UNITED STATES COAST GUARD

REPORT OF THE INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE ENGINE ROOM FIRE ON BOARD THE

M/V SSG EDWARD A. CARTER, JR.

WHILE MOORED AT MILITARY OCEAN TERMINAL SUNNY POINT, N.C., ON JULY 14, 2001 WITH THE LOSS OF TWO LIVES
INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE ENGINE ROOM FIRE ON BOARD THE M/V SSG EDWARD A. CARTER, JR., OFFICIAL NUMBER 665785, WHILE MOORED AT THE MILITARY OCEAN TERMINAL, SUNNY POINT, N.C., ON JULY 14, 2001, WITH THE LOSS OF TWO LIVES.

ACTION BY THE COMMANDANT

The record and the report of the investigation of the subject casualty have been reviewed. The record and the report, including the findings of fact, conclusions, and recommendations are approved subject to the following comments.

CAUSE OF THE CASUALTY

We concur that the cause of this casualty was human error on the part of the Second Assistant Engineer in that he failed to monitor the transfer of heavy fuel oil from the port and starboard overflow tanks to the heavy fuel oil settling tank. The resulting spill of a fuel oil mixture was ignited by an undetermined source.

COMMENTS ON FINDINGS OF FACT

Finding of Fact 57: The ship's engineering and cargo hold spaces are protected by a 22,000-pound low-pressure carbon dioxide (CO₂) system manufactured by Ginge Brand & Elektronik A/S of Denmark. The Ginge Brand system was installed on board the SSG CARTER and the 11 other ECON-class vessels built for U.S. Lines in Korea during the mid-1980s. In order not to delay delivery of the vessels and cause economic hardship to U.S. Lines, U.S. Coast Guard Headquarters (G-MVI-3, Systems Survival Branch, Merchant Vessel Inspection and Documentation Division) allowed Ginge Brand more time to complete the system component testing which already was in progress by Underwriters Laboratory (UL). The Coast Guard agreed to accept the CO₂ system before all of the approval requirements were met contingent upon Ginge Brand replacing any components that failed UL testing or that were not found satisfactory by the Coast Guard. Neither Ginge Brand, nor its successor Ginge-Kerr, received UL approval for all of the system components. Therefore, the Ginge-Kerr system installed on the SSG CARTER, and its 11 sister vessels, never received system and component approval as required by 46 CFR 95.15-1(b).
Comment: We do not concur with this finding of fact. The original involvement of Commandant (G-MVI-3) was limited to review and processing of the manufacturer's request for type approval. UL listing of the Ginge Brand CO₂ system was required to form the basis of Coast Guard type approval. Commandant (G-MTH-4) and Commander, Third Coast Guard District (mmnt) also were involved in the review of the CO₂ system for specific vessels. Commandant (G-MTH-4) indicated that components of the Ginge Brand CO₂ system could be installed provided that UL listing was obtained as soon as possible and that any components failing UL approval be immediately replaced with approved components. The initial acceptance of the systems installed on the various U.S. Lines vessels was completed under the authority of the cognizant Officer in Charge, Marine Inspection (OCMI). Neither the record of this investigation nor the currently remaining but incomplete type approval file at Coast Guard Headquarters provide specific details regarding initial OCMI acceptance of the Ginge Brand CO₂ system. The record includes a copy of a letter dated September 27, 1989 from Commandant (G-MVI-3) stating that the remaining outstanding component approval issues were resolved and that the Ginge-Kerr CO₂ system components were acceptable. Therefore, although the Ginge-Kerr system did not receive Coast Guard type approval, it did receive system and component approval per 46 CFR 95.15-1(b).

Finding of Fact 58: In their review of the Design, Installation, and Maintenance Manual submitted by Ginge Brand, G-MVI-3 cited several discrepancies that had to be corrected prior to final approval. One of the items listed in a March 22, 1985 letter from G-MVI-3 to Ginge Brand was to provide "simple instructions on how to discharge the CO₂ system manually in case of power failure." G-MVI-3 was concerned that during a power failure the electric solenoid valve would be inoperative, which in turn would prevent the opening of the main block valve. The UL component test files maintained by G-MVI-3 listed the results of under-voltage tests completed on this electric solenoid valve. There was no further discussion in the G-MVI-3 files regarding the installation of this electric solenoid valve in the system.

Comment: We partially concur with this finding of fact. Neither the record of this investigation nor the currently remaining but incomplete type approval file at Coast Guard Headquarters document a G-MVI-3 concern that the main block valve would be prevented from opening during a power failure. The UL under-voltage tests on the electric solenoid valve were completed satisfactorily.

Finding of Fact 59: The Coast Guard and SOLAS regulations for carbon dioxide fixed firefighting systems do not specifically prohibit the use of electric power to control the opening and closing of control and discharge valves. However, according to [a staff member in] (G-MSE-4, Lifesaving and Fire Safety Division), Coast Guard Headquarters has been applying a standard practice to prohibit the use of electric-controlled valves in their review of carbon dioxide fixed firefighting systems. [The staff member] reported that this practice was in place during the review of the Ginge-Brand system in 1985. G-MVI-3 did not direct the removal of the electric solenoid valve during their review.

Comment: We partially concur with this finding of fact. Neither the record of this investigation nor the currently remaining but incomplete type approval file at Coast Guard Headquarters document a Coast Guard Headquarters practice to prohibit the use of electric power to control the
opening and closing of control and discharge valves. The currently remaining but incomplete type approval file confirms the policy in effect in the 1980's and in effect today to consider new technologies that show an equivalent level of safety.

Finding of Fact 60: The general layout plan for the CO₂ System (Ginge Drawing #12-131-A38F) reviewed by G-MVI-3 listed a 1.5" ball valve in-line with the siren to the main engine room. This ball valve is prohibited because if it were to be closed, the siren would not automatically sound when the carbon dioxide is released into the engine room in accordance with 46 CFR 95.15-30. G-MVI-3 did not direct either Ginge Brand or Sea-Land to remove this ball valve from the siren line when they completed their review of the system.

Comment: We partially concur with this finding of fact. The requirements of 46 CFR 95.15 apply to high pressure CO₂ systems. Nevertheless, 46 CFR 95.15-30 does not prohibit a stop valve in the line to the siren. This valve is a necessary safety feature that prevents CO₂ from bleeding from the CO₂ tank, through the line, and into the engine or auxiliary engine room when maintenance is performed on the siren actuation valves.

Finding of Fact 62: The low-pressure CO₂ fixed fire-fighting system can be activated locally from the CO₂ room or remotely from two control stations. One of the remote control stations is located in the Fire Control Room along the port pipe tunnel on the second deck. The second remote control station is located in the passageway of the starboard pipe tunnel. To activate the system from the Fire Control Room or starboard pipe tunnel, one of the two pony bottle cylinder valves needs to be opened before pulling the two levers on the manifold between the pony bottles. This three-step operation is above the two-step limit as defined in 46 CFR 95.15-10. No comments were made in any correspondence by G-MVI-3 to address or correct this design.

Comment: We partially concur with this finding of fact. The requirements of 46 CFR 95.15 apply to high pressure CO₂ systems, which involve a different system design than low pressure systems such as the Ginge Brand. While a two-step actuation method is simpler than a three-step process and would be preferable, there is no evidence in the record that the three-step method represents a design weakness or contributed to the casualty. There is no compelling reason to require that the systems be modified to reduce the number of steps required to release the CO₂ from the remote control stations.

COMMENTS ON CONCLUSIONS

Conclusion 15: U.S. Coast Guard Headquarters (G-MVI-3) failed to enforce their standing policy to prohibit the use of electrical power to control the operation of CO₂ discharge valves during their review of the low-pressure CO₂ system. G-MVI-3 did not order the in-line ball valve to the engine room CO₂ siren to be "locked open" or removed so as to allow automatic operation as required by the regulations. G-MVI-3 did not order any design changes to the three-step procedure to activate the CO₂ system from the remote control stations. The "acceptance" letter for the Ginge-Kerr system was issued by G-MVI-3 despite knowing about the system's dependence on electricity for normal operation, the presence of the in-line ball valve, and the three-step process to activate. At least 11 other sister vessels to the SSG CARTER may have the
same type of Ginge-Kerr system as the SSG CARTER with erroneous acceptance letters issued by G-MVI-3.

**Comment:** We do not concur with this conclusion. See our comments on findings of fact 57, 59, 60, and 62.

**COMMENTS ON RECOMMENDATIONS**

**Recommendation 1:** That the American Bureau of Shipping review guidance and training programs provided to their surveyors to ensure they are instructed on and familiar with how to complete operational tests for fixed firefighting systems, especially the low pressure types.

**Action:** We concur with this recommendation. Guidance and training programs provided to surveyors for completing operational tests of fixed firefighting systems, especially low-pressure systems, will be included on the agenda for the next Alternative Compliance Program (ACP) oversight meeting.

**Recommendation 2:** That the U.S. Coast Guard initiate a rulemaking to the marine safety regulations which would require the ability to remotely close sideport doors which form part of the hull from a position outside the protected space during an emergency. The U.S. Coast Guard should propose a similar amendment to the SOLAS rules.

**Action:** We concur with the intent of this recommendation. Sideport doors and other openings that may admit air or allow extinguishing gas to escape should be capable of being closed from outside the protected space. However, 46 CFR 95.15-35, 46 CFR 97.15-17, and the International Convention for the Safety of Life at Sea (SOLAS), 1974, regulations II-2/5 and II-2/11, adequately address this issue.

**Recommendation 3:** Should the efforts to pursue regulations fail, Maersk Line Limited and other vessel operators with similar sideport door arrangements, should include a policy in their respective Safety Management Plans to keep the doors closed when the engineers are not receiving machinery supplies or equipment. The policy should specifically prohibit allowing these doors to remain open for ventilation purposes only.

**Action:** We concur with the intent of this recommendation. As indicated in the action on recommendation 2 above, adequate regulations already exist. Commandant (G-MOA) will develop and distribute a safety alert on this issue.

**Recommendation 4:** That the U.S. Coast Guard initiate a rulemaking to amend the marine safety regulations to require, at a minimum, monthly fire drills where the fire is simulated in the engine room and the crew is required to simulate activating the fixed firefighting system. The U.S. Coast Guard should propose a similar amendment to the SOLAS rules.

