



UNITED STATES COAST GUARD

**REPORT OF THE DISTRICT FORMAL
INVESTIGATION
INTO THE
SMALL PASSENGER VESSEL SPIRIT OF
NORFOLK (O.N. 982944) FIRE AND
SUBSEQUENT TOTAL CONSTRUCTIVE LOSS
ON THE ELIZABETH RIVER, NORFOLK,
VIRGINIA ON JUNE 7, 2022**



MISLE ACTIVITY NUMBER: 7476562

U.S. Department of
Homeland Security

United States
Coast Guard



Commandant
United States Coast Guard

US Coast Guard Stop 7501
2703 Martin Luther King Jr. Ave. SE
Washington, DC 20593-7501
Staff Symbol: CG-INV
Phone: (202) 372-1032
E-mail: CG-INV1@uscg.mil

16732/IIA #7476562
28 Aug 2024

SMALL PASSENGER VESSEL SPIRIT OF NORFOLK (O.N. 982944) FIRE AND SUBSEQUENT TOTAL CONSTRUCTIVE LOSS ON THE ELIZABETH RIVER, NORFOLK, VIRGINIA ON JUNE 7, 2022

ACTION BY THE COMMANDANT

The record and the report of the investigation convened for the subject casualty have been reviewed. The record and the report, including the findings of fact, analysis, conclusions, and recommendations are approved subject to the following comments. This marine casualty investigation is closed.

COMMENTS ON THE REPORT

1. I commend the members of the formal investigation team for their tireless efforts to conduct a thorough investigation of both the marine casualty and the multiagency response to it. The investigation highlights the inherent challenges of combating a vessel fire with shore-based assets and I encourage all passenger vessel operators to continuously engage and train with the first responders in their primary operating areas.
2. I would like to extend my appreciation to the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF). ATF's assistance and expertise played a critical role in determining the probable source of the fire and the causal factors that led to the incident. The Coast Guard intends to continue and expand collaborative efforts with ATF for commercial vessel fire investigations including joint training sessions and familiarization on maritime platforms.

ACTION ON RECOMMENDATIONS

Recommendation 1: It is recommended the Commandant undertake a regulatory or policy project to consider and implement installation of fire detection and fixed firefighting suppression systems within the engine room of all Title 46 Code of Federal Regulations (CFR) Subchapter K vessels, to include "existing vessels" currently exempted.

Action: I concur with this recommendation. The Coast Guard intends to evaluate the regulations for new and existing small passenger vessels and update the requirements as necessary to harmonize the fire safety requirements, including fixed fire suppression and detection requirements, across all vessels regardless of keel laid date.

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This action will also ensure transparency in the requirements and improve consistency during verification of compliance.

Recommendation 2: It is recommended the Commandant implement SMS regulations for all Title 46 CFR Subchapter K vessels, including “existing vessels”.

Action: I concur with the intent of this recommendation. A properly implemented Safety Management System (SMS) can enhance the safety of small passenger vessel operations. Title 46 CFR Subchapter K already contains many SMS elements, including emergency procedures, minimum crew competence, and regular inspections. However, this subchapter only contains limited requirements for documentation, a critical element of SMS. Congress, through the 2010 Coast Guard Authorization Act (CGAA) and 2020 CGAA, required the Coast Guard to promulgate SMS requirements for “covered small passenger vessels”, which are defined as small passenger vessels (SPVs), except fishing vessels and ferries, that have overnight accommodations for passengers or operate on a coastwise or oceans route. A portion of the Subchapter K vessel are included in the fleet of covered vessels.

The SPIRIT OF NORFOLK does not fall under the definition of a covered small passenger vessel and therefore it is not required by current law to have an SMS. The Coast Guard will continue to evaluate the potential expansion of SMS applicability beyond covered SPVs while also considering cost vs. benefit for these operations.

Recommendation 3: It is recommended the Commandant amend the current Small Passenger Vessel Risk Based Inspection Program Work Instruction. Specific focus should be given to ensure all Tier 1 vessels are attended by an Advanced Journeyman Marine Inspector to include issuing vessel operational controls, deficiency checks, and the clearing of those deficiencies on Tier 1 vessels.

Action: I concur with the intent of this recommendation. The Small Passenger Vessel Risk-Based Inspection Program, as described by the Office of Commercial Vessel Compliance’s (CG-CVC) work instruction (CVC-WI-028(series)), was developed to (1) identify small passenger vessels that are considered to be a higher priorities for Coast Guard oversight (i.e., Tier 1), (2) assign resources to bring greater focus to those vessels, and (3) be resource-neutral by reducing focus on the lower priority vessels (i.e., Tier 3). The program achieves the second goal by establishing a minimum level of experience a marine inspector must have to perform certain inspections on certain vessels. For example, all annual inspections on the highest priority vessels must be led by an Advanced Journeyman Marine Inspector (AJMI). The minimum experience level requirement implemented in the current program aligns with the intent of the recommendation. The recommendation goes farther, however, to say that an AJMI should lead every follow-up with Tier 1 vessels as well. Further increasing the focus of AJMIs on small passenger vessels must be balanced by a reduction in focus on other vessel types, such as ferries, cruise ships, and tank vessels, or on other inspection types—such as drydock or internal structural examinations. Each Officer in Charge, Marine Inspection must also maintain a certain level of discretion to assign personnel to inspections based on their own local risk

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assessment and adopting the recommendation as written would excessively impact that local discretion. The Coast Guard will continue to act on the intent of the recommendation and utilize careful risk analysis when reviewing or establishing policies related to marine inspector experience and inspection types.

Recommendation 4: It is recommended the Commandant update the Coast Guard's role in Marine firefighting by aligning and/or updating COMDTINST M16000.11 (series), Marine Safety Manual, Volume VI, Ports and Waterways Activities Chapter 8 Marine fire Fighting Activities and COMDTINST 16130.2 (series) section 4.4, Firefighting Activities Policy. Both sections have not seen a major update in decades and may no longer reflect the Coast Guard's training/capacity to coordinate or lead shipboard or facility fire incidents. This update should reflect that most major ports have robust firefighting capability and should also address the legal authority of local Fire Departments in directing firefighting activities in their jurisdictions. It should be clear the Coast Guard has statutory authority and outline responsibilities which should be a part of a major marine related firefighting operation in the COTP zone. However firefighting operations and decisions related to fire suppression and rescue during a fire incident should be with the lead fire authority on-scene. The Coast Guard should be the supporting agency and not the supported agency.

Action: In consultation with the Assistant Commandant for Response Policy (CG-5R), I concur with this recommendation. The Coast Guard will establish a working group to review and update all regulations, policies, procedures, and guidance related to Salvage and Marine Firefighting (SMFF). This working group will initially be comprised of the Office of Marine Environmental Response Policy (CG-MER), Office of Port and Facility Compliance (CG-FAC), Office of Waterways and Ocean Policy (CG-WWM), Office of Search and Rescue (CG-SAR), and the Office of Emergency Management and Disaster Response (CG-OEM) and will expand if needed in the future. CG-SAR is currently in the final stages of updating the COMDTINST 16130.2 (series) with an anticipated completion date in calendar year 2024.

Administrative Recommendation 1: It is recommended the Commandant develop and implement performance measures used to assess marine inspector job performance after qualification. This effort should be focused on proficiency at all levels, including additional training regarding engineering systems. Additionally, CG-CVC should produce (or add to existing) a regularly recurring report of Marine Inspector job performance to identify any gaps in Marine Inspector qualification and proficiency so that the Program possesses the requisite information to improve the workforce skillset to perform the marine inspection work that is so vital to the safety of the commercial vessel fleet.

Action: I concur with this recommendation. CG-CVC is currently working on a comprehensive training and competency evaluation process. The process will include requirements to report Marine Inspector job performance statistics and identification of gaps in Marine Inspector qualification and proficiency requirements.


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Administrative Recommendation 2: It is recommended the Commandant update the Critical Incident Communication process to either provide operational commanders reasonable flexibility on notification timeliness or leverage swifter communication technologies to replace the current cumbersome conference call process which removes Sector CDO's and staff from coordinating response efforts during the most critical phases in an incident response.

Action: I do not concur with this recommendation. The Critical Incident Communications Instruction (COMDTINST 3100.8) states upfront that "The speed at which many national security incidents and operational events unfold requires instantaneous notification." Thus, providing flexibility on notification timeliness is not a viable option. The instruction also notes that "Brevity is critical in the T+5 (five minutes after the initial report) conference call to allow the reporting command to respond to the incident and participants in the conference to execute agency notifications." As technologies advance, the National Command Center will continue to investigate new ways to ensure communications between reporting units are expeditious, clear, and concise.

Administrative Recommendation 3: Coast Guard Sector Virginia, in advance of this report, provided commendations and recognition as appropriate to the Good Samaritan commercial vessel crews that quickly and effectively responded to the fire and evacuated passengers from the Spirit of Norfolk. This investigation recognizes the professional skill and dedication of those maritime professionals and their operating companies in this incident.

Action: Sector Virginia recognized the Good Samaritans that provided vital emergency assistance during the SPIRIT OF NORFOLK casualty. The recognition consisted of two Distinguished Public Service Medals, seven Meritorious Public Service Medals, and seven Certificates of Merit.


W. R. ARGUIN
Rear Admiral, U.S. Coast Guard
Assistant Commandant for Prevention Policy



16732
September 8, 2023

**SMALL PASSENGER VESSEL SPIRIT OF NORFOLK (O.N. 982944) FIRE AND
SUBSEQUENT TOTAL CONSTRUCTIVE LOSS ON THE ELIZABETH RIVER,
NORFOLK, VIRGINIA ON JUNE 7, 2022**

ENDORSEMENT BY THE DISTRICT COMMANDER

The record and the report of the investigation convened for the subject casualty have been reviewed. The record and the report, including the findings of fact, analysis, conclusions, and recommendations are approved subject to the following comments. It is recommended that this marine casualty investigation be closed.

COMMENTS ON THE REPORT

1. The investigation determined the fire started on or around the Port Main Diesel Engine (PMDE) but was unable to determine the exact ignition source. The PMDE experienced an overheating event on May 15, 2022. Subsequent examination by technical representatives hired by the operator resulted in a series of repairs to the PMDE as additional damage was discovered. The repairs included replacing the water pump, left bank outboard turbo charger and overhaul of the engine. The right bank inboard turbo charger was also recommended to be replaced and was ordered and received. However, it was not replaced prior to the fire. Neither the vessel operator nor the Coast Guard restricted operation of the PMDE after the May 26th visit by the Coast Guard marine inspector who cleared the vessel to sail.
2. The Coast Guard did not exercise sufficient oversight of the repairs to the PMDE after the overheating incident. The marine inspectors did not properly document vessel operational controls or fully document the actions of the attending inspectors throughout the repairs. The Inspection Division did not adequately review the technical reports or brief their actions thoroughly to each other or the chain of command. Potential operational controls were not discussed with either the Sector Commander or Deputy. I do not believe that the marine inspectors ever suspected that the right bank/inboard turbo charger was damaged as there is no evidence to suggest they were actively tracking any repairs or requirements related to it. I have taken action to increase the Officers in Charge of Marine Inspections (OCMI) visibility of inspections of Tier I vessels within the district.
3. The crew, vessel operator, and attending Coast Guard Marine inspectors did not adequately identify the risk posed by the storage of combustible materials on shelving in the vicinity of the PMDE.
4. I commend the quick and effective response by the Good Samaritan vessels that came to the rescue of the *Spirit of Norfolk* in her time of need. These vessel crews are heroes and fully

embody the cooperative spirit of the maritime culture. The *Spirit of Norfolk* was not required to have any primary lifesaving equipment (e.g. lifeboats or life rafts), due to its limited route of operation.

5. I commend the vessel crew for their effective evacuation of the passengers to the Good Samaritan vessel. The crew and passengers conducted the evacuation in a safe and orderly manner with all passengers, including young children, wearing life jackets. I note that the A-60 overhead fire boundary of the engine room performed adequately to allow for the evacuation across the main deck and was transitable by fire fighters 2.5 hours after the fire began.
6. I thoroughly commend the Navy for opening their security barriers and allowing the *Spirit of Norfolk* to be tied to their pier despite the inherent risk posed. Naval Station Norfolk is an excellent port partner and their actions helped ensure the fire did not spread to other vessels in the port or sink in the channel.
7. The investigation details firefighting actions in this case and reinforces the challenges of extinguishing significant shipboard fires when the vessel crew is unable to extinguish it. In my experience, when a crew is unable to extinguish a fire utilizing their training and equipment, including fixed firefighting systems, the most likely “best-case” scenario is that the fire will have to consume all the combustibles before it can be extinguished. This is what occurred in this fire. Firefighters were successful in preventing the fire from spreading to other vessels or facilities. They prevented the vessel from polluting as well as from sinking. All of this was accomplished without any loss of life or significant injury.
8. While the investigation does not detail the actions of all the Sector Virginia Command Center team members, it is clear there was a delay in broadcasting the closure of the waterway to vessel traffic in the vicinity of the response. I will work with our Command Centers to address this. I do not believe the delay had any impact on the *Spar Lyra* as the vessel and pilot were not monitoring the broadcasts concerning the fire on Channel 16. The smoke from the fire and the assist vessels were clearly visible to all vessels transiting the channel well in advance and the *Spar Lyra* elected to continue to proceed despite the danger.

ENDORSEMENT ON RECOMMENDATIONS

Safety Recommendation 1. It is recommended the Commandant undertake a regulatory or policy project to consider and implement installation of fire detection and fixed firefighting suppression systems within the engine room of all Title 46 CFR Subchapter K vessels, to include “existing vessels” currently exempted.

Endorsement: Concur. It has been 27 years since the implementation of “new” 46 CFR Subchapter T and Subchapter K. As the investigation highlights, as of 2022, 24 percent of the “old T” fleet have installed both fire detection and fixed suppression systems onboard their existing vessels. The installation of these systems, when coupled with the requirement to close air ventilation openings, should have led to early detection of the fire and near immediate suppression. In turn, this would have prevented the extensive damage and limited risk to the passengers and crew onboard, as well as responders.

Safety Recommendation 2. It is recommended the Commandant implement Safety Management System (SMS) regulations for all Title 46 CFR Subchapter K vessels, including “existing vessels”.

Endorsement: Concur.

Safety Recommendation 3. It is recommended the Commandant amend the current Small Passenger Vessel Risk Based Inspection Program Work Instruction. Specific focus should be given to ensure all Tier 1 vessels are attended by an Advanced Journeyman Marine Inspector (AJMI) to include issuing vessel operational controls, deficiency checks, and the clearing of those deficiencies on Tier 1 vessels.

Endorsement: Concur with Intent. I agree that Commandant should review the Small Passenger Vessel Risk Based Inspection Program Work Instruction. I disagree that reliance on AJMIs is the proper solution for every inspection. I agree that the highest risk vessels should be given maximum oversight by the OCMI and attended by the most qualified and proficient marine inspectors. However, requiring an AJMI in every instance will overtask these members resulting in decreased performance and/or enhanced risk.

Safety Recommendation 4. It is recommended the Commandant update the Coast Guard’s role in Marine firefighting by aligning and/or updating COMDTINST M16000.11 (series), Marine Safety Manual, Volume VI, Ports and Waterways Activities Chapter 8 Marine fire Fighting Activities and COMDTINST 16130.2 (series) section 4.4, Firefighting Activities Policy. Both sections have not seen a major update in decades and may no longer reflect the Coast Guard’s training/capacity to coordinate or lead shipboard or facility fire incidents. This update should reflect that most major ports have robust firefighting capability and should also address the legal authority of local Fire Departments in directing firefighting activities in their jurisdictions. It should be clear the Coast Guard has statutory authority and outline responsibilities which should be a part of a major marine related firefighting operation in the COTP zone. However firefighting operations and decisions related to fire suppression and rescue during a fire incident should be with the lead fire authority on-scene. The Coast Guard should be the supporting agency and not the supported agency.

Endorsement: Concur with intent. The routine review of doctrine is good practice for any organization and should be done with the noted policies. I read both policies as directing COTPs and Search and Rescue Mission Coordinators to maintain a “support” or “assist as capable” posture when search and rescue is concluded. As the lead federal maritime officer within a port, COMDTINST M16000.11 directs the COTP to lead coordination of contingency planning and training for marine firefighting. The COTP had done this and had worked with various firefighting agencies and port officials to practice for an event. This was why so many firefighters responded to the incident. While firefighting efforts in this instance were unable to immediately extinguish the fire, they achieved the most likely best-case scenario by preventing any significant injuries, preventing the fire from spreading beyond the vessel, and preventing the vessel from sinking and blocking the channel as well as preventing environmental damage from a spill.

Administrative Recommendation 1. It is recommended the Commandant develop and implement performance measures used to assess marine inspector job performance after qualification. This effort should be focused on proficiency at all levels, including additional

training regarding engineering systems. Additionally, CG-CVC should produce (or add to existing) a regularly recurring report of Marine Inspector job performance to identify any gaps in Marine Inspector qualification and proficiency so that the Program possesses the requisite information to improve the workforce skillset to perform the marine inspection work that is so vital to the safety of the commercial vessel fleet.

Endorsement: Concur. It is essential to have a well-honed Marine Inspection workforce that can meet the public and the maritime industry's needs and is aligned with a quality management system.

Administrative Recommendation 2. It is recommended the Commandant update the Critical Incident Communication process to either provide operational commanders reasonable flexibility on notification timeliness or leverage swifter communication technologies to replace the current cumbersome conference call process which removes Sector CDO's and staff from coordinating response efforts during the most critical phases in an incident response.

Endorsement: Non-Concur. The notification requirements had no significant impact on this case. As stated previously, ample warning of the incident was available to the *Spar Lyra* on Channel 16 as they were getting underway if they had monitored the communications being passed. In addition, the activity associated with the fire was clearly visible to everyone transiting the channel well before they neared. While there is room for improvement in managing the many different communications that were required during this incident, it does not require a policy change.



SHANNON N. GILREATH
Rear Admiral, U.S. Coast Guard

Enclosures: (1) Executive Summary
(2) District Formal Board Report of Investigation

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Hyperlinks

Throughout this report there will be various references to supporting audio/visual material related to this investigation in the form of hyperlinks. **The hyperlinks are included in Enclosure (1).** Due to the size of the files, the files may take some time to load and view.



16732
June 21, 2023

**SMALL PASSENGER VESSEL SPIRIT OF NORFOLK (O.N. 982944)
FIRE AND SUBSEQUENT TOTAL CONSTRUCTIVE LOSS ON THE
ELIZABETH RIVER, NORFOLK, VIRGINIA ON JUNE 7, 2022**

EXECUTIVE SUMMARY

On June 7, 2022, at approximately 11:11 AM, the small passenger vessel *Spirit of Norfolk* departed Waterside District in Norfolk, VA, with a crew of 17, six marine crew and 11 hospitality staff, and 91 passengers. Among the passengers were 36 young children participating in end-of-year school field trips. The sight-seeing voyage named the "Signature Lunch Cruise" was scheduled to last approximately two hours, from 11:00 AM to 1:00 PM, and navigate the Elizabeth River along the Norfolk Navy Base and return to its departure point at Waterside Town Point Park in Norfolk. At approximately 12:00 PM, while the Captain and Captain Trainee were in the wheelhouse, a scheduled 180-degree turn was attempted near Navy Pier #4. The Captain Trainee noted a loss of electronic engine control in the port main diesel engine (PMDE).

The Captain immediately assumed the helm and began to troubleshoot the problem. Simultaneously, crew and passengers either smelled smoke or noted smoke coming from engine room ventilation openings from the port side of the vessel. Two crewmembers on the galley deck, proceeded to the watertight door between the galley and engine room, opened the door and immediately observed flame and smoke coming from the port side of the engine room. In the wheelhouse, the Captain made emergency radio calls to nearby vessels to assist and then contacted Coast Guard Sector Virginia via very high frequency (VHF) radio. A brief second attempt was made to enter the engine room to combat the fire, but the smoke and heat from the engine room were too intense for crew to enter. The *Spirit of Norfolk* crew-initiated fire response actions which included the Captain directing the securing of fuel to the engines, securing mechanical ventilation, and directing a fire hose to be prepared. However, natural air ventilation to the engine room could not be secured, which continued to fuel the fire with oxygen.

Numerous Good Samaritan vessels immediately responded, including towing vessels with firefighting capability and the *Victory Rover*, a small passenger vessel, ultimately identified as a suitable evacuation platform. Multiple towing vessels provided firefighting spray to cool the exterior of the *Spirit of Norfolk* and controlled the vessel in tow. The Captain of the *Spirit of Norfolk* ordered evacuation of all passengers and crew and all 106 were transferred to the *Victory Rover* by approximately 12:31 PM. The *Victory Rover* departed the scene and safely offloaded passengers at Waterside Town Point Park in Norfolk, VA. The Captain and Captain Trainee evacuated soon after to another small vessel and proceeded to Navy Pier #4 at Naval Station Norfolk in Norfolk, VA.

The vessel, still on fire, was safely secured pier side at Navy Pier #4 at approximately 1:08 PM. Shore side firefighting extinguishing efforts were not effective, and the vessel continued to burn over the course of several days. The vessel was safely dewatered, towed, and moored at a local shipyard on June 12, 2022. The vessel was determined to be a total constructive loss.

A District Formal Investigation was convened and they determined the cause of the casualty was a fire that occurred on or around the PMDE. The exact ignition source could not precisely be determined. Five possibilities were considered and the probable ignition source was likely the failure of the right bank/ inboard turbocharger. The company conducted repairs stemming from an earlier May 15, 2022, overheating incident, and follow-on May 18, 2022, mechanical incident which ultimately led to a “top end” rebuild of the PMDE. However, the turbocharger was not replaced as recommended by technicians.

The investigation analyzed additional factors and subsequent events related to the fire to include fire spread, vessel evacuation procedures, firefighting efforts by vessel crew and responding agencies, sufficiency of company oversight, sufficiency of Coast Guard inspection oversight, and Coast Guard response activities.



16732
June 21, 2023

**SMALL PASSENGER VESSEL SPIRIT OF NORFOLK (O.N. 982944)
FIRE AND SUBSEQUENT TOTAL CONSTRUCTIVE LOSS ON THE
ELIZABETH RIVER, NORFOLK, VIRGINIA ON JUNE 7, 2022**

DISTRICT FORMAL BOARD OF INVESTIGATION REPORT

1. Preliminary Statement

- 1.1. A Fifth District Formal Investigation was convened on June 13, 2022, consisting of CDR Randy Waddington (Lead Investigating Officer), LCDR [REDACTED], LCDR(s) [REDACTED], and legal advisors CDR(s) Karen Lee and LCDR [REDACTED]. CDR Eric Roy was added to the team as a response subject matter expert to assist the investigation. LCDR [REDACTED] provided engineering support and LCDR [REDACTED] provided external affairs support for the investigation. The purpose of the investigation was to explore all circumstances surrounding the fire and subsequent total loss of the *Spirit of Norfolk* to include securing evidence, establishing facts, conducting analysis, determining conclusions, and identifying preventative recommendations.
- 1.2. The Investigation Team conducted a comprehensive marine casualty investigation, and this report is submitted in accordance with Title 46, Code of Federal Regulations (CFR), Subpart 4.07, and under the authority of Title 46, United States Code (USC) Chapter 63.
- 1.3. The National Transportation Safety Board (NTSB) conducted a parallel safety investigation. In accordance with the joint NTSB and Coast Guard Memorandum of Understanding (MOU), the Coast Guard was designated as the lead federal investigative agency. At the conclusion of the fact-finding phase of the investigation, the NTSB conducted their own separate analysis of the facts, developed their own conclusions, and made their own recommendations.
- 1.4. In accordance with the Coast Guard and Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) MOU, personnel from ATF conducted an examination of the fire and fire path.
- 1.5. The Lead Investigating Officer designated the vessel's owner, Hornblower Cruises and Events, LLC., as a Party-In-Interest (PII) on June 27, 2022. Furthermore, on June 27, 2022, the Lead Investigating Officer designated the Captain of the *Spirit of Norfolk*, as a holder of a merchant mariner's credential and by statute the Captain of the vessel, whose conduct was under investigation a PII. On July 7, 2022, the Lead Investigating Officer designated Bay Power Solutions, the company that conducted repairs to the vessel's PMDE in May of 2022, a PII. All PII were represented by legal counsel.

