



National Transportation Safety Board
Washington, D.C. 20594

Safety Recommendation

Date: June 25, 1998

In reply refer to: M-98-95 through -97

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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 accidents¹. 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

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

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 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 addresses the need for recreational boating exposure data. The discussion in this letter is limited to operator experience and training, which includes the topic of State PWC operating restrictions.

Operator Experience and Training

Each year, many first-time PWC operators are exposed to the boating environment. In the Safety Board's 1997 sample of PWC accidents, nearly half (48 percent) of the operators of rented PWC had operated a PWC only once or never; 18 percent of the operators of privately owned

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

PWC had previously operated a PWC only once or never. This lack of experience is particularly important for PWC because the vessels have special operating characteristics, such as the loss of control during off-throttle steering and cut-off ("kill") switches activated by the use of safety lanyards to stop the vessel if the operator is ejected, that underscore the need for training.

Operating a PWC requires a high degree of vigilance. Several PWC models can exceed 60 mph, but even at a speed of 40 mph, a PWC travels about 20 yards per second. As speeds increase, the time available to react decreases. PWC are highly maneuverable vessels that can change course quickly while under power, which presents a particular problem when several PWC are traveling together.³ The timeframe for perceptually tracking another PWC can also be quite limited under these conditions. Operators of two PWC traveling at 40 mph on a head-on course will have a response time of 1.3 seconds to travel 50 yards. Even when the vessels are converging on a 45-degree angle, the response time is less than 2 seconds.⁴ The response time must accommodate perceiving the other vessel, deciding which vessel is burdened to comply with rules of the road, determining the risk of collision, and executing a response to alter course. Under these conditions, inexperienced operators who are not aware of navigation rules⁵ that dictate which vessels have the right of way and, therefore, what direction of turn can be expected for vessels on conflicting routes, are faced with split-second decisions.

The Safety Board's analysis of the 1997 State boating accident reports showed that 87 percent of the PWC operators had received no boating instruction.⁶ The NTSB supplemental questionnaire submitted by the States indicated a similar proportion. 84 percent had completed no type of boating instruction.⁷ The need for boating instruction was addressed in the Safety Board's 1993 safety study of recreational boating, 81 percent of the operators involved in fatal accidents in that study had received no boating safety instruction.⁸ A review of 1996 Coast Guard boating statistics also illustrates that recreational boaters have a low exposure to safety education. Of the 709 recreational boating fatalities, educational experience was known for 340. 50 (15 percent) had received operator education, and 290 (85 percent) were known not to have received operator

³ State boating law administrators agree that PWC operations often involve riding close to other PWC.

⁴ 40 mph = 19.5 yd/sec. On a direct course, each vessel traverses 25 yards; on a converging course, each vessel travels 35.35 yards before intersecting.

⁵ PWC are subject to inland navigation rules as stated in USCG COMDTINST M16672.2B, dated August 17, 1990.

⁶ Training information was reported for 471 of the 1,218 PWC operators: 413 had none, and 58 had completed State courses. Coast Guard Auxiliary training, Power Squadron training, Red Cross training, or other (military) training. The duration of the reported training or quality of the course content may have varied.

⁷ Responses to a boater education question that was included on the supplemental questionnaire were reported for 712 of the 1,218 operators; of those responding, 600 (84 percent) had no training.

⁸ National Transportation Safety Board 1993 Recreational boating safety Safety Study NTSB/SS-93/01 Washington, DC. 104 p. The Safety Board's experience indicates that boating accidents involving a fatality are more likely to be reported than those involving less serious injury. Fatal accidents are also better documented. The Board used fatal accidents to illustrate the proportion of operators who had received boating education because it had greater confidence in the boating education data from that subset than from all accidents.

education. Data for 1991 through 1996 reflect similar proportions regarding the fatally injured operators who had received boating safety education.

