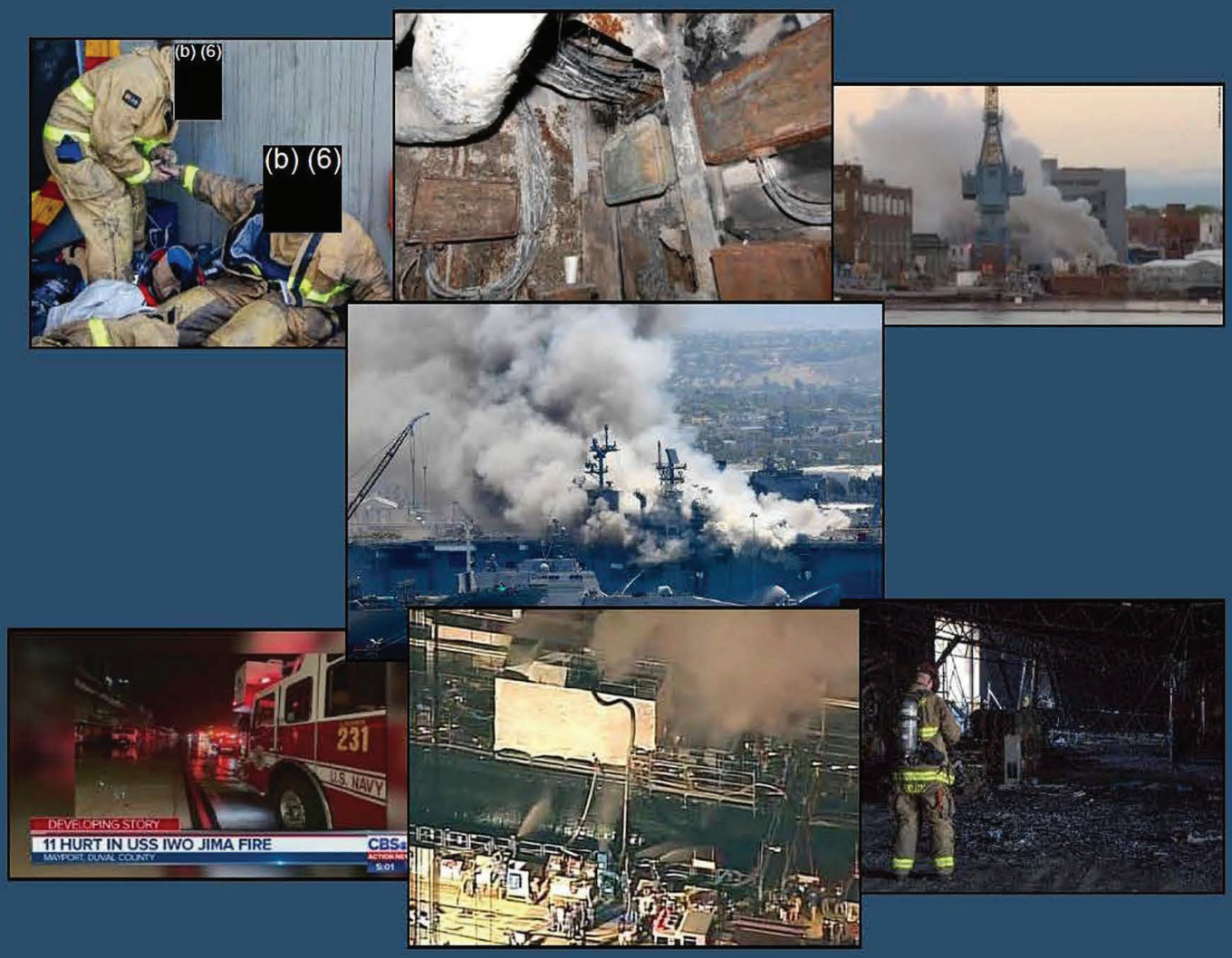

Major Fires Review

Executive Summary

Commander, U.S. Fleet Forces Command

Commander, U.S. Pacific Fleet

July 15, 2021

On the front cover:

Center: In this July 12, 2020, file photo, smoke rises from the USS Bonhomme Richard (LHD 6), after an explosion and fire onboard the ship at Naval Base San Diego. (AP Photo/Denis Poroy)

Top left: Sailors remove their firefighting ensembles after battling a fire aboard the amphibious assault ship USS Bonhomme Richard (LHD 6) at Naval Base San Diego. (MC1 Jason Kofonow/U.S. Navy photo)

Top center: Damage onboard USS George Washington (CVN 73) following the May 22, 2008 fire. (U.S. Navy photo)

Top right: Smoke billows from the burning USS Miami (SSN 755) May 24, 2012 at the Portsmouth Naval Shipyard in Maine. (Pentagon Channel)

Bottom left: Local Jacksonville news coverage of fire onboard USS Iwo Jima (LHD 2) on November 14, 2019. (Aurielle Eady, Lorena Inclán and Action News Jax)

Bottom center: The USS Miami (SSN 755) was severely damaged by a fire that broke out on May 23, 2012 in the Portsmouth Naval Shipyard. (U.S. Navy photo, CBS Boston/AP online article)

Bottom right: Federal firefighters assess damage in the hangar bay aboard the amphibious assault ship USS Bonhomme Richard (LHD 6) on July 15, 2020. (U.S. Navy photo)

Introduction

On Sunday, July 12, 2020, while in week 88 of a Chief of Naval Operations (CNO) maintenance availability at Naval Base San Diego, a fire broke out onboard the USS Bonhomme Richard (LHD 6) (BHR) in the lower vehicle storage compartment. The fire burned for five days, spread to 11 of 14 decks, and reached temperatures in excess of 1,400 degrees Fahrenheit. The fire resulted in more than $3 billion dollars in damage and a later decision to decommission what would have been one of the U.S. Navy's most combat-capable amphibious assault ships.

In the aftermath of the BHR fire, the Commanders of U.S. Naval Forces Europe/U.S. Naval Forces Africa, U.S. Fleet Forces Command (CUSFFC), and U.S. Pacific Fleet (CPF) directed immediate corrective actions. Additionally, the Naval Safety Center (NSC) began a comprehensive historical analysis of major fires onboard U.S. Navy ships. The Fleet Commanders released a "personal for" naval message to all commanders and commanding officers. In the message, the Fleet Commanders directed an immediate assessment of the fleet's fire safety posture, assigned immediate corrective actions, highlighted a requirement for compliance with fire safety principles and regulations, and delineated the need for a constant self-assessment of the fire safety kill chain.

Following the BHR fire, the Naval Safety Center (NSC) began a comprehensive historical review of major fires onboard U.S. Navy ships. In their analysis, NSC identified multiple recurring trends in the causal factors in 15 shipboard major fire related events over a 12-year period that culminated with the BHR fire. NSC concluded that non-compliance with fire prevention, detection, and response policies and procedures was likely prevalent across the fleets, which led to the NSC Commander's release of a Safety Assurance Letter, via the Vice Chief of Naval Operations (VCNO), to CUSFFC, CPF, the Commander of Naval Sea Systems Command (NAVSEA), and the Commander of Naval Installations Command (CNIC).[1]

In response to the NSC letter, VCNO tasked the Fleets to work with NAVSEA, Naval Reactors (NR), CNIC and NSC to deep dive the historical record. Specifically, VCNO directed that the Fleet Commanders complete the review in order to understand and address systemic issues underlying the persistence of shipboard fire mishaps and recommend actions that establish the necessary culture and standards required to change Navy fire safety outcomes in an enduring way.[2]

[1] CNO N09F ltr Ser 5100/Code 00 25 Jan 21, Subj: DRIVING ENDURING CHANGE IN SHIPBOARD FIRE SAFETY OUTCOMES
[2] VNCO ltr Ser N09/21U100500 26 Jan 21, Subj: DRIVING ENDURING CHANGE IN SHIPBOARD FIRE SAFETY OUTCOMES

VCNO's letter specifically highlighted the following:

- Recurring hazards despite risk controls implemented
- Consistent under-reporting
- Acceptance of excessive numbers of precursor problems and events
- Rigorous assessment of historical performance required

VCNO tasked the Fleet Commanders with examining the 15 major fire events to answer the following:

- Why actions put in place following major shipboard fires, such as implementation of reference (b) [NAVSEA Technical Publication S0570-AC-CCM-010/8010 Industrial Ship Safety Manual for Fire Prevention and Response (8010)] of the NSC letter, and related guidance did not sustainably achieve the desired outcome
- Why appropriate unit level standards were not consistently sustained relative to material control, cleanliness, and fire response readiness
- Why oversight from the ship's chain of command did not reliably identify and correct unit level performance gaps and noncompliance
- Why reporting mechanisms were not effective in providing a view of the actual risk posture
- Why lessons learned from other adverse performance events were not accelerated into fire safety doctrine and practice
- Why independent oversight organizations, such as NSC, were not effective in identifying the problems for Fleet action

With VCNO's specific questions as a guide, the Major Fires Review (MFR) set out to identify any systemic issues regarding the standards, culture and environment that are driving a lack of discipline in stowage and cleanliness; noncompliance with applicable governance; or an insufficient level of fire safety readiness. The MFR team did not limit the review to the historical incidents but also conducted a series of site visits and unit assessments in order to evaluate the current state of compliance with fire safety requirements and overall posture of the fleet.

In the course of the review, the MFR identified several underlying issues to include:

- Lessons learned are not effectively collected and are lost over time due to an ineffective and inconsistent process to collect, analyze, disseminate, and enact critical information and corrective actions to include the process to conduct shipboard safety investigations
- Ineffective Damage Control Board of Directors (DCBoD) actions and processes for damage control improvements across the fire safety kill chain of prevention, detection, and response
- A lack of appreciation for the hazards associated with significant transitions, especially during maintenance periods, and insufficient management of the associated risk
- Unmitigated threats and vulnerabilities, in particular, arson
- Hazardous and combustible material handling and stowage
- Declining standards in watchstanding and a failure to critically assess and address deficiencies in a timely and effective manner
- Insufficient defense-in-depth
- A lack of knowledge and insufficient oversight and accountability of NAVSEA Technical Publication S0570-AC-CCM-010/8010 Industrial Ship Safety Manual for Fire Prevention and Response (8010) and/or Naval Sea Systems Command (NAVSEA) Standard Item (NSI) requirements resulting in persistent noncompliance
- Underlying systemic weaknesses similar to those revealed from the Comprehensive and Strategic Readiness Reviews
- Ineffective day-to-day training and a lack of comprehensive integrated drill sets
- Inconsistent attention and resourcing on pierside fire safety and damage control readiness resulting in significantly elevated risk as well as the late detection of and ineffective response to fires
- Overwhelming majority of piers and berths at Navy installations used for maintenance do not meet requirements for performance of depot-level maintenance as delineated in 8010 and derived from NAVFAC Unified Facilities Criteria for repair piers

The MFR also found through the review of the 15 selected events, that the historical safety investigation process did not represent an effective process improvement approach with lessons learned lost over time and limited institutionalization of corrective actions.

The MFR team assessed that the Damage Control Board of Directors (DCBoD) has not been effective in driving improvement in fleet damage control posture and reducing the likelihood of a major conflagration.

The MFR found that in six of the 15 events, commanding officers and crews failed to recognize the inherent risks associated with significant transitions in operations, environment, or system and ship configuration. The MFR also found a lack of defense-in-depth both in the historic events and in the assessment of the current state of compliance. The lack of a multilayered approach to fire safety either resulted in high-consequence events or currently presents an elevated risk of a major event occurring.

This review also highlights a significant and largely unmitigated threat with regard to arson and other acts of gross negligence such as careless smoking. At least three of the fourteen fires either were the result of arson or had suspicious origins. This insider threat represents a critical hazard and requires a formalized and diligent approach to identify potential insider threats and mitigate the impact of their actions.

The review found that the improper handling and stowage of hazardous and combustible material caused or had an increase in severity in 60 percent of the fires reviewed. The site surveys identified unrecognized and persistent risks associated with materials brought and stored onboard.

Also in the review of the historic events, the MFR found that many of the mishap ships displayed declining standards in watchstanding to include poor ownership of stowage and cleanliness of spaces, poor log keeping, procedural noncompliance, absent forceful backup, and a lack of critical self-assessment. Closely tied to the declining standards, the MFR noted command climate issues similar to those found in the *Comprehensive* and *Strategic Readiness Reviews*.

The MFR found that the training continuum adequately prepares crews to combat underway fires but leaves crews unprepared to respond to fires while in port, particularly with only the duty section onboard. The MFR also found that insufficient integrated training resulted in dysfunctional incident command and control.

Based on the historical analysis presented in this report and informed by previous reviews conducted by NAVSEA and NSC, the MFR found that despite the introduction of 8010 following the major fire on USS Miami (SSN 755), mishap ships were not fully prepared for the maintenance environment, the very phase at which the risk of fire was the greatest. The site visits conducted as part of this review found lingering shortfalls in 8010 knowledge, implementation and compliance particularly at private shipyards. The review also identified maintenance pier deficiencies across multiple installations.

The MFR did find that actions in the aftermath of the BHR fire, specifically those directed in the Fleet Commanders' message and tracked by the Damage Control Board of Directors (DCBoD), resulted in some measure of a higher level of fire safety readiness in the short term. However, the MFR team recommends additional action to address noncompliance with all applicable fire safety doctrine, ineffective application of training resources, insufficient oversight of critical activities, and missed opportunities to identify and address precursor issues prior to a major fire.

Summary of Comparative Analysis of 15 Previous Incidents

This review included analysis of 15 separate fire or fire safety related events over a 12-year period from May 2008 to July 2020.[3] The estimated total damage from these 15 events was more than $4 billion. Of note, this total does not fully reflect the complete loss of the USS Miami and USS Bonhomme Richard. In addition to the loss of future deployments for these two ships, the major fires on the other ships also resulted in years of lost operational availability. The MFR derived incident summaries from Safety Investigation Reports, Command Investigations, Failure Review Boards, and other material as available to the MFR. In some cases, information was limited due to law enforcement investigations that took precedence, incomplete safety investigations, or due to inconclusive findings in individual investigations.

