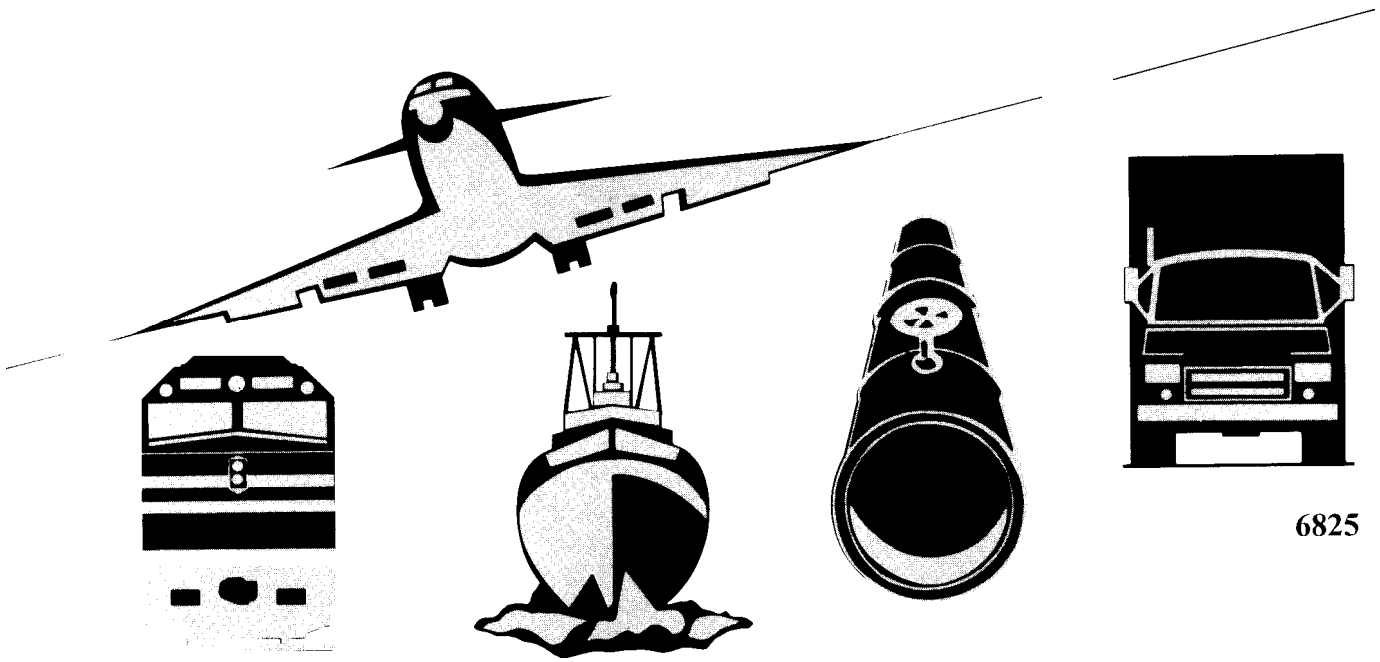
PB97-916402
NTSB/MAR-97/01/SUM

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

MARINE INCIDENT SUMMARY REPORT

NEAR GROUNDING OF THE LIBERIAN TANK SHIP *PATRIOT*
BAY OF CAMPECHE, MEXICO
OCTOBER 15,1995



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NEAR GROUNDING OF THE LIBERIAN TANK SHIP *PATRIOT*, BAY OF CAMPECHE, MEXICO OCTOBER 15, 1995

MARINE INCIDENT SUMMARY REPORT

Adopted: April 8, 1997
Notation 6825

NATIONAL
TRANSPORTATION
SAFETY BOARD

Washington, D.C. 20594

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National Transportation Safety Board
Washington, D.C. 20594

MARINE INCIDENT SUMMARY

Vessel:	Tank ship ***Patriot,*** Liberian registry, LR9006904, 798 feet long, 53,772 gross registered tons, built 1992
Accident Type:	Near-grounding incident
Location:	Bay of Campeche, Mexico
Date:	October 15,1995
Time:	Between 0300 and midnight
Owner/Operator	Conoco Shipping Company, Inc. Houston, Texas
Property Damage:	$100,000 (est.)
Injuries:	None
Complement:	27 crew

On October 15, 1995, the Liberian-registered motor vessel ***Patriot,*** a 95,000 deadweight-ton[1] tank ship (see figures 1 and 2), came within 10 miles (2-3 hours) of grounding on the north side of the Yucatan Peninsula near Campeche, Mexico, while navigating in rough seas and high winds associated with Hurricane Roxanne. Had the grounding occurred, it could have resulted in significant damage to the ship's structure, injuries or deaths among the 27 crewmembers, and damage to the environment. The vessel was en route from Galveston, Texas, to Dos Bocas, Mexico, when the near-grounding incident occurred.

In its investigation, the Safety Board identified the following safety issues: the master's decisionmaking, Conoco Shipping Company's monitoring of weather and its management of the movement of its vessels, and Conoco Shipping Company's shoreside support for shipboard decisionmaking. The following discussion includes a narrative description of the incident and the events leading to it, a consideration of the safety issues and their relationship to this incident, a list of conclusions drawn from the investigation of the incident, and a set of safety recommendations developed to help prevent a recurrence of incidents of this type.

[1]Deadweight tons refers to the total weight of cargo, fuel, and stores a ship can carry, measured in long tons (2,240 pounds).

Figure 1 -- Conoco Shipping Company tank ship *Patriot*

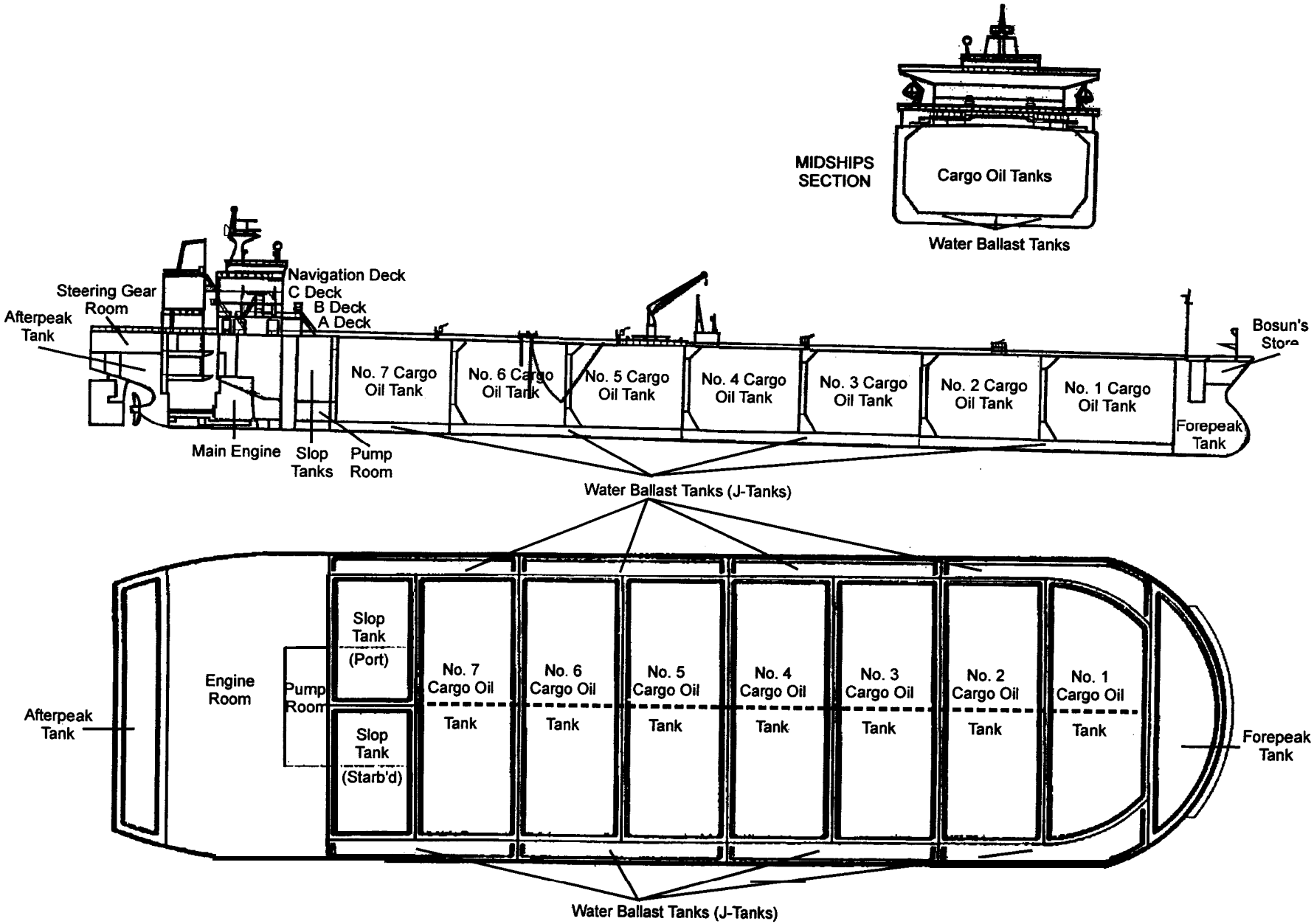

Figure 2 -- General layout of Conoco pp g mp Patriot-class tank ships

BACKGROUND OF INVESTIGATION

Because the near-grounding incident involving the ***Patriot*** occurred in international waters and did not involve a vessel of U.S. registry, the National Transportation Safety Board did not have jurisdiction to investigate, find probable cause, or make safety recommendations concerning the incident. However, Conoco Shipping Company, Inc., owner of the ***Patriot,*** was concerned about the potential damage to the company's ship, injuries to its crew, and damage to the environment that could have resulted from the ***Patriot's*** encounter with Hurricane Roxanne. In the interest of preventing similar incidents in the future, and recognizing the benefits of an independent review of the circumstances surrounding the near grounding of the ***Patriot,*** the company asked the Safety Board to undertake an investigation to determine the probable cause of the incident. The Safety Board, believing that investigations of incidents as well as accidents can yield significant safety lessons, determined that it would be in the interest of transportation safety to conduct an independent, public inquiry into the circumstances that led to this incident.

The Safety Board looked at both the shipboard and shoreside aspects of the incident. Conoco personnel were frank and honest in their response to the investigation and did not withhold any information that was requested of them. Moreover, Conoco management agreed with the Safety Board stipulation that no adverse action would be taken against any employee whose role in the incident might be questioned because of the Safety Board's scrutiny. The Safety Board commends Conoco Shipping Company for its willingness to invite scrutiny of its policies and procedures in the interest of transportation safety.