- 1.6. Coast Guard and NTSB investigators conducted 38 initial witness interviews, laboratory tested three pieces of physical evidence, and secured a large amount of documentary evidence. The Coast Guard and NTSB conducted a public hearing commencing on January 26, 2023, and concluding on February 2, 2023, to further establish facts and circumstances surrounding the incident. One follow-up virtual interview was conducted on March 21, 2023. During the entirety of the public proceeding the Coast Guard interviewed 24 witnesses under oath and introduced 104 exhibits for consideration in drafting this report.
- 1.7. All times contained within this report are estimated, using local times (Eastern Standard Time), and not synchronized due to the varied date/time stamps for multiple evidence items.
- 1.8. Securing firefighting agencies witness participation proved difficult due to the litigious posturing by parties involved, including the Parties in Interest. The Investigation determined this participation was not central to the regulatory mandate related to the *cause* of the casualty. The primary firefighting agencies involved were the Navy FEDFIRE, Norfolk Fire and Rescue, and Chesapeake Fire Department. In anticipation of the public proceeding, the Navy provided a statement regarding the fire which was made into a Coast Guard public exhibit. Norfolk Fire and Rescue and Chesapeake Fire provided written answers to a combined submission of questions from the Coast Guard, NTSB, and PII. These statements, questions and answers were made into Coast Guard public exhibits and were determined to be sufficient evidence to satisfy the purpose of the investigation.

2. Vessel Involved in the Incident

- 2.1. The *Spirit of Norfolk* was built in 1992 in Amelia, LA, with an assigned regulatory domestic tonnage of 99 gross register tonnage (GRT) and length overall of 169 feet. The vessel Certificate of Inspection (COI) allowed the vessel to carry 600 passengers and up to 61 crew or others, for a maximum of 661 persons. The vessel's COI route and conditions was for Lakes, Bays, and Sounds limited to Chesapeake Bay, Delaware Bay, and their canals and tributaries, not more than one mile from shore. The steel-hulled vessel was equipped with two main diesel engines and two diesel generators. The *Spirit of Norfolk* operated from 1992 to 2022 with a valid COI.
- 2.2. The *Spirit of Norfolk* is regulated under Title 46 Code of Federal Regulations (CFR) Subchapter K (less than 100 gross register tons) from a size and number of passengers allowed perspective. The layout of the vessel included three decks for passengers to congregate which included dance and dining areas as well as large areas to sightsee. There was one deck below the main deck where the engine room and galley were located. This deck was only accessible to the crew, not passengers. The vessel also employed a "dumbwaiter" which allowed food and other items to be easily passed vertically from deck to deck. The uppermost deck served as a sightseeing platform and contained the pilot house for vessel navigation.
- 2.3. American Bureau of Shipping (ABS), a classification society, determined that the *Spirit of Norfolk* had a domestic tonnage of 99 GRT and length of 169 feet. In order to keep the vessel under 100 GRT and avoid triggering additional regulatory requirements, ABS approved various tonnage reduction features. These features were incorporated within the *Spirit of Norfolk's* design. This is common industry practice with the goal of achieving the less stringent regulatory

requirements which in turn reduces operation, construction, and maintenance costs during a vessel’s lifetime. Utilizing one of two specific measurement systems to calculate GRT, ABS deducted these features from the overall dimensions of the vessel and provided the information to the Coast Guard National Vessel Documentation Center (NVDC). The NVDC includes the GRT on a vessel’s Certificate of Documentation which is provided to the local Officer in Charge of Marine Inspection (OCMI) and used for appropriate regulatory and policy application.



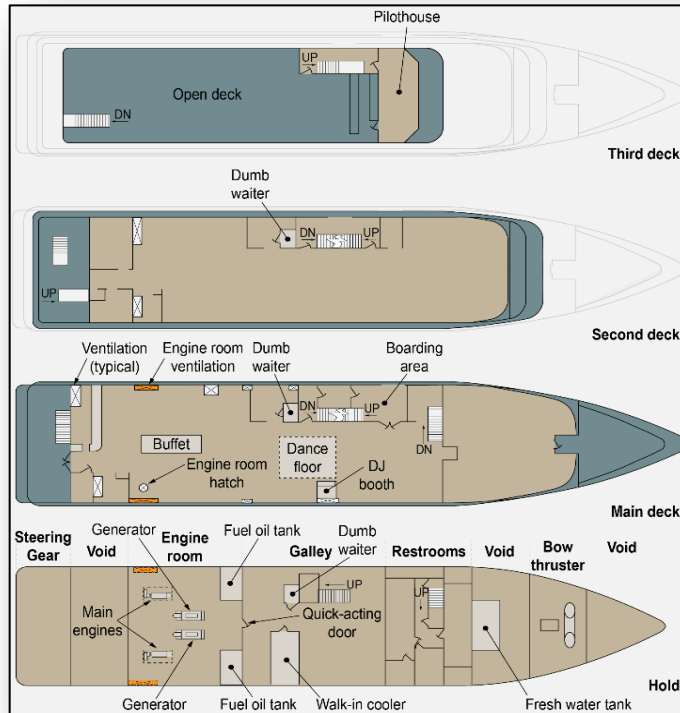
Figure 1 – Small passenger vessel *Spirit of Norfolk* underway along the Norfolk, Virginia waterfront. (Source: City Cruises)

Official Name:	<i>SPIRIT OF NORFOLK</i>
Identification Number:	982944
Flag:	United States
Vessel Class/Type/Sub-Type:	Small Passenger Vessel, Certificated as Subchapter “K”
Maximum Passengers and Crewpersons:	600 Passengers, 8 crew and 53 others not crew, Total Persons Allowed: 661
Build Year:	1992
Gross Tonnage:	1152 GT International Tonnage 99 GT Regulatory
Registered Length:	169 Feet
Beam/Width:	38 Feet
Draft/Depth:	12 Feet
Hull Construction:	Steel
Main/Primary Propulsion: (Configuration/System Type, Horsepower)	Diesel Direct, Twin Engine, Bow Thruster, Twin Screw, 1150 Horsepower

Owner/Managing Owner:	Hornblower Cruises and Events, LLC
Operator:	Hornblower Cruises and Events, LLC

Table 1 – Vessel particulars for the *Spirit of Norfolk*. (Source: USCG)

Figure 2 – Overhead schematic view of the decks of *Spirit of Norfolk* showing the location of principle equipment. (Source: NTSB)



3. Incident

- 3.1. The *Spirit of Norfolk* was scheduled for a two-hour cruise named the “Signature Lunch Cruise” beginning at approximately 11:00 AM, lasting until approximately 1:00 PM on June 7, 2022. The voyage route was scheduled to include navigation of the Elizabeth River with an emphasis on viewing local sites, including vessels of the Navy Atlantic Fleet. The vessel intended to return to Waterside Town Point Park, the same pier location it departed from in Norfolk, VA.
- 3.2. The Elizabeth River, in the vicinity of the voyage and at the scene of the fire, is within a Regulated Navigation Area (RNA) as described by 33 CFR 165.501. Regulated Navigation Areas (RNA), as outlined in 33 CFR Part 165, are established to regulate vessels and their movement within a specific area. The Coast Guard District Commander can issue an RNA to control vessel traffic in a place determined to have hazardous conditions.
- 3.3. The weather forecast called for temperatures in the low 80’s, partly cloudy, and winds from light to 20 MPH. There were 91 total passengers and 17 crew and hospitality staff scheduled for the cruise. A recently hired Captain, hereafter referred to as the Captain Trainee, was added to the cruise so the Captain could introduce him to vessel characteristics and appraise his vessel navigation skills. Noteworthy for this voyage, there were 36 elementary school-aged children

from two separate classes scheduled to be onboard. One class contained kindergarten children and another class contained fifth-grade children.

Persons Onboard SPIRIT OF NORFOLK		Accident Voyage – June 7, 2022			
Crew:					
Marine:	6	Wait Staff/Kitchen and Other:	11	Total:	17
Passengers:	Adults: 55	Children: 36	Total:	91	
Total Persons Aboard: 108					

Figure 3 - Persons onboard on the accident voyage, June 7, 2022. (Source: USCG)

- 3.4. Several crew members arrived on the vessel between 7:00 AM and 8:00 AM, including the Captain, Chief Mate (title only, not a Chief Mate from a regulatory standpoint), two Senior Deckhands, and a Deckhand. Crewmembers conducted standard checks and prepared for departure with no issues out of the ordinary noted for the vessel or scheduled events.
- 3.5. The vessel took on fuel between approximately 9:45 AM to 10:10 AM. No known issues arose from this transfer. The vessel had approximately 5,500 gallons of diesel onboard when the fuel transfer was completed.
- 3.6. Prior to getting underway, the Captain and Captain Trainee conducted a vessel familiarization and pre-underway check of the vessel, including the engine room space, between 10:00 AM and 10:40 AM. There were no issues noted during these activities.
- 3.7. Passengers began to arrive onboard at approximately 10:30 AM.
- 3.8. The crew waited for several passengers to arrive who were delayed by local road traffic. This slightly delayed the departure time by approximately 10 minutes.
- 3.9. The *Spirit of Norfolk* departed the pier located at 333 Waterside Dr., Norfolk, VA, at approximately 11:11 AM on June 7, 2022. The Captain and Captain Trainee were properly licensed Masters (another name for Captain) for the vessel type and route. The Captain Trainee was on his first vessel familiarization ride. The Captain and Captain Trainee remained at the helm, located on the bridge, from departure until the first indication of a loss of the PMDE control and subsequent fire was identified. At that point, the Captain moved about the vessel to manage the incident but remained in command of the vessel throughout.

Enclosure (1) contains hyperlink (1) which is a video-based voyage animation of the *Spirit of Norfolk* voyage based on its AIS data.

Enclosure (1) contains hyperlink (2), a movie showing movements of various vessels and *Spirit of Norfolk* based on AIS tracking supplied by the NTSB. There are two parts due to file size.

Enclosure (1) contains hyperlink (3) which is an audio recording of the routine daytime audio recorded announcement regarding the cruise and safety for the *Spirit of Norfolk*.

- 3.9 After the vessel departed the pier, the deckhands conducted regular sweeps and rotated deck security/safety positions in accordance with their standard operating procedure. Each crew vessel round lasted approximately 20-25 minutes.

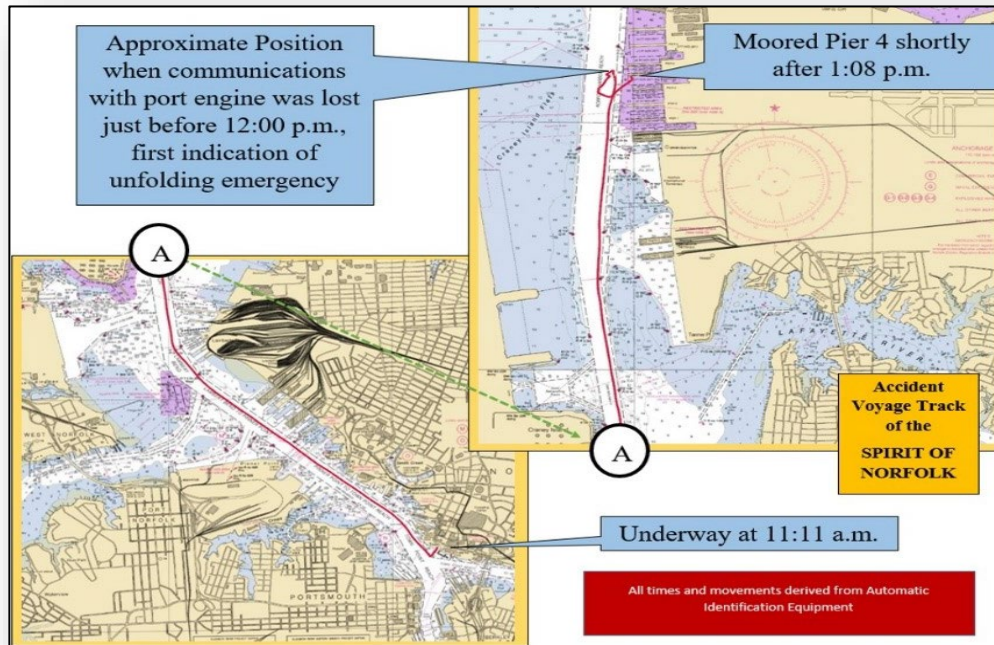


Figure 4 – Accident voyage track of the *Spirit of Norfolk*, June 7, 2022. This track derived from automatic identification equipment installed on the vessel. (Source: USCG)

- 3.10. Crewmembers conducted regular rounds in the engine room every 30-minutes, using a check-sheet for items including monitoring engine water temperature, fuel pressure, and oil pressure. All these systems were operating within parameters when checked. A Senior Deckhand and Trainee conducted the last known engine room check between approximately 11:30 AM and 11:40 AM. All systems were reported to be operating within normal parameters during that engine room check.
- 3.11. At approximately 11:58 AM, the Captain Trainee reduced speed from approximately ten knots to less than five knots in anticipation of making a 180-degree turn near Navy Base Pier #4 to return to their originating pier.
- 3.12. The exact time and sequence of events for each of the following cannot be precisely identified. However, the following represents events beginning at **approximately 12:00 PM until 12:32 PM**. During this time period, the fire was discovered, the crew responded to the fire, and all passengers and crew donned lifejackets and were evacuated (except the Captain and Captain Trainee) to the *Victory Rover*. The times that could be ascertained are identified below.
- 3.12.1. At approximately 12:00 PM, the Captain Trainee brought the engine throttles to clutch speed with the intent of splitting the shift throttle controls in order to execute a tighter 180-degree turn. When he brought the throttles to clutch speed, he noted the revolutions per minute (RPM) gauge was at zero on the PMDE. Simultaneously, the Captain Trainee

stated he smelled smoke, from what he described as an “alpha (ordinary combustibles) fire.” The Captain took over engine control at this time.

- 3.12.2. The *Spirit of Norfolk* displayed blinking alarm lights on the engine control heads as well as other blinking and audible alarm indicators. The Captain then attempted to transfer the engine control to the port side wing station that was independent from the primary engine controls at the main station. The attempted transfer of engine control the port side wing station was unsuccessful in gaining control of the engines.
- 3.12.3. While attempting to reengage the PMDE, control for the starboard main diesel engine (SMDE) was lost. The PMDE and SMDE bridge controls lost connection to the main engines and the engine controls became inoperable. The Captain exhausted all means of engaging the propulsion from the bridge. Steering capability was unknown since there was no propulsion to provide thrust to the rudders.
- 3.12.4. The first indication of a possible fire by the crew occurred when multiple crew members smelled smoke or saw smoke coming out of the port side natural air vent (see figure 5 for visual of mechanical vents labeled as #1 and natural vents labeled as #2) located on the exterior of the vessel just below the second deck. There was also mechanical air flowing into the engine room from the outside environment during this time frame.
- 3.12.5. At approximately 12:05 PM, the Captain made an emergency broadcast via VHF channel 13 (bridge to bridge navigation communications) for vessels in the area to assist.

Enclosure (1) contains hyperlink (4) which is a short movie with passenger stills and video taken aboard the *Spirit of Norfolk*, June 7, 2022.

- 3.12.6. The Captain radioed to the crew, using his handheld radio and instructed a crewmember to check on the engine room. At the time, he looked over the port side of the vessel and noted smoke coming from the aft engine room natural air ventilation vent located on the exterior of the vessel just below the second deck.
- 3.12.7. Crewmembers proceeded to the watertight door in the bulkhead separating the galley from the machinery space, opened the watertight door, and identified flame and smoke from the port side of the vessel’s engine room, and immediately closed and secured the watertight door.
- 3.12.8. As the incident unfolded, the *Spar Lyra* (630-foot, loaded, deep-draft cargo vessel) was scheduled for a northbound voyage along the Elizabeth River which would pass through the accident scene. The vessel “cast lines off” at the Lambert Point Norfolk Southern (NS) Pier 6 dock at approximately 12:05 PM.
- 3.12.9. The Captain made a broadcast at approximately 12:07 PM via VHF channel 16 to the Coast Guard Sector Virginia Command Center reporting the *Spirit of Norfolk* was experiencing a fire in the engine room onboard.

Enclosure (1) contains hyperlink (5) which is the initial distress call to the Coast Guard from the *Spirit of Norfolk*. The audio file was spliced together from various audio files.

- 3.12.10. Over the course of the next one-half hour, the Captain Trainee remained on the bridge and assumed primary VHF channel 16 (distress, safety and calling) communications. The Captain managed communications with assisting vessels and crew using primarily hand-held radios on VHF channel 13. The Captain left the bridge and returned to the bridge on multiple occasions to manage the incident.
- 3.12.11. The towing vessel *Rosemary McAllister* was located at Navy Pier #3 when the crewmembers aboard identified heavy smoke coming from the *Spirit of Norfolk*. The vessel proceeded to get underway to render assistance and arrived on-scene at approximately 12:07 PM.
- 3.12.12. The principal vessels involved with the response to the *Spirit of Norfolk* and *Spar Lyra* were fitted with an Automatic Identification System (AIS) which allowed each vessel to see the other's position and shore-based systems to also see the important characteristics of the vessels such as type, course, speed, destination, and other navigation information.
- 3.12.13. The Coast Guard Sector Virginia Command Center confirmed 108 persons onboard, and the Operations Unit Controller classified the case immediately in Distress Phase (Coast Guard Search and Rescue (SAR) classification). Coast Guard Sector Virginia assumed a SAR posture and command center personnel conducted a Risk Management assessment resulting in high concerns for rapid fire expansion and the potential challenges of a complex mass rescue.
- 3.12.14. The Coast Guard Sector Virginia Command Center has a large TV screen at the front of the room depicting real-time AIS information (CG One View). This allowed all watchstanders to view the incident and the location of vessels in the area directly from the Command Center.
- 3.12.15. Coast Guard Sector Virginia issued an Urgent Marine Information Broadcast (UMIB) of a boat fire aboard the *Spirit of Norfolk* and requesting assistance from nearby vessels at approximately 12:10 PM.

Enclosure (1) contains hyperlink (6) which is a recording of an Urgent Marine Broadcast made by the Coast Guard requesting assistance from nearby vessels to come to the aid of the *Spirit of Norfolk*.

Enclosure (1) contains hyperlink (7) which is a short video Passenger supplied images and video taken from the *Victory Rover* as it responded to the *Spirit of Norfolk* incident.

- 3.12.16. Crewmembers opened the watertight door in the bulkhead separating the galley from the machinery space a second time and were met with heat and thick smoke, and immediately closed and secured the door. The crew was hoping to discharge fire extinguishers on the fire but thought the fire intensity was too extreme for the available firefighting equipment to enter the space and fight the fire.

3.12.17. The Captain shut down mechanically powered ventilation remotely from the bridge and gave an order for a crewmember to shut remote fuel valves. Although it was not required by the regulations, natural ventilation to the engine room was not equipped with a readily available closure device(s) to secure the natural air supply from inside or outside the engine room. A Senior Deckhand subsequently closed the remote fuel valves.

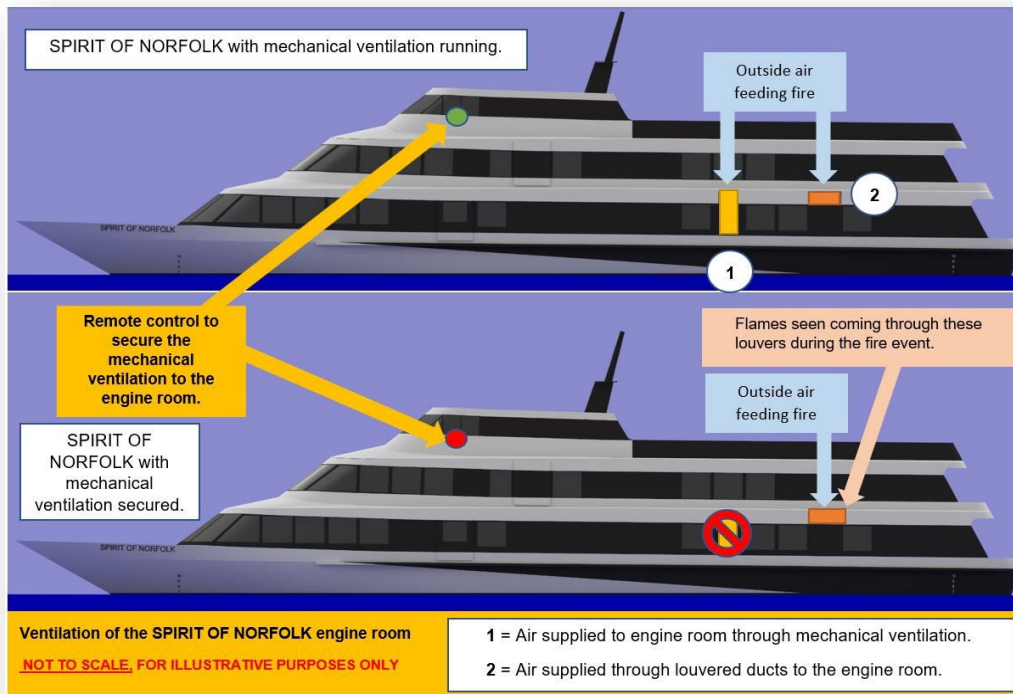


Figure 5 - Port side of the Spirit of Norfolk showing the mechanical and natural air ventilation for the engine room. In the upper image the mechanical system is in operation prior to the crew securing the system through a wheelhouse remote control. In the bottom image, the natural ventilation for the engine room would feed the fire, allow smoke and flames to escape, and allow fire water to enter the engine room. (Source: USCG)

3.12.18. A fire hose was strung out at the “ready” by crewmembers. The Captain planned to energize the fire pump (electric). However, as the incident progressed, the generators located in the engine room became inoperable and no longer energized the fire pumps. At this point, the vessel’s crew had exhausted all available means to reasonably combat the fire. Attempting fire containment to the engine room was the only remaining strategy. A group of passengers were moved from the top deck to lower decks due to smoke inhalation and breathing concerns from the smoke of the fire.

3.12.19. The Captain then ordered crewmembers to begin evacuation procedures via handheld radio communication. Crewmembers responded to the Captain’s orders and started to pass out life jackets to the passengers and directed them towards the disembarkation area on the port side of the vessel.

- 3.12.20. The *Spirit of Norfolk* was equipped with a large sliding embarkation door on the port side of the vessel; there was no similar opening on the starboard side. This large opening at main deck level would allow rapid evacuation of passengers.
- 3.12.21. At approximately 12:10 PM, the small passenger vessel *Victory Rover* arrived on-scene to begin the evacuation of passengers from the *Spirit of Norfolk*. Passengers and crew used the port side embarkation door to evacuate the vessel to the *Victory Rover*. There was a deck railing that passengers had to climb over, and small children had to be helped over to reach the *Victory Rover's* deck. However, the main deck heights for both vessels were approximately the same height.
- 3.12.22. The *Spar Lyra* proceeded upbound on the Elizabeth River, the Pilot became aware of the incident and first observed the area visually at approximately 12:10 PM, when the vessel was several miles away from the location. For an unknown reason, the Pilot did not hear the Coast Guard broadcasts, including the UMIB by Sector Virginia (possibly due to the fact the Pilot was monitoring VHF channel 13, the bridge-to-bridge navigational frequency, vice VHF channel 16 the calling, safety, and distress frequency).
- 3.12.23. From **approximately 12:13 PM until 12:32 PM**, the towing vessels *Ohio River*, *GM McAllister*, *Challenger*, *Condor*, *Z One*, fireboat *Fort Bragg*, and *CG29274* arrived on scene. These vessels rendered assistance in the form of holding the *Spirit of Norfolk* in position (vessel did not have primary propulsion, steering, or electrical power), placing water on the vessel to cool the outside, and stood-by to assist anyone who may fall into the water or as otherwise needed.

