Assistant Secretary for Legislative Affairs
U.S. Department of Homeland Security
Washington, DC 20528

MAR 3 1 2005

Homeland Security

The Honorable Daniel K. Inouye
United States Senate
Washington, DC 20510

Dear Senator Inouye:

This report complies with the U.S. Coast Guard (USCG) and Maritime Transportation Act of 2004 (P.L. 108-293), which directs that "not later than 180 days after the date of the enactment of this Act, the Secretary of the department in which the USCG is operating shall study and report to the Congress regarding measures that should be taken to increase the likelihood of survival of passengers on small passenger vessels who may be in the water resulting from the capsizing of, sinking of, or other marine casualty involving the small passenger vessel. The study shall include a review of the adequacy of existing measures."

In response to the Conference Committee's direction, the USCG formed a team comprised of officials from the offices of Design and Engineering Standards, Compliance, and Investigations and Analysis in its headquarters Marine Safety, Security, and Environmental Protection Directorate to examine the issue and develop the findings in this report.

I appreciate your interest in the Department of Homeland Security, and I look forward to working with you on future homeland security issues. If I may be of further assistance, please contact the Office of Legislative Affairs at (202) 205-4412.

Sincerely,

Pamela J. Turner
Assistant Secretary for Legislative Affairs

Enclosure

Assistant Secretary for Legislative Affairs
U.S. Department of Homeland Security
Washington, DC 20528

Homeland Security

MAR 3 1 2005

The Honorable Ted Stevens
Chairman, Committee on Commerce, Science
and Transportation
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

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U.S. Department of Homeland Security
Washington, DC 20528

MAR 3 1 2005

Homeland Security

The Honorable Don Young
Chairman, Committee on Transportation
and Infrastructure
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

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Enclosure

Assistant Secretary for Legislative Affairs
U.S. Department of Homeland Security
Washington, DC 20528

MAR 3 1 2005

Homeland Security

The Honorable James L. Oberstar
U.S. House of Representatives
Washington, DC 20515

Dear Representative Oberstar:

This report complies with the U.S. Coast Guard (USCG) and Maritime Transportation Act of 2004 (P.L. 108-293), which directs that "not later than 180 days after the date of the enactment of this Act, the Secretary of the department in which the USCG is operating shall study and report to the Congress regarding measures that should be taken to increase the likelihood of survival of passengers on small passenger vessels who may be in the water resulting from the capsizing of, sinking of, or other marine casualty involving the small passenger vessel. The study shall include a review of the adequacy of existing measures."

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Assistant Secretary for Legislative Affairs

Enclosure

U. S. DEPARTMENT OF HOMELAND SECURITY

UNITED STATES COAST GUARD

REPORT

ON

Small Passenger Vessel Safety

U.S. DEPARTMENT OF HOMELAND SECURITY

UNITED STATES COAST GUARD

REPORT

ON

SMALL PASSENGER VESSEL SAFETY

Executive Summary

This report complies with Section 624 of the Coast Guard and Maritime Transportation Act of 2004 (P.L. 108-293 – hereinafter referred to as "the Act"), which directed the U.S. Coast Guard (USCG) to undertake a study of small passenger vessel safety. The report reviews the adequacy of existing measures to keep passengers out of the water, and protect individuals from hypothermia and cold shock in water of less than 68 degrees Fahrenheit in the event of the capsizing of, sinking of, or other marine casualty involving a small passenger vessel. On the basis of this review, the report concludes that the latest revisions to the small passenger vessel safety regulations, which will be fully phased in by 2006, have been effective in reducing the risk of hypothermia and cold shock, and increasing the likelihood of survival of persons who may be in the water, by taking a preventive approach of requiring out-of-water flotation for those vessels at highest risk.

As specified in the Act, the report also specifically addresses the adequacy of existing measures for safe egress of passengers wearing personal flotation devices. It identifies amphibious ("DUKW") vessels as the only category of vessels with known egress issues because of their unique design. The report concludes that the Coast Guard's implementation of recommendations from the Marine Board of Investigation (of the MISS MAJESTIC) and from industry, through Navigation and Vessel Inspection Circular (NVIC) 1-01, will satisfactorily address passenger egress concerns through uniform national guidelines for effective design and operational measures.

The report also reviews the adequacy of compliance and enforcement efforts with regard to a regulatory requirement for masters of small passenger vessels to require passengers to wear personal flotation devices in hazardous conditions. The report concludes that the 1996 amendments to the small passenger vessel regulations leave very limited means to monitor and enforce compliance, and describes the Coast Guard's current initiatives, in partnership with the industry to improve and refine guidance to masters in determining when conditions warrant mandatory donning of life jackets.