**Action:** We concur with the intent of this recommendation. Existing requirements are sufficient to address this issue. 46 CFR 199.180(f) requires fire drills to be held monthly and that they be planned with consideration of the various emergencies that may occur for the type of vessel and
its cargo. 46 CFR 199.180(g) requires the crew to be instructed in the use of the vessel's fire-extinguishing appliances. In addition to similar requirements under SOLAS regulation III/19, the 2000 amendments to SOLAS add a requirement under regulation II-2/15 for the vessel's training manual to include an explanation of the operation and use of firefighting systems and appliances. To facilitate compliance with these requirements, we will coordinate with Training Center Yorktown to have the CG-840 inspection books updated to assist inspectors in checking these items.

Recommendation 5: That the U.S. Coast Guard initiate a rulemaking to the marine safety regulations that would require a position indicating device to readily determine if the main stop valve on a low-pressure CO₂ tank is open or closed. The U.S. Coast Guard should propose a similar amendment to the SOLAS rules.

Action: We concur with the intent of this recommendation. While we agree that additional guidance on the design and installation of low pressure CO₂ fire-extinguishing systems is needed, we do not believe that a regulatory change is the best approach. The current Coast Guard regulations for CO₂ extinguishing systems are based on a high pressure system. Additional guidance is provided in Navigation and Vessel Inspection Circular (NVIC) 6-72, which is currently under review. Guidance on low pressure CO₂ systems, including the tank shut-off valves, will be included as part of the next revision to NVIC 6-72.

Recommendation 10: That Commandant (G-MOC-2 and G-MSE-4) work together to determine which ships still have the Ginge-Kerr low-pressure CO₂ system and notify the owners of the potential problems associated with the failure of the main block valve to open in case of power failure. G-MSE-4 should review and approve all design and operation plan modifications to include removal of the electric solenoid valve. Additionally, G-MSE-4 should review and approve modifications to reduce the number of steps (from three to two) needed to release CO₂ from the remote control stations. During the interim, G-MOC-2 should inform the owners, as well as ABS surveyors and USCG marine inspectors, on the importance of ensuring the crews on ships fitted with a Ginge-Kerr system know how to operate the bypass valve in case of power failure.

Action: We partially concur with this recommendation. A safety alert was published in March 2002 alerting owners and operators of vessels with the Ginge-Kerr type and other similar fire extinguishing systems of the potential problems associated with the loss of electrical power. This safety alert also has been placed in the Marine Information for Safety and Law Enforcement (MISLE) system for easy access by Coast Guard personnel. Additionally, a search was completed to identify other ships that might have such a system installed. As a result, Maersk Lines and U.S. Ship Management Co., owners of vessels known to have Ginge-Kerr low pressure CO₂ systems, have been notified to replace the electric controls with controls not requiring electric power, and have agreed to do so. With respect to the review and approval of any modifications to systems installed on vessels, the safety alert provided guidance to the owners and operators to contact system technical representatives to determine the types of modifications necessary to ensure that normal CO₂ release procedures can be accomplished without electrical power and to initiate Flag State and classification society approval for any modifications to be made. There is no compelling reason to require that the systems be modified to reduce the number of steps required to release the CO₂ from the remote control stations. For U.S. vessels,
system modifications are normally reviewed and approved by the Marine Safety Center, or in special cases by Commandant (G-MSE-4). In two recent cases involving modifications of the Ginge-Kerr low pressure CO₂ systems on two vessels, the review and approval was completed by Commandant (G-MSE-4). The safety alert has informed the owners, as well as ABS surveyors and USCG marine inspectors, on the importance of ensuring the crews on ships fitted with a Ginge-Kerr system know how to operate the bypass valve in case of power failure.

**Recommendation 11:** That Maersk Line Limited amend their shipboard familiarization program to be consistent with the guidance set forth by STCW 95, Section A-VI/1.

**Action:** We concur with this recommendation. A copy of this report will be forwarded to Maersk Line Limited for appropriate action.

**Recommendation 12:** That a copy of this investigative report be provided to the following organizations: Military Sealift Command, Military Ocean Terminal Sunny Point, Maersk Line Limited, American Bureau of Shipping, International Maritime Organization, U.S. Coast Guard Marine Safety Office Wilmington, NC, and the estates of Mr. Paul Powell and Mr. Horace Beasley.

**Action:** We concur with this recommendation. Copies of this report will be provided as recommended.

**Recommendation 13:** That this investigation be closed.

**Action:** We concur with this recommendation. This investigation is closed.

\[Signature\]

W. D. RABE

By direction
SECOND ENDORSEMENT on Investigating Officer's ltr 16732 of 08 April 2002

From: L. J. BOWLING
CGD FIVE (m)
To: COMDT (G-MOA)


1. Approved, subject to the following comments.

2. I concur with recommendations 1 and 2.

3. I partially concur with recommendation 3. I believe it is impractical to not allow the opening of the sideport doors solely for ventilation purposes. The engine room can be a very "inhospitable" work environment at times and opening the doors to allow fresh air in can help alleviate the situation – and it can be done safely. Instead, I recommend both the Safety Management Plan and the Station Bill be amended to assign a member of the engineering department the responsibility of ensuring the doors are closed during emergency response situations. In addition, I also recommend the Oil Transfer Procedures be amended to require the doors be closed during fuel oil transfer operations in order to strengthen fire boundaries around the engine room in the event of a fire.

4. I concur with recommendation 4. The crew's inability to effectively respond to the fire was due mainly to a lack of familiarization with the ship and its firefighting system/equipment. At a minimum, Commandant should amend NVIC 6-91 to require monthly engine room fire drills and simulated activation of the fixed firefighting system. Special emphasis should be placed on proficiency in operation/activation of Low Pressure CO2 systems.

5. I concur with recommendation 5.

6. I concur with recommendations 6 and 7. I note that MOTSU has already taken action on both of these recommendations.

7. I concur with recommendations 8 and 9. MSO Wilmington shall initiate an investigation to determine if suspension and revocation proceedings and/or civil penalty action is appropriate. I have also considered other possible enforcement options under Title 18, but have determined they would not be appropriate in this case.

8. I concur with recommendation 10. It is paramount that Commandant identifies U.S. vessels that have the same Ginge-Kerr system and initiate corrective action. Commandant (G-MSE) has
SECOND ENDORSEMENT on Investigating Officer’s Ltr 16732 of 08 April 2002

already been in communication with Maersk Lines regarding several affected vessels in their fleet. In addition, Commandant should notify the foreign owners/operators of any former U.S. flag vessels that have the same system onboard. Also, in light of the importance of the firefighting system and the potential adverse results that could arise if the system fails, Commandant should establish and enforce a formal written policy on the use of electrical solenoid valves.


10. I concur with recommendation 12. I further recommend that release of the investigative report be coordinated to allow both the Parties in Interest and the next of kin for Paul C. Powell and Horace C. Beasley sufficient time to review the report before making it available to the general public.

11. I recommend this investigation be closed.

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FIRST ENDORSEMENT on Formal Investigation 16732/MC01009305 dtd 08 APR 2002

From: CAPT W. C. Benedict
Commanding Officer, Marine Safety Office Wilmington, NC

To: Commandant (G-MOA)
Thru: Commander, Fifth Coast Guard District

Subj: M/V SSG EDWARD A. CARTER, JR., O.N. D665785, ENGINE ROOM FIRE WHILE MOORED AT THE MILITARY OCEAN TERMINAL, SUNNY POINT (MOTSU), N.C., ON JULY 14, 2001, WITH THE LOSS OF TWO LIVES

1. This investigation is forwarded recommending approval.

2. Recommendation 1 requires action by the American Bureau of Shipping under the direction of Commandant (G-MOC) who oversees the Alternate Compliance Program.

3. Recommendation 2 requires action by Commandant. Although the low-pressure CO₂ system failed to activate during this casualty, the Investigating Officer has clearly shown that if it had been activated its effectiveness would have been diminished due to the large sideport openings in the hull. The intent of this recommendation is in keeping with existing U.S. and international regulations which require certain watertight doors to be closed from remote locations outside the protected space.

4. Maersk Line Limited has already taken action on Recommendation 3 as observed during the return visit of the SSG CARTER to MOTSU on 15 February 2002.

5. Recommendations 4 and 5 require action by Commandant.

6. Action on Recommendation 6 was completed when the fire department at MOTSU obtained a thermal imaging camera late last year.

7. Action on Recommendation 7 was initiated by my letter dated February 26, 2002, to MOTSU’s Commander informing him of the need to improve the response time of the fire tug. MOTSU has enhanced their crew recall procedures so that a fire tug will available to respond to a vessel fire within one hour of notification from the fire department. The Southern Coastal North Carolina Marine Firefighting Contingency Plan will be updated to include this change in response time.

8. I concur with Recommendations 8 and 9. I am prepared to initiate Suspension & Revocation and civil penalty actions as suggested.

9. Action on Recommendation 10 has been partially fulfilled by the Safety Alert which was provided to the marine industry by Commandant (G-MOA) last month. The Safety Alert described the potential problems associated with the electric operation of the main block valve and discussed alternatives in case of power failure. To date, Commandant (G-MSE) has only approved design modifications to the Ginge-Kerr system made onboard the SSG
Subj: M/V SSG EDWARD A. CARTER, JR., O.N. D665785, ENGINE ROOM FIRE WHILE MOORED AT THE MILITARY OCEAN TERMINAL, SUNNY POINT (MOTSU), N.C., ON JULY 14, 2001, WITH THE LOSS OF TWO LIVES

CARTER. No action has been taken by Commandant to determine which other U.S. vessels have the same type of Ginge-Kerr system and initiate the necessary design modifications as suggested. Also, no action has been taken by Commandant (G-MOC) to post a special notice in the MISLE database files for those vessels fitted with the Ginge-Kerr system.

10. Recommendation 11 is a change that Maersk Line Limited will have to complete to improve their shipboard familiarization program.
INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE ENGINE ROOM FIRE ON BOARD THE

M/V SSG EDWARD A. CARTER, JR.

