NATIONAL TRANSPORTATION SAFETY BOARD
Public Meeting of December 12, 2017
(Information subject to editing)

Sinking of US Cargo Vessel SS *El Faro*
Atlantic Ocean, Northeast of Acklins and Crooked Island, Bahamas
October 1, 2015
NTSB/MAR-17/01

This is a synopsis from the NTSB's report and does not include the Board's rationale for the conclusions, probable cause, and safety recommendations. NTSB staff is currently making final revisions to the report from which the attached conclusions and safety recommendations have been extracted. The final report and pertinent safety recommendation letters will be distributed to recommendation recipients as soon as possible. The attached information is subject to further review and editing to reflect changes adopted during the Board meeting.

Executive Summary

On October 1, 2015, during Hurricane Joaquin, the US-flagged cargo ship SS *El Faro* sank in the Atlantic Ocean about 40 nautical miles northeast of Acklins and Crooked Island, Bahamas. All 33 people on board perished. *El Faro* was owned by TOTE Maritime Puerto Rico and operated by TOTE Services, Inc. Damages from the sinking were estimated at $36 million. Before the loss of *El Faro*, the last comparable US maritime disaster was the sinking of the US bulk carrier *Marine Electric* off the coast of Virginia in February 1983, in which all but three of the 34 persons aboard lost their lives.

The NTSB's investigation of the sinking identified the following safety issues:

- Captain's actions
- Use of noncurrent weather information
- Late decision to muster the crew
- Ineffective bridge resource management
- Inadequate company oversight
- Company's safety management system
- Flooding in cargo holds
- Loss of propulsion

- Downflooding through ventilation closures
- Need for damage control plan
- Lack of suitable survival craft

The report also discusses other issues, such as the automatic identification system, voyage data recorders, and the Coast Guard's Alternate Compliance Program.

Findings

1. The mechanical condition or operation of *El Faro*'s boilers, steering, electrical power, and machinery were not factors in the accident.

2. The work being performed by the riding gang of foreign nationals did not contribute to the sinking of *El Faro*.

3. Neither improper securement of the trailers and containers nor inadequate maintenance of the vessel's cargo-securing gear contributed to the vessel's initial list.

4. Cargo shifting was not a major factor in the vessel's initial list.

5. The medical fitness of the *El Faro* crew and any prescription medication use by the crew were most likely not factors in the accident.

6. The captain's decision to depart Jacksonville was reasonable considering the availability of options to avoid Tropical Storm/Hurricane Joaquin.

7. There is no evidence that the vessel suffered a hull break or other significant structural failure while on the ocean surface that was a factor in the accident.

8. A rogue wave was not a factor in the sinking of *El Faro*.

9. The initial list was caused by an increasing wind on the vessel's beam generated by Hurricane Joaquin.

10. The port list, coupled with the vessel's motion, most likely caused air to enter the bellmouth of the suction pipe to the lube oil service pump, which resulted in a loss of oil pressure that caused the main engine to shut down.

11. The level of lube oil in the main engine sump was not maintained in accordance with the vessel's operations manual, which increased the propulsion system's susceptibility to loss of oil pressure.

12. If the company had provided guidance to the engineers about the list-induced operational limitations of the engine as well as about raising the level of lube oil in the main engine sump before or during heavy weather, the additional quantity of oil in the sump would

have kept the suction pipe submerged at greater angles of inclination and increased the likelihood of maintaining propulsion.

13. Increasing the minimum athwartships angle of inclination requirements for both static and dynamic conditions would provide an additional margin of safety for vessels exposed to high winds and large sea states.

14. The crew was most likely unaware of the operational limitations on the main engine from a sustained excessive list.

15. If the ship's officers had known the maximum static list angle at which the main propulsion engine would operate, they would most likely have attempted to reduce the initial list sooner and possibly avoided the loss of propulsion.

16. A watertight scuttle to cargo hold 3 on the second deck was open, allowing the unintended ingress of water and violating the ship's watertight envelope.

17. If the second deck access hatch (scuttle) had been fitted with a remote open/close indicator at a manned location, such as the bridge, the crew would have known that the watertight hatch to cargo hold 3 was open.

18. Because the automobile-lashing arrangement on *El Faro* did not meet the requirements of the vessel's approved cargo-securing manual, automobiles were more likely to shift from vessel motion in heavy weather.