Small Passenger Vessel Safety Report

In the wake of two major vessel casualties (the 1999 rapid sinking of the amphibious vessel MISS MAJESTIC 250 yards from shore in Lake Hamilton near Hot Springs, Arkansas; and the 2003 capsize of the charter fishing vessel TAKI TOOO while transiting Tillamook Bar near Garibaldi, Oregon[1]), ~~the House Committee on Transportation and Infrastructure proposed~~ *[April 2005 Post-Publication Correction: "the Senate Committee on Commerce, Science & Transportation proposed"]*, and the Conference Committee in the Coast Guard and Maritime Transportation Act of 2004 directed, the Coast Guard to conduct a study of small passenger vessel safety.

In response to the Conference Committee's direction, the U.S. Coast Guard (USCG) formed a team comprised of officials from the offices of Design & Engineering Standards, Compliance, and Investigations & Analysis to examine the issue and develop the findings in this report.

Background

"Small" passenger vessels -- by definition under 100 registered gross tons– represent fully half of the U.S. flag vessels that are inspected and certificated by the Coast Guard. As of October 22, 2004, there were a total of 5,985 small passenger vessels under Coast Guard inspection, with an aggregate passenger capacity of 447,150 persons. Almost three quarters of the vessels and passenger capacity are on the east coast. The service of small passenger vessels currently operating is very diverse and includes ferries, excursion boats used for sightseeing and dinner cruises, overnight cruise boats, party fishing (head) boats, charter fishing boats, dive boats, crew boats for the offshore oil industry (many of which also carry freight), passenger barges, and submersibles. Passenger capacity ranges from 7 to over 1,300 persons. These vessels are propelled by a wide variety of means including diesel engines; gasoline inboard, inboard/outboard, and outboard motors; electric motors; cable pull; mule tow; sail; and steam engines. The vessels also have a wide variety of hull forms with a recent increase in the number of high speed craft whose construction and maneuvering characteristics differ from those of conventional displacement vessels.

Except where specified otherwise in the Act, this report focuses on the period from 1996 to 2003. We chose 1996 as the starting point because new safety regulations for small passenger vessels took effect starting in March 1996 for new construction, with phased implementation for existing vessels to be completed no later than March 2006. These new regulations substantially upgraded small passenger vessel lifesaving equipment requirements in several areas specifically mentioned in the Act. They are contained in Title 46 of the Code of Federal Regulations, Subchapters K (Parts 114 through 124; vessels carrying more than 150 passengers or with overnight accommodations for more than 49 passengers) and T (Parts 175 through 187; all other small passenger vessels).

[1] At the time this report was prepared, the TAKI TOOO casualty was still under active investigation by the National Transportation Safety Board. As such, releasable information is limited, and discussion of specific enforcement or other actions stemming from this casualty would be speculative and inappropriate. Investigative reports for other casualties cited in this report can be found at the Coast Guard's website: http://www.uscg.mil/hq/g-m/moa/reportindexcas.htm.

The data cited in this report reflect marine casualties required to be reported to the Coast Guard by 46 U.S.C. 6101 and 46 CFR 4.05-1. In general, casualties must be reported to the Coast Guard if they involve groundings; loss of maneuvering capability; an occurrence affecting the seaworthiness of a vessel; a loss of life; injury that requires professional medical treatment beyond first aid and, in the case of a person engaged or employed on board a vessel in commercial service, that renders the individual unfit to perform routine vessel duties; or any casualty resulting in more than $25,000 in property damage.

For the eight-year period from 1996 through 2003 there were 240 fatalities on small passenger vessels, approximately 30 per year. However, of these, only 41 resulted from vessel incidents, and only 2 of the vessel incidents resulted in multiple fatalities. The great majority of fatalities (83%) were not related to operation of a vessel but rather resulted from diving accidents, swimming, snorkeling or natural causes.[2] These non-vessel-related fatalities stem from unregulated activities, and so are not addressed in this report.

A recent, longer-term study by the Coast Guard's Office of Investigations & Analysis of fatalities and injuries on small passenger vessels[3] concluded that vessel-related fatalities are very rare occurrences. The deaths are few in number with very low frequency (approximately 5 per year on average), and result from a variety of causes. When grouped by type of accident, there are no trends or patterns. As can be clearly seen in Figure 1, a single major event has a very significant impact on the statistics because of the historically low fatality rates (each of the "spikes" represents a single major casualty).

