



Log M-410E

National Transportation Safety Board
Washington, D.C. 20594

Safety Recommendation

Date. June 25, 1998

In reply refer to: M-98-98 and -99

Mr. John Donaldson
Executive Director
Personal Watercraft Industry Association
1819 L Street, N.W., Suite 700
Washington, D.C. 20036

Personal watercraft (PWC) are a type of recreational boat that has become increasingly popular in recent years. Manufacturers estimate that about 200,000 PWC are sold each year, and more than 1 million are in current operation. PWC now account for more than one-third of the new recreational boat sales in the United States.

Although the overall number of recreational boating fatalities has been declining in recent years, the number of personal watercraft-related fatalities has been increasing. At the time of the National Transportation Safety Board's 1993 recreational boating safety study, there were only 26 personal watercraft fatalities a year, and the Safety Board did not believe that separate consideration of PWC was warranted. However, in 1994, the number of PWC fatalities began to increase noticeably because the number of PWC in operation increased. Preliminary numbers for 1997 indicate 83 PWC fatalities. PWC are the only type of recreational vessel for which the leading cause of fatalities is not drowning; in PWC fatalities, more persons die from blunt force trauma than from drowning. The increase in fatalities and the distinctive way in which fatalities occur prompted the Safety Board to examine the nature of PWC accidents.

The Safety Board initiated a study to more closely examine fatalities and injury in addition to accident characteristics associated with PWC accidents.¹ The study was not designed to estimate how often PWC accidents occur. The Safety Board examined 1,739 PWC accident reports for accidents that occurred during an 18-month period, January 1996 through June 1997. For PWC accidents that occurred between January and June 1997, the Safety Board requested that State marine accident investigators provide the Safety Board with copies of their accident reports and complete a supplemental questionnaire prepared by the Safety Board specifically for

¹ National Transportation Safety Board 1998. Personal Watercraft Safety. Safety Study NTSB/SS-98/01. Washington, DC.

this study. The goal of the supplemental questionnaire was to obtain additional information concerning the accident characteristics and details concerning personal injury that have not previously been available from State boating accident reports. State accident reports and supplemental information were the sources of the Safety Board's accident information.

For the January–June 1997 period, the Safety Board received boating accident reports and questionnaire responses from 37 participating States and Territories. Boating accident reports were not always accompanied by supplemental questionnaires. Also, because of concerns over personal privacy issues, five States² did not provide the Safety Board with copies of their boating accident reports but did provide supplemental questionnaires. Consequently, the boating accident reports and the supplemental questionnaires represent two different but substantially overlapping sets of data, which contain information on a total of 814 PWC accidents involving 1,218 operators.

The Safety Board also reviewed State reports of PWC accidents that occurred in 1996. A total of 49 States and Territories provided either copies of their boating accident report forms, automated boating accident report database files, or summary information for 1996 and/or 1997.

Because the States voluntarily provided the Safety Board with accident reports and supplemental questionnaire information, and because of the incomplete nature of much of the information, the Safety Board does not claim that the results of the study are representative of all PWC accidents. The Safety Board analyzed 814 (one-third) of the 1997 reported accidents, and examined all of the data for the 1996 reported accidents. Consequently, the Board believes that a substantial number of accidents was available to identify the most important safety issues associated with PWC accidents. Further, the Safety Board's analysis did not show any biases in the types of accidents in the half-year of 1997 accidents compared to the full year of 1996 accidents. The Safety Board's interest in truncating the data collection period to 6 months was based on a goal of providing the results of this study prior to the 1998 summer boating season.

Based on the analysis of the data reviewed, the safety issues discussed in the Safety Board's report include the following: protecting personal watercraft riders from injury, operator experience and training, and boating safety standards. The study also addressed the need for recreational boating exposure data. The discussion in this letter is limited to operator experience and training, and boating safety standards.

Operator Experience and Training

For the January–June 1997 period, experience was reported for half (613) of the 1,218 PWC operators involved in the accidents.³ Nearly a third of all operators (32 percent) reported that they had operated a PWC between zero and 10 times prior to the accident: 86 never, 75

² California, Delaware, Nevada, Washington, and the Territory of Puerto Rico.