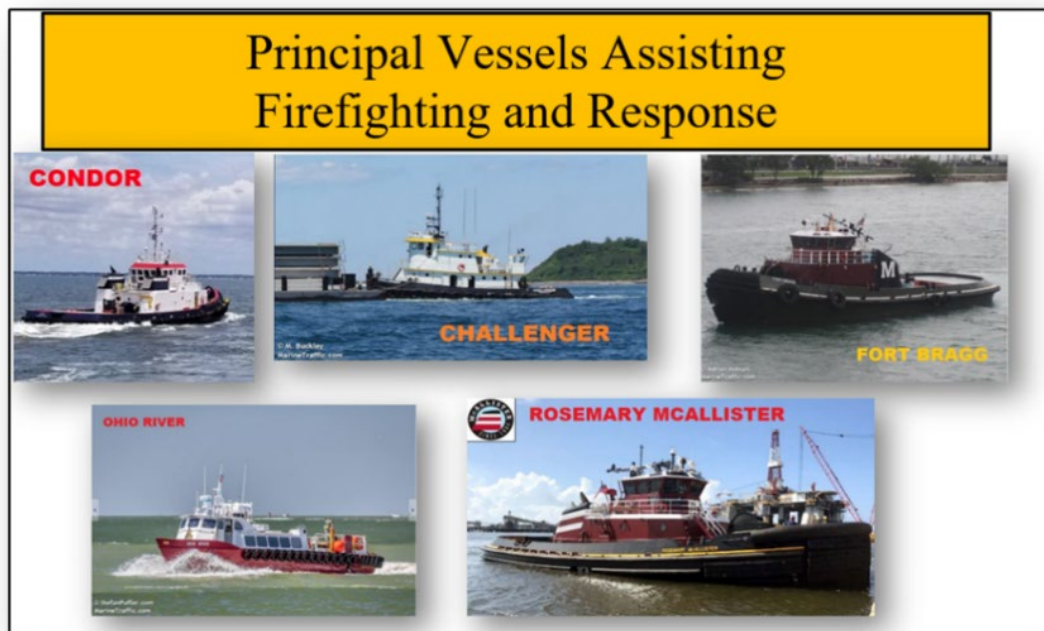


Figure 6 – Principal vessels that responded to the fire and evacuation onboard the *Spirit of Norfolk* on June 7, 2022. (Source: Various, used with permission)

- 3.12.24. The *Rosemary McAllister* Captain assumed coordination of the three McAllister towing vessels on scene as the “on-scene commander” and served as the primary on-water point of contact for the initial water-side response.
- 3.12.25. At approximately 12:15 PM, with numerous vessels responding within the marked waterway channel, the Coast Guard Deputy Sector Commander (the Captain of the Port's representative) made the decision to close the waterway to control vessel movements within the RNA to ensure the safety of responding vessels and the passenger and crew evacuation.
- 3.12.26. At approximately 12:20 PM, the *Spar Lyra* Pilot contacted an unknown vessel Captain in the area of the *Spirit of Norfolk* on VHF channel 13 coordinating passing arrangements in the accident area on the “red side of the channel.”
- 3.12.27. As the *Spar Lyra* approached the area, the *Rosemary McAllister* began moving the *Spirit of Norfolk* to gain distance from the *Spar Lyra*.

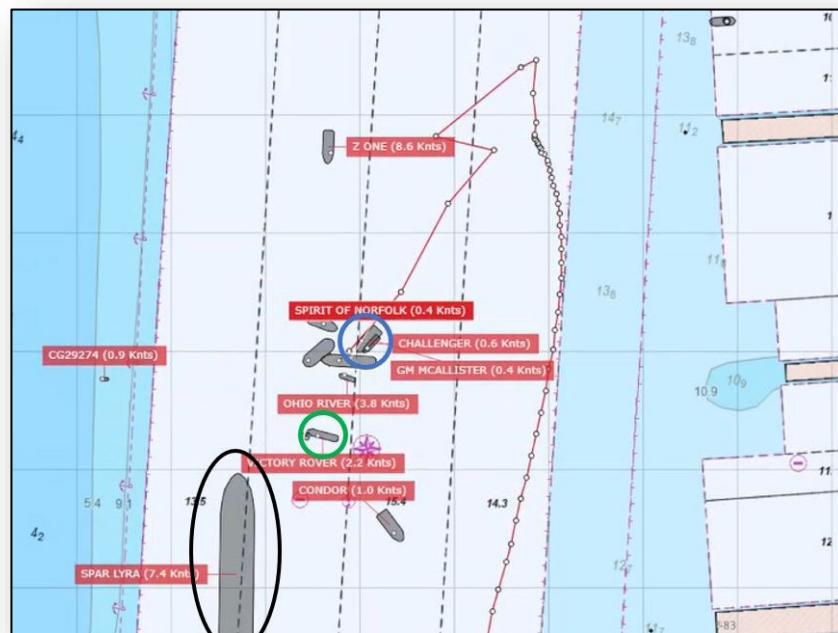


Figure 7 – AIS capture of *Spar Lyra* (black oval), *Victory Rover* (green circle), and *Spirit of Norfolk* (blue circle) at approximately 12:34 PM. (Source: NTSB and Coast Guard)

- 3.12.28. Onboard the *Spirit of Norfolk*, the restaurant manager directed the disc jockey to make a public announcement (audible to only one deck) and further directed the movement of passengers to evacuation areas. However, the general alarm was not sounded on the vessel in accordance with company procedures, and no official announcements were made by the Captain or marine crew over the public address system. A combination of both hospitality staff and marine crew assisted passengers in the donning of lifejackets and evacuating the passengers and crew. The vessel possessed adequate life jackets for both adults and the children onboard at the time of the incident.

- 3.12.29. At approximately 12:32 PM, the evacuation of all passengers and crew (except the Captain and Captain Trainee) to the *Victory Rover* was complete. The *Victory Rover* departed the *Spirit of Norfolk* enroute to Town Pointe Park located in Norfolk, VA.
- 3.13. At approximately 12:33 PM, the *Spar Lyra* arrived in the vicinity of the incident scene, passing near the fully loaded (with passengers) *Victory Rover*. The following events outline the *Spar Lyra*'s transit near the active incident response.
- 3.13.1. At approximately 12:33 PM, as the *Spar Lyra* navigated approximately amidship of the *Spirit of Norfolk*, the *Spar Lyra* passed within approximately 400 to 500 feet directly abeam of the fully loaded *Victory Rover*. The *Spar Lyra* was approximately 500 feet away from the *Spirit of Norfolk*, when they simultaneously lost all propulsion, electrical power, and steering. Just before this, the Pilot "kicked the stern away" from the accident scene which created further distance away from the assisting vessels. However, it directed the vessel's bow to starboard and in the direction of the moored naval vessels and naval base infrastructure.
- 3.13.2. The towing vessels *Fort Bragg*, *Condor*, and *Z One* immediately broke away from the *Spirit of Norfolk* to assist the *Spar Lyra* between 12:35 PM and 12:40 PM and prevented the *Spar Lyra* from alliding (allision or alliding is the collision between one fixed object and one object in motion) with protection barriers, Navy vessels, and a Navy pier. During this period, the *Spar Lyra* crew dropped one anchor to the water's edge.
- 3.13.3. The *Spar Lyra* ultimately did allide with the #9 Green Buoy marking the river channel and the sinker and chain became temporarily entangled in either the *Spar Lyra*'s rudder or propeller.
- 3.13.4. The *Spar Lyra* was able to regain electrical power and propulsion with the navigation buoy drifting clear of the ship and proceeded to anchorage G-4 to await a dive survey and permission to proceed after being examined by the Coast Guard and the Classification Society.
- 3.14. The *Spirit of Norfolk* Captain and Captain Trainee made a final sweep of the vessel and disembarked at approximately 12:40 PM. Both then boarded another smaller vessel and were brought pier-side to Navy Base Pier #4.
- 3.15. At 12:48 PM Coast Guard Sector Virginia issued its first broadcast, via VHF channel 16, closing the Elizabeth River Harbor Reach area in the vicinity of the accident to all vessel traffic unless permission was received from the Coast Guard Captain of the Port.
- 3.16. The *Victory Rover*, with all passengers and crew (except Captain and Captain Trainee), safely arrived at Waterside Town Park in Norfolk, VA at approximately 1:05 PM.
- 3.17. The *Spirit of Norfolk*, still on fire, with smoke emitting from the port side vents, was slowly towed to the Navy Base Pier #4, and moored starboard side to the pier at approximately 1:08 PM.



Figure 8 – Towing vessels maneuver the *Spirit of Norfolk* towards Navy Pier #4 after noon on June 7, 2022. The pier is in the background with staged fire personnel and equipment ready for the mooring of the vessel. (Source: WAVY TV 10 News Aerial Footage)

4. Incident Management

4.1. Overview

- 4.1.1. The incident management actions spanned from approximately 1:08 PM, June 7, 2022, when the *Spirit of Norfolk* arrived pier side, until approximately 7:30 AM, June 12, 2022, when the vessel was safely towed to a local shipyard to ultimately be examined. Incident management, in the terms described in this section, are defined as the decisions and actions made to minimize negative impacts to persons, the vessel, and/or and the surrounding environment.
- 4.1.2. The actions to aggressively extinguish the fire took place from June 7, 2022, when the vessel was brought pier side to Navy Base Pier #4, from 1:08 PM until approximately 6:30 PM. These efforts are best described as the firefighting phase (see Section 4.2). The firefighting phase includes the initial response and efforts to extinguish the fire. This phase ultimately shifted to a firefighting containment and salvage phase, due to concerns to personnel safety and vessel stability.
- 4.1.3. The firefighting containment and salvage phase (see Section 4.3) included actions to cool the vessel, respond to fire reflash, and ensure the vessel remained afloat to minimize pollution or other negative waterway impacts.
- 4.1.4. This incident resulted in a large, multi-jurisdictional agency response once the vessel was pier side at Navy Base Pier #4. A responding fire agency initiated a mutual aid “callout” for assistance with the response to potential injuries, fatalities, and firefighting. The following outlines the **primary** firefighting agencies which responded to the scene and their approximate arrival and departure times, if known.
 - 4.1.4.1. Navy FEDFIRE (also referred to as Navy Mid-Atlantic or Navy Regional by different parties and witnesses) arrived in the area of Navy Pier #4 at approximately 12:15 PM, after initial notification to their operations center at

12:09 PM. Navy FEDFIRE and other Navy resources were on-scene until the vessel departed early in the morning hours on June 12, 2022.

- 4.1.4.2. Norfolk Fire and Rescue shore-side units with personnel began arriving on-scene at approximately 12:16 PM and departed the scene at approximately 9:42 PM on June 7, 2022.
- 4.1.4.3. Chesapeake Fire shore-side fire-fighting units with personnel arrived on-scene at approximately 1:23 PM and departed the scene at approximately 10:09 PM on June 7, 2022.
- 4.1.5. The following outlines **support** (personnel or equipment) from other firefighting agencies that responded to the scene on June 7, 2022. Their approximate arrival time and departure times are indicated if known.
 - 4.1.5.1. Hampton Fire Boat #2 arrived in the area at approximately 12:30 PM and departed the scene at approximately 10:17 PM on June 7, 2022.
 - 4.1.5.2. Newport News Fire Boat #2 arrived in the area at approximately 12:35 PM and departed the scene at 5:43 PM on June 7, 2022.
 - 4.1.5.3. Newport News Fire Boat #1 arrived in the area at approximately 12:53 PM and departed the scene at 5:43 PM on June 7, 2022.
 - 4.1.5.4. Virginia Beach Fire Department Boat #1 arrived in the area at approximately 1:14 PM on June 7, 2022.
 - 4.1.5.5. **Additional** shore-side firefighting personnel dispatched, that were **not** directly involved in the firefighting included: assisting Navy personnel, assisting Norfolk Fire and Rescue personnel, and the Port of Virginia Marine Incident Response Team (MIRT) personnel (two individuals and a Command Truck).



Figure 9 – Montage of photos of firefighting activities taken on June 7, 2022. Upper left, dockside firefighters apply foam and cooling water to the side of the *Spirit of Norfolk*. Upper right, the vicinity of the Command Post on the dock at Navy Pier 4. Lower left, towing vessels and shoreside firefighting activities on the afternoon of the accident day, note the horizontal ladder used to allow firefighters to access the ship for a RECON and attack on the fire. Lower right, towing vessels cool the exterior of the offshore side of the *Spirit of Norfolk*. (Source: USCG)

- 4.1.6. Coast Guard personnel, City Cruises representatives, and salvage equipment and technical experts contracted by City Cruises, were the agencies (personnel or equipment) which were involved primarily in **salvage** during the incident.
- 4.1.7. The *Spirit of Norfolk* Non-Tank Vessel Response Plan, Fifth Coast Guard District Mass Rescue Operations Plan, Navy and Norfolk Fire and Rescue Mutual Aide Agreement, and the Hampton Roads Maritime Firefighting Contingency Plan were identified as applicable contingency plans during this incident. These plans do **not** include agency-specific standard operating procedures or plans specific to the Navy or civilian firefighting agencies.
- 4.1.8. In summary, there were a robust number of resources committed to this incident and the response representing the federal government, local government, and civilian entities.

4.2. Firefighting Phase

- 4.2.1. Navy FEDFIRE and Norfolk Fire and Rescue made up the initial Unified Command to fight the fire, which was established at approximately 12:45 PM on June 7, 2022. The fire was within Navy jurisdiction, and as such Navy FEDFIRE was the lead Incident Commander within the Unified Command. It is important to note the National Incident Management System (NIMS) Incident Command Structure (ICS) is used by federal, state, and local agencies. However, for firefighting, there is a deference to the Incident Commander, which differs slightly from how the Coast Guard normally employs an ICS Unified Command. Chesapeake Fire Department was called to the scene and operated at the direction of the Incident Commander to deploy and deliver firefighting foam to the vessel.
- 4.2.2. On-scene communications were managed in a “stove pipe” fashion among involved agencies, meaning there was no communication interoperability between Navy FEDFIRE personnel and civilian firefighting agencies. This was identified early in the response, and it was determined each agency would communicate through their respective chains of command using their respective radio frequencies.
- 4.2.3. The Port of Virginia Marine Incident Response Team (MIRT) responded to the scene. The MIRT served as a liaison with the Coast Guard. The Unified Command utilized the MIRT to assist in coordinating on-water units for firefighting and potential rescue of responders who could possibly fall into the water during the response. The MIRT possessed a significant number of portable radios, available for use to overcome incompatibility in responder radio frequencies should that contingency arise. These available radios were not utilized during this response.
- 4.2.4. When the vessel arrived pier side, there were no passengers onboard, and the true extent of the fire was not known by responding agencies. The Captain Trainee communicated with the senior MIRT representative via VHF channel 16 that the fire may have spread to the galley but was not certain.

4.2.5. An Initial Action Plan (IAP) was developed by Navy FEDFIRE to combat the fire, assess the true extent of the fire, and identify the best method to extinguish the fire. Below is an excerpt from Norfolk Fire and Rescue report articulating these initial actions.

4.2.5.1. *“An IAP was established by the Naval base chief and goes as follows: Upon the Spirit of Norfolk approaching dockside, Navy units were to stretch what appeared to be a shorter version of what we know as the Norfolk Bundle. This line would be managed by Navy Engine 11. Norfolk Engine 12 was to man the 2.5 " Big Water" to back up Navy Engine 11. A third engine crew would take an additional hand line aboard the vessel... Battalion 3 was advised of all intended actions. Upon the ship approaching the pier, attempted extinguishments via the 2.5 through vents of the ship was attempted. No improvement with the heavy smoke conditions. It was then noted that 5300 gallons of diesel fuel was supplying the involved vessel. From the pier, crews tried suppression activities with conditions worsening.”*

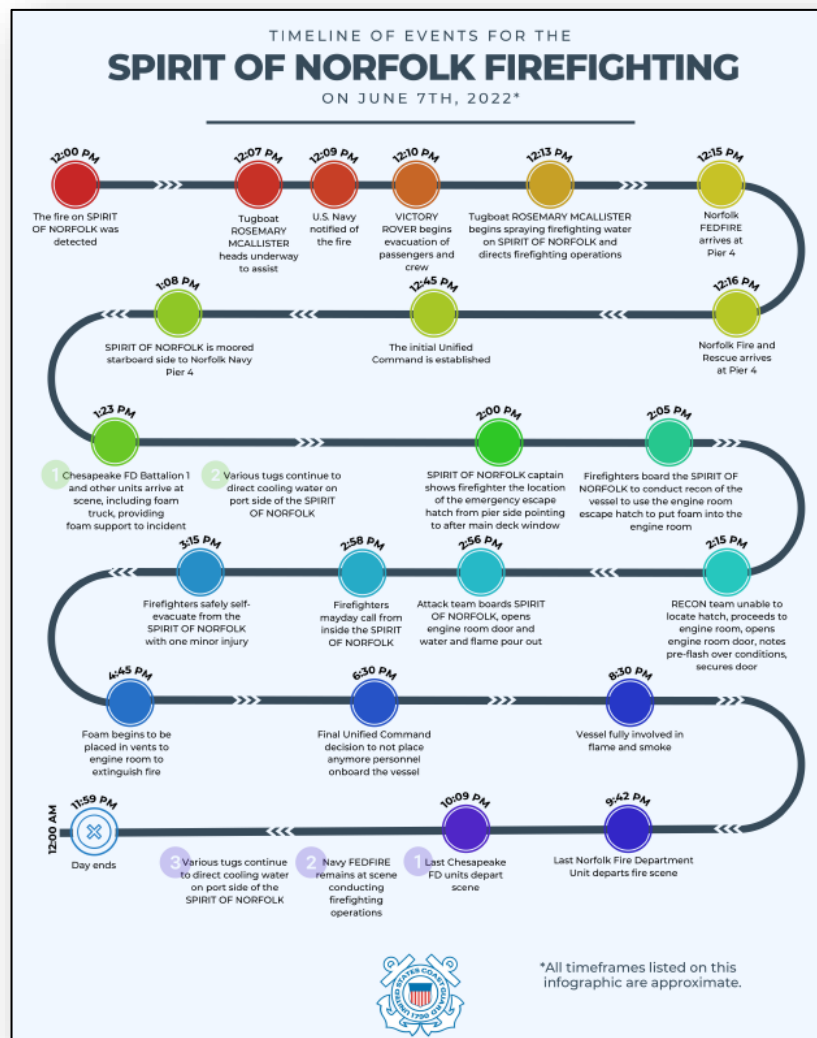


Figure 10 – Spirit of Norfolk fire reference timeline of key firefighting events on June 7, 2022. (Source: Coast Guard Auxiliary)

- 4.2.6. After the initial IAP was deemed mostly ineffective due to unsuccessful dockside firefighting tactics, a change in strategy occurred. The Captain of the *Spirit of Norfolk* provided firefighters with the location of the fire control plan, where access points on the vessel were located, including an escape hatch (vent hatch in firefighter nomenclature) to the engine room on the main deck.
- 4.2.7. A four-person (two Navy FEDFIRE, two Norfolk Fire and Rescue) Reconnaissance (RECON) team went onboard at approximately 2:05 PM and departed the vessel at approximately 2:20 PM. During that time, the RECON team was unable to locate the escape hatch so they made their way to the engine room. The RECON team opened the engine room door then re-secured the door between the engine room and the galley and exited the *Spirit of Norfolk*. Below is a continuing excerpt from the Norfolk Fire and Rescue report detailing these actions.

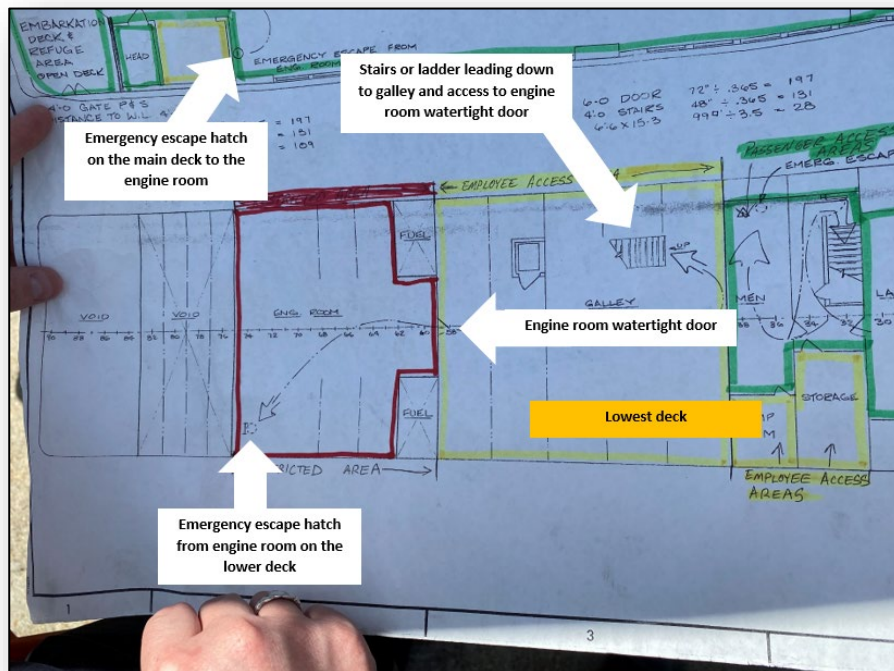


Figure 11 – *Spirit of Norfolk* fire plan recovered from the vessel on June 7, 2022, and annotated with colored outlines by the command post. Image has white arrowed labels applied by the investigation. (Source: USCG)

- 4.2.7.1. “The change was to send a RECON team on the ship to locate a vent hatch and the fire/floor plan. This action was executed with a team of four. Two members from Norfolk Engine 12 and two members from Navy Engine 4. While doing the RECON, the hatch which was supposed to be 15 feet deep and 10 feet to the right was never located. Conditions aboard the ship on the entertaining deck was visible conditions. Very little obscuring of surveying all areas aboard the ship. Crews then made their way down into the kitchen area where the engine/fire room was located. Conditions in the kitchen were dark but clear enough for foot traffic. Once the door was opened to the engine room, rollover, pre-flashover conditions were noted. The door was re-secured and B7 was informed of conditions found.

The RECON crew was then ordered to exit the structure and rehab. No Victims were found during RECON.”

Enclosure (1) contains hyperlink (8) which is a short video showing Images and video of firefighters boarding the *Spirit of Norfolk* afternoon of June 7, 2022.

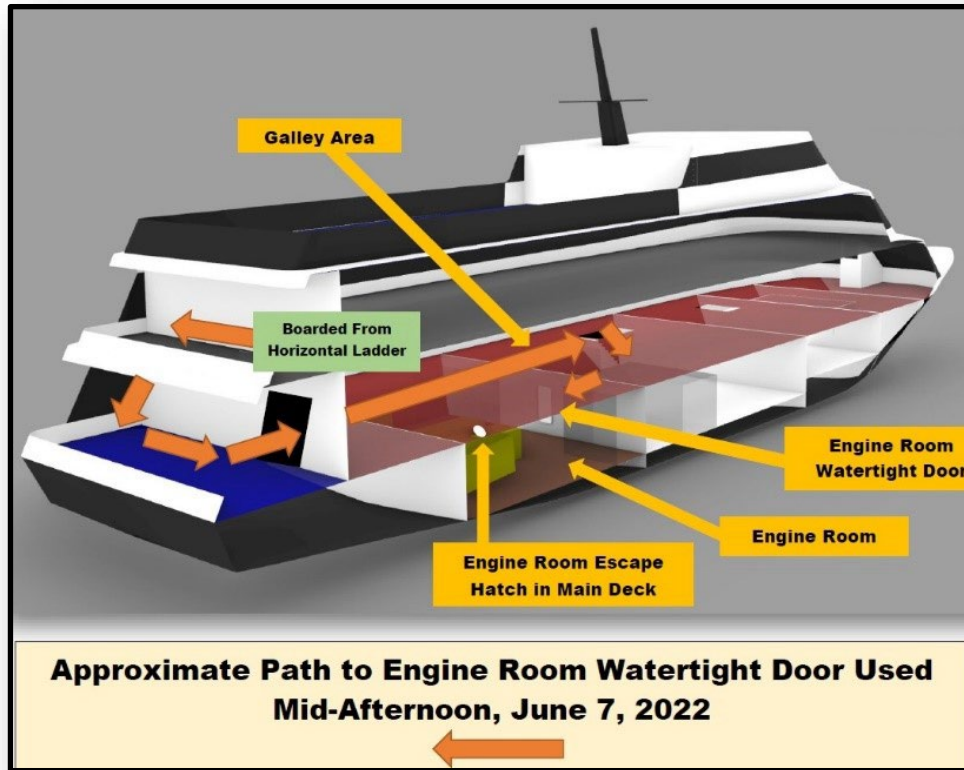


Figure 12 – Computer model showing the route from the dock, over a fire apparatus ladder and onto the *Spirit of Norfolk* on the afternoon of June 7, 2022. The image shows the two potential means of putting firefighting agent into the vessel’s engine room, the emergency escape hatch and/or the engine room watertight door. (Source: USCG)

- 4.2.8. After the RECON team went onboard, a subsequent strategy was developed to place firefighting foam into the engine room to combat the fire, as the fire was determined to be contained within the engine room. At some point, the tactics on how to accomplish this strategy altered from opening the escape hatch and inserting a hose (due to the fact the hatch could not be located), to inserting a foam line into the previously accessed engine room watertight door, then exit the vessel. The fire appeared to have intensified somewhat based upon reduced visibility conditions and an increase in deck temperatures during this time.
- 4.2.9. During this timeframe (between RECON and fire attack), enough heat was produced to release diesel fuel (possibly from the starboard or port fuel tanks) into the engine room. Additionally, water continued to be placed into the external hull engine room vents from both waterside and shoreside units. The fire attack team went onboard at approximately 2:55 PM. The team make-up was the same as the RECON team (two Navy FEDFIRE,

two Norfolk Fire and Rescue personnel) except for one member who was replaced due to heat exhaustion. As the crew attempted to access the engine room, the watertight door was opened while under pressure and thousands of gallons of water and fuel came rushing out of the door. Below is a continued excerpt from the Norfolk Fire and Rescue report describing the occurrence.