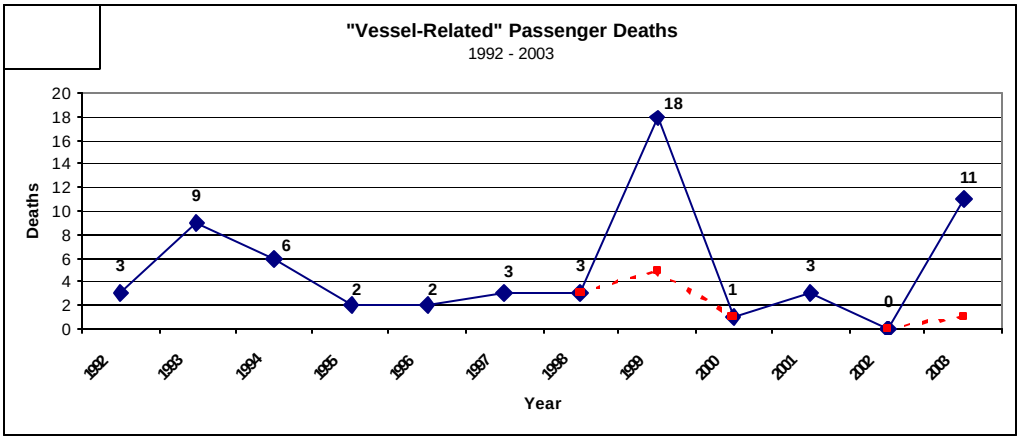

Figure 1. Vessel-related passenger deaths 1992-2003.

This report reinforces the conclusion of the earlier study. The two major casualties that occurred during the period of interest were striking anomalies in an otherwise flat trend line of 0 to 3 vessel-related fatalities a year. Nevertheless, any fatalities are regrettable, and this

[2] There is a fairly steep upward trend in natural cause fatalities, most likely due to an aging population, i.e., "baby boomers". This trend is expected to continue in the future.

[3] *Passenger Safety on Vessels Under 100 Gross Tons – A Review of Injuries and Fatalities – Calendar Years 1992-2003*

report describes three Coast Guard initiatives stemming from the lessons learned from recent casualties:

- completion of the phasing in of new small passenger vessel safety regulations;
- publication of uniform guidance for certification of "DUKW" amphibious small passenger vessels; and
- development in partnership with the small passenger vessel industry of a simple, risk-based cooperative decision support tool to provide guidance concerning donning of lifejackets in hazardous conditions

These initiatives are expected to further improve the overall excellent safety record of this significant segment of the transportation industry.

Measures to keep passengers out of the water

Prior to 1996, the last major revision to the small passenger vessel regulations was in 1963. The lifesaving requirements for small passenger vessels were based exclusively on buoyant apparatus[4] and life floats (see fig. 2) as survival craft. These two devices, which have been in use on commercial vessels for at least 70 years, are similar in that they are both like very large life rings. The primary difference is that a life float includes a platform suspended from the buoyant portion of the device by netting or similar means. Neither device supports a person out of the water; with the exception of a few persons who might be able to stand on the platform in the center of a life float and only be immersed waist-deep, they generally only provide something for persons in the water to hold on to, with most of the rated capacity hanging on the outside edge.

Figure 2. Rigid buoyant apparatus (left) *vs* life float (right)

In 1989, driven by statutory changes, increases in vessel size and capacity, changes in scope of operation, technological advances, developments in vessel design and construction, and concern over a number of small passenger vessel casualties with loss (or potential loss) of life over the previous 20 years, the Coast Guard issued a Notice of Proposed Rulemaking (NPRM) under a rulemaking project to improve small passenger vessel safety (54 FR 4412, January 30, 1989). The NPRM would have required most small passenger vessels to carry inflatable survival craft capable of keeping the occupants completely out of the water, and focused heavily on enhanced inspection and maintenance of "wood" vessels which had been involved in the bulk of the reported casualties.

[4] "Buoyant apparatus" refers to rigid, inherently buoyant devices as described in this paragraph, which do not support persons out of the water. The term "inflatable buoyant apparatus," used later in this report, refers to a different and more capable device which does provide out-of-water flotation.

In response to the NPRM, the small passenger vessel industry submitted numerous comments opposing the proposed new survival craft requirements, citing a generally good safety record which did not justify the cost of compliance, and suggesting factors that should be taken into account in determining appropriate requirements for a particular vessel. While the comments generally supported the Coast Guard's consideration of vessel route and water temperature in establishing lifesaving equipment requirements, there was concern with both the initial costs, and the recurring costs of required annual servicing of inflatable survival craft. Also, the comments noted that the casualty data, particularly in warm water, did not support such a costly upgrade. Citing the Coast Guard's own figures in its regulatory analysis, and even adding in the three fatalities in the December 1993 sinking of the EL TORO II in Chesapeake Bay, the comments correctly stated that less than one life per year on average was lost due to hypothermia on inspected small passenger vessels over the previous twenty years.

To address the comments, in 1993 the Coast Guard concluded a comprehensive study which re-examined the requirements for survival craft on small passenger vessels. The study carefully examined the casualty record of the 16 small passenger vessel losses over the previous 20 years where there was loss of life, loss of the vessel, or both. It took into account several factors not addressed in the analysis prepared in support of the NPRM, including the effect of Category I satellite Emergency Position-Indicating Radio Beacons (EPIRB's) on response and rescue times, and the reduced risk of loss of a vessel equipped with appropriate fire protection equipment and subdivision. Most significantly, this study confirmed that over 90% of the vessel casualties with loss of life over the study period involved wood vessels making up only 24% of the passenger vessel fleet.