ON JULY 14, 2001 WHILE MOORED AT THE MILITARY OCEAN TERMINAL, SUNNY POINT WITH MULTIPLE LOSS OF LIFE
EXECUTIVE SUMMARY

At approximately 1602 on 14 July 2001, a fire started on board the container ship SSG EDWARD A. CARTER, JR. (ex-SEALAND OREGON) while the vessel was moored starboard side at the south wharf of the Military Ocean Terminal, Sunny Point in Southport, NC. At the time of the fire, the SSG EDWARD A. CARTER, JR. was loaded with approximately 5 million pounds of Class 1 explosive cargoes in support of Military Sealift Command operations. Since the fire occurred on a Saturday afternoon, the explosive cargo was not being handled. Eighteen of the vessel’s crew were on board when the fire started.

At approximately 1530 on 14 July, the Second Assistant Engineer started a transfer of heavy fuel oil (HFO) from tanks within the engine room. The HFO transfer was left unsupervised and eventually overfilled the HFO settling tank before filling up the HFO vent piping. The HFO proceeded along the common vent piping and entered the main engine mixing tank which contained diesel oil. The HFO mixed with the diesel fuel oil and the mixture was forced up through two disconnected vent lines on the 01 level of the machinery casing (fidley). The diesel oil and HFO mixture spilled onto the 01 level and covered the solid deck plating. Eventually the diesel fuel oil cascaded over the 01 level deck coaming and made contact with the hot auxiliary boiler exhaust stack located several feet away. The exact ignition source was not conclusively determined but the auxiliary boiler exhaust stack was considered the most likely source to flash the diesel oil mixture into a fire.

The fire developed quickly and spread intense flame, heat, and smoke throughout the aft levels of the engine room and inside the fidley as the diesel and heavy fuel oil mixture cascaded down from the 01 level and second deck. One of the engine crew members made an initial attempt to fight the fire in the vicinity of the auxiliary boiler, on the third platform level, with a portable extinguisher but was unable to extinguish all the flames due to the amount of burning fuel “raining” down from above. The ship’s crew was unsuccessful in controlling the fire and failed in their two attempts to activate the low-pressure carbon dioxide system protecting the engine room space.

The Third Assistant Engineer and Wiper died as a result of the fire. The Third Assistant Engineer’s body was found on the 03 level inside the fidley approximately twelve feet from the fire door that leads to the galley spaces. He died from smoke inhalation while attempting to escape from inside the fidley. The Wiper drowned in the Cape Fear River after jumping overboard from the opened port sideport door on the third platform level within the engine room. One crew member made an attempt to rescue the Wiper by tossing two life rings overboard but the Wiper’s inability to swim or tread water prevented him from reaching either life ring.

At approximately 1610, firefighters from the Military Ocean Terminal, Sunny Point (MOTSU) fire department arrived at the wharf to assist with the fire response. Approximately 150 firefighters from 30 surrounding county and city fire departments responded to provide personnel support and equipment to fight the fire. Their combined efforts successfully contained the fire to the aft sections of the engine room which prevented the heat and fire from spreading forward and affecting the explosive cargo located forward of the engine room. The fire was brought under control within six hours after it had started and was completely extinguished after nine and a half hours.

Total damage to the ship was estimated to be $15 million. After the explosive cargo was offloaded, the ship was dead-ship towed to Norshipco Shipyard in Norfolk, VA to make the repairs. Besides the two deaths reported above, there were no other injuries or pollution as a result of this casualty.
On 31 July 2001, a Formal Investigation was convened by order of the Commander, Fifth Coast Guard District. Formal proceedings were held in Wilmington, NC over the course of ten days at the direction of the Investigating Officer. Testimony was received from twenty-six witnesses to include the following:

- A Port Engineer and previously assigned Chief Engineer with Maersk Line Limited;
- Two ABS surveyors who completed Alternate Compliance Program exam in June, 2001;
- The USCG marine inspector who completed last Certificate of Inspection in June, 2001;
- Eight crew members on board at the time of fire;
- The USCG Investigating Officer and Alcohol, Tobacco, & Firearms agent assigned to complete the preliminary investigation;
- A mechanical engineer from the USCG Marine Safety Center;
- A chemist from USCG Marine Safety Lab;
- The previous Chief Engineer who served on board when vessel owned by Sea-Land Inc.;
- Three service company representatives who serviced low-pressure CO2 system;
- A representative from electronic control system company;
- A commercial marine firefighting school instructor;
- The first MOTSU firefighter to respond to scene;
- Two coroners who completed autopsies on the deceased crewmen.

The proceedings included testimony from these witnesses along with the entry of 80 exhibits into evidence. Seven “Parties in Interest” were designated by the Investigating Officer as follows: Maersk Line Limited (owner/operator); Master; Chief Engineer; First Assistant Engineer; Second Assistant Engineer; widow of Third Assistant Engineer; and father of Third Assistant Engineer. The two parties representing the Third Assistant Engineer were present because his estate was not settled at the time the proceedings commenced.
From: U.S. Coast Guard Investigating Officer  
To: Commandant (G-MOA)  
Via: (1) Commanding Officer, MSO Wilmington, NC  
(2) Commander, Fifth Coast Guard District  

Subj: M/V SSG EDWARD A. CARTER, JR., O.N. D665785, ENGINE ROOM FIRE WHILE MOORED AT THE MILITARY OCEAN TERMINAL, SUNNY POINT, N.C., ON JULY 14, 2001 WITH THE LOSS OF TWO LIVES

FINDINGS OF FACT

VESSEL DATA

Name: SSG EDWARD A. CARTER, JR.  
Official Number: D665785  
Service: Freight (Container) Ship  
Gross Tons: 42,719  
Net Tons: 32,284  
Deadweight Tons (DWT): 58,943  
Length (Overall): 939.45 feet  
Breadth (molded): 105.9 feet  
Depth (molded): 51.9 feet  
Homeport: Norfolk, VA  
Date Built: 1985  
Place Built: Korea  
Built By: Daewoo Shipyard (Hull 4007)  
Owner: Maersk Line Limited  
Suite 400  
120 Corporate Blvd  
Norfolk, VA 23502-4952  
Operator: Maersk Line Limited  
Propulsion: Diesel Direct  
Horsepower: 28,000  
Master: Robert A. Vranish  
Classification Society: American Bureau of Shipping (ABS)  
Certificate of Inspection: Issued 12 June 2001 by MSO Hampton Roads  
Last Drydock: 25 June 2001 (Norshipco Shipyard)
RECORD OF DECEASED

Name:        Paul C. Powell
License/MMD: Third Assistant Engineer of Any Horsepower
Serial # 825705; MMD # 166-62-4703
Age:        35
Home Address:
Position on Vessel: Third Assistant Engineer

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Name:      Horace C. Beasley
MMD:      Ordinary Seaman/Wiper
MMD # 156-48-6617
Age:        44
Home Address:
Position on Vessel: Wiper

Narrative Description

1. The SSG EDWARD A. CARTER, JR. (hereafter referred to as the SSG CARTER) is one of five containerships chartered by the Military Sealift Command to transport explosive cargo as part of their Prepositioning Program for the U.S. Army. The vessel changed ownership from U.S. Ship Management to Maersk Line Limited (hereafter referred to as Maersk) on February 28, 2001. During the most recent drydock in June, 2001, the ship was converted to carry containerized ammunitions. Additionally, four new electro-hydraulic pedestal cranes were installed along with large cocoons to cover four container holds to control the atmosphere (dehumidified air). The ship is designed to carry 2,129 40-foot containers on deck and within 17 cargo holds. The ship was one of twelve ECON-class ships originally built for U.S Lines to run the Pacific Ocean trade during the mid to late 1980s. The ship was subsequently sold to Sea-Land, Inc and U.S. Ship Management to operate container traffic around the world.

2. At the time of the fire, the ship was loaded with 1,212 containers holding a total net explosive weight (NEW) of 5 million pounds. The vessel was to complete loading Class 1 explosives before departing the south wharf of the Military Ocean Terminal, Sunny Point (MOTSU) at the end of July. The vessel’s intended destination was the island of Diego Garcia in the Indian Ocean to fulfill a multi-year contract. The cargo stowed on board was located in cargo holds #1 through #16. Cargo hold #17, which is located immediately forward of the engine room, was empty. Cargo hold #19 is located aft of the engine room and was used to store paint (for delivery to another ship in the prepositioning fleet) and miscellaneous supplies. Cargo hold #19 is protected by the vessel’s low-pressure CO2 fixed firefighting system.

Weather Conditions

3. The weather on 14 July was clear with an air temperature of 75 degrees Fahrenheit and winds
from the southwest at 5 knots. The Cape Fear River current was slack and the tidal height was 3.8 feet in the vicinity of MOTSU at 1600. The water temperature was 72 degrees Fahrenheit.

**Vessel Layout**

4. The ship has two decks that extend the entire length of the ship; the main deck and the second deck. Above the main deck are seven levels that extend up through the main engine casing (fidley) and accommodations (house) structure. Below the second deck in the engine room space are five levels that extend down to the baseline. Figure 1 is a profile of the various decks and levels between frames 0-58. The schematic also shows the location of the sideport doors and the HFO service, settling and overflow tanks. Each frame is separated by 4.5 feet.

5. The accommodations area and navigation bridge are located aft of amidships immediately above the engine room space. Primary access to the engine room is via doors and ladders on the port and starboard sides of the main deck and second deck. A separate door and ladder leading to the aft section of the main engine room is located on the second deck. Secondary access (inport only) was through one of two large sideport doors located on the port and starboard sides of the hull at frame 47 on the third platform level. The height of these sideport doors above the design waterline is 13.5 feet. A small elevator provides access from all the accommodations levels to the port side entrance to the main engine room.

![Figure 1: Profile View of the After End of the Vessel (Frames 0-58)](image-url)
6. The center of the engine room is open between the third platform level and the main deck. The open area allows for the hoisting of machinery or other parts of the engine room equipment from various levels. In the forward section of the engine room is a grated elevated walkway that extends from the port and starboard pipe tunnels on the second deck. The port and starboard pipe tunnels extend for 720 feet (frames 25-185) to provide access to various piping and electrical equipment. The only entrances to the port and starboard pipe tunnels are through watertight doors located at frame 25 on the second deck. Along the aft section of the main engine room is the fidley that extends from the main deck up to the funnel top located above the bridge (07 level).