³ The Safety Board recognizes that the data on this topic are based on self-report and may be an overestimate of the number of PWC operators with experience and training.

once, and 225 between 2 and 10 times. PWC operators with experience of more than 10 times accounted for 18 percent (220 of the 1,218 operators)

Operator education or training was reported by 712 PWC operators: 84 percent of those operators reported that they had no training, whereas 16 percent had received some form of boating instruction. The results concerning PWC operator training are consistent with the Safety Board's findings in its 1993 study of recreational boating: as few as 7 percent and no more than 22 percent of the persons operating a boat for the first time had taken a boating safety course.⁴

On October 23, 1997, the Coast Guard issued a notice in the Federal Register requesting comments on a proposed Federal requirement for education in recreational boating. On March 20, 1998, the Coast Guard extended the comment period until May 29, 1998.⁵ The Safety Board submitted comments supporting the need for operator education and training for recreational boaters and PWC operators, and reiterating the conclusions and recommendations of its 1993 study on recreational boating safety. The Board's comments noted that the lack of education reported for the PWC operators in the current study provides further support for the need for education of recreational boat and PWC operators.

Accident data showed that operators of rented PWC in the study sample had less PWC experience than did operators of privately owned personal watercraft. Considering the unique operating characteristics of PWC, this lack of experience creates a safety risk. Given that the percentage of PWC accidents that occur within the first hour was almost twice as high for rented PWC as for nonrented PWC (73 percent compared to 39 percent), that half of the accident-involved rental operators had limited or no experience on a PWC, and that about two-thirds of accident-involved PWC renters had not had to demonstrate their ability to operate the vessel, the Safety Board is recommending that States should enact or revise their recreational boating laws, as necessary, to require rental businesses to provide safety instruction training to all persons who operate rented PWC; all the operators should be required to demonstrate their ability to operate and control a PWC. The Safety Board also believes that the Personal Watercraft Industry Association (PWIA), in conjunction with the National Association of State Boating Law Administrators (NASBLA) and the Coast Guard, should develop a checklist for boat rental businesses to use for evaluating a person's ability to operate a personal watercraft.

Boating Safety Standards

Manufacturers of inboard and outboard motorboats must meet safety standards for the manufacture of boats and associated equipment (33 CFR Part 183), including requirements for certification and labeling (Part 181) and defect notification (Part 179). The standards and regulations of Part 183 specifically address capacity, loading, flotation, electrical systems, fuel

⁴ National Transportation Safety Board. 1993. Recreational boating safety. Safety Study NTSB/SS-93/01. Washington, DC (p. 50) 104 p.

⁵ Federal Register, Vol. 63, No. 54, dated March 20, 1998, page 13585.

systems, and ventilation. In addition to the provisions included in the regulations, many requirements are incorporated by reference⁶

Federal statutes authorize the Coast Guard to issue exemptions from safety standards for manufacturers of boats to which the application of a standard is impractical or unreasonable and when the manufacturer can show that granting the exemption will not adversely affect boating safety⁷. Manufacturers must petition the Coast Guard for exemption from safety standards. The Coast Guard has granted exemptions to every petition received from PWC manufacturers, and for each model for which an exemption was requested.⁸

Personal watercraft, as a vessel design category, cannot comply with the Coast Guard standards, as currently written, and thus the exemptions from the existing standards are unavoidable. The following examples are provided to explain why PWC need exemptions from the existing standards:

- The safe loading standard, as currently written, is based on the assumption that water will flow into the vessel. If there is no load area into which water will flow, it is impossible to test a vessel in accordance with the safe loading standard; safe loading standards determine the weight limits appropriate for a particular vessel, and, by correlation, determine the person capacity⁹.
- In addition, if weight capacities cannot be determined in accordance with the safe loading standard, it becomes difficult to determine the required volume of flotation material for compliance with the flotation standard,¹⁰ thus PWC are also exempted from the flotation standard and from requirements for labeling the capacity of the PWC.¹¹

⁶ Information incorporated by reference (as listed in Paragraph 183.5) includes recommended practices developed by the Institute of Electrical and Electronics Engineers, Inc., electrical code requirements of the National Fire Protection Association, recommended practices of the Society of Automotive Engineers, Inc., and the Underwriters Laboratory, Inc.

⁷ The Coast Guard's authorization was described in correspondence dated January 17, 1995, between U.S. Coast Guard Chief, Recreational Boating Product Assurance Branch, and the Chairman of the National Association of State Boating Law Administrators.

