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THESIS

**ALL HANDS ON DECK: A PREPAREDNESS ANALYSIS
OF MUNICIPAL FIRE DEPARTMENT MUTUAL AID
DURING FIRES ABOARD U.S. NAVY VESSELS**

by

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September 2023

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DEPARTMENT MUTUAL AID DURING FIRES ABOARD U.S. NAVY VESSELS**

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ABSTRACT

Major fires aboard U.S. Navy vessels undergoing maintenance routinely require assistance from municipal fire departments for extinguishment. The spontaneous merging of these fire agencies during such incidents brings inherent operational challenges. How prepared are municipal fire departments and federal firefighting entities to perform mutual aid during a major fire aboard a U.S. Navy vessel in port for maintenance? This thesis investigates this preparedness by evaluating two case studies, major fires aboard the USS *Miami* (SSN-755) and USS *Bonhomme Richard* (LHD 6); analyzing the ship fire policies of three municipal fire departments; and interviewing subject-matter experts from agencies associated with mutual aid fire operations. The research findings indicate a varying degree of preparedness among municipal fire departments in conducting this mutual aid successfully. Differing levels of shipboard firefighting proficiency, equipment incompatibility, and various methods for assessing risk are three primary research findings that substantiate the conclusion that municipal fire departments are inconsistently prepared to perform mutual aid firefighting aboard U.S. Navy vessels. The preparedness inconsistencies stem from three existing gaps—capability prioritization, dedicated resourcing, and joint training participation.

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LIST OF ACRONYMS AND ABBREVIATIONS

BFD	Bremerton Fire Department
<i>BHR</i>	(USS) <i>Bonhomme Richard</i>
DC	damage control
EFD	Everett Fire Department
FDNY	New York City Fire Department
FEDFIRE	Federal Firefighting Department
FFD	Federal Fire Department
FEMA	Federal Emergency Management Agency
F&ES	fire and emergency services
FRP	Fire Response Plan
ICS	Incident Command System
IRB	Institutional Review Board
MHz	megahertz
MOU	memorandum of understanding
NAVSEA	Naval Sea Systems Command
NFPA	National Fire Protection Association
NFTI	naval firefighting thermal imager
NIMS	National Incident Management System
PKP	purple-K powder
PNSY	Portsmouth Naval Shipyard
PNSYFD	Portsmouth Naval Shipyard Fire Department
SCBA	self-contained breathing apparatus
SDFD	San Diego Fire Department
SFD	Seattle Fire Department
SOP	standard operating procedure
USCG	United States Coast Guard
USN	United States Navy
VHF	very high frequency

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EXECUTIVE SUMMARY

Major fires aboard U.S. Navy (USN) vessels undergoing maintenance routinely require mutual aid assistance from nearby municipal fire departments for extinguishment. History has shown that the spontaneous merging of fire agencies during these dynamic incidents brings inherent operational challenges.¹ Differing levels of shipboard firefighting proficiency, equipment compatibility, and methods for assessing risk are examples of integration challenges.² This thesis investigates the preparedness levels of municipal fire departments and federal firefighting entities in performing mutual aid during a major fire aboard a USN vessel in port for maintenance. The research involved studying mutual aid integration during two real-world fires aboard USN vessels, a ship fire policy analysis of three municipal fire departments, and findings from interviews with subject-matter experts from agencies associated with mutual aid fire operations.

This thesis includes two case studies. The first is the fire aboard the USS *Miami* (SSN-755) in May 2012 while under repair at the Portsmouth Naval Shipyard in Kittery, Maine. The second case study examines the July 2020 fire aboard the USS *Bonhomme Richard* (LHD 6) while receiving repairs at Naval Base San Diego in California. The published investigative findings of both incidents identify concerns with the preparedness and integration of the mutual aid provided by nearby municipal fire departments. Case study findings in this thesis include shipboard firefighting deficiencies, troubled incorporation of mutual aid, incompatible equipment, asynchronous risk calculations, inadequate information sharing, and poor interoperable communication.

The policy analysis compares shipboard firefighting response plans of the New York City Fire Department, Seattle Fire Department, and Everett Fire Department, which

¹ K. M. McCoy, “Final Command Investigation into the Fire That Occurred onboard USS *Miami* (SSN 755) at the Portsmouth Naval Shipyard on 23–24 May 2012” (official memorandum, Washington, DC: Naval Sea Systems Command, 2013), <https://www.navsea.navy.mil/Portals/103/Documents/FOIA-PII/ReadingRoom/201411130821.pdf>; Department of the Navy, *Command Investigation into the Fire aboard USS Bonhomme Richard (LHD 6), 12 July 2020* (Washington, DC: Department of the Navy, 2021), [https://www.secnav.navy.mil/foia/readingroom/HotTopics/BHR%20and%20MFR%20Investigations/For%20Release%20BHR%20Command%20Investigation%20\(20%20Oct%2021\).pdf](https://www.secnav.navy.mil/foia/readingroom/HotTopics/BHR%20and%20MFR%20Investigations/For%20Release%20BHR%20Command%20Investigation%20(20%20Oct%2021).pdf).

² Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*, 263–66.

represent the greater fire services' approach to shipboard firefighting. The analysis criteria used for this evaluation are vessel familiarization, interagency communications plans, and unified command considerations. The supporting reference document is municipal fire industry standard National Fire Protection Association (NFPA) 1405, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*.³

This thesis includes personal accounts from individuals providing and coordinating firefighting responses on USN ships. Their first-hand accounts convey the challenges of integrating municipal fire departments into shipboard firefighting operations. The interviews revealed three principal inclinations: municipal fire departments across the country maintain varying degrees of marine firefighting preparedness; collaborative relationships between local fire departments, the federal fire department (FFD), and the USN are critical to mutual success; and some challenges impede municipal fire department compliance with the Naval Sea Systems Command (NAVSEA)'s S0570-AC-CCM-010/8010, *Industrial Ship Safety Manual for Fire Prevention and Response*, and the aforementioned NFPA 1405.⁴

A tremendous discrepancy exists between the USN's apparent expectation for municipal fire departments to perform mutual aid firefighting aboard USN vessels during maintenance and a reciprocating emphasis on maintaining this unique capability by municipal fire department leadership. These research findings substantiate that municipal fire departments are inconsistently prepared to perform mutual aid firefighting aboard USN vessels. Despite published expectations, such as NFPA 1405 and NAVSEA's 8010, not all municipal fire departments expected to respond to USN vessel fires are prepared to perform mutual aid firefighting to the same extent.

³ National Fire Protection Association, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, NFPA 1405 (Quincy, MA: National Fire Protection Association, 2020), <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1405>.

⁴ Naval Sea Systems Command, *Industrial Ship Safety Manual for Fire Prevention and Response*, S0570-AC-CCM-010/8010 (Washington, DC: Naval Sea Systems Command, 2014), https://www.navsea.navy.mil/Portals/103/Documents/FOIA-PH/ReadingRoom/S0570-AC-CCM-010_8010_06Feb14_DistA_Version_26Aug14_smooth.pdf?ver=4-FPh-fXVS8Z1HOZP1xRJg%3D%3D×tamp=1625589459300.

The fundamental origins of the preparedness inconsistencies experienced by municipal fire departments stem from three existing gaps—capability prioritization, dedicated resourcing, and joint training participation. The USN has placed an inordinate expectation on municipal fire departments to perform shipboard firefighting with disproportionate direction and resourcing. The preparedness incongruities identified in this research could improve with shared prioritization among federal and municipal leadership. Such congruence would be an initial step toward broadening municipal fire departments’ focus on establishing and maintaining baseline mutual aid firefighting capabilities.

Currently, the USN expects to receive mutual aid shipboard firefighting capabilities, for which municipal fire departments bear the cost to maintain. Local government budget constraints deter fire department leadership from allocating limited budgetary resources toward maintaining discretionary capabilities. The infrequent need to perform shipboard firefighting on USN vessels perpetuates the decision to limit the investment in this skill set. Having dedicated federal resources to support the expected capabilities would aid in overcoming identified barriers, such as budget constraints and equipment incompatibilities.

Although not a tactical firefighting strategy typically contained in standard operating guidelines, land-based fire departments that respond to marine vessel fires would benefit from establishing a formal policy that commits to participation in joint training.⁵ Agencies that train together exercise and refine their response plans while building understanding and trust through shared experiences. This synergy occurs routinely within individual organizations but becomes more challenging when multiple agencies must come together for collective training. By nature, the simulation of a mutual aid response requires supporting agencies to participate in an external event. Interactions with others lead to

⁵ National Fire Protection Association, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, NFPA 1405 (Quincy, MA: National Fire Protection Association, 2020), 1405–34, <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1405>; U.S. Fleet Forces Command and U.S. Pacific Fleet, *Major Fires Review: Executive Summary* (Washington, DC: Department of the Navy, 2021), [https://www.secnave.navy.mil/foia/readingroom/HotTopics/BHR%20and%20MFR%20Investigations/For%20Release%20Major%20Fires%20Review%20\(19%20Oct%2021\).pdf](https://www.secnave.navy.mil/foia/readingroom/HotTopics/BHR%20and%20MFR%20Investigations/For%20Release%20Major%20Fires%20Review%20(19%20Oct%2021).pdf); U.S. Navy Fire and Emergency Services, “Shipboard Firefighting—Fire Chief Summit,” Chief Alert 2021–11 (Washington, DC: U.S. Navy Fire and Emergency Services, 2021); Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*.

formal and informal information sharing. In a training environment, participants experience first hand the capabilities and limitations of all entities. This knowledge builds a foundation upon which to draw during an actual incident. Recognition-primed decision-making research shows that critical decision-making in high-stress environments, such as a major ship fire, is regularly influenced by the familiarity of the scenario.⁶ The speed of attack directly correlates to how quickly individuals can relate to what they are encountering. Acquaintance with interagency operations best occurs through participation in joint training.

A tremendous benefit of joint training opportunities is that responders can gain exposure to worst-case scenarios without the associated consequences. Such training builds a repertoire of experiences that individuals can draw from when facing something similar. Training like this is even more crucial for municipal fire departments that provide mutual aid support during shipboard fires since they do not face such unique scenarios in their daily operations.

⁶ Gary A. Klein and Roberta Calderwood, *Investigations of Naturalistic Decision Making and the Recognition-Primed Decision Model* (Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 1996), 7, <https://apps.dtic.mil/sti/citations/ADA310303>.

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I. INTRODUCTION

The independence of the maritime transport industry's operations in oceans worldwide can be a barrier to collaboration with external firefighting and emergency response agencies during crises. Whether commercial or military, ships and their crews operate self-sufficiently on the open water away from sustainment for long periods. This powerful capability allows them to navigate remote parts of the earth. Unfortunately, unforeseen incidents can overwhelm this preparedness and require the crew to request mitigation assistance. Fire aboard a vessel is one of these instances. While self-preservation may drive a ship's crew to do whatever possible to resolve an emergency at sea, conditions are different in port when support is considerably closer. Applying the same extreme self-reliance to a ship fire response involving mutual aid resources can be counterproductive and even dangerous.

History has shown that fires aboard docked U.S. Navy (USN) vessels undergoing maintenance present significantly different circumstances from fires on the same ships at sea.¹ Integrating mutual aid during a fire at sea is rarely feasible, so it is not a well-practiced strategy when a fire breaks out on a docked ship. In port, many sailors disembark and assume shore duties, significantly decreasing the number of personnel available to perform firefighting functions. In addition, the ability of the ship's crew to isolate a fire is diminished with the fire alarm and sprinkler systems temporarily turned off. When a fire outruns a ship's finite firefighting capabilities, additional resources are needed to control and extinguish the blaze while minimizing damage to the vessel.² The USN calls upon municipal fire departments to provide such support.

¹ U.S. Fleet Forces Command and U.S. Pacific Fleet, *Major Fires Review: Executive Summary* (Washington, DC: Department of the Navy, 2021), [https://www.secnav.navy.mil/foia/readingroom/HotTopics/BHR%20and%20MFR%20Investigations/For%20Release%20Major%20Fires%20Review%20\(19%20Oct%2021\).pdf](https://www.secnav.navy.mil/foia/readingroom/HotTopics/BHR%20and%20MFR%20Investigations/For%20Release%20Major%20Fires%20Review%20(19%20Oct%2021).pdf); U.S. Navy Fire and Emergency Services, "Shipboard Firefighting—Fire Chief Summit," Chief Alert 2021–11 (Washington, DC: U.S. Navy Fire and Emergency Services, 2021), 8.

² U.S. Coast Guard, *Sector Puget Sound Marine Firefighting Plan*, Section 8100 (Washington, DC: U.S. Coast Guard, 2020), <https://rrt10nwac.com/Files/NWACP/2020/Section%208100%20v21.pdf>.

Land-based fire departments operating in the shipboard environment encounter unique hazards and challenges compared to a structure fire.³ For example, a ship's crew is familiar with navigating the passageways and ladders between the decks. In contrast, municipal firefighters risk becoming lost and running out of air in the dark, smoke-filled labyrinth with few ways out. Fire behavior in a ship differs from that in a structure, requiring divergent mitigation strategies. The common municipal practice of continuous water application may cause listing or even capsize the ship. Moreover, a steel ship with a fire deep in the hull cannot quickly disperse the smoke and heat through rooftop ventilation like a structure fire on land.⁴

USN vessels feature robust life-safety systems to help stop fires early at sea, but drydock repairs often require disabling those systems, thereby increasing risk.⁵ Without them in place, a person conducting a fire watch becomes the first line of defense. The ship's safety relies on that individual's alertness and action when a fire occurs. The USN suffered catastrophic losses with the destruction of the USS *Miami* in 2012 and the USS *Bonhomme Richard* in 2020 following fires that started while in drydock. In addition to the strategic national security implications of prematurely removing vessels from the operational fleet, the estimated costs of these fires totaled \$440 million for the USS *Miami* and over \$3 billion for the USS *Bonhomme Richard*.⁶

The USN's emergency firefighting plans incorporate mutual aid services provided by nearby municipal fire departments, but this strategy assumes departments have proficiency in such response capabilities. The Department of Defense oversees the USN while municipal fire departments answer to their city governments. The hierarchies of these

³ Angelo Verzoni, "Close Quarters," *National Fire Protection Association Journal* 113, no. 5 (2019): 28–35.

⁴ Craig H. Shelley, Anthony R. Cole, and Timothy E. Markley, *Industrial Firefighting for Municipal Firefighters* (Tulsa: PennWell Corporation, 2007).

⁵ Shelley, Cole, and Markley.

⁶ K. M. McCoy, "Final Command Investigation into the Fire That Occurred onboard USS *Miami* (SSN 755) at the Portsmouth Naval Shipyard on 23–24 May 2012" (official memorandum, Washington, DC: Naval Sea Systems Command, 2013), <https://www.navsea.navy.mil/Portals/103/Documents/FOIA-PII/ReadingRoom/201411130821.pdf>; U.S. Fleet Forces Command and U.S. Pacific Fleet, *Major Fires Review: Executive Summary*.

two organizations are distinct. As a result, the unique marine firefighting services that the USN needs from land-based fire departments run the risk of lacking city government priority and support.

In response to the USS *Miami* incident, the USN developed the Naval Sea Systems Command (NAVSEA)'s S0570-AC-CCM-010/8010, *Industrial Ship Safety Manual for Fire Prevention and Response*, in 2014.⁷ This publication establishes federal firefighting preparedness standards and acknowledges the need for municipal mutual aid. Unfortunately, municipal fire departments are not bound to this USN regulation. In addition, National Fire Protection Association (NFPA) 1405, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, is a fire service industry recommendation, not a protocol or standard, making implementation across the industry inconsistent.⁸

A broad spectrum of marine firefighting preparedness exists within municipal fire departments across the United States. Some departments are well outfitted and maintain trained members in these skills. However, others realize their lack of preparedness only after being called upon to provide mutual aid aboard a burning ship. This research studied the preparedness of land-based municipal fire departments compared to the expectations held by the USN and NFPA 1405.

A. RESEARCH QUESTION

How prepared are municipal fire departments and federal firefighting entities to perform mutual aid during a major fire aboard a USN vessel in port for maintenance?

⁷ McCoy, "Final Command Investigation"; Naval Sea Systems Command, *Industrial Ship Safety Manual for Fire Prevention and Response*, S0570-AC-CCM-010/8010 (Washington, DC: Naval Sea Systems Command, 2014), https://www.navsea.navy.mil/Portals/103/Documents/FOIA-PRI/ReadingRoom/S0570-AC-CCM-010_8010_06Feb14_DistA_Version_26Aug14_smooth.pdf?ver=4-FPh-fXVS8Z1HOZP1xRJg%3D%3D×tamp=1625589459300.

⁸ National Fire Protection Association, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, NFPA 1405 (Quincy, MA: National Fire Protection Association, 2020), <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1405>.

B. LITERATURE REVIEW

Governments must conduct successful interagency operations to provide national defense and respond to domestic incidents adequately. Scholars agree that threats to the United States are complex and require collaborative efforts between organizations to resolve them.⁹ However, how well the U.S. government conducts interagency operations is debatable.¹⁰ This literature review considers perspectives on joint military operations and collaboration with civilian agencies at the local, state, and federal levels. Still, scholars disagree about whether government agencies effectively operate when operational control deviates from the standard chain of command, blurring previously distinct lines of effort.

The challenges of interagency collaboration begin with the design of the government's institutions. Richard W. Stewart, chief historian at the U.S. Army Center of Military History, claims that the founding fathers created a government at the highest level based on the separation of powers because they feared that tyranny could emerge from an overly efficient system.¹¹ Bureaucracy and division are lasting results of America's distinct political power design.¹² Successful interagency operations continuously struggle in this environment.