19. The introduction of water to cargo hold 3, combined with the vessel's motion, led to failure of some lashings and automobiles becoming unsecured.

20. It is likely that the seawater piping below the waterline to the vessel's emergency fire pump in cargo hold 3 was inadequately protected from impact and was struck by one or more cars that had broken free of their lashings.

21. Impact damage to the seawater piping below the waterline to the emergency fire pump in cargo hold 3 most likely led to flooding in the hold, which significantly compromised the vessel's stability.

22. The rate of flooding in cargo hold 3 exceeded the design capacity of the bilge pumps and therefore did not lower the water level in the hold, despite continued pumping during the accident sequence.

23. Crewmembers in the engine room were most likely alerted to water in cargo hold 3 by the installed bilge alarm system.

24. New cargo vessels should be equipped with, and existing cargo vessels should be retrofitted with, bilge high-level alarms in all cargo holds that send audible and visible indication to a manned location.

25. All the watertight and weathertight ventilation closures to the cargo holds most likely remained open throughout the sinking sequence.

26. Vessels should not have operational requirements to maintain weathertight or watertight ventilator closures in an open position when the same closures are treated as closed when the vessel's stability and load line are assessed.

27. Had the vessel's stability booklet or CargoMax software identified the vessel's downflooding points, the ship's officers might have closed the cargo hold ventilation openings.

28. About 40 minutes before the sinking, seawater most likely entered the ventilation ducting to several main cargo holds, exacerbating the flooding already under way in cargo hold 3 and accelerating the sinking.

29. If a damage control plan had been available and the crew trained in its use, the crew would have been better able to promptly plan for and address the flooding scenario encountered during the casualty.

30. Existing cargo vessels should have the same damage control plans and booklets as are required for newly built vessels to assist crews in damage and flooding situations.

31. Approval by a classification society of damage control plans and booklets would provide an independent check to ensure uniformity and compliance with requirements.

32. A damage control plan would have helped the captain of *El Faro* assess the flooding situation.

33. The damage stability module in the CargoMax software on *El Faro* could have provided timely vessel stability information to the officers for the damage conditions the vessel experienced.

34. The original passage plan's straight-line course at departure from Jacksonville would lead directly into the storm's predicted path.

35. Although there is no direct evidence that the company applied pressure regarding the vessel's schedule, inherent pressure could have influenced the captain's decision to continue on despite the weather.

36. *El Faro* was receiving sufficient weather information for the captain's decision-making regarding the vessel's route.

37. Although up-to-date weather information was available on the ship, the *El Faro* captain did not use the most current weather information for decision-making.

38. The captain should have returned to the bridge after the second and third mates called him to gain a better awareness of the changing weather situation.

39. The captain did not take sufficient action to avoid Hurricane Joaquin, thereby putting *El Faro* and its crew in peril.

40. By failing to adequately consider the suggestions of the ship's junior officers to alter the passage plan and failing to alter his decision to proceed, the captain endangered *El Faro* and its crew.

41. The concepts of bridge resource management were not implemented on board *El Faro*.

42. The company's failure to ensure the implementation of bridge resource management contributed to the sinking.

43. The company's safety management system was inadequate and did not provide the officers and crew with the necessary procedures to ensure safe passage, watertight integrity, heavy-weather preparations, and emergency response during heavy-weather conditions.

44. The company did not have an effective process for evaluating the performance of its officers.

45. The company did not have an effective training program for the use of the CargoMax stability instrument, including its damage stability module.

46. Training in heavy-weather operations, including advanced meteorology and advanced shiphandling, from which the captain was exempt, might have provided him with additional information to consider while evaluating options and might have resulted in a different course of action.

47. The company did not have an effective officer training program for the use of the ship's Bon Voyage System weather information software.

48. The company did not ensure that *El Faro* had a properly functioning anemometer, which deprived the captain of a vital tool for understanding his ship's position relative to the storm.

49. The company subscribed to the Rapid Response Damage Assessment service, although not required, but did not train the crew in its use.

50. The company did not monitor the position of *El Faro* relative to the storm and did not provide the captain with support for storm avoidance and heavy-weather preparations during the accident voyage.

51. The company failed to assess the risk posed by Hurricane Joaquin to *El Faro*.

52. The company's lack of oversight in critical aspects of safety management, including gaps in training for shipboard operations in severe weather, denoted a weak safety culture in the company and contributed to the sinking of *El Faro*.

