



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: September 18, 1990

In reply refer to: M-90-32 through -43

Admiral J. William Kime
Commandant
U.S. Coast Guard
Washington, D.C. 20593

About 0009, on March 24, 1989, the U.S. tankship EXXON VALDEZ, loaded with about 1,263,000 barrels of crude oil, grounded on Bligh Reef in Prince William Sound, near Valdez, Alaska. At the time of the grounding, the vessel was under the navigational control of the third mate. There were no injuries, but about 258,000 barrels of cargo were spilled when eight cargo tanks ruptured, resulting in catastrophic damage to the environment. Damage to the vessel was estimated at \$25 million, the cost of the lost cargo was estimated at \$3.4 million, and the cost of the cleanup of the spilled oil during 1989 was about \$1.85 billion.¹

During the outbound voyage, the master left the third mate as the sole officer on the bridge as the vessel approached a critical course correction to maneuver around the ice. The third mate had probably had very little sleep the night before the grounding and had worked a stressful, physically demanding day. Since deballasting and cargo handling activities were ongoing while the EXXON VALDEZ was at the Alyeska terminal, the third mate was unlikely to have obtained a full off-watch period of rest when he went to bed at some time after 0100 on March 23. Also, he may have been called as early as 0520 to relieve the second mate. According to the second mate, he and the third mate were covering the chief mate's watch essentially on a 6-hours-on and 6-hours-off basis. An unlicensed crewmember recalled seeing the third mate on deck during the first half of the afternoon 1200-to-1600 watch, and the third mate stated that he did work in the afternoon conducting a salinity test and that later he relieved the chief mate during supper. The third mate testified that he had had a nap in the afternoon, but the time that he would have been resting would have been between being on deck during the 1200-to-1600 watch and relieving the chief mate for supper.

¹For more detailed information, read Marine Accident Report--"Grounding of the U.S. Tankship EXXON VALDEZ on Bligh Reef, Prince William Sound Near Valdez, Alaska, March 24, 1989" (NTSB/MAR-90/04).

The Safety Board concludes that the third mate could have had as little as 4 hours sleep before beginning the workday on March 23 and only a 1- to 2-hour nap in the afternoon. Thus, at the time of the grounding, he could have had as little as 5 or 6 hours of sleep in the previous 24 hours. Regardless, he had had a physically demanding and stressful day, and he was working beyond his normal watch period. No evidence indicated that Exxon Shipping Company had implemented a program to ensure that mates complied with the requirement in 46 U.S.C. 8401(a) that they have 6 hours off-duty time in the 12 hours before taking charge of the navigation watch.

The investigation reviewed relevant Coast Guard practices and standards for setting reduced-crew minimum manning levels for inspected vessels. The regulatory agency is admittedly under conflicting pressures from ship owners, operators, and labor unions. Long-standing manning practices are being replaced with more economically advantageous ones, and current manning appears to be at or near the limits for individual work loads. Although these circumstances explain some of the criticism of Coast Guard manning decisions and the manning review process, the Coast Guard's limited perspective for justifying reduced crews may be the primary shortcoming. The trend toward reducing crew complements has been based principally on labor-saving shipboard equipment and equipment reliability, which serve to reduce work load at sea, primarily in the engine room. However, in establishing reduced manning levels, the Coast Guard gave practically no thought to the work load in port. This omission is serious because tankship crews are required to perform much more demanding work in port than at sea, and this work leads to fatigued crews taking their ships to sea. Also, having fatigued crewmen in charge of cargo transfer operations increases the risk of a catastrophic accidental release of the cargo in port that could result in fire/explosion, as well as pollution.

The Safety Board believes that the Coast Guard must promptly implement manning safeguards that directly address crew working conditions in port, as well as at sea. If additional authority is needed, the Coast Guard should seek such authority. These safeguards should incorporate verifiable man-hour requirements for cargo handling in port and for all vessel operations, including tank cleaning, at sea. The safeguards should directly address risk factors associated with fatigue, low morale, and other consequences of longer work hours. The safeguards must also address the consequences of the social isolation that results from lower manning levels and longer tours of sea duty. The Safety Board believes that human capacities and limitations require no less attention in the manning process than the shipboard equipment criterion.