During review, the MFR team noted that at least three of the safety investigations were paused in deference to law enforcement investigations (USS Miami, USS Iwo Jima, and BHR). The MFR assessed that this practice is based on OPNAVINST 5102.1D and a Memorandum of Agreement with the Naval Criminal Investigative Service (NCIS). The MFR team did not have a completed SIR for the BHR fire and received the USS Iwo Jima SIR on March 21, 2021, 18 months after the incident.

In the three investigations cited above, the investigation board was paused until groups outside of the safety investigation board completed legal investigations due to suspected criminal activity. In the case of USS Miami, the SIR was never completed.

Finding #1: Safety investigations and report release may be subject to significant delays in cases that involve the convening of a law enforcement investigation.

In reviewing the SIRs[4], the MFR team found several issues with the Safety Investigation Board (SIB) membership, the SIR format and content, and the endorsement process. These issues with the SIR process contributed to: a failure to discover and report the broader root causes of the individual fires; a failure to connect similar fire events; failure to incorporate an appropriate level of subject matter experts; and a failure to promulgate lessons learned in a coherent and timely manner.

Finding #2: While there are requirements for the rank of the SIB senior member, shipboard fire investigations do not require a formally educated or qualified investigator, such as a Certified Fire Investigator (CFI) or Certified Fire Investigation Technician (IAAI-FIT) and are instead over-reliant on the experience, knowledge and competency of the senior member.

[3] Note: the USS ARDENT event was not a shipboard fire but was included in the 15 events in the previously complete NSC review, and this review due to the significant deviation from fire protection system requirements required by NAVSEA Technical Publication Manual S0750-AC-CCM-101/8010

[4] Note: The USS ARDENT event (improper fire safety posture) did not result in a mishap or SIR and the MFR only had access to a (b) (5) and the NAVSEA generated Failure Review Board report

Finding #3: The SIR format is ineffective in conveying the primary lessons learned and was not indicative of a prompt learning process or an effective problem solving approach.

Finding #4: The Navy does not currently have a single organization that is responsible for both the collection and dissemination of fire safety lessons learned and the validation of compliance with corrective actions.

Common Underlying Issues, Command Climate, and Leadership

In several of the historic incidents reviewed, the MFR team assessed underlying issues and ineffective leadership that resulted in a command climate marked by a prevalence of noncompliance and trends in poor adherence to fundamental watchstanding principles.

The MFR identified clear or probable indications of underlying issues in 11 of the 15 incidents reviewed. The causal and severity factors that support this finding include:

- Improper handling and stowage of combustible and hazardous material to include unauthorized material brought onboard
- Loss of ship's force ownership of stowage and space cleanliness
- Ineffective or nonexistent zone inspection program
- Noncompliance with procedures and requirements
- Lack of critical self-assessment and forceful backup
- Unprepared and task-saturated duty sections
- Poor log keeping
- Lack of fundamental damage control knowledge

In total, 14 of the investigations identified a lack of adherence to watchstanding principles ranging from poor log keeping to informal processes for the approval of hot work. Six of the investigations identified violations of 8010 ranging from improper preparation of a hot work area to the improper stowage of hazardous or combustible material.

Finding #5: Review of the 15 incidents revealed that 11 of the involved units displayed indications of broader issues indicated by widespread noncompliance with fundamental practices. Although many of the safety investigation reports did not clearly define the underlying problems, the MFR found that these issues contributed to the pinnacle events assessed in this review.

Comparison of Environmental Factors

Of the 15 events reviewed, only one occurred on a submarine, the remaining 14 involved six surface ship classes (CVN, LHD, LSD, CG, DDG, and MCM). The MFR noted a trend in fires onboard amphibious ships (5 of 14 fires). The MFR did not solely attribute this trend to a widespread cultural issue across the amphibious fleet but rather a number of contributing factors. These factors include the difficulty in setting isolations on amphibious ships due to the large connected spaces, contractor maintenance, size and scope of maintenance availabilities, and a lack of knowledge, implementation and compliance with applicable fire safety doctrine found in 8010, NAVSEA Standard Items (NSI), and elsewhere.

Of the 15 events reviewed, 11 occurred outside of the normal workday or workweek with ship's force in a duty section or reduced manning status. Reduced manning at the time of the event contributed to command and control dysfunction, delayed detection and response, and an increase in severity in nearly all of the fires that occurred outside of normal work hours.

The review noted several factors contributed to the lack of preparedness including:

- Number of duty section personnel onboard at the time of the incident
- Qualifications of those assigned to duty section
- Lack of complexity in duty section drills
- Employment of personnel to complete duties and tasks that distracted from their ability to respond in an emergency

One incident occurred in a public shipyard and three in private shipyards. Six involved contracted maintenance activity or their presence onboard during the fire or events that directly preceded the fires. Only two of 15 events occurred while underway conducting normal operations. Seven incidents occurred on the West Coast, seven incidents on the East Coast and one forward deployed.

Finding #6: Review of the 15 events revealed a higher trend in fires and increased incident severity onboard amphibious platforms.

Finding #7: Review of the 15 events revealed that fires occurring during duty-section only hours posed the highest risk of catastrophic damage with significantly reduced detection and response capability and capacity. Duty section personnel were unable to respond to prevent a major conflagration particularly with fixed firefighting systems offline

Maintenance Environment

Of the events reviewed, 13 of the 15 occurred during depot-level or unit-level maintenance with six of the fires resulting from a significant violation of established fire safety requirements or indirectly caused or increased in severity by ongoing maintenance efforts. The prevalent issues included:

- Improper knowledge and application of 8010, NSI or other established fire safety requirements
- Temporary systems impeding the setting of fire boundaries without risk mitigation
- Lack of sufficient temporary systems in place to account for the loss of permanently installed firefighting systems (detection and suppression systems)
- Lack of firefighting system redundancy
- Improper hot work (unauthorized location, work area cleanliness, failure to inspect and secure combustible material in adjacent spaces, improper fire watch)
- Temporary systems or transient material impeding fire response
- Excessive amount of transient combustible and hazardous material stowed with no recognition of fire risk
- Lack of knowledge of shipwide damage control conditions and firefighting system status and a lack of risk recognition due to removed hatches, fire systems tagged out, etc.
- Lack of a specific, detailed, and rehearsed firefighting plan for the maintenance environment to include incorporation of shore-based firefighters
- Demonstrated lack of ship's force firefighting proficiency
- Communication failures between ship's force and maintenance providers (high risk work in progress either scheduled or unscheduled without coordination with ship's force and proper integrated risk mitigation posture set)
- A lack of routine, periodic inspections or monitors for fire safety posture and compliance with all applicable fire safety requirements by administrative or operational chain of command
- Inconsistent interpretation, implementation and adherence to fire safety measures across all activities (ship, shipyard, contractors), specifically the requirements for hot work approval, execution, and oversight
- Competing priorities between safety preparedness, maintenance production, and off-ship training requirements particularly during transition periods between operations and maintenance when priorities overlap
- Lack of comprehensive, continual, and integrated training and drills during the maintenance availability

Finding #8: Despite promulgation of fire safety lessons learned following extensive investigative actions to include the development and subsequent revisions of 8010, historical analysis of the 15 events revealed that ships continue to be less than fully prepared for the maintenance environment, the phase at which the risk of fire is the greatest. This risk increases with the length of the availability and in particular, during unplanned availability extensions as the crew moves further away from their most recent basic phase certification.

Transitions

In reviewing the ship activity during each of the 15 events, the MFR noted that six of the events occurred while the ship was in a significant transition with an increase in vulnerability to fire. These periods of transition, especially those during maintenance, require additional focus and management.

Examples of transitions with increased risk include:

- Shifting power from ship to shore
- Transitioning from/to underway or shift in type of operations
- Moving to or from a shipyard
- Entering or exiting dry-dock
- Ship configuration and/or systems and equipment in transition
- Transitioning from the maintenance to the training phase to include crew move aboard and conducting significant training phase events while still conducting major maintenance

Each of these major shifts in ship posture significantly changes the ability to prevent, detect, and respond to fires. During transitions identified in the review of the previous incidents, leadership was generally focused on the movement and activities associated with the transition and rarely on the higher level risks associated with the transition itself. The lack of focus on critically important items without adequate risk mitigation during the transitions exposed associated risks. Nearly all of the reports reviewed by the MFR indicated that the ship did not understand or prepare for the major shift in fire protection posture during these transitions resulting in entirely avoidable fires and in some cases contributing to the onset of a major conflagration.

The MFR made the following observations:

- At the end of an extended maintenance availability, crews are typically disaggregated with duty section split between being onboard and on a berthing barge
- Endgame efforts to complete the availability compete with training priorities and add to the crew's workload
- High levels of transient material located throughout the ship to include hazardous and combustible material
- The crew lacks proficiency in the use of installed detection and suppression systems that were previously unavailable due to maintenance activities
- Multiple system transitions occurring during maintenance, including crew move aboard which by its nature introduces additional combustible material
- Until training certification events are complete, the crew is furthest away with respect to time from their previous assessments as they near the end of an extended availability
- Additionally, in the case of the USS Bonhomme Richard fire, COVID mitigation efforts, such as social distancing, resulted in further disaggregation of the crew

Lastly, transition and reassignment of key personnel during extended maintenance periods results in inexperienced personnel in critical positions. Senior leadership must acknowledge and mitigate this threat through mentoring and oversight until new personnel are fully qualified and integrated with the crew. Prior to the BHR fire, several key leaders rotated during the maintenance availability, including the damage control assistant and executive officer. Replacement personnel did not receive 8010 training upon their arrival and in general, were not well versed or knowledgeable of their assigned duties and responsibilities. This transition in personnel contributed to a poor fire safety posture and the accumulation of unrealized risk. As major maintenance availabilities extend, the percentage of the crew with current training certifications and experience in fire safety regimens declines, enhancing vulnerabilities to the ship.

In summary, during each of the various transitions mentioned above, leadership did not seemingly acknowledge or mitigate the potential consequences associated with the transition. Instead, leaders likely focused on managing the activities associated with transition rather than identifying and managing the hazards and risks.

Finding #9: Six of the 15 events reviewed indicated a lack of thorough risk assessment during significant transition phases and a failure to identify the vulnerabilities that accompany any transition to a new or non-standard configuration or activity.

Fire Origins

Of the 15 events reviewed, four (27 percent) are directly attributable to improper hot work being conducted by public (1) or private (3) shipyard workers.

However, six (43 percent) of the events are directly attributable to ship's force through the improper conduct of maintenance or improper stowage of hazardous or combustible material onboard.

One event, USS Miami (SSN 775), was the result of arson committed by a shipyard worker and investigators found two other events to have suspicious origins and did not rule out arson. Two events (13 percent) had unknown origins.

Up until and even in the early stages of the MFR, there was a widely accepted thesis that hot work was the major hazard. Although investigators identified hot work as the origin of four of the 14 fires, the improper stowage of hazardous and combustible material was in actuality the major hazard.

NCIS provided the MFR team with data and an analysis of shipboard arson cases that ships reported over the same period of the MFR (2009-2021). During this time, there were 50 reported cases of suspected arson on ships, for an average of about four per year. Of note, there were several cases where more than one fire was involved, with some cases involving individuals admitting to setting multiple small fires onboard their ship.

Finding #10: Arson and gross negligence such as careless or unauthorized smoking are extremely difficult to prevent but do represent a significant problem, particularly during duty-section only hours when detection and response capability and capacity are significantly reduced. The Navy currently lacks a formal approach to addressing this specific insider threat.

Finding #11: Violations of hot work requirements are far more prevalent than reflected in the 15 fire events reviewed. This demonstrated and widespread noncompliance reflects a gross under-appreciation of the risk associated with this activity.

Shipboard Standards

Review of the 15 events revealed degradations in shipboard standards to include one of more the following: improper handling and stowage of hazardous and combustible material; failures to adhere to watchstanding principles; an ineffective onboard training continuum; and the unnoticed aggregation of risk. In some of the incidents, the slow decay in shipboard standards took place over a several month period and in other incidents, the decay was likely attributable to a major environmental shift, specifically transitioning from operations to maintenance or vice versa.

The NSC letter concluded that improper material stowage was a causal or contributing or factor in 60 percent of the 15 identified and reviewed events. Eleven of the 14 fires involved some level of improper risk mitigation and in many cases provided an unexpected fuel source contributing to fire severity. The crew would have likely identified many of these hazards in the conduct of an effective zone inspection program or through strict adherence with established hot work requirements. Leadership would have also identified other hazards, like the stowage of large quantities of combustible material in an un-isolable space, had they properly conducted a deliberate risk assessment.

Finding #12: Despite the lessons learned from the fire on USS George Washington in 2008, crews did not place enough attention on mitigating the risk associated with the stowage of hazardous and combustible material onboard or on general shipboard cleanliness.

In all of the incidents reviewed, involved individuals demonstrated one or more deficiencies in adherence to basic watchstanding principles and standards to include informal communications, insufficient level of knowledge, lack of forceful backup, loss of ownership, and noncompliance with procedures.

Several of the ships also demonstrated a failure to conduct continuous formal and informal training, relying instead on infrequently conducted certification events to validate personnel and equipment readiness.

Additionally, in many of the incidents, crewmembers, to include senior leaders, allowed risk to accumulate over time without recognition or mitigation, or in some cases without properly elevating the risk up the chain of command.

Finding #13: As found in previously completed readiness and safety reviews, one or more lower-level precursor events or a demonstrated persistent failure to adhere to basic watchstanding principles preceded the majority of major fires.

Finding #14: Similar to the presence of uncorrected or unacknowledged hot work deficiencies of Finding #11, incident crews allowed risk in multiple critical areas to aggregate over time ultimately resulting in a major fire.