INVESTIGATION AND ANALYSIS

Pre-incident Events

At 2000 on October 9, 1995, the *Patriot*, operating in ballast (without cargo), departed Galveston (see figure 3) under orders to arrive at the Port of Dos Bocas on or before midnight on October 11, 1995, and there to load 500,000 barrels of crude oil. Shortly after departing Galveston, the *Patriot* received a National Weather Service (NWS) forecast[2] indicating that Tropical Storm[3] Roxanne had formed about 300 miles east-southeast of the Yucatan Peninsula. The forecast also indicated that the storm was expected to attain hurricane strength and move in a west-northwesterly direction toward the Yucatan Peninsula.

Over the next 36 hours, the *Patriot* received numerous NWS weather updates showing the storm increasing in strength as it approached the

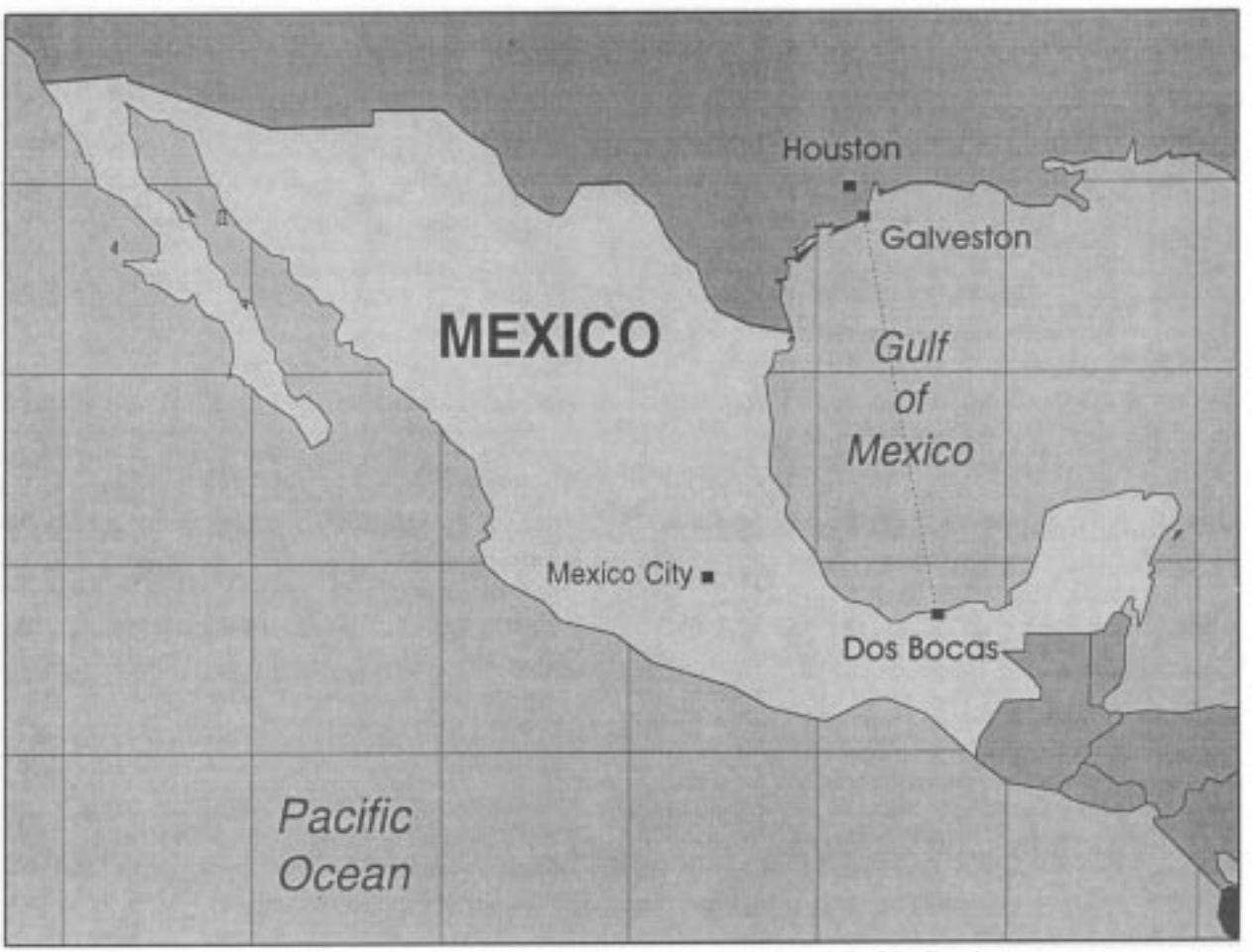

Figure 3 -- Route of Conoco Shipping Company tank ship *Patriot*

[2]The *Patriot* was fitted with a weather facsimile machine and NAVTEX receiver capable of receiving NWS weather forecasts and maps depicting the characteristics, location, heading, and speed of advance of forecast tropical storms and hurricanes. Forecasts were transmitted to the *Patriot* at 3-hour intervals.

[3]A tropical cyclone is a weather system that originates over tropical waters. Depending on wind speed, tropical cyclones are classified as either *tropical depressions* (maximum sustained surface wind speed of 33 knots), *tropical storms* (maximum sustained surface wind speed of 34 to 63 knots), or *hurricanes* (maximum sustained surface wind speed of 64 knots or more).

Yucatan Peninsula's east coast. At 2100 on October 10, Roxanne, now classified as a hurricane, made landfall about 100 miles south of Cancun, Mexico. (See figure 4.) During the next 9 hours, the storm moved in a westerly direction across the Yucatan Peninsula toward Dos Bocas at a speed of about 10 knots.

At 0853 on October 11, the agent[4] at Dos Bocas sent telexes to Conoco Shipping Company's main office in Houston and to the master of the ***Patriot,*** informing them that the port was closed because of gale-force winds[5] from Roxanne and that weather forecasts were predicting even stronger winds later that day. The message to company headquarters was received by the company's vessel coordinator, who passed it on to his supervisor, the director of chartering and traffic. The director of chartering and traffic passed the information to members of the company's tanker operations optimization team (TOOT).[6] The company took no further action. The message to the master asked that he provide the agent with the vessel's position, as well as his intentions. After checking the latest NWS forecasts, the master notified the agent that he intended to continue the voyage to Dos Bocas. (See figure 5.)

At 1500 on October 11, the ***Patriot*** arrived at the anchorage for the Dos Bocas single point mooring (SPM) facility located about 17 miles offshore, and the master tendered the vessel's notice of readiness (NOR).[7] The master said that, because of deteriorating weather and sea conditions, he chose not to anchor but to remain under way in the vicinity of Dos Bocas until weather and sea conditions improved. Between 1500 and 2000, sea condition's deteriorated sharply as Roxanne approached Dos Bocas. By 2030, the wind had increased to more than 100 knots, with the vessel rolling and pitching heavily in 20-to 30-foot seas.

At 0348 on October 12, the pitching and rolling of the ***Patriot*** became so severe that the vessel's main engine went into an overspeed condition and shut downs The engine was restarted and manually throttled down to slow ahead (50 rpm). According to the chief engineer, this speed reduction was necessary to reduce the probability that the main engine would again overspeed and shut down. Conoco management later informed the Safety Board that both the ***Patriot*** and its sister ship, the ***Guardian,*** had previously experienced main engine overspeed while operating in a light ballast condition in rough seas. The master and chief engineer on board the ***Patriot*** on October 12, 1995, were not on board the vessel during the past overspeed occurrences, and they stated that they had not been alerted to the problem before this incident.

The master was aware that one alternative for dealing with the overspeed condition was to load storm ballast into one or more of the vessel's cargo tanks.[9] Additional ballast would increase the vessel's draft and reduce the magnitude of rolling and pitching, thereby allowing engine rpm to be increased without creating an overspeed condition. (See figure 6.) At 0715 on October 12, the master ordered his

[4]Local agency representing the interests of Conoco and the charterer in the Port of Dos Bocas. The agent also acts as liaison between Conoco and local port authorities regarding such activities as the purchase of stores and bunkers, the transport of relief crews, and the loading/discharge of cargo.

[5]Winds in excess of 34 knots.

[6]*TOOT* comprised a group of senior members of Conoco management who oversaw day-to-day operation of the company's tank ship fleet. Shoreside team members included the marine superintendent, the engineering superintendent, the director of chartering and traffic, and the vessel coordinator.

[7]An *NOR*, tendered to officials at a loading/discharge port, signifies that a vessel has arrived and is ready, in all respects, to load or discharge cargo

[8]The main engine and direct-connected propeller shaft on the *Patriot* were programmed to automatically shut down if the shaft exceeded about 115 rpm. Normally, a governor regulates the main engine/propeller shaft speed and prevents overspeeding. In this case, however, the vessel's pitching motion brought the *Patriot's* propeller blades very close to the surface, thus reducing water resistance and resulting in a shaft acceleration that the governor could not correct in time to prevent engine shutdown.

[9]*Storm ballast* is saltwater ballast taken aboard to improve a vessel's seakeeping in rough seas. This ballast is in addition to the saltwater ballast the vessel normally carries.

