

# Purcell & Lincoln part 1

## 1. USCG Propeller Guard Report by Purcell & Lincoln

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### Background

In the mid 1980s:

1. Survivors and family members of those killed in boat propeller accidents began to speak out in the press.
2. Several propeller accidents were related to the lack of kill switches being on the boat.
3. More lawyers became involved, spawning numerous propeller guard and kill switch legal cases.

The U.S. Coast Guard assigned Edward S. Purcell and Walter B. Lincoln of the U.S. Coast Guard Research and Development Center in Groton Connecticut to investigate *“the problem of injuries and fatalities caused by collision of a boat or propeller with a human body. **The objective is to define the extent of the problem and identify potential safety measures that may alleviate it.**”*

Purcell and Lincoln said, *“**The magnitude and type of injuries must be determined prior to recommending any safety measures.**”* They found *“a large variation in the reported statistical data among the databases available.”*

The Coast Guard’s driving issue was to reduce the rate of fatalities by boat and propeller strikes. Purcell and Lincoln noted, *“The difference between occurrence of either a fatality or an injury in a given accident is often a matter of chance. (For example those falling overboard into the Circle of Death are either struck or not struck). **Therefore the entire range of accident causes and preventative measures must be considered.**”*

A draft of Purcell & Lincoln’s report, Project 763584.20, was dated 15 January, 1987.

Their final report followed on 1 March 1987.

### The Study

The USCG Purcell & Lincoln study was to be a paper study, meaning they would only be reviewing existing information, accident statistics, documents, etc. No actual testing or product development efforts would be undertaken.

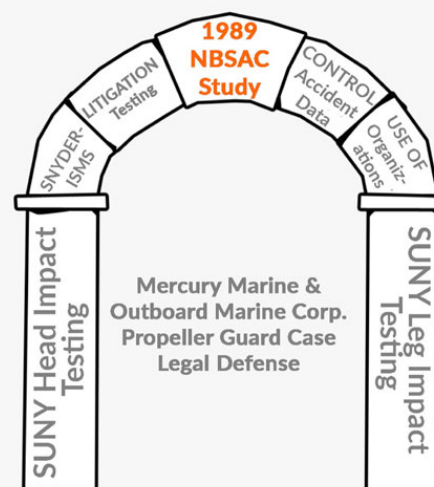
Purcell & Lincoln’s approach to the study was to:

1. Review the propeller accident statistical data.
2. Determine categories of accidents and what types of safety measures could have been taken.
3. Determine how safety measures could have been implemented.
4. Determine what causes of action the Coast Guard needs to perform to alleviate this problem: investigative, regulatory, educational, informative, or developmental.

Purcell and Lincoln’s review of accident data found most “struck by boat or propeller” accidents fall into one of four scenarios:

1. *Operator falls or is thrown into the water, and the boat circles around and runs over them. (the Circle of Death)*
2. *A water skier or fallen passenger is run over during subsequent maneuvering by the operator.*
3. *The operator is unable to maneuver the boat underway at high speed to avoid a swimmer.*
4. *A bow rider falls overboard and is run over by the boat while underway at high speed.*

The authors identified several passive and active preventative measures. Passive preventative measures are taken prior to the potential accident situation such as efforts to reduce alcohol consumption on boats. Active preventative measures prevent or correct the situation as it occurs such as the use of kill switches to kill boat engines in the Circle of Death.



USCG’s Purcell & Lincoln report predates the 1989 NBSAC propeller guard subcommittee report.

### Underwater Impact

Purcell & Lincoln identified many of the issues and forces in play in underwater impacts. They expressed great interest *“in the damage to the human body inflicted by this impact, which is a function of the deformation of the tissue and bone.”*

They assumed the extent of damage to the body would be worse underwater than a similar impact in the air, but had no actual underwater impacts to compare. Purcell and Lincoln noted the difference in sharp and blunt objects, and between propeller blade tip speed vs boat forward speed. They also identified several other variables and issues involved in understanding underwater collisions with a boat propeller.

### Purcell & Lincoln Recommendations (1987)

1. The accident study should be conducted by active sampling of hospitals. Attention should be focused on the broad spectrum of injuries, not just fatalities. The present injury data is too subjective. A much higher level of objectivity is needed.
2. **No further research on mechanical devices should be performed until the new data is analyzed and the problem is properly defined.**
3. A program to encourage development of safety measures and devices in the private sector should be initiated.
4. The use of seat belts in open high performance boats should be promoted.

### Inconclusive Findings

USCG informed the National Association of State Boating Law Administrators (NASBLA) in a March 29, 1987 letter the Purcell and Lincoln report was inconclusive.

The letter did not go into details but the Purcell & Lincoln report was inconclusive due to the lack of:

1. *“A more valid method of gathering data that is more specific to this particular problem. After a significant amount of data is acquired, which may take several years, the Accident Data Analysis should be accomplished.”*
2. *“the design of the biomechanical test is crucial to the validity of the results of such an analysis.”*
3. *“The mechanical studies would consist of a program that encourages development and submission of candidate devices and systems by the private sector.”*