NATIONAL TRANSPORTATION SAFETY BOARD
Office of Marine Safety
Washington, D.C., 20594

March 3, 2011

SURVIVAL FACTORS GROUP FACTUAL REPORT

ACCIDENT NUMBER: DCA10MM025

Vessel 1:	*DUKW 34*
Vessel 2:	*T/V Caribbean Sea*
Vessel 3:	*The Resource* (Barge)
Date:	July 07, 2010
Time:	1437 Eastern
Location:	Delaware River
Owner/Operator 1:	Ride The Ducks International, LLC
Complement:	37 persons total (2 crew, 35 passengers)
Owner/Operator 2:	K-Sea Transportation
Complement:	5 persons total
Owner/Operator 3:	K-Sea Transportation
Complement:	Unmanned

SURVIVAL FACTORS GROUP

Chairman: Liam J. LaRue, NTSB
Washington, DC

Matt Fine, LCDR, USCG
Sector Delaware Bay

John Lawrence
K-Sea Transportation

Greg Blumenthal
Ride The Ducks International, LLC

SUMMARY

On Wednesday, July 7, 2010, the empty 250-foot-long sludge barge *The Resource*, being towed alongside the 78.9-foot-long towing vessel M/V *Caribbean Sea,* allided with the anchored 33-foot amphibious passenger vehicle (APV) *DUKW 34* in the Delaware River near Philadelphia, Pennsylvania. The *DUKW 34*, operated by Ride The Ducks International, LLC, (Ride the Ducks) carried 35 passengers and 2 crewmembers. On board the *Caribbean Sea* were 5 crewmembers. Following the allision, the *DUKW 34* sank in about 55 feet of water. Two passengers were fatally injured, and 26 passengers suffered minor injuries. No one on the *Caribbean Sea* was injured.

INJURIES

The injuries sustained in this accident, shown in table 1, are categorized according to the injury criteria of the International Civil Aviation Organization (ICAO). The Safety Board uses the ICAO injury criteria in all its accident reports, regardless of transportation mode.

Table 1. Injuries sustained in APV accident. There were no injuries to crew of the tug.

Type of Injury	Crew (*DUKW 34*)	Passengers (*DUKW 34*)	Total
Fatal	0	2	2
Serious	0	0	0
Minor	1	26	27
None	1	7	8

Title 49 CFR section 830.2 defines a fatal injury as any injury that results in death within 30 days of an accident. It defines serious injury as that which requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received; results in a fracture of any bone (except simple fractures of fingers, toes, or nose); causes severe hemorrhages, nerve, muscle, or tendon damage; involves any internal organ; or involves second- or third- degree burns, or any burn affecting more than 5 percent of the body surface.

MEDICAL AND PATHOLOGICAL INFORMATION

Description of Injuries

Twenty six passengers on board the APV reported injuries as a result of the accident. The injuries were for the most part minor in nature, consisting of bumps and bruises, and small cuts and scrapes. Two passengers did not survive. Autopsies for the two fatalities listed the cause of death as drowning. The autopsies found no external or internal evidence of traumatic injury for either individual.

SURVIVAL ASPECTS

Passengers

Thirty five passengers were on board *DUKW 34* on the accident trip. Fifteen passengers were from Hungary, including 13 teenage students and 2 adult chaperones. English language skills varied greatly throughout the group with some speaking and understanding very little and others speaking and understanding at a high level. The Hungarian group was accompanied by their local American hosts, 3 adults and 4 teenagers. The Hungarians and their hosts were associated with a local church. The remaining 13 passengers on board the APV were smaller groups of "walk-up"s (one group of 4, two groups of 3, one group of 2, and one solo passenger). Passenger ages ranged from 8 to 72 years.

Safety Briefing

Prior to getting underway, the master on a small passenger vessel like the APV is required by Coast Guard regulation to provide a safety briefing to passengers[1]. The briefing must include the location of emergency exits, stowage location(s) of lifejackets, and the proper method of donning and adjusting lifejackets, including a demonstration. The brief must also inform passengers that they will be required to don lifejackets when possible hazardous conditions exist, as directed by the master. According to Coast Guard Navigation and Inspection Circular (NVIC) 01-01 (Inspection of Amphibious Passenger Carrying Vehicles), the safety briefing should also discuss the method of disembarking the vehicle during emergency egress and the method of removing egress obstructions (windows or curtains).