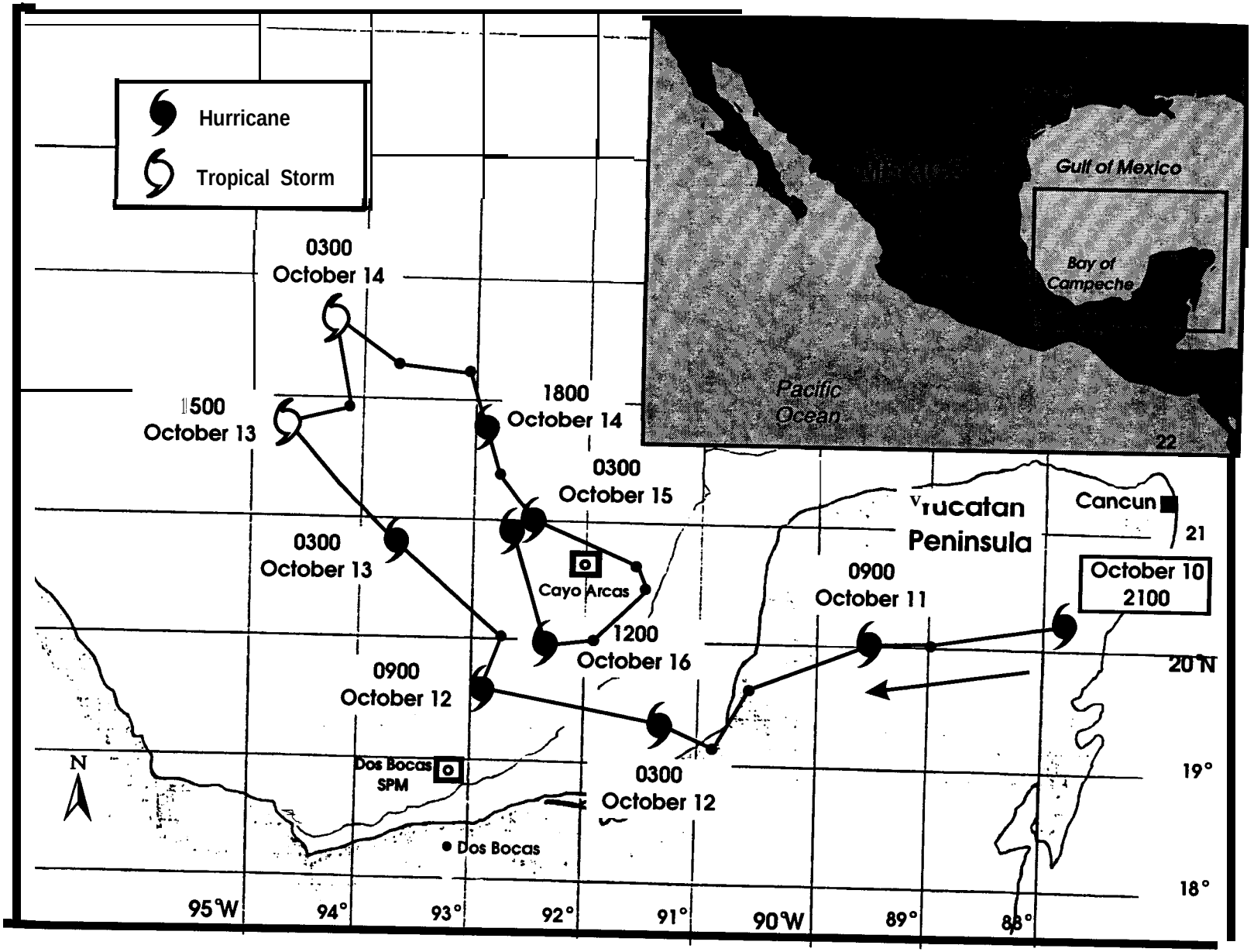

Figure 4- Approximate track of Hurricane Roxanne October 10-16,1995

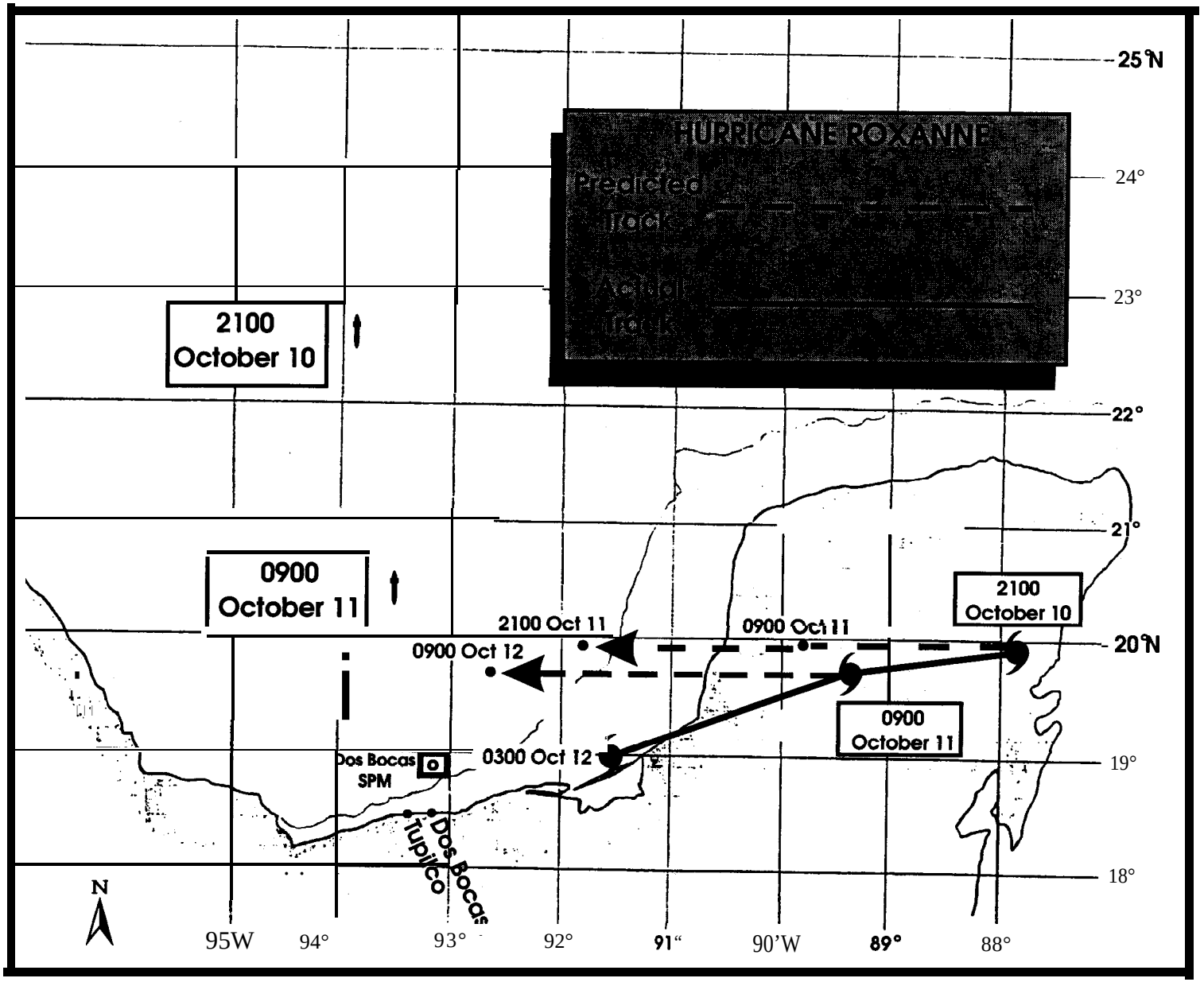

Figure 5- Relative positions of *Patriot* and Hurricane Roxanne when hurricane made landfall (2100 on October 10) and when *Patriot's* master made the decision to continue voyage toward Dos Bocas (0900 October 11)

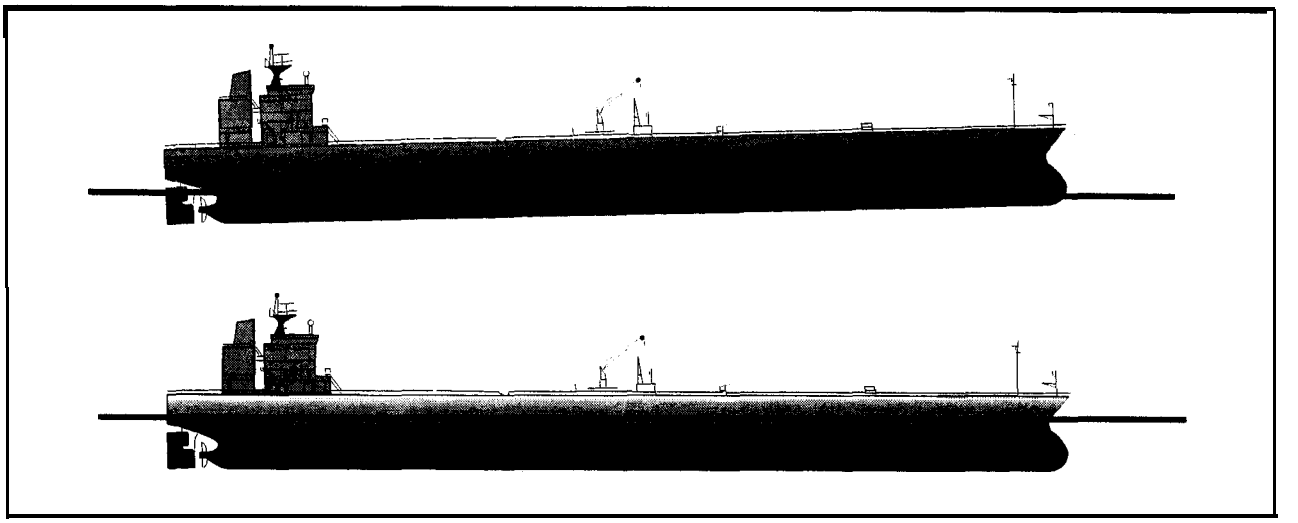

Figure 6- Approximate draft of Patriot-class tank ships when operating in light ballast condition (top) and when fully loaded (bottom)

chief officer to commence the loading of saltwater ballast into the No. 4 cargo oil tank.

Between 0900 and 1130, weather and sea conditions improved as Roxanne, now located about 60 miles north of the ***Patriot,*** was downgraded to a tropical storm. Shortly after the ***Patriot*** completed the loading of saltwater ballast (13 15), port authorities announced that the Port of Dos Bocas would soon reopen, To prepare for loading cargo, the master moved the ***Patriot*** offshore at about 1915 and began discharging storm ballast from the No. 4 cargo tank.[10]

Roxanne continued on a west-northwest heading through the evening of October 12. The 0300 October 13 NWS forecast showed the storm turning northward and weakening as it moved slowly offshore. By 1500 on October 13, the storm had moved more than 180 miles north and west of Dos Bocas and had been downgraded to a tropical storm. The NWS forecasts received during the morning of October 14, however, showed the storm regaining intensity. The 1200 and 1500 NWS forecasts on October 14 reported that Roxanne had regained hurricane strength, had turned, and was moving in an east-southeast direction toward Cayo Arcas. [11]

About 1700 on October 14, the Conoco engineering superintendent telephoned the master of the ***Patriot;*** he stated that his decision to call was prompted by an earlier conversation he had with the master of the ***Pioneer.***[12] The engineering superintendent and the master of the ***Patriot*** discussed the vessel's position in relation to Roxanne, on-scene weather and sea conditions, and whether storm ballast should be loaded into the No. 4 cargo oil tank. They did not discuss the overspeed problems experienced earlier in the voyage. According to the engineering superintendent, he was not concerned about the vessel's safety at that time because the master had told him "not to worry, that the vessel was handling the situation all right."

The Incident

By 0300 on October 15, the eye of Hurricane Roxanne had moved southeasterly to within 85 miles of the ***Patriot.*** At this point,

[10]The discharge of storm ballast was completed at 0200 on October 13.

[11]Cayo Arcas is an offshore oil production platform located 100 miles northeast of Dos Bocas.

[12]***The Pioneer*** was a sister vessel to the *Patriot* en route (in ballast) to Cayo Arcas, where it was to load a cargo of crude oil. According to the master of the *Pioneer,* his vessel had approached to within 55 miles of Cayo Arcas when it received the October 14 NWS forecasts (1200 and 1500) indicating that Roxanne had turned and was heading toward Cayo Arcas. Shortly after receiving the 1200 NWS forecast, the *Pioneer* turned onto a northeasterly direction and departed the area. At the time of the telephone call with Houston, the *Pioneer was* more than 175 miles north of the storm.

because the ***Patriot*** was essentially hemmed in between the storm and the shore with no easy avenue of escape (see figures 7 and 8), the master turned the vessel into the wind and waited for conditions to improve. During the early morning of October 15, watchstanders reported winds in excess of 130 knots and rough seas that caused the vessel to roll and pitch heavily. At 0421, the main engine once again went into an overspeed condition and shut down. Although the engine was quickly restarted, engine speed had to be limited to about 50 rpm.