Perhaps, unsurprisingly, the sought-after efficiencies of interagency operations meet resistance in the military. For example, Brigadier General Robert J. Felderman, the J5 deputy director of plans, policy, and strategy at the North American Aerospace Defense Command and the United States Northern Command, has raised the hierarchical challenges agencies encounter when performing joint operations.¹³ Local, state, and federal agencies

⁹ Frederick M. Kaiser, *Interagency Collaborative Arrangements and Activities: Types, Rationales, Considerations*, CRS Report No. R41803 (Washington, DC: Congressional Research Service, 2011), <https://sgp.fas.org/crs/misc/R41803.pdf>.

¹⁰ Kenneth R. Dahl, *New Security for New Threats: The Case for Reforming the Interagency Process* (Washington, DC: Brookings Institution, 2007), <https://www.brookings.edu/wp-content/uploads/2016/06/dahl20070731.pdf>.

¹¹ Kendall D. Gott and Michael G. Brooks, eds., *The U.S. Army and the Interagency Process: Historical Perspectives: Proceedings of the Combat Studies Institute 2008 Military History Symposium* (Fort Leavenworth, KS: Combat Studies Institute Press, 2008).

¹² James Jay Carafano, "Five Missteps in Interagency Reform—And What to Do about Them," *PRISM* 2, no. 3 (2011): 115–24.

¹³ Gott and Brooks, *The U.S. Army and the Interagency Process*.

may participate in a collective response, but each has different chains of command. Responders at the local level report to municipal leaders; state assets report to the governor, and federal forces serve the president.¹⁴ These separate command lines can complicate response preparation due to varying leadership priorities and resources.¹⁵ In this way, competing lines of authority complicate interagency responses.

To combat siloed operations in the U.S. military, the U.S. Congress passed legislation that has received mixed reviews on its effectiveness. The Goldwater-Nichols Act attempted to make the Department of Defense more efficient and unified by emphasizing joint management and administration.¹⁶ Although the legislation has improved the military's approach to collaboration on the battlefield, observers claim that an overemphasis on jointness has come at the expense of leadership development within the respective branches. Efforts of the act to increase joint operations also created undesirable consequences for the military departments' acquisition processes. They have placed civilian leadership in charge of procuring military-required equipment and eliminated uniformed members with extensive operational experience from acquisition responsibilities and advisory roles.¹⁷ As a result, the services have felt unempowered instead of enhanced by this act.

However, not all reviews of the Goldwater-Nichols Act are negative. The intelligence community embraces its impetus for improved collaboration as part of a needed change.¹⁸ The Marine Corps also views the legislation favorably. Given its inherent role as a multidomain force—air, land, and sea—it is not surprising that the Marines

¹⁴ Joint Chiefs of Staff, *Defense Support of Civil Authorities*, JP 3-28 (Washington, DC: Joint Chiefs of Staff, 2018), https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_28.pdf.

¹⁵ National Research Council, *Sustainability for the Nation: Resource Connection and Governance Linkages* (Washington, DC: National Academies Press, 2013), <https://doi.org/10.17226/13471>.

¹⁶ Kathleen J. McInnis, *Goldwater-Nichols at 30: Defense Reform and Issues for Congress*, CRS Report No. R44474 (Washington, DC: Congressional Research Service, 2016), <https://sgp.fas.org/crs/natsec/R44474.pdf>.

¹⁷ Charles Nemfakos et al., *The Perfect Storm: The Goldwater-Nichols Act and Its Effect on Navy Acquisition* (Santa Monica, CA: RAND Corporation, 2009), https://www.rand.org/pubs/occasional_papers/OP308.html.

¹⁸ Martin J. Gorman and Alexander Krongard, "A Goldwater-Nichols Act for the U.S. Government: Institutionalizing the Interagency Process," *Joint Force Quarterly*, no. 39 (2005): 51–58.

embrace the collaborative nature of the act. It has improved the branch's ability to expand its defense posture in the joint environment. Marine officers have increased upward career mobility and the opportunity to serve at the combatant commander and joint staff levels.¹⁹ These alternative voices among the intelligence and military communities reflect differing perspectives on the impact of the Goldwater-Nichols Act on the joint operational environment.

Governmental reviews of the responses to the September 11, 2001, World Trade Center terrorist attacks highlight several challenges associated with interagency response leadership. *The 9/11 Commission Report* describes the problems encountered with joint management in an incident of such magnitude.²⁰ Addressing the challenges requires a response that leverages the capabilities of multiple agencies, each of which has degrees of pre-established operational oversight. This overlap creates friction when the agencies operate jointly in a group setting. Not only does the overlap inhibit information sharing, but it also creates a conflict over who is ultimately in charge. Likewise, the U.S. National Response Team's report cites confusion among federal agency personnel regarding central command at the World Trade Center and Pentagon sites.²¹ Federal and local responders also have unclear leadership roles during joint incidents. The investigative report following the 2020 USS *Bonhomme Richard* fire in San Diego identifies confusion between USN personnel, members of the Federal Fire Department, and municipal firefighters.²² All in all, government and military documents point to the problems of overlapping roles and a failure to establish functional authority during interagency operations.

¹⁹ Asad Khan, *The Goldwater Nichols Act of 1986: Impact and Implications for the Marine Corps* (Quantico, VA: Marine Corps University, School of Advanced Warfighting, 1998), <https://apps.dtic.mil/sti/citations/ADA529074>.

²⁰ National Commission on Terrorist Attacks upon the United States, *The 9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks upon the United States* (New York: Norton, 2004).

²¹ National Response Team, *Observations and Lessons Learned from the World Trade Center and Pentagon Terrorist Attacks*, Interim Final Draft (Washington, DC: National Response Team, 2001), https://nrt.org/sites/2/files/WTC_PENTAGON.pdf.

²² Department of the Navy, *Command Investigation into the Fire aboard USS Bonhomme Richard (LHD 6), 12 July 2020* (Washington, DC: Department of the Navy, 2021), [https://www.secnav.navy.mil/foia/readingroom/HotTopics/BHR%20and%20MFR%20Investigations/For%20Release%20BHR%20Command%20Investigation%20\(20%20Oct%2021\).pdf](https://www.secnav.navy.mil/foia/readingroom/HotTopics/BHR%20and%20MFR%20Investigations/For%20Release%20BHR%20Command%20Investigation%20(20%20Oct%2021).pdf).

The Department of Homeland Security created the National Incident Management System (NIMS) and the Incident Command System (ICS) to better manage interagency collaboration. However, scholars diverge on the degree to which NIMS and ICS successfully direct the command of joint operations in interagency responses. Rosemary O’Leary and Lisa Blomgren Bingham argue that military personnel resist ICS because of the pace of operational decision-making.²³ The military expects battle rhythms tailored to the operation rather than a predetermined flow for any incident. By the same token, Buick, Trainor, and Aguirre claim that ICS and NIMS work best during routine incidents where stakeholders share a common understanding of how the incident should play out.

For this reason, NIMS and ICS pose more challenges during catastrophic events involving multiple agencies lacking a shared operational vision. Expected to implement the standardized ICS in all incidents, many organizations make deviations based on preference. Proficiency correlates with the frequency of use.²⁴ Organizations that implement ICS regularly are more comfortable operating within its framework. Agencies infrequently using ICS are less familiar with its process and have less expertise.

Besides different operational protocols, philosophical risk assessment differences between the USN and municipal fire departments present challenges during joint shipboard fire responses. According to the Office of the Chief of Naval Operations, the Navy Fire and Emergency Services program mission aims to “enhance the Department of Defense’s mission capability by protecting the U.S. homeland and critical bases of operation through risk management, education, and emergency response.”²⁵ The USN may prioritize accomplishing the mission through the protection of tangible assets.²⁶ In contrast, the fire

²³ Rosemary O’Leary and Lisa Blomgren Bingham, *The Collaborative Public Manager: New Ideas for the Twenty-First Century* (Washington, DC: Georgetown University Press, 2009), ProQuest Ebook Central.

²⁴ Jessica Jensen and William L. Waugh, “The United States’ Experience with the Incident Command System: What We Think We Know and What We Need to Know More About,” *Journal of Contingencies and Crisis Management* 22, no. 1 (2014): 5–17, <https://doi.org/10.1111/1468-5973.12034>.

²⁵ Office of the Chief of Naval Operations, *Navy Fire and Emergency Services Program*, OPNAVINST 11320.23G (Washington, DC: Department of the Navy, 2013), <https://www.secnv.navy.mil/doni/Directives/11000%20Facilities%20and%20Land%20Management%20Ashore/11-300%20Utilities%20Services/11320.23G.pdf>.

²⁶ Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*.

service values public and responder safety as the primary concern.²⁷ In this case, military and civilian agencies are at cross-purposes regarding priorities and protocols during critical incidents.

C. RESEARCH DESIGN

The research design for this thesis consisted primarily of a thematic analysis of case studies, policy analysis, and interviews to evaluate the preparedness of municipal fire departments in responding to ship fires safely and effectively on USN vessels under repair in shipyards. This thesis offers recommendations to improve relationships between municipal fire departments and the USN.

1. Thematic Analysis

This research involved reviewing existing investigations and reports from fire incidents on USN vessels to derive common themes. Likewise, the research extracted such themes from the case studies.

2. Case Studies

This thesis provides an analysis of two real-world incidents. The first is the fire aboard the USS *Miami* (SSN-755) in May 2012 while under repair at the Portsmouth Naval Shipyard in Kittery, Maine. The second case study examines the July 2020 fire aboard the USS *Bonhomme Richard* (LHD 6) while receiving repairs at Naval Base San Diego in California. The published investigative findings of both incidents identify concerns with the preparedness and integration of the mutual aid provided by nearby municipal fire departments.

3. Policy Analysis

This thesis contains a policy analysis comparing shipboard firefighting response plans of the New York City Fire Department, Seattle Fire Department, and Everett Fire

²⁷ U.S. Fire Administration, *Risk Management Practices in the Fire Service* (Emmitsburg, MD: U.S. Fire Administration, 2018), https://www.usfa.fema.gov/downloads/pdf/publications/risk_management_practices.pdf.

Department, which represent the greater fire services' approach to shipboard firefighting. Analysis criteria are based on industry standards contained in NFPA 1405.

4. Interviews

This thesis includes personal accounts from individuals providing and coordinating firefighting responses on USN ships. Their first-hand accounts convey the challenges of integrating municipal fire departments into shipboard firefighting operations.

This research project required an Institutional Review Board (IRB) determination to conduct interviews with experts from multiple disciplines on municipal firefighting in the shipboard environment. The IRB office reviewed the human subject research determination request (case identification #4185) and determined that this study met the federal definition of research involving human subjects. This thesis research received the determination number NPS.2022.0063-DD-Y and followed all IRB protocols.

D. CHAPTER OUTLINE

Chapter II examines two major fires aboard USN vessels undergoing maintenance that required municipal fire department mutual aid for extinguishment. Case studies of the USS *Miami* and USS *Bonhomme Richard* provide investigative findings. Chapter III is a shipboard firefighting policy analysis of three municipal fire departments—the New York City Fire Department, Seattle Fire Department, and Everett Fire Department—using the defined analysis criteria of vessel familiarization, interagency communications plans, and unified command considerations. Chapter IV describes the interview research and summarizes the interview findings. The resulting themes include varying degrees of preparedness, collaborative relationships, and compliance challenges. Chapter V contains overall conclusions and recommendations of this research. Specific recommendations address the identified gaps and areas for future research.

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II. CASE STUDY AND RESULTING LITERATURE

This chapter provides an overview of two significant fires aboard USN vessels that have significantly influenced the role and expectations of municipal fire departments in the USN's major fire response plans. It also lends context for the USN's and fire industry's standards for measuring shipboard firefighting preparedness. The case studies examined are the fires aboard the USS *Miami* (SSN 755) in 2012 and USS *Bonhomme Richard* (LHD-6) in 2020, each comprising an overview of the incident and relevant investigative findings. The chapter concludes with an analysis and recommendations for improving mutual aid response operations during major ship fires.

A. USS *MIAMI*

On May 23, 2012, a fire broke out on the USS *Miami* while in drydock undergoing a scheduled 20-month engineering overhaul and systems upgrade at the Portsmouth Naval Shipyard (PNSY) in Kittery, Maine.²⁸ The *Miami* was a 22-year-old Los Angeles-class nuclear propulsion attack submarine that had conducted combat operations supporting Operation Desert Fox and Operation Allied Force when the incident occurred.²⁹ The USN conducted an official administrative investigation of the incident and published the findings in a final report dated May 15, 2013.³⁰

A disgruntled PNSY painter intentionally started the fire one level below the main deck in Wardroom Stateroom 1 at approximately 1730.³¹ A shop supervisor observed heavy smoke and instructed another person on board to activate the casualty control system, a temporary alarm and communications system installed when a ship's permanent onboard life-safety systems are disabled for maintenance. For an unknown reason, after becoming aware of the fire, the sailor responsible for using a carbon dioxide fire

²⁸ McCoy, "Final Command Investigation," 24.

²⁹ "SSN 755—USS *Miami*," Seaforces.org, accessed April 16, 2022, <https://www.seaforces.org/usnships/ssn/SSN-755-USS-Miami.htm>.

³⁰ McCoy, "Final Command Investigation."

³¹ McCoy, 28.

extinguisher for an immediate fire attack did not go below deck to investigate but remained topside.³² This delay in locating the fire and providing fire suppression allowed the fire to grow, spreading to adjacent portions of the *Miami*.

The PNSY Fire Department (PNSYFD) is a federal fire department (FFD) with one fire station, nine apparatus, and 35 members stationed at PNSY.³³ Based on the time of day, 13–15 personnel are on duty to respond to emergencies 24 hours a day. PNSYFD Engine 83 arrived nearly 15 minutes after the fire started, followed by the remaining available PNSYFD firefighting resources.³⁴ The PNSYFD and sailors assigned to the *Miami*, the ship's force, struggled to conduct a coordinated fire attack for the next two and a half hours. Small teams from the ship's force descended into the boat wearing self-contained breathing apparatus (SCBA) and advancing a dry hose line, only to run low on air and return topside before locating the seat of the fire. Flashover likely occurred in Wardroom Stateroom 1 around 1800.³⁵ Flashover happens when every combustible surface exposed to thermal radiation simultaneously ignites, typically when temperatures in the upper portions of the fire compartment reach approximately 1,100 degrees Fahrenheit.³⁶

The PNSYFD struggled to gain control of the fire. Its unfamiliarity with the shipboard environment was evident by the fire chief's need for whiteboards and drawings to understand submarine terminology.³⁷ The inability of the ship's force and the PNSYFD to mount an effective fire attack in the early stages of the fire led to a request for municipal mutual aid. According to the official investigative report, nearly two and a half hours into

³² McCoy, 29.

³³ "Portsmouth Naval Shipyard Fire Department Portsmouth New Hampshire/Kittery Maine U.S. Navy Mid Atlantic Region District 8, Station 26," Northeast Firenews, accessed August 12, 2023, <http://www.firenews.org/nh/p/portsmouthnaval/portsmouthnavaln.html>.

³⁴ McCoy, "Final Command Investigation," 31.

³⁵ U.S. Fleet Forces Command, *USS Miami (SSN 755) Fire Panel Recommendations* (Norfolk, VA: U.S. Fleet Forces Command, 2012).

³⁶ U.S. Fire Administration, "Recognizing Flashover Conditions Can Save Your Life," *Coffee Break Bulletin* (blog), May 5, 2020, <https://www.usfa.fema.gov/blog/cb-050520.html>.

³⁷ McCoy, "Final Command Investigation," 35.

the incident, fire departments within 100 miles responded.³⁸ The following local fire departments provided equipment and personnel in response to the incident: Dover, Eliot, Greenland, Hampton, Hanscom Air Force Base, Kittery, Logan, Massport, Newcastle, Newington, Pease, Rollingsford, Rye, Somersworth, South Berwick, South Portland, Naval Submarine Base New London, York Beach, York Village, and York County.³⁹ Firefighting efforts increased productivity with additional resources on the scene. Hose teams provided continual suppression by rotating in new members instead of abandoning the hose line to exit the boat when their air levels were depleted. Mutual aid units provided for the critical shortage of SCBA bottles as well.

When standing water on the submarine's exterior began turning to steam, firefighters directed pier-side hose streams to the outside surfaces to cool the *Miami*. Fire crews also applied water to the interior through cuts in the hull. Extreme interior temperatures and temporary utilities run throughout the boat to provide power, lighting, and air-inhibited advancement to the seat of the fire. These connections tether the vessel to the shore since the vessel's primary power sources are disabled during maintenance periods.⁴⁰ Adequately resourced and using mutual aid to implement an effective offensive fire attack, the fire teams brought the blaze under control at 0314 and declared it out at 0550, nearly 12 and a half hours after it had started (see Figure 1).⁴¹

³⁸ McCoy, 38.

³⁹ McCoy, 38.

⁴⁰ Shelley, Cole, and Markley, *Industrial Firefighting for Municipal Firefighters*, 228.

⁴¹ McCoy, "Final Command Investigation," 40.



Figure 1. Blaze aboard the USS *Miami*.⁴²

The USN estimated fire damage costs between \$400 and \$500 million and added four to six months to the original drydock schedule.⁴³ Despite initial intentions to return the *Miami* to the fleet, damage assessments rose to almost \$700 million, driving the decision to decommission the attack submarine.⁴⁴ Salvageable equipment was removed from the submarine before tug boats towed it away for scrap.⁴⁵ The *Miami*'s 10-year premature departure from the USN's inventory increased operational stress on the remaining Los Angeles-class submarines deployed worldwide.

⁴² Source: Sam LaGrone, "Navy to Decommission Fire Damaged USS *Miami* Today," USNI News, March 28, 2014, <https://news.usni.org/2014/03/28/navy-decommission-fire-damaged-uss-miami-today>.