In early 1994, the Coast Guard issued a Supplementary Notice of Proposed Rulemaking (SNPRM) (59 FR 1994, January 13, 1994). The SNPRM made significant changes to the proposals in the NPRM, based largely on the results of the 1993 study which identified those types and services of vessels at significantly elevated risk. The SNPRM adopted a risk-based approach to lifesaving equipment requirements, taking into account water temperature, vessel construction (wood vs. non-wood), vessel stability (subdivided vs. not subdivided), vessel route, carriage of satellite EPIRB's (the 1993 study determined that more lives would have been saved if the vessels involved had carried EPIRB's rather than inflatable survival craft), and whether the vessel has overnight accommodations (significant because a vessel without such accommodations would normally be expected to operate on shorter and thus less exposed routes).

For those vessels at highest risk, the SNPRM proposed carriage of inflatable survival craft. Such survival craft include "inflatable buoyant apparatus" and inflatable liferafts. The two are structurally very similar; however the inflatable liferaft provides better protection from the elements as it is equipped with a canopy to protect the occupants from wind and waves, and the floor is insulated. On the other hand, because the top of an inflatable buoyant apparatus is open, it has the demonstrated potential of carrying up to 50% over its rated capacity while remaining a viable survival craft in calm seas. It is also well suited to vessels with high passenger volumes because its open construction means that it can be boarded faster than an inflatable liferaft which has discrete entrances (see fig. 3).

Figure 3. Inflatable buoyant apparatus (left) *vs* inflatable liferaft (right)

For wood vessels or any vessels without subdivision operating in cold exposed[5] waters, the SNPRM proposed carriage of sufficient inflatable survival craft to accommodate all of the persons on board (in some cases based on the potential 50% surplus capacity for inflatable buoyant apparatus). For vessels operating in warm exposed waters, the requirements range from 100% life float capacity, to 100% inflatable buoyant apparatus capacity (for larger vessels with overnight accommodations). ("Cold" and "warm" water are discussed in detail in the section below.)

The 1993 study documented several cases where the limited buoyancy of a rigid buoyant apparatus, and its inability to support at least some survivors out of the water, reduced its effectiveness. Life floats proved to be more capable lifesaving devices because they allowed at least some persons to be held partially out of the water, at a cost only marginally greater than for buoyant apparatus. Thus, where the NPRM had required (rigid) buoyant apparatus, the SNPRM required life floats instead, with existing buoyant apparatus to be either converted to the life float configuration, or phased out by attrition.

Consistent with the risk-based approach, and taking into account the probability of rapid response and rescue, the SNPRM reduced the survival craft requirements from those proposed in the NPRM for operation in less exposed waters and at shorter distances to land. For the least exposed routes in warm water, the SNPRM required no survival craft, under the assumption that personal lifesaving appliances (i.e., lifejackets) would be sufficient to sustain survivors afloat and with minimal risk of hypothermia until rescue arrives.

In determining the number and type of survival craft to be required in the SNPRM, the Coast Guard balanced its public responsibility for crew and passenger safety with industry concerns, as expressed in the comments to the NPRM, by considering vessel factors such as survivability, casualty analysis and rescue scenarios, number of passengers, overall level and type of other required equipment, and route. The Coast Guard philosophy in developing the requirements for survival craft in the SNPRM was that, except in limited circumstances, if survival craft are needed, enough should be provided for everyone on board, not just a small percentage as was the case in the existing regulations. The Coast Guard took into consideration that inflatable buoyant apparatus can be overloaded in calm water, and still keep people completely out of the water, while life floats used at their rated capacity will

[5] "Exposed" wears refers to Oceans or Coastwise routes more than 3 miles from shore. It does not include "Lakes, Bays, and Sounds" or Rivers routes.

generally leave people in the water hanging on to the outside of the device. Therefore, the SNPRM proposals reflected that life floats should not be overloaded in circumstances where rescue resources (Coast Guard or other vessels which would be nearby) would not be expected to arrive quickly on scene in case of a casualty requiring abandonment of a vessel. They also took into account that, as discussed in the 1993 study, a vessel carrying a large number of passengers could overwhelm the capacity of rescue resources which could be quickly brought on scene to assist persons in the water. In such instances, it is likely that a major surface rescue effort would have to be initiated from shore or by vessels already in the area to provide rescue assistance. For persons in cold water suffering from hypothermia, time is of the essence, and they might not be able to wait for large vessels to arrive. For this reason the Coast Guard considered increased survival equipment requirements to be necessary for these vessels, to provide protection in the event of a low probability yet unacceptably high consequence casualty.

