

***The National Marine Manufacturers Association / American  
Boat and Yacht Council / BoatUS  
Engine Cut-Off Lanyard Test Program***

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Final Report



**August 19, 2011**

# Mako Operator Lanyard Switch



# Sea Doo Operator Lanyard Switch





# The Start/Stop Tests



The Dinghy Start/Stop Test



The Mako Start/Stop Test



The Sea Ray Start/Stop Test



The Sea Doo Start/Stop Test

# Lanyards



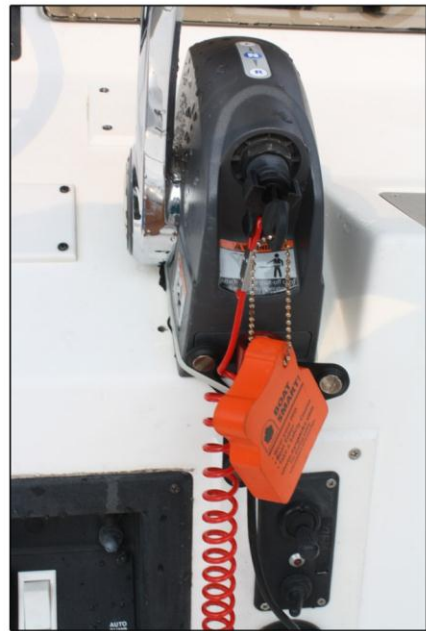
The Dinghy



The Dinghy



The Mako



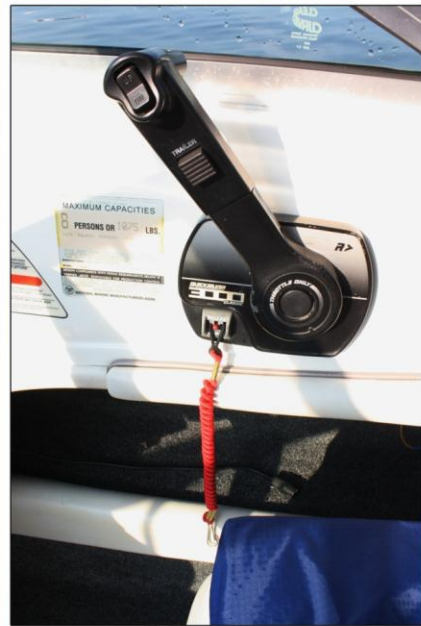
The Mako



# Lanyards



The Sea Ray



The Sea Ray



The Sea Doo



The Sea Doo

## NMMA/ABYC/BoatUS Lanyard Application Test Report

### Executive Summary

One of the major uncertainties surrounding a potential regulation that would require operators to wear an engine cut-off lanyard while underway is the perceived difficulty in both starting the engine and in switching operators while underway. In an effort to answer these questions, NMMA, ABYC, and BoatUS designed this test program to measure the time it took to perform these functions and also record any difficulties. Eight boat operators with varying levels of experience performed start/stop tests on four different vessels: a 19' Mako center console fishing boat, an 18' Sea Ray open bow runabout, a 23' Sea Doo jet boat open bow runabout, and a 9' Johnson Dingy with a 3.5 hp Tohatsu tiller drive. Technicians from ABYC and NMMA recorded the amount of time it took for the operator to start the engine without an attached lanyard and with the lanyard attached.

For the operator lanyard switch test, four operators performed the test on the Mako and ten performed the test on the Sea Doo. The technicians measured the time it took for two operators to switch command at the helm and transfer the lanyard while underway. The 9' Johnson Dingy and the 18' Sea Ray were not used for the operator lanyard switch test, as the size and design of the vessels make switching helm positions while underway unlikely.

For both the start-stop test and the operator lanyard switch test, any problems associated with use of the lanyard were minimal. The operators of the Sea Ray did note that the metal clip on the lanyard was old and stiff and thus difficult to attach to clothing. Once the operator formed a loop on the lanyard, it became easy to attach as reflected in the more detailed tables in the body of the full report. The following summary table reports the average amount of time it took for all operators on each vessel to start the engine with and without a lanyard attached. The second table reports the average time it took for operators to switch positions at the helm and attach the lanyard while underway.