Finding #15: Several of the incident ships displayed an overreliance on outside certification events and formal schools and lacked a comprehensive and continual day-to-day learning and training approach. This sinusoidal readiness resulted in significant weaknesses and most cases is reflective of a command that does not perform or value internal critical assessment and improvement. This resulted in a widespread lack of fundamental knowledge, underdeveloped junior personnel and unprepared duty sections.

Ship Configuration Control

A lack of formal ship configuration control with regard to damage control material condition readiness was a factor in several of the incidents reviewed. The issues ranged from missing logbook entries for exceptions to damage control closures to a complete lack of knowledge of available fixed firefighting systems. In addition to missing log entries and general informality in managing ship configuration, in some cases outdated drawings, manuals, or internally generated instructions led to delays and difficulties in responding to the fire and subsequently increased fire severity and damage.

Some examples include:

- Multiple incidents identified a lack of knowledge or documentation of ship configuration changes that significantly decreased damage control material readiness to include removed hatches, unavailability of installed detection and suppression systems, missing insulation, and lack of redundancy for electrical power or firemain
- Multiple incidents identified an inability to set fire boundaries due to removed Ellison doors or other hatches with no temporary fire curtains or closures provided, temporary systems without quick disconnects impeding the setting of fire boundaries, the presence of equipment or other material such as scaffolding impeding fire response, and unfamiliarity with fire curtain use
- Three incidents revealed misuse of Halon due to a lack of knowledge of ship configuration

These deficiencies in the critical management of the ship's configuration with regard to damage control material readiness led to slow and in some cases, ineffective response furthering the spread and severity of the fire.

Finding #16: Informality in managing ship configuration, resulted in damage control material condition vulnerabilities that went unacknowledged and unmitigated resulting in an increase in fire severity.

Defense-in-Depth

In reviewing, analyzing, and categorizing the various failure areas highlighted above, the MFR Team concluded that each failure contributed to an overall lack of defense-in-depth in nearly all of the incidents reviewed. Reliance on checklists to provide protection has degraded the critical thinking necessary to effectively prevent and mitigate fire hazards. Additionally, the MFR Team concluded that failing to create and maintain a layered approach to fire safety may in fact be indicative of the Navy's overall approach to addressing this hazard and not merely isolated to the incident ships.

The MFR found evidence of an entrenched checklist mentality in several reports. Crews seemingly relied on setting conditions in accordance with 8010 or similar instructions and expecting the word of the manual to provide adequate protection. Additional thought beyond the requirement may have resulted in the proper application of fire safety measures. The crews in several incidents displayed little critical thinking beyond rote compliance, and lacking that thinking, conditions deteriorated to a level that resulted in a major incident. In summary, examples of inadequate defense-in-depth include:

- Vulnerabilities in critical fire safety equipment such as a lack of redundant electrical power or insufficient temporary systems in lieu of unavailable installed fire detection and suppression systems
- Lack of comprehensive review, approval and oversight of hot work
- Reliance on off-hull firefighting assets without appropriate understanding of adequacy and with insufficient first-response capability
- Lack of fire safety awareness and readiness at all levels
- Missing or malfunctioning damage control equipment
- Removal of hatches and other damage control closures preventing space isolation enabling the fire to spread or rendering suppression systems ineffective

Defense-in-depth begins with the adherence to fundamental watchstanding principles, continues with establishing an effective command climate. A climate that values and emphasizes critical self-assessment and reporting, learning at all levels, and trusts that all personnel conduct sufficient operational risk management at all times. Defense-in-depth includes paying attention to and accounting for losses that occur in a given fire safety system that frequently occur during maintenance and mitigating those losses by adding new layers of defense that give equivalent protection.

Finding #17: Across the previous fires, the MFR identified several failures to establish and maintain defense-in-depth. This lack of layered protection left the ships vulnerable to single-point failures that resulted in cascading problems and highly consequential outcomes.

Comparative Analysis of Implemented Corrective Actions

The MFR made the following findings in review of implemented corrective actions in the previous 15 incidents:

Finding #18: Material handling and stowage was a causal or significant contributing factor to at least five of the major fires. This included improper stowage of combustible and hazardous materials, large quantities of combustible materials being brought onboard (beyond that required), and stowage in unauthorized spaces or spaces with degraded fire protection systems.

Finding #19: Many of the historical SIRs included impractical or unachievable corrective actions that distract from the most important actions that directly target the causal factors. Although many of the conclusions and comments included in SIRs rightfully call out the root causes, the reports do not consistently address the identified issues with appropriate corrective actions.

Finding #20: The most consequential and meaningful corrective action assigned following the USS Miami investigation was the development, release, and implementation of 8010. However, even nine years after the fire on USS Miami, the Navy has not consistently adhered to the requirements of 8010 in maintenance availabilities, leading to the continuation of preventable fires, most notably on surface ships in maintenance.

Finding #21: The fire on (b) (5) was the third major fire in this exact space on a (b) (5) class cruiser over a 30-year period and the MFR assessed that the fleet did not implement two significant recommendations from the (b) (5) on (b) (5) . The majority of historical safety investigation reports (SIRs) reviewed did not specify a formal mechanism for the reporting, tracking, and validation of corrective action completion aside from the seemingly seldom adherence to the reporting process mandated by OPNAVINST 5102.1.

Finding #22: SIR corrective actions via naval messages are less effective than doctrinal or institutionalized changes with lessons learned lost over time. (Note: RMI has recently replaced the message format; effectiveness of this change is yet to be determined)

Finding #23: The MFR assessed that the timeliness and content of the post-Bonhomme Richard message to commanders and commanding officers, as well as the tracking and reporting of completion by the Damage Control Board of Directors, increased the fleet's immediate fire safety posture. However, further action is required to ensure the assigned tasks and lessons learned are not lost over time.

Review of the 15 major fires or events revealed that the overwhelming majority of corrective actions were associated with doctrinal changes, firefighting training, and fire detection and firefighting equipment.

Doctrinal, procedural, and administrative changes were by far the largest percentage of corrective actions recommended, accounting for 35% of all the recommended corrective actions. These recommendations targeted changes to overarching documents that govern fire safety, fire response procedures, and fleet-wide actions. The changes ranged from formal modifications of existing manuals and instructions to the development of entirely new and comprehensive governance such as the release of 8010 following the USS Miami fire. In some cases, the investigations and corrective actions addressed conflicting requirements and regulations across multiple documents. In other cases, these changes addressed previously unrealized hazards.

In analyzing the specific corrective actions assigned to the cognizant authorities, the MFR found that most, if not all, were appropriate modifications to existing documents or represented much-needed new doctrine. Overall, these recommendations were accepted and acted upon through the higher echelons. However, the MFR found several factors that inhibited enduring change through doctrinal updates. These factors including inconsistent dissemination of doctrinal changes to activities and commands, shortfalls in baseline knowledge of existing doctrine, and inadequate oversight and ineffective application of all established requirements. For example, USFFC staff reported that they reviewed correspondence files and tasker systems back to 2018 and found no record of notification for the release of OPNAVINST 3440.18 “Procedures and Reporting Requirements for Major Shipboard Non-Nuclear Casualties While in Port at a U.S. Naval Installation or a U.S. Ship Repair or Construction Activity.”

Finding #24: Compliance with updated manuals, instructions, and doctrine was insufficient due to delays in promulgating changes, inadequate oversight, inconsistencies across applicable regulations, and an insufficient level of knowledge on the behalf of those activities implementing the regulations.

The second largest category for corrective actions was the refinement of training in firefighting, damage control, and hazardous/combustible material handling. The subject of training, whether it be internal to the mishap ship, or external in other organizations, accounted for 20 percent of the recommended actions. Investigations assigned 31 corrective actions related to training to the applicable mishap unit and 40 corrective actions to external organizations. Many of the internal actions involved duty section training and preparedness in the 11 fires that took place outside of the normal workday. Figure 8 contains the distribution of corrective actions directed at internal and external organizations.

Analysis of the previous incidents did not reveal significant shortfalls or trends with formalized training, from initial accession training all the way through crew certification events. However, the investigation reports were relatively consistent in highlighting proficiency as the key issue that either delayed response or resulted in an ineffective response, leading to a marked increase in fire severity.

The recurring themes across the previous incidents included:

- Duty sections were unprepared due to a lack of complex and recurring fire drills
- Insufficient integrated fire drills with shore-based firefighting resources
- Lack of proficiency and knowledge in the use of damage control and communications equipment
- Lack of knowledge of status and use of installed detection and suppression systems
- Lack of knowledge of ship's configuration and the hazards associated with exceptions to damage control material condition (e.g. missing or tagged-out closures, obstructions to fire zone boundaries, un-isolable spaces rendering Halon ineffective)
- Lack of training and experience of real-world, worst case scenarios
- Lack of formal and persistent training in preparation for maintenance availabilities and while in the industrial environment

Finding #25: Review of the 15 incidents revealed that internal training shortfalls, particularly proficiency and duty section training, were a significant factor in fire detection, prevention and response. Several mishap ships lacked a comprehensive approach to establish and maintain proficient and capable in-port emergency teams. Areas of training deficiencies included basic and advanced firefighting skills, incident management skills, firefighting in an industrial environment and 8010 implementation and compliance.

The comparative analysis of all recommendations and corrective actions from the historical FRB reports and SIRs highlighted a lack of a centralized action tracking system and repository. Although by instruction, NSC is responsible for receiving reports of corrective action completion, the MFR found that mishap commands do not consistently adhere to the process.

Finding #26: The majority of historical safety investigation reports (SIRs) reviewed did not specify a formal mechanism for the reporting, tracking, and validation of corrective action completion aside from the seemingly seldom adherence to the reporting process mandated by OPNAVINST 5102.1. The MFR noted improvements in the approach to USS Miami corrective actions. Beginning in 2014 with the USS McCampbell incident, SIRs began to mandate reporting to the Naval Safety Center. However, this requirement for formal reports was not consistent across all corrective actions and all SIRs.

Current State of Compliance

The MFR team coordinated 38 ship visits to conduct site surveys and assess the current state of compliance with fire safety policies, procedures, and requirements. MFR teams also visited key locations ashore in the public and private shipyards. The survey teams collected both quantitative and qualitative data and information through individual questionnaires, individual and group interviews, and ship and installation tours and inspections. The MFR team provided the points of inquiry and objective quality evidence (OQE) checkpoints following the review of the 15 historical incidents.

The MFR team then built the survey framework to assess compliance and depth of knowledge and applied the following focus areas:

- 8010/NAVSEA Standard Items (NSI) level of knowledge
- Compliance with all applicable governance (8010, NSI, Fleet/Type Commander (TYCOM)/NAVSEA directives)
- Manning levels and critical billet gaps
- Training and qualifications
- Procedures and processes in place for fire prevention, detection, and response
- Internal or external barriers to compliance
- Command climate or environmental issues
- Best practices or innovative measures

In addition to the focus areas listed above, the survey teams also assessed compliance with the previously released Fleet Commanders' message for the implementation of corrective actions following the BHR fire. As a point of reference, the fleets and NAVSEA had reported completion of all but three of the actions at the commencement of the MFR. The DCBoD assumed responsibility for tracking these actions to completion. NAVSEA has completed two of the three, namely, the cost estimate of 8010 compliance and the integration and implementation of 8010 into private nuclear shipyard availabilities. The last open item is the CNIC and NAVSEA action item to develop a new strategy and associated doctrine for the employment of helicopters in shipboard firefighting.

The site surveys noted generally adequate crew knowledge and prevention posture for areas under their direct control, namely, preplanned fire response, maintenance of damage control equipment, knowledge of firefighting actions for fire spread beyond incipient stage, and daily safety deficiency correction and communication process.

Six main areas of concern surfaced during the site assessments and subsequent analysis:

- Crew training and 8010 and NSI level of knowledge
- Crew manning levels during the Maintenance Phase, watchbill management, and duty section alignments for surface ships and aircraft carriers
- Hazardous material management and daily cleanliness standards (aggregation of risk)
- Hot work processes – management, authorization, oversight (including fire watch management and execution)
- Pier infrastructure – power, water, loading capacity not meeting 8010 standards
- Significant deficiencies in contractor compliance enabled by poor contractor oversight and accountability and multiple NSIs implementing 8010

Finding #27: With a few exceptions, the requirements in NSIs are equivalent to the requirements in 8010 however, ship's force does not fully understand NSIs and the existence of multiple fire safety references contributes to a lack of understanding and compliance.

The MFR noted several issues with contractor compliance with NSIs. These include an inability to develop a Fire Safety Plan or provide temporary fire protection that meets NSI requirements, required fire safety plans not specifically tailored to ship/availability, and a lack of emphasis on establishing an initial fire safety and prevention posture at the start of each availability. The MFR Team graded Fire Safety and Prevention Preparedness Posture at 3.1 out of 10 based on the OQE received for all CONUS RMCs and FDRMC (Bahrain). The MFR Team also noted poor discipline in the submission of required reports related to fire safety, in particular operational tests of temporary firefighting systems.

Finding #28: Maintenance projects are authorizing hot work even when there is a non-compliant fire response plan or temporary fire protection plan in place. RMCs are not holding contractors accountable to NSI requirements nor are RMCs consistently writing corrective action requests formally documenting these non-compliances.[5]

[5] Note: Team 2 immediately shared site assessment information, such as Finding #28, with applicable TYCOMs prior to analysis and report release

Type Commander Assessments

Following the ship and site surveys, the MFR Team directed that TYCOM, NAVSEA, and CNIC staffs generate their own corresponding assessments. The MFR Team reviewed their summarized findings and found no significant differences from the MFR Team's independent review of collected evidence.

Submarine Force Assessment Summary

Site surveys of submarines revealed that understanding, implementation, and compliance with fire safety requirements is relatively high with a few noted exceptions and shortfalls. Most submarine crews and command triads are taking fire prevention seriously and conducting the required training events and fire drills at the prescribed periodicity. Crews and associated shipyards are sensitive to and display a sense of urgency to correct 8010 deficiencies when identified, and shipyards are responsive to concerns raised by commanding officers. Most submarine crews and leadership are aware of the USS Miami fire lessons learned as well as the outcomes of the SUBFOR corrective actions review performed in 2020.