The Safety Board is particularly interested in the outcome of two research efforts sponsored by the Coast Guard that are intended to examine variables in human factors on reduced-crew vessels. One project, which is being conducted by the Marine Board at the National Academy of Sciences, has used input from vessel operators and marine labor unions to obtain information about existing work loads and working conditions. The Safety Board believes it is important that the Coast Guard evaluate different viewpoints in order to assess the current safety of manning and to develop guidelines to ensure that future manning levels are appropriate to the work

load. Similarly, the Safety Board recognizes the interest that the Coast Guard and the Maritime Administration have shown in the fatigue factor in their companion project for manning vessels with smaller crews.

Although Coast Guard officers stated that the review process for manning decisions used a "worse case" criterion, there is no evidence of this consideration in documentation related to the manning of the EXXON VALDEZ or EXXON LONG BEACH. Nor is there any evidence that the Coast Guard considered the fact that crewmen may be fatigued from in-port work or additional work owing to tank cleaning or to machinery breakdown. The Safety Board believes that the Coast Guard should re-examine minimum manning practices and establish amended standards using the same care given to other safety standards for vessels. For example, calculations to obtain structural standards acceptable to the Coast Guard are normally predicated on the vessel being in adverse loading conditions and, in some cases, the most adverse conditions possible. Even if it can be argued that the vessel will seldom operate in those adverse conditions, standards based on less rigorous loading criteria are generally considered inadequate. The Safety Board urges the Coast Guard to exercise comparable rigor for manning standards and to set minimum manning requirements that provide safe vessel operation for all foreseeable operating circumstances.

During the outbound voyage, the master made a series of questionable decisions -- he left the bridge during the passage through Valdez Narrows, he ordered the autopilot engaged when departing the traffic lanes, he failed to tell the third mate that the autopilot was engaged, and he left the third mate as the sole officer on the bridge as the vessel approached a critical course change to maneuver around the ice. While there might be justification for individual aspects of the master's actions, taken together, the actions provide a picture of impaired judgment that is consistent with the toxicological and speech evidence.

The Safety Board concludes that the master of the EXXON VALDEZ was impaired by alcohol at the time the vessel grounded on Bligh Reef and that impairment of his judgment owing to alcohol consumption caused him to leave the bridge at a critical time.

By conducting an examination of the National Driver Register (NDR) and driving records, the Safety Board was able to determine that the master of the EXXON VALDEZ had an alcohol abuse problem. A similar periodic, routine review of the NDR could be made to ascertain if any licensed merchant marine officers are involved in drug or alcohol abuse that is affecting their driving record. Furthermore, each time a person applies for a license or license renewal, in addition to checking the NDR, a review of the applicant's driving record could be made to determine if there are any offenses related to drug or alcohol abuse. Accordingly, the Safety Board believes that the Coast Guard should have access to the NDR and other driving records and make use of such information to prevent persons with a drug or alcohol problem from holding a merchant marine license.

The Safety Board concludes that the Coast Guard was not maintaining an effective Vessel Traffic Service (VTS) in Prince William Sound at the time of the EXXON VALDEZ grounding. The EXXON VALDEZ could almost certainly have been tracked considerably farther than 7.7 miles, probably all the way to the grounding site, if the 1600-to-2400 Vessel Traffic Center (VTC) watchstander had set a higher range scale on the master radar console. Had the watchstander tracked the EXXON VALDEZ, he or the relieving 0000-0800 VTC watchstander would have recognized that the vessel had changed course to 180° and that this course would cause the vessel to head out of the traffic separation scheme (TSS) toward shoal water east of Bligh Reef. The use of the traffic lane overlay on the radar would have enabled the watchstander to recognize more quickly that the vessel probably was going to depart the TSS and to determine where and when the departure would occur. Since the EXXON VALDEZ remained on course 180° for nearly 18 minutes, the VTC watchstander had ample time to call the vessel to ascertain the intentions of the navigation watch. Any inquiry from the VTC regarding the vessel's intentions probably would have alerted the third mate to turn earlier or to use more rudder. A subsequent followup inquiry from the VTC would surely have alerted him to the fact that his vessel could be standing into danger and that a sharp right turn back toward the traffic lanes was needed. Any action by the third mate to turn earlier or to use more rudder could have been sufficient to steer the vessel clear of Bligh Reef.