Human Factors

7. The vessel’s Certificate of Inspection requires the SSG CARTER to have at least 20 crew members on board. The engine room is considered minimally attended because the vessel is fitted with automated control and monitoring of the machinery systems as described in 46 CFR Part 62.50-20. Six of the vessel’s crew reported on board the vessel on or after 15 June while the vessel was moored at MOTSU. Four of these six were licensed officers, including the Chief Mate, the Chief Engineer, the First Assistant Engineer, and the Third Assistant Engineer. All the crewmembers held the proper Coast Guard and International credentials to fulfill their assignments.

8. The deceased Wiper, Horace Beasley, completed basic safety training as required by the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers, 1978, as amended in 1995 (STCW 95), on 08 October 1999 at the Maritime Institute of Technology & Graduate Studies (MITAGS). As part of the basic safety training, the Wiper had to demonstrate the ability to safely jump from a height of at least one meter into the water while wearing a lifejacket and keep afloat for one minute without wearing a lifejacket.

9. The Master, Robert Vranish, assumed his duties on 10 June 2001 just prior to the ship’s departure from Norfolk Shipyard (Norshipco). He has held a Coast Guard license to serve as a Master since 1990 and has sailed with Maersk for 17 years. He has spent time sailing as the Master on board a variety of ships, including sister vessels to the SSG CARTER within Maersk’s Military Prepositioning Program.

10. None of the licensed engineers had ever served on an ECON-class vessel like the SSG CARTER prior to this casualty.

11. The Chief Engineer, Louis Champa, Sr. has worked for Maersk during the past two years serving on board a gas-turbine ship. The majority of his 20-year career has been served on board machinery plants powered by heavy fuel oil.

12. The First Assistant Engineer, George Howard, has served with Louis Champa previously on two vessels. Although he holds a license to sail as Chief Engineer, he has only done it twice since 1987.
13. Of all the licensed engineering officers, the Second Assistant Engineer, Peter Donat, had the most experience with the plant on the SSG CARTER since he had served on board continuously since late February, 2001.

14. The deceased Third Assistant Engineer, Paul Powell, was previously assigned to a gas-turbine ship while working for Maersk. He received the initial issue of his Coast Guard license in June, 1999.

15. The Wiper, Horace Beasley reported on board the SSG CARTER on 16 May, 2001.

16. During the watch that ended with this casualty, the vessel was manned with the following engineering personnel assigned to the duties listed:

   Chief Engineer – Louis Champa, Sr.; non-watchstander
   First Assistant Engineer – George Howard; watchstander
   Second Assistant Engineer – Peter Donat; dayworker
   Third Assistant Engineer - Paul Powell; dayworker
   Electrician – Donald Hastings; dayworker
   QMED – not filled
   Wiper – Horace Beasley; dayworker

17. Nine days prior to the casualty, the QMED, Bobby Taylor, was discharged from the vessel due to a sprained ankle. His replacement had yet to report on board. According to the SSG CARTER’s Station Bill, the QMED is assigned the duty to set fire boundaries.

Safety Management Plan Requirements

18. Maersk has an established fleet-wide shipboard familiarization training program for all crew members assigned to their ships to fulfill the requirements of the STCW Code, Section A-VI/1. According to the company’s Safety Management Plan, the Master is responsible for ensuring that newly assigned crew members, or those serving in assigned positions for the first time, receive this on board familiarization training. The training is divided into two categories: 1) those that need to be completed before the ship sails and, 2) other miscellaneous checks. The mandatory pre-sail items include review of abandon ship station and duties, location of personal floatation devices, and location of fire station and duties. The Master testified that it should take no longer than two hours to complete the pre-sail items. In addition to these required pre-sail items, the familiarization form for the licensed engineers includes a line item to review lock out and tag out procedures for the machinery equipment. The Maersk form does not include a requirement to complete familiarization training for identifying emergency escape routes as required by STCW Code, Section A-VI/1-2.

19. The vessel’s Safety Management Plan states that the Chief Mate is responsible for ensuring that all of the vessel’s firefighting and damage control equipment is maintained and that the crew is properly trained in its use. In addition, the Plan requires the Chief Engineer to inform the Master when any of the vessel’s equipment is not maintained in good working order. The Chief Engineer is responsible for ensuring that all of the engine department personnel are
familiar with lockout/tagout procedures and they are aware of escape routes from shipboard spaces where engine personnel may be assigned to work.

20. Once a crew member completes all the required items, the Chief Mate makes a report to the Master. The Master then signs a letter documenting the dates that the familiarization items were completed. A review of the signed letters for the crew on the SSG CARTER revealed the following:

a. All the pre-sail items for the deck department were completed on 13 June and all other miscellaneous items were signed on 21 June;
b. All pre-sail items for the stewards department were completed on 13 June and all other miscellaneous items were completed on 19 June;
c. All pre-sail items for the engineering department were completed on 9 June and all other miscellaneous items completed on 10 July, with exception of the First Assistant Engineer Howard;
d. Both pre-sail and all other line items for First Assistant Engineer Howard were completed on 10 July;
e. The completion dates for the pre-sail items for the Chief Engineer and Third Assistant Engineer preceded their reporting dates by six and nine days respectively; and
f. There was no indoctrination letter on file for the Chief Mate who arrived on board on 2 July.

21. The Master testified that the indoctrination completion dates for the First Assistant Engineer were the same because his original letter was lost. The amount of days it took to complete the pre-sail items ranged in time from 15 days for the deck crew, 20 days for the steward department staff, and over three months for the Second Assistant Engineer and Electrician. The Master claims that all the forms for the engineers were lost and had to be redone after the ship sailed from Norfolk based on his recollection of what the previous Chief Mate told him. The Master testified that it should take about two weeks to complete all the familiarization items.

22. The Third Mate testified that the crew received training on the location of all the Emergency Escape Breathing Apparatus (EEBA) as part of the lifesaving equipment familiarization.

23. During the morning fire drill held on 14 July, everyone mustered (with exception of the Master who remained on the bridge) at repair locker #1 located inside the port pipe tunnel. The Station Bill required everyone to muster, including the Wiper, at repair locker #1 during a fire. A review of the Station Bill determined that it was consistent with the guidance set forth in Navigation and Vessel Inspection Circular 7-82 and SOLAS 74 (1983 Amendments), Chapter III, Part C, Regulation 53. Two fire hoses were charged using the emergency fire pump. The Chief Mate had everyone move to repair locker #2 located on the 03 level passageway to hold a training session. Several lectures were given on various topics to include use of portable extinguishers, confined space entry, hypothermia, and a review of the repair locker locations. No training was provided on how to activate the fixed CO2 system or instructions on how to complete a muster. The Chief Mate testified that he informed all hands, after consulting with the Master, that they were to muster at repair locker #2 for future fire and abandon ship emergencies before they secured from the drill. The Master informed the Chief Mate to make the appropriate changes to the Station Bill. The change was not made
on the Station Bill before the fire.

Post-Casualty Drug Testing

24. Post-casualty drug testing was completed for the Master, Chief Engineer, First Assistant Engineer, Second Assistant Engineer, and Electrician at Dosher Memorial Hospital in Southport, NC. All tests were negative. It was not possible to take blood or urine samples from the deceased due to the extent of burns on the Third Assistant Engineer and the advanced state of decomposition for the Wiper. Alcohol testing was not completed on the crew due to their prolonged involvement in the firefighting efforts. Preliminary interviews conducted on all crew members during the latter stages of the firefighting effort revealed that no individuals were or had been consuming alcohol on the day of the fire.

Norshipco Shipyard Period – Surveys and Exams

25. Maersk purchased the SSG CARTER in late February, 2001 from Sea-Land, Inc. The ship was subsequently brought to Norfolk Shipyard Company (Norshipco) facility in Norfolk, VA to complete a drydock, renew its hull and machinery classification certificates and Certificate of Inspection, and upgrade its cargo handling equipment. The upgrades included installation of four new self-unloading container cranes and large neoprene cocoons on the main deck to maintain a dehumidified atmosphere in four cargo holds (numbers 10, 11, 14, 15).

26. A team of American Bureau of Shipping (ABS) surveyors worked from 12 March to 13 June to complete the following surveys: drydocking, tail shaft, annual hull, annual machinery, annual automation, Alternate Compliance Program, Safety Equipment, Safety Construction, International Oil Pollution Prevention, Load Line, and a special 5-year hull survey. The ship has been enrolled in the Coast Guard’s Alternate Compliance Program (ACP) since 1995. Maersk had a Safety Management Plan (revision 19, dated 26 January 2001) in place for the SSG CARTER but had yet to complete any audits for issuance of a Safety Management Certificate (SMC) as part of the International Safety Management (ISM) program. The deadline for the SSG CARTER to receive its SMC is 01 July, 2002. The two ABS surveyors who completed the majority of the exams were Charlie Hughes and Mark Patricola, both from the Norshipco field office. No outstanding conditions of class were issued as a result of their surveys. The ship was issued all the proper international certificates and classification society documents for carriage of cargoes on an international route.

27. As part of the process to renew the Safety Equipment Certificate, the fire protection systems were tested and operated satisfactory. The systems tested included the newly installed smoke detection system in the cargo holds, the smoke detection system in the engine room, the fixed low-pressure CO₂ system, and the main/emergency fire pumps. The fire control plan was verified through independent confirmation of the various fire and life saving equipment throughout the vessel.

28. Surveyor Mark Patricola completed tests of the remote shutdown for the engine room ventilation fans, and tested the general alarm and the public address systems. Random tests were completed on the machinery control systems to include checks of various indicators and alarms. Based on their testimonies, neither Mark Patricola nor Charlie Hughes tested the control actuators
connected to the fuel oil quick-closing valves in the engine room. The ABS checklist for renewal of the Safety Equipment Certificate includes a line item on page 5 to test remote controls for shutting off machinery fuel supplies. This item was checked “yes” and signed by Charlie Hughes in ABS report #NN11731-A dated 25 June 2001. The ABS surveyors were not aware that the crew had repaired O-rings on the fuel quick-closing valves due to air leaks in early March.