The survey team found that one public shipyard had stovepipes with regard to 8010 compliance wherein different codes were acting independently leaving the impression that fire prevention was not a unified team endeavor. Chapter 12/13 drill scenarios tend to be repetitive and do not exercise worst-case scenarios. As a result, there is concern that the drills and training are more of an 8010 "check in the box" rather than a true test of a team's ability to combat a major fire.

Site surveys also revealed that submarines conducting maintenance outside of major CNO availabilities do not necessarily conform to all 8010 requirements even though 8010 still applies during events such as pierside Continuous Maintenance Availabilities (CMAVs). Although there is typically less total hot work during a CMAV, there is usually a larger amount of flammable material onboard. As a result, the probability of a fire is lower, but the severity potential is higher, leaving the total risk at an equivalent level in our assessment. Pre-availability assessment of planned 8010 controls in these cases is sometimes cursory or incompletely documented compared to that accomplished for a major availability. Piers in Pearl Harbor where non-CNO availabilities routinely occur also do not support the installation of 8010-compliant temporary firefighting systems, as discussed in the Shore Facilities section of this report.

The MFR assessed that the Submarine Force implements an effective training approach and is currently enhancing the continuum specifically focusing on fires in the industrial environment and compliance with 8010. The Damage Control – Industrial (DC-I) training and certification program will incorporate team training events in live fire trainers. CSL has also formally requested to integrate federal firefighters into these team-training events.

Naval Air Force Assessment Summary

Site surveys of aircraft carriers revealed concerns with duty section and manning practices, level of knowledge and training (including lessons learned), and hazardous and combustible material handling and stowage. The survey team also noted heightened concerns from the crews and leadership with contractor adherence to fire safety requirements in private shipyards.

While technically in compliance with directives, watchbill practices do not fully support consistent and effective team emergency response. Ships had differing numbers of sections for different departments. Some had the majority of the ship in 8-section, Engineering Department in 4-section, and Reactor Department in 3-section. While this has been a typical approach for aircraft carriers, this practice does limit effective team building. For example, Section 8 trains with Section 1 and Section 3 on one duty day, then a completely different combination the next duty day. Additionally, there were no standard answers across any of the ships regarding who approves watchbill changes, leaving the potential for low awareness by the CDO, Duty Section Leader, and Duty Fire Marshall should watchbill changes in any single department affect the IET as a whole. Reductions in manning levels during the Maintenance Phase, to include across critical damage control oversight positions, exacerbates the problem. The MFR also assessed from crew comments, a perception that IET was the responsibility of Engineering Department and not the entire duty section. The observed drills tended to reflect that belief with a lack of ship-wide involvement unlike Antiterrorism and Force Protection (ATFP) drills that do typically involve the entire crew.

Related to manning concerns while in the Maintenance Phase, the survey team also heard concerns about the CVN Machinery Control and Monitoring System (MCMS). This system includes damage control monitoring and alarming functions designed to support an optimized manning construct. However, the reported rate of spurious false alarms are high enough that the number of roving watches required has not decreased.

As to level of knowledge overall, less than 10 percent of crews knew what the 8010 manual is, and the majority that did were senior leadership. Fewer know what NAVSEA Standard Items (NSIs) are. Although NSA Shipbuilding Specialists (SBS) are the government representatives that assist in enforcing NSIs, there are not enough of these individuals to validate compliance, necessitating some level of familiarity with NSIs among the crew. Most personnel were familiar with NSTM 555, which is consistent with the fact that most Sailors feel more confident with the at-sea fire party than with the IET. Most CVN Sailors could not cite any lessons learned from the USS Miami fire or the 2017 collisions in the Pacific. The responses that interviewees did provide regarding lessons learned centered on fatigue, overwork, and miscommunication rather than any specific fire safety or damage control lessons learned.

In general, members of Engineering and Reactor Departments had both a higher overall level of knowledge and confidence in their abilities to combat casualties when compared to the other members of the IET. Most members of the IET had concerns about the non-engineering Damage Control Training Team members' abilities to

effectively prepare, brief, and execute drill packages. Many cited recycled drill scenarios, unfamiliarity with equipment in the repair locker's area of responsibility, and a low level of knowledge as compared to that of their engineering counterparts.

Sailors across the board, as in the Submarine Force assessment, expressed concerns with the lack of complex, realistic, or challenging in-port drill sets. More complex drills that involve a fire party change-out (requiring personnel from outside the IET but in the duty section), or declaring a major fire are necessary. Only one ship reported they incorporated drills that would drive the CDO to declare a major fire. Sailors, both junior and senior, expressed a strong desire for more hands-on training, breaking out damage control equipment, actually performing procedures, and completing practicals (i.e. pipe patching, de-smoking and hose handling drills).

Finally, as implemented in availabilities, hazardous material issue and return processes can result in extensive delays (2-3 hours in line), while other policies restrict the turn-in of material to the same individual that checked it out. Sailors believe these issues are driving the high risk (and generally unrecognized) behavior of stowing material in unauthorized locations for convenient access in order to get work done on time.

Naval Surface Force Assessment Summary

Site surveys of surface ships revealed concerns with manning, contractor-provided equipment, lack of maintenance berths on Navy installations, and inconsistency in the application and enforcement of NSIs at private shipyards.

Manning levels for surface ships are at the lowest level during the Maintenance Phase primarily due to lack of inventory and the intentional prioritization of ships entering the Integrated Phase. Individual ships in the Maintenance Phase are back-filling gaps from within; however, the necessary training takes time and typically requires off-ship school attendance. Minimum rank limitations in TYCOM policy can have the secondary effect of inhibiting ships from sourcing gapped billets internally, e.g. an E-4 cannot become a Repair Locker Leader per the EDORM. CNSF is considering implementing personnel redlines for the Maintenance Phase. CNSF is applying concepts from the Surface Maintenance Experience (SURFMEX) project to derive key billets, experience, and seniority considerations correlated with risk. Site surveys revealed that some ships did not fully assess the need to provide contracted worker oversight, account for contracted work on multiple shifts, and provide senior supervision at all hours when determining the number of duty sections.

The survey team found that each shipyard was unique in how their personnel accomplished work as defined by the contract and NSIs. The team observed, that for some ships in the yards there was a reasonable level of contractor cleanliness while others had trash, urine bottles, rags, gloves, and cigarette butts left onboard each day.

When interviewed, crewmembers stated they bring these items to multiple coordination meetings at multiple levels and the problem may abate but typically for only a short time. One ship observed that their shipyard workers had differing views of the level of compliance necessary, depending on the classification of hazardous material. Workers were sensitive to flammable material but took a less cautious approach to caustics. In all private shipyards, the assessors discovered inconsistences in contractor supervision, and often a clear absence of supervision.

Crews noted some substandard contractor-supplied equipment directly related to detection and response. Temporary 1MC systems are at times inaudible, connections to the berthing barge are unreliable, and contractors are not conducting preventative and corrective maintenance to ensure reliability. Ship’s force noted that one company drops off the equipment and turns it over to the crew with no follow-up to check on status. For other equipment such as standby electrical power generators and dewatering gear, maintenance is acceptable but training is not. The single training session conducted with ship’s force when contractors provide the equipment is not sufficient to ensure the crew is familiar and proficient. This is a particular issue during longer availabilities. Crews on ships in private shipyards also reported significant internet limitations with the systems provided by contract. The crew’s reduced capability to draw information from SharePoint sites, learning management (e.g. Navy eLearning) sites, Collaboration At-Sea (CAS), NSC RMI, lessons learned databases, and even unclassified emails slows information sharing and access.

The survey teams also visited ships that had left the private yard to complete the availability at a Navy installation and ships that were completing the entirety of their maintenance at Navy installations other than the public shipyards. The MFR found that nearly all of the piers on Navy installations lacked any substantial fire protection features. For example, Naval Base San Diego does not have firemain capability on the piers, and the nearest hydrant to a ship on the end of the pier can be several hundred yards away. Required equipment such as generators, tool and hazardous material lockers, trailers, cranes, delivery vehicles, and worker vehicles encroach on fire lanes, particularly when more than one ship is conducting maintenance at the same pier. As mentioned earlier, one shipyard had a significant limitation regarding vehicle weight. This same shipyard had water pressure issues and fire hydrant standpipes located a considerable distance away from the ship. The responsible RMC was aware of all these issues. This shipyard currently had one ship present; however, two additional and consecutive availabilities will commence this year at the same shipyard.

In interviews, crews expressed positive comments regarding formal 8010 drills and stated that TYCOM Damage Control Assistant (DCA) presence during preparations and execution improved drills. Crews did state that they wanted more than this single event held during working hours, such as a table-top exercise followed by a walkthrough or a prep drill prior to the graded event. However, gaps were still evident in the training of duty sections and the IET. The MFR also found that ships do not incorporate the quarterdeck or the entire duty section during drill sets and training teams tend to build scenarios based on the at-sea environment. Current TYCOM efforts to roll out the DC-I certification and recertification process will improve the training continuum. TYCOMs are also increasing the number of spot checks and verifications conducted by ISIC and TYCOM representatives.

Finding #29: Surface ship and aircraft carrier crews are not adequately trained on 8010/NSI requirements.

Finding #30: Maintenance Phase manning, driven by a lack of distributable inventory to fill at-sea billets negatively affects the ship's fire safety posture.

Public Shipyards

The MFR team completed site surveys of facilities and infrastructure at repair activities and conducted interviews with shipyard personnel. Although the shipyards have made significant improvement, and in general found to be complaint with 8010, the MFR noted areas for further attention and resourcing. A pervasive issue noted during the surveys and review was a lack of a defensive mindset relative to fire prevention. There is a perception that fire safety is primarily the responsibility of others with no validation of established protective measures or continuous validation of posture. This creates a false sense of security and reduces the overall fire safety defense.

The MFR found a significantly higher number of issues with contractor work onboard the public shipyards. The Ship Safety Officer at one organization reported dedicating 80 percent of their efforts to resolving noncompliance issues on surface ships, which impacts the time remaining for support to submarine maintenance projects.

Several interviewees reported not only an accumulation of hazardous and combustible material but also improper stowage locations with no acknowledgement of the associated risk. Some ships also identified a large amount of unnecessary hazardous and combustible material in onboard supply storage spaces with no plan to offload before commencing the availability. In one instance, a ship reported that the shipyard was not prepared to execute a plan to offload hazardous material and instead of moving to an off-ship location, the material had to be temporarily stowed in a third location until the shipyard was ready to receive the material. As seen in several of the historic fires, transient hazardous and combustible material poses a significant risk.

Finding #31: The MFR revealed a lack of a defensive mindset in fire prevention and prioritization of fire safety during maintenance periods.

The MFR discovered several contractor knowledge gaps with regard to 8010 requirements. Examples include:

- A contractor-installed and tested temporary firemain system found to not meet 8010 requirements
- A contractor-provided temporary announcing system (1MC) that had insufficient coverage both onboard the ship and the berthing barge. In this case, the ship recognized the deficient condition and purchased an alternate temporary system
- Large amounts of combustibles in supply storerooms with no plans to offload and no mitigations in place
- Emergency backup generator not set up properly due to lack of system components and limited knowledge of operating procedures
- Contractor had difficulties developing a fire safety plan that met requirements. In this case, the Ship Safety Officer rejected their plan four times prior to obtaining an acceptable version
- Quick disconnect fittings not consistently in place within the required 10 feet from each fire zone boundary
- Fire response plan (FRP) referenced in memorandums of agreement (MOAs) is incorrect (outdated/ superseded, yet still active instruction). Each detachment site has a site-specific FRP that was not part of the Fire Safety MOAs. Some detachment site FRPs were still in a draft form and being utilized as part of the response plan
- Project management personnel and Emergency Control Center Response Team personal do not have documented Federal Emergency Management Agency (FEMA) on-line training courses- IS100, IS200, IS700, and IS800 completed
- NSA does not feel empowered with the authority to direct the ship to remove material and comply with storage requirements

Finding #32: Contractors are not meeting all NSI requirements and insufficient oversight is in place to validate compliance. The Navy does not consistently hold contractors accountable for NSI noncompliance. There is no formal NAVSEA/CNRMC headquarters process to adjudicate major departures from or instances of noncompliance with 8010 or associated NSIs.

Response Preparedness

The site survey interviews revealed that most Sailors felt more confident and better prepared to fight an underway fire vice in port. Interview questionnaires also highlighted a lack of knowledge on the approach and tactics for fighting a fire while pierside. Additionally, the survey teams found that many Sailors were unfamiliar with the fire safety program while in an industrial environment. Along with insufficient training on the fire safety program, the MFR attributed this lack of knowledge to the high crew turnover rate in the Maintenance Phase, particularly during lengthy or extended availabilities.

The MFR found that shipboard drills in the public shipyards are not comprehensive and rarely incorporate a problem set that would drive watchstanders to request off-ship support. During on-site inspections, the team identified repetitive drill scenarios that do not exercise the worst-case fire response situations. In these cases, specifically for 8010 chapter 12 and 13 drills, the team identified a prevalent “check the box” mentality rather than truly testing the team. Conversely, interviews with enlisted personnel assigned to damage control positions indicated a strong desire to train and test methods and skills in drill conditions. Comprehensive examination of team response and identification of weaknesses are key facets to ensure appropriate defense-in-depth. Additionally, site surveys revealed that despite the clear training requirements delineated in 8010, crews were unfamiliar with the National Incident Management System (NIMS). A baseline understanding of NIMS would improve command and control during major incidents and provide the framework to identify responsibilities across multiple involved organizations and agencies.

Finding #33: Infrequent, shallow, and repetitive drills are prevalent across multiple ships and locations. Frequently, drills fail to exercise the entirety of the duty section or validate ship-wide response. This practice fails to exercise all aspects of the fire protection system and indicates a lack of defense-in-depth. Furthermore, 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.