Following a firm, clear policy that all participating vessels, especially loaded tankships navigating Valdez Arm, were to be plotted could have made all VTC personnel aware that vessels occasionally were passing close to Bligh Reef. If he had had such information, the commanding officer (CO) would probably have recognized that an unsafe situation existed and that some action by his command to improve safety was warranted. Such action might have included improved ice reporting, mandatory position reports from vessels avoiding ice, enhanced supervision of the VTC, mandatory use of the traffic lane overlays, and maximum effort to track those vessels avoiding ice. The Safety Board believes that a permanent policy of tracking and plotting all participating vessels between the pilot station south of Bligh Reef, or as close to the pilot station as possible, and the vessels' berths in Port Valdez should be adopted. The Safety Board also believes that a sufficient number of permanent VTC watchstanders should be provided to meet the workload associated with these plotting requirements.

The loss of seven Marine Safety Office (MSO)/VTS billets in 1988 necessitated the reassignment of additional duties and responsibilities to remaining VTS supervisory personnel because there had been no commensurate reduction in the functions performed by the MSO. As a result, the operations officer and the assistant operations officer both had numerous non-VTS duties and responsibilities that precluded them from spending much time overseeing the VTS. The assistant operations officer, who was a senior chief radarman, was also required to perform administrative duties outside the operations department, some involving duties in supply. Thus, the person who had the seniority, the rating specialty that had prepared him specifically for operating radar to track vessels, and the experience as a VTC watchstander was not readily available to supervise the VTC watchstanders. Consequently, the responsibility was delegated to the next most senior petty officer, the

senior watchstander, who was a radarman first class. The senior watchstander was thus responsible for supervising the VTC watchstanders and for making sure that the VTS was operated according to Coast Guard regulations and VTC instructions. His duties included assigning the watchstanders to specific shifts, preparing performance evaluations, approving requests for leave, and issuing guidance by memoranda to the watchstanders.

The supervision of the day-to-day operation of the VTC should be the responsibility of persons who are not only senior to the watchstanders in rank and/or grade but who also have some expertise in VTC traffic watchstanding. This would ensure that supervisory personnel have both the requisite qualifications to supervise and an awareness of the use and limitations of the radar and radio systems utilized by VTC watchstanders. Had the MSO been able to maintain the commanding duty officer section, the CO and the operations officer might have learned that long before the EXXON VALDEZ was grounded, vessels had deviated from the TSS because of ice in the traffic lanes. The Safety Board believes that the number of supervisory personnel had been reduced to such an extent that supervision of the VTC was adversely affected and that additional supervisory personnel are therefore needed at the Valdez MSO. Moreover, there should be some officer whose primary duty is to be fully in charge of the VTC. Therefore, the operations officer should be divested of some of his duties or an additional officer should be assigned to the operations department so that an officer is in charge of the VTC who has the experience and time to manage it effectively.

The circumstances in which a vessel must navigate an area 1/2- to 1-mile wide that is bordered on one side by glacial ice and on the other by a dangerous reef are similar to the situation confronting vessels at Valdez Narrows and can, as this accident shows, be very dangerous. Accordingly, the vessels that may be forced to pass close to Bligh Reef merit tracking on radar by the VTC with the same degree of reliability and precision exercised by the VTC at Valdez Narrows.