Although no State or Territory requires a special boating license to operate a PWC, 16 jurisdictions have special boating education requirements to operate a PWC.⁹ Effective June 23, 1993, PWC operators in Connecticut were required to take a safe handling course to obtain a certificate for PWC operation; there are no exceptions. Mandatory education requirements include 10 hours of basic boating safety and an additional 2.5 hours of instruction concentrating on PWC safety. Even though there has been a substantial increase in the number of PWC operations, there have been no fatalities attributable to PWC operations in Connecticut in the past 10 years. The boating law administrator for Connecticut indicates that accidents and injuries have decreased over the last 5 years. Training is typically offered by the States' marine safety officers. Michigan's marine education program¹⁰ certified 50,554 students in classroom courses in 1996.¹¹ That State also conducts a PWC education/enforcement program that began in 1995; it involves 30 marine officers assigned to PWC patrol who review regulations, discuss safety, and give equipment demonstrations. Even with a growth in PWC operations, that State has seen a decrease in both PWC accidents and fatalities; PWC accidents in Michigan accounted for 45 percent of all boating accidents in 1995 and dropped to 41 percent in 1996.

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, 1998.¹² 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.

The National Association of State Boating Law Administrators (NASBLA), BOAT/U.S., the Coast Guard Auxiliary, the U.S. Power Squadrons, the National Safe Boating Council, and the National Water Safety Congress support recreational boating education. NASBLA's Education Committee has a review process designed to standardize training information by approving boating safety curriculums. NASBLA has also developed a model PWC boating course. This course outline may be used by the individual States to pattern the courses they develop, and it serves as a guide to educational organizations that work within the local

⁹ The following States and Territories require PWC education: Colorado, Connecticut, Delaware, Georgia, Idaho, Kansas, Massachusetts, Minnesota, Nevada, Rhode Island, Tennessee, Texas, Utah, Wisconsin, U.S. Virgin Islands, and American Samoa. Nevada requires PWC education only of PWC operators who rent the vessel. (National Association of State Boating Law Administrators 1997. Reference guide to State boating laws. 3d ed. Lexington, KY (p. 21). 182 p., plus appendixes.)

¹⁰ Michigan's course is only 1 hour long; most States require 6 to 8 hours of classroom instruction.

¹¹ *Small Craft Advisory* Dec. 1997/Jan. 1998. Lexington, KY: National Association of State Boating Law Administrators; 13(2): 20.

¹² Federal Register, Vol. 63, No. 54, dated March 20, 1998, page 13585.

communities to provide training. In addition to NASBLA's education efforts, the Personal Watercraft Industry Association (PWIA) has also been developing model PWC education requirements. PWIA advocates mandatory education for PWC operators and has mandatory education as an element of its model legislation.

PWC manufacturers provide safety information in printed and video formats with every PWC sold, and dealers are asked to review these safety techniques with customers. The PWIA has also developed classroom material used in several State safety education courses. One manufacturer recently introduced a PWC training program that requires dealers to deliver a boating safety presentation (video and law review) to all purchasers of new PWC.¹³ The product cannot be warranty-registered until the customer receives the information. The Safety Board commends industry efforts to provide PWC owners with point-of-purchase education and training. However, this point-of-purchase information may not reach relatives and friends of the PWC owner who may use the vessel. In its 1993 study on recreational boating, the Safety Board recommended that each State

Implement minimum recreational boating safety standards to reduce the number and severity of accidents, consider requirements such as mandatory use of personal flotation devices for children, demonstration of operator knowledge of safe boating rules and skills, and operator licensing. (M-93-1).¹⁴

Although some progress has been made in responding to the Safety Board's recommendation, as shown by the 4 States that now require boater certification and the 20 that mandate boating education, the Safety Board continues to believe that if more recreational boaters were trained, the number of persons killed and injured in recreational boating accidents, including those involving PWC, would be reduced. Therefore, the Safety Board is reiterating Safety Recommendation M-93-1 in the report of its PWC study. Because two-thirds of PWC owners also owned a powerboat prior to purchasing a PWC,¹⁵ it is reasonable to believe that powerboat operators taking a recreational boating education course may someday be PWC owners or operators. To reach the maximum number of persons who may operate a privately owned PWC, recreational boating education courses should provide some level of PWC training. This is not to say that all boaters should take a PWC course, but rather that all recreational boating courses should address PWC safety issues. Therefore, the Safety Board believes that the States, the Coast Guard Auxiliary, BOAT/US, the U.S. Power Squadrons, and NASBLA should include information on the safe operation of PWC in all recreational boating courses.