29. As part of the ACP examination, Chief Warrant Officer (CWO) Ken Edmundson (assigned to MSO Hampton Roads) visited the vessel on 04 and 08 June. On 04 June, CWO Edmundson held a 16-minute long simulated fire drill in the ship’s galley to evaluate the crew’s response readiness and effectiveness. The general alarm was tested along with the emergency fire pump, which provided an effective supply of water from two separate hose stations. The emergency fire pump is rated to provide 440 gallons per minute at a pressure of 145 psi. The main fire pump is rated to provide 1,200 gallons per minute at a pressure of 145 psi. The crew mustered at repair locker #2 located on the 03 level while responding to the simulated galley fire. CWO Edmundson reported that crew was knowledgeable on how to use the fire equipment, dress out a four-person fire team and secure the ventilation and electrical power to the galley.

30. The ship’s crew prepared for the drill by holding various training sessions during the week prior to the fire drill. The crew held a simulated fire drill in the crew’s lounge on the 04 level. The crew mustered at the repair locker on the 03 level and led uncharged fire hoses to put out the fire. Following the fire drill, the crew received training on self-contained breathing apparatus use and confined space entry. Total time spent on the practice drill and lectures was 70 minutes.

31. A total of eight worklist items were issued by CWO Edmundson following his inspection on 04 June. Three of the worklist items were related to fire protection standards for the vessel, to include the following:

   a. no approved fire/safety plan (plan under review for approval by ABS);
   b. accommodations stairwell self-closing fire doors were not closing completely; and
   c. manual holdbacks were installed on fire doors within the accommodations spaces.

32. CWO Edmundson returned to the vessel on 08 June to clear all eight worklist items. He confirmed that Mark Patricola completed his review of the fire/safety plan and observed that the fire doors closed properly and all the manual holdbacks in the accommodations spaces were removed. The other remaining five worklist items were also cleared on 08 June. He issued a Temporary Certificate of Inspection on 12 June with no CG-835 deficiencies.

33. The ship departed Norshipco in the early morning hours of 13 June and arrived at MOTSU the following day.

Existing Problems with the Fuel Venting System

34. To prepare the ship for the drydock, all the diesel oil and heavy fuel oil (HFO) had to be removed from all of the storage and service tanks. While transferring the HFO from the service tank to a barge alongside, the barge tankerman informed the Chief Engineer at that time, Larry Gustafson, that the flow rate was below normal. Chief Gustafson confirmed the slow rate by
looking at the tank level indicator panel in the engine room control station. When Chief Gustafson opened the service tank’s sounding tube (1-1/2” diameter) to gauge the fuel level, he confirmed that the service tank was under a vacuum by hearing air flow into the tube. He left the sounding tube open to complete the transfer. In addition, Chief Gustafson ordered the First Assistant Engineer at that time, Joe Serva, to clean the flame screen attached to the HFO service tank vent. Eventually, the transfer rate improved to complete the transfer. Chief Gustafson wasn’t sure if the normal flow was attained as a result of keeping the sounding tube open or cleaning the flame screen. Chief Gustafson did not investigate if any other part of the HFO service tank vent arrangement was the source of the transfer problems. The crew did not inform the ABS surveyors of the problems with the fuel tank vents during any of their surveys completed between March and June, 2001.

35. The Second Assistant Engineer, Peter Donat, testified that the diesel oil service tank became overpressurized when the ship was receiving diesel oil following the drydock. The Second Assistant Engineer knew that this condition was not due to clogged flame screens because they had been either cleaned or replaced previously by the crew. In order to clear the diesel oil service tank vent line, the Second Assistant Engineer worked together with the Electrician, Donald Hastings, and the QMED, Bobby Taylor, to disassemble the intermediate fuel oil (IFO) and diesel oil (DO) vent collection chamber located on the 01 level. The IFO/DO vent collection chamber was disconnected and lowered to the deck in order to clean the rust particles that were mixed with accumulated diesel oil residue. In order to remove the rust from the diesel oil service tank vent line, the vent line was disconnected at the flange located just above the tank top. Compressed air was used to clear the diesel oil service tank vent line. This work was completed entirely by the crew while the ship was on shore power at the shipyard with no machinery operating in the engine room.

**Continued Fuel Tank and Vent Problems at MOTSU**

36. The engine room crew did not have any additional problems with overpressure or vacuum developing in the fuel tanks during the one-day voyage from Norfolk, VA to the Military Ocean Terminal Sunny Point (MOTSU) in Southport, NC on 13 June.

37. During the first two weeks of July, the Second Assistant Engineer noticed that the HFO settling tank developed an overpressure condition that progressively became worse. This condition was apparent during the transfers of HFO from either the port or starboard overflow tanks to the settling tank. The Second Assistant Engineer realized he needed to correct the problem when the pressure built up inside the HFO settling tank to the point where the release of pressure, upon opening the sounding tube to the HFO settling tank following a transfer, sprayed droplets of oil on his coveralls and glasses.

38. The Second Assistant Engineer discussed the overpressure situation and possible options to correct the problems with the Chief Engineer, Louis Champa, and the First Assistant Engineer, George Howard. One option discussed was to cut open the 3” HFO settling tank vent line to remove the blockage. Since the crew could not pinpoint the exact location of the blockage, they planned to cut open the vent line at several different places and use water pressure or a snake to clear the blockage. The crew had to cut into the vent line because there were no flanged
connections in the line, which could be opened to provide access. The First Assistant Engineer ordered dresser couplings to repair those sections of the vent line that would be cut.

39. The second option discussed was to disconnect the HFO vent collection chamber (a.k.a. “HFO Christmas tree”) from the various vent and drain lines it serves so it could be lowered to the deck to access the vent lines for cleaning. The HFO Christmas tree is held in place by two flanged connections mounted to the starboard bulkhead on the 01 level. Once removed, the crew would have unrestricted access to the settling tank vent line so that compressed air could be used to clear the blockage. This process proved to be successful in clearing the diesel oil service tank vent in the shipyard several months earlier. With the consent of the Chief Engineer, the First Assistant Engineer ordered the Electrician, Donald Hastings, to disconnect the vent lines connected to the HFO Christmas tree on 11 July or 12 July. The Electrician worked alone to disconnect four vent line flanges and two drain line flanges that are labeled “disconnected” on Figure 2 below.

40. Also shown (on the right side of sketch) is the smaller IFO/DO vent collection chamber that was disconnected and cleaned by the crew while in the shipyard. The blank flange was found attached to the IFO/DO vent collection chamber by only one bolt. It was not determined why the crew did not secure this flange prior to the fire.

![Figure 2: Schematic of HFO and IFO/DO Vent Collection Chambers](image)

41. After disconnecting the flanges, the Second Assistant Engineer and Electrician both observed significant amounts of rust particles inside the vent lines and the HFO Christmas tree. On most of the vent lines, over 50% of the inside pipe diameter was blocked by the buildup of rust. After disconnecting the flanges, the engineers realized that the small gap between the flange openings precluded the use of compressed air to clear the blockages as performed on the diesel vent collection system. The Electrician testified that he disconnected the flanges from the HFO
Christmas tree before the engineers had traced all the vent lines to determine which tanks they served. The vent lines disconnected on the right side of the HFO Christmas tree (marked G and H in Figure 2) had yet to be traced by any of the engineers. The Electrician placed the various bolts and nuts removed from the disconnected flanges into a coffee can on the 01 level deck several feet from the HFO Christmas tree. The licensed engineers did not foresee any risks associated with keeping the vent lines open and the HFO Christmas tree disconnected while machinery was operating in the engine room. Neither the HFO transfer pump nor any of the suction or discharge valves associated with the transfer system were “tagged” out to prevent them from being operated by the engine room crew. The Chief Engineer did not inform the Master that the vent lines attached to the HFO Christmas tree were disconnected.

42. On the same day the flanges were disconnected from the HFO Christmas tree, the Chief Engineer and Electrician completed a test to determine the extent of blockage within the HFO settling tank vent line. During this test, the Second Assistant Engineer transferred approximately six tons of HFO into the settling tank while the Chief Engineer and Electrician held their hands across the disconnected flange (marked D in Figure 2). The Chief Engineer and the Electrician only felt a little vapor flow across their hands during the test. Upon securing the transfer pump, the Second Assistant Engineer opened the sounding tube cap for the HFO settling tank and felt pressure escape from the sounding tube indicating the vent line was still partially blocked. The HFO Christmas tree and the IFO/DO Christmas tree were left in the condition indicated in Figure 2 prior to the fire.

**HFO Transfer Operations**

43. The Second Assistant Engineer, Peter Donat, was responsible for transferring and accounting for all the fuels (both diesel and HFO) on board the ship. The engine room crew, including Chief Engineer Gustafson and Chief Engineer Champa, relied upon the Second Assistant Engineer to handle all the activities associated with the handling of fuel on board the ship. As part of his duties, the Second Assistant Engineer took daily soundings from the HFO settling tank, HFO service tanks and the diesel oil service tank. He completed soundings of “secondary” tanks, to include the storage and overflow tanks, once per week.

44. Under normal conditions, the port and starboard overflow tanks located at frame 50 are empty. They are designed to collect HFO in case of accidental spillover while filling any of the HFO, diesel oil, or intermediate fuel oil tanks. The port overflow tank collects liquid from any one of the port side HFO storage tanks. The starboard overflow tank collects liquid from any one of the starboard side HFO storage tanks and any overflow from the HFO, diesel oil and intermediate fuel oil service and settling tanks in the engine room. Once HFO enters either of the two overflow tanks, the only way to empty them is to transfer the fuel into the HFO settling tank via the HFO transfer pump. Inside the HFO settling tank is a series of steam coils that are used to heat the HFO to help separate any water which may have collected while in the storage tanks. The decanted water can be drained from the bottom of the HFO settling tank. Additionally, the oil from the HFO settling tank is transferred through purifiers before entering the HFO service tank (day tank). The HFO service tank can only be filled directly from the HFO settling tank.
45. The HFO transfer pump can be controlled locally in vicinity of the pump on the second platform level or from the engine control room console. The HFO transfer pump circuit breaker and automatic/manual selector switch is located in the engine control room. The Second Assistant Engineer testified that he preferred to initially start the pump from the local station and then monitor the transfers from the engine control console since pump control is within close proximity of the tank level indicators (TLIs).

