National Transportation Safety Board

Washington, DC 20594

Safety Recommendation

Date: November 4, 2011

In reply refer to: M-11-19 through -21

Twenty-four states and the territories of Guam and Puerto Rico
(See attached distribution list.)

The National Transportation Safety Board (NTSB) is an independent Federal agency charged by Congress with investigating transportation accidents, determining their probable cause, and making recommendations to prevent similar accidents from occurring. We are providing the following information to urge your organization to take action on the three safety recommendations in this letter. The NTSB is vitally interested in these recommendations because they are designed to prevent accidents and save lives. Information supporting the recommendations is discussed below. The NTSB would appreciate a response from you within 90 days addressing the actions you have taken or intend to take to implement our recommendations.

Background

The recommendations are derived from the NTSB's investigation of the January 23, 2010, accident in which the 810-foot-long oil tankship *Eagle Otome* collided with the 597-foot-long general cargo vessel *Gull Arrow* at the Port of Port Arthur, Texas. A 297-foot-long barge, the *Kirby 30406*, which was being pushed by the towboat *Dixie Vengeance*, subsequently collided with the *Eagle Otome*. The tankship was inbound in the Sabine-Neches Canal with a load of crude oil en route to an ExxonMobil facility in Beaumont, Texas. Two pilots were on board, as called for by local waterway protocol. When the *Eagle Otome* approached the Port of Port Arthur, it experienced several unintended heading diversions culminating in the *Eagle Otome* striking the *Gull Arrow*, which was berthed at the port unloading cargo.

A short distance upriver from the collision site, the *Dixie Vengeance* was outbound with two barges. The towboat master saw the *Eagle Otome* move toward his side of the canal, and he put his engines full astern but could not avoid the subsequent collision. The *Kirby 30406*, which was the forward barge pushed by the *Dixie Vengeance*, collided with the *Eagle Otome* and breached the tankship's starboard ballast tank and the No. 1 center cargo tank a few feet above the waterline. As a result of the breach, 862,344 gallons of oil were released from the cargo tank, and an estimated 462,000 gallons of that amount spilled into the water. The three vessels

remained together in the center of the canal while pollution response procedures were initiated. No crewmember on board any of the three vessels was injured.[1]

The National Transportation Safety Board determines that the probable cause of the collision of tankship *Eagle Otome* with cargo vessel *Gull Arrow* and the subsequent collision with the *Dixie Vengeance* tow was the failure of the first pilot, who had navigational control of the *Eagle Otome*, to correct the sheering motions that began as a result of the late initiation of a turn at a mild bend in the waterway. Contributing to the accident was the first pilot's fatigue, caused by his untreated obstructive sleep apnea and his work schedule, which did not permit adequate sleep; his distraction from conducting a radio call, which the second pilot should have conducted in accordance with guidelines; and the lack of effective bridge resource management by both pilots. Also contributing was the lack of oversight by the Jefferson and Orange County Board of Pilot Commissioners.

Pilot Oversight and Bridge Resource Management

The Sabine Pilots Association, to which the two pilots on board the *Eagle Otome* belonged, had developed piloting guidelines specifying the duties and responsibilities during two-pilot operations in the Sabine-Neches Waterway. The piloting guidelines were detailed in a printed document called "Guidelines Governing Aboard Vessels Requiring Two Pilots When Transiting the Sabine-Neches Waterway." However, the Sabine pilots were not consistently applying the piloting guidelines in their operations. In the postaccident Marine Board of Investigation hearing that the U.S. Coast Guard convened in Port Arthur March 9–11, 2010, the chairman of the Jefferson and Orange County Board of Pilot Commissioners ("the commission"), which had regulatory authority over the Sabine pilots, stated that the commission was not a party to the Sabine Pilots Association's piloting guidelines or other guidelines pertaining to ship operations in the Sabine-Neches Waterway and that the commission was not aware of the piloting guidelines until they were introduced as evidence during the hearing. He also stated that he had a standing invitation to attend the meetings held by the Southeast Texas Waterways Advisory Council (SETWAC, a safety committee for the ports and waters of the Sabine-Neches Waterway) but had not attended one since his term began in 2001.

The intent of the Sabine Pilots Association guidelines with respect to two-pilot duties and responsibilities seemed to be that the association wanted its pilots to form navigation teams. This intent was commendable; the use of teams in operating complex systems, such as navigating large vessels in narrow waterways, is preferable to single operators. Researchers have noted the following:[2]

> Teams have become the strategy of choice when organizations are confronted with complex and difficult tasks. Teams are used when errors lead to severe consequences; when the task complexity exceeds the capacity of an individual; when the task

[1] For more information, see *Collision of Tankship* Eagle Otome *with Cargo Vessel* Gull Arrow *and Subsequent Collision with the* Dixie Vengeance *Tow, Sabine-Neches Canal, Port Arthur, Texas, January 23, 2010*. Marine Accident Report NTSB/MAR-11/04 (Washington, DC: National Transportation Safety Board, 2011), available at http://www.ntsb.gov.