⁴³ Colin Clark, "Early Estimate Pegs USS *Miami* Sub Fire Damage Up to \$500 Million," Breaking Defense, June 5, 2012, <https://breakingdefense.sites.breakingmedia.com/2012/06/early-estimate-pegs-uss-miami-sub-fire-damage-up-to-500-million/>.

⁴⁴ LaGrone, "Navy to Decommission Fire Damaged USS *Miami* Today."

⁴⁵ David Sharp, "Damaged Sub *Miami* Leaves Shipyard, to Be Scrapped," *Navy Times*, June 13, 2015, <https://www.navytimes.com/news/your-navy/2015/06/13/damaged-sub-miami-leaves-shipyard-to-be-scrapped/>.

1. Investigative Findings

The USN's formal investigation following the fire on the *Miami* identified concerns leading up to the incident and made recommendations for corrective actions moving forward. Findings that contributed to the incident included insufficient shipboard firefighting skills, the inadequate incorporation of mutual aid, and incompatible equipment.

a. *Deficient Shipboard Firefighting Skills*

The USN accepts increased risk by reducing the ship's force and diminishing fire protection systems' capabilities while workers perform vessel maintenance. Naval leadership mitigates this risk by trusting that professional firefighters are trained and ready to respond to an incident. Although the PNSYFD provides initial fire response capabilities for structural and shipboard incidents, its firefighters did not have an expectation established by their higher authority to train for shipboard firefighting.⁴⁶ Shipboard firefighting is not a required core competency for the FFD either.⁴⁷ According to the "Final Command Investigation into the Fire That Occurred Onboard USS *Miami*," of the 54 fire drills aboard submarines that the PNSYFD has run since 2009, only one tested the crew's ability to keep the fire from spreading to the level above.⁴⁸ The crews conducted most drills with uncharged hose lines, and none were conducted in a degraded visual condition to mimic a smoke-filled environment. The "Final Command Investigation" also states that none of the drills exercised all necessary capabilities to respond "to a major, fully developed fire onboard a ship in drydock."⁴⁹ This lack of realistic firefighting experience led to maritime firefighting knowledge gaps.

During post-incident interviews, the FFDs at the New London Submarine Base and PNSY demonstrated limited submarine familiarity, including layout and standard nomenclature.⁵⁰ Despite these facts, following a regional administrative assessment in

⁴⁶ McCoy, "Final Command Investigation," 22.

⁴⁷ U.S. Fleet Forces Command, *USS Miami (SSN 755) Fire Panel Recommendations*, 46.

⁴⁸ McCoy, "Final Command Investigation," 23.

⁴⁹ McCoy, 23.

⁵⁰ McCoy, 23.

October 2011, the commander of the Navy Installations Command found the PNSYFD “fully ready.”⁵¹ The PNSYFD’s established policy was to ensure every PNSY firefighter had exposure to the interior of the vessels to which they might respond. Companies were required to perform monthly inspections to tour the ships, test fire alarms, and determine access points. PNSYFD inspection records for the *Miami* were incomplete, however.⁵² Had PNSYFD firefighters better familiarized themselves with the *Miami*, they might have been more successful in mitigating this incident at both the strategic and tactical levels.

b. Troubled Incorporation of Mutual Aid

Fundamental USN shipboard damage control doctrine assumes a timely and effective response. At sea, the ability to deploy the right resources rapidly to mitigate the problem makes the difference between the vessel’s staying afloat or sinking. This prediction relies on effectively integrating the ship’s force, the FFD, and mutual aid responders in port. Response operations during the *Miami* fire were not timely, effective, or well integrated. Post-fire investigations revealed a general assumption among shipyard personnel that once notified, the PNSYFD would arrive with the relevant expertise and robust equipment necessary to resolve the problem quickly.⁵³ PNSYFD policy provided that during a response, FFD members would relieve the ship’s force and bring the situation under control.⁵⁴ This premise contradicts NIMS’s use of a unified command during a multijurisdictional or multiagency incident.⁵⁵ A post-incident interview with the PNSYFD fire chief found that although mutual aid from nearby agencies would respond during a major fire, no pre-planned response to request those assets existed.⁵⁶

⁵¹ U.S. Fleet Forces Command, *USS Miami (SSN 755) Fire Panel Recommendations*.

⁵² McCoy, “Final Command Investigation,” 24.

⁵³ U.S. Fleet Forces Command, *USS Miami (SSN 755) Fire Panel Recommendations*, 72.

⁵⁴ U.S. Fleet Forces Command.

⁵⁵ Federal Emergency Management Agency, *National Incident Management System*, 3rd ed. (Washington, DC: Department of Homeland Security, 2017), https://www.fema.gov/sites/default/files/2020-07/fema_nims_doctrine-2017.pdf.

⁵⁶ U.S. Fleet Forces Command, *USS Miami (SSN 755) Fire Panel Recommendations*.

c. Incompatible Equipment

The USN and municipal fire departments use distinct communication devices. Sailors use the vessel's rugged and reliable sound-powered communication system, which allows users to talk to each other without external power. The handheld radios used by the PNSYFD and other mutual aid fire departments are incompatible and prevent firefighters from sharing information.⁵⁷ Without additional equipment to extend the range of handheld radios, users cannot transmit while inside a vessel due to the impenetrable steel structure. Not only does this create operational challenges, but it significantly increases safety concerns. Handheld radio users cannot communicate hazards due to changing fire conditions, disorientation, low air, or injury. To overcome this gap, ship's force members are physically partnered with municipal firefighters to relay information through their respective communication devices. Nevertheless, this solution is resource-intensive and rarely practiced.

2. Resultant Documentation

As a result of the *Miami* fire, NAVSEA created the *Industrial Ship Safety Manual for Fire Prevention and Response*. Commonly referred to as the 8010, this document represents the effort to address fire prevention gaps during the *Miami* incident. As noted in the manual, its purpose is to “provide a single source document of requirements for the prevention of, detection of, and response to fires onboard Navy vessels during industrial work to ensure safety of equipment and personnel.”⁵⁸ The manual specifies that multiple organizations have “distinct and shared responsibilities for shipboard fire prevention and response” and that NIMS is the standard for incident management.⁵⁹

Chapters 12 and 13 of the manual specifically address fire drill requirements and mutual aid incorporated into the response. The manual specifies that “fire drills shall be conducted every 90 days for submarines and every 180 days for surface ships in chief of

⁵⁷ McCoy, “Final Command Investigation,” 53.

⁵⁸ Naval Sea Systems Command, *Industrial Ship Safety Manual*, 29.

⁵⁹ Naval Sea Systems Command, 31.

naval operations (CNO) scheduled availabilities (scheduled for greater than 6 months duration).”⁶⁰ Chapter 12, which details fire drills by design, addresses the gaps identified during the *Miami* and other previous fire responses. Examples include using charged hose lines, conducting extended response operations, and training in an environment with partially obscured visibility. Additional variables, such as equipment failures and communication issues, must be incorporated annually.⁶¹ Chapter 12’s drills have prescribed design, execution, and evaluation requirements; discourage the nationalization of mutual aid fire and emergency services (F&ES), and require a corrective action plan and reevaluation within 30 days for any unsatisfactory grades.⁶² Chapter 13 of NAVSEA’s manual stipulates that an annual fire drill “comprehensively evaluates the ability of ship repair and construction activities to execute its full Fire Response Plan (FRP) and Emergency Response capability, and provides the attributes, guides, and criteria for planning and executing the drills.”⁶³ These drills build on the fire drills established in Chapter 12 and include echelons of the USN’s command well above the evaluated group. NAVSEA’s manual encourages the incorporation of mutual aid support into FRPs but does not require the participation of these organizations in the prescribed drills. As a result, external F&ES agencies participate of their own accord.

3. Summary

The *Miami* fire demonstrates the response challenges associated with a significant USN vessel fire in a maintenance environment. The firefighting plans and sailor availability at sea are different from in port. An integrated fire response with multiple external agencies is required to locate and extinguish the fire rapidly. Time is of the essence during fire suppression. The development of the 8010 is evidence that the USN places a high priority on maritime firefighting with the intent of avoiding future catastrophic fire

⁶⁰ Naval Sea Systems Command, 118.

⁶¹ Naval Sea Systems Command, 113–14.

⁶² Naval Sea Systems Command, 117.

⁶³ Naval Sea Systems Command, 119.

damage. The new doctrine outlines the USN's expectations to achieve a coordinated and well-rehearsed interagency response.

B. USS *BONHOMME RICHARD*

On July 12, 2020, a fire started aboard the USS *Bonhomme Richard* (*BHR*). Fire investigators later determined that the fire had originated in the Lower Vehicle Stowage Area (Lower V). The ship was undergoing two years of scheduled maintenance at Naval Base San Diego and was subject to increased fire risk due to non-operational fire protection systems. Sailors saw white smoke coming from the Lower V at about 0800.⁶⁴ Damage Control Central, the group of sailors on the *BHR* responsible for controlling damage caused by fire or collision, was immediately notified. Members investigating the situation were forced back from the Lower V by heat and smoke. By approximately 0820, *BHR* sailors assembled in the hangar to don firefighting ensembles. Around the same time, crews from nearby ships, the USS *Russell* (DDG-59) and the USS *Fitzgerald* (DDG-62), observed smoke coming from the exterior of the *BHR* and prepared rescue and assistance teams to help. Despite conflicting reports on the exact event order, *BHR* personnel assigned as investigators initially descended to the Lower V equipped with naval firefighting thermal imagers (NFTIs) and dry chemical fire extinguishers (purple-K powder [PKP] bottles) to locate the seat of the fire.⁶⁵ NFTIs identify heat signatures in low-visibility environments, and PKP bottles contain potassium bicarbonate powder, an extinguishment agent for flammable liquid and electrical fires. These investigative efforts were unsuccessful due to the heat and smoke encountered (see Figure 2).

⁶⁴ Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*, 35.

⁶⁵ Department of the Navy, 38.

Navy finds 'repeated failures' in Bonhomme Richard fire

Once the July 12, 2020, fire aboard the Bonhomme Richard spread from the lower vehicle storage area to the space above it, the chance of stopping the blaze was lost, a Navy investigation found. In many areas, fire and explosions created large openings between the decks and ship spaces.

■ Fire damaged areas

Bonhomme Richard Amphibious assault ship, Wasp class

Used by the Navy to carry Marines and Marine equipment for amphibious operations.

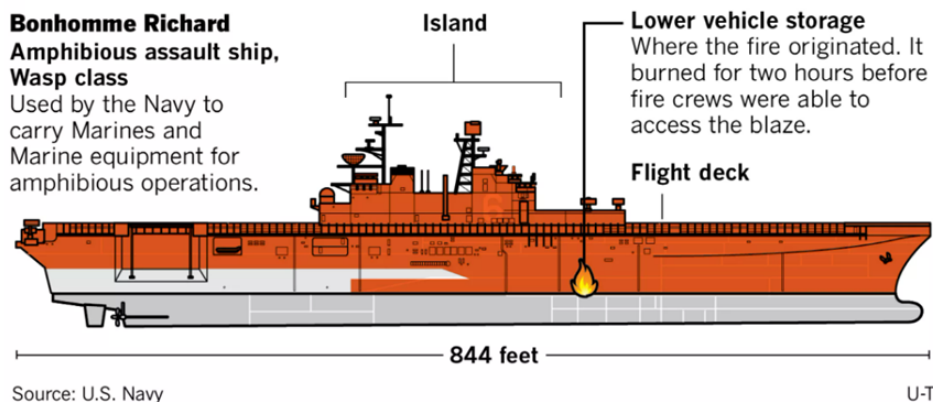


Figure 2. Diagram of the Fire's Origin on USS *Bonhomme Richard*.⁶⁶

BHR sailors wearing SCBAs formed two hose teams and reportedly went on air at 0840 and 0904, respectively.⁶⁷ Although tasked to apply water to the fire, neither team took a hose line. The first team descended from the hangar to the Upper Vehicle Stowage Area (Upper V), planning to utilize the prepositioned fire hoses at one of the ship's many hose storage racks. Unfortunately, the team found both hoses unserviceable. Workers had utilized one hose for non-emergency purposes, and the other, for an unknown reason, had the couplings cut off.⁶⁸ Without usable firehoses, the team returned to the hangar, which allowed the fire to grow.

In addition to challenges with water application, the ship's force struggled to establish fire boundaries to confine the blaze. Setting fire boundaries is a common tactic

⁶⁶ Source: Andrew Dyer, "Bonhomme Richard Fire Burned Unabated for 2 Hours, Navy Finds, Blaming Top Officers and Crew," *San Diego Union-Tribune*, October 20, 2021, <https://www.sandiegouniontribune.com/news/military/story/2021-10-20/navy-failures-bonhomme-richard-fire>.

⁶⁷ Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*, 40.

⁶⁸ Department of the Navy, 29.

used in the maritime community and taught by the USN.⁶⁹ Crews limit the fire's ability to spread by closing specific doors and hatches throughout the ship. However, temporary services passing through openings throughout the ship complicated this process on the *BHR*. Post-fire investigations revealed that the ship's force members were unfamiliar with the quick disconnects on the cables and hoses as limited training had been provided on this skill when the *BHR* entered into maintenance.⁷⁰ Additionally, portions of the ship, like the Upper and Lower V areas, were too large and open to effectively limit the spread of fire. Inadequate fire suppression and the inability to limit the fire spread were not the only problems that *BHR* crews experienced. The integration of additional resources also proved cumbersome. Sailors from the USS *Russell* and USS *Fitzgerald* saw the smoke and offered assistance, but the Federal Fire Department (FEDFIRE) told them to stand by and never used them as part of the response.

FEDFIRE San Diego consists of 12 stations surrounding San Diego Bay. Its purpose is to provide crash, fire, rescue, and hazmat response services to USN installations and facilities in the San Diego area. Battalion 12 provides initial response coverage to Naval Base San Diego.⁷¹ Of the on-duty units that day, the official *BHR* after-action report recounts the involvement of Engine 161, Engine 12, Engine 19, Truck 17, and some command presence. FEDFIRE arrived on scene at 0829 and received a report that the location of the fire was still unknown. For roughly half an hour, FEDFIRE Engine 161 laid fire hose throughout the hangar and down toward the Lower V. This labor-intensive work resulted in FEDFIRE members running low on air and having to exit the ship before locating the seat of the fire. Truck 17 replaced Engine 161 and reached the bottom of the Lower V ramp but had to retreat due to low water, low air, heat upwards of 500 degrees Fahrenheit, and zero visibility. Their replacements, Engine 12, encountered similar challenges and had to back out. Members of Engine 19 replaced Engine 12 but made it

⁶⁹ Herman Miller, John McIntire, and James Southerland, *Damage Controlman*, NAVEDTRA 14057 (Pensacola, FL: Naval Education and Training Professional Development and Technology Center, 2001), 9, <https://maritime.org/doc/pdf/damagecontrolman.pdf>.

⁷⁰ Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*, 30.

⁷¹ Department of the Navy, 176.

only as far as the Lower V ramp before turning around. The combination of fire spreading to the Upper V, members running low on air, and confusion with the deployment of San Diego Fire Department (SDFD) firefighters contributed to FEDFIRE's complete withdrawal. Although FEDFIRE did incorporate some of the ship's force into its teams, the consensus among the *BHR*'s sailors was that upon their arrival, FEDFIRE had assumed responsibility and control of firefighting efforts.⁷² This erroneous assumption highlighted that each agency conducted siloed fire operations without integration.

At 0900, the first SDFD units arrived to provide mutual aid. Although many *BHR* sailors knew where the fire was by this time, FEDFIRE briefed the SDFD that the fire location was still unknown and instructed its members to assist the FEDFIRE crew in advancing hose lines. Within minutes, units from other municipal fire departments, including National City, Chula Vista, and Coronado, arrived at the request of the SDFD for additional resources. The municipal fire departments on scene had interoperable radio systems and extensive experience working together. They naturally assembled under the SDFD command structure, with the senior ranking member of the SDFD serving as the incident commander, who partnered with FEDFIRE to establish a unified command. After relocating on the pier, an SDFD team entered the ship from the Side Port Ramp on the Upper V level and determined the vicinity of the fire one deck below. Nearly two hours after the fire had started, SDFD teams advanced into the ship far enough to apply water to radiant fires burning on the Upper V. Although crews aggressively attacked the fire for 45 minutes, its size and intensity halted their progress.

The conditions on the ship continued to deteriorate. A series of decisions by the ship's force led engineers to secure all shore power to the ship, leaving the *BHR* with a total loss of power. Without power, all fire suppression systems were rendered useless. Smoke conditions also started to change. Firefighters on the pier observed heavy black and yellowish smoke moving back into the ship, characteristics of a pending smoke explosion.⁷³ Smoke explosions occur when the mixture of smoke, heat, and pressure

⁷² Department of the Navy, 34.

⁷³ David W. Dodson, "The Art of Reading Smoke," *Fire Engineering*, June 27, 2014, <https://www.fireengineering.com/leadership/david-dodson-the-art-of-reading-smoke/>.

combine to the point of ignition.⁷⁴ At 1035, members of the SDFD indicated they had “lost the space” in the Upper V, meaning the fire had grown in size to the point that suppression efforts were no longer practical (see Figure 3).⁷⁵ The unified command recognized the deteriorating conditions and initiated a complete withdrawal of firefighters on the *BHR*. Retreating firefighters narrowly missed being caught in a smoke explosion in the Upper V moments later. Everyone evacuated the pier, and fire crews set up unmonitored devices to apply water from the exterior. Agency leaders convened to determine a new location for the incident command post and develop an updated firefighting strategy. The SDFD committed to supporting the firefighting effort but declared that SDFD personnel would not reenter the *BHR*. According to SDFD policy, “Activities that pose a significant risk to firefighters shall only be taken when there is a potential to save lives.”⁷⁶ Because all sailors had evacuated the *BHR*, the SDFD was unwilling to risk the safety of its members for the USN vessel. This decision frustrated the USN and FEDFIRE leadership, which placed significant value and importance on saving the *BHR* as a naval asset. After a series of discussions, FEDFIRE informed the SDFD that its members could leave if they were not going to return to the ship for firefighting.⁷⁷ In response, the SDFD left a liaison with FEDFIRE for advising purposes, and all municipal agencies collected their equipment and departed the scene. The departure of the SDFD and municipal fire departments created confusion and disappointment among *BHR*’s leadership.