53. *El Faro*'s stability booklet should have included downflooding angles and windheel criteria to increase the officers' awareness of the ship's vulnerabilities in heavy weather, such as unintentional flooding and listing.

54. Neither the Coast Guard nor the classification society adequately assessed the vessel's stability booklet to ensure that it contained critical information detailed in Coast Guard regulations and guidance.

55. Coast Guard Navigation and Inspection Circular (NVIC) 4-77 (*Shifting Weights or Counter Flooding During Emergency Situations*) should be revised to include specific guidance regarding the dangers of taking corrective action if Ro/Ro cargo is adrift or the decks are wet.

56. The Coast Guard's Alternate Compliance Program is not effective in ensuring that vessels meet the safety standards required by regulations, and many vessels enrolled in the program are likely to be operating in substandard condition.

57. The 2005–2006 conversion of *El Faro* to carry load-on/load-off containers and the associated increase in draft should have been designated a major conversion by the Coast Guard.

58. For inspected vessels in coastal, Great Lakes, or ocean service, having their lifesaving appliances regularly reviewed for compliance with current standards would improve crew survivability.

59. The captain's decision to muster the crew and abandon ship was late and may have reduced the crew's chances of survival.

60. The severe weather, combined with *El Faro*'s list, made it unlikely that the lifeboats could be boarded or launched.

61. The vessel's open lifeboats would not have provided adequate protection even if they had been launched.

62. Survivability would be increased if open lifeboats on all vessels remaining in service were replaced with enclosed lifeboats that adhered to the latest safety standards.

63. Survivability would be increased if new cargo vessels were equipped with stern-launched freefall lifeboats, where practical.

64. The severe weather, combined with *El Faro*'s list, made it unlikely that the liferafts could be launched manually or boarded by crewmembers once in the water.

65. Search-and-rescue efforts were carried out as effectively as possible given the extreme weather conditions in the days following the accident.

66. Because of differences in latitude and longitude formatting between Inmarsat-C and the Coast Guard's search-and-rescue optimal planning system (SAROPS), the last known position of *El Faro* according to SAROPS was 23 nautical miles from the actual position.

67. Although position errors did not affect the outcome of search-and-rescue efforts after *El Faro* sank, position information should adhere to a standardized format to eliminate similar errors in future accidents.

68. The use of older emergency position indicating radio beacons (EPIRBs) such as the one on *El Faro* that do not transmit global positioning system (GPS) positions reduces positional accuracy in search-and-rescue operations.

69. Providing all persons employed on board vessels in coastal, Great Lakes, and ocean service with personal locator beacons would enhance their chances of survival.

70. The poor audio quality and poor placement of the voyage data recorder (VDR) microphones aboard *El Faro* inadequately recorded conversations on the navigation bridge, which impeded investigators' ability to accurately transcribe the recording.

71. The most effective performance testing of voyage data recorder (VDR) audio quality would take place while the ship is under way using its main source of propulsion.

72. *El Faro*'s voyage data recorder (VDR) system was not configured or required to capture both sides of internal phone calls, which prevented investigators from hearing the engineering officers' communications with the bridge.

73. To ensure optimum sound quality for accident investigation, it is vital that all very-high-frequency radios used for ship operations be recorded by individual inputs on the ship's voyage data recorder (VDR).

74. The annual performance test for *El Faro*'s voyage data recorder (VDR) was inadequate because the technician did not replace the locator beacon's battery even though it would expire before the next performance test.

75. The postaccident recovery of *El Faro*'s voyage data recorder (VDR) was greatly hampered because the battery had expired about 4 months before the sinking and the beacon was silent during the search.

76. The design of the Global Maritime Distress and Safety System equipment used on *El Faro* allows erroneous ship positions to be sent in emergency alerts.

77. Increased reporting and improved transmission of meteorological and oceanographic data from vessels at sea would significantly improve the availability of vital information to enhance weather awareness, forecasting, and advisory services aimed at improving mariner safety.

78. Because of the significant benefit that the automatic identification system (AIS) could provide in improving the quantity of weather reports from ships globally, a "proof-of-concept" project is warranted to establish its viability.

