Head part 1

10. SUNY Head Impact Testing

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Introduction

The combination of the two claims below made by the 1989 NBSAC propeller guard subcommittee report dealt a devastating blow to propeller guard advocates:

1. Being struck by a propeller guard at speed results in blunt trauma injuries that are worse than being struck by an open propeller.
2. Up to 80 percent of underwater impacts occur at normal operating speeds. (see pie chart our 1989 Part 5 poster for actual distribution of speeds)

The two claims above were accepted as fact in the NBSAC report, however neither claim was proven. If either of those two claims are false, NBSAC's report crumbles into dust.

By controlling accident data, the industry was able to run a bluff on the Snyderism that 80 percent of underwater impacts occur at normal operating speeds. However, they knew they would have to support the blunt trauma claim. Thus the SUNY underwater Head and Leg impact studies were born.

SUNY Head Impact Testing

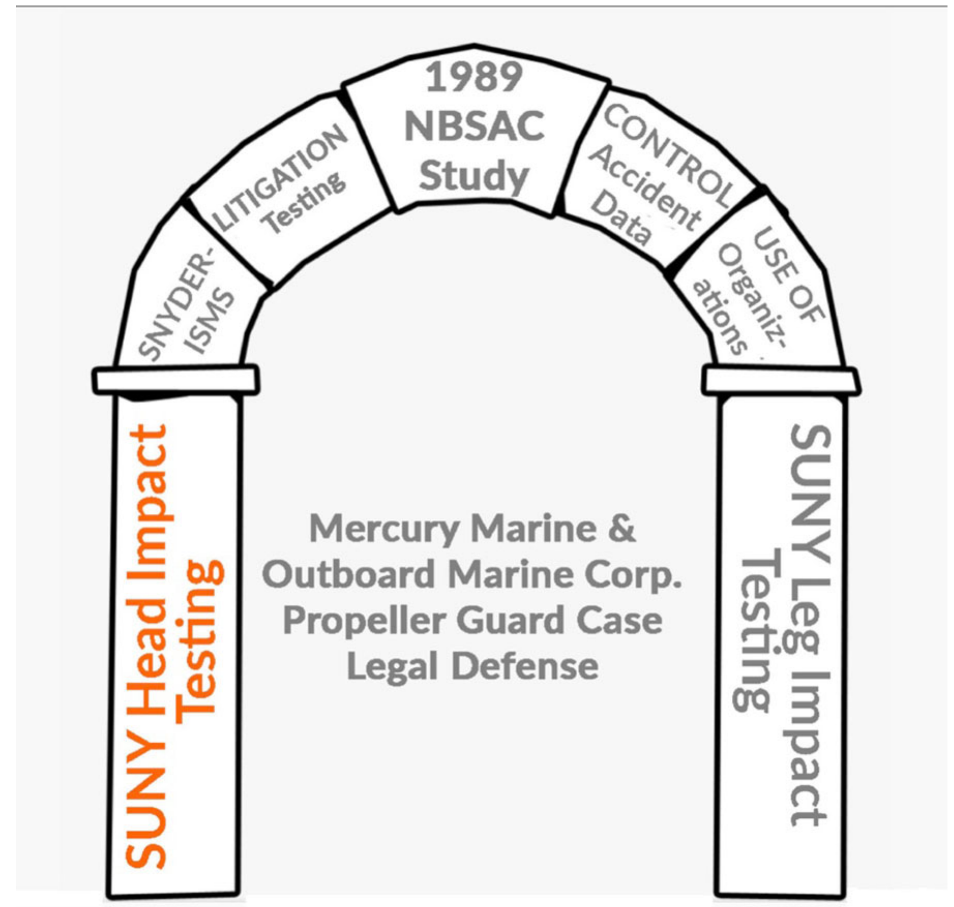
The State University of New York at Buffalo (SUNY) had a very large donut shaped water tank. The tank featured a long rotating arm that could drag things around the tank.

Dick Snyder of Mercury had long been trying to simulate propeller guard impacts. He saw a presentation on motorcycle leg impacts by University of Tennessee researchers. Snyder visited with them about the possibility of conducting similar tests underwater. University of Tennessee researchers worked alongside Biodynamic Research Corporation (BRC) researchers at SUNY. A representative of BRC had presented to the NBSAC subcommittee and was described as an expert witness for defendants. The researchers, along with several lawyers, Dick Snyder of Mercury and Don Kueny of OMC, made up the project team.

The basic plan was to mount an OMC outboard motor with Mercury's patented propeller guard on it to the rotating arm. Then swing the motor around the tank at various speeds, impacting an underwater, seated crash dummy in the head as seen in the image at far right.

Michael Scott of BRC, previously at SUNY, was to be the primary researcher.

The particular dummy used, a Hybrid III ATD (Anthromorphic Test Dummy) was well known for having a neck spring several times stiffer than a human neck, making the head impacts seem more severe than they really were.



Did Not Represent Worst Conditions?

The final version of the head impact paper said testing with the dummy in an upright position reduced the probability of neck injury. They said if the torso was more pitched forward like that of a swimmer, the impact would have to move some of the torso mass out of the path of the lower unit as well as the head and neck.

Most viewing the test setup image at right would find it hard to imagine a worse condition than being struck in the forehead by the sharpest point of the guard, except being struck by the propeller.

As to assuming more of a swimming position, most swimmers coming at the propeller guard are more likely to strike the slanted sides of the guard and slide off, or try to dive under the propeller.

Vertical Trim

Don Kueny of OMC said he found a way to represent propeller thrust during the SUNY testing. By trimming the outboard motor into a vertical position (zero trim), when it impacted the dummy, the resistance to drive swinging upward provided by the log strike system would represent the forward thrust of the propeller. While that part might be true, striking the dummy's head with the drive in a vertical position, removed the opportunity for the dummy's head to slide down the slanted leading edge of the drive. This makes it more like running into a brick wall than sliding down hill.

When Does Neck Injury Occur

When the SUNY paper was written, little information was available about the effects of head and neck impact forces Mike Scott chose to use the Mertz study. Mertz worked for General Motors in 1978 and was charged with evaluating restraint systems (like seat belts) in frontal collisions.

Mertz reviewed a 1976 paper by J.S. Torg studying three high school athlete injuries from collisions with spring-loaded football tackling and blocking dummies. There were just bits of data and no record what type of helmet the athletes were wearing. Mertz used these accidents plus three more and tried to recreate the events using the Hybrid III crash dummy to measure impact forces and times.

Mertz measured crash dummy neck loads. Using neck loads combined with real world injury data, Mertz developed upper and lower bounds for how long humans could endure given head impact forces before they began to have neck injuries.