About 0600, the master telephoned the engineering superintendent at. home and reported that he was having difficulty maneuvering his vessel. The engineering superintendent reported this "urgent matter" to his superiors. Meanwhile, the vessel's inability to move out of the storm's path and its proximity to land and nearby hazards to safe navigation prompted the master (at 0611) to order the second officer to transmit a series of distress messages via the vessel's INMARSAT A, INMARSAT C,[13] and VHF-FM radiotelephone. The distress calls were routed to the U.S. Coast Guard in New Orleans and to Conoco Shipping Company in Houston. The second officer also made calls for assistance to nearby vessels and to the Mexican Government. No immediate assistance was available because of the severity of the on-scene weather and sea conditions.

While the second officer was transmitting distress messages, the master ordered the chief officer to assemble all available crewmembers outside the radio room, where they were updated on the situation. At 0637, the master ordered his chief officer to once again begin loading saltwater ballast into the vessel's forepeak, afterpeak, and No. 4 cargo tanks. Later, the master decided to load additional saltwater ballast into the No. 7 port and starboard slop tanks. [14]

Deteriorating weather and sea conditions hampered efforts to load the storm ballast from the outset. According to the chief engineer, the rolling movement of the ***Patriot*** repeatedly activated the auxiliary steam boilers' low-water trip switches, resulting in the periodic shutdown of the vessel's two auxiliary boilers, which supplied steam to power the ballast pump.

Global Positioning System (GPS) fixes taken between 0600 and 0830 showed the ***Patriot*** being set by the wind and sea in a northeasterly direction toward shoals about 23 miles away. The waters in this area were littered with oil rigs and numerous uncharted hazards to safe navigation, such as underwater well-heads and pipelines. About 1030, the helmsman reported that the vessel was no longer responding to the rudder. Shortly thereafter (1043), the master participated in a conference call with senior Conoco Shipping Company management in Houston (the company president, the marine superintendent, the engineering superintendent, the manager of operations and engineering, the fleet safety officer, and others) and apprised them of the circumstances facing the ***Patriot,*** which at that time was about 15 miles west of the shoals off Campeche[15] and 40 miles from the eye of the storm.

Shortly after 1300, on-scene weather and sea conditions improved as the ***Patriot,*** now less than 10 miles west of the shoals off Campeche, entered the eye of Hurricane Roxanne. For the next 6 hours, the vessel reported light winds out of the south-southwest at 4 to 6 knots. The chief officer used this time to complete the loading of ballast. Almost as soon as the loading of the additional ballast was completed (1900), the ***Patriot*** passed through the wall of the eye,

[13] *1NM4RSAT A is the* original INMARSAT (satellite-based) communications system, which has been in operation since 1982. The system is based on analog techniques and is capable of global two-way voice-grade telephony (and voice-band data transfer), facsimile, and telex communications. *INM4RSAT C is* a digital satellite communications system, operating since 1991, that provides two-way store-and-forward messaging and distress alerting capability.

[14] *Slop tanks are* used to store oily residue resulting from the cleaning of cargo tanks.

[15] Campeche is located about 275 miles northeast of Dos Bocas, The city has no deepwater harbor. In addition, shoals located north and south of this city extend more than 45 miles into the Gulf of Mexico.

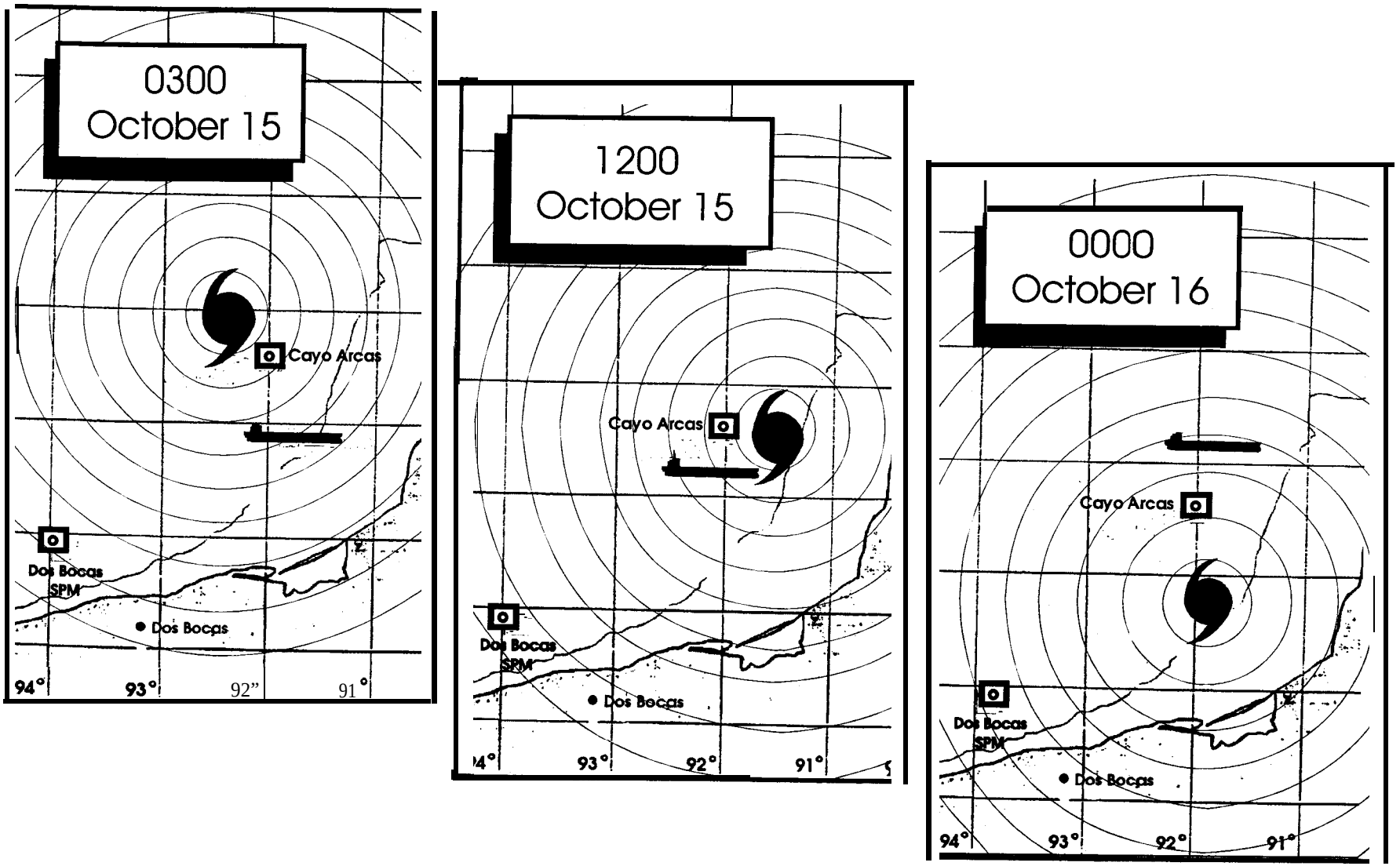

Figure 7- Relative positions of *Patriot* and Hurricane Roxanne during the tank ship's most serious encounter with the storm

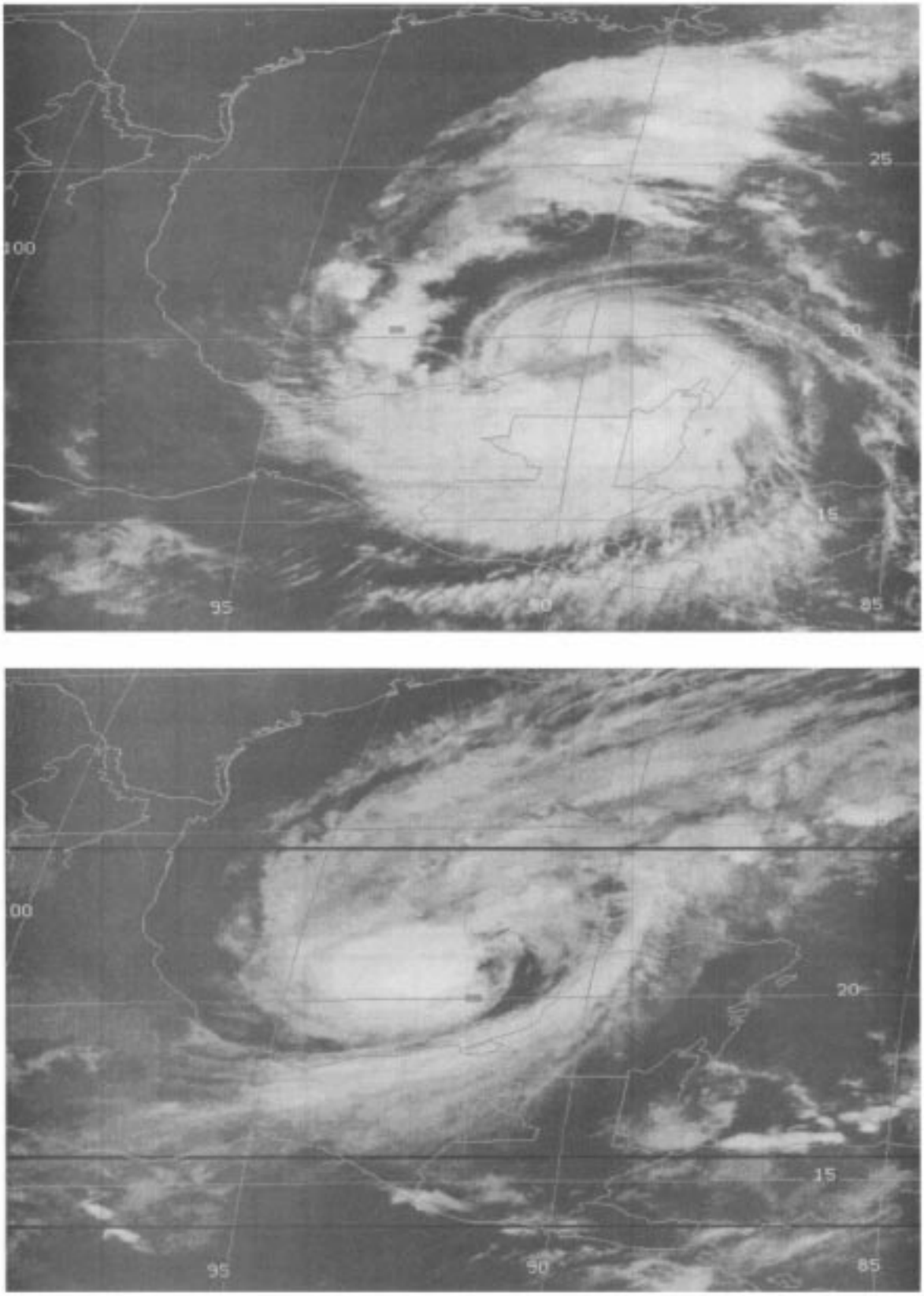

Figure 8A -- Enhanced satellite images indicating relative positions of *Patriot* (small dark rectangle) and Hurricane Roxanne at 1216 on October 11 (top) and 0616 on October 15 (bottom).