79. If the "proof-of-concept" project recommended in this report establishes that the automatic identification system (AIS) can deliver, in a single message, (1) meteorological and oceanographic data obtained directly from both automated instrumentation and humans on board vessels at sea, (2) vessel position and time of observation, and (3) other important metadata, via satellite and land-based receivers, to global meteorological authorities via the Global Telecommunications System with acceptable time delay, AIS must be utilized immediately to improve the quantity of ship weather reports across the globe.

80. Expanding automatic identification system (AIS) message transmission capabilities to provide mariners with timely access to a variety of navigational, weather, and marine safety information by establishing new channels for the very-high-frequency data exchange system (VDES) is a prudent international effort.

81. Had the deck officers more assertively stated their concerns, in accordance with effective bridge resource management principles, the captain's situational awareness might have been improved.

PROBABLE CAUSE

The National Transportation Safety Board (NTSB) determines that the probable cause of the sinking of *El Faro* and the subsequent loss of life was the captain's insufficient action to avoid Hurricane Joaquin, his failure to use the most current weather information, and his late decision to muster the crew. Contributing to the sinking was ineffective bridge resource management on board *El Faro*, which included the captain's failure to adequately consider officers' suggestions. Also contributing to the sinking was the inadequacy of both TOTE's oversight and its safety management system. Further contributing factors to the loss of *El Faro* were flooding in a cargo hold from an undetected open watertight scuttle and damaged seawater piping; loss of propulsion due to low lube oil pressure to the main engine resulting from a sustained list; and subsequent downflooding through unsecured ventilation closures to the cargo holds. Also contributing to the loss of the vessel was the lack of an approved damage control plan that would have assisted the crew in recognizing the severity of the vessel's condition and in responding to the emergency. Contributing to the loss of life was the lack of appropriate survival craft for the conditions

RECOMMENDATIONS

New Recommendations

As a result of its investigation, the NTSB makes recommendations to the US Coast Guard, the Federal Communications Commission, the National Oceanographic and Atmospheric Administration, the International Association of Classification Societies, the American Bureau of Shipping, Furuno Electric Company, Ltd., and TOTE Services, Inc.

To the U.S. Coast Guard:

1. Revise regulations to increase the minimum required propulsion and critical athwartships machinery angles of inclination. Concurrently, requirements for lifeboat launching angles should be increased above new machinery angles to provide a margin of safety for abandoning ship after machinery failure.

2. Propose to the International Maritime Organization (IMO) that design maximum operating angles of inclination for main propulsion machinery and other critical shipboard equipment be included in damage control documents, stability instruments and booklets, and in the safety management systems for all applicable vessels.

3. Propose to the International Maritime Organization (IMO) that all watertight access doors and access hatch covers normally closed at sea be provided with open/close indicators both on the bridge and locally.

4. Propose to the International Maritime Organization (IMO) that on new and existing vessels, seawater supply piping below the waterline in all cargo holds be protected from impact.

5. Propose to the International Maritime Organization (IMO) to require that new cargo vessels be equipped with bilge high-level alarms in all cargo holds that send audible and visible indication to a manned location.

6. Propose to the International Maritime Organization (IMO) to require that existing cargo vessels be retrofitted with bilge high-level alarms in all cargo holds that send audible and visible indication to a manned location.

7. Propose to the International Maritime Organization (IMO) that any opening that must normally be kept open for the effective operation of the ship must also be considered a downflooding point, both in intact and damage stability regulations and in load line regulations under the International Convention on Load Lines.

8. Require that information regarding openings that could lead to downflooding be included in damage control documents, stability instruments and booklets, and safety management systems for vessels subject to the intact stability criteria of Title 46 *Code of Federal Regulations* 170.170, regardless of the designation or treatment of such openings in intact stability calculations.

9. Propose to the International Maritime Organization (IMO) that existing cargo vessels operating under the International Convention for the Safety of Life at Sea (SOLAS) be required to have damage control plans and booklets on board that meet current standards.

10. Propose to the International Maritime Organization (IMO) that damage control plans and booklets required by the International Convention for the Safety of Life at Sea (SOLAS) be class-approved.

11. Publish policy guidance to approved maritime training schools offering bridge resource management (BRM) courses to promote a cohesive team environment and improve the decision-making process, and specifically include navigational and storm-avoidance scenarios.

12. Require recurring bridge resource management (BRM) training for all deck officers when renewing their credentials.

13. Require that all deck officers, at both operational and management levels, take a Coast Guard–approved meteorology course to close the gap for mariners initially credentialed before 1998.