[2] E. Salas, N.J. Cooke, and M.A. Rosen, "On Teams, Teamwork, and Team Performance: Discoveries and Developments," *Human Factors*, vol. 50 (2008), pp. 540–547.

> environment is ill-defined, ambiguous, and stressful; when multiple and quick decisions are needed; and when the lives of others depend on the collective insight of individual members [p. 540].

The use of two operators to navigate large vessels on the Sabine-Neches Waterway is consistent with human factors principles. That is, given the complexity of the task, the use of teams on the waterway would enable pilots to share navigation-related tasks so that one pilot does not become overloaded. For example, while one pilot focuses on vessel navigation tasks, the other pilot communicates with nearby vessels. Teams also enable pilots to monitor each other's performance to reduce errors and their consequences, which is consistent with good bridge resource management (BRM)[3] practice. However, because the Sabine pilots were not consistently applying the piloting guidelines in their operations, the first pilot on board the *Eagle Otome* had the conn in the accident area when the second pilot should have. More significantly, when the first pilot should have been focusing on the upcoming turn in the waterway where the problem began, he—not the second pilot, as should have been the case when the first pilot had the conn—was conducting the radio call with the *Dixie Vengeance* master. When the second pilot was needed to assist the first pilot after the radio communication, he was not prepared to do so because he had not been sufficiently engaged in the navigation. Leading up to the accident, neither pilot appeared to take full advantage of having an experienced and equal colleague on the bridge. The second pilot allowed himself to lose situational awareness by reading the newspaper and disengaging from performing radio and miscellaneous duties specified in the piloting guidelines. The first pilot chose to conduct both the conning and miscellaneous duties by himself and thus did not use all of the resources that were available to him. The two pilots had both attended BRM training; however, their most recent training had taken place more than a decade before the accident. The NTSB concluded that although both pilots completed BRM training, they failed to apply the team performance aspects of BRM to this operation. The NTSB therefore recommends that governors of states and territories in which state and local pilots operate require local pilot oversight organizations that have not already done so to implement initial and recurring BRM training requirements.

Mariner Fatigue

Also as a result of this investigation, the NTSB determined that the first pilot, who had the conn of the *Eagle Otome* leading up to the accident, was fatigued because of his untreated obstructive sleep apnea and his work schedule which did not prevent extended hours of wakefulness and disruption to circadian rhythms. For at least 3 days during the week before the accident, the first pilot had maintained a day-awake, night-asleep work schedule. However, in the 1–2 days before the accident, he worked two consecutive piloting assignments that resulted in his being awake for at least 27 hours straight. He subsequently rested during daytime hours, which was contrary to the circadian rhythms that he had been maintaining.

The Sabine Pilots Association had a rest period policy in place; however, because it did not consider circadian rhythms nor prevent extended wakefulness, the policy was ineffective in preventing fatigue. Further, no regulatory body with pilot oversight authority had rules or

[3] BRM is the effective use by a vessel's bridge team (masters, officers, crew, and pilots) of all available resources—information, equipment, and personnel—to safely operate the vessel.

regulations in place that could have precluded the adverse effects of fatigue-inducing scheduling practices from impairing the very cognitive skills that the pilots needed most to effectively navigate vessels through the Sabine-Neches Canal. Therefore, the NTSB concluded that no effective hours of service rules were in place that would have prevented the Sabine pilots from being fatigued by the schedules that they maintained.

The Jefferson and Orange County Board of Pilot Commissioners asserted that its authority only extended to pilot licensing and pilot training. The commission's lack of scheduling rules created a void that permitted fatigued pilots to perform safety-critical duties in a busy, challenging waterway. Such a void in a complex transportation system poses a threat to property, ecosystems, and the lives of those in and near the waterway. Researchers have suggested criteria—such as time of day, circadian rhythms, duration of opportunity for sleep, sleep quality, predictability, sleep debt, time on task, and short breaks—to evaluate the efficacy of hours of service rules.[4] Although it can be argued that not all of the criteria are appropriate to a fatigue mitigation and prevention regulatory scheme, these criteria can be used as a standard of comparison against which regulations can be assessed, and most hours of service rules in place today meet at least several of these criteria. However, because no regulatory body had established effective hours of service rules that Sabine pilots were required to follow, the pilots were at risk for fatigue in each of the suggested criteria, highlighting the safety hazard posed by the regulatory vacuum that existed. Without effective hours of service rules and education in fatigue management, there was little to mitigate the effects of fatigue among the Sabine pilots except for Coast Guard medical oversight of mariner sleep disorders. Therefore, the NTSB concluded that the absence of an effective fatigue mitigation and prevention program among the pilots operating under the authority of the Jefferson and Orange County Board of Pilot Commissioners created a threat to the safety of the waterway, its users, and those nearby.