The Safety Board is concerned about persons who rent PWC. Nearly one-quarter of the PWC operators involved in the accidents analyzed by the Safety Board for this study (292 of

¹³ Polaris Industries, Inc.

¹⁴ Safety Recommendation M-93-1 has been classified "Closed—Acceptable Action" for 7 States, "Open—Acceptable Response" for 28 States, "Open—Response Received" for 4 States, "Open—Awaiting Response" for 9 States, and "Closed—Unacceptable Action" for 4 States.

¹⁵ Bowe Marketing Research. 1996 PWIA owner usage, attitude, and demographic research. Survey of PWC owners commissioned by the PWIA and presented at the PWIA Board of Directors meeting July 23, 1996.

1,218, or 24 percent) were operating rented PWC.¹⁶ Accident case analysis showed that 68 percent of the operators of rented PWC were under age 25, and 73 percent had been riding less than 1 hour at the time of the accident; 84 percent of the accidents involved collision with another vessel.

There was limited reporting of PWC renters who received safety information (110 of 292 rentals), but for those for whom the information was reported, the safety information was usually transmitted by verbal instruction (56 percent). Only one out of three PWC renters included in the Safety Board's accident analysis indicated that the rental agent had required them to demonstrate PWC riding ability. To encourage all rental businesses to be responsible partners in safe boating, the PWIA provides a free education package for PWC rental businesses. The package includes a videotape, waterproof checklist, safety posters, and safety literature.

Nearly half of the rented PWC in the Safety Board's accident sample were operated by out-of-state residents. If the PWC was rented, 48 percent of the operators reported were not State residents (132 of 277); for nonrented PWC, only 11 percent of the accident operators resided outside the State (80 of 757). Out-of-state operators may be less familiar with the recreational waterways in which they are operating the PWC and with the local boating regulations.

Operators of rented PWC were twice as likely as operators of personally owned PWC to have ridden the vessel less than 1 hour before the accident occurred. The Board's review of the data indicate that 73 percent of rental-operator accidents occurred within the first hour of operation (102 of 139) compared with 39 percent for nonrental operators (107 of 272). However, this finding may be confounded by the fact that PWC are rented by the hour and some portion of renters will rent the vessels for only an hour. About half of the operators of rented PWC had previously operated a PWC only once or never; this underscores the need for PWC education and training.

Reported causes of the accidents involving rented PWC appeared to show a somewhat different pattern than nonrented PWC. Operators of rented PWC were somewhat more likely to have accidents reported as resulting from inexperience and inattention, but they were not as likely to have an accident reported as resulting from inappropriate speed for the operating conditions.

Twenty States have taken steps to address the safety of PWC rental operations. For example, in Oregon and Florida, the minimum age (by statute) to operate a PWC is 14, but it is 16 for operators who rent PWC. In Wisconsin, the allowable operating age with training and adult supervision is 12, but 16 for those who rent a vessel. Idaho law effective July 1996 specifically requires all rental businesses and agents to educate all PWC renters concerning the safe operation of the vessel and to place a decal on the vessel that lists safe operating techniques and boating laws. The law requires the renter to take the education (PWC video and instruction provided at

¹⁶ Boating accident report forms of all States contain a field to designate whether or not the vessel was rented. Rental information was provided for 85 percent (1,034 of the 1,218) of the PWC operators involved in the accidents that occurred during the January–June 1997 study period.

the point of rental) and to carry an acknowledgment-of-education form while operating the PWC. Violation is an infraction of the law. Florida requires an on-water checkride to be provided by rental agents. Nevada requires not only the renter, but each person who will operate under the rental contract, to receive instruction in the laws and safe operation of the PWC. A dozen States specify education or training requirements that rental agents must provide PWC renters.

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 believes 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 and to require the operators to demonstrate their PWC riding ability. The Safety Board also believes that NASBLA, in conjunction with the Coast Guard and the PWIA, should develop a checklist for boat rental businesses to use for evaluating a person's ability to operate a personal watercraft.