- 4.2.9.1. *“The next plan of action after rehab was to send the RECON team back inside with a hand line and foam canister to place inside the fire/engine room. The initial foam hand line that was put together by Chesapeake units was supposed to be backed up with a secondary hand line and foam canister. Hand line size was an inch and three quarters. The backup line never made its way on the ship and crews never had a ready RIT team available at the point of entry. The point of entry was going to be on deck that serviced the entertaining at the rear entrance.”*
- 4.2.9.2. *“The entry team was eagerly directed on the ship to get the foam in operation. At this point, conditions had started to change drastically. visibility had decreased, but was still manageable, and the entry decking was a little warmer. Entry was made downstairs, into the galley area for foam deployment. The plan was to open the engine/fire room door, open the foam nozzle and keep it open and rapidly vacate the structure. With a slight quarter turn on the turn wheel, pressure from behind the door was felt. Instantly, the engine room door exploded open causing what appeared to be a minor back draft/flash over inside the kitchen area where the engine room was located. Thousands of gallons of rapid water came rushing out from the fire room.”*

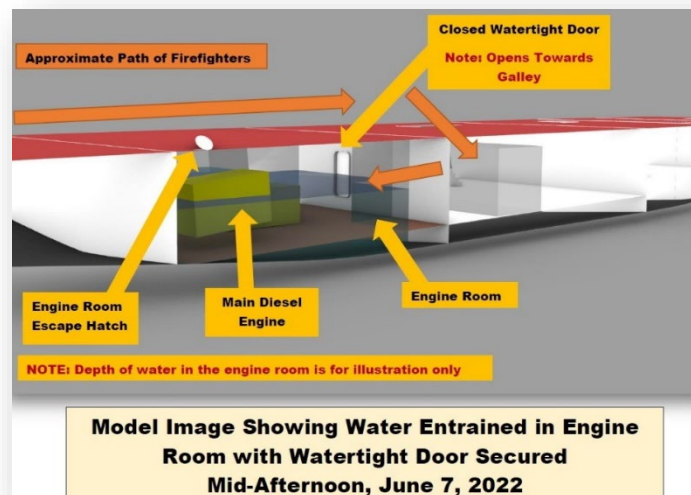


Figure 13 – Image that displays a representational amount of entrained firefighting water in the engine room prior to the opening of the engine room watertight door. Firefighters reported opening that door and being engulfed with a four-foot wall of water and a backdraft of flame. (Source: USCG Marine Safety Center)

- 4.2.9.3. *“This rapid water created a separation of the initial entry team. The officer of the entry team was trapped behind the door of the engine room and unable to secure [the door] because of the weight of the rapidly moving water. At the same time the*

water came rushing out, it went up into flames and knocking over the nozzle man. The crews, disoriented below deck tried self-extricating unaware of the condition of the other team member. A mayday was called by the officer of Norfolk Engine 12 for one of the Navy members. The Navy team member had also called a Mayday on his tac-channel for the officer of Engine 12.”

- 4.2.9.4. *“During this same time, orders to evacuate were given. Rapid burst on air horns by the closest units, the announcement over the assigned tac channel and the running man symbol was noted. Do (sic) to poor radio reception, the radio transmissions were never heard. These orders may have also been gibe (sic) while crews were trying to self-extricate the rapid, engulfed waters. Command stated that the vessel appeared to have been capsizing after the explosion which was the reason for the evacuation.”*
- 4.2.10. The firefighting team, saturated with water and diesel fuel, was able to self-recover and self-evacuate with no major injuries. As a result, the watertight door was unable to be resecured.
- 4.2.11. The onboard firefighters initiated a “mayday” call (urgent firefighter call indicating injured, missing, or trapped personnel). After the fire attack team departed, the primary firefighting strategy was changed to cooling the outside of the vessel and not to inject additional water in the vessel so the vessel would not take on too much water and capsize or sink at the pier.
- 4.2.12. At some point in the mid-afternoon, the Coast Guard determined the engine room could be entirely flooded and not capsize the vessel. However, once water and oily discharge escaped outside the engine room, the Coast Guard reevaluated due to increased concerns regarding the safe stability of the vessel.
- 4.2.13. The fire at this point appeared to abate, but there were still elevated temperature readings detected by fire agencies. Between 3:30 PM and 5:30 PM, the Unified Command evaluated strategies, then made the decision to apply fire suppression foam through vents as the next best course of action. This strategy alternated rotations of applying foam for approximately 10 minutes, then wait and see if temperatures onboard the vessel declined. Unfortunately, this proved unsuccessful in extinguishing the fire.
- 4.2.14. Concurrently, between approximately 3:30 PM to 6:30 PM, there was considerable discussion among responding agencies regarding the next appropriate steps. This Unified Command now began to involve stakeholders not involved in the original firefighting centric focus, including the Coast Guard, City Cruises representatives, and State/local environmental agencies. City Cruises contracted salvage and engineering representatives, who were also beginning to arrive on-scene to evaluate the situation and assist.
- 4.2.15. The Unified Command discussed potential re-entry into the vessel (primarily led by Navy FEDFIRE personnel), stability considerations, and how to best proceed. In particular, the Captain of the Port's representative prioritized that no other personnel should be placed on the vessel until such time as the stability of the vessel could be

validated. Norfolk Fire and Rescue appeared to agree with this assessment, while Navy FEDFIRE and City Cruises' salvage representatives made initial plans to go back on board the vessel. Ultimately, the decision was made by the Unified Command that every effort should be made to keep the vessel afloat and for no one else to go onboard the vessel in the interest of safety. Accordingly, the strategy shifted from fire extinguishing to fire containment.

4.3. Firefighting Containment and Salvage Phase

- 4.3.1. A Unified Command meeting took place at approximately 8:00 PM on June 7, 2022. This meeting signaled a new phase of the incident response with a focus on keeping the vessel afloat and salvaging the vessel once the fire was extinguished. This required considerable planning, stability observations/calculations, and the introduction of additional equipment to dewater the vessel so that it could ultimately be towed to a local shipyard. During this meeting, the fire intensified significantly, and the fire continued to burn throughout the night into June 8, 2022.
- 4.3.2. Another Unified Command meeting was held the morning of June 8, 2022, at approximately 10:00 AM. The primary entities involved in this phase of the incident were City Cruises representatives, the Coast Guard, State/local agencies, and the U.S. Navy as a support agency. The Unified Command focused on cooling the vessel, monitoring stability, and developing salvage plans. It was estimated there were between 125,000 and 150,000 gallons of entrained water onboard the vessel and an additional 5,000 gallons of diesel fuel. City Cruises engineering and salvage representatives submitted stability calculations and developed a salvage plan for approval.
- 4.3.3. The salvage/dewater plan was approved by the Unified Command at approximately 2:20 PM on June 8, 2022. The plan required the use of a tank barge to transfer water and oily waste from the *Spirit of Norfolk*, additional storage tanks for watery waste (often referred to as "FRAC" tanks), and pumps to transfer water and oily waste.
- 4.3.4. At 4:20 PM on June 8, 2022, dewatering commenced, and the first gallons of entrained water was taken off the vessel using pumps and the storage tanks at a rate of approximately 200 gallons per minute.
- 4.3.5. On June 9, 2022, a towing vessel with a tank barge, *T/B C&M18*, arrived at approximately 12:06 AM to offload oily water mixture from the *Spirit of Norfolk*.
- 4.3.6. At approximately 2:30 AM on June 9, 2022, the port stern quarter of the *Spirit of Norfolk* was dangerously low in the water, and there was concern from the Sector Virginia Marine Inspector on scene that the vessel could capsize.
- 4.3.7. The Captain of the Port, Coast Guard Sector Virginia authorized an emergency "... over-the-top (goosenecked) transfer of water from *Spirit of Norfolk* to *T/B C&M18* through ullage opening ..." to dewater the vessel. This occurred without the required Person in Charge (as required by pollution regulations) who was not on-scene at the time.

4.3.8. Despite difficulties with pumps, and with the assistance of Navy personnel and additional equipment, by approximately 7:30 AM on June 9, 2022, more than 77,000 gallons of oily water had been transferred off the *Spirit of Norfolk* to the tank barge. Stability and draft readings of the vessel in the water greatly improved.

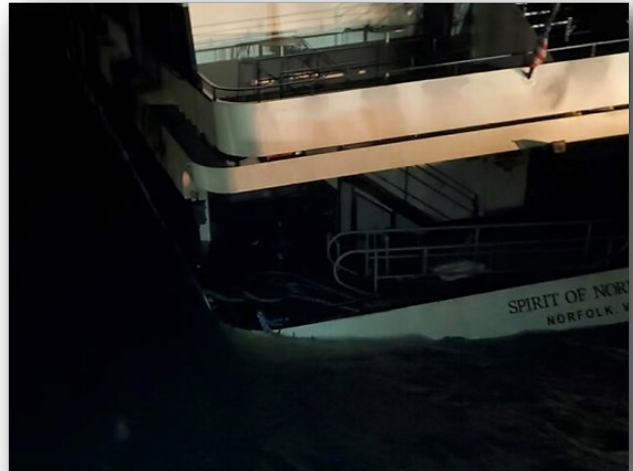


Figure 14 – Photo taken at 3:55 AM on June 9, 2022, showing the *Spirit of Norfolk* listing heavily to port and the bulwarks on the main deck submerged. (Source: USCG)

4.3.9. By 2:48 PM on June 9, 2022, a total of approximately 191,000 gallons of water had been transferred off the *Spirit of Norfolk* with approximately 48,000 gallons remaining onboard.

4.3.10. Although there remained some spots of increased temperature in the galley, salvors were able to access the engine room. The salvors noted the starboard fuel tank had split open, and the port fuel tank was bulging outward. The pumping of water was ceased overnight to monitor the watertight integrity of the vessel for the upcoming towing operation.

4.3.11. At 7:12 AM on June 10, 2022, fire teams were still actively putting out hotspot fires and cooling and overhauling the fire on the vessel.

4.3.12. By 4:00 PM on June 10, 2022, it was estimated 241,000 gallons of water mixture was taken off the vessel and transferred into the tank barge. It was also determined the port side fuel tank was empty of diesel fuel contents. Additionally, other potential fuel sources were taken off the vessel on other decks by this time.

4.3.13. At approximately 10:00 AM on June 11, 2022, the fire on the *Spirit of Norfolk* was declared extinguished by the Unified Command. City Cruises submitted a tow plan to the Sector Virginia Captain of the Port who subsequently approved the plan.

4.3.14. At approximately 5:20 AM on June 12, 2022, the *Spirit of Norfolk* departed Navy Pier #4. The vessel was safely towed to a local shipyard and moored at 7:20 AM, on June 12, 2022.

4.3.15. The company identified six crewmembers from the *Spirit of Norfolk* as being directly involved in a serious marine incident and were subject to mandatory chemical testing for evidence of drug and alcohol use in accordance with 46 CFR Subpart 4.06. All tests were negative. The formal investigation further considered negative impacts from distracted operations (i.e., cell phones, computers, etc.) and did not identify any significant issues.

Enclosure (1) contains hyperlink (9) which is a short video of computer modeling showing the effects of the entrained water onboard the *Spirit of Norfolk* based on draft readings taken during the fire and salvage events.

5. Background and Contextual Information

5.1. Regulatory and Policy Framework

5.1.1. The *Spirit of Norfolk* is Coast Guard certificated as a Title 46 CFR Subchapter K vessel with a significant number of regulatory requirements using old Title 46 CFR Subchapter T (T-L vessel) requirements. Regulatory and policy applicability varied, dependent upon vessel system using the below regulatory and policy guidance documents. For example, most firefighting requirements were dictated by old Title 46 CFR Subchapter T, but the vessel was required to comply with current security requirements. Below is a list of the regulatory and/or policy documents that applied to the *Spirit of Norfolk*.

- Marine Safety Manual Vol. II
- Title 46 CFR Part 10
- Title 46 CFR Part 15
- Title 46 CFR Subchapter T
- Title 46 CFR Subchapter K
- Title 46 CFR Subchapter H
- T - K Manual
- Small Passenger Vessel Risk Based Inspection Program Mission Management System (MMS) Instruction

5.1.2. Title 46 CFR Subchapter T was initially published in the Federal Register (FR) as a final rule (25 FR 9315) on September 29, 1960. Title 46 CFR Subchapter T underwent a significant revision on January 10, 1996, when final rule (61 FR 947) was promulgated. New small passenger vessels are required to meet requirements in the updated Title 46 CFR Subchapter T regulations or Title 46 CFR Subchapter K regulations, while existing vessels (meaning those built before 1996) maintain certain regulatory standards from the original Title 46 CFR Subchapter T. Vessels that have undergone major conversions are required to meet the new Title 46 CFR requirements. The *Spirit of Norfolk* had not undergone a major conversion.

5.1.3. The *Spirit of Norfolk* was as an existing, steel hulled vessel when the new Title 46 CFR Subchapter T (which also required compliance with Title 46 CFR Subchapter K) was implemented. The *Spirit of Norfolk* was thus not required to install fire detection or fixed firefighting suppression in the engine room because those were only requirements for small passenger vessels built after the new regulations were enacted in 1996. The *Spirit of Norfolk's* approved firefighting equipment consisted of ten fire extinguishers and five one-half inch 50-foot fire hoses. The vessel also possessed some integrated structural fire protection, including engine room fire boundaries in the form of an A-60 deck (ceiling), duct work leading to other decks to minimize fire spread, and four A-0 bulkheads (walls). These boundaries are defined in Subchapter K regulations as:

5.1.3.1. *“A-Class bulkheads or decks must be composed of steel or equivalent material, suitably stiffened, and made intact with the main structure of the vessel, such as the shell, structural bulkheads, and decks. They must be so constructed that, if subjected to the standard fire test, they are capable of preventing the passage of smoke and flame for 1 hour. In addition, they must be so insulated with approved structural insulation, bulkhead panels, or deck covering so that, if subjected to the standard fire test for the applicable time period listed below, the average temperature on the unexposed side does not rise more than 139 °C (250 °F) above the original temperature, nor does the temperature at any one point, including any joint, rise more than 181 °C (325 °F) above the original temperature:*

<i>A-60 Class</i>	<i>60 minutes</i>
<i>A-30 Class</i>	<i>30 minutes</i>
<i>A-15 Class</i>	<i>15 minutes</i>
<i>A-0 Class</i>	<i>0 minutes”</i>

5.1.3.2. *“Penetrations in A-Class fire control boundaries for electrical cables, pipes, trunks, ducts, etc. must be constructed to prevent the passage of flame and smoke for one hour. In addition, the penetration must be designed or insulated so that it will withstand the same temperature rise limits as the boundary penetrated.”*

5.1.4. In summary, safety regulations applicable to the *Spirit of Norfolk* are found in Title 46 CFR Subchapter K, but with many systems regulated primarily under old Title 46 CFR Subchapter T (also known as T-L) or Title 46 CFR Subchapter H. In addition to regulatory requirements, the Coast Guard promulgates guidance and policy to assist Coast Guard Marine Inspectors in the course of their inspection and oversight duties.

5.2. Coast Guard Compliance Oversight

5.2.1. The *Spirit of Norfolk*'s Certificate of Inspection (COI) was issued on February 10, 2020. This is a certification document that is good for five years as long as the vessel successfully completes annual inspections each of the subsequent years.

5.2.2. The most recent COI annual inspection was completed on May 10, 2022, with no deficiencies noted. The vessel was deemed fit for service and route. The Lead Inspector on this inspection was an Advanced Journeyman Marine Inspector (AJMI) in accordance with the Small Passenger Vessel Risk Based Inspection Program.

5.2.3. The vessel was determined by the Coast Guard to be a “Tier 1” vessel making it an elevated risk in accordance with a risk-based matrix work instruction promulgated by the Coast Guard's Office of Commercial Vessel Compliance (CG-CVC) in 2020 and updated in 2021. The Small Passenger Vessel Risk Based Inspection Program arose as a Coast Guard programmatic initiative after the small passenger vessel *Conception* fire which resulted in the loss of 34 lives and the loss of the vessel. The key elements of this instruction include enhanced OCMI oversight, greater frequency of inspections, and the use of more experienced Marine Inspectors during the increased inspection regime.

- 5.2.4. While underway on a passenger excursion on May 15, 2022, the PMDE over-heated due to an internally corroded water pump housing failure. This created an approximately 3/4” hole in the housing which emitted steam and engine coolant at the bottom of the engine. There was no logbook entry noting or further describing this incident. City Cruises filed a proper Coast Guard Report of Marine Casualty (using form CG-2692) for the incident.
- 5.2.5. The exact length of time the PMDE operated in excessive heat condition is unknown. However, it is estimated to have been between five and eight minutes. The hole in the housing released most or all of the coolant from of the engine. This assessment was based upon the Captain’s (in his role as Director of Marine Operations) review of the incident on a black/white closed-circuit TV/camera in the vessel engine room. A crewmember initially believed the steam was smoke from a fire in the engine. The crewmember opened the engine room watertight door to investigate and ultimately expended two dry chemical fire extinguishers onto the engine. The engine was secured, and the vessel transited safely back to the pier under power from the SMDE.
- 5.2.6. The overheating incident on May 15, 2022, initiated a substantial amount of activity involving the PMDE between May 16 until May 26, 2022, which involved City Cruises, Bay Diesel Solutions as the technical representatives, and Coast Guard Sector Virginia. The following are key points in this sequence of events.
- 5.2.6.1. A Bay Diesel representative conducted a preliminary assessment of the PMDE on the evening of May 15, 2022. This representative noted that two hours after the incident, the engine temperature remained elevated, estimated to be between 180 to 220 degrees. The water pump damage was evaluated and the representative recommended replacement of the water pump housing, belts, and thermostats.
- 5.2.6.2. City Cruises Director of Marine Operations (also the Captain of the *Spirit of Norfolk*) sent an email and technical report with three photos to the Sector Virginia Inspections email inbox on May 16, 2022. The substance of the email detailed that the company was working to conduct repairs to the water pump.
- 5.2.6.3. Sector Virginia issued an operational control (CG-835v) on May 16, 2022, that required the vessel representative to make repairs to the satisfaction of a Coast Guard Marine Inspector prior to the carriage of passengers in accordance with Title 46 CFR Subchapter K Part 119.100.
- 5.2.6.4. Bay Diesel technicians went onboard the vessel a second time on May 17, 2022, and repaired the water pump, belts, and thermostats. The technician recommended replacement of the left bank turbocharger and oil supply lines that exhibited signs of damage, including leaking oil. A technician noted the right bank/inboard turbocharger looked “ok” at the time. City Cruises authorized the recommended repairs to the left bank turbocharger.
- 5.2.6.5. Bay Diesel technicians went onboard the vessel a third time on May 18, 2022, and replaced the left bank turbocharger, oil supply lines, exhaust pipe bolts, and gaskets.



Figure 15 – Damage to PMDE from the initial coolant leak in that engine on May 15, 2022. Left, damaged pistons from the overheating event necessitating a top end overhaul of the engine. Right, arrow points to hole in the water pump cover caused by internal corrosion. (Source: Bay Diesel & USCG)

5.2.6.6. Coast Guard Sector Virginia dispatched two Marine Inspectors (one an Advanced Journeyman Marine Inspector) who attended the vessel on May 18, 2022, and verbally cleared the deficiency. However, the operational control issued was not cleared (noted as resolved) in any documentation found at Coast Guard Sector Virginia, including in the Coast Guard’s official vessel recordkeeping database, Marine Information for Safety and Law Enforcement (MISLE).

5.2.6.7. City Cruises Director of Marine Operations (also Captain of the *Spirit of Norfolk*) sent a follow-up email to the Coast Guard Sector Virginia inspections email inbox on May 18, 2022, at 7:02 PM. The substance of the email was to provide the technical report for repairs to the water pump and left bank/outboard turbocharger.

5.2.6.8. The following day, on May 19, 2022, while underway on an excursion, a second PMDE “smoke” incident was discovered (described as white smoke coming from the oil fill cap or “blow-by” from the crankcase). Bay Diesel technicians evaluated the PMDE engine finding coolant in the oil pan and significant liner damage. Technicians recommended a “top-end, in-frame” PMDE overhaul due to damage incurred from the overheating incident of May 15, 2022. The recommendations included replacement of liners, pistons, rings, pins, rod, and main bearings.

5.2.6.9. City Cruises Director of Marine Operations (also Captain of the *Spirit of Norfolk*) sent an email to Coast Guard Sector Virginia Inspections email inbox on May 19, 2022, at approximately 9:46 AM. The substance of the

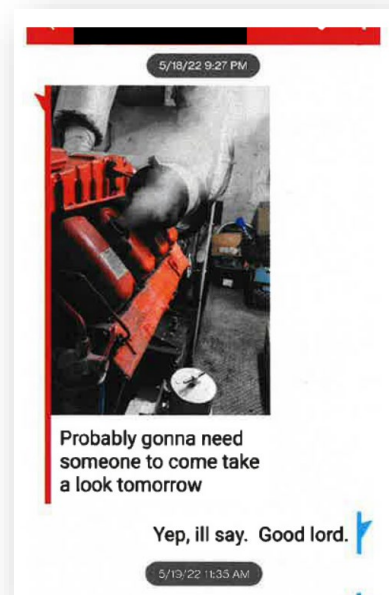


Figure 16 – City Cruises and Bay Diesel text message exchange on May 18, 2022. (Source: Bay Diesel & USCG)

email noted the excessive smoke out of the PMDE and that Bay Diesel was contacted to analyze the problem. The Captain proactively requested to use a towing vessel escort for a scheduled dinner cruise that day while the PMDE was not in service so that the vessel could still operate.

- 5.2.6.10. A Coast Guard Sector Virginia Marine Inspector sent a reply email from the Coast Guard Sector Virginia Inspections email account to the Director of Marine Operations (also Captain of the *Spirit of Norfolk*) on May 19, 2022, at approximately 10:38 AM authorizing the Captain's request to operate with a towing vessel escort for that day.
- 5.2.6.11. Director of Marine Operations (also Captain of the *Spirit of Norfolk*) sent an email on May 20, 2022, to the Coast Guard Sector Virginia Inspections email inbox at approximately 9:10 AM providing an update. The update stated that a Bay Diesel technician recommended PMDE overhaul and replacement of the right bank/inboard turbocharger. The email also requested a towing vessel assist during the overhaul time period for the vessel to continue operating with passengers while repairs for the PMDE were ongoing. A target date for repair and subsequent sea trials was estimated to be May 25 or May 26, 2022.
- 5.2.6.12. A Coast Guard Sector Virginia Duty Marine Inspector replied to the towing vessel assist request on Friday, May 20, 2022, at approximately 5:15 PM, stating the request was approved through the weekend. A review of historical Automatic Identification System (AIS) data by Coast Guard investigators determined that a towing vessel of suitable size and horsepower did in fact escort the *Spirit of Norfolk* during the approved timeframes.
- 5.2.6.13. After the Coast Guard's e-mail approval, there was no operational control placed on the vessel, regarding their request for towing vessel assistance or the PMDE overhaul.
- 5.2.6.14. Bay Diesel attended the vessel on multiple days between May 21, May 23, May 24, May 25, and May 26, 2022. During this timeframe the overhaul was completed on the PMDE and the crew prepared for sea trials on May 26, 2022.
- 5.2.6.15. At some point during the PMDE overhaul, Bay Diesel technicians discovered the lower and upper water temperature alarms were not properly set to manufacturer recommendations (they were calibrated at too high a temperature) and were adjusted lower to proper specifications during the engine overhaul.
- 5.2.6.16. Bay Diesel technicians also discovered oil or similar residue on the right bank/inboard turbocharger at the bottom of the compressor on May 26, 2022. Bay Diesel ordered a replacement turbocharger and recommended the crew "keep an eye" on the right bank/inboard turbocharger until the replacement arrived.