The master of *DUKW 34* told investigators that he conducted a safety briefing prior to departing on the accident trip. He described his pre-departure brief to investigators as follows:

> "Okay, folks, I want to you to know this is a Coast Guard inspected vessel. I am required to tell you about a PFD. Folks, we're not going to need these today but I need to tell you about these. Okay. They're located here and there. This side is for adults. This side is for children. I'm holding the jacket, pointing to them, for children. Okay. If you're not sure if you're an adult or a child, the Coast Guard

[1] 46 CFR 185.506

> really doesn't care about your emotional level of stability. They only care about weight. Ninety pounds and over, ninety pounds and under. If you're right at 90 pounds like me, make sure you put the bigger jacket on, okay. Now folks, if I tell you, and only if I tell you to put the jackets on, here's what you need to do. Pull down on the yellow tab, the jacket comes down, looks like this. Unhook the clip. It looks like a dog leash clip. Open up, put it over your head and around your neck. This thing goes around the back of your body and comes back to the front. I don't do the procedure with the jacket over my head. I show them how to put it on and I said, but to simplify this, I took it off, I said this thing goes around the back of your body, comes back and clips on the D ring. It doesn't matter what side you use. Both sides will work. Okay. Now if you do what I ask you to do, you, too, are going to float like a -- and everybody is supposed to yell "Duck."[2]"

Passengers remembered hearing the master's safety brief prior to departing on the tour. There was considerable difference of opinion regarding the adequacy of the safety brief between the American passengers and the group of Hungarians. No American passengers commented negatively on the briefing, while 11 of the 13 surviving Hungarians had negative comments. Several Hungarian survivors commented on the fact that the master did not physically demonstrate on his body how to put on a lifejacket. On Hungarian compared it to the safety brief on airplanes saying "Because yes, you know, if you were on an airplane, there is a video demonstration there, and everybody is so bored, because you can see it many times, as many times as you travel. But now, I would have been curious how it [a lifejacket] should be used, because it is the first time I am on that vehicle.[3]" Two other Hungarians indicated that after listening to the master's brief, they would not know how to put on a lifejacket.

Lifesaving Equipment

The APV was required to carry lifesaving equipment on board as per its Coast Guard issued Certificate of Inspection (COI). The COI required 39 adult lifejackets, and 4 child lifejackets, as well as a ring buoy with line attached. Because the tours often carried large

[2] Fox interview, 07-09-10, p. 49-50
[3] Mereticzki interview

groups of children, Ride The Ducks outfitted its boats with more than the minimum number of required child-sized lifejackets. Investigators were not able to verify the exact number of lifejackets carried on board at the time of the accident; however, the vessel was inspected by the Coast Guard on March 25, 2010, and found to be carrying all required lifesaving equipment at that time.

Lifejackets were stowed in the overhead on both sides of the vessel. Adult lifejackets were stowed in stacks of two on the starboard side above all but the last row of seats. Child-size lifejackets were stowed similarly on the port side and were above all but the last three rows of seats. The bottom end of each lifejacket was resting in a metal channel just below the canopy on each side (figure 1).

Figure 1. Adult Lifejacket stowage on APV boats

The top end of each lifejacket pair was secured to the overhead using a black nylon strap with a yellow tip, and button-type snap (figure 2). Passengers needed only to pull the yellow strap end to release the snap and free the lifejackets from the overhead.

Figure 2. Securing strap for lifejackets

Evacuation

Coast Guard NVIC 01-01 discusses the issue of emergency egress from APV vessels. "Due to the size of a DUKW, 177.500(o)[4] requires only one means of escape. Most DUKWs have been granted special consideration for reduced aisle widths with the stipulation that the primary means of escape is over the side. This goes against human nature, which is to exit in the same manner one enters. The method of boarding, for the majority of DUKWs, is over the stern; hence the perceived escape is over the stern. These vehicles have a tendency to sink stern first. This places the perceived escape in the opposite direction from which the passengers should go. Because of this, the master should give specific instructions to the passengers during the safety orientation concerning the method of escape from the vehicle. Side windows or curtains, if installed, should be able to be opened with minimal force, generally by a simple action by one person."

[4] 46 CFR 177.500(o) states that only one means of escape is required if the space has a deck area less than 30 square meters (322 square feet). Normally two means of escape are required.

According to Ride The Ducks, *DUKW 34* complied with the guidance in NVIC 01-01 with regard to evacuation, including requirements for seat spacing, aisle width, deck rails, window openings, and means of escape.