Interviews revealed routine underreporting of fires. Additionally, fire reports are often inaccurate and the project team does not perform sufficient investigation and trend analysis post-fire. Incident reports and lessons learned are not readily available as training tools for the crew. All of these issues contribute to a significant gap in learning, adapting, and preventing future incidents.

The shipyards rely on knowledgeable leaders to recognize and report any fire safety trends during their normal duties. The Shipyards are collecting, maintaining and performing basic analysis on all shipboard fires as required. However, there is a lack of a systematic process to identify and address current and emerging trends.

Finding #34: Underreporting is prevalent across all locations. Fire reports are often inaccurate and lack meaningful trend analysis or incorporation of lessons learned.

Regional Maintenance Centers, Supervisor of Shipbuilding, and Private Shipyards

The current state of compliance with regulations, doctrine and instructions within the Regional Maintenance Centers (RMC) and the private shipyards is less than adequate and below the current state of the public shipyards. There are disconnects between policy documents, knowledge and understanding of the requirements and differing language within maintenance contracts across the enterprise that have allowed for gaps in fire prevention, fire protection and fire response. While some initiatives have improved the private shipyard and RMC fire safety posture, there is still much work to do. The MFR assessed the following:

- A requirement to improve staffing levels at the RMCs for the execution and oversight of fire safety
- A more streamlined approach for fire safety policy in maintenance contracts
- Improved training for the RMC and shipyard workforce on fire policies and procedures
- A need for additional mechanisms for holding private shipyards to the requirements and deliverables set forth in NSIs

Finding #35: The process to contract, execute, and oversee NSIs during maintenance availabilities conducted in a private shipyard is cumbersome and requires the RMC/SUPSHIP to reference multiple documents to ensure compliance. This is contrary to the public naval shipyards who only use one document, the 8010 manual.

There is also a need for improvement in the direct oversight for fire safety across the RMC enterprise. The current staffing at CNRMC within the safety organization does not allow for proper reviews and validation of processes, nor does it provide an opportunity to drive commonality across the enterprise. Furthermore, RMCs would have likely discovered instances of non-compliance with NSIs and other fire safety policies if routine audits and inspections, as required by the Joint Fleet Maintenance Manual (JFMM), had been completed.

Finding #36: The term Ship Repair and/or Construction Activity (SRCA) is a generic term used in the 8010 manual that leads to uncertainty when identifying responsibilities between the RMC and the Lead Maintenance Activity (LMA)(private shipyard), resulting in exclusion of the LMA as a principle member of the FSC. (Note: 8010 Advance Change Notice (ACN) 3A clarifies SRCA and the responsibilities of the RMC and private shipyard))

The additional authority, responsibilities, qualifications required by the Fire Safety Officer (FSO) make it impossible for the FSO position to be a collateral duty. The use of military personnel puts a strain on the RMC due to the continuous training and qualification process required that would accompany the continuous rotation of military personnel. Lastly, contractors lack the contractual authority necessary to carry out 8010 FSO requirements.

Finding #37: CNRMC headquarters and RMCs have insufficient staff to ensure an adequate fire safety posture across all surface ship availabilities.

Navy Installations Command Assessment Summary

The MFR identified that berths at the public shipyards meet 8010 requirements except for those at Norfolk Naval Shipyard (NNSY) and Pearl Harbor Naval Shipyard (PHNSY); however, only 59 of the total 163 berths at Navy installations meet 8010 requirements. NNSY and PHNSY install temporary systems to meet 8010 repair berth requirements. However, outside of the public shipyards, depot-level maintenance is currently ongoing at piers that do not meet the requirements of 8010. As of the end of May 2021, only 22 of the 119 general-purpose berths hosting intermediate and depot-level maintenance meet all 8010 ACN 3A fire safety requirements.

Finding #38: There is no formal Navy policy governing assignment of berths at Navy installations and 8010 Maintenance Berth Fire Safety requirements are not the prime consideration for assigning maintenance berths outside of the public shipyards.

Finding #39: Aside from the public shipyards, only 22 of the 119 available berths at Navy installations meet 8010 requirements for surface ship maintenance availabilities.

Underlying Fire Safety Approach and Practices

The MFR found a distinct shortfall in the level of effort placed on preparing crews for the unique challenges associated with in-port fire prevention, detection, and response particularly in preparation and during maintenance availabilities. The industrial environment brings unique challenges to damage control and firefighting equipment with normal systems replaced with temporary services, installed detection and suppression systems unavailable due to ongoing maintenance, and repair lockers displaced and relocated. Expecting that Sailors will respond with the same level of timeliness and effectiveness under these unique and ever-changing conditions is a deeply flawed assumption and clearly demonstrates the necessity for an adaptive underlying philosophy, approach, and practices for fire safety in the industrial environment.

The unique conditions in the industrial environment require constant attention and validation so that leaders and all responders know the actual condition of the ship. Detailed government oversight and government/contractor teaming is required because individual contractors may not have an overall ship safety perspective, piecing together aspects of maintenance, crew and government capabilities, and installed safety systems.

Finding #40: There is a significantly lower level of attention and resourcing in preparation for and during the Maintenance Phase with regard to fire safety preparedness compared to the other phases of the Optimized Fleet Response Plan.

Finding #41: Higher echelons and external supporting organizations are not fully supporting commanding officers in the full application of 8010 or NSIs due to insufficient training and a lack of oversight.

Finding #42: The Navy lacks full appreciation for the need for a specific approach to successfully prevent, detect, and respond to shipboard fires in the industrial environment, attributable in part to a training continuum that focuses nearly exclusively on at-sea damage control.

Barriers to Enduring Change

In order to ensure compliance with all fire safety requirements, commanding officers and administrative and operational chains of command need a formalized and institutionalized approach to critically assess individual units and preemptively intervene to avoid another major shipboard fire. Commanding officers must be empowered to make difficult decisions to enforce the necessary fire safety posture, and then receive the necessary support to resolve any resulting shortfalls in production schedules and cost.

Finding #43: The MFR assessed that the acceptance of risk at the unit level instead of the transfer of risk (cost and schedule) to upper echelons is nearly identical to a similar issue revealed by the Comprehensive and Strategic Readiness Reviews.

Ineffective Damage Control Board of Directors

The MFR team assessed that the DCBoD has not been effective in driving improvement in fleet damage control posture and reducing the likelihood of a major conflagration. A review of DCBoD minutes found that the board failed to shift from their initial focus on Miami fire corrective actions to the strategic objectives of proposing changes to doctrine, in-depth analysis of mishap and fire drill trends, evaluation of damage control training programs, and championing of damage control modernization and new technology proposals. The MFR assessed that this failure to move on to strategic objectives was due in large part to the prolonged time spent adjudicating Miami fire actions (approximately six years), as well as other major fire events that occurred in the interim. These included the (b) (5) and (b) (5), both of which generated significant post-major fire actions, recommendations and lessons learned. Currently, the DCBoD is primarily focusing on actions, recommendations and lessons learned stemming from the USS Bonhomme Richard fire.

The MFR also assessed the organizational construct of the DCBoD was not conducive for driving enduring change for the following reasons:

- Organized on a series of committees that operate on consensus and periodic meeting schedules, the DCBoD lacks the focus and agility of a line organization
- A high rate of leadership turnover resulting in little continuity or retention of institutional knowledge
- Board and working groups are collateral duties for senior personnel with significant primary duties
- No full-time staff. There is no group or individual whose sole focus is the day-to-day business of the DCBoD

Since the Navy does not currently have a single organization that is responsible for both the collection and dissemination of fire safety lessons learned and the validation of compliance with corrective actions, this responsibility has fallen to the DCBoD. However, the DCBoD does not have wide visibility across the Navy and does not show up in any formal organizational chart or directory. This may have contributed to the DCBoD missing important policy changes, such as issuance of the OPNAV 3440 instruction in 2018 or the more recent Jensen Hughes recommendations regarding combustible material on SSBNs.

Despite the DCBoD's efforts to adjudicate post-fire actions, 10 of the 15 major fire events the MFR reviewed occurred after USFFC established the board. The MFR concludes that Navy damage control lacks a rigorous, systematic and programmatic approach to fire prevention, fire identification and immediate response, integrated firefighting, oversight, learning from past mishaps and funding future technology. In other important Navy programs, these processes are the responsibility of a line organization and not a board and working group construct. These constructs are typically more effective in addressing short-term issues.

Finding #44: The Damage Control Board of Directors (DCBoD) has been ineffective in enacting damage control improvements across the fire safety kill chain of prevention, detection, and response.

Disincentives and Barriers to Reporting

Central to the ability to learn from past events and avoid major disasters is the expeditious reporting of minor events as they occur. Recognizing and adjusting to near misses and potentially significant events is the key to operational safety theory. Organizational learning occurs when the errors or experiences of others are readily available and learned without having to repeat them. Arguably, information from frontline workers on near misses and hazards is even more central to learning and sustainable improvement than that provided by expensive, formal investigations and reviews. Fire reporting, especially of lower level events, does not always occur despite several policy requirements for accurate and timely reporting.

This fact could be marked down to a simple issue of awareness and compliance, and the solution would be to provide more training and enforcement of existing reporting policy. However, the MFR found that although the Navy and in particularly NSC have undertaken measures to increase reporting compliance and introduce a new safety reporting system (RMI), the fundamental problem is in the amount of time it takes for unit-level users to successfully gather the requisite data and produce the reports. For a variety of policy and system design reasons, it takes Fleet users from 2 – 6 hours to complete a single Hazard Report. It takes only slightly less time for them to retrieve operationally relevant reports that would be useful in planning for current operations.

NSC and the Fleets are collaborating to address this issue, but do not have a target time-required goal for report entry or report retrieval that would drive necessary change. Without progress on the several root causes of this issue, Navy will unable to collect, analyze, or disseminate tailored information on leading indicators or precursor events for fires or any other mishaps in an effective manner. These capabilities are necessary to cue ships, enable consistent organizational learning at the unit level and above, and thus avoid major mishaps.

Finding #45: Excessive time is required at the unit level to produce safety hazard reports and retrieve operationally relevant safety reports for learning and planning.

In summary, the MFR identified the following issues in underlying approaches and practices that have created barriers to enduring change:

- There is a significantly lower level of attention and resourcing in preparation for and during the Maintenance Phase with regard to fire safety preparedness compared to the other phases of the Optimized Fleet Response Plan
- There is a lack of full understanding and appreciation for risk that drives the need for a different approach necessary to successfully prevent, detect, and respond to shipboard fires in the industrial environment attributable in part to a training continuum that focuses nearly exclusively on at-sea damage control
- Commanding officers have a sense of empowerment to shut down operations and request assistance in the Training, Deployment, and Sustainment Phases and a low appreciation for that same authority in the Maintenance Phase in the face of production schedule and cost pressures
- Commanding officers are hesitant to pass schedule and cost risk to upper echelons and instead accept additional risk at the unit level by not fully implementing all fire safety requirements
- Commanding officers are not fully supported in the full application of 8010 or NSIs with insufficient training and a lack of oversight
- Mishap ships all displayed, but did not recognize, leading indicators or precursor events that would cause an ineffective team response
- Inconsistent, and often nonexistent, collection, analysis, and dissemination of lessons learned and timely, tailored fire safety threat information
- A significant level of underreporting
- Improvements in the fire safety kill chain including prevention, detection, and response are not prosecuted in a timely manner

Summary of Findings

As presented in the introduction, the MFR found the following broad issues driving not only previous fire incidents but also contributing to a current state of elevated risk. While this list is not all inclusive of the findings of this review, it represents the most significant issues that are preventing the institutionalization of enduring change in outcomes:

MFR Major Findings

- Lessons learned are not effectively collected and are lost over time due to an ineffective and inconsistent process to collect, analyze, disseminate, and enact critical information and corrective actions to include the process to conduct shipboard safety investigations
- Ineffective Damage Control Board of Directors (DCBoD) actions and processes for damage control improvements across the fire safety kill chain of prevention, detection, and response
- A lack of appreciation for the hazards associated with significant transitions, especially during maintenance periods, and insufficient management of the associated risk
- Unmitigated threats and vulnerabilities, in particular, arson
- Improper hazardous and combustible material handling and stowage
- Declining standards in watchstanding and a failure to critically assess and address deficiencies in a timely and effective manner
- Insufficient defense-in-depth
- A lack of knowledge and insufficient oversight and accountability of NAVSEA Technical Publication S0570-AC-CCM-010/8010 Industrial Ship Safety Manual for Fire Prevention and Response (8010) and/or Naval Sea Systems Command (NAVSEA) Standard Item (NSI) requirements resulting in persistent noncompliance
- Underlying systemic weaknesses similar to those revealed from the *Comprehensive* and *Strategic Readiness Reviews*
- Ineffective day-to-day training and a lack of comprehensive integrated drill sets
- Inconsistent attention and resourcing on pierside fire safety and damage control readiness resulting in significantly elevated risk as well as the late detection of and ineffective response to fires
- Overwhelming majority of piers and berths at Navy installations used for maintenance do not meet requirements for performance of depot-level maintenance as delineated in 8010 and derived from NAVFAC Unified Facilities Criteria for repair piers

Returning to VCNO's direction to the Fleet Commanders, this section lists the high-level issues in accordance with their applicability to VCNO's original six questions and then provides a summary of the findings found throughout the report. **Several of the MFR's findings apply to more than one of VCNO's questions, while others are not directly applicable to the original questions but are still significant enough for inclusion in this summary.**

(A) "Why actions put in place following major shipboard fires, such as implementation of reference (b) [NAVSEA Technical Publication S0570-AC-CCM-010/8010 Industrial Ship Safety Manual for Fire Prevention and Response (8010)] of the NSC letter, and related guidance did not sustainably achieve the desired outcome"

Compliance with fire safety requirements that existed at the time would have prevented or reduced the severity of all of the major fires that occurred during maintenance. The MFR revealed that the primary issues contributing to a lack of enduring change and the reoccurrence of major shipboard fires are ineffective learning; a lack of knowledge and ineffective application of 8010/NSI fire safety requirements, particularly on surface ships, and the persistence of underlying weaknesses similar to those discovered in the *Comprehensive Review*. These underlying issues include declining shipboard standards in watchstanding, hazardous and combustible material stowage, training, ship configuration management, and a lack of defense-in-depth. In most cases, the MFR found that ineffective command climate and insufficient ISIC (both OPCON and ADCON) and TYCOM oversight of underperforming commands enabled these underlying issues.