14. Publish policy guidance to approved maritime training schools offering management level training in advanced meteorology, or in an appropriate course, to ensure that the curriculum includes the following topics: characteristics of weather systems including tropical revolving storms; advanced meteorological concepts; importance of sending weather observations; ship maneuvering using advanced simulators in heavy weather; heavy-weather preparations; use of technology to transmit and receive weather forecasts (such as navigational telex [NAVTEX] or weather-routing providers); ship-routing services (capabilities and limitations); and launching of lifeboats and liferafts in heavy weather.

15. Provide policy guidance to approved maritime training schools offering operational level training in meteorology to ensure that the curriculum includes the following topics: characteristics of weather systems, weather charting and reporting, importance of sending weather observations, sources of weather information, and interpreting weather forecast products.

16. Require that vessels in ocean service (500 gross tons or over) be equipped with properly operating meteorological instruments, including functioning barometers, barographs, and anemometers.

17. Revise Title 46 *Code of Federal Regulations* 170.110 (stability booklet) to require (1) stability instructions, guidance, or data on wind velocity used to calculate weather criteria; (2) list of closures that must be made to prevent unintentional flooding; (3) list of closures that must be made for an opening not to be considered a downflooding point; and (4) righting arm curve (metacentric height [GM]) table to note the angle at which initial downflooding occurs, and add a windheel table for vessel full load displacement or the condition of greatest vulnerability to windheel.

18. Update the guidance in Navigation and Inspection Circular 4-77 (*Shifting Weights or Counter Flooding During Emergency Situations*), based on the

circumstances of the *El Faro* accident, to include a warning that actions by ship personnel intended to correct a list can produce dangerous results if Ro/Ro cargo is already adrift and water has reduced the coefficients of friction for lashed cargo.

19. Conduct a complete review of the Alternate Compliance Program to assess the adequacy and effectiveness of the program.

20. Review and implement training of Coast Guard inspectors and accredited classification society surveyors to ensure that they are properly qualified and supported to perform effective, accurate, and transparent vessel inspections, meeting all statutory and regulatory requirements.

21. Review and revise the policy for major conversion determinations to consider load line (maximum) draft as a principal vessel dimension.

22. At regular intervals, not to exceed 20 years, review all lifesaving appliances on inspected vessels that are required by Title 46 *Code of Federal Regulations*, part 199, and require compliance with current standards.

23. Require that open lifeboats on all US inspected vessels be replaced with enclosed lifeboats that meet current regulatory standards, and freefall lifeboats where practicable.

24. To prevent future errors in converting position data such as occurred in the *El Faro* accident, work with manufacturers of Global Maritime Distress and Safety System (GMDSS) equipment, communication providers, and land earth stations to remove ambiguity from the Inmarsat-C distress alert position reports.

25. Require that all personnel employed on vessels in coastal, Great Lakes, and ocean service be provided with a personal locator beacon to enhance their chances of survival.

26. Modify guidance and training for marine inspectors to ensure that voyage data recorder (VDR) annual performance tests include the replacement of locator beacons prior to expiration and that audio used to evaluate quality is recorded while a ship is under way using its main propulsion unit.

27. Propose to the International Maritime Organization (IMO) to amend resolution MSC.333(90) to specify that "normal operations" are defined as when a ship is under way using its main propulsion unit and to assess voyage data recorder (VDR) problems, including not capturing both sides of internal phone calls on the bridge electric telephone and unrecorded very-high-frequency (VHF) communications, and identify steps to remedy them.

28. If the actions recommended to the National Oceanographic and Atmospheric Administration in Safety Recommendation M-[00-00] establish that the automatic identification system (AIS) is a viable means by which to relay (with

acceptable time delay) meteorological and oceanographic data and metadata from vessels at sea for use by global meteorological authorities, propose to the International Maritime Organization (IMO) that vessels required to use AIS also be equipped with meteorological and oceanographic sensors—including, at a minimum, sensors for barometric pressure and sea-surface temperature—that will automatically disseminate the data at high-temporal resolution via AIS.

29. Propose to the International Maritime Organization (IMO) that vessels under regulations of the International Convention for the Safety of Life at Sea (SOLAS) that are not already automatically disseminating meteorological and oceanographic data by other means be required to manually disseminate such data while at sea via the automatic identification system (AIS) or the Voluntary Observing Ship program at the times of 0000 UTC, 0600 UTC, 1200 UTC, and 1800 UTC.