⁷⁴ Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*, 47.

⁷⁵ Department of the Navy, 45.

⁷⁶ Randy Wilkinson and Andrea Dominguez, “Firefighter Safety,” chap. 3 in *SDFD Drill Manual*, ed. John Brubaker et al. (San Diego: San Diego Fire Department, 2018), 3–5.

⁷⁷ Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*, 54.



Figure 3. The USS *Bonhomme Richard* Overwhelmed by Smoke.⁷⁸

Over the next several days, the USN transitioned to defensive firefighting tactics, utilizing tugboats capable of applying large volumes of water to the ship's exterior and helicopters that dropped water from the air. On July 16, 2020, nearly five days after the fire had started, the USN declared the fires aboard the *BHR* had gone out.⁷⁹ The USN determined that the cost to repair the resulting damage on the *BHR* would exceed \$3 billion and take five to seven years to complete.⁸⁰ The USN officially decommissioned the *BHR* on April 14, 2021, during a ceremony at Naval Base San Diego.⁸¹ The next day, tug boats started towing the stripped-down hull of the former warship to a scrapyard on the Gulf Coast.⁸²

⁷⁸ Source: Dyer, "Bonhomme Richard Fire Burned Unabated for 2 Hours."

⁷⁹ Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*, 69.

⁸⁰ Dustin Jones, "Navy Will Dismantle USS *Bonhomme Richard*," NPR, November 30, 2020, <https://www.npr.org/2020/11/30/940302619/navy-will-dismantle-uss-bonhomme-richard>.

⁸¹ "Navy Decommissions USS *Bonhomme Richard*," U.S. Navy, April 15, 2021, <https://www.navy.mil/Press-Office/News-Stories/Article/2573452/navy-decommissions-uss-bonhomme-richard/>.

⁸² Sam LaGrone, "Former USS *Bonhomme Richard* Towed from San Diego Ahead of Scrapping," USNI News, April 15, 2021, <https://news.usni.org/2021/04/15/former-uss-bonhomme-richard-towed-from-san-diego-ahead-of-scrapping>.

1. Investigative Findings

The USN assembled a command investigation team to conduct an in-depth review of the circumstances surrounding the *BHR* fire and the actions taken in response. The report revealed several challenges associated with effectively incorporating mutual aid firefighting agencies into the response. These included differences in calculating risk, inadequate information sharing, and poor interoperable communications.

a. *Asynchronous Risk Calculations*

FEDFIRE and municipal fire departments demonstrated fundamental differences in risk assessment during the *BHR* fire. The SDFD, the lead agency for the municipal fire departments on the scene, applied the firefighting priorities contained in the SDFD's *Drill Manual*: "Activities that pose a significant risk to firefighters shall only be taken when there is potential to save lives."⁸³ Knowing that all *BHR* sailors were safe and having experienced an intense explosion from within the ship, the SDFD was unwilling to conduct offensive tactics by placing its members aboard the *BHR* to save property, not lives. Instead, the SDFD deemed it appropriate to conduct defensive tactics from the pier with its personnel.

FEDFIRE demonstrated a greater tolerance for placing its members in positions of increased risk to save the *BHR* from destruction. USN policy adheres to a risk threshold similar to the SDFD's. However, it directs the incident commander—in this case, FEDFIRE—to manage the operational risk during shipboard fires.⁸⁴ As outlined by the Office of the Chief of Naval Operations, "It is imperative F&ES personnel or other first responders do not risk their safety when there is no possibility to save lives. In situations where the risk to F&ES personnel is excessive, activities are limited to defensive operations."⁸⁵ FEDFIRE's position to direct operations with increased risk during this incident was perplexing given its own internal shipboard firefighting guideline. FEDFIRE

⁸³ Wilkinson and Dominguez, "Firefighter Safety," 3–5.

⁸⁴ Office of the Chief of Naval Operations, *Navy Fire and Emergency Services Program*, 5–1.

⁸⁵ Office of the Chief of Naval Operations, 5–1–2.

Metro Standard Operating Guideline 176 indicates, “FEDFIRE will not support Ship’s Force personnel who engage in fire suppression activities when there is a risk of imminent danger to FEDFIRE personnel due to explosives.”⁸⁶ The *BHR* fire highlights the need for a synchronized and adopted risk analysis calculus across all agencies involved. Mutual aid firefighting tactics can be employed effectively only when all parties involved have the same commitment to the operation.

b. Inadequate Information Sharing

Fire operations suffered from insufficient information sharing between agencies during the *BHR* fire. The ship’s force, FEDFIRE, and the SDFD all conducted independent operations during critical portions of the response. *BHR* sailors knew the fire’s general, if not specific, location but did not explicitly share it with either FEDFIRE or the SDFD.⁸⁷ Conversely, responding fire agencies did not adequately bring the ship’s force into the response effort. *BHR* sailors erroneously assumed that the arrival of FEDFIRE had relieved them of firefighting operations. As a result, FEDFIRE and the SDFD duplicated fire attack efforts, spending tremendous time and energy unnecessarily searching for the fire.

Both FEDFIRE and the SDFD were unfamiliar with the *BHR*’s layout. Sailors use printed schematics of the ship, referred to as damage control (DC) plates, to track and coordinate firefighting operations. DC plates could have served as a map for supporting agencies to navigate the ship more efficiently but were not provided to FEDFIRE or the SDFD.⁸⁸ The fire investigation report indicates that FEDFIRE had asked for DC plates in advance, but the USN denied the request because the information was classified. *BHR* crews reportedly left the DC plates aboard the ship when they evacuated. It was not until the USS *Boxer* (LHD-4), a nearby ship with a similar layout, delivered its DC plates to the incident command post that FEDFIRE and SDFD chiefs understood the interior layout. Without a map, fire crews lost precious time navigating the ship while the fire continued to spread.

⁸⁶ Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*, 178.

⁸⁷ Department of the Navy, 263.

⁸⁸ Department of the Navy, 263.

c. Poor Interoperable Communications

Communications between agencies challenged the incident from the beginning. Incompatible portable radios forced FEDFIRE and the SDFD to conduct face-to-face communications.⁸⁹ The radios that FEDFIRE uses operate on an antiquated 400-Megahertz (MHz) system. The SDFD has 800 MHz radios compatible with every firefighting agency in San Diego County, except FEDFIRE.⁹⁰ Although San Diego Metro Dispatch and the Regional Dispatch Center could patch the two departments' communications onto the same channel, FEDFIRE leadership was unfamiliar with this capability and preferred to swap radios on the fire ground instead.⁹¹ FEDFIRE believed that patched communications would have resulted in delayed transmissions and saw the technique as more inhibiting than helpful.⁹² More frequent mutual aid training focused on communications would have eliminated these false assumptions.

2. Summary

The *BHR* incident reinforces how unique and dangerous the ship maintenance environment can be. It also shows that policy alone will not detour the disastrous impacts of a ship fire. Despite the USN's implementation of the 8010 following the *Miami* fire, the *BHR* ship's force, FEDFIRE, and the SDFD-led municipal fire departments were not well versed or coordinated in their response. None of these agencies had prepared to effectively combat the fire with the speed necessary to prevent spread and provide extinguishment.

C. CONCLUSION

This chapter identified the potential for a catastrophic fire aboard a USN ship while under maintenance. The review of fires aboard the *Miami* and *BHR* highlights the operational deficiencies of incorporating municipal fire department mutual aid. An analysis

⁸⁹ Department of the Navy, 265.

⁹⁰ Department of the Navy, 192.

⁹¹ Department of the Navy, 193.

⁹² Department of the Navy, 265.

of these fire incidents reveals issues with skill proficiency, incompatible equipment, risk management, non-interoperable communications, and information sharing.

Despite doctrinal requirements to incorporate mutual aid support, the USN failed to successfully integrate local fire department resources into its responses. The post-fire investigations for both fires show that the *Miami* and *BHR* ship's force and the respective FFD agencies lacked proficiency in conducting major ship fire operations. The inability to promptly locate and suppress these fires suggests that the USN and FFDs underestimated the skill, equipment, and resources needed to perform these firefighting functions in a shipboard environment. Complacency may have also contributed to a sense of overconfidence.

These case studies illuminate the need to incorporate municipal fire departments into training events focused on exercising shipboard firefighting response plans. The 8010 addresses the need for non-federal F&ES support during a major ship fire. However, no regulatory requirement exists for mutual aid partners to participate in the fire drills prescribed in Chapter 12 or 13. The NFPA, which sets the fire service's recognized standards, acknowledges that "the value of a marine firefighting exercise is immeasurable."⁹³ Unfortunately, municipal fire department compliance with NFPA standards is voluntary.⁹⁴ The lack of combined training among stakeholders in the *Miami* and *BHR* fires led to late disturbing revelations. It was only during the response that FEDFIRE realized the coupling threads on its fire hoses were incompatible with the fire hoses on the *BHR*. This oversight meant that the two agencies' hoses could not be connected and forced FEDFIRE to spend precious time laying redundant hoses throughout the ship rather than simply extending off the already laid lines.⁹⁵ Similarly, municipal fire departments providing mutual aid were unfamiliar with the interior layout of the vessels and experienced radio compatibility issues with FEDFIRE and the ship's force. These concerns could have been resolved well before an interagency ship fire response.

⁹³ National Fire Protection Association, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, 1405–34.

⁹⁴ National Fire Protection Association, 1405–1.

⁹⁵ Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*, 34.

The *Miami* and *BHR* represent just two of the major ship fires aboard USN vessels in port for maintenance between 2012 and 2020. As noted in the 8010, a major fire is one “that has progressed beyond the incipient stage, beyond the ability of the initial responders (usually the ship’s force on ships in commission) to control, and is still not under control when the first hose team outfitted in SCBAs and firefighting equipment needs to be relieved.”⁹⁶ Major fires occurred on the USS *Gunston Hall* (LSD-44) in 2015, the USS *Oscar Austin* (DDG-79) in 2018, and the USS *Iwo Jima* (LHD-7) in 2019, resulting in accumulative damages greater than \$73 million.⁹⁷

The potential for future major fires is ever-present. USN submarines are in port for six months to three years every four to six years to receive significant maintenance. Surface vessels are in port for the same duration every two to three years.⁹⁸ Federal and municipal fire departments must improve their individual and collaborative preparation for shipboard firefighting to avoid future disasters like those on the *Miami* and *BHR*.

⁹⁶ Naval Sea Systems Command, *Industrial Ship Safety Manual*, 171.

⁹⁷ Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*, 221.

⁹⁸ Diana Maurer, *Navy Ship Maintenance: Actions Needed to Monitor and Address the Performance of Intermediate Maintenance Periods*, GAO-22-104510 (Washington, DC: Government Accountability Office, 2022), 8, <https://www.gao.gov/assets/gao-22-104510.pdf>.

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III. SHIP FIRE POLICY ANALYSIS

The fire service uses a call-and-response model. From minor medical needs to catastrophic disasters, the fire department responds to calls for assistance during emergencies. The variety of potential emergencies is endless. To increase preparedness, agencies anticipate the most common types of calls and prepare accordingly. Many departments use internal policies and operating guidelines to provide a framework for safely and effectively controlling an incident.

This chapter analyzes the shipboard firefighting response plans of the New York City Fire Department (FDNY), Seattle Fire Department (SFD), and Everett Fire Department (EFD). For this policy analysis, these three represent differently sized municipal fire departments with varying resource levels, each responsible for responding to maritime maintenance facilities that conduct work on USN vessels or similar ships. These fire departments may represent the greater fire services' approach to shipboard firefighting. The policies are the playbooks each municipal fire department applies when called to provide mutual aid to a major fire aboard a USN ship during maintenance. The criteria for analyzing these policies derive from challenges identified in the *Miami* and *BHR* case studies. This policy analysis intends to gauge the spectrum of municipal fire department preparedness to provide mutual aid during a shipboard fire response on a USN vessel undergoing maintenance. While each fire department may possess department-wide capabilities to address the defined analysis criteria, this review focuses on the elements explicitly documented in its marine firefighting response plan. The study highlights best practices and concerning omissions.

A. REFERENCE DOCUMENTS

Due to the number of resources necessary to respond adequately to a major ship fire, it is reasonable to assume that responding agencies may join organizations that operate under distinctly different policies. The ship is a USN asset under Department of Defense guidance, and federal firefighters follow F&ES response plans. However, municipal firefighters observe their internal fire department policies. The lack of a single overarching

response plan that all agencies adopt can complicate operations on the fire ground. The autonomy of each organization means that directives prescribed by one agency need not be observed by others during the preparation or response phases of an incident. The USN's 8010 manual contains prescriptions for how the ship's force will prepare for a fire but applies only to USN personnel. Similarly, NFPA recommendations are standards observed primarily by municipal fire departments.

Since this chapter analyzes the ship fire policies of municipal fire departments, NFPA 1405, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, serves as the primary reference for evaluating preparedness. USN and federal F&ES plans contain many best practices, but NFPA 1405 is the standard that most directly influences municipal fire department policy. Recommendations stemming from the *Miami* and *BHR* fires reinforce municipal fire departments' adoption of the NFPA 1405 standards.

B. POLICY ANALYSIS CRITERIA

1. Vessel Familiarization

The design and construction of USN ships present a challenging operating environment that is unintuitive to firefighters entering the space for the first time.⁹⁹ Ships typically consist of a labyrinth of narrow passageways and decks that extend above and below the waterline. Methods for orienteering a navy vessel include maritime terminology and the bullseye reference system. The maritime community uses unique terms like *bow*, *stern*, *port*, and *starboard* to reference locations and direct personnel.¹⁰⁰ Firefighters must understand the language used aboard a ship to communicate effectively in this environment. The compartment numbering system allows individuals to identify their specific location on a ship using standardized markings, placed on the walls every 14 feet

⁹⁹ U.S. Navy Fire and Emergency Services, "Shipboard Firefighting," 4; National Fire Protection Association, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*.

¹⁰⁰ National Fire Protection Association, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*.

and at least once in each compartment.¹⁰¹ The markings, or *bullseyes*, consist of four parts: the deck number, frame number, position relative to the ship's centerline, and compartment use. This information requires an understanding of abbreviations to decipher the code. For example, "2-115-1-L" is on the second (2) deck with a forward boundary at frame (115), in the first (1) compartment to the starboard side (odd number) of the ship's centerline, and in a living quarter, medical or dental space, or a passageway (L).¹⁰² The information in the second and third lines of the bullseye provide the frame range, division responsibility, and work center responsibility for that compartment (see Figure 4).

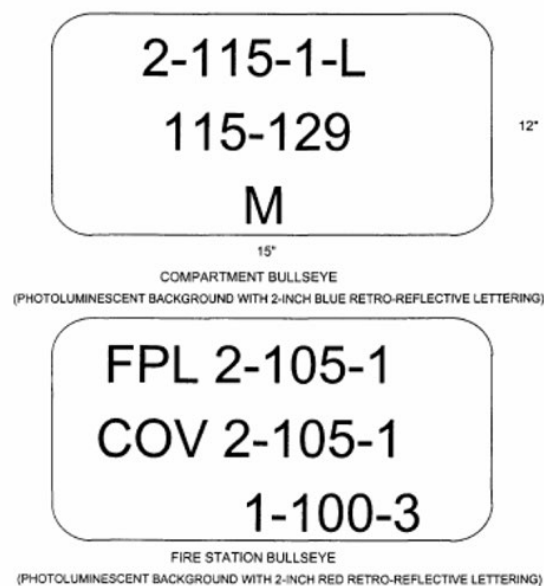


Figure 4. Example of Compartment Bullseye on USN Vessels.¹⁰³

¹⁰¹ USS *Abraham Lincoln* Damage Control Department, *Compartment Damage Control Marking Guide* (Washington, DC: Department of the Navy, 2013), <https://multimedia.3m.com/mws/media/906896O/damage-control-marking-guide.pdf>.

¹⁰² USS *Abraham Lincoln* Damage Control Department. Even numbers in the third position refer to the distance from the centerline to the port side.

¹⁰³ Source: USS *Abraham Lincoln* Damage Control Department, 11, fig. 5.

The interior of a USN vessel is markedly different from that of a residential or commercial structure. According to NFPA 1405, the inside spaces and “ladders, companionways, and passageways are much smaller than those in a building.”¹⁰⁴ Firefighters need to understand this distinction to apply effective tactics. Knowledge of the ship’s layout will impact the selection of ingress and egress points, air management considerations, hose selections to reach portions of the vessel, and applications of the internal systems, such as fire pumps, for use in stabilizing the incident.

Response personnel must familiarize themselves with terminology commonly used in the marine environment, such as bow for front and stern for the back of a vessel as well as port and starboard for left and right, respectively. These terms will be essential in size-up as well as in directing operations.¹⁰⁵

2. Interagency Communications Plan

Effective communications are a critical component of any incident response. Compatible systems must be in place for agencies to share information quickly, yet communication systems are not standardized among the first-responder community.¹⁰⁶ Despite the *9/11 Commission Report*’s recommendation to “improve interoperable communications at all levels of government,” significant challenges remain at the federal, state, and local levels.¹⁰⁷ Individual agencies have unique communication and emergency response protocols, professional practices, radio frequencies, and public safety missions.¹⁰⁸ Some agencies, such as the military and law enforcement, encrypt their communications for security. These differences, coupled with technical infrastructure and

¹⁰⁴ National Fire Protection Association, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, 1405–13.

