

NATIONAL TRANSPORTATION SAFETY BOARD
Public Meeting of November 15, 2016
(Information subject to editing)

**Amphibious Passenger Vehicle DUCK 6 Lane Crossover Collision With Motorcoach on
State Route 99, Aurora Bridge, Seattle, Washington**
September 24, 2015
NTSB/XXX-16-XX

This is a synopsis from the NTSB's report and does not include the Board's rationale for the conclusions, probable cause, and safety recommendations. NTSB staff is currently making final revisions to the report from which the attached conclusions and safety recommendations have been extracted. The final report and pertinent safety recommendation letters will be distributed to recommendation recipients as soon as possible. The attached information is subject to further review and editing to reflect changes adopted during the Board meeting.

Executive Summary

On Thursday, September 24, 2015, about 11:11 a.m. Pacific daylight time, the 2005 *DUCK 6* amphibious passenger vehicle (APV) was traveling north on the Washington State Route 99 (SR-99) Aurora Bridge in Seattle, Washington. At the same time, a 2009 Motor Coach Industries motorcoach was traveling south in the center lane. The *DUCK 6* driver heard a loud noise at the left front of the APV; the vehicle drifted to the right and then veered left suddenly; the driver lost control of the vehicle. The APV crossed the center line into the southbound lanes of oncoming traffic and struck the motorcoach.

Three other vehicles were damaged during the crash event: a southbound 2011 Ram Trucks pickup truck and two northbound vehicles—a 2006 Toyota Highlander sport utility vehicle and a 2007 Toyota Tundra pickup truck. As a result of this crash, five motorcoach passengers died. Seventy-one motorcoach and APV occupants reported injuries ranging from minor to serious.

The crash investigation focused on the following safety issues:

- Failure by an unregistered vehicle manufacturer to properly remedy a defective safety-related motor vehicle part under the federal recall process,
- Lack of adequate oversight of APV maintenance and failure to conduct effective safety repairs as recommended in service bulletins,
- Lack of adequate occupant protection in APVs used in commercial passenger tours, and
- Risk management in APV operations.

Findings

1. None of the following were factors in the crash: (1) *DUCK 6* or motorcoach driver performance; (2) highway or bridge factors; (3) motorcoach motor carrier operations; (4) motorcoach or passenger car mechanical condition; or (5) weather conditions.
2. The emergency response to the crash was timely and effective.
3. The left front axle housing on the *DUCK 6* failed due to multiple initiation fatigue cracking.
4. The 2004 tab modification was flawed due to inadequate stiffness to eliminate the stress concentration in the transition region and because of poor weld quality, specifically the lack of fusion and lack of penetration; moreover, it is likely that the weld of the tab fractured before the axle housing fractured.
5. The mechanical failure of the *DUCK 6*'s axle housing resulted in a loss of steering and vehicle control; the failure also resulted in a loss of front braking and an overall reduced braking capability, which contributed to the severity of this collision.
6. The 2004 modification that Ride the Ducks International made to the axle housings on its stretch amphibious passenger vehicles was poorly executed and provided no long-term benefit in preventing future axle failures.
7. Ride the Ducks of Seattle did not have adequate protocols in place to verify that the work specified in service bulletins from Ride the Ducks International was completed, even though the company knew that the bulletins addressed work important to the safety of its stretch amphibious passenger vehicle fleet.
8. Ride the Ducks of Seattle's lack of procedures to ensure that work called for in the manufacturer's service bulletins was performed on its stretch amphibious passenger vehicle fleet resulted in a failure to address the known risk of axle failure.
9. Ride the Ducks International did not adequately remedy the front axle fractures on the stretch amphibious passenger vehicles it manufactured, which led to the axle housing failure that caused the *DUCK 6* crash.
10. As a vehicle manufacturer under the National Traffic and Motor Vehicle Safety Act of 1966, Ride the Ducks International should be registered as a vehicle manufacturer with the National Highway Traffic Safety Administration to address any safety defects through the recall program.
11. The failure of the majority of seats in the *DUCK 6* and the lack of occupant protections, such as effective seat design and seat belts, contributed to passenger ejections and injury.
12. The crashworthiness of amphibious passenger vehicles would be improved by requiring such vehicles to meet existing, applicable sections of the *Federal Motor Vehicle Safety Standards* for buses.