DUKW 34 was canopy covered and fitted with plastic window coverings that could be rolled up into the overhead when not needed. On the day of the accident, as was normal for operations during warm weather months, the plastic covers were rolled up, leaving the windows completely open[5]. In case of an emergency requiring evacuation while underway, passengers would be instructed to don lifejackets and exit through the window openings. Coast Guard NVIC 01-01 notes that "Canopies and canopy supports can impede the egress of passengers. Again, the primary egress on these vehicles is over the side. Canopy supports should be positioned to allow the majority of passengers unobstructed egress." Canopy support stanchions were located in line with seat backs and they would not impede evacuation over the side.

The APV's master told investigators that after anchoring, he coordinated with the main office and made radio calls. Standard Operating Procedure was to have another APV vessel tow them in with all passengers remaining on *DUKW 34*. As they waited for the tow, the APV's master observed the tug and barge heading towards them. He told investigators that he called out three times to the tug on VHF channel 13 as the tug and barge approached, saying, "Northbound tug in front of Penn's Landing, I am broke down and anchored. Please alter course." He further indicated that shortly before the allision he realized the tug did not see them or hear his radio calls, so he instructed passengers to put on lifejackets. Not all passengers recalled hearing the master's instructions; however, passengers did attempt to retrieve lifejackets prior to the collision. Many did so after seeing other passengers begin pulling them down from the

[5] If emergency evacuation were necessary on *DUKW 34* with the side window curtains down, the master could have activated manual levers (1 on each side) that allowed the top ends of the roller curtains to fall outward from the sides due to gravity.

overhead. One passenger told investigators that "one of the ladies… from our church got up, and she yelled, "'We've got to move.' And she started pulling down the life vests, and people started screaming, and other people were getting up and pulling life vests down, and that's right before the barge hit.[6]" Not all passengers were able to get a lifejacket prior to the barge striking them. Several passengers were able to get a lifejacket over their head, but none were able to put on a lifejacket and fasten it properly. Many passengers weren't able to hold onto their lifejackets when the vessel capsized and so they grabbed lifejackets when they surfaced.

Investigators reviewed video of the accident from the JUMPS camera on the New Jersey side of the river. According to the time stamp on the video, the barge made contact with the stern of the APV at 14:37:30[7]. Ten seconds later, at 14:37:40, the APV had rolled over onto its starboard side and was pushed completely under water.

None of the passengers on board were able to evacuate the APV prior to impact. The deckhand however, jumped off the starboard bow prior to impact and swam towards the middle of the river. Most passengers were unsure about how they evacuated the vessel and made it to the surface. Several stated that one moment they were under water and the next they were on the surface. A number of passengers described seeing sunlight through the water and swimming toward it. A few reported feeling the metal either from the window-frames or the side of the vessel and swimming out of the vessel and up towards the water surface.

Emergency Procedures

The Ride The Ducks Captains' Operations Manual contained emergency procedures for incidents occurring on the water. Their procedure for a loss of propulsion included the

[6] Amanda Johnston interview

[7] The time stamps on the video are believed to be approximately correct, but they had not been precisely verified. The time stamp in this video and other time information gathered in the investigation will be synchronized to standard time in a separate "electronic data" factual report.

instruction to "brief the passengers that there is no danger and to remain calmly seated calm and don lifejackets." According to interviews, passengers did not attempt to get lifejackets until shortly before the barge impacting the APV.

The company's standard operating procedures call for the master to immediately notify the Coast Guard by radio of a water incident such as a loss of steering, loss of propulsion, or injury or death. The master did not contact the Coast Guard.

Emergency Response

The primary responders to this accident included the Philadelphia Marine Police, Coast Guard, and two Good Samaritan vessels (a local ferry and a navy small boat). The Ferry *Freedom* was making its regularly scheduled trip from Camden, New Jersey, on the east side of the river to Penn's Landing in Philadelphia, on the west side when the accident occurred. The master of the *Freedom* told investigators that he departed Camden at 1430. Around 1435, as he was heading north, he heard the APV call to the tug and barge three times on VHF channel 13, saying, "I cannot maneuver; I'm at anchor.[8]" He was approximately ¾ to 1 mile away and saw the barge bearing down on the APV. He got on channel 13 and attempted to hail the tug with no response. His view of the APV became obscured by the barge, and shortly after, his senior deckhand reported seeing lifejackets in the water. He made best possible speed towards the accident site and, as they approached, he saw people in the water. As the first responder on scene, he surveyed the area and noticed that one person was further from shore than the others, more towards the center of the river. He decided to assist that person first. The person was the deckhand, and he quickly recovered him. After rescuing the deckhand, he saw that the marine police and Coast Guard had arrived and were assisting the rest of the passengers.