- 5.2.6.17. While repairs were being made to the PMDE, the vessel operated a total of eight cruises, escorted by an assist towing vessel, carrying more than 1400 passengers in total.
- 5.2.6.18. Coast Guard Sector Virginia inspections staff were not aware of the extent of damage and repairs. Additionally, there was no up-to-date documentation regarding the vessel in the vessel hard copy file in the inspection division, or anywhere easily accessible to any Marine Inspector attending the vessel in the future.
- 5.2.6.19. The vessel conducted sea trials on May 26, 2022. A Marine Inspector attended the vessel, then departed prior to conducting the sea trials. The vessel was inspected to Title 46 CFR Subchapter K and the operational control (CG-835v) issued utilized a Subchapter K regulation although the engine room was substantially inspected to old Title 46 CFR Subchapter T (properly noted as a T-L vessel using regulatory language). The Marine Inspector was not a qualified “K-boat” inspector but, did possess a “T-boat” inspector qualification and a major Hull inspector qualification. The Marine Inspector did not possess a Machinery Inspector qualification.
- 5.2.6.20. The Marine Inspector viewed the PMDE in operation for approximately ten minutes and cleared the vessel for operation. The Marine Inspector did not have all the technical reports submitted to the Coast Guard prior to attending the vessel (the final six of ten technical reports were sent after the Marine Inspector left the vessel). The Marine Inspector did not request or inquire further regarding additional technical reports or additional work completed on the PMDE. The Marine Inspector was not aware of the technical report regarding the potential replacement of the right bank/inboard turbocharger nor asked what was meant by the suggestion from Bay Diesel to “keep an eye” on the turbocharger.
- 5.2.6.21. The City Cruises Director of Marine Operations (also Captain of the *Spirit of Norfolk*) sent an email with the remaining six technical reports to the Coast Guard Sector Virginia inspections email inbox on May 26, 2022, at approximately 7:15 PM stating all repairs were made and vessel sea trials were successful.
- 5.2.6.22. On May 31, 2022, at approximately 2:15 PM, a Bay Diesel representative notified City Cruises Director of Marine Operations (also Captain of the *Spirit of Norfolk*) via text message that the replacement right bank/inboard turbocharger had been received and inquired about the vessel schedule that week (May 31 through June 6, 2022).
- 5.2.6.23. City Cruises Director of Marine Operations (also Captain of the *Spirit of Norfolk*) responded via text that there were two cruises per day scheduled for the next week. A Bay Diesel representative responded via text, “*He wanted to think about it and didn’t want to break an exhaust stud or something like that.*” The Bay Diesel representative asked via text how the engine was running. City Cruises Director of Marine Operations (*also Captain of the Spirit of Norfolk*) responded

via text that the engine was running great and only had to add some coolant the first day or two which he deemed “normal.”

- 5.2.6.24. During the time frame of May 15, 2022, through May 26, 2022, the Coast Guard issued one operational control (CG-835v) related to the entirety of the work which was completed including the allowance of repairs underway with a towing vessel escort. This operational control was verbally cleared on May 17, 2022, (but not documented) by the attending Marine Inspectors, prior to the PMDE overhaul.
- 5.2.6.25. Following the repairs, the vessel operated 18 times between May 26, 2022, and the day of the accident.
- 5.2.6.26. In summary, ten technical reports were submitted by Bay Diesel to City Cruises between May 15, 2022, and May 26, 2022.
- 5.2.6.27. In summary, nine technical reports (and substance of those reports and associated photos) were submitted by City Cruises to the Coast Guard. Six technical reports were submitted on May 26, 2022, after the entirety of repairs had been made, except for the recommended replacement of the right bank/inboard turbocharger.
- 5.2.7. City cruises operated the *Spirit of Norfolk* from May 26, 2022, to June 6, 2022, carrying more than 3,000 passengers, with a single voyage total high of 395 persons, for a two-hour voyage, beginning at 11:30 PM on June 4, 2022, without further known incident.
- 5.2.8. City Cruises filed an insurance claim for the water pump failure which required the PMDE overhaul, including a new water pump, PMDE overhaul, and replacement of both PMDE turbochargers.
- 5.2.9. ***Post-Fire Technical Notations:*** A significant post-fire examination regarding the condition of the vessel and recent vessel surveys was conducted by Coast Guard and NTSB investigators, insurance surveyors, and associated technical representatives related to the owner/operator of the *Spirit of Norfolk*. Additionally, the ATF conducted an independent post-fire examination of the vessel and conducted their own analysis of the fire and fire path and provided a Report of Investigation outlining their observations and findings in accordance with the National Fire Protection Association standard process for fire and explosion investigations.
- 5.2.10. On June 2, 2022, the vessel underwent an insurance survey by Knox Marine Services, stemming from the insurance claim from water pump failure to assess the damages and validate the claim. The surveyor noted damages to liners. It was also noted in the survey report that both turbochargers were damaged by the overheating incident. The surveyor noted significant damage from the overheating incident and recommended replacement of both turbochargers based upon his observations of the damaged parts. Upon inquiry by the surveyor after the fire of June 7, 2022, regarding the right bank/inboard turbocharger’s installation status, a Bay Diesel representative replied via email it had not been installed because the vessel was busy.

- 5.2.11. The vessel had an extensive valuation survey on June 6, 2022, by Castlerock, Inc., regarding the condition of the vessel. There were no significant safety or engineering issues noted by the surveyor. The vessel was estimated to have a current market value of \$5,000,000.
- 5.2.12. During these two surveys, the contemporary pre-fire condition of the vessel was established. These surveys included approximately 200 photographs of the entire vessel. One photograph (see figure 21) from June 2, 2022, displayed storage of miscellaneous items, including a large cardboard box located directly behind the PMDE, a large cardboard box at the base of the PMDE, and approximately 25-30 cardboard and plastic boxes stored on a nearby shelving along the bulkhead in close proximity to the PMDE. Furthermore, a June 6, 2022, photograph identified the same cardboard box behind the PMDE that was displayed in the June 2, 2022, photograph. A post-fire examination by the Coast Guard noted the same storage shelf in a “burned out” condition, as well as the metallic contents of what was stored in the large cardboard box at the base of the PMDE.
- 5.2.13. Coast Guard investigators conducted a thorough examination of both the inside and outside of the vessel. The Coast Guard and NTSB secured several physical items for testing related to the hydraulic steering system in or in the vicinity of the engine room including a hydraulic relief valve. The testing of the hydraulic items was either inconclusive or indicated fire damage compromised the item beyond the ability to test satisfactorily.
- 5.2.14. During the public proceeding, the Coast Guard secured a mechanical technical expert to assist with considering the mechanical aspects of the investigation related to the PMDE and associated equipment. The expert witness testified regarding basic marine diesel engineering concepts, troubleshooting marine diesel engines, and repair and replacement of marine diesel engine components.

5.3. Company Profile and Oversight

- 5.3.1. The *Spirit of Norfolk* is owned by Hornblower Cruises and Events LLC. (Hornblower). Hornblower operated under a subsidiary business unit named City Cruises (also referred to as the company throughout this report). According to Hornblower’s internet website, the ownership operates more than 250 vessels, both domestic and international, comprised of all types of small passenger vessel operations with multiple subsidiary business units. The business unit named City Cruises operates approximately 123 vessels, with 24 of those vessels Coast Guard certificated under primarily old Title 46 CFR Subchapter T requirements.
- 5.3.2. The Director of Marine Operations in the City Cruises organization played a critical role in the overall safety of the *Spirit of Norfolk* and the other Norfolk based vessel, the *Freedom Elite*. This role included the operations, training, navigation, engineering support, and security of the vessels. In the case of the *Spirit of Norfolk*, the Director of Marine Operations frequently served as the Captain of the two small passenger vessels located in Norfolk. There was a “team” approach and a “dotted line” relationship to upper management engagement, vice a clear chain of command for reports on issues related to

vessel operations or engineering. None of the City Cruises representatives that were interviewed could clearly describe what the “dotted relationship” meant. The Director of Marine Operations directly reported to the site General Manager who possessed no vessel specific training. In the hearing, the General Manager was asked who she would turn to if she could not get a safety issue resolved, she replied the “National Marine Team.” When asked to specify who she would make this report to on the National Marine Team, she stated, “I would go directly –either of one of two choices. I’d start with the Regional Director for the Mid-Atlantic, or I would go directly to the VP of Marine Operations”.

- 5.3.3. City Cruises in Norfolk, VA, was reliant upon third-party vendors for all the engineering troubleshooting and repairs related to both of the vessels homeported in Norfolk, VA. There was no in-house port engineer or engineering expertise (including the Director of Marine Operations) who could manage issues beyond routine maintenance.
- 5.3.4. At the time of the accident, there were multiple vacancies within upper-level management as noted on the organization chart below (see Figure 16). Those responsibilities were absorbed into other positions as individuals promoted within the organization, until filled.

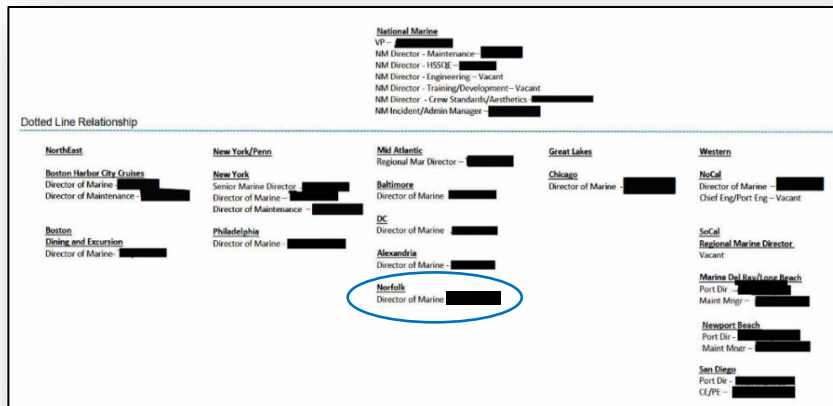


Figure 17 – Hornblower and City Cruises organization chart as of January 2023. City Cruises in Norfolk, VA is identified with a blue oval. Note “vacant” positions in the National Marine Team, in the top of the organization chart. (Source: City Cruises & Coast Guard)

- 5.3.5. Based upon the *Spirit of Norfolk’s* limited route and certification in accordance with current small passenger vessel requirements, the vessel was not required to implement a Safety Management System (SMS). In contrast, domestic towing vessels and small passenger vessels on international routes are required to implement an SMS.
- 5.3.6. Hornblower management stated they have a strategic goal of implementing the voluntary Passenger Vessel Association (PVA) created SMS prototype, at some point in the future. There was also an assertion by Hornblower representatives that the company had instituted “85%” of what an SMS would entail in the methods used by the company to manage their vessel fleet.

5.4. Relevant Small Passenger Fleet Snapshot

- 5.4.1. Small passenger vessel fleet statistics for background and industry context (data pulled on October 10, 2022) are provided below. New Title 46 CFR Subchapter T requirements

went into force in 1996. Old Title 46 CFR Subchapter T requirements are 1960's era regulations.

- 5.4.1.1. Since 2017, the annual average of reportable marine casualties (excluding pollution only events) for all commercial vessel types occurring in US jurisdiction is approximately 3,300 per year.
- 5.4.1.2. Since 2017, the annual average of reportable marine casualties (excluding pollution only events) involving at least one small passenger vessel is approximately 400 per year.
- 5.4.1.3. Since 2017, small passenger vessels accounted for approximately 36% of the entire US Coast Guard certificated fleet, while accounting for approximately 12% of all reportable marine casualties.
- 5.4.1.4. In 2022, there were approximately 6,500 Coast Guard certificated small passenger vessels within the US fleet certificated to Title 46 CFR Subchapter T and Subchapter K as outlined in the Code of Federal Regulations.
- 5.4.1.5. Contained within the total fleet populations there are approximately 2,800 small passenger vessels certificated using *primarily* old Title 46 CFR Subchapter T requirements (approximately 43% of all small passenger vessels).
- 5.4.1.6. One of the significant differences between new Title 46 CFR Subchapter T and old Title 46 CFR Subchapter T vessels relevant to this investigation, were the fire protection requirements, specifically two major components of the fire protection, fire detection and fixed fire suppression somewhere onboard the vessel (engine room, galley, living quarters, etc.). Requirements differ dependent upon propulsion type and hull type for engine room installations.
- 5.4.1.7. In 2022, of the approximately 2,800 small passenger vessels certificated using *primarily* old Title 46 CFR Subchapter T, approximately 2,100, or 75%, had an installed fixed fire-fighting system somewhere onboard the vessel.
- 5.4.1.8. In 2022, of the approximately 2,800 small passenger vessels certificated using *primarily* old Title 46 CFR Subchapter T, approximately 720, or 26%, had installed fire detection systems somewhere onboard the vessel.
- 5.4.1.9. In 2022, of the approximately 2,800 small passenger vessels certificated using *primarily* old Title 46 CFR Subchapter T, approximately 670, or 24%, had installed both fire detection **and** fixed fire-fighting systems somewhere onboard the vessel.
- 5.4.1.10. Between 2011 and 2021, out of *all* small passenger vessels, there were 135 reportable marine casualties involving a fire, with an estimated total damage amount of nearly \$14,000,000.

- 5.4.1.11. Between 2011 and 2021, for vessels certificated using *primarily* old Title 46 CFR Subchapter T, there were approximately 70 reportable marine casualties involving a fire, with an estimated total damage of \$10,500,000.
- 5.4.1.12. Vessels certificated using *primarily* old Title 46 CFR Subchapter T represented approximately 75% of all fire related monetary damage amounts incurred by the US small passenger vessel fleet during this timeframe.

6. Analysis

6.1. **Overview:** This section outlines the analysis conducted by the investigation. The investigation secured a tremendous amount of evidence during the course of this investigation, including robust witness testimony, which at times, proved contradictory. Due to this fact, the investigation *weighted* the large trove of evidence as appropriate to develop the analysis for this incident. While there are highly technical issues contained within this analysis, the investigation attempted to author a plain language analysis. The following are key areas of analysis determined relevant to the purposes of the investigation.

- Fire Origin – Area Where Fire Began
- Fire Fuel
- Fire Oxygen
- Fire Ignition
- Fire Prevention
- Fire Mitigation
- Mass Evacuation
- Coast Guard Search and Rescue Mission Coordination
- Coast Guard Waterway Management
- Coast Guard Salvage
- Professional Fire Agencies Coordination and Communication

6.1.1. Despite the investigation’s best efforts to secure independent, third-party cause and origin reports from the Parties in Interest for this incident, they declined to provide those to the Coast Guard or NTSB. Securing these reports may have been beneficial to the investigation analysis and represents a potential gap in understanding to better determine the cause of the fire. Despite this gap, the investigation is confident regarding the causal analysis and findings of this investigation.

6.2. **Fire Origin – Area Where Fire Began:** The area on the port side of the engine room, specifically on or around the PMDE, was the point of origin for this fire based upon the totality of the evidence. Supporting evidence is below.

6.2.1. *Spirit of Norfolk* crewmember statement: Two days after the fire occurred, on June 9, 2022, the only witness to the fire in the engine room stated, “... *I could clearly see the flame over here on the main and I know it was the main...*” and, “*I could see a flame at the starboard main (later in the interview, corrected it was the port main) and I know that's what I'm seeing, that's what I saw, I saw the flame, I closed the door immediately.*”

When asked by investigators about the description and height of the fire, the crewmember stated, “... so it [flame] was at the main and I can clearly see across... and I see the flame as clear as day right now. But from what I see, I mean that flame, [was] at least two, three feet.”

- 6.2.2. *Spirit of Norfolk* Captain Trainee statement: “So we went over to the portside window, I went first, he followed right behind me, I looked out and I said yeah, we have smoke coming out the port stern and actually, there was flame coming out, as well” and, “I saw the flames on the outside from the side of the boat, from the port side you could see the flames coming out. I didn't see any flames on the starboard side.”

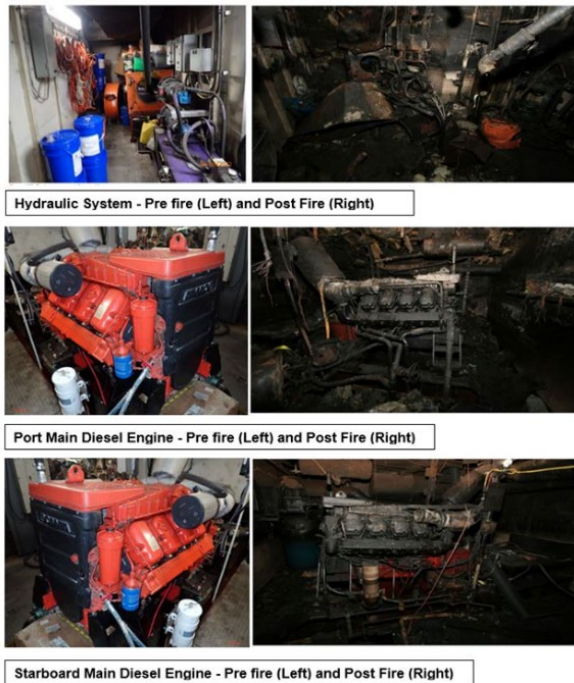


Figure 18 – Pre fire photos of main diesel engines and hydraulic area on the left. On the right images of the same equipment post fire showing the extent of the damage. (Source: Castlerock and Milner Surveys June 2,3 and 6, 2022, post fire images taken by NTSB)

- 6.2.3. The Captain of the *Spirit of Norfolk* testified he received a loss of communication alarm in the wheelhouse as a first indication of trouble on the vessel. The alarm was for the electronic controls on the PMDE. The electrical connections for the sensors for the PMDE electronic controls are located directly over the forward end of the PMDE. The wiring then leads to the engine control panels, forward on the bulkhead and to port of the engine, which indicated the overhead wiring array would have been impacted by the vertical growth of fire early in the event.
- 6.2.4. ATF Report of Investigation: “The most damaged portion of the room was on and around the port side engine. The top of this engine was significantly damaged, with some mass loss and melting to some metal components. The shelves adjacent to this engine and the items on these shelves were also significantly damaged and acted as an early fuel during this event. This port side engine was the origination point of this fire event.”

- 6.2.5. ATF Report of Investigation: “Based upon the fire scene examination and a review of witness statements, photographs, video, and documents provided by other investigators, it is the opinion of the fire investigators this event originated in, on, or about the port side engine of the vessel. Fire spread from this engine to adjacent shelving where combustible material was present.”
- 6.2.6. An Insurance Claims Surveyor who attended the vessel before the fire on June 2, 2022, and attended the vessel again on June 22, 2022, after the fire stated, “... the general consensus of the people that were on the boat -- and there were a number of people on the boat the days I was there -- was that it was somewhere around the port engine.”
- 6.2.7. Early incident photos at the discovery of the fire displayed visible flames outside the engine room escaping through the port side vent, suggested an intense fire on the port side of the vessel. The image to the right (Figure 20) is approximately five minutes after the initial discovery, displaying visible flames emanating from inside the engine room.



Figure 19 – The excursion vessel *Victory Rover*, which took 106 persons off the *Spirit of Norfolk* on June 7, 2022, to transport those persons to shore. (Source: McAllister Towing Personnel on scene)



Figure 20 – Video capture by passenger view from the upper most deck looking over the port side of the *Spirit of Norfolk* approximately 5 minutes after discovery of the fire. (Source: Passenger)

6.3. Fire Fuel

- 6.3.1. **Flammable liquids:** There were several flammable liquids in and around the PMDE that may have played a factor in the ignition, sustainment, and growth of the fire. Those flammable liquids included diesel fuel, oil used for a prime mover, and lubricating or hydraulic oil. At some point after the fire ignition, but before the fire agencies attempted to access the engine room a second time, enough heat was produced in the engine room to cause the starboard side fuel tank to leak or split open, releasing diesel fuel within the engine room. Diesel fuel floated on top of the water in the engine room. While the water protected the lower portions of the engine room from the burning diesel fuel, the portions

above the waterline were subject to more intense heat, as the fire was fueled by the flammable fuel source on top of the water.

- 6.3.2. **Combustible materials:** Combustible materials around the PMDE were determined to be a significant fuel source for the fire, once ignited. There were cardboard boxes below, behind, and on a shelf within a few feet of the PMDE. Additionally, there were plastic storage boxes and other potential combustibles including rags, aerosols, filters, and/or cleaning supplies. It is unknown when this shelf was added to the vessel, although pictures from 2020 indicate the shelf was not present.
- 6.3.3. The regulatory requirement for old Title 46 Subchapter T references the applicability of Title 46 Subchapter H, which requires combustible materials be kept clear of internal combustion engines. This requirement is normally and appropriately left to the discretion of a Marine Inspector and if noted, resolved “on-the-spot,” and not typically documented as a deficiency in the Coast Guard database. A search of the vessel history did not identify this item as noted as a deficiency during any Coast Guard inspection. It is unknown whether this condition was related to the ignition, rather more likely a notable factor in the spread of the initial fire after ignition.

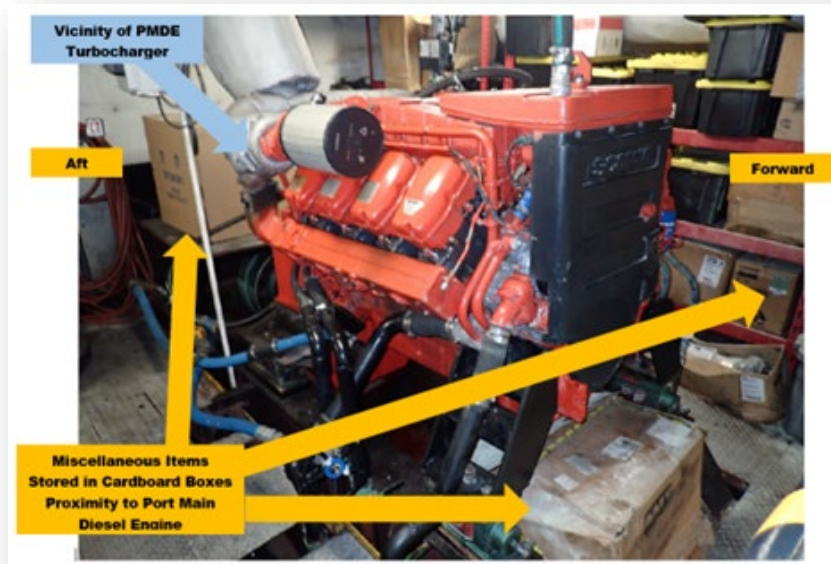


Figure 21 – Stored combustible materials near the port main diesel engine room. (Source: Milner Post Engine Damage Survey, taken June 2 and 3, 2022)

- 6.3.4. From a company perspective, the vessel’s “Standard Operating Procedure 3-03 Cruise Safety Operating Procedures” did not include details of the expectations for cleanliness and order in the engine room. City Cruises and the Director of Marine Operations provided minimal detail for personnel to follow to ensure the engine room was kept in order and clear of any combustible material being stowed near engines.
- 6.4. **Fire Oxygen (Oxidizer):** The engine room was outfitted with both natural ventilation (unobstructed migration of air in or out of the engine room) and mechanical forced air ventilation. Once the fire started, the Captain of the *Spirit of Norfolk* appropriately and in a

timely fashion secured the mechanical ventilation to the engine room. However, there was no closure mechanism required for the natural air vents. Since there was no way to secure the natural air vents, there was enough oxygen to allow the fire to continue to burn unabated.

6.4.1. As previously noted, the regulatory structure for Title 46 CFR Subchapter T and K underwent a major revision in 1996. As a result, The Coast Guard determined certain “existing vessels” were exempted from full implementation of the new Title 46 CFR Subchapter T and K regulations. This determination was made based upon identified casualty data, public comment, and practicality across multiple OCMI zones at the time of implementation. The *Spirit of Norfolk*, due to its build date, is considered an “existing” vessel for regulatory requirements. By designation in the new regulations, the OCMI had discretion for applicability of the “new” and “existing” regulations. A search of the MISLE database and a search of the vessel hard copy file failed to locate a specific OCMI determination regarding the issue of closure devices. Regardless, this arrangement was ultimately determined to be within OCMI discretion. Unfortunately, the inability to completely and totally secure ventilation proved to be a key factor in the fire being able to sustain itself.

6.5. **Fire Ignition (Heat and Combustion)**: The precise ignition source could not be identified. However, five main possibilities were assessed by the Investigation that may have created the heat and combustion (ignition) to create the fire: 1) the failure of the right bank/inboard turbocharger, 2) port generator failure, 3) hydraulic system failure, 4) electrical fire, or 5) internal PMDE failure. The investigation used a scale to rate the likelihood of each possibility. That scale included: “probable” (scenario most likely to have occurred, but uncertain), “plausible” (scenario which may have occurred), and “possible” (scenario given widest range given all possibilities) scale to rate the likelihood of each scenario.

6.5.1. ***Turbocharger Failure: Probable Ignition Source.*** The right bank/inboard turbocharger on the PMDE was not replaced per the recommendations of technicians who conducted the “in-frame” overhaul between May 20 and May 26, 2022. The turbocharger was subjected to stress, extreme temperatures and most likely suffered unknown internal damage as a result of the PMDE initial extreme overheat event and subsequent excessive crankcase pressure on May 19, 2022, that caused the need to overhaul the engine. Turbochargers operate at extremely high temperatures during normal operations. When subjected to possible internal bearing wear and other anomalies they can create an ignition source. Turbochargers require pressurized oil to drive internal rotating components at high speed. This oil could have served as an early fuel source if the turbocharger ignited.

6.5.2. In testimony, an expert witness explained how an oil leak could accumulate in the turbocharger; *"Well, usually it would be the bearing and then the compressor side that the two have the hot side and cold side have a shaft between them, a spinning shaft and it spins it very high like 90,000 to 150,000 RPM. And so ... when those bearing fails, then the seal leaks, and oil can seep out. If the gasket or the bolts come loose on the oil line or from that or the line breaks, that's another way..."* speaking to the potential source of fuel reaching the extremely hot surface of the failed turbocharger.