To the Federal Communications Commission:

30. Require that all US vessels required to carry 406-MHz emergency position indicating radio beacons (EPIRBs) immediately discontinue the use of EPIRBs that are not global-positioning-system (GPS)-enabled.

31. Reserve the designated application-specific message (ASM) frequencies for very-high-frequency (VHF) data exchange system (VDES) use in US territories, as identified in International Telecommunications Union (ITU) recommendation ITU-R M.2092-0, and consistent with international efforts.

To the National Oceanic and Atmospheric Administration:

32. Coordinate with the National Weather Service, vessel operators, automatic identification system (AIS) service providers, and required onboard technology vendors, to perform a "proof-of-concept" project to establish whether AIS, or another suitable alternative, can practically deliver, in a single message (1) meteorological and oceanographic data obtained directly from automated instrumentation and manual observation on board vessels at sea, (2) vessel position and time of observation, and (3) other important metadata, by satellite and land-based receivers, to global meteorological authorities via the Global Telecommunication System with acceptable time delay.

To the International Association of Classification Societies:

33. Recommend to your members to increase the minimum required propulsion and critical athwartships machinery angles of inclination. Concurrently, requirements for lifeboat launching angles should be increased above new machinery angles to provide a margin of safety for abandoning ship after machinery failure.

34. Recommend to your members to require that design maximum operating angles of inclination for main propulsion machinery and critical shipboard equipment be included in damage control documents, stability instruments and booklets, and in the safety management systems for all applicable vessels.

35. Recommend to your members to require that all watertight access doors and access hatch covers normally closed at sea be provided with open/close indicators both on the bridge and locally.

36. Recommend to your members to require that on new and existing vessels, seawater supply piping below the waterline in all cargo holds be protected from impact.

37. Recommend to your members to require that new cargo vessels be equipped with bilge high-level alarms in all cargo holds that send audible and visible indication to a manned location.

38. Recommend to your members to require that existing cargo vessels be retrofitted with bilge high-level alarms in all cargo holds that send audible and visible indication to a manned location.

39. Recommend to your members that any opening that must normally be kept open for the effective operation of the ship must also be considered a downflooding point, both in intact and damage stability regulations and in load line regulations under the International Convention on Load Lines.

40. Recommend to your members that existing cargo vessels be required to have damage control plans and booklets on board that meet current standards.

41. Recommend that your members require that damage control plans and booklets required by the International Convention for the Safety of Life at Sea (SOLAS) be class-approved.

To the American Bureau of Shipping:

42. Enhance training of your surveyors to ensure that they are properly qualified and supported to perform effective, accurate, and transparent vessel surveys, meeting all statutory and regulatory requirements.

To Furuno Electric Company, Ltd.:

43. Update your Global Maritime Distress and Safety System (GMDSS) software to detect and correct user errors when entering ship positions using the global positioning system (GPS).

To TOTE Services, Inc.:

44. Establish standard operating procedures for heavy weather that address operational limitations and oil levels in critical machinery to ensure their continued operation.

45. Establish procedures for opening, closing, and logging all closures that make up a vessel's watertight envelope while the vessel is at sea.

46. Ensure that damage control plans and booklets are aboard all your load-lined vessels, and that officers and crewmembers are trained in their use.

47. Require senior officers to receive formal training approved by the manufacturer in all functions found in installed stability programs, including damage stability modules.

48. Revise your safety management system and bridge resource management programs to contain detailed polices, instructions, procedures, and checklists to mitigate the risks of severe weather to your vessels.

49. Conduct an external audit, independent of your organization or class society, of your entire safety management system to ensure compliance with the International Safety Management (ISM) code and correct noted deficiencies.

50. Require your vessels to be equipped with properly operating meteorological instruments, including functioning barometers, barographs, and anemometers.

51. Institute a formal company process to provide independent weather routing, passage-planning assistance, and vessel position monitoring.

52. Provide formal and recurrent training to your deck officers on the public and commercial weather information systems provided on board each vessel to ensure that the officers are fully knowledgeable about all weather information sources at their disposal and understand the time delays in the information provided.

53. Provide shoreside management and vessel senior personnel with training in the Rapid Response Damage Assessment program and standard operating procedures, to include requirements to conduct annual drills and submit departure stability conditions for each vessel on each voyage.