Overall, the survival craft requirements proposed in the SNPRM were reduced from those in the NPRM in consideration of the increased requirements for bilge level alarms, increased carriage of Category 1 satellite EPIRB's, increased radar requirements for certain ferries on rivers routes, and increased requirements for installation of fixed fire extinguishing systems. On January 10, 1996, the Coast Guard published an Interim Final Rule (IFR) in the Federal Register (61 FR 864). Based on the comments on the SNPRM, the survival craft requirements were further reduced in some cases from those proposed in the SNPRM, by taking into account other new requirements comprising an overall vessel safety system designed to reduce the risk of a vessel loss and shorten emergency response time. The IFR also increased use of the potential overload capacity of inflatable buoyant apparatus to reduce the number of these devices needed to safely accommodate the total number of persons on board certain vessels. The IFR was different from the previous rulemaking notices in that it not only provided an opportunity for public comment, but became an effective, enforceable regulation on March 11, 1996. After an additional 150 day IFR comment period and a series of public meetings to discuss the IFR, on September 30, 1997, The Coast Guard published the Final Rule in the Federal Register (62 FR 51326) with only minor adjustments from the IFR.

Although the new requirements are still being phased in, with existing vessels allowed up to ten years from their keel laying date to comply (thus effectively until March 2006 at the latest), by all indications they have been effective. An analysis of all available reports of casualties involving water exposure or potential water exposure during the period examined in this report found no cases where the investigation determined the survival craft requirements to be a relevant factor in the outcome. Since 1996, there have been only two small passenger vessel casualties with abandonment of the vessel resulting in multiple loss of life. In both cases, although numerous persons ended up in the water, the speed or nature of the incident were such that it is highly unlikely that any currently available survival craft could have been of any use. In the case of the MISS MAJESTIC, the Marine Board of Investigation did not find the lack of survival craft to be a factor in the fatalities (as noted earlier, the TAKI TOOO casualty is still under investigation).

Measures to protect individuals from hypothermia and cold shock in cold water

Hypothermia from cold water exposure has claimed the lives of countless people at sea over the years. Water transfers heat from the human body 25 times faster than air at the same temperature. In cold water, heat is removed from the body faster than the body can make it up. The result is that as the body core temperature drops, the victim gradually loses muscular control as the body tries to conserve warm blood for the brain and other vital organs. The victim then may either ingest water and drown, or succumb to the effect of hypothermia itself as the heart and lungs stop functioning. It was hypothermia that claimed the lives of many who died in the water in the TITANIC disaster. Although many people managed to abandon ship successfully in lifejackets, the frigid water quickly sapped them of their strength.

As discussed above, in its development of lifesaving equipment requirements for small passenger vessels, as well as in other rulemaking projects for other types of vessels, the Coast Guard has taken the approach that the best method of protecting individuals from hypothermia and cold shock in cold water is prevention. By requiring vessels operating on exposed routes in cold water to carry survival craft providing out-of-water flotation, the risk of immersion of survivors in cold water is minimized.

The Act specifically cites "measures…to protect individuals from hypothermia and cold shock in water having a temperature of less than 68 degrees Fahrenheit." The Coast Guard has long employed 15 degrees Celsius (59 degrees Fahrenheit (° F)) as the dividing line for lifesaving equipment requirements keyed to "cold water." Extensive research has identified this as a critical temperature, at or below which exposure is physically painful, and hypothermia seems to progress much faster than in warmer waters. Based on the best available data, death from hypothermia is highly improbable for a lightly clothed, non-exercising person in calm water just above this temperature for at least 3.5 hours, with an average survival time of at least 6 hours.[6] Although waves adversely affect survival time, empirical data suggest that water at this temperature may be considered "safe" for an unprotected person for about 2 hours, with an estimated 50% rate of survival for at least 4.5 hours.[7]

Immersion suits[8] are capable of increasing survival time from 2 to 10 times that for a lightly clothed person. However, immersion suits are generally considered to be inappropriate for use by untrained passengers who are not familiar with them. In a very rapid sinking or capsize (as is typical of major small passenger vessel casualties), the increased donning time

[6] International Maritime Organization (IMO) *International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual*, para. 3.6 and Annex N, Figure N-14.

[7] It should be noted that several factors make data collection somewhat imprecise:

a) When bodies are recovered, the precise period of exposure and time of death cannot always be determined;

b) Some victims are never found, and so the time and cause of death cannot be determined;

c) The extent to which a drowning death should be attributed to incapacitation by hypothermia often cannot be determined; and

d) Other factors may be involved, such as heavy seas, darkness, and personal injury.

[8] This is currently the internationally preferred term, although the devices are also sometimes referred to as exposure suits or survival suits.

required, and the potential for panic and confusion, would likely only exacerbate the situation. In addition, in a case where persons are in the water before they can don any protective gear, an untrained person is far more likely to be able to don a lifejacket in the water than an immersion suit (although it is likely that neither would be easy) (see fig. 4).

Figure 4. Donning a typical immersion suit.