- *Ineffective Learning*
- *Noncompliance with 8010/NSIs*
- *Underlying Issues*
- *Poor Material Control and Cleanliness*
- *Training Shortfalls*
- *Underway vs. In-Port Preparedness and Posture*
- *Declining Standards in Watchstanding*
- *Insufficient Defense-in-Depth*
- *Unmitigated Threat of Arson*
- *Unmitigated Risk During Transitions*
- *Deficient Infrastructure to Support Maintenance Availabilities*

(B) "Why appropriate unit level standards were not consistently sustained relative to material control, cleanliness, and fire response readiness"

The MFR revealed that the primary issues contributing to declining shipboard standards are the lack of ownership by responsible divisions and departments for proper stowage of materials and cleanliness standards, lack of an effective zone inspection program, and ineffective training, all underpinned by a command climate that does not enable and enforce continual critical self-assessment and self-improvement. Additionally, as discussed in depth in Chapter 5 of this report, the MFR found that the underlying approach and practices for shipboard fire response nearly exclusively focus on combatting fires that occur underway, even for ships in major maintenance availabilities.

- *Ineffective Learning*
- *Noncompliance with 8010/NSIs*
- *Underlying Issues*
- *Poor Material Control and Cleanliness*
- *Training Shortfalls*
- *Underway vs. In-Port Preparedness and Posture*
- *Insufficient Defense-in-Depth*
- *Unmitigated Risk During Transitions*
- *Deficient Infrastructure to Support Maintenance Availabilities*

(C) "Why oversight from the ship's chain of command did not reliably identify and correct unit level performance gaps and noncompliance"

For the affected units themselves, the MFR found that an overreliance on outside assessments, a lack of a defense-in-depth mindset, aggregation of unrecognized risk over time, lack of knowledge of fire safety requirements, and command climates that do not reinforce critical self-assessment were the most significant factors contributing to failures to reliably identify and correct performance gaps and noncompliance.

The MFR found substantial gaps in coverage of fire safety on surface ships by the ISIC (both OPCON and ADCON) and the TYCOM over their units, especially in maintenance environments. The MFR found many cases where the ship's chain of command overly focused on time and schedule issues to the detriment of the ship's readiness to prevent, prepare for, and ability to fight fires.

- *Noncompliance with 8010/NSIs*
- *Underlying Issues*
- *Training Shortfalls*
- *Declining Standards in Watchstanding*
- *Insufficient Defense-in-Depth*

(D) "Why reporting mechanisms were not effective in providing a view of the actual risk posture"

The MFR confirmed that underreporting of fires is prevalent across the fleet. The MFR attributed this behavior to a number of factors to include ineffective and inaccurate reporting mechanisms, lack of appreciation of the potential consequences of a shipboard fire, and the lack of meaningful collection, analysis, and dissemination of lessons learned. These issues result in an incomplete picture of the true extent of the problem. However, the MFR found that there was still sufficient reporting of shipboard fires that should have alerted all cognizant commands of the inherent threat that was building over time.

The MFR also noted a largely unmitigated threat with regard to arson and gross negligence such as careless or unauthorized smoking. These events are not only underreported but also once the command turns the case over to NCIS, the fleet unnecessarily loses all visibility and all safety investigation ceases. This is true for both major and minor fires. Aside from the fire on USS Miami, the Navy has learned little from actual or suspected arson cases and in the case of Miami, it took months for the lessons learned to be collected and years to implement the still uncompleted corrective actions.

- *Ineffective Learning*
- *Underlying Issues*
- *Unmitigated Threat of Arson*

(E) "Why lessons learned from other adverse performance events were not accelerated into fire safety doctrine and practice"

As discussed in the answer to (A), the primary barrier to accelerating lessons learned from other adverse performance events into safety doctrine and practice is ineffective learning. The MFR found that SIBs missed opportunities to uncover broader root causes and thus failed to recommend sufficient corrective action. SIBs typically assigned actions to the single mishap command and rarely specified a validation mechanism to ensure that corrective actions brought about the intended change in an enduring manner.

The *Comprehensive Review of Recent Surface Force Incidents* (CR) completed in October 2017 identified many systemic issues. The MFR assessed that while the CR focused on the operational surface force and forward deployed forces, the CR team noted and communicated that the issues were "not unique to the surface force," recommending that each community examine the CR results and "assess the principles of the findings for broader applicability." The MFR assessed that these issues are equally applicable to in-port and maintenance operations and risks. The CR found broadly applicable issues including:

- Degraded watch team performance and misunderstood human performance factors
- Erosion of crew readiness, planning, and safety practices
- Headquarters processes inadequately identified, assessed, and managed operational risk
- Assessments do not reinforce effective learning
- "Can do" culture undermined basic watchstanding and safety practices

These issues are inherent in many MFR findings. Individual commander reviews post-CR also inadequately assessed the systemic risks inherent in our industrial private sector maintenance. As noted in this report, a NAVSEA review of industrial fires, early in 2020, identified a trend of fires, but subsequent actions failed to correct the underlying issues associated with 8010 understanding, combustible and flammable material accumulation, risk management, contractor compliance, government oversight, and fire safety governance. The failing of the 2020 NAVSEA report is that it focused entirely on preventing the source of the fire (mainly hot work) from an industrial activity perspective, and did not consider the crew's perspective, accumulation of risk, and weaknesses in our defense-in-depth posture imposed by the above issues.

In addition, the CR recommended some specific broader actions including:

- Improved utilization of near miss reporting to share lessons across the surface force
- Improve Naval Safety Center and fleet and force headquarters safety programs and data analysis to provide predictive operational safety and risk information
- Establish human performance expertise at all type commander staffs
- Establish commanding officer mentors in surface ship homeports

Finally, the CR recommended areas for further study including:

- Improving processes that support learning across the Navy (i.e., between warfare communities)
- Improvements in damage control

The MFR found significant gaps in the implementation and current effectiveness of many of the above recommendations, especially in industrial environments for private contracted surface ship availabilities. The MFR noted that most CR actions and recommendations focused on operational OFRP phases (Training, Deployment/Sustainment) and failed to consider many of the risks identified by the MFR in the Maintenance Phase or seemingly benign in-port operations.

- *Ineffective Learning*
- *Noncompliance with 8010/NSIs*
- *Underlying Issues*
- *Poor Material Control and Cleanliness*
- *Training Shortfalls*
- *Underway vs. In-Port Preparedness and Posture*
- *Declining Standards in Watchstanding*
- *Insufficient Defense-in-Depth*
- *Unmitigated Threat of Arson*
- *Unmitigated Risk During Transitions*
- *Deficient Infrastructure to Support Maintenance Availabilities*

(F) "Why independent oversight organizations, such as NSC, were not effective in identifying the problems for Fleet action"

The MFR found that NSC is unnecessarily distant from the fleet. Although in recent years, the SIR process has evolved and now requires the reporting and tracking of corrective action completion, the MFR found that the fleet is not consistently following this mandatory process. NSC lacks authority to enforce the requirement and furthermore lacks the resources to provide additional on-site validation of corrective action effectiveness and completion. Somewhat by design, NSC is not organized and structured to conduct inspections and therefore is reliant on the receipt of timely and accurate reports, something that is not consistently occurring. The Navy currently lacks a central organization with the authority and resources to collect, analyze, and disseminate fire safety and damage control lessons learned or an organization with the authority to regulate fire safety standards and their enforcement.

- *Ineffective Learning*

Conclusion

During each of the Navy's major shipboard fires, many of our Sailors engaged in individual heroic acts, however, the integrated efforts of the team ultimately extinguished the fire. The MFR reconfirmed the same overall conclusion as each of the major fire investigations; these heroic actions were entirely avoidable. In each fire, to include those attributed to arson or suspicious origins, the MFR found that adherence to existing fire safety requirements at the time of the incident would have prevented the fire or at a minimum, lessened the severity of the damage. These requirements include those associated with fire prevention and detection as well as those associated with ensuring that our duty sections are trained and proficient for fire response.

The MFR revealed 12 significant issues supported by 45 findings. However, the MFR also found clear examples of effective leadership in establishing and maintaining an adequate fire safety posture. During site surveys, the MFR team noted that some crews were not only knowledgeable in fire safety requirements but also confident in their ability to effectively detect and respond to a shipboard fire. These commands had several common characteristics, namely, a solid sense of ownership, strict adherence to watchstanding principles and standards, and a command climate built on critical self-assessment, trust, and accountability.

As mentioned earlier, the MFR did find some level of effectiveness in the post-BHR 12-star messages, however, the effectiveness was not consistently found across all organizations and platform types and will undoubtedly be short-lived without further action. The MFR presents seven strategic recommendations and 56 specific recommendations and corrective actions aimed at enabling enduring change in fire safety outcomes.

Corrective Actions and Recommendations

Strategic Recommendations

Similar to many of the recommendations found in the *Comprehensive Review and Strategic Readiness Review,* the following seven strategic recommendations present actions that require additional deliberate planning to develop implementation plans. While the MFR did intentionally set out with an intent to avoid recommending further studies and reviews, the team also felt that omitting these bold actions would amount to a missed opportunity to bring about enduring organizational change.

(1.A) Changes to the Naval Safety Center and DCBoD

Applicable major finding: *Ineffective Learning* (p. 118)

(1.A.1) Modify Naval Safety Center missions, functions, and tasks, creating a more effective organization that is responsible for establishing policy, conducting investigations, assessing trends, recommending resourcing, and overseeing Fleet implementation and enforcement of non-nuclear safety standards and performance. NSC shall set reporting levels for non-nuclear safety events, accept/reject/assess these reports, aggregate data, conduct data analysis, and take action on adverse trends well before issues grow to systemic levels. A newly enabled and refocused Naval Safety Command (vice Center) would provide a layer of defense-in-depth for non-nuclear safety oversight and enforcement but would not diminish the authority, responsibility, and accountability of the chain of command. The intent is to ensure there is a single individual at the echelon1 level who has ownership and is overall responsible for damage control and fire safety, and who will closely coordinate with other key stakeholders including the Major Fleet Commanders, NAVSEA, CNIC, and NETC. (OPNAV)

(1.A.2) Sunset the Executive Agent for Damage Control and assign the associated missions, functions, and tasks in the DCBoD charter to the Naval Safety Command. (OPNAV, Fleets)

(1.A.3) Fleet Commanders shall ensure the Deputy Commander, via the Fleet Safety Officers, are accountable for implementing and enforcing non-nuclear safety standards and regulations in the fleet. If required, they shall create additional policies or requirements to ensure effective non-nuclear safety programs. (OPNAV, Fleets)

(1.B) Develop and operationalize an organizational learning posture

Applicable major findings: *Ineffective Learning* (p. 118), *Underlying Issues* (p. 122), and *Training Shortfalls* (p.126)

(1.B.1) The Fleets and TYCOMs shall develop/improve operational safety programs, executing a tiered approach that values and addresses near misses and minor events. These programs, led by a senior line officer or civilian, will contribute to a learning culture that prevents minor issue growth into major problems and mishaps. They shall incorporate processes and lessons learned across multiple communities (*e.g.*, Aviation Safety Officer curriculum, SUBSAFE program, Naval Nuclear Propulsion Program principles, Submarine Collisions and Groundings review and subsequent upgrading actions, etc.). In addition, modify the goal of external reviews from ISICs and other oversight organizations to reinforce unit ownership of their problems by pointing out weaknesses the units don't see or understand, and helping units learn from this process on why they were not able to identify their own weaknesses and correct them. (Fleets, TYCOMs)

(1.B.2) Fleets and TYCOMs shall clearly define oversight roles and responsibilities regarding fire safety throughout the entire readiness cycle, including roles and responsibilities within chains of command through coordination with numbered fleet commanders, CSGs, ESGs, and ISICs. Incorporate oversight of the above principles to establish and maintain the expectation that units must be self-reliant through a disciplined approach to self-awareness, self-criticism, and self-improvement. Training and oversight expectations and processes shall be planned for all levels of the administrative and operational chains of command, and include waterfront training groups and inspection teams. (Fleets, TYCOMs)

(1.B.3) Based on multiple indications of ineffective learning identified throughout the review (similar to the CR/SRR), OPNAV N7 should lead, with appropriate stakeholders and recognized experts to include senior enlisted, the assessment and development of a plan with lines of effort to operationalize the core tenet of institutional and individual learning as a means for improvement across the Navy. Core to effecting lasting change is a curriculum and training that inculcates the principles of critical self-assessment and self-improvement. See Appendices J and K for additional guidance and information. (OPNAV, Fleets, NETC)

(1.C) Address the totality of the threat, including arson

Applicable major finding: *Unmitigated Threat of Arson* (p. 134)

(1.C.1) OPNAV and the fleet must recognize the unabated threat of arson and develop comprehensive mitigation strategies. Chief among these is the development of a comprehensive defense-in-depth mindset and much higher day-to-day standards with regard to shipboard fire prevention, detection, and response. This action is not only necessary to address the threat of arson, but also to effectively mitigate the increased fire safety risks in the in-port and industrial environments. Much like insider threat awareness and training at many levels for various dangers such as cyber and physical security, develop and implement similar measures for arson and careless smokers. OPNAV and the fleet must also work with medical experts to develop or incorporate into existing programs a Sailor mental health strategy. Additionally, OPNAV and the fleet must work with NCIS to identify methods to identify potential arsonists based on typical threat recognition factors. (OPNAV, Fleets)

(1.D) Eliminate the difference in fire protection standards, compliance, and oversight between public and private maintenance availabilities

Applicable major finding: *Noncompliance with 8010/NSIs* (p. 120)

(1.D.1) Review and correct deficiencies found in the NSA's oversight and accountability processes for industrial fire safety in private sector maintenance and modernization work. Address RMC/SUPSHIP organizational structure, staffing and training to ensure appropriate government service human resources (including Fire Safety officers) are available to provide effective oversight and compliance with fire safety requirements in contracts. Fund and resource the proper government oversight of contracted work. Improve the mechanisms for holding private shipyards to the requirements and deliverables in the NSIs covering fire safety requirements, particularly hot work. (NAVSEA, OPNAV supporting)

(1.D.2) Establish a single NSI with 8010 requirements for LMAs, or directly invoke 8010 in contracts. The single NSI should include all LMA 8010 requirements with no gaps. For clarity, list only 8010 requirements in this Standard Item. (NAVSEA)

(1.E) Upgrade all piers to have the required access and services for the safe conduct of maintenance availabilities.