46. The Second Assistant Engineer reported that HFO had entered the port and starboard overflow tanks when the First Assistant Engineer at that time, Charlie McKenna, accidentally closed a storage tank fill valve while bunkering prior to the ship’s departure from Norshipco shipyard. The Second Assistant Engineer mentioned that the overfill occurred because the First Assistant Engineer mistakenly believed that the fill valve could be partially opened to control the flow. The valve was actually closed which caused the HFO to spillover into the two overflow tanks. Chief Engineer Gustafson testified that he was not aware that the First Assistant Engineer and the Second Assistant Engineer had problems during the bunkering operation.

47. Throughout the one-month period that the ship was moored at MOTSU, the Second Assistant Engineer was focused on removing the HFO from the port and starboard overflow tanks. He realized that the overflow tanks were not meant to serve as long-term storage tanks and wanted to drain them prior to the next bunkering operation. The only method to remove the oil from the overflow tanks was to transfer through the HFO transfer pump to the HFO settling tank. Transfer into the HFO settling tank could be completed automatically or manually. The automatic mode would activate the HFO transfer pump once a low level condition in the HFO settling tank was reached. Automatic control requires the transfer valves from the overflow tanks to the transfer pump, and the discharge valves from the transfer pump to the HFO settling tank to remain open. The HFO transfer pump selector switch in the engine control room would be set to the “automatic” position. The pump would automatically cycle on and off, without the crew’s knowledge, based on input from a series of float-type gauges located in the HFO settling tank. A manual transfer requires the HFO transfer pump to be turned on/off.

48. Within the engine control room, there are visual and audible alarms, called the Tank Level Indicator (TLI) system, that actuate when the bilges or any liquid storage, settling, or service tank has reached a high or low level. The TLI system is connected to two different types of sensors. One type is the float-type sensor (GEMS model) that measures and displays the liquid level for various intermediate fuel oil (IFO), ballast/bilge/potable water, and miscellaneous tanks. The other type is the pressure transducer (Weschler-model) used to measure the liquid levels in the HFO and diesel oil storage, service, and settling tanks. The high and low level set points for both models are preset by the engine crew and usually remain unchanged. When a tank level is outside the preset parameters, the alarm panel gauge lights on the engine room control panel will change from yellow to red. Additionally, an audible alarm will sound within the control room and throughout the engine room space to notify the crew. Once the audible alarm is actuated, a crew member has to go to the engine control room to silence the alarm by pressing a spring-loaded toggle switch to the “acknowledge” position. Acknowledging and silencing the audible alarm does not have any effect on changing the color of the level indicator lights.
49. The Second Assistant Engineer, Peter Donat, testified that he wedged the pencil (shown in Picture 1) in place to hold the TLI audible alarm toggle switch in the “acknowledge” position. He positioned the pencil in place several months before the fire because the TLI system was not functioning properly since the audible alarm was constantly sounding even though the tank levels were not at an alarm condition. The Second Assistant admitted that other pencils were used previously to hold the toggle switch in the “acknowledge” position. Chief Engineer Champa testified that he was not aware of any problems with the TLI system prior to the fire.

50. The Second Assistant Engineer stated that Maersk inherited problems with the TLI system when the ship was bought from U.S. Ship Management in February. Standards Calibrations, Inc. (SCI) from Chesapeake, VA, checked the TLI system while the ship was completing conversion work at Norshipco. In the SCI report dated 13 April, four of the vessel’s six fuel tanks using by the GEMS-type sensors were unsatisfactory due to failed operational tests and contaminated in-tank cables and transmitters. Mr. Bill Eager (SCI) reported that the cable jackets within each of these four tanks were saturated with fuel oil. In addition, 16 out of the other 39 GEMS sensors tanks had similar problems that resulted in unsatisfactory tests. The SCI report stated that alarm problems with the GEMS system would most likely go away once the tank equipment was repaired. Mr. Eager stated that the condition of the GEMS equipment would likely send a false alarm to the TLI receiver in the engine control room. SCI submitted their report to Mr. Andy
tertiary fires in the lower levels below. He stated that the only direct connection between the
damaged areas found on the upper and lower levels in the engine room were from oil dripping
down from above. He testified that the fires that burned on the lower levels were separate and
distinct from the fires located on the second deck and above.

205. The majority of the fire and heat damage sustained within the engine room and fidley was
limited to the areas between frames 23 and 35. According to the Mr. Rabuse (Maersk), the
fire caused an estimated $15 million in damages to the ship. Most of the heaviest damaged
areas were located on three decks between the main deck and the second platform deck.
Additional damage was noted in shaft alley which is located on the floor level. The areas
above the main deck, throughout the fidley and within the port and starboard pipe tunnels,
were covered with a thick layer of soot from the smoke generated by the fire.

206. Mr. Rabuse reported that the exhaust fan louvers located on the aft side of the fidley on the 06
and 05 levels were deformed from the heat that passed up through the fidley. He stated that
the manually controlled cables that close these louvers were intact but not working because
the louvers were warped. It could not be determined if this louvers were warped prior to the
Second Mate’s attempts to close them during the fire.

207. On the main deck and second deck levels, the steel gratings and handrails were severely
twisted and warped from the intense heat. The areas near the HFO settling tank on the second
deck suffered intense heat as evident by the warped steel bulkhead separating the incinerator
room to the main engine room and the damaged auxiliary boiler exhaust stack sheathing and
control panel. The steel bulkhead that forms the HFO settling tank was not warped. Mr.
Golder testified that steel melts at approximately 1700 degrees Fahrenheit and aluminum
melts at 1100 degrees Fahrenheit.

208. The flames and heat destroyed the set of access doors leading to the starboard supply fan
room on the main deck. Mr. Rabuse testified that the doors and framing had to be cut away
from the bulkhead because of severe distortion. The surrounding bulkheads in the vicinity of
the starboard supply fan room had paint missing and were buckled and warped. The two
starboard supply vent fan units had burned and were removed for restoration of the motors.
The pneumatic-actuated fire dampers attached to the four supply fan units (port and starboard
supply fan rooms) had to be replaced due to heat damage. The vent louvers for the four
supply fans along the exterior of the fidley on the 01 and 02 levels were distorted and
replaced. The port supply fan room doors did not sustain as much heat damage as the
starboard doors. The port doors only needed to be realigned following the fire.

209. Along the exterior on the main deck, the bulkhead that forms part of the engine room fidley
just forward of hold #19, is damaged and its paint blistered. The aft engine room bulkhead on
the second deck (which forms forward bulkhead for hold #19) was also damaged. Along the
second and third platform levels, the four access doors leading to the auxiliary generator room
had to be replaced. The forward bulkhead of the auxiliary generator room on the second
platform level was cracked. The entire 28-foot length of this bulkhead was replaced due to
the extent of the cracking.
210. The Class A self-closing fire screen door between the main engine space and the elevator room on the second deck level was renewed due to heat damage. The investigative team found a hold-back installed directly behind this door. Hold-backs are not permitted according to the regulations found in SOLAS 74 (1983 Amendments), Chapter II-2, Part C, Regulation 47. Mr. Rabuse reported that all hold-backs found on board the ship were removed during the post-fire repairs. The four watertight doors that form the exterior boundary of the main engine room along the port and starboard pipe tunnels on the second deck were replaced with quick-acting watertight doors to better accommodate closure in port. Mr. Rabuse testified that normal practice was to keep these watertight doors open while in port and close only at sea.

211. Mr. Rabuse testified that some of the quick-closing valves connected to the various fuel tanks throughout the engine room were repaired due to valve seat problems and bad springs. One of the quick-closing valves (he could not identify which one) was missing a control actuator altogether.

212. Along the floor level, the aluminum housings for the main engine lube oil pumps had melted. The 24" diameter stub shaft (between the main engine flywheel and intermediate shaft) had warped and was measured to be 3 millimeters out of tolerance. The cast iron plating along the aft section of the main engine block along with the foundation in the vicinity of the cylinder number one had to renewed due to severe heat damage.

213. Extensive electrical damage resulted from the fire including melted light fixtures, damaged power cables, and burned motor controllers.

214. The forward engine room bulkhead, designed to meet A-60 structural fire protection requirements, remained intact. There was no evidence of any direct flame impingement or effects from sustained elevated temperatures on this bulkhead which makes up the aft end of the port and starboard overflow tanks. This bulkhead is designed to A-60 standards to prevent heat from progressing forward to any potential explosive cargoes located within cargo hold #17. The paint along the main deck in the garage area (frames 33-48) had peeled from the intense heat in the engine room directly below. The paint on the main deck forward of frame 49 remained intact. The aft end of cargo hold #17 is at frame 50. The aft end of hold #16, where the explosive cargoes were stored, is at frame 59 which is approximately 25.5 feet forward of the areas where paint was peeling on the main deck.