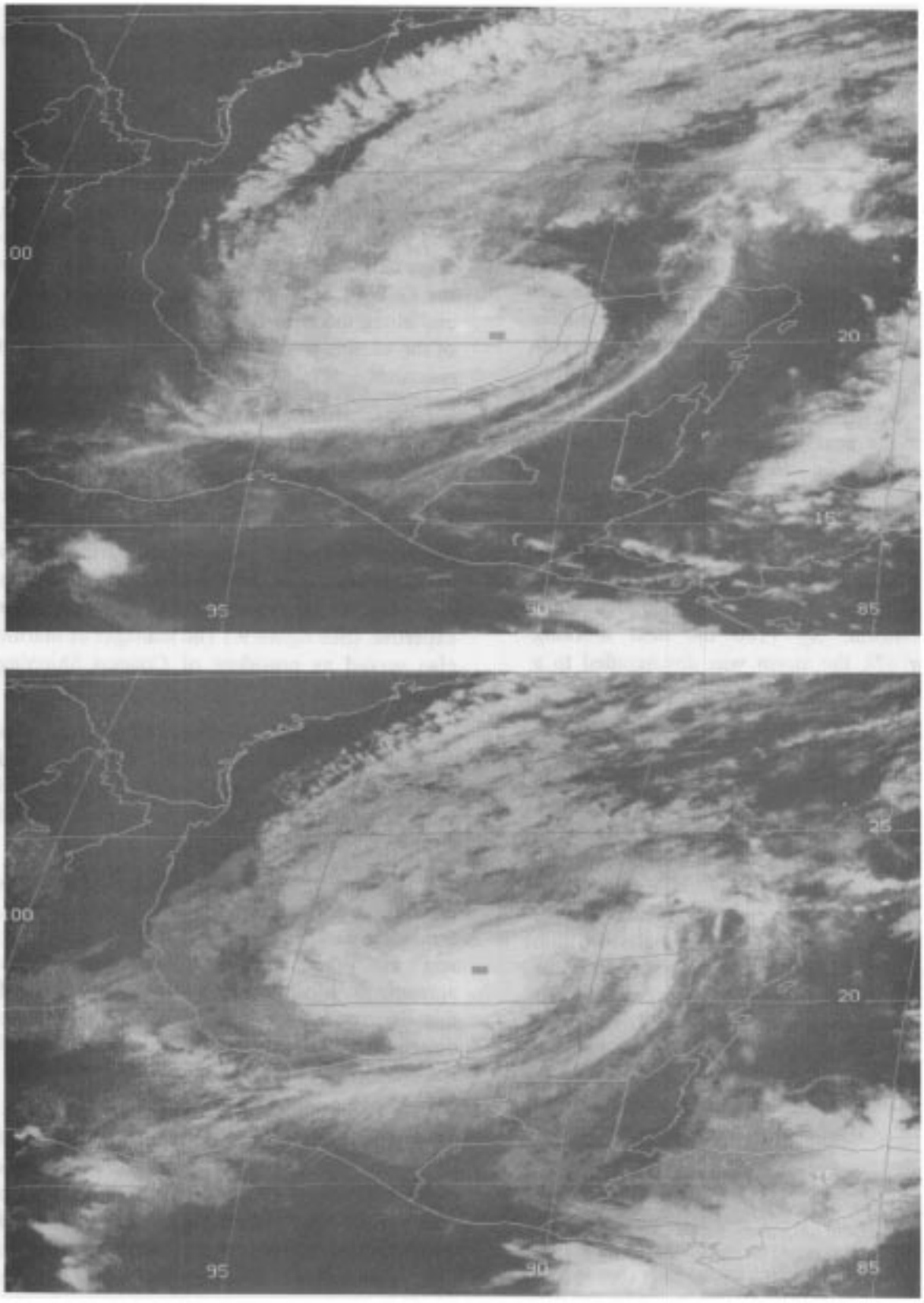

Figure 8B -- Enhanced satellite images indicating relative positions of *Patriot* (small dark rectangle) and Hurricane Roxanne at 1217 on October 15 (top) and 0046 on October 16 (bottom).

entered the storm's navigable semicircle,[16] and encountered rough seas and winds reportedly in excess of 130 knots. The additional ballast improved the ***Patriot's*** ability to maneuver by increasing the vessel's draft and thus permitting increased main engine rpm. The chief engineer was able to increase rpm from slow ahead to half ahead (70 rpm), providing the vessel with enough speed to move in a northerly direction away from the storm. By midnight on October 15, the ***Patriot,*** though continuing to encounter hurricane-force winds and rough seas, was able to move about 50 miles offshore and away from the nearest shoals.

Over the next 12 hours, the master of the ***Patriot*** continued to maneuver the vessel offshore and away from Roxanne. By noon on October 16, the vessel had cleared the shoals north and east of Cayo Arcas and was able to head for open sea. By 2100, the NWS reported Roxanne had again been downgraded to a tropical storm. By 1100 the next morning (October 17), the storm was downgraded to a tropical depression.

Post-incident Events

Following its encounter with Hurricane Roxanne, the ***Patriot*** proceeded to Galveston. While en route, the crew conducted a deck and engineering darnage survey. The survey revealed no structural damage to the ***Patriot,*** but an inspection of the No. 4 cargo tank showed that the movement of saltwater ballast within the tank during the emergency had ripped the heating coils and hydraulic lines free of their fasteners, rendering them unusable. The damage to the hydraulic lines, which controlled the opening/closing of the ballast/cargo valves in the No. 1 and No. 4 cargo tanks and the No. 7 port and starboard slop tanks, was so severe that the cargo and ballast valves in these tanks were no longer operable.

Conoco Operations

At the time of this incident, Conoco operated a fleet of 8 tank ships, 7 towboats, and 17 barges engaging in international, coastwise, and inland trades. The company's four **Patriot-**class tank ships operated almost exclusively in the Gulf of Mexico, the East/West Caribbean, and along the U.S. East and Gulf Coasts. None of the vessels were equipped with voyage event recorders.

Organizational Structure -- At the time of this incident, the three main operating units of Conoco Shipping Company were the Domestic Marine Department, the Chartering and Traffic Department, and the Operations and Engineering Department, all answering to the manager of marine, who was a licensed master with commercial experience and ship operations expertise. (See figure 9.) The manager of marine also served as president of Conoco Shipping Company.

The ***Domestic Marine Department*** was responsible for the day-to-day operation and oversight of Conoco's fleet of tugboats and barges operating primarily in the inland and western rivers trade.

The ***Chartering and Traffic Department was*** responsible for chartering and scheduling ships, arranging cargoes for the entire Conoco fleet, and all other matters related to charter agreements. Most of the day-to-day activities of this department were the responsibility of the director of chartering and traffic and the vessel coordinator.

The ***Operations and Engineering Department*** was responsible for the maintenance and repair, stores, and staffing of the company's eight tank ships. The department was also responsible for maintaining, updating, and implementing the policy guidance contained **in** the company's ***Dec/Engine Procedures Manual; Navigation, Safety and Bridge Management Manual;*** and ***Vessel Response Plan.*** The Operations and Engineering

[16]In the northern hemisphere, the *dangerous semicircle* is that half of a storm lying to the *right* of the storm's track. It is within this area that mariners can expect to encounter the strongest winds, the heaviest rain, and the highest seas. The *navigable semicircle* is that half of a cyclone lying to the left of its track where weather and sea conditions are less severe, allowing vessels an opportunity to move more easily away from the storm.

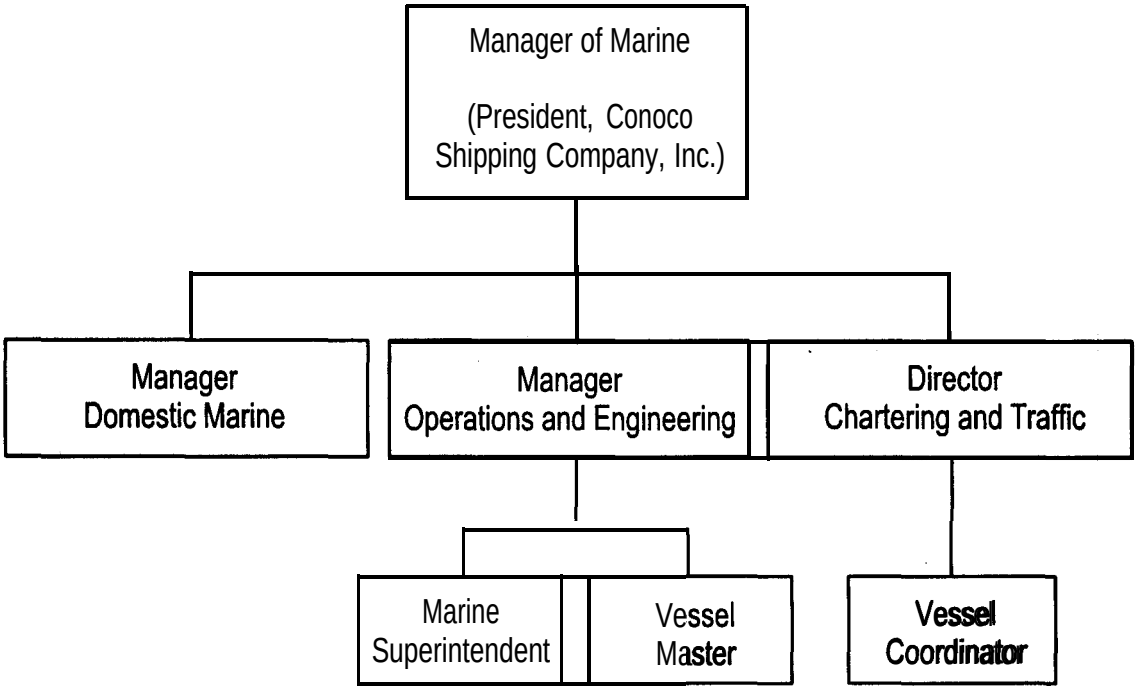

Figure 9-- Selected organizational elements of Conoco Shipping Company, Inc.

Department staff included several licensed masters and chief engineers, including the marine superintendent during this incident, who had extensive experience and expertise in operating crude oil tank ships.