The commission's charter calls for it to "adopt rules and issue orders to pilots and vessels when necessary to secure efficient pilot services," a responsibility that gives the commission the authority to regulate the safety of pilot actions and performance. Pilot oversight organizations should use the power that the governors of their states and territories have given them to fully regulate practices that enhance the safety of their waterways. To enhance safety in the Sabine-Neches Waterway, the commission could have been aware of and enforced the intent of the two-pilot guidelines that the Sabine Pilots Association developed for piloting large vessels through the Sabine-Neches Waterway and played an active role in SETWAC. The commission could also have implemented a fatigue mitigation and prevention program to educate pilots about fatigue and require that fatigue-preventing hours of service rules govern pilot schedules. The commission's lack of familiarity with the Sabine Pilots Association's two-pilot guidelines further illustrates that the commission did not take an active role to ensure waterway safety through establishing safety rules and piloting oversight. Therefore, the NTSB concluded that the Jefferson and Orange County Board of Pilot Commissioners should have more fully exercised its authority over pilot operations on the Sabine-Neches Waterway by becoming aware of and enforcing the Sabine Pilots Association's two-pilot guidelines and implementing a fatigue mitigation and prevention program among the Sabine pilots.

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[4] C.B. Jones and others, "Working Hours Regulations and Fatigue in Transportation: A Comparative Analysis," *Safety Science*, *43* (2005), pp. 225–252.

The NTSB is concerned that other pilot oversight organizations, like the Jefferson and Orange County Board of Pilot Commissioners, may not be exercising their authority to ensure the safety of our nation's waterways by effectively overseeing the activities and work schedules of local pilots. In the interests of safety, therefore, organizations that oversee pilots must ensure that sufficient regulations are in place so that pilots follow best practices for safety. Because most pilots are required to have Coast Guard licenses, Coast Guard oversight of mariner medical standards is already in place to reduce the risk of fatigue from sleep disorders. However, the circumstances of this accident suggest that pilot oversight organizations may lack regulations that promote the highest level of safe practices among their pilots, including hours of service rules that prevent fatigue-inducing scheduling. Therefore, the NTSB recommends that governors of states and territories in which state and local pilots operate ensure that local pilot oversight organizations effectively monitor and, through their rules and regulations, oversee the practices of their pilots to promote and ensure the highest level of safety. In addition, the NTSB recommends that governors of states and territories in which state and local pilots operate require local pilot oversight organizations that have not already done so to implement fatigue mitigation and prevention programs that (1) regularly inform mariners of the hazards of fatigue and effective strategies to prevent it and (2) promulgate hours of service rules that prevent fatigue resulting from extended hours of service, insufficient rest within a 24-hour period, and disruption of circadian rhythms.

As a result of this accident investigation, the National Transportation Safety Board makes the following recommendations to governors of states and territories in which state and local pilots operate:

> Ensure that local pilot oversight organizations effectively monitor and, through their rules and regulations, oversee the practices of their pilots to promote and ensure the highest level of safety. (M-11-19)
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> Require local pilot oversight organizations that have not already done so to implement fatigue mitigation and prevention programs that (1) regularly inform mariners of the hazards of fatigue and effective strategies to prevent it and (2) promulgate hours of service rules that prevent fatigue resulting from extended hours of service, insufficient rest within a 24-hour period, and disruption of circadian rhythms. (M-11-20)
>
> Require local pilot oversight organizations that have not already done so to implement initial and recurring bridge resource management training requirements. (M-11-21)

The NTSB also issued safety recommendations to the U.S. Coast Guard, the Sabine Pilots Association, the Jefferson and Orange County Board of Pilot Commissioners, and the American Pilots' Association.

In response to the recommendations in this letter, please refer to Safety Recommendations M-11-19 through -21. If you would like to submit your response electronically rather than in hard copy, you may send it to the following e-mail address: correspondence@ntsb.gov. If your response includes attachments that exceed 5 megabytes, please e-mail us asking for instructions

on how to use our Tumbleweed secure mailbox. To avoid confusion, please use only one method of submission (that is, do not submit both an electronic copy and a hard copy of the same response letter).

Chairman HERSMAN, Vice Chairman HART, and Members SUMWALT, ROSEKIND, and WEENER concurred in these recommendations.

[Original Signed]

By: Deborah A.P. Hersman
Chairman

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