[8] Flynn interview.

Philadelphia police were notified of the accident at 1439 via 9-1-1 and dispatched units at 1440. The marine police launched two boats. At about the same time, the Coast Guard launched three boats, including two 25-foot RB-S boats (CG 25575 and CG 25740), and a 41-foot utility boat (UTB) (CG 41358). Philadelphia Marine police and Coast Guard Sector Delaware Bay share the same office building and dock facilities on the Delaware River, approximately 2.5 nm south of the accident site. Marine police and Coast Guard boats arrived on scene in "less than three minutes[9]" after being notified, according to one marine police officer. They immediately began assisting passengers from the APV that were in the water.

Also assisting in the rescue effort were members of the U.S. Navy Special Boat Team 20, based out of Little Creek, Virginia. The team had two Mark V Special Operations Crafts[10] (hull numbers 975 and 976) in port at the pier immediately south of the Independence Seaport Museum at Penn's Landing. They were providing vessel tours to the public at the time of the accident. A senior chief petty officer from the team heard a distress call on the VHF radio, first responder sirens, and commotion coming from the waterfront. He ran to the waterfront and observed "approximately 20-30…people in the water[11]." He returned to the marina, quickly boarded vessel 976, and got it underway with several crewmembers. Once underway they launched a small zodiac boat, called a Combat Rubber Raiding Craft (CRRT), with four crewmembers on board. Crewmembers on the CRRT helped pull survivors out of the water. Back on shore, other Navy personnel joined first responders in assisting survivors who swam to shore.

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[9] Napoli, 07-12-10, p. 7

[10] The Mark V is used to carry Special Operations Forces, primarily SEAL combat swimmers, into and out of operations where the threat to these forces is considered to be low to medium. They are 82 feet in length, with a beam of 17 feet 6 inches. They can reach speeds of up to 50 knots. (source: navy.mil)

[11] Weaver 07-12-10, page 6, line 5-7

Table 2 below shows how the passengers and crew from the APV were recovered. Nineteen of those on board were recovered by various vessels, while 16 managed to swim to shore. The bodies of the two fatalities were recovered several days later. Six passengers were taken by ambulance to Hahnemann University Hospital. One passenger was taken to Jefferson Hospital.

Table 2

Recovery Method	Number of APV Survivors
Ferry Freedom	1
Marine Police Boat 1	4
Marine Police Boat 3	10
Coast Guard 25575	0
Coast Guard 25740	1
Coast Guard 41358	0
Navy CRRT	3
Swam to Shore	16
Total	**35**

Location of Passengers

The *DUKW 34* was configured with an aisle that ran down the centerline of the vessel and with nine rows of bench seats on either side of the aisle, similar to a school bus. Each bench seat could fit two people. Investigators interviewed all surviving passengers (except for the six children, aged 8 through 12) and asked them to identify where they were sitting and who was around them, using a vessel diagram with seats numbered fore to aft. Based on those interviews investigators were able to determine the seat location of each passenger on board the vessel at the time of the accident. Table 3 below illustrates the location of each passenger based on these interviews. The two fatally injured passengers were seated together on the starboard side forward, in row 3 (highlighted below in red).

Table 3: *DUKW 34* Seating Chart

Seat #	Operator Station			Jump Seat		Seat #
2	Male (age 11)	Female (age 31)	Aisle	Female (age 48)	Female (age 9)	1
4	Female (age 8)	Male (age 50)		Male (age 20)	Female (age 16)	3
6	Female (age 51)	Male (age 16)		Female (age 16)	Female (age 16)	5
8	Male (age 16)	Male (age 16)		Female (age 67)	Male (age 8)	7
10	Female (age 17)	Female (age 16)		Male (age 16)	Female (age 19)	9
12	Female (age 19)	Female (age 18)		Female (age 54)	Female (age 67)	11
14	Empty	Male (age 72)		Female (age 16)	Female (age 17)	13
16	Female (age 34)	Female (age 37)		Female (age 15)	Female (age 16)	15
18	Female (age 12)	Female (age 10)		Male (age 53)	Female (age 30)	17