Day-to-day oversight of all company tank ships was the responsibility of the company's two engineering superintendents. According to Conoco, these two individuals consulted on voyage maintenance and repair issues, supervised shipyard repairs, and prepared requisitions and work orders for materials or technical services. They were also responsible for developing relationships with key equipment and technical services suppliers. The engineering superintendent assigned to oversee the day-to-day activities of the ***Patriot*** before the incident was a licensed chief engineer.

Master's Qualifications - The master of the ***Patriot*** during this incident was fully licensed and met all international standards and requirements for shipmasters. He had more than 15 years' experience as a ship's officer and had served as master on Patriot-class vessels for about 1 year prior to this incident.

SAFETY ISSUES

The first in the sequence of events leading to the near grounding of the ***Patriot*** occurred on October 11, 1995, when the ***Patriot's*** master decided to sail his vessel into an area where NWS forecasts showed he would probably encounter Hurricane Roxanne. Despite the weather predictions, the master chose to maneuver his vessel toward the hurricane rather than away from it. This decision ultimately placed the ***Patriot*** in the eye of the storm.

In its investigation of this incident, the Safety Board attempted to determine why a qualified and experienced seaman such as the master of the ***Patriot*** would take such a course of action. A review of the activities of Conoco Shipping Company shoreside managers preceding and during this incident suggests that the questionable decision by the ***Patriot's*** master and the subsequent difficulties experienced by the ***Patriot*** in its encounter with Hurricane Roxanne could have been avoided.

The following major safety issues were identified during this investigation:

- The master's decisionmaking;
- Conoco Shipping Company's monitoring of weather and its management of the movement of its vessels; and
- Conoco Shipping Company's shoreside support for shipboard decisionmaking.

The Master's Decision

In the view of the Safety Board, the master of the ***Patriot*** demonstrated poor judgment when he directed his vessel into an area directly threatened by a hurricane. When investigators asked the master why he decided to continue toward, rather than away from, Dos Bocas when he knew a hurricane was approaching the area, he said he based his decision on the following factors:

. His expectation that Roxanne would alter course toward the northwest because of the tendency of hurricanes in the northern hemisphere to follow a northwesterly track;

. His concern that if the storm continued on its westerly track, the ***Patriot*** could be caught in the storm's dangerous semicircle;

. His belief that, even if the storm continued on its predicted track, the ***Patriot*** had sufficient power to avoid it; and

. His concern that failing to tender an NOR before midnight on October 11 (as required by the charter agreement) would make Conoco liable for substantial additional operating expenses and could affect his annual performance evaluation.[17]

The Safety Board examined these and other factors that influenced the master's decision to proceed to Dos Bocas, as well as subsequent decisions he made during the near-grounding incident.

Monitoring and Management of Weather-Related Activities -- A copy of the weather forecasts received and plotted by the ***Patriot's*** master between 0900 on October 10 and 1200 on October 11 clearly showed Roxanne heading in a west-southwest direction toward Dos Bocas at a speed of about 10 knots. Neither weather reports nor forecasts indicated the storm was about to turn and head in a northwesterly direction when the master made his decision to continue southward toward Dos Bocas. By the time the ***Patriot*** arrived at the Dos Bocas anchorage and tendered its NOR (1500 on October 11), the eye of the storm was less than 160 miles away.

Because the effects of Roxanne were felt over such a large area (estimated at more than 150 miles from the eye), the ***Patriot*** would probably have encountered the brunt of the storm regardless of whether Roxanne veered toward the northwest as the master anticipated. As the circumstances later showed, the weather forecasts received by the ***Patriot*** between October 9 and 12 were accurate. Roxanne did, as forecast, follow a west-southwest track toward Dos Bocas. By the time it became evident to the master that Roxanne was not going to turn toward the northwest, it was already too late for him to do anything but remain near Dos Bocas and ride out the storm as best he could.

This incident demonstrates the potential problems associated with relying primarily on shipmasters to evaluate the risks posed by tropical cyclones and hurricanes. The Safety Board is concerned that the ***Patriot's*** master would even contemplate operating the ***Patriot*** near a tropical storm, let alone a hurricane, when it could have been avoided. Had a grounding incident actually occurred, the

[17] The contract stipulated that, should the vessel not tender the NOR on time, the cost of operating the vessel would be shouldered by Conoco Shipping Company. While the charter agreement specified a demurrage rate of $19,000 per day, the master of the *Patriot* stated that the *Patriot* costs approximately $32,000 per day to operate. According to Conoco officials, the contract did not state who would have paid the *Patriot's* operating expenses had the vessel been delayed in tendering its NOR because of deteriorating weather and sea conditions en route.

damage to the ship's structure, salvage expenses, lost revenue, and costs associated with the clean-up of any resulting pollution (the ***Patriot*** was carrying more than 120,000 gallons of diesel fuel and lubricating oil) could have run into the millions of dollars.

In the view of the Safety Board, the failure of Conoco to anticipate the weather-related problems facing the ***Patriot*** and to initiate communications with the ship's master before the vessel became engaged with the storm suggests that, at the time of this incident, company oversight of the activities of its Patriot-class tank ships operating near tropical storms and hurricanes was deficient. When Conoco officials were asked where company managers obtained weather information during this incident, they stated that the information came from calling the NWS or from watching The Weather Channel on television,

When the vessel coordinator was notified on October 11 that the Port of Dos Bocas was closed because of high winds, he notified his supervisor, who notified the tanker operations optimization team, but no one took any action with respect to the ***Patriot,*** which was known to be sailing toward the port. The marine superintendent said he did not become personally involved with the ***Patriot*** until the manager of marine called him and other personnel to ask that they report to the office "to monitor the situation and assist the vessel as necessary." This was October 15, several days after the ***Patriot's*** initial encounter with Roxanne. The Safety Board concludes that Conoco Shipping Company, at the time of this incident, did not have in place a shoreside multidisciplinary team specifically responsible for assisting and advising the company's masters in assessing and responding to the risks posed by tropical storms and hurricanes.

Conoco Shipping Company's practices related to weather monitoring and vessel oversight are of particular concern to the Safety Board, given the frequency with which tropical cyclones pass through the company's operating area and the risks those storms pose to the safety and well-being of the company's vessels and crews. According to the NWS, more than 900 tropical cyclones were reported in the North Atlantic between 1886 and 1992. A large percentage of these storms followed a track into the East/West Caribbean, the Gulf of Mexico, and the U.S. East and Gulf Coasts, where Conoco's Patriot-class tank ships operate. In 1995 alone, 19 tropical cyclones were reported in this area, 3 of which (Tropical Storm Gabrielle and Hurricanes Opal and Roxanne) passed through the Bay of Campeche. At least three tropical cyclones and hurricanes passed through the Bay of Campeche during the 1996 hurricane season.

The Safety Board commends Conoco for the actions the company has taken since this incident to provide for more effective weather monitoring. According to Conoco officials, various operations and commercial personnel now monitor weather, and the vessel coordinator sends weather updates to a vessel whenever a storm is in proximity to it. The marine superintendent said that he now becomes involved whenever a tropical depression, storm, or hurricane threatens a company vessel to ensure that communications are being exchanged between the vessel and the vessel coordinator. He said the vessel coordinator is to advise operations personnel (the marine superintendent or engineering superintendent) whenever their support is required. These actions demonstrate that Conoco Shipping Company is aware of the need for more effective oversight of vessels threatened by hazardous weather and sea conditions.

To further improve the effectiveness of company oversight over day-to-day operations and to ensure a more cooperative approach to evaluating weather-related risks to vessel safety, the Safety Board believes Conoco Shipping Company should develop and implement a heavy weather operations contingency plan similar to its ***Vessel Response Plan*** that is capable of providing a timely assessment of the risks to vessels in the fleet operating near tropical storms and hurricanes. The plan should, at a minimum, (1) establish a shoreside response team that includes individuals knowledgeable in meteorology and in all engineering, operational,

and commercial factors that affect the safety of vessels in the Conoco fleet; (2) outline the duties and responsibilities of the response team; and (3) provide procedures to facilitate coordination and consultation between response team members on shore and Conoco shipmasters at sea.

Vessel Maneuverability -- The master stated that he believed the ***Patriot*** had sufficient maneuverability to evade the storm, whether or not it veered to the northwest as he anticipated. He was clearly overestimating his vessel's ability to maneuver in rough seas while operating in a light ballast condition. Patriot-class tank ships carry a minimum amount of ballast; thus they tend to roll and pitch heavily in rough seas. Further, few tank ships operating in a light ballast condition in heavy weather and rough seas can be operated safely at their full sea speed. These factors alone make it unlikely that the ***Patriot,*** without the benefit of a substantial head start, could have outrun the fast-moving Roxanne.

The ***Patriot's*** ability to maneuver through rough seas was further compromised by the unexpected (by the master and chief engineer) incidents of engine overspeed and shutdown the vessel experienced. Following each overspeed incident, shaft speed had to be limited to about 50 rpm, which had a continuous impact on maneuverability. This impact was particularly evident on October 15, when the ***Patriot*** was not only unable to maneuver away from the storm, but also was no longer able to maneuver within it, as evidenced by the loss of steerage during the morning and early afternoon of October 15. As weather and sea conditions deteriorated during that time, onshore winds began setting the ***Patriot*** in a southeasterly direction toward land. Only after the vessel entered the eye of the storm and the loading of storm ballast was completed were engineers able to increase engine rpm sufficiently to allow the ship to move toward the north and away from the storm.

A review of Conoco records revealed that two of its four Patriot-class tank ships ***(Patriot*** and ***Guardian)*** had experienced overspeeding of the main engine on three occasions prior to the near-grounding incident. On two of the three occasions, the overspeed condition occurred while the vessels, in a light ballast condition, were encountering 22- to 33-knot winds and 5- to 10-foot seas. The third overspeed incident occurred aboard the ***Guardian*** just 6 months prior to this incident, while the vessel was operating in a light ballast condition in heavy weather and rough seas off the U.S. East Coast.

On September 28, 1992, Conoco sent an urgent message to the shipbuilder and to the manufacturer of the engine governor and its regulating linkage seeking their assistance in resolving the overspeed problem (the two vessels were still under warranty at the time). Shortly thereafter, service representatives from the shipyard and from the manufacturer of the governor and regulating linkage arrived and inspected the governor controls aboard both vessels, According to Conoco, the shipbuilder and engine manufacturer reported that the governors aboard both the ***Patriot*** and the ***Guardian*** performed according to specifications. They also reported that main engine overspeeds due to heavy weather and rough sea conditions could be avoided if the main engine speed were reduced by 7 percent. Conoco subsequently informed its chief engineers of this operational limitation, but the company did not ensure that masters and chief engineers who joined the company or began to work aboard Patriot-class vessels subsequent to this period (such as the master and chief engineer in this incident) were informed of the tendency for Patriot-class tank ships to experience an overspeed condition.