The 59° F criterion for cold water (or alternatively, the 60° F criterion for "warm water") in current Coast Guard regulations stems from Congressional direction in Section 22 of the Coast Guard Authorization Act of 1984 (P.L. 98-557). A provision in this Act directed the Secretary of Transportation to adopt a warm water exemption line of 32 degrees north or south latitude in the Atlantic Ocean for carriage of immersion suits on certain vessels (cargo vessels, tank vessels, and mobile offshore drilling units). This provision stemmed from S.1441, introduced by Senators Trible and Stevens, which would have established a strict 60° F temperature criterion rather than a geographic dividing line.

The 1984 Authorization Act also directed submission of a report on the benefits and disadvantages of moving the exemption lines from 32 to 31 degrees north and south latitude. This report (*Exposure Suits on Certain Inspected Vessels: Analysis of Changing Warm Water Carriage Exemptions to 31° N and 31° S World-Wide*), submitted to Congress in early 1985, found that 32 degrees north latitude corresponds best with the near-shore 60° F average temperature on the west coast of North America in the coldest months of the year, and that on the east coast, average near-shore water temperatures at 32 degrees north latitude exceed 60° F in the coldest months of the year. (Open ocean surface water temperatures are warmer in the winter and colder in the summer, than temperatures near shore.) Citing the consistency of the 32 degrees latitude exemption lines with the 60° F temperature criterion, and certain practical issues with respect to moving the lines to 31 degrees north and south latitude, the recommendation in the report was to retain the exemption lines at 32 degrees and 32 degrees south latitude, where they have remained to date. The 32 degrees north latitude line falls just south of Savannah, GA on the east coast, and includes the entire west coast of the continental United States, falling just north of Ensenada, Mexico.

The 32 degrees latitude exemption lines have served well over the years as a practical tool for determining and enforcing carriage requirements for hypothermia-protective immersion suits on large commercial ships in Oceans or international service. However, small passenger vessels often operate in a limited area and/or on a seasonal basis. The established world-wide exemption lines represent the worst case, and do not take into account local and seasonal fluctuations in water temperature. For that reason, the small passenger vessel

regulations employ a water temperature criterion rather than a fixed exemption line. To simplify determination and enforcement of equipment requirements for small passenger vessels (and other vessels with similar requirements, such as uninspected commercial fishing vessels), the Coast Guard developed Navigation and Vessel Inspection Circular (NVIC) 7-91, that delineates cold water areas north of 32 degrees north latitude on a monthly basis. Using NVIC 7-91 as guidance, a vessel operating seasonally in an area where the water remains "warm" throughout the operating season would not need to carry equipment required for "cold" waters, regardless of latitude. Use of NVIC 7-91 as a reference rather than specifying cold water/warm water areas in the regulations gives several benefits: (1) It allows flexibility to periodically update geographical limits of areas having seasonal cold water; (2) seasonal changes and geographical limits can be portrayed on chartlets which can be quickly accessed and easily understood; and (3) it avoids repetition of a long list of geographical boundaries in more than one location or set of regulations.

The number of hypothermia-related fatalities in the small passenger vessel industry is historically minimal. It is expected that with the completion of the phasing in of the new small passenger vessel safety regulations in 2006, the risk of hypothermia to persons on small passenger vessels will be even further reduced by ensuring that those vessels at greatest risk carry survival craft providing out-of-water flotation for the persons on board. Based on available data, the Coast Guard believes its longstanding use of 59 degrees Fahrenheit as the dividing line for lifesaving equipment requirements keyed to "cold" water remains appropriate.

Measures for safe egress of persons wearing Personal Flotation Devices

The only reported casualty where egress of persons wearing personal flotation devices has been a significant issue was the 1999 sinking of the Coast Guard inspected small passenger vessel MISS MAJESTIC. On May 1, 1999, the MISS MAJESTIC (a "DUKW" amphibious vehicle, originally designed as a World War II military transport) rapidly sank in 60 feet of water about 250 yards from shore in Lake Hamilton, near Hot Springs, Arkansas. Flooding of the vehicle was not apparent to those on board before downflooding over the stern became imminent. The vehicle sank in less than 30 seconds after the master recognized the vehicle was in distress. The master and seven of the twenty passengers escaped from the vehicle after it sank, and made it to the surface alive. Thirteen of the twenty passengers drowned. A Marine Board of Investigation determined the cause of the casualty to be "unchecked flooding … resulting from the aft shaft boot seal dislodging from the shaft housing at the start of waterborne operation." It also revealed a serious problem with the method of egress from the vessel. MISS MAJESTIC sank rapidly stern first forcing the passengers into the canopy and toward the windshield. The windshield was locked in the up position and the canopy came to the top of the windshield. Further, vinyl side windows had been installed to the sides of the windshield. The passengers were trapped.