⁸ The Coast Guard has issued exemptions from its standards for both inboard- and outboard-powered personal watercraft, hovercraft, airboats, raceboats, and submarines.

⁹ To receive an exemption, PWC manufacturers provide the Coast Guard with test data to show adequate flotation, boat weight and passenger capacity, and the amount of flotation material installed. Based on this information, the Coast Guard determines whether each PWC model contains sufficient flotation to meet the intent of the standard.

¹⁰ Basic flotation, as applied to inboard and inboard-outdrive boats, requires sufficient flotation material so that if the vessel capsizes or swamps, the boat will remain floating with some portion of its hull above the surface of the water.

¹¹ Manufacturers are considering the use of a capacity label that would indicate the rated person capacity. The proposed capacity marking label would state that the vessel complies with ISO 13590 of the International Standards Organization and that it is certified by the National Marine Manufacturers Association.

- Manufacturers of personal watercraft have also received exemptions from electrical and fuel systems standards and from the requirement for powered ventilation in the ventilation standard. The manufacturers' main justification for requesting these exemptions is that PWC design features minimize the possibility of arcing or sparks; specifically, fuel systems minimize the possibility of fuel vapor leakage, and the comparatively smaller size of the engine compartment compared to larger, more conventional boats limit the air supply and the PWC's ability to support combustion. Because PWC have a tendency to capsize and could take on water through their blowers, the powered ventilation standards, as currently written, cannot be applied.

Voluntary industry construction standards have been developed by the Society of Automotive Engineers (SAE) and the International Standards Organization (ISO); these standards are similar to the Coast Guard boat standards but are specific to PWC. SAE's Personal Watercraft Subcommittee of the Marine Technical Committee has developed standards to address personal watercraft flotation (Recommendation Practice J1973), electrical systems (J2120), fuel systems (J2046), and ventilation (J2034). In its rationale for issuing these standards, the SAE recognized that PWC cannot comply with the Coast Guard regulations for conventional boat system designs, and it recognized the specific differences that affect PWC system requirements. For example, the SAE fuel system standard is more stringent than Coast Guard requirements; the SAE standard requires that the PWC system not leak liquid fuel into the vessel when rotated through a 180-degree roll in either direction or overturned through 90 degrees of pitch in either direction. The Safety Board recognizes that industry representatives serve on SAE committees and that all of the major PWC manufacturers voluntarily comply with the SAE standards. Industry representatives have also contributed to the development of ISO standards, which are similar to SAE standards.

In May 1997, NASBLA asked the Coast Guard to consider developing standards for PWC. Based on this request, the Coast Guard noted the similarities between SAE and ISO standards and specifically identified the differences between SAE standards and the existing safety standards as defined in Part 183. In October 1997, the Coast Guard's Boating Safety Advisory Committee requested the Coast Guard to review how manufacturers determine capacity on multiple-occupant rated PWC models—how the lack of an industry-wide standard for determining and displaying "persons capacity" impacts rider safety, including consideration of accident data. Coast Guard staff, in a meeting with Safety Board staff on April 10, 1998, indicated that there was no compelling statistical evidence that PWC problems warrant modifying existing safety standards for flotation (capacity), electrical system, fuel systems, and ventilation.

The Safety Board notes that the Coast Guard's four standards were developed, in part, to address the most serious safety concerns of traditional motorboats: drowning, fire, and explosion. The Safety Board's study clearly points out, however, that these are not the most prevalent safety concerns for PWC. PWC, as previously mentioned, is the only type of recreational vessel for which the leading cause of death is not drowning. Also, in traditional boats, falling overboard and swamping would be considered emergency situations; however, for PWC, these are expected

events and, consequently, PWC are designed and constructed to different design criteria than traditional boats.

The Safety Board questions the need for the Coast Guard to continue the exemption process for PWC, particularly given that industry standards exist (and in certain areas are more stringent than the Coast Guard's), that there is voluntary compliance with the standards, and that the standards appear to provide an equivalent level of safety as envisioned by the Coast Guard standards. The Safety Board concludes that the existing process of exempting PWC from standards that were defined for conventional boats is an inappropriate method for certifying the safety and seaworthiness of PWC. In the Safety Board's opinion, the exemption process does little in terms of evaluating possible safety risks that may be associated with the unique operating characteristics of PWC. The Safety Board is aware that the Coast Guard is working with the PWIA to incorporate SAE standards by reference as an alternate method of compliance with existing Federal regulations. The fact that PWC do not "fit" existing standards for open-hull vessels does not release the Coast Guard from its responsibility to regulate the safety of these vessels, particularly since personal watercraft now represent more than one-third of the new recreational boats sold. The Safety Board is recommending, therefore, that the Coast Guard eliminate the existing process of exempting PWC from standards that were defined for conventional boats and develop, in conjunction with the manufacturers of personal watercraft, comprehensive standards that are specific to the safety risks of PWC.