The fact that overspeeding had occurred on Patriot-class tank ships was information needed by the masters and chief engineers of all the company's Patriot-class vessels so they could factor it into their risk assessments. In this instance, the ***Patriot's*** master and chief engineer lacked critical information concerning the operation of their vessel in rough seas. Because neither individual was aware of the overspeed problem, they were unable to adequately assess its effect on the ***Patriot's*** ability to maneuver in rough seas. This information would certainly have been a factor in the decision to continue

the voyage to Dos Bocas. The Safety Board therefore believes that Conoco Shipping Company should amend its ***Deck/Engine Procedures Manual*** and ***Fleet Procedures Guide*** to ensure that shipmasters and chief engineers assigned to Patriot-class tank ships are aware of the potential for an engine overspeed condition, the circumstances under which this condition can occur, and its effect on vessel maneuverability. The company should also provide the deck and engineering officers aboard these vessels with specific guidance concerning the actions to be taken to prevent a main engine overspeed condition from developing.

While the ***Patriot's*** master was not aware of the potential for engine shutdown in rough seas, he also did not take into account other operational limitations of Patriot-class tank ships. For example, the master understood that taking on storm ballast would improve the vessel's seakeeping in rough seas. But he apparently did not factor into his decisionmaking either the time it takes to complete the loading of ballast or the fact that exaggerated rolling of the vessel could shut down the auxiliary boilers that supply the steam necessary to drive the ballast pumps, thereby making the ballasting even more difficult and time-consuming. Had the master taken either of these factors into account, he might not have made the decision to continue to Dos Bocas, and he almost certainly would not have delayed his decision to load storm ballast for the second time. The Safety Board concludes that, had the ***Patriot's*** master better understood the operational limitations of his vessel, had he known the vessel could enter an overspeed condition, and had he considered the effects rough seas could have on his vessel's ability to load storm ballast, he probably would not have entered the Bay of Campeche, much less continued the voyage to Dos Bocas. The Safety Board therefore believes that Conoco Shipping Company should conduct an engineering and operational analysis of the performance of its Patriot-class tank ships when operating in a light ballast condition in heavy weather and rough seas with the objective of determining the operational actions that should be taken to ensure the safety of those vessels under such conditions. The company should then provide the masters, deck officers, chief engineers, and engineering officers assigned to these tank ships with the training and guidance necessary to ensure that they fully understand the operational characteristics, capabilities, and limitations of Patriot-class vessels and are aware of the actions that must be taken to ensure the safety of those vessels when operating in rough seas.

Satisfying the Charter Agreement -- The master's desire to satisfy the terms of the charter agreement was another factor affecting his decision to continue the voyage to Dos Bocas. Under the terms of its contract, the ***Patriot*** was required to arrive in Dos Bocas and tender its NOR to the local cargo agent before midnight on October 11. The master expressed his concern that the expenses incurred as a result of his inability to tender the NOR on time could affect his job performance evaluation.[18]

Conoco's ***Navigation Safety and Bridge Management Manual*** contains numerous references to the master's prerogative to take any action in the interest of preserving the safety of the ***Patriot*** and its crew. For example, company guidance states that the master:

> is to observe weather conditions closely at all times and he is not to hesitate to alter course, reduce speed, or put into port to avoid weather that may be hazardous to the vessel or endanger those aboard.

Despite this general guidance, the terms of the charter agreements and masters' perceptions of the criteria used by the company to evaluate their job performance can motivate masters to take undue risks in order to stay on schedule. In the view of the Safety Board, the ***Patriot's*** master should have been provided with company guidance specifically permitting him

[18]Documentation provided by Conoco indicates that, of the factors making up the final performance appraisals for company masters, 50 percent are safety-related; 25 percent rate leadership skills; and 25 percent reflect other performance criteria.

to postpone the tendering of the NOR on account of poor weather and sea conditions. More significantly, had procedures been in place to facilitate his speaking to Conoco management about Roxanne and its potential effect on his ability to fulfill the terms of his charter agreement, the decision to continue the voyage to Dos Bocas, as well as the difficulties encountered by the ***Patriot*** resulting from that decision, could have been avoided.

Ballast Operations -- The delay in loading storm ballast during the ***Patriot's*** second encounter with Roxanne had serious safety implications. Because of the reduced engine speed, rough seas, deep swells, and hurricane-force winds out of the west-northwest, the ***Patriot*** soon lost steerageway, began to drift toward nearby shoals, and began to experience heavy rolling. At one point, the vessel reportedly rolled more than 39 degrees. [19] By 0615, the master had become sufficiently concerned about the situation that he ordered the second officer to transmit a series of distress messages. Despite the master's concern about the danger of grounding, he did not initiate the loading of storm ballast until several hours after the recurrence of the overspeed condition and more than 13 hours after receiving word that Roxanne had turned around and was heading in his direction.

This delay greatly hampered the master's efforts to maneuver his vessel in the rough sea conditions. Moreover, the increased rolling experienced by the ***Patriot*** during the morning of October 15 caused the thousands of tons of ballast already in the No. 4 cargo oil tank to move around, extensively damaging the tank's heating coils and hydraulic lines; it also caused the vessel's two auxiliary boilers to shut down repeatedly. The damage to the heating coils and hydraulic lines did not have an immediate impact on operations, but the shutdown of the auxiliary boilers seriously hampered efforts to complete the loading of storm ballast.

[19] The maximum reading on the vessel's inclinometer was 39 degrees.

The engineering superintendent assigned to monitor the Patriot-class tank ship fleet stated that he spoke with the ***Patriot's*** master twice prior to the vessel's second encounter with the storm. But the engineering superintendent was not experienced in shiphandling, stability, or meteorology and thus was unable on either occasion to provide effective decisionmaking assistance to the master. While the two men talked about the possibility of loading storm ballast, the decision whether to load the additional ballast was left to the master, who said that at the time the vessel was operating "all right." The master did not discuss with the engineering superintendent the vessel's previous difficulties, nor did they discuss the conditions the vessel would likely encounter or the actions that should be taken should Roxanne continue on its predicted path toward the ***Patriot.***

The Safety Board concludes that if Conoco employees and managers having both operations and engineering experience had been in contact with the ***Patriot's*** master during the critical period leading up to the vessel's second and more serious encounter with the storm, these individuals could have assisted the master with his decisionmaking. This assistance could have included advice about the benefits of loading storm ballast in a timely manner as a means of avoiding/mitigating an emergency situation.

Shoreside Participation in and Support of Decisionmaking

The circumstances of this incident indicate that Conoco should take a more active role in evaluating and responding to the risks to its fleet posed by tropical storms and hurricanes. For example, had Conoco management identified the risks to vessel safety posed by Roxanne and had management discussed the situation with the ***Patriot's*** master during his initial approach to Dos Bocas, a more informed discussion of the course of the storm, its effect on the ***Patriot,*** and alternative courses of action would probably have occurred.

Active decisionmaking support prior to the vessel's second encounter with the storm would have been particularly meaningful given the

conditions under which the master and his crew were working during the emergency. All crewmembers interviewed said that their normal routines were interrupted as a result of deteriorating weather conditions beginning at or about 1600 on Wednesday, October 11. The master essentially remained awake for the next 16 hours, until the morning of Thursday, October 12. Additionally, he stated that about 2 days later, he remained awake and on the bridge for approximately 48 hours straight, during which time he napped for intervals of between 20 and 30 minutes. The Safety Board therefore concludes that the likely fatigue of the master as a result of his lack of rest during the protracted emergency may well have compromised his ability to make good and timely decisions. Under these conditions, assistance from well-rested shoreside experts would have been particularly appropriate.

The ***Patriot's*** master did participate in a conference call with top Conoco Shipping Company officials on October 15. But by then, the vessel was already enduring the brunt of the storm, and the company officials could do little more than offer encouragement. The Safety Board concludes that, had Conoco's operations and engineering personnel been in contact with the ***Patriot*** master earlier than they were in the vessel's voyage, the entire incident could have been avoided.

To ensure that incidents or accidents like this do not threaten the safety of Conoco vessels and crews in the future, the Safety Board believes that Conoco Shipping Company should develop and implement procedures whereby management officials communicate and consult with shipmasters at sea in times of potential or actual emergencies or during safety-critical periods of a voyage. The procedures should be directed toward facilitating timely decisions affecting the safety of company vessels and their crews.

International Safety Management (KM) Code

The circumstances of this near-grounding incident highlight the types of issues that led the International Maritime Organization (IMO) to adopt, in November 1993, the ***International Safety Management Code for the Safe Operation of Ships and for Pollution Prevention*** (ISM Code) .20 The ISM Code recognizes and codifies the responsibilities of shipping company management in ensuring adherence to marine safety guidelines and environmental protection standards.

A dominant theme of the ISM Code is accountability, which, according to the IMO, can no longer be limited to shipmasters and crews, but now must extend to the upper levels of company management. The degree of management oversight demonstrated by Conoco Shipping Company during the incident involving the ***Patriot*** would probably not have met the standards established by the ISM Code, had the requirements of the code been in effect at the time of the incident. For example, Article 8.1 of the ISM Code states that:

> The company should establish procedures to identify, describe and respond to ***potential emerging shipboard situations.*** (Emphasis added.)

Conoco Shipping Company did not have procedures in place to recognize, assess, and respond to the potential threat that Hurricane Roxanne posed to the ***Patriot.*** Company management did not become involved with the vessel before its first encounter with the storm (when the incident could have been avoided) or during the critical period when the ***Patriot's*** fatigued master was making decisions affecting the safety of his ship and crew.

Article 8.3 of the ISM Code states:

> The SMS [the company's safety management system] should provide for measures ensuring that the ***Company's organiza-***

[20]Dead1ines for compliance with the ISM Code are July 1, 1998, for all passenger ships and for oil tankers, chemical tankers, gas carriers, bulk carriers, and cargo high-speed craft of more than 500 gross tons; and July 1, 2002, for all other cargo ships and mobile offshore drilling units (MODUs) of 500 gross tons or more. See appendix B for a summary of ISM Code requirements and provisions.

> ***tion*** can respond at any time to hazards, accidents and emerging situations involving its ships. (Emphasis added.)

This article clearly extends responsibility for responding to hazardous situations beyond shipmasters to include shoreside management. But because Conoco Shipping Company at the time of this incident did not have (and was not required to have) the well-defined "lines of communication between and amongst, shore and shipboard personnel" that will be required by the ISM Code, the company was not prepared to respond in a way that would have prevented this incident.

The near-grounding incident involving the ***Patriot*** demonstrates the need for the changes to traditional lines of authority and accountability that are called for in the ISM Code. According to Conoco officials, the company obtained ISM Code certification on March 13, 1997. The Safety Board notes that Conoco Shipping Company is among the first companies to become ISM certified.[21] The Safety Board urges Conoco to review the safety management system it has developed in response to ISM Code requirements and ensure that it contains provisions that will address the safety issues that were identified during this investigation.