Figure 5. DUKW modified for small passenger vessel service

One of the recommendations from the Marine Board of Investigation report was for the Coast Guard and the amphibious passenger vehicle industry to meet and develop comprehensive guidelines containing best practices on the inspection and operation of these vehicles. A two-day meeting between owners/operators of DUKW vehicles, industry experts and Coast Guard personnel was convened in February 2000. This meeting yielded open and frank discussions on the regulation, inspection and operation of these vehicles.

Based on the results of the February 2000 meeting, the Coast Guard published Navigation and Vessel Inspection Circular (NVIC) 1-01, containing a national guideline to ensure that the major safety systems aboard these vehicles are reviewed and inspected consistently nationwide. This guidance replaced various national and local guidance documents concerning inspection and certification of DUKW's, and provides a consistent basis for determining equivalency of passenger-carrying amphibious vehicles to conventional small passenger vessels.

The NVIC extensively addresses egress issues unique to amphibious passenger vessels, and DUKW's in particular, in light of the lessons learned from the MISS MAJESTIC casualty. Like any other small passenger vessel of its limited size, a DUKW is only required to have one means of escape, which is generally over the side. However, because the method of boarding, for the majority of DUKW's, is over the stern, the natural human inclination is to perceive that escape is over the stern as well. Since these vehicles have a tendency to sink stern first, this places the perceived escape in the direction opposite from that which the passengers should go. Because of this, in addition to the physical measures discussed below, the NVIC specifies that the required passenger safety orientation on a DUKW should include specific instructions to the passengers concerning the method of escape from the vehicle, particularly in relation to the windows/curtains and windshield.

Since the primary egress route for these vehicles is over the side, the NVIC extensively covers measures to ensure that egress over the side is not impeded. Side windows or curtains, if installed, should be able to be opened with minimal force, generally by a simple action by one person. Arrangements should be in place to allow the master the ability to open all windows and/or curtains on each side from a point located at the control station. The windshield should be designed to fold down with minimal force to allow egress. Since canopies and canopy supports can impede the egress of passengers, canopy supports should be positioned to allow the majority of passengers unobstructed egress. If a canopy support is located directly adjacent to a passenger's seat it should be shown, through a practical test,

that the passenger can adequately egress the vehicle. The window framing vertical distance should be sufficient for a passenger to exit while wearing a lifejacket, with a recommended vertical distance of 32 inches from gunwale to canopy. Overhead storage of lifejackets should not impede the egress of passengers. Finally, the NVIC provided guidance regarding deck rail heights to ensure that they do not unduly hamper egress over the side.

With these measures in place, the unique egress issues of DUKW vessels should be satisfactorily addressed. Based on the available casualty history, the Coast Guard is not aware of any outstanding egress issues relating to other, more conventional types of vessels.

Enforcement efforts and degree of compliance with requirements for the master to require passengers to wear personal flotation devices when hazardous conditions exist

Background

The 1996 amendments to the small passenger vessel regulations in parts 122 (Subchapter K) and 185 (Subchapter T) of Title 46, Code of Federal Regulations require the master of a small passenger vessel to require passengers to wear personal flotation devices when possible hazardous conditions exist including—

(a) When transiting hazardous bars or inlets;
(b) During severe weather;
(c) In the event of flooding, fire, or other events that may call for evacuation; and
(d) When the vessel is being towed, except during the towing of a non-self-propelled vessel under normal operating conditions. (46 CFR 122.508 and 185.508)

This regulation is based upon recommendations of the NTSB following the PEARL C (31-foot charter fishing vessel, 1976 capsize while crossing the Columbia River Bar – 1 drowned, 7 missing), SAN MATEO (46-foot charter fishing vessel, 1983 capsize while crossing a bar at the entrance to Morro Bay, CA – all 32 persons on board rescued), and MERRY JANE (64-foot charter fishing vessel, 1986 broach while approaching Bodega Bay, CA – 9 drowned, 1 missing) casualties. Passengers and crew members suddenly entered the water as a result of the capsizing or near capsizing of these vessels as they crossed hazardous bars or inlets.

Although the June 2003 capsize of the 35-foot charter fishing vessel TAKI TOOO while transiting Tillamook Bar near Garibaldi, Oregon is still under investigation by the NTSB, some information has been released publicly by the NTSB[9] and the Coast Guard. On the day of the casualty, the Coast Guard had posted two "Rough Bar" warnings, one at its lower station near the harbor and the other on its tower near the entrance to the bay, and had prohibited recreational and uninspected commercial vessels from transiting the bar that morning. The TAKI TOOO capsized quickly, apparently after being struck on its port side by a large wave.