## Summary Table

### Start-Stop Test

Vessel Description	w/o lanyard attached (seconds)	w/lanyard attached (seconds)
18' Sea Ray	1.34	9.48
9' Johnson Dinghy	2.19	10.85
19' Mako	2.48	10.40
23' Sea Doo	*	6.14

*\*Note: no data was collected on the Sea Doo w/o lanyard attached.*

### Operator Lanyard Switch Test (Sea Doo Jet Boat Open Bow Runabout)

*All operators wore PFDs during this test.*

Operator ID Numbers	Average (seconds)
Operator #1 to #2 and #2 to #1	8.82
Operator #3 to #9 and #9 to #3	7.94
Operator # 4 to #5 and #5 to #4	7.63
Operator #7 to #8 and # 8 to #7	13.65
Operator # 8 to # 6	12.95

### Operator Lanyard Switch Test (Mako Center Console Fishing Boat)

*This test looked at both the time it took to switch helm positions and the time it took to attach a lanyard to the operators' clothing vs. a ring on a PFD.*

Operator ID Numbers	Average (seconds) with PFD	Average (seconds) w/o PFD
Operator #1 to #2 and #2 to #1	6.98	7.28
Operator #4 to #5 and #5 to #4	3.12	7.65

## Findings

In summary, the data show that for the start/stop test, considering the average of all vessels tested, the additional time burden for installing a lanyard vs. not installing a lanyard is about **eight** seconds. For the operator lanyard switch test, the average amount of time to perform this operation on both vessels was between **three and fourteen** seconds.



## **Background**

On June 8, 2011, the U.S. Coast Guard published in the Federal Register an Advance Notice of Proposed Rulemaking (ANPRM) on the Installation and Use of Engine Cut-off Switches. An engine cut-off switch is commonly referred to as a "lanyard." The ANPRM has a 90 day comment period which closes on 6 September 2011.

This ANPRM is the result of a recommendation made to the Coast Guard by the National Boating Safety Advisory Council (NBSAC) believes that it is a simple, low-cost requirement that will save lives by turning a vessel's engine off should the operator be ejected from the vessel. This will prevent the vessel from going into a circular turn and possibly hitting the operator (or ejected passengers) with the hull or propeller in a scenario often referred to as the "circle of death."

Because of some uncertainties regarding the number of lives potentially saved, costs, and other related issues, the U.S. Coast Guard decided to go with an ANPRM instead of a Notice of Proposed Rulemaking (NPRM). This will allow them to gather more information and develop the best possible rulemaking proposal.

One of the challenges that boaters could face would be the difficulty of attaching the lanyard to their clothing or PFD and the proper installation of the lanyard to the ignition switch. The concern is the amount of time and effort that is required for the operator to install the clip on the lanyard to his or her person, attach it to the ignition switch, and start the engine.

A second challenge that boaters could face would be the difficulty of changing operators at the helm while underway.

Based on discussions with between the U.S. Coast Guard, NMMA, ABYC and BoatUS this test was designed to investigate these issues and determine if this raises a significant concern. The objective of this test was to measure the amount of time it takes for participants, referred to herein as "operators," with a wide range of boating experience, to start the engine with the lanyard installed.

## **Test Program**

In test 1, an operator was timed to determine how long it took to properly install the lanyard and turn the key. This amount of time was compared to the amount of time it took the operator to turn the key with the lanyard already installed, but not properly attached to the operator.

In test 2, the two operators were timed to determine how long it took to switch operators at the helm while underway, without affecting the operation of the vessel. In addition to the measured time, notes were recorded regarding any difficulties experienced.

## **Test Plan**

Participants in the test had a wide range of boating experience which is documented into three groups.

- 0-10 hours per year                      Low
- 10-35 hours per year                    Moderate
- 35 and higher hours per year        High

The test consisted of four different styles of vessels for the start/stop test and two vessels for the operator lanyard switch test.

These included the following vessels:

- 23' Sea Doo Jet Boat Open Bow Runabout
- 19' Mako Center Console Fishing Boat
- 9' dinghy with a Tohatsu 3.5 hp two stroke tiller
- 18' Sea Ray runabout

## **Operator Lanyard Switch Test**

Test conducted on the following vessels:

- 19' Mako Center Console Fishing Boat
- 23' Sea Doo Jet Boat Open Bow Runabout

Each vessel was manned with a technician from NMMA or ABYC who conducted the test using new identical stop watches and who then recorded the results. Prior to the test each operator received instruction from the technician on the proper installation of the lanyard.

For Test 1 the operator retrieved the lanyard and took position at the helm. The single test consisted of six data points. Three data points were collected as the operator installed the key, or, in the case of the tiller, pull the cord without installing a lanyard. Three data points were collected requiring the installation of the lanyard.