- 6.5.3. In testimony the same expert witness described the operating temperatures of a turbocharger; *“...somewhere between uh, 850 to 1100 degrees Fahrenheit, which is about 450 to 525 Celsius centigrade ... and the ignition temperature of lubricating engine oil is, about 450 to 480 degrees Fahrenheit.”*
- 6.5.4. When asked what would happen if the engine experienced excessive temperatures for an extended period of time, the same expert witness stated, *“It'll basically destroy the engine. Then it'll break the cracked the liners, cracked the cylinder heads. Maybe in the Lube oil will also overheat, causing bearing damage. The water will get down into the bearing, into the Lube oil, and then get pumped through the whole system and take out the turbocharger bearings. The rod bearings. Again, cracked heads, cracked liners, piston scuffing. Piston holes and Pistons burned through. That's it's generally a catastrophic event in terms of the engine itself.”*
- 6.5.5. The right/inboard turbocharger replacement was ordered from Bay Diesel on May 26, 2022, and available for installation on the afternoon of May 31, 2022. The Director of Marine Operations decided to wait until sometime in the schedule when there were no cruises, and the part was not replaced as of the accident date. This despite the relatively short installation time for changing out the turbocharger. A technician who testified about the length of time necessary for a turbocharger to be replaced stated, *“Change out a turbocharger, it would take five, six hours, sometimes. It all depends on because sometimes something comes up, you tear a gasket or something and you've got to have another one sent to you or something. So, I'd say with replacing it and doing a good test run to ensure that it's in good operating condition say six hours-ish.”*
- 6.5.6. City Cruises ultimately filed an insurance damage claim for both turbochargers stemming from the May 15, 2022, incident. The total cost of the claim was approximately \$71,000. After the fire, the insurance claims surveyor emailed a Bay Diesel representative asking if both turbochargers had been replaced and if any additional charges were incurred. The Bay Diesel representative responded, *“The right bank turbo was not installed. It was ordered, received at our parts department and available to put on, but the boat was busy.”*
- 6.5.7. The following question was posed to the expert witness about the continued use of the right bank/inboard turbocharger: *“If the inspection of the right bank/inboard turbo had proved satisfactory and the engine ran for a couple of weeks, 50 hours or more of operating time without any indication or problem, no leak, no smoking, no sound, nothing to indicate that's a problem. Would that give you a degree of comfort that the left or right bank turbo the one that was due to be replaced, did not need to be replaced urgently?”* The expert witness responded, *“Total opposite ... that using it every day is the wrong way to go. I would ... in my opinion and my experience which I've managed thousands and hundreds of engines. Maybe 1000, as the manager of Marine of port engineer or maintenance, I would have changed that turbocharger.”*

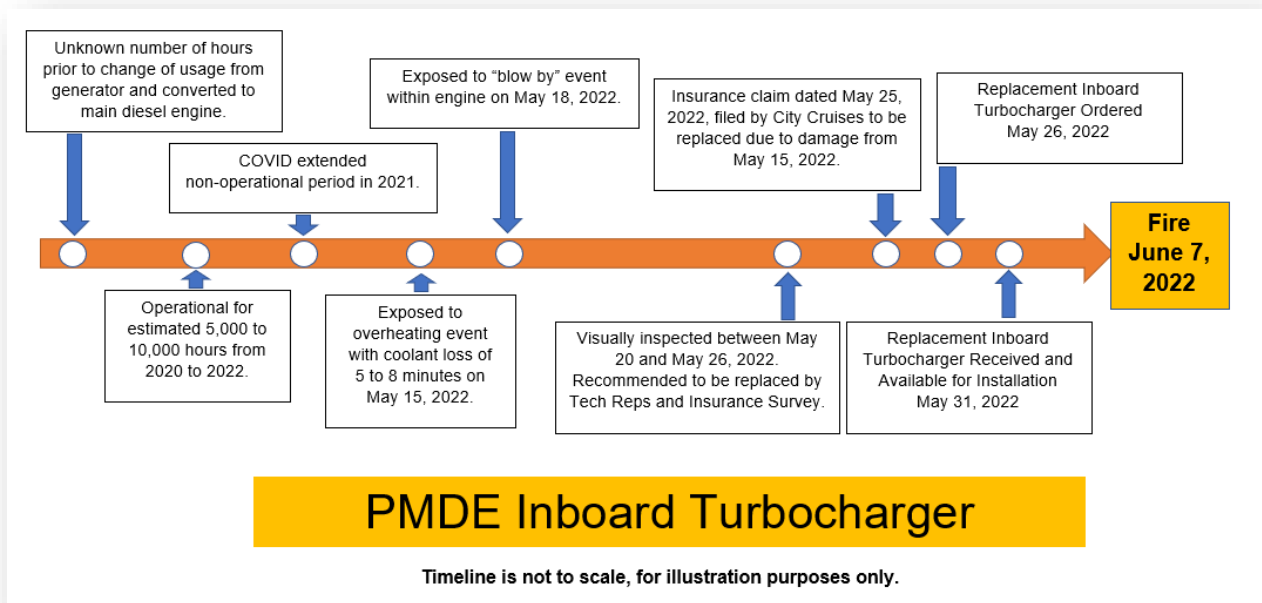


Figure 22 – Timeline of the life cycle of the right bank/inboard turbocharger from approximately 2020 to the time of the fire, June 7, 2022. (Source: USCG)

- 6.5.8. **Port Generator Failure: Possible Ignition Source.** The Port Generator, located forward of the PMDE, was in operating condition at the time of the accident. The initial witness who observed the fire in the engine room, indicated the fire was coming from the vicinity of the PMDE. There were no initial reports of power loss indicative of failure or fire on a generator. Further the ATF Report of Investigation stated, "*Investigators examined the generators in the engine room, and they appeared in working order. The damage to them appears to be from fire spread from the area of the Port side engine. Witness statements from the crew reported that power to the vessel failed sometime after the Port side engine failed. The generators did not cause this event.*"
- 6.5.9. **Hydraulic System Failure: Possible Ignition Source.** Components of the hydraulic system were examined after the fire to determine if the failure of these components could have caused a mist or stream of flammable hydraulic oil, but there is no evidence to suggest this was the fuel which was ignited during the start of the fire. Investigators examined the preventative maintenance history of the hydraulic system, routine system checks, and the NTSB Materials Lab examined suspected points of failure on piping above the PMDE and could not identify a hydraulic system (or piping) failure on the vessel that would have caused the fire origin.
- 6.5.10. Regarding the hydraulic system, the ATF Report of Investigation states, "*There was some mechanical damage to the hydraulics on the Port side of the engine room. It is the belief of the fire investigators this damage was likely caused later in the event, possibly when the water rushed from the engine room into the galley area when the door was breached.*"
- 6.5.11. **Electrical Fire: Possible Ignition Source.** There was no evidence gathered by the investigation that indicated that this started as an electrical fire. The last engine room

round ended at approximately 11:40 AM (twenty minutes prior to the fire being detected) with no electrical issues noted. Additionally, there were no known electrical problems identified by crew or hospitality staff or a loss of electrical power identified on the vessel by any passenger, crew, or hospitality staff until the fire had progressed.

- 6.5.12. ***Catastrophic PMDE Failure: Possible Ignition Source.*** Post-fire analysis of the PMDE by Coast Guard investigators did not identify signs of catastrophic damage which could indicate such damage caused the fire.

6.6. **Fire Prevention**

- 6.6.1. The Coast Guard provides regulatory oversight for small commercial passenger vessels. The company bears the responsibility of safe vessel operations, and the Coast Guard is charged with ensuring the vessel meets minimum federal regulatory requirements. While regulations set the minimum standard, vessel operators may exceed these standards. The safe operation of passenger vessels relies on strong communication and coordination between the vessel operators, company, and Coast Guard.
- 6.6.2. With this context in mind, and the probability the fire originated on or around the PMDE, the Investigation analyzed how the company and the Coast Guard managed oversight of the vessel, specifically as it relates to the PMDE repairs and surrounding circumstances in May and June of 2022.
- 6.6.3. ***Company Oversight:*** As stated earlier, a SMS was ***not*** required for the company or vessel operation based upon existing regulations. However, a senior company representative stated they employed “... 85% of what a safety management system would require across the company right now, across City Cruises.” As of May 2023, the Coast Guard is currently in the process of assessing regulations for SMS for small passenger vessels. In the NTSB’s current “Most Wanted List” (MWL), they indicated instituting an SMS as one of their highest priority recommendations for passenger vessels. The investigation attempted to evaluate the company oversight through the lens of an effective safety management system based upon the company’s assertions. Although the vessel did not have an SMS and was not required to have such a program, a healthy safety culture within a company should include many of the elements of a typical SMS.
- 6.6.4. Testimony indicated that certain vessels in the Hornblower LLC fleet, which includes both domestic and internationally operated vessels, do in fact employ a safety management system.
- 6.6.5. Key elements of a functional SMS include internal audits, documented processes and procedures, risk assessment, lines of communication, and roles and responsibilities for key safety personnel. An SMS is scalable, detailed, and descriptive of vessel or fleet of vessels in operation. Additionally, the Passenger Vessel Association (PVA), a national organization representing the US passenger industry created their own SMS prototype available to membership. The PVA’s Flagship Safety Management System in many aspects mirrors the regulatory scheme and lists the following functional elements of a SMS as follows:

6.6.5.1. *"A safety management system is a structured and documented system enabling both shore side and vessel side personnel to effectively manage the safety of operations through a proactive culture of continual improvement. Overall, it is the commitment, competence, attitudes, and motivation of all personnel at all levels within a company that will determine the successful implementation of any safety management system."*

6.6.5.2. *"For vessels participating in the PVA Flagship SMS, the company must establish and document the following:*

- *Management commitment*
- *Safety and environmental protection policy*
- *Organizational structure to define levels of authority and lines of communication between and among shore and vessel personnel.*
- *Designated Person(s) role and responsibilities*
- *Master's authority*
- *Compliance with mandatory rules, regulatory and reporting requirements*
- *Functional safety and operational requirements*
- *Procedures to prepare for and respond to emergency situations.*
- *Event tracking procedures*
- *Maintenance procedures*
- *Document control*
- *Measurement, analysis, and improvement, including audits and reviews"*

6.6.6. In reviewing City Cruises operation, and more specifically how that impacted their day-to-day vessel operations, several organizational and workplace factors emerged impacting vessel operations, how engineering items were managed, and how risk assessment was conducted. The following were noted by the investigation.

6.6.6.1. Managers of City Cruises at the Norfolk operational level could not clearly articulate who in the National Marine Team was directly responsible for specific duties, such as safety, training, and/or maintenance support. The managers and directors referred to the ambiguous term "dotted line relationship" to support their assessment that the company had an effective organization in place to support the safety of operations.

6.6.6.2. City Cruises established a position of Port Safety Officer in June 2020. This was a positive step, although repeatedly company officials stated that this program was just getting started. This new duty required the Director of Marine operations to assume additional responsibilities, including continuing to serve as Captain of their two vessels in Norfolk. This added another responsibility on the Director of Marine Operations position, many of them related to training, safety, operations, and maintenance oversight. As was evidenced with the port main engine overhaul, there was no known company support for decisions related to engineering. Ultimately, it was difficult to trace what the specific roles and responsibilities were for each individual throughout City Cruises.

- 6.6.6.3. The company exhibited minimal ability to audit processes or implement lessons learned from previous incidents to improve the safety of vessel operations. An examination of incidents available to the investigation showed that the company did not always identify and act on incidents classed as Serious Marine Incidents. The company defines Serious Marine Incidents as events that can disrupt normal operations. For example, no evidence was provided that the company classified the May 15, 2022, engine overheating, which was initially thought to be a fire, or the return to the dock with passengers on one engine as an incident. That event was also not logged in the vessel deck logs.
- 6.6.6.4. While the company had a standard operating procedure, various documents and witness testimony indicated there were no standard operating procedures for the maintenance of engineering equipment nor corporate oversight of critical engineering decisions such as engine overhauls and associated repairs. Repairs and modifications at Norfolk, beyond routine maintenance, were taken care of by third party contractors. The only company oversight these contractors had was from the Director of Marine Operations in Norfolk, who had limited engineering expertise. The Director of Marine Operations did not have an engineer's credential or a background in marine engineering and relied significantly upon Bay Power Solutions to determine the need for and to carry out engine repairs on the *Spirit of Norfolk*.
- 6.6.6.5. The investigation was not able to determine from the available evidence, how deferral of critical maintenance was required to be handled or what constitutes critical maintenance verse normal maintenance. For example, section 03-3 of "*Cruise Standard Operating Procedures*" in the Emergency and Critical Equipment section, stated: "*Emergency equipment and Critical Equipment listed in Chapter 10 of the SMS is to be maintained in a ready and operable condition at all times by routine checks and drills. The Captain on duty is to ensure these items are ready for the cruise by checking logs to ensure equipment has been tested, inspecting the vessel, or testing the equipment. Critical Equipment:*
- *Main Propulsion Engines*
 - *Electric Generators*
 - *Battery Back-ups, were installed*
 - *Fuel Supply System*
 - *Fire Pump(s)*
 - *Bilge Pump(s)*
 - *Fire Protection Systems, where installed*
 - *Steering Systems*
 - *Main Engine (Throttle) Controls*"
- 6.6.6.6. Having identified the engines and fuel supply systems as critical, no company personnel outside of those in Norfolk provided decision oversight or were required to sign off on the decision to defer the installation of the right bank/inboard turbocharger, which was available for installation on the afternoon of May 31, 2022, or similar specific engineering decisions. In addition, the

documentation provided to the investigation by the company mentions an SMS, which was not in place for the *Spirit of Norfolk*.

- 6.6.6.7. City Cruises was not able to offer evidence regarding any risk assessment methodology for making engineering decisions. On May 20, 2022, the Director of Marine Operations sent an email to the VP of Operations and the Mid-Atlantic Marine Director stating, “*Bay Diesel has recommended an overhaul including but not limited to Replacement of Cylinder Packs, Heads, I/B Turbocharger, and possibly Main Crankshaft Bearing depending on inspection.*” There is no evidence the company assessed the need to immediately replace the right bank/inboard turbocharger as a critical safety issue.
- 6.6.7. In summary, in view of the investigation, given the size and scope of the operating company, there appeared to be gaps in oversight that impacted the *Spirit of Norfolk* operations, particularly as it related to vessel operations and engineering.
- 6.6.8. **Coast Guard Oversight:** The investigation examined the Coast Guard’s regulatory oversight of the *Spirit of Norfolk* during the month of May 2022, the investigation identified deviations from what may be considered “standard” Coast Guard oversight, particularly for a higher risk Tier 1 vessel. This represented a missed opportunity for Coast Guard Sector Virginia inspections personnel to better understand or challenge the efficiency of repairs onboard the vessel including identifying fire risk. This important level of oversight typically comes from experienced and proficient inspectors.
- 6.6.9. The Coast Guard’s Tier 1 vessel designation of the *Spirit of Norfolk* was based on the Coast Guard’s Work Instruction on the Small Passenger Vessel Risk Based Inspection Program. This designation involves increased frequency of Coast Guard inspections by AJMI’s (minimum 3 years’ experience, at least five inspection qualifications, with at least one advanced qualification) using arguably the most proficient inspectors. It also requires enhanced oversight by the OCMI. The OCMI would be expected to be briefed on the inspection activity for the vessel, but the language in the work instruction uses the language “should”, as opposed to “must” or “shall”. There was and is no requirement for a brief on the activities related to mechanical deficiencies. As such, the “Tier 1” designation would not require an OCMI brief regarding the PMDE casualty on the *Spirit of Norfolk* and the resultant overhaul. Furthermore, there is not a requirement for an Advanced Journeyman Inspector to attend a vessel deficiency check or clear deficiencies, only to conduct the annual exam and COI inspections. This work instruction is neither policy nor regulation, but rather a program enhancement to improve the safety of small passenger vessel operations.
- 6.6.10. The Tier 1 inspection regime focuses on a class of small passenger vessels that are at a higher risk and places a strain on the inspection workforce to meet the mission for these important requirements. The program analyzes various metrics annually and creates an updated list of Tier 1 vessels. The annual inspections and additional inspection required create a strain on inspection resources. If AJMI’s were required to attend deficiency checks and other inspection activities on Tier 1 vessels, it would add additional strain on the unit. An identification of the highest risk vessels, as opposed to the higher risk vessels

and an expansion of the required oversight of those vessels would allow the Marine Inspection Program to focus proficient resources on the safety of those vessels.

- 6.6.11. As previously outlined, the PMDE suffered an extreme overheat event when the water pump housing failed on May 15, 2022, and an operational control (CG-835v) was issued to the vessel with a code “701” (repair prior to carriage of passengers).
- 6.6.12. When Coast Guard Sector Virginia was notified on May 18, 2022, that the repair was completed, a discussion ensued within the Coast Guard Sector Virginia inspections staff leading to the assignment of an experienced (advanced journeyman) marine inspector who attended the vessel accompanied by a less experienced marine inspector. The marine inspectors “verbally” cleared the deficiency allowing the vessel to resume operations. However, the documented deficiency was never cleared in the MISLE database system. This oversight began a series of missed steps and lead to confusion surrounding what was transpiring on the *Spirit of Norfolk*.
- 6.6.13. On May 20, 2022, the Director of Marine Operations emailed the Coast Guard and provided a synopsis from the technician and their proposed plan to conduct an overhaul of the PMDE, to include the replacement of the right bank/inboard turbocharger. A deficiency was not issued for this casualty. According to the Coast Guard Sector Virginia Chief of Inspections (CID), the rebuild of an internal combustion engine would normally require a deficiency (CG-835v) being placed on the vessel. However, a new deficiency for the rebuild or tug escort was never issued to the company nor documented in the MISLE database. The CID characterized this as an administrative oversight. The prior deficiency that was issued on May 15, 2022, after the water pump failure caused PMDE overheating, remained open, despite Coast Guard inspectors attending the vessel and verbally clearing the deficiency.
- 6.6.14. In the view of the Director of Marine Operations, there appeared to be confusion from inspections staff personnel with exactly what was occurring on the vessel. The company personnel made proper notification of the PMDE overhaul and on their own volition, employed a towing vessel (“tug”) escort for safety and provided each technical report to the Coast Guard as they became available. The following excerpt was a question and response from the Director of Marine Operations regarding the interaction with the Coast Guard:
- 6.6.14.1. Question: “*So ... the Coast Guard, they didn't put any operations limitations on you that said you needed to have tug assist?*”
Answer: “*So no, actually, it was kind of strange, in my opinion, the way all that transpired. I knew that I was doing the right thing in getting a tug assist and I knew that that's what they wanted. There were e-mails that went back and forth, some of them that said, you know, we will allow you to operate with a tug assist through the weekend, but that was not actually what I'm accustomed to, which is an 835 that says, you know, requiring a tug assist for the cruises. I never saw one. So then when I did call, there was a little bit of confusion when I was ready to check everything off, like, you know, what are we checking off exactly on this thing. But, you know, there was records of the conversations I had with everybody*”

and there was e-mails back and forth regarding the tugboat to assist us and there was nothing that, you know, I was trying to hide from anybody, so they did come out and check, though.”

- 6.6.15. The Marine Inspector that then attended the vessel on May 26, 2022, was posed the following questions during the public hearing:

Question: *“Have you ever had to clear any deficiencies that somebody else wrote?”*

Answer: *“Yes”*

Follow-up question: *“How did that process work?”*

Answer: *“Well, if you have to clear a deficiency somebody else wrote, you'd go into MISLE and you'd look up what the deficiency was, you'd get in touch with the inspector to find out what they've seen and then you'd go out and take a look.”*

- 6.6.16. On May 26, 2022, the PMDE repairs were completed. City Cruises requested a Coast Guard inspector attend the vessel to clear the PMDE overhaul, even though a deficiency was never issued by the Coast Guard for the PMDE overhaul. The inspector who attended was not qualified to inspect a Subchapter K vessel, nor was the individual an Advanced Journeyman Marine Inspector. However, there is no Coast Guard policy that details the inspections qualification or proficiency that an inspector must possess to clear a deficiency in any vessel or in the Tier 1 inspection program in particular.
- 6.6.17. The information as to the scope of the deficiency that the inspector was going to clear on May 26, 2022, is conflicted, preliminary testimony was that there was no one in the office and based on that fact, the Marine Inspector was going to clear the water pump deficiency issued on May 16, 2022. MISLE entries reviewed affirm this perception. However, formal testimony indicated the Marine Inspector discussed with the CID about clearing related issues with the vessel’s PMDE, despite the fact that all of the technical reports were not available to assess prior to attending the vessel. Confusion existed as to what the Marine Inspector was to inspect.
- 6.6.18. The Marine Inspector attended the vessel on May 26, 2022, but did not go out on the sea trial (when the vessel got underway and in which the Coast Guard was not required to actually witness, the company could attest to the fact that it was successfully completed). The Marine Inspector viewed the PMDE in operation for approximately ten minutes, then verbally cleared the vessel to return to normal operations once Sector Virginia received the remaining technical reports.
- 6.6.19. MISLE documentation and the supporting inspection notes are the record of Coast Guard activities related to inspection performance and deficiencies and the actions that lead to resolving issues involving vessels system. In this case, it is unclear exactly what the Marine Inspector was clearing since there was no deficiency issued for the PMDE overhaul and there were no part replacement requirements issued to the vessel. The Marine Inspector cleared the deficiency for the PMDE without reviewing the complete documentation of the mechanical issues on the vessel and technician reports detailing the full scope of the repairs. Once aboard to attend and clear the deficiency, the Marine

Inspector did not discuss any of the outstanding issues or recommendations with technicians or the vessel operator regarding the PMDE overhaul.

6.6.20. City Cruises sent Coast Guard Sector Virginia a follow-up email regarding the success of the sea trial and provided six technician reports that detailed the entirety of the PMDE overhaul. One of the technician reports clearly notated, "...oil at bottom of the compressor..." and for the crew to "...keep an eye on the RB turbo...as a precaution ... until the replacement is put on ..." and ultimately recommended replacement of the right bank/inboard turbocharger as was also noted in the email City Cruises sent to the Coast Guard on May 20, 2022. The Marine Inspector did not follow-up by reviewing the May 26, 2022, email or technician reports sent to Coast Guard Sector Virginia. Neither the inspections staff nor the Marine Inspector documented anything in MISLE related to a PMDE overhaul, including the requirement for a tug escort, or the outstanding recommendation to replace the right bank/inboard turbocharger.

6.6.21. Below is a comparison chart of what may be considered "standard" Coast Guard oversight and any deviations that occurred in this instance. The investigation recognizes the fact that the ignition source was not precisely identified. However, the investigation attempted to highlight what it believes should have been the standard given the totality of circumstances. The investigation noted a proficiency gap with the Marine Inspector which may indicate a broader problem within the Coast Guard inspection program. There is currently no measure in place utilized by the Coast Guard to evaluate Marine Inspector proficiency after qualification. The Marine Inspector did not possess the proficiency to evaluate a marine diesel engine or know the questions to ask that would have identified potential risk of operating with a turbocharger that was recommended to be replaced by a technician.

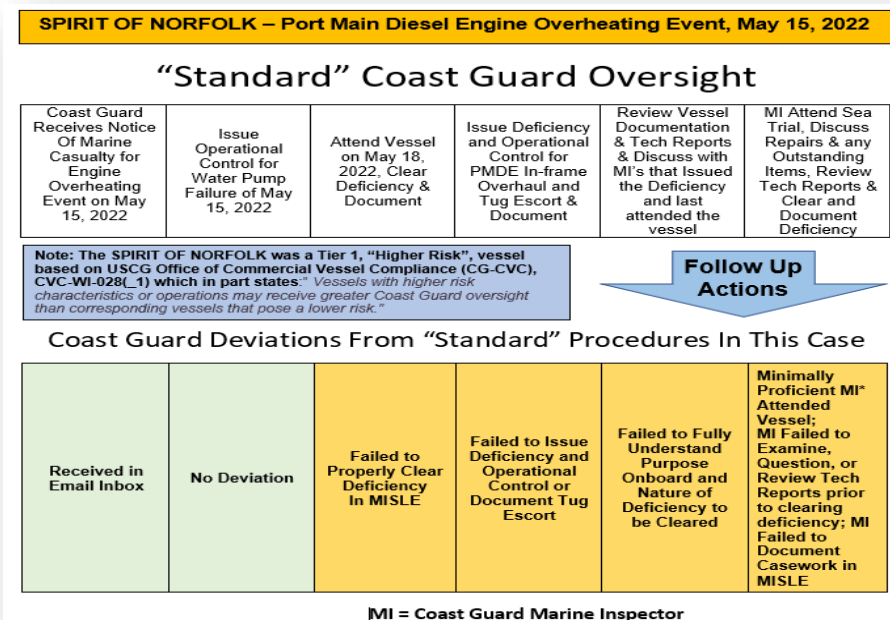


Figure 23 – Chart comparing "standard" Coast Guard oversight process with the actions Coast Guard Sector Virginia personnel exhibited from May 15, 2022, until May 26, 2022. (Source: USCG)

6.6.22. Additional factors were also identified, which included Coast Guard Sector Virginia inspections staff's poor overall vessel documentation, lax situational awareness, and lack of proactive inspector dispatching (staff had six-day advance notice prior to sea trial to identify an experienced engineering Marine Inspector to attend) that placed the Marine Inspector in a difficult position. In totality, the proficiency of all of the Marine Inspectors involved was identified as a gap, vice the qualification of personnel involved in the Coast Guard oversight in May 2022.