¹⁰⁵ National Fire Protection Association, 1405–11.

¹⁰⁶ National Fire Protection Association, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, 1405–36; U.S. Navy Fire and Emergency Services, “Shipboard Firefighting”; Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*.

¹⁰⁷ National Commission on Terrorist Attacks upon the United States, *The 9/11 Commission Report*, 397.

¹⁰⁸ Department of Homeland Security, *Implementing 9/11 Commission Recommendations: Progress Report 2011* (Washington, DC: Department of Homeland Security, 2011), 44, <https://www.dhs.gov/xlibrary/assets/implementing-9-11-commission-report-progress-2011.pdf>.

equipment hurdles, can make it difficult for mutual aid agencies to swiftly and seamlessly join the communications network utilized for the incident. The lack of a standard communication system hindered the municipal fire departments that provided mutual aid during the *Miami* and *BHR* fires.¹⁰⁹

Interagency plans must also address the limitations of an agency's communications equipment. The Federal Communications Commission allocates portions of the 800 MHz band for public safety use.¹¹⁰ The steel operating environment of a USN vessel can interfere with mutual aid agencies' portable radio systems by absorbing radio signals and preventing line-of-sight transmissions. This limitation was observed during the *BHR* fire when some of FEDFIRE's portable radio communications could not penetrate the ship's steel hull.¹¹¹ Lower radio frequencies have an increased ability to penetrate obstacles, meaning radio frequencies typically used by municipal fire departments are subject to increased signal attenuation.¹¹²

The structure of most large vessels creates communications difficulties for responders. Large amounts of steel often make portable radios unusable. The long duration of these incidents often depletes reserves of batteries. Alternate means of communications (i.e., runners, sound-powered phones, wired systems, and even the ship's systems) should be considered in pre-fire planning. . . .

It should not be presumed that because a fire department's radio procedures and systems meet its routine needs that they automatically meet its needs during a shipboard fire. However, as with any major incident/disaster, a department's operations should be an extension, by degree, of its day-to-day operations.¹¹³

¹⁰⁹ McCoy, "Final Command Investigation"; Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*, 265.

¹¹⁰ U.S. Fire Administration, *Voice Radio Communications Guide for the Fire Service* (Washington, DC: Federal Emergency Management Agency, 2016), 89, https://www.usfa.fema.gov/downloads/pdf/publications/voice_radio_communications_guide_for_the_fire_service.pdf.

¹¹¹ Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*, 181.

¹¹² Patricia Frazier et al., *Current Status, Knowledge Gaps, and Research Needs Pertaining to Firefighter Radio Communication Systems* (Arlington, VA: TriData Corporation, 2003), 32, <https://www.cdc.gov/niosh/fire/pdfs/FFRCS.pdf>.

¹¹³ National Fire Protection Association, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, 1405–36.

3. Unified Command Considerations

The magnitude of a significant ship fire can quickly outrun the capabilities of initial first responders. As seen in the *Miami* and *BHR* incidents, it took resources from the ship's force, the FFDs, and multiple municipal fire departments to bring the fires under control. Hierarchical challenges tend to occur when agencies join to operate in a combined fashion. Even with the best intentions, individual organizations may have vastly different approaches to incident management.¹¹⁴ These differences are markedly noticeable when joining municipal agencies with the federal military.

In 2003, the federal government recognized the need for a standardized approach to incident response regardless of size and complexity. Homeland Security Presidential Directive 5 called for developing a "single, comprehensive national incident management system."¹¹⁵ In 2004, the Department of Homeland Security established NIMS as the standardized method for managing incidents for all local, state, and federal responders.¹¹⁶ State and local agencies have integrated NIMS into daily response operations over the past two decades. It is standard practice for municipal fire departments to establish command at every incident regardless of size and use NIMS to incorporate mutual aid resources from local and state agencies. A unified command represents stakeholder organizations whereby joint objectives are approved to manage the incident.¹¹⁷

As seen in the *Miami* and *BHR* fires, though, the federal military has faltered in applying NIMS. Findings from the *Miami* investigation highlighted the following: "The failure to establish effective and integrated on-scene Incident Command in the first phase of the casualty response contributed significantly to missing the window of opportunity to

¹¹⁴ Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*, 303; National Fire Protection Association, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, 1405–31, 1405–44.

¹¹⁵ Executive Office of the President, *Management of Domestic Incidents*, HSPD 5 (Washington, DC: Executive Office of the President, 2003), 1, <https://www.dhs.gov/publication/homeland-security-presidential-directive-5>.

¹¹⁶ Federal Emergency Management Agency, *National Incident Management System*, 4.

¹¹⁷ Federal Emergency Management Agency, 22.

contain and control the fire.”¹¹⁸ The *BHR* report found that “policy on command and control for major shipboard fire requiring an integrated response is disseminated throughout multiple instructions, manuals, and local Standard Operating Procedures (SOPs) and is not consistently defined or trained.”¹¹⁹ Moreover, one finding from the 2021 USN’s *Major Fires Review* was that “despite 8010 requirements, fleet personnel lack a basic understanding of the FEMA National Incident Management System and consequently lack the ability to integrate rapidly into the nationwide system for incident management.”¹²⁰

A major fire incident involving a USN ship poses unique challenges for incident command relations. Municipal fire departments establish incident command regularly and typically have the latitude to make fire ground decision. According to 10 U.S.C. § 6011, the commanding officer, whether of the naval installation, naval shipyard, or ship itself, is charged with absolute responsibility for the ship.¹²¹ Establishing a unified command with a commanding officer retaining the complete authority of activities occurring on the vessel runs contrary to the collaborative nature of incident management intended through NIMS. This divide extends to establishing incident objectives and the accepted risk of achieving them. Municipal fire departments tend to prioritize life safety over property conservation. In contrast, FFD and USN leadership are more willing to put personnel in harm’s way to save the ship, as was the case during the *BHR* fire.¹²²

Where a shipboard fire is managed under the incident management system, a number of key individuals should be included, as follows: (1) The vessel’s master or master’s representative should provide particulars of the vessel and its cargo and condition of loading. (2) The Coast Guard’s captain of the port has authority over marine disasters and is primarily concerned with safety and the effects of emergencies on navigable waters. (3) Port and terminal representatives can help identify exposures to port facilities as well

¹¹⁸ McCoy, “Final Command Investigation,” 52.

¹¹⁹ Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*, 303.

¹²⁰ U.S. Fleet Forces Command and U.S. Pacific Fleet, *Major Fires Review: Executive Summary*, 27.

¹²¹ Department of the Navy, “The Commanding Officer,” in *United States Navy Regulations* (Washington, DC: Department of the Navy, 1990), 63, <https://www.secnav.navy.mil/doni/US%20Navy%20Regulations/Chapter%208%20-%20The%20Commanding%20Officer.pdf>.

¹²² Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*, 54.

as provide equipment and crews for assistance. (4) Passenger vessel pursers and shoreside company officials can assist in accounting for passengers before they leave the scene. An area to which passengers are to report should be designated immediately. Comparisons of this passenger information with that of passengers taken to hospitals can reduce unnecessary entries for search and rescue.¹²³

C. POLICY ANALYSIS

The FDNY, SFD, and EFD are all land-based fire departments that respond to marine vessel fires. Each department has created policies and response plans that guide its shipboard firefighting operations. The basis for evaluating these response plans is determining the extent to which the departments address vessel familiarization, interagency communications plans, and unified command considerations.

1. New York City Fire Department

As cited on the department’s website, “FDNY is the largest fire department in the United States and universally is recognized as the world’s busiest and most highly skilled emergency response agency.”¹²⁴ It possesses a robust maritime program consisting of a chief of marine operations, a marine battalion, marine companies, and the Rapid Rescue Craft Program.¹²⁵ While the FDNY does not have a USN vessel maintenance facility in its jurisdiction, the GMD Shipyard is the largest drydock facility in New York City and poses similar shipboard firefighting challenges.¹²⁶ The FDNY maintains its ship fire policies and response plans in the department’s *Marine Manual*.¹²⁷ The document addresses the policy analysis criteria to varying degrees and documents the department’s robust fireboat capabilities.

¹²³ National Fire Protection Association, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, 1405–45.

¹²⁴ “Overview,” New York City Fire Department, accessed August 12, 2023, <https://www.nyc.gov/site/fdny/about/overview/overview.page>.

¹²⁵ New York City Fire Department, *Marine Manual* (New York: New York City Fire Department, 2021), 21.

¹²⁶ “Home Page,” GMD Shipyard Corp., accessed August 12, 2023, <https://www.gmdshipyard.com/>.

¹²⁷ New York City Fire Department, *Marine Manual*.

a. *Vessel Familiarization*

The FDNY's *Marine Manual* acknowledges the importance of obtaining various ship documents to familiarize municipal firefighters with the vessel. Specifically mentioned are the Fire Control Plan, General Arrangement Plan, General Cargo Stowage Plan, and Dangerous Goods Manifest.¹²⁸ Obtaining copies of these ship plans will help the incident commander quickly understand the vessel's fire extinguishment systems, the interior layout, and the summary of onboard cargo. The FDNY instructs first arriving units to attain a copy of the Fire Control Plan and deliver it to the incident commander.¹²⁹ While the focus of the FDNY's vessel familiarization lies in the use of vessel plans, it notes the assistance that the ship's crew can provide. The *Marine Manual* provides a brief reminder that a ship's officer can help overcome language barriers and provide vessel layout, cargo carried, fire location information, the crew and passenger status, and the ship's stability.¹³⁰ The FDNY's *Marine Manual* provides a glossary of maritime terms but does not refer to the USN's bullseye vessel layout system.

b. *Interagency Communications Plan*

The FDNY's *Marine Manual* includes communications capabilities and procedures for use during a ship fire. The 800 MHz radio system utilized by many public safety agencies is the FDNY's primary radio communication. It also monitors very high frequency (VHF) radios, commonly used in the maritime community due to their greater range.¹³¹ The *Marine Manual* addresses the communications challenges associated with a ship's steel construction. Specific recommendations include augmenting communications with five-watt handheld transceiver channels, handheld transceiver relays, and post-radios.¹³² The FDNY also encourages using a ship's communication systems, such as handheld portable radios (Simplex systems), fixed telephones, sound-powered phones, and

¹²⁸ New York City Fire Department, 15.

¹²⁹ New York City Fire Department, 15.

¹³⁰ New York City Fire Department, 32.

¹³¹ New York City Fire Department.

¹³² New York City Fire Department, 34.

public address systems. The communication plan does not explicitly mention exchanging radios with interagency partners.

c. Unified Command Considerations

The FDNY emphasizes applying the unified command construct to a ship fire response. The *Marine Manual* explicitly states, “Control of an incident involving multiple agencies with overlapping responsibilities and authority is accomplished by the implementation of a Unified Command. Unified Command allows agencies with jurisdictional responsibility for an incident to manage such an incident by establishing a common set of strategies designed to accomplish the goals set forth.”¹³³ Even within this cooperative framework, department policy grants the FDNY incident commander the authority to commit fire department resources and make operational decisions.¹³⁴ The FDNY recognizes the overarching authority of a ship’s officer, specifically regarding granting the fire department permission to come aboard. When differences between the FDNY and the ship’s leadership occur, the department relies on the United States Coast Guard (USCG) to reconcile the situation. The captain of the port is a USCG position with broad federal authority to direct actions in the maritime environment that will minimize threats and promote safe, secure, and environmentally sound port operations.¹³⁵ The FDNY’s marine battalion consists of a dedicated battalion chief and two firefighters who supervise and coordinate all marine assets during maritime emergencies. This group supports the incident commander and coordinates all FDNY activities with the USCG.¹³⁶

¹³³ New York City Fire Department, 29.

¹³⁴ New York City Fire Department, 29.

¹³⁵ Andrew E. Tucci, “The Captain of the Port, a Vital Authority in Service to Our Nation,” *Proceedings of the Marine Safety & Security Council* 75, no. 2 (2018): 8.

¹³⁶ New York City Fire Department, *Marine Manual*, 21.

2. Seattle Fire Department

The SFD is a moderate-sized metropolitan fire department with just under 1,000 uniformed members.¹³⁷ The department is responsible for 193 miles of Puget Sound waterfront and is the first fire agency to respond to Vigor, a private shipyard that performs maintenance on USN ships.¹³⁸ The SFD documents its marine operations in a chapter of the department's comprehensive policy and operating guidelines. The policy portion provides source references, specific policy aspects, definitions, and personnel responsibilities for marine operations. The operating guideline section addresses maritime firefighting operations primarily on ships and in marinas. The SFD policy and operating guidelines in *Marine Operations* address the policy analysis criteria of general maritime firefighting operations. The SFD's policy states that landside operations generally focus on deploying a "Recon/Assessment Team" to a fire vessel.¹³⁹ Most of the department's published *Marine Operations* guidance addresses how members function outside the burning vessel. The SFD emphasizes fireboat operations; underwater, remotely operated vehicle use; and marina firefighting tactics.

The SFD establishes memoranda of understanding (MOUs) with the USN, which are specific to each vessel. These MOUs address each agency's overarching roles and responsibilities if a fire occurs on board while under repair.¹⁴⁰ While the SFD's *Marine Operations* guidelines do not include these MOUs, they contain helpful information, such as integrating force members who possess radio communications and knowledge of the ship's layout into SFD firefighting teams.

¹³⁷ Seattle Fire Department, *2021 Annual Report* (Seattle: Seattle Fire Department, 2021), 9, https://www.seattle.gov/documents/Departments/Fire/2021_Annual_Report_Web_FINAL.pdf.

¹³⁸ "Home Page," Vigor, accessed August 12, 2023, <https://vigor.net/>.

¹³⁹ Seattle Fire Department, *Marine Operations*, Policy 5013 (Seattle: Seattle Fire Department, 2022), 7.

¹⁴⁰ Robert L. Franklin and Harold D. Scoggins, "Firefighting Operations onboard USS *John Paul Jones* (DDG 53)" (memorandum of understanding, Washington, DC: Department of the Navy, October 17, 2022).

a. Vessel Familiarization

The SFD recognizes that the shipboard firefighting environment is distinctly different from structural firefighting. Its policy acknowledges general challenges related to space constraints and high-heat conditions. The guideline draws similarities to combating fire in a warehouse, hotel, or industrial power plant to correlate land-based firefighting tactics.¹⁴¹ The department encourages vessel familiarization by listing the review of vessel plans and identifying fire boundaries, fixed fire protection systems, and access and egress points as a function of landside operations during a ship fire.¹⁴² The SFD's *Marine Operations* policy does not include the need to understand maritime terminology and the bullseye marking system.

b. Interagency Communications Plan

The SFD addresses shipboard firefighting interagency communications through specific radio frequencies. The *Marine Operations* guideline references using Marine VHF, 800 MHz Zone 2 (direct channel), and 450 MHz capabilities.¹⁴³ These methods supplement the tactical SFD 800 MHz simplex radio channel, which would require a dispatch center to patch other agencies into shared communications. The SFD *Marine Operations* guideline does not explicitly address how to address anticipated interagency communication challenges during a shipboard firefighting incident.

c. Unified Command Considerations

The SFD *Marine Operations* guidelines acknowledge that a significant ship fire will involve local, state, and federal responders and that a unified command will likely be necessary.¹⁴⁴ The department partners heavily with the USCG and reports all marine fires and rescue incidents to the USCG for awareness and possible support.¹⁴⁵ Its policy

¹⁴¹ Seattle Fire Department, *Marine Operations*, 4.

¹⁴² Seattle Fire Department, 7.

¹⁴³ Seattle Fire Department, 6.

¹⁴⁴ Seattle Fire Department, 3.

¹⁴⁵ Seattle Fire Department, 2.

designates the SFD as the incident commander for all land-based vessel fires. However, it acknowledges that SFD members must receive permission from the vessel's responsible party before boarding. Like the FDNY, the SFD relies on the USCG's captain of the port to resolve any impasses.¹⁴⁶ The SFD will also leverage the ship's crew for its vessel knowledge. The *Marine Operations* guideline directs all ship leadership and engineering crew to remain available as a resource for the incident commander.¹⁴⁷ The SFD emphasizes equipping the unified command to make informed decisions and calls for liaisons between the SFD, the USCG, vessel personnel, and maritime specialists, such as marine chemists, marine architects, tugs, and salvors.¹⁴⁸

3. Everett Fire Department

The EFD is a small municipal department with nearly 200 uniformed members.¹⁴⁹ The city of Everett, Washington, sits along the shore of northern Puget Sound and is home to Naval Station Everett, a busy port that provides full logistical support for USN ships.¹⁵⁰ The EFD addresses shipboard firefighting plans in its *Transportation Fires: Naval Vessels* SOP. The creation of this SOP was a joint effort between the EFD and Navy Region Northwest Fire and Emergency Services, the FFD responsible for responding to ship fires at Naval Station Everett. The EFD's *Naval Vessels* SOP establishes guidelines for use when the FFD requests the department as mutual aid for a fire aboard a naval vessel.¹⁵¹ The *Naval Vessel* SOP addresses each of the policy analysis criteria.

¹⁴⁶ Seattle Fire Department, 2.

¹⁴⁷ Seattle Fire Department, 4.

¹⁴⁸ Seattle Fire Department, 7.

¹⁴⁹ "Why EFD," Everett, Washington, accessed August 12, 2023, <https://www.everettwa.gov/1293/Why-EFD>.