Applicable major finding: *Deficient Infrastructure to Support Maintenance Availabilities* (p. 136)

(1.E.1) Cease performing maintenance availabilities on piers that do not meet proper fire protection requirements. Long term planning and funding are required to meet the total capacity required. In the interim, every maintenance period conducted, whether a major CNO availability or a continuous maintenance availability (CMAV), will use full mitigations and temporary systems that bring the site up to the standard if a maintenance pier is not available. Update the Port Operations Management Systems (POMS) tool to flag mismatches in assigning ships to inadequate piers. Any deviations to this standard should be rare and only approved by the Fleet Commander. (CNIC Lead, NAVSEA/Fleets/TYCOMs supporting)

(1.E.2) Formally define the requirements for repair or maintenance piers/berths vs. general-purpose piers/berths and ensure the consistent application of these definitions throughout the 8010 manual (NAVSEA Lead, CNIC supporting).

(1.E.3) Require private contractors to certify their piers/berths and dry docks where new construction and maintenance availabilities meet the requirements of the (updated) 8010 manual and provide unimpeded access to fire response vehicles. (NAVSEA lead, CNIC supporting)

(1.F) Address poor hazardous and combustible material handling and stowage practices and recognize the accumulated fire risk they create

Applicable major findings: *Noncompliance with 8010/*NSIs (p. 120), *Underlying Issues* (p. 122), *Poor Material Control and Cleanliness* (p. 124), and *Unmitigated Risk During Transitions* (p. 135)

(1.F.1) Establish and enforce a much higher standard for shipboard cleanliness and stowage of both combustible and hazardous materials, no matter the ship's location or phase of the OFRP. These standards are necessary to ensure that a potential arsonist or careless smoker cannot find or exploit such weaknesses that allow the rapid growth of a small fire into a major conflagration. (Fleets, NAVSEA)

(1.F.2) Review 8010 to ensure cleanliness and stowage requirements are adequate to optimize/minimize combustible and material loading in the industrial environment. Coordinate with CSF on the implementation of recommendations regarding combustible material loading on SSBNs raised in the Jensen Hughes report. (NAVSEA)

(1.F.3) Ensure design guidance is adequate for surface ships, submarines, and aircraft carriers to ensure adequate storage provided for allowances of combustible and hazardous materials. NAVSUP develop and provide guidance to the fleet on recommended best practices for in-service platform material storage. Within NSTM 670, provide a guide, by ship class or space classification, on the design considerations for the storage of hazardous material. (NAVSEA, NAVSUP)

(1.F.4) Evaluate the efficacy of the stock system's ability to provide adequate supply of combustible and hazardous materials of concern during ship deployments. Where deficiencies exist, implement corrective action such that ships regain confidence in the stock system, eliminating the need to "overstock" prior to deployment. Periodically validate allowances and compliance. (NAVSUP lead, Fleet supporting)

(1.F.5) Overhaul and streamline the HAZMAT issue/turn-in processes to reduce incentives for improper storage of materials in work centers. Ensure NSTM 670 for Afloat HAZMAT handling, stowage, and usage addresses this issue. (NAVSUP, NAVSEA/Fleets supporting)

(1.G) Address Fire Safety Kill Chain vulnerabilities, particularly during maintenance and transitions

Applicable major findings: *Noncompliance with 8010/*NSIs (p. 120), *Underlying Issues* (p. 122), *Poor Material Control and Cleanliness* (p. 124), *Training Shortfalls* (p. 126), *Underway vs. In-Port Preparedness and Posture* (p. 128), *Declining Standards in Watchstanding* (p. 130), *Insufficient Defense-in-Depth* (p. 132), *Unmitigated Risk During Transitions* (p. 135), and *Deficient Infrastructure to Support Maintenance Availabilities* (p. 136)

(1.G.1) In the 15 events examined, the MFR found a myriad of missed opportunities to address vulnerabilities. This issue also existed in the corrective actions assigned, particularly on ships in maintenance availabilities and during major transitions. The wide range of intent of these actions, their overlap, and varying statuses warrants a holistic approach to fire vulnerabilities. All organizations that play a role across the fire safety kill chain spectrum of fire prevention, detection, and response to include training and policy must examine their approach to fire safety oversight and accountability against this report and effectively and efficiently address the findings. In addition to this self-assessment, address specific actions and recommendations provided below. Special emphasis shall be placed on bringing automated shipboard fire detection systems online as discussed in paragraph 2.B.1.a. (Fleets with NAVSEA, CNIC, NETC supporting)

Additional Corrective Actions and Recommendations

Unlike the strategic recommendations presented above, the MFR makes the following 56 corrective actions and recommendations with the intent of immediate or near-term resourcing and action with limited follow-on analysis required.

(2.A) Safety Policy, Investigations, and Data

Applicable major finding: *Ineffective Learning* (p. 118)

(2.A.1) Update OPNAVINST 5102.1D and supporting processes for investigations of fire incidents to ensure:

a) Safety investigations look at broader root causes of individual fires and associated damage, capturing the entire fire safety kill chain from prevention through overhaul and recovery.

b) Mishap investigation reports specify a formal mechanism for the reporting, tracking and validation for corrective actions

c) A single fire-reporting format and distribution model to pass the critical lessons learned and intended corrective actions to the fleet with the goal of better capturing and rapidly communicating causes, lessons learned, and actions to a wide audience in plain language, with graphics that provide clarity. The final product should be authoritative, removing conflicting information and endorsement comments. This report would be likely separate from the SIB/RMI report that would still contain protected and conflicting information in individual endorsements. The SIB/RMI would be foundational to building the recommended single lessons learned report distributed to the fleet. (OPNAV, NSC supporting)

(2.A.2) Develop and implement a formal mechanism for reporting, validating, and implementing fire safety corrective actions that provides action requirements, dependencies between organizations, and deadlines at all echelons. (Fleets)

(2.A.3) Implement an internal Hazard Review Board process and regularly update senior Navy and unit level leadership of status, barriers to completion, resources necessary, outstanding operational risk to mission/risk to force, and effectiveness of actions taken. (NSC Lead, OPNAV and Fleets supporting)

(2.A.4) Update safety investigation requirements to include standards for mishap investigation board member training, to include formal interview and evidence collection practices, and employ causal analysis that includes, but is not limited to the Human Factors Analysis Classification System (HFACS). (NSC lead, Fleets/CNIC supporting)

(2.A.5) Implement Hazard Review Boards within each convening authority that manage open corrective actions and evaluate their effectiveness. Provide aggregated, periodic Hazard Review Board updates to the Navy Executive Safety Board and Fleet Operational Safety Board. (Fleets, NAVSEA, CNIC)

(2.A.6) Using all-source data within the Navy data science system of record (ADVANA/Jupiter) develop the means and methods to accurately report the number and types of fires, and provide analysis to recognize developing trends, uncover causal factors, and ensure broad awareness of critical threat factors for correction. Include reports currently captured within RMI, contractor action reports, NAVSEA methods, and OPREPs to gain and establish consolidated reporting criteria for fires. (OPNAV, NSC)

(2.A.7) Establish (or expand on existing processes) to identify leading indicators of fire safety conditions in the private shipyards for use in predictive analysis. (NSC lead, NAVSEA/Fleets supporting)

(2.A.8) Ensure the near miss reporting processes established by the *Comprehensive Review* (CR) are effectively sharing lessons across the surface force. (Fleets)

(2.A.9) Change practice and update OPNAVINST 5102.1D to allow for safety investigations of events that may have a criminal element to continue. Navy must be able to fully investigate both safety and legal/criminal aspects of major events at the same time for different purposes, prioritizing organizational learning. Beyond and regardless of the initiation/ignition event, other aspects of the fire safety kill chain must be investigated and improve and the current practice subordinates organizational learning to law enforcement investigations and prosecution. (OPNAV)

(2.A.10) Develop a process for the fleet, NSC, NAVSEA and NCIS to collaborate and share NCIS conclusions from suspicious fire investigations so that the larger Navy system understands the data, can trend it, and take action as necessary. (Fleet lead, NSC, NAVSEA, NCIS supporting)

(2.A.11) Review the processes for issuing and updating manuals, instructions and doctrine to ensure timely and effective communication of changes to the fleet to address the practice of providing new policy via messages and incomplete interim changes without accompanying training, messaging, or assured receipt. (OPNAV, NAVSEA, Fleets)

(2.A.12) Navy Inspector General (IG) missed multiple indicators over the last decade of a growing and unabated threat of shipboard fires, in two cases resulting in a total loss of the platform. As shown in this review, the Navy and contracted maintenance providers failed to maintain standards and meet requirements. As the Navy's conscience and last line of defense, Navy IG should be able to detect significant adverse trends in safety and waste that the Navy is not properly reacting to as part of their defined mission. The Navy IG should conduct a self-assessment of their missed role and ineffectiveness in this case and take action to upgrade performance. (SECNAV, OPNAV)

(2.A.13) Coordinate with NCIS/NAVSEA to provide training to commands and local investigators regarding preservation of all fire scenes where the cause is not immediately obvious until the arrival of NCIS/coordination of the investigation(s). (Fleets)

(2.A.14) The MFR assessed that fire reporting is prevalent across the fleet and maintenance providers. As noted in the Chapter 5 section "Disincentives and Barriers to Reporting," and discussed in "The Problem Severity Triangle" found in Appendix J, organizational learning and prevention of high-consequence problems require expeditious reporting of minor events and near misses as they occur. Revise the present Situation Report (SITREP) fire reporting guidance to lower the reporting threshold for all fires. In addition, modify fleet training and enforcement of reporting requirements to ensure that commands report all fires in a SITREP as a minimum. (NSC lead, NETC/Fleets supporting)

(2.A.15) Enable low-level event and near miss reporting, as well as retrieval of operationally relevant lesson learned, by improving both policy and systemic issues that burden fleet users with excessive time requirements. Set and achieve a time-required goal of under 30 minutes for entry or retrieval of hazards under the day-to-day conditions experienced in the fleet at the unit level. (NSC, NAVSEA, Fleets)

(2.B) Fire Detection and Suppression Systems, Firefighting Equipment and Ship Design Initiatives

Applicable major findings: *Ineffective Learning* (p. 118), *Noncompliance with 8010/NSIs* (p. 120), *Underway vs. In-Port Preparedness and Posture* (p. 128), *Insufficient Defense-in-Depth* (p.132), *Unmitigated Threat of Arson* (p. 134), and *Deficient Infrastructure to Support Maintenance Availabilities* (p. 136)

(2.B.1) Fire detection systems:

(2.B.1.a) Prioritize efforts to bring automated shipboard fire detection systems online. Recognize the threat of arson when designing and back-fitting temporary or permanent fire detection systems, including actions that remain open from the 2012 MIAMI Fire Panel Recommendations. Expeditiously revisit the previous proposal and initiate funding and installation of ship-wide fire detection systems for new ship construction and in-service ships. (OPNAV, NAVSEA, Fleet)

(2.B.1.b) Develop principles to maintain the readiness of fire detection systems throughout maintenance availabilities. (NAVSEA)

(2.B.1.c) Until improvements in automated detection and surveillance capability are in place, provide for additional duty watch rotations and checks of typically unmanned spaces to mitigate the periods that potential bad actors have the opportunity to exploit. (TYCOMS)

(2.B.2) Fire suppression systems:

(2.B.2.a) Recognize the threat of arson when designing and back-fitting temporary or permanent fire suppression systems, including actions that remain open from the 2012 MIAMI Fire Panel Recommendations. Revisit the previous proposal and initiate funding and installation of fire suppression systems for new ship construction and in-service ships. (OPNAV, NAVSEA, Fleet)

(2.B.2.b) Develop principles to maintain the readiness of fire protection systems throughout maintenance availabilities. (NAVSEA)

(2.B.2.c) Develop 8010 requirements that place limits on the amount of vehicle stowage, well deck, mission bay, and hangar deck area that can have scaffolding erected/suspended at any given time. Provide written guidance regarding the use of open-grate scaffold decking when appropriate/feasible. (NAVSEA)

(2.B.3) Other firefighting equipment and ship design initiatives

(2.B.3.a) Fund the assessment, implementation, and outfitting for both back-fit and forward-fit ships, of improved fire-prevention features and materials, and advanced fire-fighting equipment. The assessment should include but not be limited to: (1) the use of intumescent paint (especially in the highest risk areas of ships); (2) increased applications of fire insulation for critical supporting and fire spread prevention structures (i.e. DC Decks, Fire Zone boundaries, controlling stations; (3) support stanchions and critical longitudinals); (4) fire rated division doors and roller doors for subdivision separation at large openings and spaces; (5) state-of-the-art thermal imaging cameras (including mandatory upgrades when approved for use); (6) upgraded shipboard radio emergency communication systems; (7) the Advanced Damage Control System (ADCS); and (8) extreme measures such as high expansion foam. Improve the timeline of integration and installation of these systems as applicable shipboard and ashore. (OPNAV, NAVSEA, Fleet, CNIC)