**Condition of the Emergency Generator**

215. Mr. Rabuse testified that the emergency generator was examined and tested post-fire under a no-load condition. The emergency generator started and ran for a short period without any problems. Mr. Rabuse did not have any reason to explain why the emergency generator had shut down after running for approximately two hours during the fire. He had heard that one possible reason for the shut down was due to low lube oil pressure. The lube oil level, as well as the fuel oil level, were checked and confirmed to be adequate. Mr. Rabuse stated that one possible explanation for the shutdown was due to a faulty low lube oil pressure sensor. He had this pressure sensor replaced following the operational test.
CONCLUSIONS

1. The proximate cause of this casualty was human error on the part of the Second Assistant Engineer who failed to monitor the transfer of approximately 20 tons of heavy fuel oil (HFO) from the port and starboard overflow tanks to the HFO settling tank on the afternoon of 14 July. The approximate time the transfer started was 1530. As a result in failing to monitor this transfer, the HFO settling tank, and its vent cross connection to the main engine mixing tank, became filled with HFO. The HFO mixed with approximately one ton of diesel fuel oil contained in the main engine mixing tank and the oil mixture continued to flow up to HFO Vent Collection Chamber (a.k.a. Christmas tree) on the 01 level within the fidley. (Findings 43, 44, 45, 47, 53, 54, 55, 78, 82, 123, 124, 125, 126, 128, 129, 130, 131, 135, 137, 138, 143, 150, 153, 158, 160, 161, 169)

2. Part of the oil mixture flowed out from the main engine mixing tank vent line flange that was disconnected from the HFO Christmas tree and spilled onto the 01 level deck plating. Part of the oil mixture entered the HFO Christmas tree and flowed down through the partially blocked drain line to return to the HFO starboard overflow tank. The partially blocked drain line restricted the flow which allowed the oil mixture to spill through the drain line flange which was also disconnected from the HFO Christmas tree. The HFO did not flow up the HFO settling tank’s primary vent line because it was completely plugged with rust and debris. The oil mixture at first collected on the 01 level deck before eventually spilling over into the areas directly below within the fidley and main engine room areas. The oil mixture flowing through the main engine mixing tank vent line caused an installed “homemade” drain line to fail. This failure resulted in additional amounts of the oil mixture flowing directly on the second deck grating and areas below. (Findings 42, 140, 141, 142, 144, 145, 159, 163, 164)

3. The investigation could not determine the exact reason why the HFO settling tank was only 90% full following the fire. One possible theory is that HFO continued to flow from the top of the HFO settling tank through the vent collection system after the crew secured the HFO transfer pump. The HFO continued to flow due to the volumetric expansion of the oil and water mixture inside the HFO settling tank as a result of thermal heating. The investigation revealed that there was extreme heat present in the areas adjacent to the HFO settling tank. The investigation could not determine if the contents of the HFO settling tank became hot enough to expand to the extent necessary to increase the pressure inside the HFO settling tank and “force” approximately five tons of HFO up through the vent collection system. (Findings 101, 135, 138, 207)

4. The exact source for the ignition of the oil mixture could not be determined. The most likely source of ignition was the auxiliary boiler exhaust stack which passed within three feet of the HFO Christmas tree. Although the temperature of the auxiliary boiler exhaust stack at the time of the fire was hot enough to ignite the diesel oil component within the mixture, samples of insulation and scrapings removed from the boiler exhaust stack did not conclusively match the fuel oil samples analyzed. Other potential sources of ignition considered were the incinerator stack, the three ship’s service generator stacks and various lighting and power panels within the fidley. (Findings 156, 170, 171, 172, 173, 174, 175, 177)

5. The fire developed very rapidly and filled the entire engine room and fidley with fire, smoke and...
intense heat. The initial fire was most likely located in the vicinity of the HFO Christmas tree on the 01 level. The fire burned hot enough to consume the residual oil which flowed through the upper sections of the main engine mixing tank vent line and the HFO Christmas tree drain line. As the fire dropped down from the 01 level, secondary and tertiary fires readily ignited from the main deck down to the bilges. The damaged areas were consistent with a vertical “fall-down” type fire event contained within a longitudinal length of 32 feet. (Findings 84, 85, 87, 88, 91, 93, 95, 100, 146, 148, 176, 204, 205, 206, 207, 208, 209, 212, 213)

6. Although the two Chief Engineers denied knowing of any problems with the TLI system before the fire, it is reasonable to expect them to have seen the pencil in the alarm panel based on their daily workings in the engine control room and the conspicuous nature of the violation. Both Chief Engineers failed to report the problems with the TLI system and insist on making the proper repairs prior to the fire. (Findings 49, 50, 51)

7. The steam coil leak that was discovered in the main engine mixing tank after the fire did not contribute to this casualty. (Findings 132, 134, 149)

8. The smoking vapor seen by the Master venting from the starboard overflow tank vent piping on the main deck was due to the heated HFO which flowed through the line connected to the main engine mixing tank. (Findings 101, 131, 154)

9. The crew’s failure to close the fire and watertight doors to set boundaries around the engine room allowed heavy smoke to advance into the port pipe tunnel, the Fire Control Room, and the CO2 room. This black smoke made it difficult for the crew to access the repair locker #1 equipment and to see the posted instructions on how to activate the CO2 system. (Findings 62, 67, 69, 90, 105, 106, 110, 111)

10. The attempt by the Third Mate and Electrician to release the CO2 from the Fire Control Room failed because they did not open the series of valves in the correct order to properly activate the system. Their attempt to activate the system was hindered by the amount of smoke in the space which made it difficult to see the posted instructions. (Findings 62, 63, 105, 185, 186, 196)

11. The Electrician’s second attempt to release CO2 from the CO2 room failed because the fire had already damaged the cable providing electrical power to the re-release button for the starboard remote control station. This damaged cable ground shorted the normal and emergency power supplies to the instrument panel which prohibited the main block valve from opening. The “whoosh” sound heard by the Electrician and shoreside firefighter was not the flow of CO2 through the discharge lines but rather the flow of pilot gas to a series of pneumatic valves and time delay bottle. No CO2 was released into the engine room to fight the fire. (Findings 64, 67, 68, 106, 187, 188, 189, 191, 192, 193, 194, 195)

12. The change in density and color of the smoke seen exiting from the fidley exhaust louvers was not due to the release of CO2. More than likely, the change in color and intensity was due to the effect the shoreside firefighters were having in attacking the fire from within the engine room. (Findings 106, 116, 117)
13. The design of the main stop valve installed on top of the CO₂ storage tank for the Ginge-Kerr systems makes it difficult to determine whether the valve is open or closed. (Finding 73, 183)

14. The in-line ball valve installed along the line which supplies CO₂ gas to the siren was closed prior to and during the fire event. This closed valve prevented the CO₂ siren from working when the Electrician opened the two pilot valves in the CO₂ room. (Findings 72, 75, 106, 184)

15. U.S. Coast Guard Headquarters (G-MVI-3) failed to enforce their standing policy to prohibit the use of electrical power to control the operation of CO₂ discharge valves during their review of the low-pressure CO₂ system. G-MVI-3 did not order the in-line ball valve to the engine room CO₂ siren to be “locked open” or removed so as to allow automatic operation as required by the regulations. G-MVI-3 did not order any design changes to the three-step procedure to activate the CO₂ system from the remote control stations. The “acceptance” letter for the Ginge-Kerr system was issued by G-MVI-3 despite knowing about the system’s dependence on electricity for normal operation, the presence of the in-line ball valve, and the three-step process to activate. At least 11 other sister vessels to the SSG CARTER may have the same type of Ginge-Kerr system as the SSG CARTER with erroneous acceptance letters issued by G-MVI-3. (Findings 1, 57, 58, 59, 60, 61, 62, 189, 190)

16. The fire team on the 03 level was ineffective in attacking the fire because the Second Mate, who was the designated team leader, was overwhelmed by smoke and not able to stay with the team for a prolonged period. Without any further guidance or direction, the team was limited to maintaining a fire boundary. (Findings 93, 95)

17. The loss of water pressure in one of the two fire hoses used by the fire team on the 03 level was due to the opening of several 2.5” fire hoses by the crew on the main deck. The emergency fire pump could not provide enough pressure to the four opened 2.5” hoses on the main deck and the two 1.5” hoses on the 03 level. The Second Mate acted quickly by starting the main fire pump from the bridge, increasing the water pressure so that additional fire hoses could be used. [Findings 29, 95, 96, 97, 100, 101]

18. An unrestricted flow of air entered the engine room through the opened starboard supply fan room doors, the opened port and starboard sideport doors, and the opened fire doors around the engine room. Smoke and hot gases exited from the top of the fidley through the opened exhaust vent louvers. With the fire burning in an area close to the bottom of the fidley, a chimney effect was created which provided the fire with a sufficient supply of oxygen to continue burning. The chimney effect helped to keep the fire in a relatively concentrated area and did not allow the heat of the fire to spread forward to affect the ammunition located in the cargo holds. (Findings 2, 83, 98, 99, 100, 109, 110, 111, 179, 180, 181, 182, 205, 206, 208, 210, 214)

19. If the low-pressure CO₂ system had been discharged properly with the sideport doors open, the CO₂ gas would have been displaced by the large amounts of air passing through the vent openings. The degree of reduced effectiveness could not be determined. (Findings 181, 182)

20. The port and starboard sideport doors remained open prior to the fire for ventilation purposes. There are no regulations or Maersk company policy which requires these doors to be closed while
the vessel is inport. The opened starboard side port door provided the shoreside firefighters with
derirect and convenient access to the engine room to fight the fire. (Findings 5, 83, 116)

21. The #1 and #3 ship’s service generator main engines continued to operate for 4.5 hours after the
fire started because the HFO and diesel oil service tank quick-closing shutdown valves failed to
close properly. The cause of the failure was due to lack of maintenance on the spring that closes
the valve once pneumatic pressure is released. The engine crew failed to perform the required
maintenance on a majority of the quick-closing valves to make sure the springs would operate
correctly. (Findings 83, 90, 96, 121, 178, 211)

22. The two ship’s service generators and the emergency generator continued to run concurrently and
provide normal and emergency power to the ship’s circuits. It cannot be determined how long the
two ship’s service generators continued to provide power. The emergency generator ran for
approximately two hours before shutting down. The exact cause for the failure of the emergency
generator could not be determined. The most likely reason is that a faulty low lube oil pressure
switch shut down the generator prematurely. (Findings 94, 96, 118, 119, 215)

23. The ABS surveyor failed to complete tests of the remote shutdown for the fuel quick-closing
valves in accordance with ABS and Coast Guard policy. The surveyor incorrectly documented in
the ABS condition report that these fuel valves were tested on the ABS classification report.
(Findings 26, 28)

24. The ABS surveyor failed to witness a full operational test of the low-pressure CO2 system in
accordance with the ACP program. His lack of experience with the design and operation of low-
pressure systems contributed to his inability to recognize that the in-line ball valve to the siren was
closed. (Findings 70, 72)

25. Fire Protection Services, Inc. representatives failed to ensure that the in-line ball valve to the CO2
siren was open during their June, 2001 service exam. (Findings 70, 71, 72)

26. With the exception of the closed in-line ball valve on the siren line, the low-pressure CO2 system
was fully operational prior to the fire. (Findings 70, 71, 72, 73, 75)