¹⁵⁰ "Naval Station Everett Operations and Management," Navy Installations Command, accessed August 12, 2023, <https://cnrnw.cnmc.navy.mil/Installations/NS-Everett/Operations-and-Management/>.

¹⁵¹ Everett Fire Department, *Transportation Fires: Naval Vessels*, SOP 2.07A (Everett, WA: Everett Fire Department, 2022), 1.

a. *Vessel Familiarization*

The EFD *Naval Vessel* SOP includes a list of maritime terms with definitions. While the terms promote vessel familiarization and facilitate directing operations, the list does not reference the ship's bullseye location method.¹⁵² The EFD emphasizes the use of DC plates as a means of familiarizing members with the ship. DC plates and the FFD's detailed pre-incident plans by ship class will be brought to the incident command post to increase awareness of the vessel.¹⁵³

b. *Interagency Communications Plan*

The EFD's plan for interagency communications includes an extensive list of definitions to establish a shared vernacular. USN terms and positions, such as "casualty" and "damage control assistant," are defined in the EFD's *Naval Vessel* SOP.¹⁵⁴ Many of these words are not commonly used by municipal fire departments and are essential for effectively communicating with the USN and FFD.

The Incident Communications Systems section of the EFD's *Naval Vessel* SOP summarizes the radio capabilities and limitations of both the USN and FFD. Neither the FFD nor the EFD can patch a ship's internal radio system into its networks. To address this incompatibility, the EFD *Naval Vessel* SOP calls for an FFD or municipal officer to be physically collocated with a member of the ship's force to relay radio communications across the separate networks.¹⁵⁵ The FFD communicates on a proprietary 700 MHz network outside the 800 MHz system used by the EFD and the Regional Dispatch Center, SNO911. The EFD *Naval Vessel* SOP delineates that when municipal fire department mutual aid is required, FFD members will move their communications to a designated SNO911 talkgroup provided to them.¹⁵⁶ The regional SNO911 communications van will

¹⁵² Everett Fire Department, 1.

¹⁵³ Everett Fire Department, 1, 3.

¹⁵⁴ Everett Fire Department, 1.

¹⁵⁵ Everett Fire Department, 6.

¹⁵⁶ Everett Fire Department, 6.

be requested to assist with patching and monitoring the various talkgroups and networks at the incident.¹⁵⁷

c. Unified Command Considerations

The EFD *Naval Vessel* SOP clearly defines the roles and responsibilities of the agencies performing firefighting functions. The plan acknowledges that Naval Station Everett is a federal installation not subject to local or state jurisdictional rules and regulations and that the base's commanding officer has command authority over the FFD. The commanding officer of any USN vessel is the incident commander, the ultimate authority for all actions aboard the vessel.¹⁵⁸ These distinctions identify the EFD and other municipal fire departments as mutual aid resources in support of Naval Station Everett and the incident commander. This delineation assists with establishing authority and provides a framework for developing incident objectives and assessing risk.

The Incident Management System section of the EFD's *Naval Vessel* SOP identifies the desired individuals to participate in the unified command and the location of the incident command post. The unified command will include the FFD's and municipal fire department's command officers, the vessel's commanding officer and command duty officer, and the vessel's project manager.¹⁵⁹ The EFD's *Naval Vessel* SOP omits the USCG from the unified command.

The Fire Operations section of the EFD's *Naval Vessel* SOP outlines considerations associated with the composition of firefighting teams. A firefighting team will comprise a complete municipal fire department company and two ship's force members carrying the ship's network radio. The municipal fire department's company officer oversees the joint firefighting team, which assumes the municipal company's unit designation. The ship's force firefighters will provide navigation aboard the vessel, will report their SCBA air levels to the municipal company officer, and must not depart the firefighting team.¹⁶⁰

¹⁵⁷ Everett Fire Department, 6.

¹⁵⁸ Everett Fire Department, 5.

¹⁵⁹ Everett Fire Department, 5.

¹⁶⁰ Everett Fire Department, 7.

4. Summary

This chapter reviewed three municipal fire department's shipboard firefighting policies, specifically regarding mutual aid for a fire aboard a USN vessel undergoing maintenance. The analysis examined what the FDNY, SFD, and EFD include in their written plans regarding vessel familiarization, interagency communications plans, and unified command considerations. The results of this study reveal that not all municipal fire departments approach shipboard firefighting identically, and the specificity of written plans can vary by department. All three departments address vessel familiarization, interagency communications plans, and unified command considerations to varying degrees.

a. *New York City Fire Department*

The FDNY's *Marine Manual* indicates that the FDNY will obtain vessel plans to familiarize crews with the layout of the ship and the firefighting systems aboard. It also plans to use the ship's crew to better understand the vessel layout, cargo on board, and passenger status. The FDNY's shipboard firefighting plans do not specifically address understanding the USN's bullseye reference system as a method for familiarizing members with the interior of a USN vessel.

The FDNY's plans indicate that the department will utilize its internal capabilities to communicate with external agencies during a ship fire. The 800 MHz portable radio system will be the primary communication method at the incident, augmented by Marine VHF radios and utilizing the ship's systems. The FDNY's *Marine Manual* does not refer to exchanging radios or physically partnering with the ship's force as a method of interagency communications.

The FDNY recognizes that responding agencies will have different jurisdictional authority and plans to emphasize the unified command during a ship fire. The FDNY's *Marine Manual* identifies that the ship's officer has overarching authority for activities aboard the vessel. The FDNY will operate as a member of the unified command to support the collective firefighting objective and rely on the USCG's captain of the port to resolve

any discrepancies between agencies. The department's plans make no mention of integrating the ship's force members into FDNY firefighting teams.

b. Seattle Fire Department

Like the FDNY, the SFD intends to use the ship's plans for just-in-time vessel familiarization. Obtaining documents that communicate the ship's layout should help crews navigate the vessel in fire conditions and maximize the capabilities of its onboard life-safety systems. The SFD acknowledges the unique and more challenging firefighting environment that members can expect to face during a ship fire. Although the SFD can expect to be the first fire department to respond to a USN ship fire at Vigor shipyard, its *Marine Operations* plans do not explicitly include the USN's bullseye reference system as a part of vessel familiarization.

As with the FDNY's plans, the SFD's *Marine Operations* policy and operating guidelines indicate that the department will use organic communication equipment to share information with other responding agencies. The 800 MHz portable radio system will remain the primary means of communication. Marine VHF and some 450 MHz radios will supplement interagency communications. The SFD's policy and operating guidelines do not refer to pairing members with the ship's force to relay radio communications over each other's exclusive networks.

Like most municipal fire departments, the SFD includes unified command considerations in its interagency response plans. The SFD's *Marine Operations* policy and operating guidelines acknowledge the USN officer's principal authority for operations aboard the vessel and anticipate that the USCG's captain of the port will settle any jurisdictional disputes. The department does not detail integrating the ship's force into SFD firefighting teams to enhance the unified command during a ship fire.

c. Everett Fire Department

Like the FDNY and SFD, the EFD describes an on-scene review of the ship plans to provide vessel familiarization for responding crews. The EFD tailors this requirement to USN vessels by specifying the need for USN DC plates and FFD pre-incident plans. The

EFD's *Naval Vessel* SOP defines many USN vessel terms but does not reference the USN's bullseye reference system as a part of vessel familiarization.

The EFD dedicates a section of its *Naval Vessel* SOP to interagency communications. In addition to providing an extensive glossary with USN-specific terminology, the plan assesses the compatibility of the FFD's and EFD's communications systems. Unlike the FDNY and SFD, the EFD plans to collocate the ship's force members with other agencies to bridge the communications gap. The EFD also outlines a plan to merge separate radio networks utilizing pre-planned talkgroups.

The EFD was the only department in this policy analysis to partner with another responding agency in developing its ship fire SOP. As a result, the EFD's *Naval Vessel* SOP clearly defines the authority of USN commanders and the mutual aid role in which the EFD operates. EFD plans to attach two of the ship's force members to any municipal firefighting team to better facilitate the unified command. Table 1 compares the three ship fire policies related to the selected analysis criteria.

Table 1. Comparison of the FDNY's, SFD's, and EFD's Ship Fire Policies

FDNY	SFD	EFD
Vessel Familiarization		
+ Obtain ship plans for orientation and system capabilities	+ Obtain ship plans for orientation and system capabilities	+ Obtain ship plans and pre-incident plans for orientation and system capabilities
+ Utilize ship crew to assist with vessel layout, cargo, and passenger status	+ Acknowledges unique firefighting environment and associated challenges	+ Extensive list of maritime terms with definitions
– No reference to the USN bullseye reference system	– No reference to the USN bullseye reference system	– No reference to the USN bullseye reference system
Interagency Communications Plan		
+/- Utilize 800 MHz network as primary means of communication	+/- Utilize 800 MHz network as primary means of communication	+/- Utilize 800 MHz network as primary means of communication
+ Supplemental use of Maritime VHF, 450 MHz, and ship's communications systems	+ Supplemental use of Maritime VHF and 450 MHz	+ Defined terminology to create shared vernacular

FDNY	SFD	EFD
– No plan to pair members with the ship’s force to relay communications	– No plan to pair members with the ship’s force to relay communications	+ Plan to partner members with the ship’s force and the use of talkgroups to merge communications
Unified Command Considerations		
+ Strong emphasis on the use of unified command	+ Strong emphasis on the use of unified command	+ Strong emphasis on the use of unified command
+ Recognition of the USN officer’s overarching authority	+ Recognition of the USN officer’s overarching authority	+ Recognition of the USN officer’s overarching authority
– No specific plan to integrate the ship’s force into municipal firefighting teams	– No specific plan to integrate the ship’s force into municipal firefighting teams	+ Plan to integrate the ship’s force into municipal firefighting teams

Note. The + symbol indicates a favorable evaluation of the department’s policy related to the suggested requirements in NFPA 1405. The – symbol indicates an area that was not addressed or lacks sufficient content.

D. CONCLUSION

This policy analysis suggests a direct correlation between the detail in a municipal fire department’s written policy for its response to a USN vessel fire undergoing maintenance and the department’s level of preparedness in operating as mutual aid in that environment. This claim is supported by the fact that the three municipal fire departments evaluated against criteria in NFPA 1405, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, have different levels of preparedness, as gauged by the extensiveness of their written plans, in performing mutual aid for a major fire aboard a USN ship undergoing maintenance. Two of the three departments, the FDNY and SFD, have more general ship fire plans, which they will institute if there is a fire aboard a USN vessel while in maintenance. The EFD has a comprehensive ship fire plan designed to address specific challenges that a municipal fire department faces when providing mutual aid aboard a USN ship. The thoroughness of its plan reflects an intentional joint effort with Navy Region Northwest Fire and Emergency Services to address the recommendations derived from the *BHR* incident investigation.

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IV. INTERVIEW FINDINGS

Minimal research exists regarding the preparedness of municipal fire departments for firefighting aboard USN vessels undergoing maintenance. This thesis research involved interviews using protocols approved by the Naval Postgraduate School's IRB. Eight subject-matter experts participated in the study. Before the meetings, each participant received a standard set of questions to guide the conversation on the research topics of interest. Interviewees were free to expand on topics and deviate from the published questions during the one-on-one interviews. The gathered information provided first-hand accounts of preparedness levels compared to the expectations defined in NAVSEA S0570-AC-CCM-010/8010, *Industrial Ship Safety Manual for Fire Prevention and Response*, and NFPA 1405, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*. This chapter summarizes the interview findings.

A. METHODOLOGY

Structured interviews and invoked dialogue resulted in findings used to answer the research question of this thesis: How prepared are municipal fire departments and federal firefighting entities to perform mutual aid during a major fire aboard a USN vessel in port for maintenance? This author informed the research subjects that the findings would help drive recommendations to close any identified gaps.

B. PARTICIPANT SELECTION

Three initial research subjects received invitations to participate based on their knowledge of and association with shipboard firefighting, either as a municipal fire department or USN affiliate. Seven additional subjects received invitations based on referrals as the research process moved forward. Two potential research subjects declined to participate. The following individuals participated in the human research interviews.

1. Captain Joshua Menzel, commanding officer of Naval Station Everett, represents the unique command authority of a USN officer as it relates to municipal fire departments operating on a federal installation.

2. Sean Merrill, district fire chief of Navy Region Northwest Fire & Emergency Services, represents the FFD element in the municipal fire department's mutual aid relationship.
3. Dave DeMarco, fire chief of the Everett Fire Department, represents a municipal fire department that provides mutual aid to a nearby USN base.
4. Captain Chad Willenberg of the San Diego Fire Department represents a municipal fire department that provided mutual aid in response to the major fire incident aboard the USS *Bonhomme Richard* (LHD-6).
5. Daniel Mustard, battalion chief of the Bremerton Fire Department, represents a municipal fire department that provides mutual aid to a nearby USN base.
6. Kurt Waeschle, retired fire chief of Navy Region Northwest Fire & Emergency Services, provides a historical perspective of the FFD element in the municipal fire department's mutual aid relationship.
7. Eric Wilmarth, supervisor for shipyard and damage control operations at the Puget Sound Naval Shipyard & Intermediate Maintenance Facility, Ships Safety (Code 304), represents a shipyard that performs maintenance on USN ships.
8. Noah Katka, captain of emergency preparedness for the Seattle Fire Department, represents a municipal fire department that responds to a local private shipyard that conducts maintenance on USN ships and provides marine firefighting mutual aid in the region.

C. INTERVIEW FORMAT

Interviews took place over the phone or virtually via Microsoft Teams and did not have prescribed time constraints. Research subjects signed consent forms, agreeing to the use of their responses for this thesis research.

1. Survey Questions

The following questions facilitated interview discussion with each research subject. The list includes four questions asked twice using two different references: NAVSEA S0570-AC-CCM-010/8010 and NFPA 1405. This series of questions encouraged the research subjects to tie their individual experiences and observations to an objective source document.

1. What are your observations regarding the preparedness of municipal fire departments to effectively conduct mutual aid firefighting operations as laid out in NAVSEA S0570-AC-CCM-010/8010?
2. Based on actual incident responses and training exercises, what municipal fire departments have performed well conducting mutual aid firefighting operations as laid out in NAVSEA S0570-AC-CCM-010/8010?
3. What trends do you see that indicate successful preparation for mutual aid firefighting operations as laid out in NAVSEA S0570-AC-CCM-010/8010?
4. Based on your observations, what are the most significant challenges that prevent successful mutual aid firefighting operations as laid out in NAVSEA S0570-AC-CCM-010/8010?
5. What are your observations regarding the preparedness of municipal fire departments to effectively conduct maritime firefighting operations as laid out in NFPA 1405?
6. Based on actual incident responses and training exercises, what municipal fire departments have performed well conducting maritime firefighting operations as laid out in NFPA 1405?
7. What trends do you see that indicate successful preparation for maritime firefighting operations as laid out in NFPA 1405?

8. Based on your observations, what are the most significant challenges that prevent successful maritime firefighting operations as laid out in NFPA 1405?

The interviews provided the researcher latitude to explore responses further by asking unscripted questioning. Alternatively, questions for which the research subject had little to contribute received less emphasis.

2. Interview Results

This research created an open dialogue with industry experts regarding municipal fire departments' preparedness for mutual aid in the marine firefighting domain. Based on the interview responses, municipal fire departments appear to have varying degrees of preparedness in performing mutual aid firefighting functions in support of a major fire on a USN vessel undergoing maintenance. Common themes arose regarding insufficient preparedness and challenges preventing adequate readiness. After 10-plus hours of research interviews, the following predominant themes emerged.

a. Varying Degrees of Preparedness

A correlation exists between the emphasis that municipal fire departments place on preparedness for shipboard firefighting and their level of preparation. Municipal fire departments provide fire suppression for the cities or towns they serve. Predominantly land-based jurisdictions, these fire departments maintain the structural firefighting skills and equipment needed to combat fires in residential, commercial, and industrial buildings. Fighting fires in a marine environment presents unique challenges compared to structural firefighting.¹⁶¹ A typical municipal fire department does not maintain the capabilities to safely and effectively respond to a vessel fire.¹⁶² While NFPA 1405 is the fire service's recommended industry standard for a comprehensive marine firefighting response program, municipal fire departments do not have the means to comply fully. Individual fire

¹⁶¹ Shelley, Cole, and Markley, *Industrial Firefighting for Municipal Firefighters*, 215.

¹⁶² National Fire Protection Association, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, 1405–5.

departments choose the level of resources invested in marine firefighting preparedness. Some municipal fire departments provide marine firefighting capabilities by creating a specialty team. In this model, the fire department provides team members with the technical training and unique equipment associated with marine firefighting. Other departments have less-structured approaches. The Bremerton Fire Department (BFD) in Washington state operates three stations, responds to approximately 10,000 emergency incidents annually, and provides mutual aid to Naval Base Kitsap, the USN's third-largest fleet concentration in the United States.¹⁶³ The BFD does not currently provide its members with formal marine firefighting training and plans only to provide pier-side support in the event of a major fire at Naval Base Kitsap.¹⁶⁴

Expected to resolve any emergency scenario, fire department leadership must prioritize the allocation of its finite budgets and training time. The response type probability is a standard decision-making criterion. Departments invest time and money to prepare their members for the high-frequency incidents they will likely face. The U.S. Fire Administration reports that 353,500 fires occurred in residential buildings throughout the country in 2021.¹⁶⁵ In comparison, an April 2023 Government Accountability Office report references "15 major fire incidents that occurred from May 2008 through July 2020" aboard USN ships docked for maintenance.¹⁶⁶ Based on the rate of occurrence, it is no surprise that fire departments focus most of their efforts on residential firefighting.