[9] *NTSB Advisory*, June 20, 2003

Of the 19 persons aboard the TAKI TOOO, 9 died and 2 are missing and presumed dead. Of the 8 survivors, one passenger was out on deck without a lifejacket and survived. The deckhand was thrown from the flying bridge and survived; she also did not have a lifejacket. Six passengers in the cabin were able to access lifejackets during the accident sequence (one did not survive). Although the vessel was upside-down with water filling the cabin, four of the five survivors were able to don the lifejackets and escape the cabin, one through a door and the others through broken windows; the fifth had to remove the lifejacket to get through a window and was not able to recover it. The circumstances surrounding the rescue of the eighth survivor are not yet known.

The master and 7 passengers were thrown from the vessel and drowned; none were wearing lifejackets. Two passengers are still missing and presumed dead; they were on the outside deck at the time of the capsizing and were not wearing lifejackets. Based on the number of persons not wearing lifejackets at the time of the casualty, it seems unlikely that the master had instructed the passengers to don lifejackets.

Enforcement of, and compliance with the regulations

At present, there have been no citations issued to vessels or masters for violations of this regulation since it became effective, and the degree of compliance is unknown, for two reasons. First, as a practical matter, enforcement or monitoring of compliance with an operational requirement such as this--which would likely apply only very rarely, if ever, for a given vessel—is problematical at best. Enforcement action would require either direct observation by the Coast Guard, testimony or reporting by a passenger (who are unlikely to complain about not wearing lifejackets) or crew member, or come about as a result of a casualty. Further complicating enforcement, the regulation contains little metric guidance to determine when a bar or inlet is sufficiently "hazardous", or weather sufficiently "severe", to trigger the requirement for a given vessel and its capabilities and the experience of its master. In the case of the TAKI TOOO, the master was very familiar with the waters around the Tillamook Bar, and had 17 years of experience operating the vessel -- and thus may not have perceived the same degree of risk as a less experienced operator. As noted in the preamble to the 1996 IFR, the intent of the requirement was to raise the sensitivity of the master, based on his/her discretion and judgment, with regard to donning of lifejackets, and to raise the priority of donning lifejackets in certain hazardous and deteriorating operating conditions.

In addition to the practical difficulties in enforcing the regulation, there have not at present been any specific corresponding civil penalty provisions established in connection with it (although in cases where a master shows poor discretion or judgment that rises to the level of negligence, action could be taken against the master's license).

Immediately following the TAKI TOOO casualty, the Coast Guard issued an informative Safety Alert[10] to reiterate the duty of masters of small passenger vessels during potentially hazardous conditions. It noted that although donning lifejackets might make passengers apprehensive, it could easily be explained as similar to wearing seatbelts during aircraft

[10] SAFETY ALERT – WEARING OF LIFEJACKETS, June 17, 2003 (http://www.uscg.mil/hq/g-m/moa/docs/3-03.htm)

takeoffs and landings and during periods of turbulence; and that when in doubt, passengers and crew should don lifejackets.

Casualties involving violations of the regulations 1998-2003

As discussed above, there have been no citations for violations of the regulations either in connection with a casualty or otherwise. The case of the TAKI TOOO remains under investigation; however since the master is deceased and the vessel a total loss, it is unlikely that it will result in any citations.

Recommendations for improving compliance with, and possible modifications to, the regulations

The TAKI TOOO casualty, and the history of other incidents where passengers have ended up in the water unexpectedly, has led to a dialogue between the Coast Guard and the small passenger vessel industry concerning the need for further guidance. Unrelated to the preparation of this report, in late 2004 the Coast Guard began coordination with the industry to charter a Natural Working Group (NWG) to develop and implement a simple, risk-based cooperative decision support tool to provide guidance as to what conditions may warrant the mandatory donning of lifejackets on both inspected and uninspected small passenger vessels. The draft charter has been circulated to the participants, with approval anticipated by early Spring 2005. The preliminary time line for the NWG calls for submission of final deliverables for action and adoption within one year of the charter.

This approach of partnership with the industry is believed to be preferable to a regulatory solution in view both of the practical issues discussed above, and opposition within the industry to a mandatory requirement. At least one small passenger vessel industry association has taken a public position in opposition to the mandatory use of lifejackets in the marine charter and small passenger vessel industry. A statement by the National Marine Charter Association:

> *". . .opposes the mandatory use of Personal Floatation Devices (PFDs) for operators and passengers in the marine charter and small passenger vessel industry. Passengers on charter vessels have the distinct safety advantage of professional guidance from trained, licensed, and experienced operators and crew. Operators of passenger vessels are licensed by the U.S. Coast Guard and have the training and experience to know when circumstances warrant passengers donning PFDs. The safety briefings Captains give to passengers before being underway show where PFDs are kept and how they should be worn. A government intrusion on and regulation of this important business-customer relationship is unwarranted and unneeded, and has not been proven beneficial by any studies or empirical evidence."*

The Coast Guard is hopeful that the work of the NWG will result in useful guidance for masters of small passenger vessels to supplement their discretion and judgment with regard to donning of lifejackets in hazardous and deteriorating operating conditions, with a view to further improvement of the already excellent safety record of the industry.