The VTC was sometimes able to monitor the movement of vessels out to Bligh Reef; however, the watchstander had to shift from the 6-mile range scale to the 12-mile range scale (in offset). Use of the 12-mile range scale may have prevented the watchstander from noting the smaller course and speed changes that are more easily observed at the lower range scales. The larger range scale also introduced a small degree of error in bearings and ranges. As a result, the monitoring of vessels using the higher range scale, while necessary, reduced the accuracy of the radar tracking. This problem, however, could be solved by installing a remote radar site closer to Bligh Reef, perhaps on Bligh Island or Reef Island. A remote radar site closer to Bligh Reef would permit the VTC to monitor the transits of vessels through the Valdez Arm using lower and more accurate range scales. The reduced distance to the traffic lanes would also greatly improve the probability of tracking vessels during inclement weather. Accordingly, the Safety Board believes that a radar site near Bligh Reef is necessary to enable the VTC to ensure that vessels avoiding ice or other hazards or navigating in poor visibility do not venture too close to Bligh Reef.

Even before the VTS was established in 1977, the Coast Guard was aware that ice from the Columbia Glacier was drifting into the Valdez Arm. Because vessel traffic in the area prior to 1977 consisted primarily of fishing boats, tour boats, and an occasional cruise ship, the presence of ice in this area caused little concern; however, when tankship traffic commenced, concern for safety increased dramatically. The MSO began to receive more frequent reports of ice interfering with tankship traffic through the Valdez Arm. By the early 1980s, both the Coast Guard and the maritime industry had become increasingly concerned about the presence of ice in the traffic lanes. As a result, when ice was reported on the traffic lanes, the Coast Guard on several occasions broadcast Notices to Mariners that tankships should either reduce speed or await daylight before transiting the area. Several oil companies, including Exxon, Mobil, and Sohio, began to occasionally limit their vessels to daylight transits or to place speed restrictions on their vessels when ice was reported in Valdez Arm. About this time, the Coast Guard requested all participating vessels to provide ice reports to the VTC. By the end of 1981, the U.S. Geological Survey had predicted that calving of ice from the Columbia Glacier would continue to increase during the next 10 to 30 years. Despite warnings and concern, the port of Valdez has never been closed to vessel traffic because of ice in the traffic lanes.

In 1981, the CO of the MSO recommended the installation of radar on Bligh Island or Glacier Island. He pointed out that radar on either one could enable the VTC to determine when ice was present in the traffic lanes. Radar could provide current information about ice, thereby eliminating the common problem facing the masters of the four vessels transiting Valdez Arm on March 23, all of whom were uninformed about the ice conditions that they would encounter in the traffic lanes. According to the chief engineer, the master of the EXXON VALDEZ had seriously considered at some time during the afternoon postponing departure until daylight to be able to avoid ice. Upon arriving on the bridge, the master immediately inquired whether an ice report had been received. The pilot stated that he told the master about the ice report that he had heard the ARCO JUNEAU transmit to the VTC. However, by this time, the tugs were alongside and the pilot was on board, and it probably was too late to decide to remain in port based upon the information that was available to him. Accurate information about the ice conditions earlier in the day would have allowed the master to make a timely decision about whether to leave port.

During the evening of March 23, the Naked Island and Cape Hinchinbrook remote communications sites were inoperative. In order to maintain VHF-FM communications with vessels in the system, including the EXXON VALDEZ, the VTC was forced to route VHF-FM communications through a tertiary site near Cordova. At that time, the VTS communications system failed to meet Coast Guard Specific Operating Requirements. There was no notable improvement subsequent to the grounding, as evidenced by the fact that during the first three quarters of Fiscal Year 1989, the VTS communications system failed to meet the Coast Guard's Specific Operating Requirement of 99.9 percent operational status.

