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15. What Does All This Mean?

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History

1. The Coast Guard's own 1987 study (Purcell & Lincoln) identified several things that need to happen before a decision could be made on the use of propeller guards.

2. Yet in 1988-1989, The Coast Guard's National Boating Safety Advisory Council (NBSAC)'s propeller guard subcommittee reviewed much of the same information, completed none of the steps Purcell & Lincoln said had to be completed before a decision could be made, and found "**The U.S. Coast Guard should take no regulatory action to require propeller guards**."

3. Several serious issues with the 1989 NBSAC report are identified in posters #5,6,7,8,9 and even more in our four part manuscript.

4. An early version of the head impact report noted blunt trauma was a major reason the 1989 NBSAC study rejected propeller guard. However no evidence was put forward in the 1989 report to show blunt trauma from striking a propeller guard was as bad or worse than being struck by an open propeller. The early version of the head impact report says that is why the industry undertook the underwater head and leg impact projects. To "fix" a problem with the 1989 NBSAC report.

5. Several serious issues with the head impact study are identified in posters #10,11 and even more in our four part manuscript.

6. Several serious issues with the leg impact study are identified in posters #12,13 and even more in our four part manuscript.

It is easy to see, this series of posters and the corresponding four volume manuscript prove these three studies (NBSAC, head impact, leg impact) are not valid. They only have historical merit in propeller guard conversations.

If these studies are flawed, most to all studies built upon one or more of them are similarly flawed.

Similarly, propeller strike legal cases in which one of more of the three studies (NBSAC, head impact, leg impact) played a major role in finding for the defense are examples of an industry creating alternative facts for self serving purposes.

None of the three studies meet the burden of proof regarding their findings (see the detailed problems with their findings identified in these posters and supported in depth in our four part manuscript including footnotes and dozens of reference documents.)

The Three R's of Engineering & Science Studies

The 1989 NBSAC propeller guard subcommittee was not an engineering study. No engineers were among the subcommittee members.

Engineering and Science studies, like the head impact study and the leg impact study, should be **Repeatable**, **Reproducible**, and **Replicable**.

Repeatable - same team, same experimental setup. For example if Scott and Kress, along with the others assisting, went back a month later to the same tank with the same approach, same crash dummy, and cadavers from the same lot, the results should be very similar.

Replicable - different team, same experimental setup. For example if a different pair of researchers along with a different set of technicians and assistants went to SUNY at Buffalo and ran the same set of tests on the same crash dummy, and cadavers form the same lot, the results should be very similar.

Reproducible - different team, different experimental setup. For example if a different pair of researchers along with a different set of technicians and assistants went to a facility other than SUNY at Buffalo and ran similar tests on a similar crash dummy and similar cadavers, the results should be very similar.

In this instance the head impact and leg impact study MIGHT be Repeatable, Replicable, and Reproducible but there would be no reason to rerun these studies if you are interested in evaluating the use of boat propeller guards.

Additional Problems

The Hybrid III crash dummy's neck was many times stiffer than a human neck, the cadavers were over 70 years of age, had been embalmed for several years, with the fleshier areas becoming "leather like". Tests were conducted with the drive vertical (at zero trim) providing no opportunity for the head or legs to slide down and off the guard. The impact point of the forehead on the sharpest area of the guard with the body sitting in a chair probably represents the only time in history somebody was struck under those conditions. They used crash dummy parameters in the simulation to compare with the results vs. human parameters.

Backing up to the NBSAC propeller guard subcommittee, they based their decisions on about half of Event 1 data as reported by the U.S. Coast Guard BARD database. Actual BARD reported fatalities were about four times what they were told.

NBSAC's propeller guard subcommittee report stated:

1. Propeller guards had about 300 percent of the forward facing cross sectional area of an open propeller. If they are talking about a rotating open propeller, the actual increase would be more of the nature of 30 percent. Some would argue it would only be half of that (15 percent) since if you hit both sides of a guard you would have hit the open propeller anyway.

2. Propeller guard impacts at speed were worse than open propeller strikes which was not and still has not been proven.

3. Open propellers make nice clean cuts that are easy for surgeons to sew back together. They failed to mention marine biological infections are a major issue with propeller wounds, many struck by propellers bleed to death, some struck by propellers drown, or the life changing difficulties of amputations and prosthetics.

USCG's Purcell and Lincoln pointed out before NBSAC's subcommittee was formed, to evaluate the potential use of propeller guards you would have to:

1. Gather accident data needed to make a decision on propeller guards which could take years.

2. Consider injury data in addition to fatality propeller strike data.

3. Biomechanical studies would have to be completed before a decision. (Determine conditions under which serious injuries from impact with propeller guards and with open propellers occur, determine distribution of positions and orientations of those struck.)

4. Mechanical studies would have to be completed and the public sector would need to be encouraged to develop propeller guards to be tested. (Impact forces and their duration would need to be understood, design assistance would need to be provided to those manufacturing propeller guards.) Computer Aided Design (CAD) and computer simulation would likely be involved in a project like this today.

5. Conduct tests for injury severity.

6. Rank potential solutions.

7. Identify acceptable solutions.

8. Perform validation testing.

NBSAC did none of these. They just said there were no acceptable solutions. The NBSAC study did not meet the burden of proof.