6.7. Fire Mitigation

6.7.1. ***Fire Detection and Fixed Suppression System:*** Once the fire started, mitigating the impacts of the fire was critical to the safety of passengers and the vessel, as well as the waterway and environment. The most critical actions related to mitigating a fire onboard a vessel is early detection with a fire detection system and a quick, efficient way in which to combat the fire, such as a fixed suppression system. The *Spirit of Norfolk* was not required to possess either in the engine room. As previously discussed, this vessel possessed many systems which were "grandfathered in" under old Title 46 CFR Subchapter T requirements.

6.7.2. As new safety regulations are contemplated by the Coast Guard, certain vessel systems are "grandfathered" or not required to be updated to conform with new safety regulations due to the potential implementation cost or insufficient casualty data to support their implementation. This applies to all systems, including critical safety systems such as firefighting or lifesaving. For example, in 2015, the *SS El Faro* still operated with "open lifeboats" instead of newer, more protective enclosed lifeboats for crew evacuation off the vessel because the vessel was not required to conform to updated safety regulations. There is no mechanism to reevaluate these less than adequate regulations that are identified unless a subsequent regulatory process is initiated and implemented. However, in these instances, the associated risks rarely go down, rather, the risk increases as a vessel ages. Critical safety systems, such as firefighting or lifesaving systems should be continually reexamined to determine if those systems should be updated to ensure the safety of passengers.

6.7.3. Despite the relatively large size of the *Spirit of Norfolk*, the regulatory tonnage was less than 100 GRT. This less than 100 GRT classification is achieved through various means, such as exempting the passenger space above the second deck or closing spaces open to the weather with tonnage hatches or coverings. The tonnage of the vessel by international standards was 1152 International Tons. Had the *Spirit of Norfolk* been classified as 100 GRT or more, it would have been required to meet more stringent safety regulations.

6.7.4. Both the classification of the vessel as old Title 46 CFR Subchapter T and the regulatory tonnage created a situation that reduced the design safeguards and safety standards for the *Spirit of Norfolk* despite the size and passenger carrying capacity. With respect to the initial fire discovery and response, there are three significant contributors: 1) lack of a fire detection system, 2) lack of a fire suppression system, and (3) means to quickly

secure all engine room ventilation which is often dictated by the fire suppression system in the engine room.

- 6.7.5. **Detection:** The Captain and crew did not realize there was a fire in the engine room until they saw smoke and flames emanating from the engine room vents and concurrently lost propulsion of the PMDE. Early detection, in all vessels, especially for a vessel with the capacity to carry 600 passengers is essential to ensure safe vessel operations.
- 6.7.6. **Fire Suppression:** A fixed fire suppression system most likely would have extinguished the initial fire and contained the intensity of the fire to the engine room and may have drastically reduced the amount of damage caused by the fire, possibly saving the vessel from becoming a total loss.
- 6.7.7. Not possessing the ability to secure the natural ventilation to the engine room allowed oxygen to continue to feed the fire. The Captain contemplated putting a tarp over the engine room vents aft on the sides of the upper hull of the vessel to suffocate the fire. This plan was abandoned due to the evolving situation aboard the vessel and the need to ultimately abandon the vessel.
- 6.7.8. There is no regulation or policy that prevents operators from designing, acquiring, and installing these fire detection and fixed fire suppression systems, that meet regulatory standards, in the interest of safety.
- 6.7.9. **Crew Fire Response:** The crew did not attend formal marine shipboard firefighting training. They received basic onboard firefighting orientation in the use of fire extinguishers and hoses, the location and operation of fuel cut offs and shut offs for mechanical ventilation. They also received some basic firefighting training for unlicensed personnel that the company provided. The vessel was not required to be equipped and the crew were not trained or supplied with self-contained breathing apparatus (SCBA) or firefighter's protective suits, "bunker gear" to enter the engine room in a smoky atmosphere to fight the type of fire that took place on the vessel. Given the potential for hazardous substances in a fire, they would have needed both protective measures. The fuel shutoff valves were used and mechanical ventilation was secured properly. Given the circumstances, the crew used all available means on board the *Spirit of Norfolk* at the time, in an attempt to contain the fire.
- 6.7.10. **Good Samaritan Fire Response:** The time of day and location of the vessel's voyage on the Elizabeth River in Norfolk Harbor *fortuitously* meant numerous vessels were near the *Spirit of Norfolk*. The towing vessels on standby at the nearby piers were highly capable of providing almost immediate firefighting and towing response. Upon detection of the fire, the Captain of the *Spirit of Norfolk* immediately notified the nearby vessels and the Coast Guard Sector Virginia Command Center to alert them to the nature of the emergency and need for assistance. Many response vessels immediately responded to the call for assistance and without delay proceeded to the position of the vessel ready and capable to respond. The small passenger vessel, *Victory Rover*, underway on a cruise to the north of the *Spirit of Norfolk*, immediately responded and proceeded to the scene to embark the passengers and crew of the *Spirit of Norfolk* onto the vessel. The *Victory*

Rover provided the capacity necessary to safely evacuate the *Spirit of Norfolk* in a single attempt. The towing vessel *Rosemary McAllister* arrived on scene and took on the responsibility of directing vessel towing and firefighting activities of the numerous responding vessels.

- 6.7.11. Had the fire taken place at night or in hazardous weather, the immediate assistance from nearby vessels may not have been as effective or robust. On the evening of June 3, 2022, around midnight the *Spirit of Norfolk* was underway with nearly 400 passengers, under these conditions the effective evacuation of these passengers and crew would have been much more difficult, both in terms of the immediacy of the Good Samaritan response and the additional challenges that a night mass evacuation would entail. In this very real scenario, numerous vessels would have been needed to evacuate this number of passengers and crew safely and effectively. The company had no plan in place for this type of challenging mass rescue scenario. With the same preconditions for the fire in place, had the fire occurred on that night cruise just days before the fire on June 7, 2022, the outcome would most likely have been less successful.

6.8. **Mass Evacuation**

- 6.8.1. The mass evacuation onboard the vessel succeeded based in large part due to the coordination of the Captain with the *Victory Rover* and the hospitality staff's assistance with safety procedures. For vessel emergencies like the fire, the procedure in the City Cruises Emergency Response Plan states, upon the occurrence of a Serious Marine Incident, the Person-in-Charge of the vessel will "...sound the general alarm using the ship's horn, public address system..." and goes on to further state the Person-in-Charge will "...inform passengers through the public address system of the nature of the emergency and instruct them to remain calm and follow the instructions of the crew." At no time during the initial fire discovery, until the time the entire crew and passengers evacuated the vessel onto another vessel, did the Captain, or any other member of the marine crew make a public announcement over the public address system, nor sound the general alarm.
- 6.8.2. Ultimately, it was the restaurant manager who directed the movement of passengers and directed the disc jockey using a local public address system available only on that deck, to make an announcement directing the movement of passengers and the donning of life jackets as they moved to the debarkation point on the main deck port side. Appendix B to the City Cruises Emergency Response Plan provided a sample abandon ship announcement and stated to repeat the message three times. Ultimately, no vessel wide announcement was made regarding the nature of the emergency, or an announcement as for the plan for passengers to evacuate the vessel. During passenger interviews, parents with children onboard stated they would have preferred to hear an announcement from the Captain informing them of the unfolding situation.
- 6.8.3. The company did not have an effective mass evacuation plan, for when the vessel was drifting without propulsion. It was stated by witnesses, that had the responding towing and other vessels not been available, with the *Spirit of Norfolk* lacking steering or propulsion, the passengers would have had to enter (jump into) the water if the fire got

out of control or smoke inhalation became too unbearable. This would have included three dozen children.



Figure 24 – (Left) Red box indicates the port side embarkation sliding door. This door was opened and utilized to allow the transfer of passengers to the *Victory Rover*. (Source: Castlerock Survey June 6, 2022) and (Right) – Screen capture from a video by a passenger on the *Victory Rover* (right) during the evacuation from the *Spirit of Norfolk*. (Source: passenger).



Figure 25 – Screen capture from a video shot by a passenger on the *Victory Rover* while on the upper deck of that vessel and looking at the *Spirit of Norfolk* on the left side of the image. Flames are coming from the louvers for the natural ventilation to the engine room. (Source: Passenger).

- 6.8.4. The lifesaving capability on the *Spirit of Norfolk* was minimal, primarily due to the limited route in which the vessel operated. The vessel was required and did carry a full passenger compliment of life jackets and three ring buoys. However, the vessel was not required by the COI nor equipped with any life rafts, life floats, or other buoyant apparatus to keep passengers afloat if the need arose to go into the water. The only two evacuation options available in the circumstances presented on June 7, 2022, were to evacuate all personnel from the vessel or to have the persons on the vessel enter the water if the fire worsened and no boat-to-boat evacuation was possible. If passengers and crew had to go into the water due to fire or smoke, it would most likely have led to tragic results. The vessel was not equipped with immersion suits and winter air and water

temperatures would have greatly increased the danger of people having to resort to abandoning the vessel into the water.

- 6.8.5. Ultimately, the effective mass rescue operation which occurred was due to the immediate availability and professionalism of the crew of the towing vessels and other vessels in the area and was not due to a preset agreement, understanding, or company plan/policy.
- 6.8.6. The evacuation was carried out under ideal weather conditions, with full daylight and no adverse weather to hamper either the evacuation or the other response activities on the water.
- 6.8.7. As previously highlighted but is worth repeating, in totality, the success of this Mass Rescue Operation (MRO) events were fortuitous circumstances and extraordinary professional mariners who responded to the incident. This led to a swift and effective evacuation. The entire evolution took approximately 21 minutes from the time the *Victory Rover* turned to assist, until the evacuation of the 106 passengers and crew from the *Spirit of Norfolk* was completed. Given the mix of children and adult passengers, as well as the crew who evacuated, this evacuation without apparent injury was proved effective.

6.9. **Coast Guard Search and Rescue Coordination**

- 6.9.1. During the Search and Rescue response, the Coast Guard played a relatively minor role for the on-water response to the emergency. The evacuation was carried out under almost ideal weather and daylight conditions. Numerous nearby commercial vessels quickly responded to the VHF radio calls for assistance from the *Spirit of Norfolk* and were prepared to evacuate passengers and conduct firefighting as necessary.
- 6.9.2. The rapid evacuation of passengers from the *Spirit of Norfolk* made the deployment of large Coast Guard vessels and aircraft, and additional assets unnecessary. The two 29-foot patrol boats that arrived on-scene did not have the size capacity to evacuate the *Spirit of Norfolk* passengers rapidly and effectively.
- 6.9.3. The decision to send a Coast Guard Sector Virginia Command Center representative to the scene immediately after the initial notification greatly enhanced Coast Guard Sector Virginia Command Center's ability to pass and receive accurate information to plan or react to on-scene changes. This streamlined communications and allowed swift and accurate Coast Guard information flow regarding the incident and provided SAR personnel with the ability to plan or react quickly.
- 6.9.4. With the passengers and crew evacuating the vessel, there was a headcount to ensure that all persons were accounted for. This same accounting was carried out when the *Victory Rover* docked and debarked her passengers and the *Spirit of Norfolk* personnel. The total persons onboard count for the *Spirit of Norfolk* was always correct. There was however an unexplained and persistent error reported in the count for the number of children onboard (company statements and media accounts noted 89 children) the vessel on the accident voyage.

6.10. Coast Guard Waterways Management

- 6.10.1. The Coast Guard Sector Virginia Deputy Sector Commander, when questioned about the events of June 7, 2022, stated, “*At that time, we decided to close the waterway to all traffic just so we could stabilize the situation because we didn't know how it was going to kind of unfold. So that was about 12:15 when we closed the waterway thereabouts...*” Based upon the events surrounding the response, this was a prudent and appropriate safety measure. There were many vessels in the area and an active MRO evolution underway, all occurring in a limited navigation channel with inbound and outbound vessel traffic.
- 6.10.2. However, for an unknown reason, there was a delay in **broadcasting** to on-water vessel operators and on-scene Coast Guard vessels, that a closure or safety zone around the incident scene was in place. The closure was not broadcast until approximately 12:48 PM, according to communication logs. Without notice of the closure or safety zone by a broadcast or on scene CG representative enforcing the limited access area, there was no way for waterway users to know that there was a hazard on the waterway and adhere to the waterway restriction.
- 6.10.3. The reasons for this delay in notice are not known precisely, however one item stood out which was the time dedicated to fulfilling Command Center requirements to notify senior Coast Guard local and national leadership (Critical Incident Communications) of the situation onboard the *Spirit of Norfolk* and update the status of the situation through teleconferences. The initiation of this notification to senior leadership started at approximately 12:19 PM and ended at approximately 12:35 PM. The exact time was difficult to determine, because the Coast Guard Sector Virginia Command Center telephone recordings were not calibrated to a date and time signature. However, the Coast Guard Fifth District Command Center telephone recordings did contain calibrated date/time stamp for calls and were used as a guide to determine the time it took to start and finish this call, which occurred in the middle of both Coast Guard Command Centers managing the *Spirit of Norfolk* incident. Removing the Command Duty Officer (CDO) and staff from overseeing all aspects of a response within the first 15 minutes of this complex case, to initiate a mandatory notification call, may have been a contributing factor in the loss of situational awareness and functional capacity of the four-person Coast Guard Sector Virginia Command Center watch team.
- 6.10.4. The *Spar Lyra* passed near the *Spirit of Norfolk* response activities as it lost propulsion and steering and then veered directly towards the nearby naval facility and moored naval vessels. It was only by the professional actions taken by towing vessel Captains and pilot that prevented a more serious incident in the vicinity of the *Spirit of Norfolk* response activities and critical naval assets. At a critical time in the *Spirit of Norfolk* evacuation, at least three towing vessels broke away to head to the *Spar Lyra* to arrest its course towards the naval ships and piers. The Coast Guard was not aware of the situation until well after the incident.
- 6.10.5. The Coast Guard SAR Mission Coordinator (SMC) testified during the public hearing of not being aware of this *Spar Lyra* incident (*Spar Lyra* loss of propulsion and subsequent

potential allision with the security barrier at the naval piers) until after the *Spar Lyra* anchored. Additionally, from the SMC's point of view, there was, "...a 500-yard safety zone around the vessel..." and that the Coast Guard 29' foot boats were on-scene, "...enforcing the safety zone around the area."

- 6.10.6. The monitoring of the complex waterway status of the Elizabeth River, using the available automatic identification system AIS tracking tool in the Coast Guard Sector Virginia Command Center, should have enabled Command Center watch standers to monitor the real-time status of the waterway and the need for prompt waterway control measures to ensure the safety of the firefighting and evacuation scene. The Sector Virginia Command Center identified Coast Guard Station Little Creek as On-Scene Coordinator (OSC) but did not provide them any other tasking other than designating them as the OSC. At no time did the investigation receive evidence that the OSC, or other Coast Guard assets on-scene, notified the Sector or other responding vessels of the large, loaded bulk carrier *Spar Lyra* approaching the incident scene.
- 6.10.7. The purpose of this analysis thread is to highlight the important safety consideration of effectively controlling the area around an MRO. It was prudent for the Captain of the Port to control the area immediately around the *Spirit of Norfolk* and the *Victory Rover*, given the circumstances. Sector Virginia possessed: 1) the capability to real-time monitor the area with the available CG One display in the Command Center, 2) possessed readily available authority as the area was located in a RNA, 3) a decision by the Captain of the Port representative to close the waterway, 4) the time to exercise that authority to prevent the *Spar Lyra* from navigating into the incident response, until the fully loaded *Victory Rover* was clear of the scene, and 5) the capability to enforce that waterway restriction with Coast Guard vessels in the immediate area. The fact the *Spar Lyra* lost propulsion and steering in the accident area was of secondary concern, not the primary focus in this analysis. In view of the investigation, the *Spar Lyra* should have been kept clear of the area as directed by the Captain of the Port representative until the *Victory Rover* was well clear of the incident scene, regardless of the *Spar Lyra*'s operational condition.

6.11. **Professional Fire Agencies Coordination and Communication**

- 6.11.1. The firefighting response to the *Spirit of Norfolk* was swift and robust; however, as with many responses involving multiple agencies, there were challenges with coordination and communication. Mutual aid response for this event encompassed local fire agencies, small fire boats responding from the agencies, as well as the Port of Virginia's Marine Incident Response Team (MIRT) and its associated equipment. As the *Spirit of Norfolk* neared Navy Pier #4 there was substantial firefighting equipment and personnel arrayed on the pier to combat the fire.
- 6.11.2. In the initial stages of the firefighting response the SMC coordinated directly with the Senior Director of the Port of the MIRT for firefighting efforts. As a technical matter, the Senior Director and the MIRT did not possess firefighting authority, this role was advisory only. Coast Guard policy (SAR Addendum) explicitly states (note: section bolded in policy): "...SMCs shall assume the responsibilities of the Incident Commander upon receiving a report of a fire involving a commercial vessel or

waterfront facility that involves search and rescue. As the incident evolves beyond normal search and rescue actions, consideration shall be given to identify the appropriate firefighting authority with specific firefighting expertise. The discussion to determine the appropriate agency for Incident Commander or members of the Unified Command shall occur as the Incident Command is established. Once an initial Incident Command is established, SMC shall transition firefighting coordination to the firefighting authority.”

- 6.11.3. The SMC’s reliance upon the MIRT personnel with whom there was an established relationship was understandable; however, since MIRT personnel possessed no firefighting authority this resulted in a missed opportunity for the Coast Guard to have a direct line of communication (**...discussion to determine the appropriate agency for Incident Commander or members of the Unified Command ...**) with the firefighting authority early on in the firefighting phase. This was mitigated to a degree with a senior Coast Guard representative on-scene, but this individual also expressed early confusion as to who was in charge of the firefighting. Ultimately this placed the Coast Guard outside direct coordination and communications which may have assisted in meeting the objectives of the firefighting authority since the Coast Guard possessed firsthand knowledge of the vessel itself, commercial vessel design characteristics, and stability considerations. These were all concerns expressed in the Navy’s prepared statement to the Coast Guard investigation.
- 6.11.4. There was little time to plan for the most effective mooring of the vessel. Tugs moored the vessel in most expedient method so shore side firefighters could begin to attack the fire. The way that the vessel was moored made access to the vessel difficult due to a large cylindrical fender which held the vessel off the pier making ready access difficult for firefighters. The vessel was also moored starboard side to the pier. The large embarkation door was on the port side and not having access to a large midship door on the starboard main deck made it difficult for firefighters to access the vessel directly from the starboard side.
- 6.11.5. Firefighters did not share a common communication radio channel (as noted previously), even though the MIRT personnel possessed adequate portable radios available for such a contingency.
- 6.11.6. Testimony indicated there were two Incident Commanders in the initial stages, both notionally and visually indicated by Incident Commander vests worn at the Incident Command post on-scene: one from Navy FEDFIRE and one from Norfolk Fire and Rescue. This caused confusion to anyone not directly in the flow of communication, which was already “stove piped” due to the communication challenges. Additionally, there were various senior firefighting personnel in the area, which also challenged communication flow to and from the Unified Command. For example, when company salvage personnel arrived, there was discussion with a “fire chief” regarding next steps in combatting the fire. Unfortunately, it was unclear who this “fire chief” was, what their actual role was in the response, and if they were representing the Incident Commander or Unified Command.

6.11.7. As already described, the first aggressive firefighting action was a plan to have a RECON party locate the engine room escape hatch on the main deck, starboard interior, and direct firefighting foam agent into the engine room. The escape hatch was covered by a piece of carpet on the deck indistinguishable from the surrounding carpet, and potentially obscured by tables and chairs in the area, although there is no direct evidence on this point. The RECON team that went aboard failed to locate the hatch in the deck and proceeded further into the vessel, down a flight of stairs, turned around and opened a watertight door in the engine room bulkhead. Evidence indicates at this juncture the watertight door was then resecured.

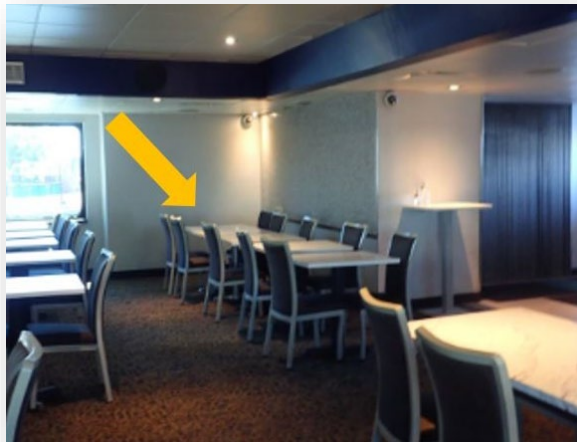


Figure 26 – After starboard side of the main deck of the *Spirit of Norfolk*. Arrow marks the approximate location of the emergency escape hatch from the engine room, which is on the deck. The location is described as the area around the tables and the inside starboard interior wall. (Source: Castlerock June 6, 2022, Survey)

6.11.8. The investigation believes that, at this point in time, there was **considerable** damage to the entire engine room space; enough that would likely have rendered the vessel a total constructive loss. The A-60 above deck and A-0 bulkheads are not designed for extended fire and heat. At some point, they would have failed to contain the fire and would have spread to other sections of the vessel through radiated heat alone, catching fire to the adjacent surfaces of the engine room. Evidence of this, was the crew identifying smoke coming through the “stuffing box” for engine room deck penetrations. The “stuffing box” allows wires and cables to penetrate into the engine room and the area around the wires and cables is caulked to seal the engine room from adjacent spaces.

6.11.9. The time from the first opening of the engine room watertight door by the RECON team, to the second opening, when the attack team attempted to place a foam line into the space, was approximately 45-50 minutes. In that timeframe, firefighting water, and diesel fuel from the ruptured or leaking fuel tank in the engine room, caused the volume of liquid to significantly increase. The initial opening of the engine room watertight door would indicate that although water was in the engine room, it was below the engine room watertight door sill. This proved to be the **critical** juncture for firefighting agencies attempting to extinguish the fire.

6.11.10. Ideally, a two-stage operation of a watertight door closure mechanism would be used to open the watertight door. First, move the handle to the stage one position, then crack the door slightly allowing the fire team to check for water and other dangers and then if

safe, the movement of the handle to the second stage which would allow the door to swing open completely.

- 6.11.11. It is unclear if this two-stage methodology was used, or if it was unavailable for use, or if something else hindered this type of door opening as the door had been successfully accessed 45-50 minutes prior. Regardless, it is certain the door swung open unexpectedly under intense water pressure. This temporarily trapped a firefighter behind the door and allowed water and fire to flood out of the engine room, creating the mayday situation and spreading the entrained water and the fire.
- 6.11.12. A Coast Guard analysis was conducted to estimate the amount of firefighting water that may have entered the engine room between the RECON team's first and second attempts to enter the space, taking into consideration the volume of the space, draft readings from multiple sources, and the types of firefighting pumps used. It was quite possible that the engine room could have been fully flooded by the equipment used to attempt to cool and contain the fire within the first and second entry attempts. Vessels and shoreside assets were directing firewater into the engine room vents during this time. In order to flood the space from the tank top plating to the sill of the door, approximately 21,700 gallons of water would be needed to fill the space. Four additional feet above the sill, which could result in what was described in the RECON team's report, would be equivalent to approximately 50,400 gallons of entrained water and fuel in the engine space.
- 6.11.13. The firefighting agencies were asked to comment on firefighting operations as part of this investigation in response to a series of detailed questions from all parties. Norfolk Fire and Rescue responded with the most complete set of responses listing the challenges of responding to this vessel fire. Below are the items they noted as important factors in the firefighting response.
 - 6.11.13.1. The main deck engine room escape hatch was difficult to locate and never located on June 7, 2022, despite assistance from the vessel Captain pointing to the position of the hatch from the dock and detailed positional information on the vessel fire response plans.
 - 6.11.13.2. Navy FEDFIRE was the lead federal agency in the Unified Command.
 - 6.11.13.3. There were people in and around the command post who were not part of Unified Command and should not have been present—there were miscellaneous personnel present who were onlookers and not assisting in the firefighting efforts.
 - 6.11.13.4. Salvage company representatives contracted by City Cruises would not commit if the vessel was stable for re-entry.
 - 6.11.13.5. The dedicated foam fire suppression agent hose line took a while to set up.