27. The Third Assistant died as a result of smoke inhalation while he was attempting to escape from
the fidley. The thick smoke and intense heat which developed quickly within the fidley made it
difficult for him to breath and see as he made his way down from the exhaust fan platform near top
of fidley. Once he reached the 03 level, he became disoriented and could not find the fire door
leading from the fidley to the galley spaces. He tripped over a ladder, lost consciousness, and died.
Although the time of his death could not be determined, he most likely died within the first few
minutes of the fire. (Findings 79, 93, 95, 107, 196, 197, 198)

28. The Wiper died from drowning in the Cape Fear River. There was no indication that smoke
inhalation was a contributing cause for his death. The Wiper entered the Cape Fear River, without
a lifejacket, by jumping approximately 15 feet from the opened port sideport door to escape from
the burning engine room. It could not be determined if he attempted to hold onto the yellow line
that was attached to a ladder rung in the vicinity of the port sideport door to help him remain afloat.
His inability to swim or tread water for a short period of time prevented him from reaching the two ring buoys that were tossed to him by the First Assistant. It was not determined why the Wiper could not remain afloat even though he met the basic safety survival standards. The First Assistant and the nearby CG 41-foot boat took the appropriate actions in attempting to rescue the Wiper. (Findings 8, 103, 104, 200, 202)

29. The exact escape route taken by the Wiper to get from the separator room on the second platform level to the port sideport door was unknown. The most likely route would have been up the ladder in front of the main engine to the third platform level. Directly in front of him was the ladder that led up to the port pipe tunnel on the second deck. It could not be determined why the Wiper chose not to climb this ladder to safety. (Findings 80, 199)

30. There is evidence to support that the Wiper knew about the location of the Emergency Escape Breathing Apparatus (EEBA) and lifejacket located in the engine control room. He would have passed these items during his daily activities in the engine control room since his arrival on 16 May. Documentation records showed that he received the proper pre-sail shipboard familiarization training which includes a review of the location of lifejackets and EEBA s throughout the ship. (Findings 20, 22, 201)

31. The broken valve hand wheel to the starboard side international shore connection prevented the shoreside team from using the ship’s firemain system. The Incident Commander, Chief Scott Brown, was not aware that the ship was fitted with another international shore connection on the port side. (Finding 114)

32. The MOTSU fire tug took too long to arrive on scene to provide assistance to the Incident Commander. The two fire tugs from MOTSU and the City of Wilmington did not have any direct impact in helping to control or extinguish the fire. (Finding 120)

33. The Incident Commander overcame the shortfall of not having a fire control plan available by relying on the crew to identify major pieces of equipment and location of access doors. (Findings 113, 115)

34. The thermal imaging cameras used by the shoreside firefighters enabled them to go on the offensive and attack the fire since the camera helped identify the hot spots. (Finding 121)

35. There is no evidence that any member of the crew was influenced by drugs or alcohol at the time of this fire. (Finding 24)

36. There is evidence to support that the Master failed to complete his duties as the person designated to be “In Command” of a fire response. He did not order all the crew to gather at one central location, he did not order or receive an accurate and timely muster, he failed to set fire boundaries, he was not aware that two crew members attempted to enter the burning engine room without fire hoses, he did not assign duties to crew members in accordance with the Station Bill, and he failed to establish working communications with the fire parties. (Findings 76, 85, 91, 101, 102, 105, 107, 108, 110, 118)
37. The Master failed in his attempt to start the main fire pump from the bridge. He did not know the proper procedures to open the suction and discharge valves prior to starting the pump. The Master’s inability to be able to open the fire pump valves led to a 10-minute delay before water was provided to the firemain. This delay was minimized by the quick actions taken by the Chief Mate to place the emergency fire pump on-line. (Findings 12, 92, 94, 96)

38. There is evidence to support that the Master acted with negligence by waiting 35 minutes to issue the order to release the low-pressure CO2 into the engine room space. This lengthy delay allowed the fire to continue to burn that resulted in increased temperatures within the engine room spaces. This increased temperature would have reduced the effectiveness of the CO2 to extinguish the fire since it does not have good “cooling” properties. (Findings 102, 105)

39. The Master was aware that the opened port and starboard sideport doors would reduce the effectiveness of the CO2 system, but made no attempts to close them before giving the order to activate the CO2 system. (Findings 83, 100, 102)

40. There is evidence to support that the Master falsified the crew’s ship familiarization forms under the company’s Safety Management Plan. (Findings 20, 21)

41. There is evidence to support the Chief Engineer acted with negligence by not tagging out the HFO transfer pump and associated valves to ensure the transfer system remained off-line while the HFO Christmas tree flanges were disconnected for maintenance while continuing to operate machinery. (Findings 37, 38, 39, 41, 77, 83)

42. There is evidence to support the Chief Engineer failed to inform the Master that the HFO Christmas tree vent lines were disconnected due to clogged fuel vent lines in the engine room in violation of the company’s Safety Management Plan. (Findings 19, 41)

43. There is evidence to support that the Chief Engineer violated the regulation found in SOLAS 74 (1983 Amendments), Chapter II-2, Part C, Regulation 47 by allowing a holdback to be installed on the Class A self-closing fire door between the engine room and the elevator room on the second deck. (Finding 210)

44. There is evidence to support the Second Assistant Engineer acted with negligence when he jammed a pencil into the “acknowledge” switch on the TLI alarm panel several months prior to the fire. The Second Assistant silenced the audible alarm several months prior to the fire to avoid the constant nuisance alarms triggered by false signals received from cables which were contaminated with fuel within several of the HFO tanks. The pencil prevented the audible warning that would have notified the engine crew that the HFO settling tank exceeded the 95% level prior to the fire. This advanced warning may have prevented this casualty from occurring. The Second Assistant was the only one aware that a transfer was in progress and was not present in the engine control room to monitor the TLI gauges. (Finding 48, 49, 50, 127)

45. There is evidence to support that Mr. Andy Rabuse and Mr. Dan Welch failed to make the proper repairs to the TLI equipment required for periodically unattended engine room manning allowances prior to the vessel leaving the shipyard. Mr. Rabuse incorrectly assumed that the TLI
sensor problems were limited to only calibration errors. Mr. Rabuse did not fully investigate the extent of the problems by not checking with the Second Assistant Engineer. (Findings 50, 51, 52)

46. There is evidence to indicate that the Chief Mate failed to ensure the crew received training and knew how to operate the CO\textsubscript{2} system, including “emergency” procedures to activate the system in case of power failure. (Findings 23, 76, 105)

47. There is evidence to indicate that the Chief Mate failed to ensure that the low-pressure CO\textsubscript{2} system was properly maintained and ready for use in accordance with the company’s Safety Management Plan. (Findings 19, 74, 183)

48. Except as noted above, there is no evidence of actionable misconduct, inattention to duty, negligence, or willful violation of law or regulation on the part of licensed or documented persons, nor evidence that failure of inspected material or equipment, nor evidence that any personnel of the Coast Guard, or any other government agency or any other person, contributed to his casualty.

**RECOMMENDATIONS**

1. That the American Bureau of Shipping review guidance and training programs provided to their surveyors to ensure they are instructed on and familiar with how to complete operational tests for fixed firefighting systems, especially the low-pressure types.

2. That the U.S. Coast Guard initiate a rulemaking to the marine safety regulations which would require the ability to remotely close sideport doors which form part of the hull from a position outside the protected space during an emergency. The U.S. Coast Guard should propose a similar amendment to the SOLAS rules.

3. Should the efforts to pursue regulations fail, Maersk Line Limited and other vessel operators with similar sideport door arrangements, should include a policy in their respective Safety Management Plans to keep these doors closed when the engineers are not receiving machinery supplies or equipment. The policy should specifically prohibit allowing these doors to remain open for ventilation purposes only.

4. That the U.S. Coast Guard initiate a rulemaking to amend the marine safety regulations to require, at a minimum, monthly fire drills where the fire is simulated in the engineroom and the crew is required to simulate activating the fixed firefighting system. The U.S. Coast Guard should propose a similar amendment to the SOLAS rules.

5. That the U.S. Coast Guard initiate a rulemaking to the marine safety regulations that would require a position indicating device to readily determine if the main stop valve on a low-pressure CO\textsubscript{2} tank is open or closed. The U.S. Coast Guard should propose a similar amendment to the SOLAS rules.

6. That Military Ocean Terminal, Sunny Point (MOTSU) fire brigade obtains at least one thermal imaging camera and become familiar with the general arrangements of each vessel that calls at their facility.
7. That U.S. Coast Guard Marine Safety Office Wilmington, NC and MOTSU work together to reduce the response time for MOTSU’s fire tug from four hours to one hour, and update the Southern Coastal North Carolina Marine Firefighting Contingency Plan.

8. That the Officer in Charge, Marine Inspection Wilmington, NC consider initiating administrative Suspension and Revocation actions against the licenses issued to the following individuals: Robert Vranish (Master), Louis Champa, Sr. (Chief Engineer), William McDonald (Chief Mate) and Peter Donat (Second Assistant Engineer).

9. That civil penalty actions be taken against Maersk Line Limited for failing to correct the problems associated with the TLI sensors.

10. That Commandant (G-MOC-2 and G-MSE-4) work together to determine which ships still have the Ginge-Kerr low-pressure CO2 system and notify the owners of the potential problems associated with the failure of the main block valve to open in case of power failure. G-MSE-4 should review and approve all design and operation plan modifications to include removal of the electric solenoid valve. Additionally, G-MSE-4 should review and approve modifications to reduce the number of steps (from three to two) needed to release CO2 from the remote control stations. During the interim, G-MOC-2 should inform the owners, as well as ABS surveyors and USCG marine inspectors, on the importance of ensuring the crews on ships fitted with a Ginge-Kerr system know how to operate the bypass valve in case of power failure.

11. That Maersk Line Limited amend their shipboard familiarization program to be consistent with the guidance set forth by STCW 95, Section A-VI/1.

12. That a copy of this investigative report be provided to the following organizations: Military Sealift Command, Military Ocean Terminal Sunny Point, Maersk Line Limited, American Bureau of Shipping, International Maritime Organization, U.S. Coast Guard Marine Safety Office Wilmington, NC, and the estates of Mr. Paul Powell and Mr. Horace Beasley.

13. That this investigation be closed.

R. J. RAKSNIS