(2.C) Inspections, Certifications, and Assist Visits

Applicable major findings: *Ineffective Learning* (p. 118), *Noncompliance with 8010/NSIs* (p. 120), *Underlying Issues* (p. 122), *Poor Material Control and Cleanliness* (p. 124), *Training Shortfalls* (p. 126), *Underway vs. In-Port Preparedness and Posture* (p. 128), *Declining Standards in Watchstanding* (p. 130), *Insufficient Defense-in-Depth* (p.132), and *Unmitigated Risk During* Transitions (p. 135)

(2.C.1) Clarify the type commander's role for training ship's force for maintenance availabilities, including 8010. (Fleets)

(2.C.2) Rather than grading inspections and certifications on the single event outcome or a checklist alone, evaluate the ability of the unit to effectively self-assess and self-improve. Strengthen unit-level critical self-assessment and continuous improvement to prevent day-to-day degradation of performance of fire prevention, detection and response while in port. Use and require assist visits and Readiness Assistance Teams to specifically address and improve this ability. (TYCOMs)

(2.C.3) The Damage Control – Industrial training plan must be part of the overall maintenance phase plan, similar to mandatory certifications in the Basic Phase of OFRP. Update OFRP instruction. (Fleets)

(2.C.4) Regarding the new Damage Control – Industrial (DC-I) crew certification requirement, add a required team trainer event for each IET, similar to the flight deck firefighting team event or the navigation team trainer events for bridge watchstanders. (TYCOMs)

(2.C.5) Evaluate unit and ISIC ability to demonstrate both effective ORM (in planning and execution) and organizational learning at each key milestone, especially during maintenance availabilities and other major transitions of the OFRP. (TYCOMs)

(2.C.6) Periodically require an outside assessment of the effectiveness of the unit training team triggered by a turnover of these personnel, using the crew continuity model. (TYCOMs)

(2.C.7) Conduct integrated site surveys of the ship's configuration and fire readiness during the maintenance phase to assess the environment and preparations. Include fire safety experts and off-ship responders in these periodic walkthroughs and discussions. (TYCOMs)

(2.C.8) Define the requirements for individual Damage Control Training Team membership, certify the teams, and institute a mechanism to revisit and assess the teams throughout an extended maintenance availability. Include standards for turnover of individuals (crew continuity requirement). (TYCOMs)

(2.C.9) Establish policy, mechanisms, and assessments to ensure understanding and mitigation of changes to the fire safety posture of ships during major and minor transitions. This includes entering and exiting maintenance, moves to a different pier, commencing and finishing major maintenance availabilities, and crew moves on and off the ship. Mechanisms to be considered include formal readiness reviews and risk assessments in advance of these changes, similar to what is done for major operational changes (LOA, Ready-for-Sea Assessments, etc.), along with regular spot checks conducted during vulnerable periods (nights and weekends). (TYCOMs)

(2.C.10) Conduct regular, unannounced inspections of ships in industrial availabilities to address improper stowage of combustible and hazardous materials, excessive quantities of these materials being brought aboard (exceeding material allowances), and stowage in unauthorized spaces or spaces with degraded fire protection systems. (TYCOMs)

(2.D) Unit-level Command Support Improvements

Applicable major findings: *Underlying Issues* (p. 122), *Training Shortfalls* (p. 126), *Declining Standards in Watchstanding* (p. 130), *Insufficient Defense-in-Depth* (p.132), *Unmitigated Threat of Arson* (p. 134), and *Unmitigated Risk During* Transitions (p. 135)

(2.D.1) Ensure a sufficient senior military presence on the waterfront within assessing units (e.g., TYCOMS, ISIC, CSG, ESG) to provide regular, credible executive level feedback directly to commanding officers and senior enlisted leadership that moves beyond a list of checklist discrepancies to specific actions that would preclude recurrence. (Fleets)

(2.D.2) For continuity and institutional memory, weave in senior civilians to complement transient military personnel, including senior mentors and assessors within TYCOMs, Afloat Training Groups, and Warfighting Development Centers, similar to the Submarine Learning Center model. These highly experienced, focused personnel can help address transitions, defense-in-depth, poorly developed enlisted personnel, effective ISIC oversight, day-to-day standards, watchstanding fundamentals, and self-assessment/self-improvement at the unit level and above. (Fleets)

(2.D.3) Target investments and training in the mental health of crews before and during high-risk/high stress periods during maintenance availabilities, provide mitigations for specific billet assignments, and address specific transitions. (OPNAV and Fleets)

(2.D.4) Examine and revise current practices for Divisional Damage Control Petty Officer DC PMS assignment via work center ER09 and the PMS assigned to work center ER04 for opportunities to level load assigned maintenance and ensure appropriate oversight of maintenance execution. (Fleet 3-M Requirements Management Board (RMB))

(2.E) Maintenance Availability Preparations and Planning

Applicable major findings: *Noncompliance with 8010/NSIs* (p. 120), *Training Shortfalls* (p. 126), *Underway vs. In-Port Preparedness and Posture* (p. 128), *Insufficient Defense-in-Depth* (p.132), *Unmitigated Risk During* Transitions (p. 135), and *Deficient Infrastructure to Support Maintenance Availabilities* (p. 136)

(2.E.1) Include an assessment of industrial fire safety risk and implementation of 8010 requirements in the agenda of 1-star and 3-star "stack hands" meetings held in advance of CNO availability starts. (NAVSEA)

(2.E.2) Implement a milestone review for ships within 4 months of entering the maintenance phase that addresses the fire safety requirements, expectations for ship's force oversight of contractor work, drill and training time, and maintenance phase certification. (TYCOMs)

(2.E.3) Implement a formal process to ensure compliance with pier infrastructure requirements for ships in maintenance availabilities. This process needs to include transitions when ships in maintenance move from a shipyard pier to a naval station pier, and differentiate between major/CNO availabilities and minor/continuous maintenance availabilities. (NAVSEA lead, CNIC, Fleets, Numbered Fleet Commanders supporting).

(2.E.4) Institutionalize the training of surface ship, submarine, and aircraft carrier crews on 8010 industrial fire safety requirements. Include how these requirements are translated to contracts via NSIs for private sector work, the associated oversight and accountability processes, the authority of ship's force to stop work when fire safety concerns are raised, the fire safety council, fire response plans, fire safety systems, major fire lessons learned, and 8010/3440 structure and policy for command and control. (NAVSEA for curriculum, Fleets for implementation)

(2.E.5) Improve duty section and in-port emergency team training and proficiency for fire prevention, detection and response. Specific areas to address include basic and advanced firefighting, knowledge of installed fire detection and suppression systems, incident management, integration with shore-based federal or civilian firefighters, firefighting in an industrial environment, 8010 implementation and compliance, knowledge of changes to ship's configuration, knowledge of exceptions to damage control material condition and training on real-world and worst-case scenarios. (TYCOMs, NETC supporting)

(2.E.6) Include arson as a primary risk area accounted for and mitigated when building shipboard fire safety and response plans. (NAVSEA, Fleets supporting)

(2.E.7) Provide policy clarification and considerations relative to placing damage control equipment into Inactive Equipment Maintenance (IEM) status. (Fleet 3-M RMB, NAVSEA assist)

(2.F) Philosophy and Mindset

Applicable major findings: *Ineffective Learning* (p. 118), *Noncompliance with 8010/NSIs* (p. 120), *Underlying Issues* (p. 122), *Poor Material Control and Cleanliness* (p. 124), *Training Shortfalls* (p. 126), *Underway vs. In-Port Preparedness and Posture* (p. 128), *Declining Standards in Watchstanding* (p. 130), *Insufficient Defense-in-Depth* (p.132), *Unmitigated Threat of Arson* (p. 134), *Unmitigated Risk During* Transitions (p. 135), and *Deficient Infrastructure to Support Maintenance Availabilities* (p. 136)

(2.F.1) Establish a defense-in-depth mindset and establish lasting actions regarding in-port fire safety, especially in an industrial environment. This includes the following: (1) adherence to fundamental watchstanding principles; (2) strong deckplate ownership of day-to-day stowage and cleanliness standards; (3) exercising complex, frequent and varied drill scenarios that test the ship's defensive fire safety posture and ability to quickly close the fire safety kill chain; (4) strong command oversight through zone inspections; (5) periodic senior leadership walkthroughs of infrequently occupied spaces; and (6) with establishing a command environment that emphasizes critical self-assessment and improvement, reporting, learning, and proper accountability. (Fleets lead, all others supporting)

(2.F.2) Provide training to leadership triads on the frequency of shipboard arson cases and the characteristics of arsonists identified in past cases. (Fleets, OPNAV supporting)

(2.F.3) Share best practices on the use of ISIC and TYCOM "watch lists" which have proven to be an effective mechanism to maintain focus on high-risk units. Increase formality – TYCOMs present their plan and resulting lists to the Fleet Commander. (Fleets lead, NAVSEA supporting).

(2.F.4) Conduct a comprehensive study on aggregation of risk and the identification of an appropriate holistic risk posture. Currently there are no tools for the effective assessment of total organizational or project risk. The Navy should initiate the effort to lead this area of development (similar to past efforts such as SUBSAFE). (OPNAV)

(2.G) Additional Resources and Programs

Applicable major findings: *Ineffective Learning* (p. 118), *Noncompliance with 8010/NSIs* (p. 120), *Underlying Issues* (p. 122), *Poor Material Control and Cleanliness* (p. 124), *Training Shortfalls* (p. 126), *Underway vs. In-Port Preparedness and Posture* (p. 128), *Insufficient Defense-in-Depth* (p.132), *Unmitigated Risk During* Transitions (p. 135), and *Deficient Infrastructure to Support Maintenance Availabilities* (p. 136)

(2.G.1) Develop and implement a zone inspection software and training system that improves both onboard effectiveness and provides continuous self-assessment and self-improvement data to higher headquarters for trends, oversight, and solutions to common problems. (Fleet Lead, OPNAV/NAVSEA supporting)

(2.G.2) Establish a maintenance phase manning floor metric for shipboard manning FIT/FILL rates. While a review of manning data for each of these 15 events indicated manning rates were not a causal factor, the MFR viewed this as just a matter of coincidence rather than active risk mitigation. A review of current shipboard manning metrics shows the assumption of signification risk in manning our ships in the maintenance phase, unnecessarily adding to the aggregation of fire safety risk. In addition, OPNAV should program 100% of the manpower associated with our surface ships, to include aircraft carriers, and coordinate with the Fleet Commanders on a revision to OPNAVINST 3120.32 section 4.21 with regard to the number of duty sections maintained while in U.S. ports. (Fleets, OPNAV)

(2.G.3) Define and direct the supporting roles of ISICs (OPCON/ADCON) in the unified area command for in-port casualty response in accordance with OPNAVINST 3440.18, including requisite training in NIMS. (Fleets). To codify this near-term direction, revise OPNAVINST 3440.18 to include these supporting roles and training requirements. (OPNAV)

(2.G.4) Review and address reports of significant internet limitations with systems provided by contract for crews on ships in private shipyards. This problem reduces the crew's ability to draw information from Navy eLearning sites, SharePoint sites, Collaboration at Sea (CAS), NSC's RMI, and other systems in order to share lessons learned and best practices. This also creates a barrier to reporting through web-based systems such as RMI. (NAVSEA lead)

(2.G.5) Ensure LMAs provide regular updates to the Integrated Production Schedule (IPS) as required by the NSIs. LMAs must provide status of installed temporary fire detection, suppression systems, and items effecting elevated fire risk. Lack of compliance in this area results in an incomplete picture of hazards across the ship and no single, accurate reference for risk analysis and mitigation for the NSA and ship's force. (NAVSEA)

(2.H) Career and En Route Training

Applicable major findings: *Ineffective Learning* (p. 118), *Underlying Issues* (p. 122), *Training Shortfalls* (p. 126), *Underway vs. In-Port Preparedness and Posture* (p. 128), and *Insufficient Defense-in-Depth* (p.132)

(2.H.1) Ensure that ORM training during all career milestone officer and enlisted training and enlisted leadership courses includes fire prevention and response in at-sea, in port (routine) and industrial maintenance conditions. Develop and mandate recurring training focused on lessons learned from major events and tailor for various levels of leadership. (NETC lead, NSC supporting)

(2.H.2) Develop an advanced firefighter school and training, specifically tailored to DC rate. Intent of training would be to create SME firefighters out of the DC rating. Topics and training should include more advanced fire scenarios, such as flashovers, backdraft, and fire prevention. Treat this school as a mandatory "C" school for all E-4 and above DC rated personnel. Emulate the International Fire Service Training Association/National Fire Protection Association (IFSTA/NFPA) Firefighter I & II courses. Revisit cross training the DC rating to Fire and Emergency Services (F&ES). (NETC lead, NAVSEA develop curriculum criteria and auditing, CNIC/NAVSEA/Fleets supporting)

(2.H.3) Develop an integrated industrial firefighting course for damage control leadership and personnel with the intent of integration with Navy F&ES/municipal fire departments. Include training and qualification on NIMS to improve understanding of integration with shore-based support (e.g., F&ES, community mutual aid). These courses should include the necessary topics for student certification at the end of the course. (NETC lead, CNIC/NAVSEA auditing/Fleets supporting)

(2.H.4) Review and revise the content and training techniques employed during the General Shipboard Firefighting (SCBA) (A-495-0416) and Advanced Shipboard Firefighting (J-495-0419) courses where necessary to ensure realism. These should include: (1) training in dense smoke or simulated near zero visibility; (2) evaluation of nozzle techniques via feedback to encourage proper nozzle use and judicious water application; (3) use of equipment used during training matching that in fleet use; and (4) use of realistic attack methods where personnel and hose team numbers attacking fires are aligned with those to be used during actual shipboard fires. (NETC Lead, NAVSEA auditing/Fleets supporting)