Actions Taken By Conoco Since This Incident

Conoco Shipping Company officials report that the company has taken the following actions since and in response to the incident involving the ***Patriot***

- Issued an August 28, 1996, letter to its fleet clarifying company policy regarding the loading of storm ballast;
- Issued a February 4, 1997, letter to company shipmasters providing them with additional guidance regarding the making of go/no-go decisions in situations similar to the one faced by the master of the ***Patriot*** on October 11, 1995;
- Held company seminars for masters, chief mates, and chief engineers to disseminate information about this incident and to discuss the circumstances surrounding it;
- Instituted at Conoco headquarters a new weather-tracking system that, on a daily basis, monitors the position of each vessel in the Patriot-class fleet in relation to nearby tropical storms and hurricanes;
- Installed a voyage event recorder aboard the newest company tank ship and developed plans for installing such units aboard each vessel in the company's tank ship fleet; and
- Instituted a program to conduct failure mode and effects analysis (FMEA) of critical shipboard systems to ensure that these systems meet 1S0 9000 standards.

The Safety Board appreciates Conoco's proactive attitude since this incident and acknowledges the actions the company has already taken in response to it. These actions, in combination with implementation of the safety recommendations resulting from this investigation, may be expected to prevent future incidents of this type.

In the view of the Safety Board, the circumstances surrounding the near grounding of the ***Patriot*** raise serious issues of marine safety that have application not only to the specific company and vessel involved, but to the marine industry as a whole. This is particularly true in light of the fact that all ship owners and/or operators engaged in international trade will be required to develop safety management systems in response to ISM Code requirements. The National Transportation Safety Board

[21] According to records of the International Association of Classification Societies (IACS), fewer than 5 percent of the 18,500 vessels required to comply with the ISM by July 1, 1998, have been certified by IACS members.

therefore believes that the International Association of Independent Tanker Owners should disseminate to its members the facts and circumstances of this incident and the National Transportation Safety Board recommendations in order to assist the organization's members in the development of appropriate safety decisionmaking programs, heavy weather operations contingency plans, and safety management oversight systems in response to the requirements of the ISM Code.

CONCLUSIONS

Findings

1. Conoco Shipping Company, at the time of this incident, did not have in place a shoreside multidisciplinary team specifically responsible for assisting and advising the company's masters in assessing and responding to the risks posed by tropical storms and hurricanes.

2. Had the ***Patriot's*** master better understood the operational limitations of his vessel, had he known the vessel could enter an overspeed condition, and had he considered the effects rough seas could have on his vessel's ability to load storm ballast, he probably would not have entered the Bay of Campeche, much less continued the voyage to Dos Bocas.

3. If Conoco employees and managers having both operations and engineering experience had been in contact with the ***Patriot's*** master during the critical period leading up to the vessel's second and more serious encounter with the storm, these individuals could have assisted the master with his decisionmaking.

4. The likely fatigue of the master as a result of his lack of rest during the protracted emergency may well have compromised his ability to make good and timely decisions.

5. Had Conoco's operations and engineering personnel been in contact with the ***Patriot*** master earlier than they were in the vessel's voyage, the entire incident could have been avoided.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the near-grounding incident involving the tank ship ***Patriot*** was the master's decision to sail his vessel into the predicted path of a hurricane, a decision that resulted from Conoco Shipping Company's ineffective management of the movements of its vessels and inadequate shoreside support for critical shipboard decisions affecting vessel safety.

RECOMMENDATIONS

As a result of its investigation of this incident, the National Transportation Safety Board makes the following safety recommendations:

--to Conoco Shipping Company, Inc.:

Develop and implement procedures whereby Conoco Shipping Company management officials communicate and consult with shipmasters at sea in times of potential or actual emergencies or during safety-critical periods of a voyage. The procedures should be directed toward facilitating timely decisions affecting the safety of company vessels and their crews. (M-97-29)

Develop and implement a heavy weather operations contingency plan similar to your ***Vessel Response Plan*** that is capable of providing a timely assessment of the risks to vessels in the fleet operating near tropical storms and hurricanes. The plan should, at a minimum, (1) establish a shoreside response team that includes individuals knowledgeable in meteorology and in all engineering, operational, and commercial factors that affect the safety of vessels in the Conoco fleet; (2) outline the duties and responsibilities of the response team; and (3) provide procedures to facilitate coordination and consultation between response team members on shore and Conoco shipmasters at sea. (M-97-30)

Amend your ***Dec/Engine Procedures Manual*** and ***Fleet Procedures Guide*** to ensure that shipmasters and chief engineers assigned to Patriot-class tank ships are aware of the potential for an engine overspeed condition, the circumstances under which this condition can occur, and its effect on vessel maneuverability. Provide the deck and engineering officers aboard these vessels with specific guidance concerning the actions to be taken to prevent a main engine overspeed condition from developing. (M-97-3 1)

Conduct an engineering and operational analysis of the performance of your Patriot-class tank ships when operating in a light ballast condition in heavy weather and rough seas with the objective of determining the operational actions that should be taken to ensure the safety of those vessels under such conditions. Provide the masters, deck officers, chief engineers, and engineering officers assigned to these tank ships with the training and guidance necessary to ensure that they fully understand the operational characteristics, capabilities, and limitations of Patriot-class vessels and are aware of the actions that must be taken to ensure the safety of those vessels when operating in rough seas. (M-97-32)

Review the safety management system (SMS) you have developed in response to requirements of the ***International Safety Management Code for the Safe Operation of Ships and for Pollution Prevention*** (ISM Code) and ensure that it contains provisions that will address the safety issues that were identified during this investigation. (M-97-33)

--to the International Association of Independent Tanker Owners:

Disseminate to your members the facts and circumstances of this incident and the National Transportation Safety Board recommendations in order to assist the organization's members in the development of appropriate safety decisionmaking programs, heavy weather operations contingency plans, and safety management oversight systems in response to the requirements

of the ***International Safety Management Code for the Safe Operation of Ships and for Pollution Prevention (1SM*** Code). (M-97-34)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

JAMES E. HALL
Chairman

ROBERT T. FRANCIS II
Vice Chairman

JOHN A. HAMMERSCHMIDT
Member

JOHN J. GOGLIA
Member

GEORGE W. BLACK, JR.
Member

April 8,1997

Investigation

Conoco Shipping Company notified the National Transportation Safety Board of the near-grounding incident involving the ***Patriot*** on Tuesday morning, October 17, 1995. Because the incident occurred in international waters and did not involve a vessel of U.S. registry, the National Transportation Safety Board did not have jurisdiction to investigate. However, Conoco, concerned about the potential for damage to its ship, injuries to the crew, and damage to the environment, and recognizing the benefits of an independent review of this incident, asked the Safety Board to undertake an investigation and determine the cause of this incident. The Safety Board determined that it would be in the public interest to conduct an independent inquiry of the circumstances that led to this incident.

On October 18, 1995, a four-person investigative team consisting of an investigator-in-charge, an engineering factors specialist, a human performance specialist, and a survival factors specialist was dispatched to Houston, Texas, to be briefed by the president, Conoco Shipping Company, Inc., and his staff. On October 19, 1995, the team joined the ***Patriot*** off Galveston, Texas, and proceeded toward Dos Bocas, Mexico. During their 2 weeks aboard the vessel, the team conducted numerous interviews with the crew and collected documentation concerning the events preceding the near-grounding incident. On November 1, 1995, the team returned to Washington, D.C.

On November 17, 1995 the accident investigation team traveled to Houston to meet a second time with senior Conoco Shipping Company management. The purpose of the second meeting was to interview key management staff and to collect additional documentation concerning the operation of the ***Patriot.*** These interviews concluded the on-scene portion of the investigation.

Conoco Shipping Company was designated as party to the investigation. No Board Member participated in the on-scene investigation of this incident.

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The International Safety Management (ISM) Code

The International Maritime Organization (IMO), in November 1993, adopted the ***International Safety Management Code for the Safe Operation of Ships and for Pollution Prevention*** (ISM Code). The ISM Code recognizes and codifies the responsibilities of shipping company management in ensuring adherence to marine safety guidelines and environmental protection standards. The stated objectives of the ISM Code (Article 1.2.1) are to:

> ensure safety at sea, prevention of human injury or loss of life, and avoidance of darnage to the environment, in particular to the marine environment, and to property.

A dominant theme of the ISM Code is accountability, which, according to the IMO, can no longer be limited to shipmasters and crews, but now must extend to the upper levels of company management. Compliance with the ISM Code will require that companies[1] develop and maintain a safety management system (SMS) that will:

- Provide for safe practices in ship operation and a safe working environment;
- Establish safeguards against all identified risks; and,
- Improve the safety management skills of personnel both ashore and on ships.

The SMS must include the following functional requirements:

- A safety and environmental protection policy;
- Instructions and procedures to ensure safe vessel operation and environmental protection in compliance with relevant international and domestic laws;
- Defined levels of authority and lines of communication between and among shipboard and shoreside personnel;
- Procedures for reporting accidents and non-conformities;
- Emergency preparedness and response procedures; and,
- Internal audit and management review procedures.

The ISM Code also requires that companies appoint a “designated person” (or persons) ashore with direct access to the highest level of management. The designee must have the responsibility and authority to monitor the safety and pollution aspects of each of the company’s ships and to ensure that adequate resources and shore-based support are available to maintain the SMS.

[1] ***Companies*** in this case includes ship owners, but it also includes other persons or entities who have assumed responsibility for operating a ship or ships and, by so doing, have also assumed responsibility for adhering to the ISM Code.

The ISM Code states that the company should clearly define and document the master's responsibility regarding:

- Implementing the safety and environmental protection policy of the company;
- Motivating the crew in the observation of that policy;
- Issuing appropriate orders and instructions in a clear and simple manner;
- Verifying that specified requirements (such as marine regulations, operational directives, etc.) are observed; and
- Reviewing the SMS and reporting its deficiencies to shore-based management.

Under procedures established by the IMO, companies that demonstrate compliance with the ISM Code will be issued a Document of Compliance. Vessels owned and/or operated by these companies will be issued a Safety Management Certificate to be displayed on board the vessel. While the ISM Code was developed primarily for deep-draft ships engaged in international commerce, its provisions might be applied to all sectors of the maritime industry, including inland and coastal barge and towing operations.

Compliance with the ISM Code is mandatory for companies operating large vessels in international trade. Deadlines for compliance are July 1, 1998, for all passenger ships and for oil tankers, chemical tankers, gas carriers, bulk carriers, and cargo high-speed craft of more than 500 gross tons; and July 1, 2002, for all other cargo ships and mobile offshore drilling units (MODUs) of 500 gross tons or more. Companies that fail to comply will be considered in violation of the International Convention for the Safety of Life at Sea (SOLAS) and may be prevented from trading.