from previously assigned missions to provide humanitarian assistance from disaster relief 366 times between 1979 and 2000. As has been illustrated multiple times previously, the number and severity of natural disasters are increasing in INDOPACOM, and it can be inferred that the Navy's response will continue to these disasters will grow in proportion.

When a natural disaster that the State Department decides necessitates military support, the Geographic or Component Commander will direct his staff to draft Warning (WARNORD) and Operational Orders (OPORD) to provide to the operational assets for execution. Their staff will draw from existing orders and standard joint and naval doctrine to draft and then promulgate them. Having the ability for these staffs to be able to give more direct guidance on what the Commander's intentions are, based on the potential costs and benefits that were outlined in the previous paragraph, could help the tactical decision makers utilize the appropriate tools to achieve the Commanders desired end state. Currently the Universal Joint Task List (UJTL) has standardized mission sets that include conducting humanitarian assistance, coordinating with Non-Governmental Organizations, and

conducting stabilization efforts (JCS, 2023), but neither in the title or description of the mission have any reference to utilizing unmanned vehicles. Our proposal would be to either include the usage of unmanned vehicles in the description of the existing standard mission sets, or to create entirely new missions for the exclusionary use of utilizing unmanned vehicles. Having a standardized mission set for using these technologies would not preclude from including the standard humanitarian assistance missions in the WARNORD or OPORD but allow for the different echelon commanders to give more explicit guidance when they see fit.

B.   CONCLUSION

Recommending the usage of unmanned vehicles for delivering humanitarian aid is a practical and effective solution to help bolster the United States Navy's ability to react to HADR missions. The MSC expertise in logistical operations, should take the lead in terms of drone delivery to execute this mission. Procuring commercial unmanned vehicles will save time and resources compared with the regular contracting process. The integration of drones into the UJTL and UNTL will enable the USN to maximize the benefits of unmanned technology for future operations. By embracing drones and unmanned remotely piloted aircraft, the Navy can better serve those in need during humanitarian crises while also enhancing its operational capabilities. The DOD should consider these recommendations as it moves forward with humanitarian aid efforts.

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