13. To ensure the consistent and uniform application of federal safety requirements, the US Coast Guard's assumed average weight per person should be used when calculating gross vehicle weights for amphibious passenger vehicles.
14. Because amphibious passenger vehicles are high-occupancy passenger vehicles operating on public roads, the National Highway Traffic Safety Administration should take action to provide occupant protection to their passengers.
15. Although installing seat belts in amphibious passenger vehicles would most likely reduce ejections and injuries in crashes that occur on land, seat belts could pose egress problems during emergencies on water.
16. Survival space was compromised for motorcoach passengers in the path of the *DUCK 6*, as it traversed the motorcoach interior upward to the roofline and for almost the entire length of the vehicle.
17. For those in the intrusion area, the bow of the *DUCK 6* striking the side of the motorcoach at close to 40 mph caused catastrophic intrusion damage and severe injuries that additional motorcoach sidewall protections and seat belts most likely would not have prevented.
18. By adding a tour guide to each amphibious passenger vehicle on every excursion, Ride the Ducks of Seattle has reduced the risk of driver distraction in its operations.
19. Given the recent Seattle and Boston amphibious passenger vehicle (APV) crashes, which resulted in multiple deaths and numerous injuries, the APV industry should develop and implement risk management practices geared to the special needs of APV operations.

PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of the Seattle, Washington, crash was the mechanical failure, due to improper manufacturing by Ride the Ducks International (vehicle manufacturer) and inadequate maintenance by Ride the Ducks of Seattle (operator), of the left front axle housing of the stretch amphibious passenger vehicle (APV) *DUCK 6*, which resulted in loss of vehicle control. Contributing to the severity of the motorcoach occupant injuries was the APV's structural incompatibility with the motorcoach, causing intrusion into the motorcoach sidewall, windows, and interior passenger compartment. Contributing to the severity of the APV passenger injuries were the lack of occupant crash protections and the high impact forces.

RECOMMENDATIONS

New Recommendations

As a result of its investigation, the National Transportation Safety Board makes the following new safety recommendations:

To the National Highway Traffic Safety Administration:

1. Require that Ride the Ducks International, as a manufacturer, issue a recall for the stretch amphibious passenger vehicle front axle safety defect to provide owners a remedy as required under the Safety Recall Campaign. (H-16-XX)
2. Adopt the US Coast Guard's assumed average weight per person and amend the certification regulation in 49 *Code of Federal Regulations* Part 567 to specify that the gross vehicle weight rating for an amphibious passenger vehicle "shall not be less than the sum of the unloaded vehicle weight, the rated cargo load, and 185 pounds times the vehicle's number of designated seating positions." (H-16-XX)
3. Classify all amphibious passenger vehicles (APV) as non-over-the-road buses and, under the authority of the National Traffic and Motor Vehicle Safety Act of 1966, make newly manufactured APVs subject to applicable *Federal Motor Vehicle Safety Standards* in effect at time of manufacture. (H-16-XX)

To the US Coast Guard:

4. Amend Navigation and Vessel Inspection Circular 1-01 to ensure that (1) amphibious passenger vehicle (APV) operators tell passengers that seat belts must not be worn while the vessel/vehicle is operated in the water and (2) before the APV enters the water or departs the dock, the master or other crewmember visually checks that each passenger has unbuckled his or her seat belt. (M-16-XX)
5. Distribute a Safety Alert on amphibious passenger vehicle operations that addresses the role of risk assessment to mitigate driver distraction, as well as the need to tell passengers to remove seat belts before waterborne operations begin. (M-16-XX)

To Ride the Ducks International:

6. Develop a thoroughly verified and tested repair or alternative axle housing for the front axles of your stretch amphibious passenger vehicles (APV), and repair or replace the axle housings on your own stretch APVs as necessary. (H-16-XX)
7. Communicate the repair or replacement information concerning the front axle housings of your stretch amphibious passenger vehicles, developed in response to Safety Recommendation [6], to your franchisees and licensees. (H-16-XX)
8. Instruct your franchisees and licensees to immediately halt operation of their stretch amphibious passenger vehicles and not resume operations until they complete the axle housing repair or replacement process developed in response to Safety Recommendation [6]. (H-16-XX) (Urgent)

To Ride the Ducks of Seattle:

9. Add to your 250-hour and annual inspection processes a procedure to verify that all actions indicated in service bulletins have been completed on all inspected vehicles. (H-16-XX)

To the Passenger Vessel Association:

10. Notify all your amphibious passenger vehicle (APV) operator members of the importance of the following: (1) learning the lessons from the Seattle, Washington, and Boston, Massachusetts, crashes; (2) completing proper maintenance and service bulletin repairs; (3) using the pretrip safety orientation to tell passengers of APVs equipped with passenger seat belts to unbuckle their belts before the APV begins any marine operations; (4) conducting a visual inspection to ensure that passengers have unbuckled their seat belts prior to water entry; (5) reducing the risk of driver distraction by having a tour guide conduct each tour; (6) managing risk in tour operations by addressing such factors as driver distraction, route planning, vehicle characteristics, traffic density, and vehicle speed; and (7) conducting operations according to Navigation and Vessel Inspection Circular 1-01 guidance and US Coast Guard Safety Alerts. (M-16-XX)