Unfortunately, low-frequency incidents can produce some of the highest risks and consequences. As described in NFPA 1405, "Because most land-based firefighters fight shipboard fires infrequently, the value of a marine firefighting exercise is immeasurable. The exercises that have been conducted by fire departments throughout the United States

¹⁶³ "Naval Base Kitsap," Navy Installations Command, accessed August 12, 2023, <https://cnrnw.cnmc.navy.mil/Installations/NAVBASE-Kitsap/>.

¹⁶⁴ Daniel Mustard, interview with author, July 20, 2022.

¹⁶⁵ "Residential Fire Estimate Summaries," U.S. Fire Administration, April 28, 2022, <https://www.usfa.fema.gov/statistics/residential-fires/>.

¹⁶⁶ Diana Maurer, *Navy Ship Fires: Ongoing Efforts to Improve Safety Should Be Enhanced*, GAO-23-105481 (Washington, DC: Government Accountability Office, 2023), 1, <https://www.gao.gov/assets/gao-23-105481.pdf>.

have proved to be of significant benefit when response to a shipboard fire is necessary.”¹⁶⁷ In 2018, the SDFD conducted a sizable marine firefighting drill on the guided-missile cruiser USS *Chosin* (CG-65). At the time, the SDFD did not have a formal marine firefighting program. The drill revealed that many participating municipal fire departments were ill-prepared for a vessel fire response. Firefighters responded to the drill scenario with the same approach as a structure fire, only to find themselves operating in an environment fraught with disorientation and maneuverability challenges.¹⁶⁸

b. Collaborative Relationships

Preparedness is an investment not only in tactical readiness but also in relationships. The research subjects emphasized the importance of establishing and maintaining positive relationships among agency leaders. Organizational differences are evident nearly anytime multiple agencies come together. During a mutual aid response to a fire aboard a USN ship undergoing maintenance, it is likely that the FFD and municipal fire departments will find themselves working together. While the USN and FFD will have a rapport due to colocation on the Navy installation, there is a reasonable chance that the municipal fire departments will meet the others for the first time at the incident. Coordinated emergency responses require high degrees of trust among team members. Partners develop this trust during periods of non-emergencies. Participation in joint training events is an ideal time for responders to become aquatinted with each other and build confidence in their respective capabilities.

Departmental leadership needs to establish interagency relationships ahead of the emergency as well. The message among the research subjects was unanimous: “Relationships cannot be surged.” Senior leaders must be on a first-name basis and only a phone call request away when support is needed.¹⁶⁹ Acquaintanceship does not negate municipal fire departments’ resource constraints but establishes a foundational trust

¹⁶⁷ National Fire Protection Association, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, 1405–34.

¹⁶⁸ Chad Willenberg, interview with author, July 19, 2022.

¹⁶⁹ Kurt Waeschle, interview with author, July 20, 2022.

between partner agencies. The routine rotation of USN leaders makes the need for continual leader interaction even more crucial.¹⁷⁰

The fire chief of the EFD in Washington state has exemplified cross-jurisdictional relationship building. Fire Chief Dave DeMarco leads the 186-uniformed member department, which provides mutual aid to Naval Station Everett in northern Puget Sound.¹⁷¹ Under Fire Chief DeMarco's leadership, the EFD participated with South County Fire Department and Marysville Fire Department as mutual aid in the USN Chapter 13 firefighting drill aboard the USS *John S. McCain* (DDG 56) in April 2022. Chapter 13 fire drills are an annual requirement designed to evaluate the ability of the shipyard and ship's sailors to execute their complete FRP and emergency response capabilities.¹⁷² The value Fire Chief DeMarco placed on training for a USS *Bonhomme Richard*-like response was worth the non-reimbursable \$11,000 overtime expense he had to absorb.¹⁷³ Following the Chapter 13 drill, Fire Chief DeMarco partnered with the FFD district fire chief to develop a standard operating procedure for the EFD specifically addressing fires aboard naval vessels.¹⁷⁴ In addition to building relationships with Naval Station Everett and the FFD, Fire Chief DeMarco ensures that city leadership understands the importance of maintaining adequate marine firefighting preparedness.¹⁷⁵ Routine communication with the mayor of Everett ensures the echelons of government above the local fire department understand this need. The awareness also arms the mayor to set preparedness priorities, allocate limited resources, and advocate for marine firefighting capabilities within the city.

¹⁷⁰ Joshua Menzel, interview with author, July 8, 2022.

¹⁷¹ Seattle Fire Department, *2021 Annual Report*, 3.

¹⁷² Naval Sea Systems Command, *Industrial Ship Safety Manual*, 13–1.

¹⁷³ Dave DeMarco, interview with author, July 19, 2022.

¹⁷⁴ Everett Fire Department, *Transportation Fires: Naval Vessels*.

¹⁷⁵ DeMarco, interview with author.

c. Compliance Challenges

Barriers exist that challenge the ability of municipal fire departments to prepare for mutual aid responses. Research subjects identified the predominant limitations of physical security measures, exercise design, and resource constraints.

The fire service staffing model is unique in multiple ways. Many departments operate on a multi-platoon, rotating, 24-hour shift schedule. Depending on the department, employees may be on duty from 0800 on the first day to 0800 on the second before being relieved by an oncoming member starting a 24-hour shift. The off-going member may not have to return to work for 48 or 96 hours. While these work patterns can be predictable, firefighting does not align with the typical Monday-through-Friday workweek. To add nuance, firefighters may be off for several reasons, including shift trades, vacation, or sick leave. Research subjects identified this atypical work schedule as challenging when navigating the strict USN installation security requirements.

NFPA 1405 emphasizes the importance of conducting vessel pre-fire planning, tours, and drills to prepare for a marine vessel fire.¹⁷⁶ The 8010 also identifies mutual aid participation during ship fire drills as essential to proficiency and coordination.¹⁷⁷ Physical security at most USN bases requires non–Department of Defense credentialed personnel to receive background checks before being allowed on the installation. This by-name access requirement has become a barrier to mutual aid participation due to the fluid staffing of municipal fire departments.¹⁷⁸ Retired Chief Waeschle recounted an instance when he spent months coordinating the names and social security numbers of firefighters from a local fire department projected to be on duty for the scheduled 8010 Chapter 13 fire drill, only to find out the day of the drill that the staffing had changed, resulting in an unvetted member working, meaning that the entire unit was no longer available for the drill.¹⁷⁹

¹⁷⁶ National Fire Protection Association, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, 1405–31–34.

¹⁷⁷ Naval Sea Systems Command, *Industrial Ship Safety Manual*, 113.

¹⁷⁸ Willenberg, interview with author; Waeschle, interview with author.

¹⁷⁹ Waeschle, interview with author.

While the 8010 fire drill requirements promote collective training that engages the ship's force, the FFD, and mutual aid partners, the drill, by design, evaluates USN personnel and processes. The USN exercise design team develops the drill's objectives. The utilization of municipal fire departments is sought but only for predetermined purposes, and mutual aid support may be simulated if needed.¹⁸⁰ The scripted use of mutual aid participants reduces the training value for municipal fire departments. It significantly reduces the joint training potential needed to close the gaps cited in the USS *Miami* and USS *Bonhomme Richard* fire investigation reports and the *Major Fires Review*.¹⁸¹

Often, mutual aid fire departments have different training objectives. Captain Katka has coordinated the SFD's participation in several 8010 fire drills at a Vigor shipyard in Seattle. Vigor is a private shipyard that performs maintenance on USN vessels. Lacking an FFD presence, the SFD is the first-responding fire department for any fire incident at Vigor. Captain Katka has worked to have the 8010 fire drills include SFD-driven training objectives. For example, the SFD sought to include a scenario requiring its members to practice using carbon dioxide to extinguish a fire in a compartmentalized space on the ship. The 8010 does not include this variable on the required drill attributes or potential anomalies list.¹⁸² After some convincing, the design team included the carbon dioxide component in the drill script as a secondary task for completion without interfering with other drill attributes.

This example demonstrates that 8010 drills have a single purpose: to evaluate the successful demonstration of USN firefighting personnel. The research subjects agreed that, while well-intentioned, the 8010 fire drills ultimately impact maintenance productivity, which inherently has operational and monetary implications.¹⁸³ Captain Willenberg

¹⁸⁰ Naval Sea Systems Command, *Industrial Ship Safety Manual*, 12–2.

¹⁸¹ McCoy, “Final Command Investigation”; Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*; U.S. Fleet Forces Command and U.S. Pacific Fleet, *Major Fires Review: Executive Summary*.

¹⁸² Naval Sea Systems Command, *Industrial Ship Safety Manual*, 12–2.

¹⁸³ Willenberg, interview with author; Noah Katka, interview with author, May 11, 2023; Waeschle, interview with author.

described his experience preparing for an 8010 fire drill, including rehearsals of the actual evaluation to increase the likelihood of the ship's receiving a passing mark. A drill's failure would mean a period of retraining during which maintenance could not occur. Without maintenance, the overall schedule would fall behind, causing undesirable downstream impacts.¹⁸⁴

The lack of resources required for municipal fire departments to accomplish the requirements listed in the 8010 and recommendations identified in NFPA 1405 was the overwhelming challenge mentioned by all research subjects. The two most considerable resource challenges mentioned were the availability of personnel to send to the mutual aid training and financial means to pay for members' off-duty participation.

Caused partly by generational retirements and COVID-19 pandemic vaccination requirements, municipal fire departments nationwide are experiencing critical staffing shortages.¹⁸⁵ "Every fire agency is resource-limited," said retired Fire Chief Kurt Waeschle.¹⁸⁶ When municipal fire departments struggle to staff units to cover their jurisdictions, the feasibility of participating in 8010 fire drills plummets. Municipal fire department leadership must prioritize the allocation of assets, and even with a desire to participate, discretionary training is canceled, sometimes at the last minute, without the personnel available to meet city requirements. Eric Wilmarth recognizes that the municipal fire department staffing shortages severely hinder the ability of all parties to plan drills with high levels of certainty.¹⁸⁷

The absence of funding to source the correlated marine firefighting requirements and recommendations is the number one challenge municipal fire departments face. The USN expects local fire departments to absorb the cost of participating in 8010 fire drill requirements. Municipal fire departments must allocate already tight budgets to meet the

¹⁸⁴ Willenberg, interview with author.

¹⁸⁵ Daniel Gilbert and Sarah Grace Taylor, "Seattle Fire Department Staff Shortage Forces Extreme Hours, \$37.7M of OT," *Seattle Times*, August 29, 2022, <https://www.seattletimes.com/seattle-news/times-watchdog/behind-seattle-fires-record-overtime-staffing-shortfalls-lead-to-extreme-hours/>.

¹⁸⁶ Waeschle, interview with author.

¹⁸⁷ Eric Wilmarth, interview with author, July 21, 2022.

needs of their cities. Department leadership is unlikely to spend funds on training for a low-frequency, high-risk occurrence. Unfortunately, without additional funding or a mechanism to incentivize city leaders to prioritize participation, the gaps in joint training between many municipal fire departments, the FFD, and the USN will likely remain.¹⁸⁸

D. CONCLUSION

The interviews conducted as a part of this research revealed three principal inclinations: 1) municipal fire departments across the country maintain varying degrees of marine firefighting preparedness; 2) collaborative relationships between local fire departments, the FFD, and the USN are critical to mutual success; and 3) challenges impede municipal fire departments' compliance with NAVSEA S0570-AC-CCM-010/8010 and NFPA 1405. Experienced individuals representing multiple facets of shipboard firefighting on USN vessels undergoing maintenance provided first-hand accounts to support these findings.

¹⁸⁸ Katka, interview with author.

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V. CONCLUSION AND RECOMMENDATIONS

This research examined the interactions between organizations during a major fire aboard a USN vessel. Specifically, it sought to answer the following research question: How prepared are municipal fire departments and federal firefighting entities to perform mutual aid during a major fire aboard a USN vessel in port for maintenance? The methodology employed to answer this question included case studies of fires aboard the USS *Miami* (SSN 755) in 2012 and the USS *Bonhomme Richard* (LHD-6) in 2020; an analysis of shipboard firefighting response plans of the FDNY, SFD, and EFD; and interviews with subject-matter experts possessing knowledge of, or association with, shipboard firefighting, either as a municipal fire department or USN affiliate. These research findings provide broad insight into the preparedness of the municipal fire service to provide effective mutual aid during a USN vessel fire.

A. RESEARCH FINDINGS

1. Case Studies

History has shown that municipal fire departments are needed to assist with major fires aboard USN vessels undergoing maintenance. These instances regularly present dangerous and unexpected challenges. Mutual aid responses to the fires aboard the USS *Miami* in 2012 and the USS *Bonhomme Richard* in 2020 revealed a lack of skill proficiency, equipment incompatibilities, mismatched risk management policies, non-interoperable communications, and information-sharing deficiencies. Unfortunately, the investigative reports for these incidents disclose inadequacies associated with mutual aid preparedness and implementation.¹⁸⁹ Findings from the case study research provide a historical baseline to gauge the current state of municipal fire preparedness for similar responses.

¹⁸⁹ McCoy, “Final Command Investigation”; Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*.

2. Policy Analysis

A comparison study of three municipal fire department policies and operating guides for ship fire responses provided trending evidence that varying degrees of written preparedness exist across the fire service. This research chose the FDNY, SFD, and EFD to represent the broader municipal fire service. These departments accounted for diversity in agency size, resourcing, and proximity to USN bases that perform vessel maintenance. NFPA 1405, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, served as the reference document to objectively compare policy aspects of vessel familiarization, interagency communication plans, and unified command considerations. This policy analysis recognized that all three departments had ship fire response plans containing varying strengths and weaknesses, as determined by the defined analysis criteria. No department policy contained content sufficiently addressing all NFPA 1405 evaluation criteria used in this study. Only the EFD had a policy that specifically addressed the scenario associated with performing mutual aid during a fire aboard a USN vessel undergoing maintenance. The FDNY and SFD plan to apply more general ship fire response guidelines when called upon for mutual aid on a USN ship. This study determined that the more specific a municipal fire department's written policy is, the more prepared it will be to operate as mutual aid in that environment.

3. Interviews

Interviews with research subjects versed in the mutual aid response model used during a major fire aboard a USN vessel in port for maintenance yielded consistent preparedness themes—a wide range of response readiness exists among municipal fire departments; pre-established relationships and collaboration between local fire departments, the FFD, and the USN are critical to joint success during an incident; and barriers exist that hinder municipal fire department compliance with NFPA 1405 and NAVSEA S0570-AC-CCM-010/8010. Interviewees attributed differences to the leadership-dependent prominence in maintaining a shipboard firefighting response capability, varying tolerance for risk, and a lack of funding allocation. The prioritized mission of most municipal fire departments is to provide structural firefighting capabilities

for the jurisdictions they serve. Allocating limited time and money to prepare for the low-frequency yet high-risk shipboard fire response is a risk that many departments seem willing to take. Maintaining relationships with the FFD and USN and participating in joint training in preparation for a mutual aid response are other areas that municipal fire departments emphasize differently. Although NFPA 1405 and the 8010 highlight the need for collaborative training, leaders of the departments interviewed inconsistently committed to routine marine firefighting exercises, specifically at the frequency identified in Chapters 12 and 13 of the 8010.¹⁹⁰ Physical security measures restricting municipal fire department members from getting on a naval base, USN-centric exercise design goals, limited staffing, and a lack of dedicated funding are all hurdles detouring routine joint training.

B. RESEARCH CONCLUSIONS

The research findings produced by the case studies, policy analysis, and interviews consistently indicate significant preparedness variances within the fire service regarding a municipal fire department's ability to perform mutual aid during a major fire aboard a USN vessel in port for maintenance. Given the response magnitude required to adequately address a major fire aboard a USN vessel during maintenance, the Department of the Navy will continue to depend heavily on municipal fire departments as the backstop to save its burning vessels. The USN ship's force and FFD firefighters have a finite capability to extinguish fires in their early stages. If allowed to grow, as seen with the USS *Miami* and the USS *Bonhomme Richard* fires, municipal mutual aid will inevitably be called. Municipal fire departments are the last line of defense when a vessel fire has outrun the USN and FFD's internal extinguishment capabilities.

A tremendous discrepancy exists between the USN's apparent expectation for municipal fire departments to perform mutual aid firefighting on USN vessels during maintenance and a reciprocating emphasis on maintaining this unique capability by municipal fire department leadership. These research findings substantiate that municipal fire departments are inconsistently prepared to perform mutual aid firefighting aboard USN

¹⁹⁰ Naval Sea Systems Command, *Industrial Ship Safety Manual*, 12–16, 13–1.

vessels. Despite published expectations, such as NFPA 1405 and the 8010, not all municipal fire departments expected to respond to USN vessel fires are prepared to perform mutual aid firefighting to the same extent.

C. RECOMMENDATIONS: GAP FULFILLMENT

The fundamental origins of the preparedness inconsistencies experienced by municipal fire departments stem from three existing gaps: capability prioritization, dedicated resourcing, and joint training participation.

1. Capability Prioritization

This thesis research suggests that the USN and FFD may have false confidence in the shipboard firefighting capabilities maintained by municipal fire departments. The USN has placed an inordinate expectation on municipal fire departments to perform shipboard firefighting with disproportionate direction and resourcing. The preparedness incongruities identified in this research could improve with shared prioritization among federal and municipal leadership. This alignment would be an initial step toward broadening municipal fire departments' focus on establishing and maintaining baseline mutual aid firefighting capabilities.

2. Dedicated Resourcing

Currently, the USN expects to receive mutual aid shipboard firefighting capabilities, for which municipal fire departments bear the cost to maintain. Local government budget constraints deter fire department leadership from allocating limited budgetary resources toward maintaining discretionary capabilities. The infrequent need to perform shipboard firefighting on USN vessels perpetuates the decision to limit the investment in this skill set. Dedicated federal resources to support the expected capabilities would aid in overcoming identified barriers, such as budget constraints and equipment incompatibilities.