The States' 1997 PWC accident cases analyzed by the Safety Board involved 77 PWC operators age 15 or under (6.3 percent of the accident-involved PWC operators). Fifty-one States and Territories have established a minimum age, by statute, for PWC operation. However, there is a wide disparity among State laws regarding the age at which a young person can operate a PWC. In most States, provisions exist that allow operators who are younger than the minimum age by statute to operate a PWC. For example, boater training or PWC certification (for PWC operating privileges at a special age) is required in 23 States and 2 Territories. Colorado law, for example, has a minimum PWC operating age of 16, but the age is lowered to 14 for holders of a PWC training certificate. Thirty States and 2 Territories have provisions for adult supervision of younger PWC operators.

Recent legislative activity by some States tends to show movement toward raising the minimum age for operating PWC. For example, California set new minimum age standards that took effect in January 1998. PWC operators must be at least 16 years old. But the new law allows persons 12 to 15 years of age to operate a PWC with adult supervision. Maryland recently set the minimum PWC operator age at 16.¹⁷ In a boating survey conducted by Virginia,¹⁸ where PWC operators can be as young as age 14,¹⁹ 81 percent of the survey respondents believed there

¹⁷ Maryland regulations are published in Title 8 Department of Natural Resources, Subtitle 18: Boating—Speed Limits and Operation of Vessels, Chapter 2: Personal Watercraft, Paragraph 5: Restrictions.

¹⁸ Virginia Department of Game and Inland Fisheries. 1997. Boating education in Virginia. Richmond.

¹⁹ The Commonwealth of Virginia's General Assembly and Senate passed new PWC age requirements effective January 1, 1999: persons ages 14 and 15 may operate a PWC with training and age 16 without training. A training card must be carried by 14- and 15-year-old operators.

should be a minimum age to operate a motorboat: 33 percent believed the age should be 14, and 40 percent believed the age should be 16.

The PWIA and NASBLA have developed model acts for PWC that States may use in their legislative initiatives. The PWIA model act proposes 16 as the minimum operator age: it has advocated 16 as the minimum operator age since 1988. Twenty-one of the 56 States and Territories with statutes that specify a minimum age requirement have set 16 as the minimum age for PWC operators; 7 States and Territories have an older age requirement. The NASBLA model act also proposes age 16; however, that act includes a provision for 12- to 16-year-olds to operate a PWC if a person age 18 or older is on board the vessel.

All but five jurisdictions have established a minimum operating age, but many States have special provisions for training, certification, or adult supervision that substantially lower the minimum age requirement. Of the 28 States and Territories with statutes that have set a minimum age of 16 years or older, all but 6 have special provisions that allow PWC operation at a younger age than set by statute. The Safety Board supports the initiatives by NASBLA, the PWIA, and the States to establish State statutes that set 16 as the minimum operating age, and the Board acknowledges efforts to promote safety through boater education, certification, and supervision. The Safety Board is concerned, however, that special provisions are being used to lower or negate minimum operator age requirements and believes that NASBLA should examine the effects of special provisions on the operator minimum age requirement for PWC.

Therefore, the National Transportation Safety Board recommends that the National Association of State Boating Law Administrators:

Include information on the safe operation of personal watercraft in all recreational boating courses. (M-98-95)

Develop, in conjunction with the U.S. Coast Guard and the Personal Watercraft Industry Association, a checklist for boat rental businesses to use for evaluating a person's ability to operate a personal watercraft. (M-98-96)

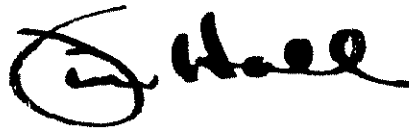
Examine the effects of special provisions on the operator minimum age requirement for personal watercraft. (M-98-97)

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 Personal Watercraft Industry Association, the U.S. Power Squadrons, BOAT/U.S., 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-98-95 through -97 in your reply

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

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A handwritten signature in black ink, appearing to read "J. Hall". The signature is written in a cursive style with a large, stylized initial "J" that loops around the first part of the name.

By. Jim Hall
Chairman