



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

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In reply refer to. M-98-87 through -91

Admiral James M. Loy
Commandant
U.S. Coast Guard
2100 Second Street, S.W.
Washington, D.C. 20593

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 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

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

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.

Exposure Data

Riding time is an important factor in interpreting accident and injury information. To accurately compare PWC accidents to accidents involving other types of recreational boats, it is necessary to quantify the usage time by vessel type. If PWC are used more often than other types of boats, then their exposure time for incurring an accident would be higher.

A national boating survey conducted in 1988-89 by the American Red Cross occurred at a time when PWC were just becoming popular. The survey reported 45 passenger hours per year

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

for PWC compared to 117 passenger hours per year for all recreational boats.³ Since 1989, the number of PWC has increased nearly six-fold and now account for 36 percent of new boat sales. The dramatic rise in popularity of PWC demonstrates that boating practices have changed in the intervening years since the Red Cross survey was completed and highlights the need for a current, unbiased measure of boat usage for all recreational boat types (for example, personal watercraft, sailboat, motorboat, canoe, and rowboat).

A PWC owner survey commissioned by the Personal Watercraft Industry Association (PWIA) documented a high usage time for PWC: an average of 7 days per month during the 1995 season.⁴ Another source of information about usage, the National Recreational Boating Needs Assessment Survey, was prepared in response to 1997 Congressional hearings for the reauthorization of transportation trust funds.⁵ Because the survey data were intended to be one tool to help in determining the allocation of monies derived from gasoline tax, the survey collected information only about motorboats, without an interest for other categories of recreational boats. The survey was conducted through telephone interviews to 1,000 U S households; the results were based on information provided by the 266 that were boating households (By comparison, the national boating survey conducted in 1989 by the American Red Cross surveyed 5,031 households). The National Recreational Boating Needs Assessment Survey, which distinguished only two categories for motorboat usage (motorboats 18 feet or less and motorboats 19 feet or more), found that motorboats 18 feet or less were used an average of 30 days a year and 5 hours a day (150 hours per year).

Estimates of usage time specifically comparing PWC and outboard motorboats were prepared by industry in 1996 and submitted to the Environmental Protection Agency (EPA) in support of rulemaking for marine engines.⁶ Annual time of use for PWC was 77.3 hours per year compared to 34.8 hours per year for outboard vessels, using these measures of usage time, the exposure factor for PWC was 2.22 times higher than for outboard vessels. This is a substantially different estimate than the one developed by the National Recreational Boating Needs Assessment Survey. Given the changes in boating practices since the 1989 Red Cross boating survey and the differences in estimates of PWC usage reported by industry, the Safety Board concludes that a

³ U S Department of Transportation, United States Coast Guard 1991 American Red Cross national boating survey: a study of recreational boats, boaters, and accidents in the United States. Washington, DC; grant agreement 1801-82 350 p.

⁴ 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. The survey response rate (2,800 replies from 11,500 mailed surveys) represents 26 percent of the deliverable mail-outs. The survey results did not indicate the proportion of rental agents included in the survey.

⁵ Hagler Bailly, Inc 1997 The national recreational boating needs assessment survey. Final report prepared for the International Association of Fish and Wildlife Agencies, Washington, DC. 36 p, plus appendixes. Project funded by the U S Fish and Wildlife Service, Washington, DC; Sportfish Restoration Program grant agreement 14-48-98210-97-G067.

⁶ Submission by Mercury Marine in response to EPA request for comments concerning Rule—Air pollution control, gasoline spark-ignition marine engines. Federal Register, Vol 61, No 194, dated October 4, 1996, page 52088.

rate of injury for PWC in relation to all recreational boat types cannot be determined because accurate information on usage by boat type is not available

The Coast Guard has recognized the need for boat usage time and exposure data, and in 1997 issued a notice seeking application for grants to conduct a comprehensive national boating survey.⁷ The Safety Board commends the Coast Guard in recognizing this need and urges completion of the survey. Once this effort is completed, there is a continuing need to accurately assess recreational boat use. The Safety Board believes, therefore, that the U.S. Coast Guard should collect recreational boating exposure data such as "operational use time" or "vessel running time" and update this information on an annual basis or conduct periodic surveys.

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.⁸ 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 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)

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.⁹ The NTSB supplemental questionnaire submitted by the States indicated a similar proportion: 84 percent had completed no type of boating instruction.¹⁰ 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.¹¹ 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 education. Data for 1991 through 1996 reflect similar proportions regarding the fatally injured operators who had received boating safety education.

⁷ Federal Register, Vol. 62, No. 193, dated October 6, 1997, page 52175

⁸ 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.

⁹ 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.

¹⁰ 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.

¹¹ 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.

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/US, 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 communities to provide training. In addition to NASBLA's education efforts, the 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

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

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.

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 is recommending that the States, the Coast Guard Auxiliary, BOAT/U.S., the U.S. Power Squadrons, and NASBLA include information on the safe operation of PWC in all recreational boating courses.

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 PWC. The Safety Board also believes that the Coast Guard, in conjunction with NASBLA and the PWIA, 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 systems, and ventilation. In addition to the provisions included in the regulations, many requirements are incorporated by reference.¹⁶

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.

¹⁶ 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.

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 safety.¹⁷ 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.¹⁸

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 capacity.¹⁹
- 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,²⁰ thus PWC are also exempted from the flotation standard and from requirements for labeling the capacity of the PWC.²¹

¹⁷ 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

¹⁸ The Coast Guard has issued exemptions from its standards for both inboard- and outboard-powered personal watercraft, hovercraft, airboats, raceboats, and submarines

¹⁹ 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

²⁰ 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

²¹ 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 believes, therefore, that the Coast Guard should eliminate the existing process of exempting PWC from standards that were defined for conventional boats and develop, with the PWC manufacturers, 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 1997.²² 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 believes that within 2 years the Coast Guard should determine, through research, the feasibility of providing PWC operators more control in an off-throttle steering situation. The Safety Board also believes that the Coast Guard should work with the PWIA 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 U.S. Coast Guard:

Eliminate the existing process of exempting personal watercraft from standards that were defined for conventional boats and develop, with the personal watercraft manufacturers, comprehensive standards that are specific to the risks of personal watercraft. (M-98-87)

Determine within 2 years, through research, the feasibility of providing personal watercraft operators more control in an off-throttle steering situation. (M-98-88)

Work with the Personal Watercraft Industry Association to use the results of off-throttle steering research described in Safety Recommendation M-98-88 to develop appropriate standards for steering on jet-pump propelled vessels. (M-98-89)

Develop, in conjunction with the National Association of State Boating Law Administrators 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-98-90)

Collect recreational boating exposure data such as "operational use time" or "vessel running time" and update this information on an annual basis or conduct periodic surveys. (M-98-91)

²² Federal Register, Vol. 62, No. 193, dated October 6, 1997, page 52176.

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 Auxiliary, the National Association of State Boating Law Administrators, the Personal Watercraft Industry Association, the U S Power Squadrons, BOAT/US , and the Governors of the States and Territories.

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

A handwritten signature in black ink. The first part is a large, stylized capital letter 'J' that loops around and underlines the word 'Jim'. The second part is the name 'Hall' written in a cursive script.

By: Jim Hall
Chairman