3. Joint Training Participation

Although not a tactical firefighting strategy typically contained in standard operating guidelines, land-based fire departments that respond to marine vessel fires would benefit from establishing a formal policy that commits to participation in joint training.¹⁹¹ Agencies that train together exercise and refine their response plans while building understanding and trust through shared experiences. This synergy occurs routinely within individual organizations but becomes more challenging when multiple agencies must come together for collective training. By nature, the simulation of a mutual aid response requires supporting agencies to participate in an external event. Interactions with others lead to formal and informal information sharing. In a training environment, participants experience firsthand the capabilities and limitations of all entities. This knowledge builds a foundation upon which to draw during an actual incident. Recognition-primed decision-making research shows that critical decision-making in high-stress environments, such as a major ship fire, is regularly influenced by the familiarity of the scenario.¹⁹² The speed of attack directly correlates to how quickly individuals can relate to what they are encountering. Acquaintance with interagency operations best occurs through participation in joint training.

A tremendous benefit of joint training opportunities is that responders can gain exposure to worst-case scenarios without the associated consequences. Such training builds a repertoire of experiences that individuals can draw from when facing something similar. Training like this is even more crucial for municipal fire departments that provide mutual aid support during shipboard fires since they do not face such unique scenarios in their daily operations.

¹⁹¹ National Fire Protection Association, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, 1405–34; U.S. Fleet Forces Command and U.S. Pacific Fleet, *Major Fires Review: Executive Summary*; U.S. Navy Fire and Emergency Services, “Shipboard Firefighting”; Department of the Navy, *Investigation into the Fire aboard USS Bonhomme Richard*.

¹⁹² Gary A. Klein and Roberta Calderwood, *Investigations of Naturalistic Decision Making and the Recognition-Primed Decision Model* (Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 1996), 7, <https://apps.dtic.mil/sti/citations/ADA310303>.

D. RESEARCH LIMITATIONS

This research focused specifically on the preparedness of municipal fire departments in performing mutual aid firefighting on USN vessels undergoing maintenance. Limitations of this research include circumstances requiring municipal fire departments to perform this capability. Moreover, it did not study the need for municipal fire departments to perform shipboard firefighting capabilities on vessels underway. This research did not include marine firefighting other than aboard USN vessels. Specifically, while some strategies and tactics might be similar, this research did not focus on capabilities for responding to fires aboard other vessels, such as fishing boats, cruise ships, ferries, and pleasure craft. Finally, while the case study, policy analysis, and interview sampling sizes purposefully sought a representative cross section of the fire service, their scope was limited.

E. FUTURE RESEARCH

Future studies associated with shipboard firefighting will enhance the efforts of this research. A focused examination of enacting the provided recommendations could identify solutions to implementation challenges. This research will benefit specifically from a focused examination of shared federal and local government capability prioritization and dedicated resourcing.

LIST OF REFERENCES

- Carafano, James Jay. “Five Missteps in Interagency Reform—And What to Do about Them.” *PRISM* 2, no. 3 (2011): 115–24.
- Clark, Colin. “Early Estimate Pegs USS *Miami* Sub Fire Damage Up to \$500 Million.” *Breaking Defense*, June 5, 2012. <https://breakingdefense.sites.breakingmedia.com/2012/06/early-estimate-pegs-uss-miami-sub-fire-damage-up-to-500-million/>.
- Dahl, Kenneth R. *New Security for New Threats: The Case for Reforming the Interagency Process*. Washington, DC: Brookings Institution, 2007. <https://www.brookings.edu/wp-content/uploads/2016/06/dahl20070731.pdf>.
- Department of Homeland Security. *Implementing 9/11 Commission Recommendations: Progress Report 2011*. Washington, DC: Department of Homeland Security, 2011. <https://www.dhs.gov/xlibrary/assets/implementing-9-11-commission-report-progress-2011.pdf>.
- Department of the Navy. “The Commanding Officer.” In *United States Navy Regulations*, 47–66. Washington, DC: Department of the Navy, 1990. <https://www.secnav.navy.mil/doni/US%20Navy%20Regulations/Chapter%208%20-%20The%20Commanding%20Officer.pdf>.
- . *Command Investigation into the Fire aboard USS Bonhomme Richard (LHD 6), 12 July 2020*. Washington, DC: Department of the Navy, 2021. [https://www.secnav.navy.mil/foia/readingroom/HotTopics/BHR%20and%20MFR%20Investigations/For%20Release%20BHR%20Command%20Investigation%20\(20%20Oct%2021\).pdf](https://www.secnav.navy.mil/foia/readingroom/HotTopics/BHR%20and%20MFR%20Investigations/For%20Release%20BHR%20Command%20Investigation%20(20%20Oct%2021).pdf).
- Dodson, David W. “The Art of Reading Smoke.” *Fire Engineering*, June 27, 2014. <https://www.fireengineering.com/leadership/david-dodson-the-art-of-reading-smoke/>.
- Dyer, Andrew. “*Bonhomme Richard* Fire Burned Unabated for 2 Hours, Navy Finds, Blaming Top Officers and Crew.” *San Diego Union-Tribune*, October 20, 2021. <https://www.sandiegouniontribune.com/news/military/story/2021-10-20/navy-failures-bonhomme-richard-fire>.
- Everett Fire Department. *Transportation Fires: Naval Vessels*. SOP 2.07A. Everett, WA: Everett Fire Department, 2022.
- Everett, Washington. “Why EFD.” August 12, 2023. <https://www.everettwa.gov/1293/Why-EFD>.

- Executive Office of the President. *Management of Domestic Incidents*. HSPD 5. Washington, DC: Executive Office of the President, 2003. <https://www.dhs.gov/publication/homeland-security-presidential-directive-5>.
- Federal Emergency Management Agency. *National Incident Management System*. 3rd ed. Washington, DC: Department of Homeland Security, 2017. https://www.fema.gov/sites/default/files/2020-07/fema_nims_doctrine-2017.pdf.
- Franklin, Robert L., and Harold D. Scoggins. "Firefighting Operations onboard USS *John Paul Jones* (DDG 53)." Memorandum of understanding. Washington, DC: Department of the Navy, October 17, 2022.
- Frazier, Patricia, Brian Orgen, Nicole Hankin, and James Williams. *Current Status, Knowledge Gaps, and Research Needs Pertaining to Firefighter Radio Communication Systems*. Arlington, VA: TriData Corporation, 2003. <https://www.cdc.gov/niosh/fire/pdfs/FFRCS.pdf>.
- Gilbert, Daniel, and Sarah Grace Taylor. "Seattle Fire Department Staff Shortage Forces Extreme Hours, \$37.7M of OT." *Seattle Times*, August 29, 2022. <https://www.seattletimes.com/seattle-news/times-watchdog/behind-seattle-fires-record-overtime-staffing-shortfalls-lead-to-extreme-hours/>.
- GMD Shipyard Corp. "Home Page." Accessed August 12, 2023. <https://www.gmdshipyard.com/>.
- Gorman, Martin J., and Alexander Krongard. "A Goldwater-Nichols Act for the U.S. Government: Institutionalizing the Interagency Process." *Joint Force Quarterly*, no. 39 (2005): 51–58.
- Gott, Kendall D., and Michael G. Brooks, eds. *The U.S. Army and the Interagency Process: Historical Perspectives: Proceedings of the Combat Studies Institute 2008 Military History Symposium*. Fort Leavenworth, KS: Combat Studies Institute Press, 2008.
- Jensen, Jessica, and William L. Waugh. "The United States' Experience with the Incident Command System: What We Think We Know and What We Need to Know More About." *Journal of Contingencies and Crisis Management* 22, no. 1 (2014): 5–17. <https://doi.org/10.1111/1468-5973.12034>.
- Joint Chiefs of Staff. *Defense Support of Civil Authorities*. JP 3-28. Washington, DC: Joint Chiefs of Staff, 2018. https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_28.pdf.
- Jones, Dustin. "Navy Will Dismantle USS *Bonhomme Richard*." NPR, November 30, 2020. <https://www.npr.org/2020/11/30/940302619/navy-will-dismantle-uss-bonhomme-richard>.

- Kaiser, Frederick M. *Interagency Collaborative Arrangements and Activities: Types, Rationales, Considerations*. CRS Report No. R41803. Washington, DC: Congressional Research Service, 2011. <https://sgp.fas.org/crs/misc/R41803.pdf>.
- Khan, Asad. *The Goldwater Nichols Act of 1986: Impact and Implications for the Marine Corps*. Quantico, VA: Marine Corps University, School of Advanced Warfighting, 1998. <https://apps.dtic.mil/sti/citations/ADA529074>.
- Klein, Gary A., and Roberta Calderwood. *Investigations of Naturalistic Decision Making and the Recognition-Primed Decision Model*. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 1996. <https://apps.dtic.mil/sti/citations/ADA310303>.
- LaGrone, Sam. “Former USS *Bonhomme Richard* Towed from San Diego Ahead of Scrapping.” USNI News, April 15, 2021. <https://news.usni.org/2021/04/15/former-uss-bonhomme-richard-towed-from-san-diego-ahead-of-scrapping>.
- . “Navy to Decommission Fire Damaged USS *Miami* Today.” USNI News, March 28, 2014. <https://news.usni.org/2014/03/28/navy-decommission-fire-damaged-uss-miami-today>.
- Maurer, Diana. *Navy Ship Fires: Ongoing Efforts to Improve Safety Should Be Enhanced*. GAO-23-105481. Washington, DC: Government Accountability Office, 2023. <https://www.gao.gov/assets/gao-23-105481.pdf>.
- . *Navy Ship Maintenance: Actions Needed to Monitor and Address the Performance of Intermediate Maintenance Periods*. GAO-22-104510. Washington, DC: Government Accountability Office, 2022. <https://www.gao.gov/assets/gao-22-104510.pdf>.
- McCoy, K. M. “Final Command Investigation into the Fire That Occurred onboard USS *Miami* (SSN 755) at the Portsmouth Naval Shipyard on 23–24 May 2012.” Official memorandum. Washington, DC: Naval Sea Systems Command, 2013. <https://www.navsea.navy.mil/Portals/103/Documents/FOIA-P/ReadingRoom/201411130821.pdf>.
- McInnis, Kathleen J. *Goldwater-Nichols at 30: Defense Reform and Issues for Congress*. CRS Report No. R44474. Washington, DC: Congressional Research Service, 2016. <https://sgp.fas.org/crs/natsec/R44474.pdf>.
- Miller, Herman, John McIntire, and James Southerland. *Damage Controlman*. NAVEDTRA 14057. Pensacola, FL: Naval Education and Training Professional Development and Technology Center, 2001. <https://maritime.org/doc/pdf/damage-controlman.pdf>.

- National Commission on Terrorist Attacks upon the United States. *The 9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks upon the United States*. New York: Norton, 2004.
- National Fire Protection Association. *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*. NFPA 1405. Quincy, MA: National Fire Protection Association, 2020. <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1405>.
- National Research Council. *Sustainability for the Nation: Resource Connection and Governance Linkages*. Washington, DC: National Academies Press, 2013. <https://doi.org/10.17226/13471>.
- National Response Team. *Observations and Lessons Learned from the World Trade Center and Pentagon Terrorist Attacks*. Interim Final Draft. Washington, DC: National Response Team, 2001. https://nrt.org/sites/2/files/WTC_PENTAGON.pdf.
- Naval Sea Systems Command. *Industrial Ship Safety Manual for Fire Prevention and Response*. S0570-AC-CCM-010/8010. Washington, DC: Naval Sea Systems Command, 2014. https://www.navsea.navy.mil/Portals/103/Documents/FOIA-PII/ReadingRoom/S0570-AC-CCM-010_8010_06Feb14_DistA_Version_26Aug14_smooth.pdf?ver=4-FPh-fXVS8Z1HOZP1xRJg%3D%3D×tamp=1625589459300.
- Navy Installations Command. “Naval Base Kitsap.” Accessed August 12, 2023. <https://cnrnw.cnmc.navy.mil/Installations/NAVBASE-Kitsap/>.
- . “Naval Station Everett Operations and Management.” Accessed August 12, 2023. <https://cnrnw.cnmc.navy.mil/Installations/NS-Everett/Operations-and-Management/>.
- Nemfakos, Charles, Irv Blickstein, Aine Seitz McCarthy, and Jerry M. Sollinger. *The Perfect Storm: The Goldwater-Nichols Act and Its Effect on Navy Acquisition*. Santa Monica, CA: RAND Corporation, 2009. https://www.rand.org/pubs/occasional_papers/OP308.html.
- New York City Fire Department. *Marine Manual*. New York: New York City Fire Department, 2021.
- . “Overview.” Accessed August 12, 2023. <https://www.nyc.gov/site/fdny/about/overview/overview.page>.
- Northeast Firenews. “Portsmouth Naval Shipyard Fire Department Portsmouth New Hampshire/Kittery Maine U.S. Navy Mid Atlantic Region District 8, Station 26.” Accessed August 12, 2023. <http://www.firenews.org/nh/p/portsmouthnaval/portsmouthnavaln.html>.

- Office of the Chief of Naval Operations. *Navy Fire and Emergency Services Program*. OPNAVINST 11320.23G. Washington, DC: Department of the Navy, 2013. <https://www.secnav.navy.mil/doni/Directives/11000%20Facilities%20and%20Land%20Management%20Ashore/11-300%20Utilities%20Services/11320.23G.pdf>.
- O’Leary, Rosemary, and Lisa Blomgren Bingham. *The Collaborative Public Manager: New Ideas for the Twenty-First Century*. Washington, DC: Georgetown University Press, 2009. ProQuest Ebook Central.
- Seaforces.org. “SSN 755—USS *Miami*.” Accessed April 16, 2022. <https://www.seaforces.org/usnships/ssn/SSN-755-USS-Miami.htm>.
- Seattle Fire Department. *Marine Operations*. Policy 5013. Seattle: Seattle Fire Department, 2022.
- . *2021 Annual Report*. Seattle: Seattle Fire Department, 2021. https://www.seattle.gov/documents/Departments/Fire/2021_Annual_Report_Web_FINAL.pdf.
- Sharp, David. “Damaged Sub *Miami* Leaves Shipyard, to Be Scrapped.” *Navy Times*, June 13, 2015. <https://www.navytimes.com/news/your-navy/2015/06/13/damaged-sub-miami-leaves-shipyard-to-be-scrapped/>.
- Shelley, Craig H., Anthony R. Cole, and Timothy E. Markley. *Industrial Firefighting for Municipal Firefighters*. Tulsa: PennWell Corporation, 2007.
- Tucci, Andrew E. “The Captain of the Port, a Vital Authority in Service to Our Nation.” *Proceedings of the Marine Safety & Security Council* 75, no. 2 (2018): 6–9.
- U.S. Coast Guard. *Sector Puget Sound Marine Firefighting Plan*. Section 8100. Washington, DC: U.S. Coast Guard, 2020. <https://rrt10nwac.com/Files/NWACP/2020/Section%208100%20v21.pdf>.
- U.S. Fire Administration. “Recognizing Flashover Conditions Can Save Your Life.” *Coffee Break Bulletin* (blog), May 5, 2020. <https://www.usfa.fema.gov/blog/cb-050520.html>.
- . “Residential Fire Estimate Summaries.” April 28, 2022. <https://www.usfa.fema.gov/statistics/residential-fires/>.
- . *Risk Management Practices in the Fire Service*. Emmitsburg, MD: U.S. Fire Administration, 2018. https://www.usfa.fema.gov/downloads/pdf/publications/risk_management_practices.pdf.
- . *Voice Radio Communications Guide for the Fire Service*. Washington, DC: Federal Emergency Management Agency, 2016. https://www.usfa.fema.gov/downloads/pdf/publications/voice_radio_communications_guide_for_the_fire_service.pdf.

- U.S. Fleet Forces Command. *USS Miami (SSN 755) Fire Panel Recommendations*. Norfolk, VA: U.S. Fleet Forces Command, 2012.
- U.S. Fleet Forces Command and U.S. Pacific Fleet. *Major Fires Review: Executive Summary*. Washington, DC: Department of the Navy, 2021. [https://www.secnav.navy.mil/foia/readingroom/HotTopics/BHR%20and%20MFR%20Investigations/For%20Release%20Major%20Fires%20Review%20\(19%20Oct%2021\).pdf](https://www.secnav.navy.mil/foia/readingroom/HotTopics/BHR%20and%20MFR%20Investigations/For%20Release%20Major%20Fires%20Review%20(19%20Oct%2021).pdf).
- U.S. Navy. “Navy Decommissions USS *Bonhomme Richard*.” April 15, 2021. <https://www.navy.mil/Press-Office/News-Stories/Article/2573452/navy-decommissions-uss-bonhomme-richard/>.
- U.S. Navy Fire and Emergency Services. “Shipboard Firefighting—Fire Chief Summit.” Chief Alert 2021–11. Washington, DC: U.S. Navy Fire and Emergency Services, 2021.
- USS *Abraham Lincoln* Damage Control Department. *Compartment Damage Control Marking Guide*. Washington, DC: Department of the Navy, 2013. <https://multimedia.3m.com/mws/media/906896O/damage-control-marking-guide.pdf>.
- Verzoni, Angelo. “Close Quarters.” *National Fire Protection Association Journal* 113, no. 5 (2019): 28–35.
- Vigor. “Home Page.” Accessed August 12, 2023. <https://vigor.net/>.
- Wilkinson, Randy, and Andrea Dominguez. “Firefighter Safety.” Chap. 3 in *SDFD Drill Manual*, edited by John Brubaker, Tim Stevenson, Shannon Mueller, and Eric Matteson, 3–1–47. San Diego: San Diego Fire Department, 2018.

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