The ability of the VTS to keep the communications system operational has declined because: (1) the communications system is old (has exceeded the

10-year expected life cycle) and spare parts are no longer readily available, (2) the requested funding for the upgrade and/or replacement of the communications system has not been forthcoming, and (3) the harsh Alaskan coastal climate has continued to degrade sensitive electronic equipment at the remote sites.

The fact that the communications system had already deteriorated to a point that it no longer met Coast Guard Specific Operating Requirements indicates that eventually it will probably become impractical to keep all essential components of the system operational simultaneously. In the absence of a reliable VTS communications system, the Prince William Sound VTS could become unable to function. Should the major portions of the communication system fail during the winters, the VTS could be out of service for several days. The Safety Board believes that in order for the VTS to have an appropriate level of VHF-FM communications in Prince William Sound, PP #17-012-85, submitted by MSO Valdez to the Commander, Seventeenth Coast Guard District, for action on December 3, 1985, should be implemented as quickly as practicable.

On the day of the accident, the microwave system installed in Prince William Sound was more than 12 years old and needed replacement and/or upgrading. The microwave transmission system provided the essential link between the remote radar and communication sites and the VTC. Despite the age, condition, and importance of the microwave system, funding to upgrade and/or replace it has not been available.

The Safety Board believes that the microwave system in Prince William Sound should not be allowed to deteriorate further and that the Coast Guard should place a higher priority on implementing that part of PP #17-012-85 that covers the update and/or replacement of the microwave system as soon as practicable.

The public had two opportunities to comment on the proposed rules to reduce Federal pilotage requirements in Prince William Sound. The proposed changes would have eliminated any requirement that U.S. domestic vessels have a Federal pilot or an officer with a Federal pilotage endorsement between Cape Hinchinbrook and the former pilot station at Rocky Point. This reduction in pilotage requirements would have allowed vessels to pass Bligh Reef, both inbound and outbound, without having a pilot on the bridge. The grounding of the EXXON VALDEZ, plus the fact that tankships frequently pass close to Bligh Reef while avoiding ice, leads the Safety Board to believe that vessels passing Bligh Reef should be under the control of an officer who has local knowledge of Valdez Arm. The requirement for Federal pilotage on almost all transits, although not adhered to by the master of the EXXON VALDEZ, ensured that a Federal pilot was in charge of each vessel throughout Valdez Arm.

Moreover, the requirements for nonpilotage vessels that were established by former COTP Order 1-80 appear to have contributed to the safety of such vessels, since there is no history of accidents attributable to nonpilotage vessels. The CO's decision to rescind the requirement for daylight passage when visibility is 2 miles or more seems to be reasonable, especially since

there will be a pilot on board between a point south of Bligh Reef and Port Valdez. The requirement in the COTP Order for an extra officer to plot the vessel's position between the entrance and the pilot station is normally accomplished by the presence of the master on the bridge. The requirement that an officer be on the bridge who can speak English is considered warranted, since reliable communications are essential to safety. The Safety Board believes that retention of the requirements of former COTP Order 1-80 (except for daylight transit) as VTS regulations would contribute significantly to navigation safety in Prince William Sound.

Therefore, the National Transportation Safety Board recommends that the U.S. Coast Guard:

Develop a means for rigorous enforcement of 46 U.S.C.8104(a) to ensure that officers on watch during departures from ports have had at least 6 hours of off-duty time in the previous 12 hours. (Class II, Priority Action) (M-90-32)

Expedite the study programs to establish manning levels and safeguards based on human factors, as well as on shipboard hardware and equipment, and incorporate the findings into the manning review process. (Class II, Priority Action) (M-90-33)

Establish manning standards to ensure that crew complements reflect all expected shipboard operating situations and that procedures are in place for dealing with unusually high workloads at sea, such as tank cleaning, and with cargo handling operations in port. (Class II, Priority Action) (M-90-34)

Seek authority for access to the National Driver Register and other driving records and make use of the information from these sources to prevent any person with a drug and/or alcohol problem from holding a merchant marine license. (Class II, Priority Action) (M-90-35)