The Safety Board notes, however, that industry has voluntarily complied only with those standards that address the existing Coast Guard boating safety standards (flotation, capacity, electrical, fuel, and ventilation) that were established for conventional boats. The Safety Board is concerned that there are other safety issues associated with PWC that warrant attention. The need for improved steering control and prevention of "runaway" PWC once an operator is ejected serve as two prime examples of areas where improvements in design could result in a decrease in accidents.

State marine accident investigators have recognized that steering issues are associated with many PWC accidents. The Safety Board reviewed available accident reports for 1996 and 1997 and, based on narrative information contained in the accident reports, determined that more than 350 (20 percent) of the cases reviewed indicated steering or loss of control problems. Accident reports reviewed for the Safety Board's study highlight problems of operator control during off-throttle steering situations. Some portion of operator control problems may be attributed to the operating design of personal watercraft.

The narrative report of an accident that occurred in Illinois included the following investigator comment: "She (V1) stated that as they came close, she let off the throttle and then tried to turn but couldn't. She stated that V2 hit her in the side of the Sea-Doo causing a tremendous amount of damage. V2 advised that as she came close to V1 she turned to avoid her, but it didn't turn because she let off of the throttle." The report of a fatal Missouri accident included the following investigator comments: "He did not think that she knew that he was behind her. He said that it was less than a second between when she turned and when he struck her. He let go of the throttle, but it did not help."

On September 10, 1997, NASBLA adopted a resolution (No. 97-3) petitioning the Coast Guard to evaluate off-throttle steering of jet-pump propelled craft and to develop appropriate standards. The Coast Guard issued a grant request in October 1997.¹² The objective of this work will be to identify the most effective of the available and emerging technologies/methodologies in the area of off-throttle steering. As part of the background information in the grant description, the Coast Guard stated: "A large percentage of accidents involving jet-pump propelled craft involve collisions with other craft or fixed objects. Because of the unique relationship between the amount of throttle and steering response on jet-pump propelled craft, there is concern that a sudden loss of engine power—either due to part failure or operator decision—may play a significant role in these collisions." Announcement of the grant award is anticipated in the near future. The Safety Board study data support the need for this research, and an evaluation of PWC steering design is warranted. The Safety Board is concerned that the Coast Guard has not taken a proactive role in assessing the safety risks of PWC. Therefore, the Safety Board is recommending that within 2 years the Coast Guard determine, through research, the feasibility of providing PWC operators more control in an off-throttle steering situation (Safety Recommendation M-98-88). The Safety Board also believes that the PWIA should work with the Coast Guard to use the results of this research to develop appropriate standards for steering on jet-pump propelled vessels.

Therefore, the National Transportation Safety Board recommends that the Personal Watercraft Industry Association.

Develop, in conjunction with the U.S. Coast Guard and the National Association of State Boating Law Administrators, a checklist for boat rental businesses to use for evaluating a person's ability to operate a personal watercraft. (M-98-98)

Work with the U.S. Coast Guard to use the results of off-throttle steering research described in Safety Recommendation M-98-88 to the Coast Guard to develop appropriate standards for steering on jet-pump propelled vessels. (M-98-99)

Also as a result of this study, the Safety Board issued safety recommendations to the manufacturers of personal watercraft (Kawasaki, Yamaha, Polaris, Bombardier, and Arctic Cat, Inc./Tiger Shark), the U.S. Coast Guard, the U.S. Coast Guard Auxiliary, the National Association of State Boating Law Administrators, the U.S. Power Squadrons, BOAT/US, and the Governors of the States and Territories.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any actions taken as a result of its safety recommendations and would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations M-98-98 and -99 in your reply.

¹² Federal Register, Vol. 62, No. 193, dated October 6, 1997, page 52176

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations

A handwritten signature in black ink, consisting of a stylized 'J' followed by 'im Hall'.

By: Jim Hall
Chairman