6.11.13.6. Each agency was on a different radio channel, so they were unaware of what the other agency knew unless it was conveyed to the entire Unified Command—Navy FEDFIRE and Norfolk Fire and Rescue had different communication systems. These agencies did not have a common radio frequency to manage the fire event.

6.12. Salvage Oversight

- 6.12.1. Generally, the oversight of salvage operations was adequately performed. Coast Guard Sector Virginia assigned personnel around the clock and adjusted their processes to ensure there were proper communication and procedures in place for salvage oversight. City Cruises hired and employed qualified salvage experts. The Qualified Individual as required by the vessel Non-Tank Vessel Response Plan quickly responded to the scene and managed the company's roles and responsibilities for proper salvage of the vessel.
- 6.12.2. One item noted by the investigation was Coast Guard Sector Virginia's limited engagement with the Coast Guard's Salvage Engineering Response Team (SERT) early in the response. The SERT has 24-hour duty watch standers with particular expertise in stability, vessel design characteristics, and salvage as well as access to vessel plans and other documents stored at the Coast Guard Marine Safety Center for immediate access. Coast Guard Sector Virginia filled out a Rapid Salvage Survey and submitted it to SERT but did not request or receive any further direct advice, analysis, or recommendations according to the SERT. However, the company's salvage personnel were proactively engaged with SERT personnel and this satisfied the needs of the salvage.
- 6.12.3. Swift actions by a Coast Guard Sector Virginia Marine Inspector at the scene to immediately notice and report the dangerous stability situation during the early morning hours of June 9, 2022, undoubtedly saved the vessel from possibly capsizing or sinking as described earlier in the report. Having experienced and knowledgeable Coast Guard personnel on-scene and available to communicate and coordinate directly with the Captain of the Port is a best practice.

7. Conclusions

7.1. Causal Determinations

- 7.1.1. Based upon the weighted evidence, **the known initiating event for this incident was determined to be a fire** of an undetermined ignition origin.
- 7.1.2. The fire started on or around the area of the PMDE.
- 7.1.3. The exact ignition source for the fire could not be precisely determined based upon available evidence, although there is circumstantial evidence to support some component failure of the right bank/inboard turbo charger as the probable ignition source, creating the heat source to begin combustion.

- 7.1.4. Once the fire ignited, combustible materials stored around the PMDE and on the adjacent shelving provided fuel for the fire.
 - 7.1.5. The *Spirit of Norfolk* Captain and crew response to the fire was reasonable given the nature of the fire, their equipment and training.
 - 7.1.6. The *Spirit of Norfolk* Captain and crew response to the vessel evacuation was reasonable and effective as evidenced by no known injuries occurring, swift evacuation, and all passengers wearing life vests.
 - 7.1.7. The Good Samaritan professional mariner response to the *Spirit of Norfolk* fire and evacuation was highly effective and commendable.
 - 7.1.8. City Cruises failed to exercise prudent risk assessment and risk mitigation by allowing the *Spirit of Norfolk* to operate with a potentially damaged turbocharger when a replacement was available to be installed.
 - 7.1.9. City Cruises does not possess the in-house engineering expertise needed to evaluate and conduct risk assessments related to the mechanical aspects of vessel operations.
 - 7.1.10. City Cruises fulfilled their regulatory responsibilities to ensure proper Coast Guard interaction throughout the entirety of May and June of 2022.
 - 7.1.11. The *Spirit of Norfolk* was in substantial compliance with Coast Guard regulatory, policy, and inspection requirements on the day of the incident.
 - 7.1.12. Coast Guard Sector Virginia Inspections staff missed an opportunity to exercise proactive intervention in vessel operations oversight. Failing to fully understand the totality of events surrounding the overheating casualty, PMDE repairs, and conducting timely review of technical reports which in totality, increased the potential fire risk to the vessel.
- 7.2. Evidence of Act(s) or Violation(s) of Law by Any Coast Guard Credentialed Mariner Subject to Action Under 46 USC Chapter 77.
 - 7.2.1. There is no evidence the Captain or Captain Trainee of the *Spirit of Norfolk*, the only required credentialed mariners onboard, committed any acts of negligence or misconduct as defined by 46 USC 7703 and 46 CFR Part 5.
- 7.3. Evidence of Act(s) or Violations(s) of Law by Coast Guard Personnel, or any other person
 - 7.3.1. There was no evidence to indicate any Coast Guard or other federal government employee committed acts in violation of any laws.
- 7.4. Evidence of Act(s) Subject to Civil Penalty
 - 7.4.1. There is no evidence to support civil penalty action for this incident.

7.5. Evidence of Criminal Act(s)

7.5.1. There is no evidence to support the referral of a potential criminal violation for this incident.

7.6. There was no evidence drugs or alcohol, or distracted vessel operations were causal factors for this incident.

7.7. Need for New or Amended U.S. Law/Regulation or Policy

7.7.1. The current regulatory fire protection standards for a vessel the size and passenger carriage capacity of the *Spirit of Norfolk* are insufficient. Allowances for existing vessels to continue using fire protection standards from old 46 CFR Subchapter T do not adequately protect the vessel, its crew, and passengers from the risk of an engine room fire.

7.7.2. The implementation of an effective SMS would have reduced the likelihood that the *Spirit of Norfolk* would have continued operating with a higher risk for a potential fire over an extended period, following the May 15, 2022, overheating event. Title 46 CFR Subchapter K currently lacks the requirement for operators of applicable vessels to implement a SMS.

7.7.3. The current Coast Guard oversight for vessels determined to have elevated risk as outlined in the Small Passenger Vessel Risk Based Inspection Program is inadequate. The oversight of Tier 1 vessels should be holistic, not just focused on an increased regular inspection regimen. All Coast Guard interactions, including damage surveys, operational controls, and documentation should be conducted with increased scrutiny and greater awareness by Officers in Charge of Marine Inspection. At a minimum, Advanced Journeyman Marine Inspectors should conduct the inspection and clear deficiencies on a Tier 1 vessel. To accomplish this, CG-CVC may have to reexamine and adjust the risk algorithms on the formulas that identify Tier 1 vessels in order to manage this workload and focus on the truly higher risk vessels.

7.8. Unsafe Actions or Conditions that Were Not Causal Factors

7.8.1. Coast Guard Sector Virginia staff did not exercise effective waterways management by not broadcasting waterway restrictions and thus not notifying waterways traffic of the hazardous condition around the accident scene in a timely fashion. In particular, the Critical Incident Communications procedure requirements may have hindered the Sector Virginia staff.

7.8.2. The firefighting coordination and communication for this incident did not appear to work effectively, despite a robust response and the considerable and available resources to combat the fire. Coast Guard roles and responsibilities, particularly for regulated vessels and facility fires, may not contain the necessary level of operational guidance to facilitate coordinating these events and are not keeping pace with current operational realities.

8. Actions Taken Since the Incident

- 8.1. City Cruises employed the use of another vessel, the *Spirit of Mount Vernon*, to operate in the Norfolk, VA, to conduct dinner cruise and sightseeing operations in 2022. The company installed a CO₂ fixed fire suppression system in the engine room. The vessel is similar in build date, arrangement, and applicable regulatory requirements. These systems were voluntarily installed and were not previously onboard the vessel until the vessel arrived for Norfolk, VA operations.
- 8.2. On March 24, 2023, the *Spirit of Boston*, a Hornblower/City Cruises owned and operated vessel, similar in route, size, age, and passenger capacity, experienced a fire onboard after a voyage, during a pier-side, post-cruise cleaning by hospitality staff. The vessel was also classified as an old Title 46 CFR Subchapter T vessel, but it had a fire detection system onboard which had been installed on the vessel for some time. The fire resulted in substantial damage to the vessel, and it was deemed a Major Marine Casualty. A formal investigation was initiated with the Coast Guard as the lead agency and National Transportation Safety Board conducting a joint investigation. The following actions were taken.
 - 8.2.1. Coast Guard Commercial Vessel Compliance (CG-CVC) developed, initiated, and completed a Concentrated Inspection Campaign throughout the Coast Guard certificated small passenger vessel fleet. This undertaking led to a focused inspection regime for more than 400 passenger vessels, particularly dinner cruise vessels, to ensure regulatory compliance and reiterate fire safety with owners and operators.
 - 8.2.2. A Safety Alert was issued by the Coast Guard identifying lessons learned from both incidents focusing on fire prevention and included in the Safety Alert was the proper storage of combustible material within the engine room. Also addressed, was recommended marking of escape hatches for all possible contingencies.

9. Recommendations

9.1. Safety Recommendations

- 9.1.1. It is recommended the Commandant undertake a regulatory or policy project to consider and implement installation of fire detection and fixed firefighting suppression systems within the engine room of all Title 46 CFR Subchapter K vessels, to include “existing vessels” currently exempted.
- 9.1.2. It is recommended the Commandant implement SMS regulations for all Title 46 CFR Subchapter K vessels, including “existing vessels”.
- 9.1.3. It is recommended the Commandant amend the current Small Passenger Vessel Risk Based Inspection Program Work Instruction. Specific focus should be given to ensure all Tier 1 vessels are attended by an Advanced Journeyman Marine Inspector to include issuing vessel operational controls, deficiency checks, and the clearing of those deficiencies on Tier 1 vessels.

9.1.4. It is recommended the Commandant update the Coast Guard's role in Marine firefighting by aligning and/or updating COMDTINST M16000.11 (series), Marine Safety Manual, Volume VI, Ports and Waterways Activities Chapter 8 Marine fire Fighting Activities and COMDTINST 16130.2 (series) section 4.4, Firefighting Activities Policy. Both sections have not seen a major update in decades and may no longer reflect the Coast Guard's training/capacity to coordinate or lead shipboard or facility fire incidents. This update should reflect that most major ports have robust firefighting capability and should also address the legal authority of local Fire Departments in directing firefighting activities in their jurisdictions. It should be clear the Coast Guard has statutory authority and outline responsibilities which should be a part of a major marine related firefighting operation in the COTP zone. However firefighting operations and decisions related to fire suppression and rescue during a fire incident should be with the lead fire authority on-scene. The Coast Guard should be the supporting agency and not the supported agency.

9.2. Administrative Recommendations

9.2.1. It is recommended the Commandant develop and implement performance measures used to assess marine inspector job performance after qualification. This effort should be focused on proficiency at all levels, including additional training regarding engineering systems. Additionally, CG-CVC should produce (or add to existing) a regularly recurring report of Marine Inspector job performance to identify any gaps in Marine Inspector qualification and proficiency so that the Program possesses the requisite information to improve the workforce skillset to perform the marine inspection work that is so vital to the safety of the commercial vessel fleet.

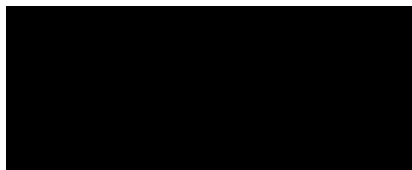
9.2.2. It is recommended the Commandant update the Critical Incident Communication process to either provide operational commanders reasonable flexibility on notification timeliness or leverage swifter communication technologies to replace the current cumbersome conference call process which removes Sector CDO's and staff from coordinating response efforts during the most critical phases in an incident response.

9.3. Recognition

9.3.1. Coast Guard Sector Virginia, in advance of this report, provided commendations and recognition as appropriate to the Good Samaritan commercial vessel crews that quickly and effectively responded to the fire and evacuated passengers from the *Spirit of Norfolk*. This investigation recognizes the professional skill and dedication of those maritime professionals and their operating companies in this incident.

9.3.2. The investigation would like to extend our sincere appreciation to the ATF for responding to the incident scene, sharing their expertise, and participating in the public proceeding. Their efforts were critical in assisting the Coast Guard during the fact-finding and analysis portions of this report.

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RANDY S. WADDINGTON
Commander, U. S. Coast Guard
Formal Investigation Lead Investigating Officer

List of Acronyms

CFR	Code of Federal Regulations
COI	Certificate of Inspection
COMDTINST	Coast Guard Commandant Instruction
COTP	Captain of the Port
FR	Federal Register
GPM	Gallons Per Minute
MISLE	Marine Information for Safety and Law Enforcement
MMC	Merchant Mariner Credential
MOU	Memorandum of Understanding
MPH	Miles Per Hour
MRO	Mass Rescue Operation
MSC	Marine Safety Center
MSM	Marine Safety Manual
NTSB	National Transportation Safety Board
NVIC	Navigation and Vessel Inspection Circular
OCMI	Officer in Charge of Marine Inspections
OSC	On-Scene Coordinator
PFD	Personal Flotation Device
PMDE	Port Main Diesel Engine
PVA	Passenger Vessel Association
RECON	Reconnaissance
RNA	Regulated Navigation Area
SAR	Search and Rescue
SMC	SAR Mission Coordinator
SMDE	Starboard Main Diesel Engine
SMS	Safety Management System
USC	United States Code
USCG	United States Coast Guard
VHF	Very High Frequency

Enclosure (1)

List of Hyperlinks for *Spirit of Norfolk* Report of Investigation

Hyperlink No.	Items	Type	Hyperlink
1	Animation of the accident voyage with labels showing significant events during the voyage. You can pause the animation at any point to view the label contents. There is an audio recording of portions of the initial call to the USCG.	MP4 Video	CG 001_1-Spirit of Norfolk Animation AIS Based .mp4
2	Movements of the various vessels and the <i>Spirit of Norfolk</i> based on automatic identification system tracking and supplied by the NTSB. There are two parts due to file size.	MP4 Video	Part 1 of 2 CG 001_1 Spirit of Norfolk Voyage Animation Part 1 Part 2 of 2 CG 001_1 Spirit of Norfolk Voyage Animation Part 2
3	Routine daytime audio recorded announcement regarding the cruise and safety for the <i>Spirit of Norfolk</i> .	MP3 Audio	CG-025-Safety Announcement Daytime
4	Passenger Stills and Video taken aboard the <i>Spirit of Norfolk</i> , June 7, 2022.		CG-044-Passenger Video and Still Photos
5	Initial distress call to the USCG from the <i>Spirit of Norfolk</i> . The audio file was spliced together from various audio files.	MP3 Audio	CG-018-Initial VHF CH 16 Radio Calls SPIRIT OF NORFOLK To/From USCG
6	Urgent Marine Information Broadcast made by the USCG requesting assistance from nearby vessels to come to the aid of the <i>Spirit of Norfolk</i> .	MP3 Audio	CG-019-CG Urgent Marine Broadcast SPIRIT OF NORFOLK, 12 09 PM EST
7	Passenger supplied images and video taken from the <i>Victory Rover</i> as it responded to the <i>Spirit of Norfolk</i> incident.	MP4 Video	CG-073-Video and Still Footage Taken from the VICTORY ROVER
8	Images and video of firefighters boarding the <i>Spirit of Norfolk</i> afternoon of June 7, 2022.	MP4 Video	CG-061-Mid-Afternoon, June 7, 2022, Firefighters Boarding SPIRIT OF NORFOLK
9	Computer modeling showing the effects of the entrained water onboard the <i>Spirit of Norfolk</i> based on draft readings taken during the fire and salvage events.	MP4	CG-085-Animated Computer RHINO Model of SON Draft and Flooding Conditions

Note: These audiovisual files are relatively large files and will take time to load on your browser so you can view them. If these links are broken to the external site, the reader may obtain these files through a Freedom of Information Act Request referencing this MISLE case activity number (see title page) and the exhibit number at efoia@uscg.mil.

Enclosure (2)

List of Exhibits for Formal Public Hearing

Note: The reader may access these exhibits by searching on the internet for: USCG *Spirit of Norfolk* Document Library and clicking on the exhibit number. If unable to locate, a Freedom of Information Act Request referencing this MISLE case activity number (see title page) and the exhibit number may be requested at efoia@uscg.mil.

Exhibit	Doc #	Exhibit Title	Type
CG	001	CG Hearing Opening Factual Presentation	PPT
CG	001.1	<i>Spirit of Norfolk</i> Voyage Animation with Labels Significant Events	VIDEO
CG	002_1	<i>Spirit of Norfolk</i> Amended COI	PDF
CG	003	Logs and Statements From Assist Vessels On Scene	PDF
CG	004	Vessel Critical Profile	PDF
CG	005	MV <i>Spar Lyra</i> CG 2692 and other supporting documents	PDF
CG	006	Vessel movements related to <i>Spirit of Norfolk</i> , animation of AIS data, NTSB supplied	VIDEO
CG	007_1	Bay Diesel Tech Reports with associated photos May 15 to May 26, 2022	PDF
CG	008_4	City Cruises Hornblower Org Charts	PDF
CG	009	Images of <i>Victory Rover</i> alongside <i>Spirit of Norfolk</i>	PDF
CG	010	Nautical Charts Norfolk Harbor Area	PDF
CG	011_1	Hampton Roads Maritime Firefighting Contingency Plan	PDF
CG	012	Images of Port of Virginia MIRT Equipment	PDF
CG	013	Agendas of MIRT Training-Marine Firefighting and Command Courses	PDF
CG	014	Salvor Dewatering Plan for <i>Spirit of Norfolk</i> , Jun 8, 2022 6:37 PM	PDF
CG	015	Weather Information For Vicinity of Incident	PDF
CG	016	Reported Draft Marks <i>Spirit of Norfolk</i> June 7-12, 2022	PDF
CG	017	Salvo Emails June 8, 2022	PDF
CG	018	Initial VHF CH 16 Radio Calls <i>Spirit of Norfolk</i> To/From USCG	MP3
CG	019	CG Urgent Marine Information Broadcast <i>Spirit of Norfolk</i> , 12:09 PM EST	MP3
CG	020	Milner Survey Pre-Fire Photos, Reports and Associated Documents	PDF
CG	021	Milner Provided Joint Field Survey <i>Spirit of Norfolk</i> Post Fire	PDF
CG	022	PVA Manuals Firefighting and Personal Safety	PDF
CG	023	2022 <i>Spirit of Norfolk</i> Survey, June 6, 2022	PDF
CG	024	Combined VHF audio clips Burkett and Nadeau June 7, 2022 12:43 PM	MP3
CG	025	Safety Announcement Daytime	MP3
CG	026	Crew Positions for Accident Voyage June 7, 2022_Redacted	PDF
CG	027	<i>Spirit of Norfolk</i> PowerPoint with vessel features_Promotional_Redacted	PDF
CG	028	<i>Spirit of Norfolk</i> Fire Extinguisher Inspection Report_Redacted	PDF
CG	029	Vessel Plans Fire and Lifesaving	PDF
CG	030	Images of the Port Side Main Deck Access Door	PDF
CG	031_1	Emergency Response Plan 2021 and Appendix B_Redacted	PDF
CG	032	Various Vessel Checklists	PDF
CG	033	<i>Spirit of Norfolk</i> Vessel Logs May, 2022_Available Ashore	PDF
CG	034_1	Scheduled and Completed Trips May 1, 2022, to Accident Date	PDF

CG	035	Vessel Plans Evacuation Plan Drawing	PDF
CG	036	CG 2692 Report of Marine Casualty <i>Spirit of Norfolk</i> June 7, 2022	PDF
CG	037	Employee Handbook and Deckhand Training Redacted	PDF
CG	038	Vessel Plans General Arrangement	PDF
	039_1	Vessel Plans and Photos Hydraulic Steering System	PDF
CG	040	Vessel Plans Bilge _ Fire System	PDF
CG	041	Crew handbook 2021_Redacted	PDF
CG	042_1	Image Two Incident Commanders June 7, 2022	PDF
CG	043_1	Images of Significant Vessels That Provided Assistance	PDF
CG	044	Passenger Video and Still Photos	VIDEO
CG	045	Vessel Shoreside Alarm Monitoring Service Report	PDF
CG	046	CG Inspection/ Investigation since May 10, 2022	PDF
CG	047_1	Engine Room Escape Hatch and Watertight Door	PDF
CG	048	Notes Marine Salvor and Night Orders	PDF
CG	049	Combined General Hydro Statics (GHS) Modeling For <i>Spirit of Norfolk</i>	PDF
CG	050	2016 Interior Renovation	PDF
CG	051	Vessel Plans Structural Fire Protection	PDF
CG	052	Engine Room Post Fire Photos	PDF
CG	053	Port Main Engine Turbocharger Post Fire Photos	PDF
CG	054	Still image and short video of a cellar nozzle in action	VIDEO
CG	055	Model of <i>Spirit of Norfolk</i> With Path to ER Hatch and WTD	PDF
CG	056	Pre and Post Fire Photos- General	PDF
CG	057	Text Messages From Bay Diesel To/From Captain [REDACTED]	PDF
CG	058	Port Engine Before and After Jacket Water Casualty	PDF
CG	059	Image with Markup Showing the Port sea chest Small Diameter Flex Hoses	PDF
CG	060	Passenger Interview Diagrams	PDF
CG	061	Mid-Afternoon, June 7, 2022, Firefighters Boarding <i>Spirit of Norfolk</i>	VIDEO
CG	062	Images of Interior Wheelhouse <i>Spirit of Norfolk</i> from June 6, 2022, Survey w/CG Markups	PDF
CG	063	SCANIA Provided Emails and Documents/ Partial/ Relevant	PDF
CG	064	Extracts from the NTSB Conception Report on the Fire on the Small Passenger Vessel <i>Conception</i> , September 2, 2019	PDF
CG	065	33 CFR Part 96 Extracts Safety Management System	PDF
CG	066	Police Scanner Notes for Sr. VP City Cruises	PDF
CG	067	Port list <i>Spirit of Norfolk</i> early morning June 9, 2022	PDF
CG	068_1	Fire Plan <i>Spirit of Norfolk</i> at the Command Post Pier 4 on June 7, 2022, with CG markups	PDF
CG	069	Aerial News Footage of <i>Spirit of Norfolk</i> Fire Event	AVI
CG	070	Flagship Safety Management System for Members of the PVA	PDF
CG	071	Combined Pre- Hearing NTSB Produced Interview Transcripts	PDF
CG	072	USCG Work Instruction SPV Risk Based Inspection Program	PDF
CG	073	Video and Still Footage Taken from the <i>Victory Rover</i>	VIDEO
CG	074	Extracts <i>Spirit of Norfolk</i> Preventative Maintenance Program	PDF
CG	075_1	Small Passenger Vessel Fleet Statistics For Background And Industry Context 11_1_22	PDF
CG	076	<i>Spirit of Norfolk</i> Non-Tank Vessel Response Plan (NTVRP)	PDF
CG	077	Typical CG Sector Marine Inspection Organization	PDF
CG	078	USCG Small Passenger Vessel Tier System	PDF

CG	079_1	Engine Placement Sketch Plan View quarter inch equal one foot	PDF
CG	080	Vessel Side Profile and Overhead Sketch With Labels (NTSB)	PDF
CG	081	Emails regarding <i>Spirit of Norfolk</i> between May 15 and May 26, 2022	PDF
CG	082	<i>Spirit of Norfolk</i> - Origin and Cause ATF_Redacted	PDF
CG	083_1	Incident Situation Reports UC and Other Related Sources_June 6, 2022	PDF
CG	084	Items In The Vicinity Of The Port Main Diesel Engine_June 6, 2022	PDF
CG	085	Animated Computer RHINO Model of <i>Spirit of Norfolk</i> Draft and Flooding Conditions	VIDEO
CG	086_1	Bundled City Cruises Emails GM and Dir of Marine Ops_Redacted	PDF
CG	087	22-080-Rel NTSB Materials Lab Factual Report Hydraulics_Redacted	PDF
CG	088	Fire Agencies Initial Reports minus Norfolk Navy Report	PDF
CG	089	<i>Spirit of Norfolk</i> Replacement Turbo Shipping Information CG Markups_Redacted	PDF
CG	090	HOLSET Turbo Troubleshooting Bulletin CG Markups	PDF
CG	091	CG Procedure for Issuing Deficiencies to U.S. Flag Vessels_Redacted	PDF
CG	092	Extract COMDTINST M16130.2F Addendum SAR Manual_Firefighting	PDF
CG	093	Combined Images of <i>Spirit of Norfolk</i> Firefighting USCG_Redacted	PDF
CG	094	USCG Regulations SME Presentation	PDF
CG	095	USCG Compliance SME Presentation	PDF
CG	096	<i>Spirit of Norfolk</i> CFD Presentation Rev 2023-01-20 (002)	PDF
CG	097	Navy Statement regarding <i>Spirit of Norfolk</i> Fire	PDF
CG	098	Norfolk Firefighters Q and A	PDF
CG	099	USCG PQS T_K	PDF
CG	100	Elements of Standard Operating Procedures	PDF
CC	City Cruises		
CC	A	Photo Afternoon June 7, 2022	JPEG
CC	B	Photo <i>Spirit of Norfolk</i> Night June 7, 2022 8:56 PM	JPEG
CC	C	Series of Post Fire <i>Spirit of Norfolk</i> Photos, 13 pages	PDF
BP	Bay Power Solutions		
B	A	High Resolution Image Vicinity of Turbocharger	PDF