Adopt a permanent policy to plot all vessels participating in the Valdez Vessel Traffic System between the pilot station south of Bligh Reef, or as near the pilot station as possible, and their berths in Port Valdez. (Class II, Priority Action) (M-90-36)

Increase the manning level at the Marine Safety Office, Valdez, Alaska, to provide the following: enough watchstanders to plot all participating vessels between the pilot station south of Bligh Reef and their berths in Port Valdez; an officer-in-charge of the Vessel Traffic System who will have time to manage and supervise the system effectively; and sufficient additional officers to staff a duty officer watch with officers capable of

monitoring and supervising vessel traffic watchstanders outside normal working hours. (Class II, Priority Action) (M-90-37)

Install an additional radar site as close to Bligh Reef as feasible to enable the Vessel Traffic Center to accurately monitor and plot all participating vessels and ice in the area of Valdez Arm from Busby Island to the pilot station south of Bligh Reef. (Class II, Priority Action) (M-90-38)

Initiate procedures to collect information on ice conditions in Valdez Arm so that all participating vessels receive accurate and timely ice reports before departing port and so that all supervisory personnel associated with the Valdez Traffic System are cognizant of ice conditions in Valdez Arm. (Class II, Priority Action) (M-90-39)

Improve the communications system operated by the Marine Safety Office in Valdez, Alaska. (Class II, Priority Action) (M-90-40)

Improve the microwave system operated by the Marine Safety Office in Valdez, Alaska. (Class II, Priority Action) (M-90-41)

Limit any proposed reduction in Federal pilotage to that part of Prince William Sound from the entrance outside Cape Hinchinbrook to the current pilot station at latitude 69°49'N, longitude 174° 01'W, which is south of Bligh Reef, thus ensuring that Federal pilots will be required between the entrance to Valdez Arm south of Bligh Reef and the berths in Port Valdez. (Class II, Priority Action) (M-90-42)

Incorporate into the Vessel Traffic Service regulations for all vessels the provisions of former COTP Order 1-80 (except the requirement for daylight transit), including the requirements about vessel condition, crews, navigation equipment, and publications, as well as the requirement that a licensed officer in addition to the licensed officer on watch be available to plot the vessel's position. (Class II, Priority Action) (M-90-43)

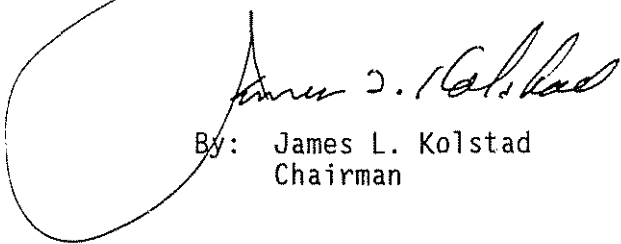
In addition, the Safety Board reiterates the following safety recommendation to the U.S. Coast Guard:

Seek legislation to require all pilots of commercial vessels on the navigable waters of the United States to have a Federal pilot's license which would be legally superior to all State-issued documents, licenses or

commissions that a State may continue to employ to accredit those pilots that it desires to pilot vessels engaged in foreign commerce. (Class II, Priority Action) (M-88-1)

Also, the Safety Board issued Safety Recommendations M-90-26 through -31 to the Exxon Shipping Company and all shipping companies operating in Prince William Sound; M-90-44 through -47 to the Environmental Protection Agency; M-90-48 and -49 to the Alaska Regional Response Team; M-90-50 through 52 to the State of Alaska; M-90-53 through -58 to the Alyeska Pipeline Service Company; and M-89-59 to the U.S. Geological Survey. The Safety Board also reiterated Safety Recommendations I-89-1 through -12 to the Department of Transportation.

KOLSTAD, Chairman, COUGHLIN, Vice Chairman, and LAUBER and BURNETT, Members, concurred in these recommendations.



By: James L. Kolstad
Chairman