## **Conclusion**

After compiling and analyzing the data and after discussions with both the operators and technicians, it is clear that for the randomly-chosen vessels in this test that at no time were there constraints against wearing a safety lanyard either during the start-up operation or while underway. Operators would, with the type of lanyards that were tested, be required to stay at the helm during their use.

The following are the full results for all four vessels from Test #1 the Start/Stop Test.

**Lanyard Test #1**

18' Sea Ray  
 August 19, 2011  
 Start-Stop Test

***Without Lanyard***

<b>Operator ID Number</b>	<b>Test #1 (sec.)</b>	<b>Test #2 (sec.)</b>	<b>Test #3 (sec.)</b>	<b>Mean (Average) (sec.)</b>	<b>Boating Experience Level</b>
Operator #1	1.50	1.34	1.75	1.53	Low
Operator #2	1.38	1.25	1.75	1.46	High
Operator #3	1.21	1.53	1.40	1.38	High
Operator #4	1.15	1.16	1.23	1.18	High
Operator #5	1.21	1.29	1.30	1.27	Low
Operator #6	0.81	1.90	1.72	1.48	Medium
Operator #7	1.31	1.16	0.97	1.15	High
Operator #8	1.37	1.44	1.06	1.29	High
<b>Average Total</b>	<b>1.24</b>	<b>1.38</b>	<b>1.40</b>	<b>1.34</b>	

***With Lanyard***

<b>Operator ID Number</b>	<b>Test #1 (sec.)</b>	<b>Test #2 (sec.)</b>	<b>Test #3 (sec.)</b>	<b>Average (sec.)</b>	<b>Boating Experience Level</b>
Operator #1	16.68	8.06	7.25	10.66	Low
Operator #2	N/A	8.43	6.25	7.34	High
Operator #3	11.38	10.72	12.03	11.38	High
Operator #4	12.06	6.31	5.91	8.09	High
Operator #5	11.60	8.22	7.06	8.96	Low
Operator #6	7.81	6.41	6.93	7.05	Medium
Operator #7	19.19	7.44	16.13	14.25	High
Operator #8	7.56	10.28	6.41	8.08	High
<b>Average Total</b>	<b>12.33</b>	<b>8.23</b>	<b>8.49</b>	<b>9.48</b>	

**Lanyard Test #1**

19' Mako w/ 175 Evinrude

August 19, 2011

Start-Stop Test

***Without Lanyard***

<b>Operator ID Number</b>	<b>Test #1 (sec.)</b>	<b>Test #2 (sec.)</b>	<b>Test #3 (sec.)</b>	<b>Average (sec.)</b>	<b>Boating Experience Level</b>
Operator #1	1.94	2.75	2.72	2.47	Low
Operator #2	2.27	2.32	2.44	2.34	High
Operator #3	2.32	2.22	2.00	2.18	High
Operator #4	2.13	2.15	1.78	2.02	High
Operator #5	1.87	2.34	2.00	2.07	Low
Operator #6	2.47	2.37	2.87	2.57	Medium
Operator #7	3.60	3.87	3.66	3.71	High
<b>Average Total</b>	<b>2.37</b>	<b>2.57</b>	<b>2.49</b>	<b>2.48</b>	

***With Lanyard***

<b>Operator ID Number</b>	<b>Test #1 (sec.)</b>	<b>Test #2 (sec.)</b>	<b>Test #3 (sec.)</b>	<b>Average (sec.)</b>	<b>Boating Experience Level</b>
Operator #1	7.47	7.34	7.35	7.38	Low
Operator #2	12.57	8.22	7.28	9.35	High
Operator #3	8.75	8.34	8.35	8.48	High
Operator #4	8.68	7.25	7.75	7.89	High
Operator #5	9.90	8.97	11.84	10.23	Low
Operator #6	15.66	13.66	11.88	13.73	Medium
Operator #7	18.19	14.87	14.28	15.78	High
<b>Average Total</b>	<b>11.60</b>	<b>9.80</b>	<b>9.81</b>	<b>10.40</b>	



### Lanyard Test #1

9' Johnson Dinghy w/ 3.5 Tohatsu 2-stroke engine

August 19, 2011

Start-Stop Test

#### *Without Lanyard*

Operator ID Number	Test #1 (sec.)	Test #2 (sec.)	Test #3 (sec.)	Average (sec.)	Boating Experience Level
Operator #1	2.28	2.39	1.25	1.97	Low
Operator #2	3.19	3.21	1.78	2.72	High
Operator #3	1.59	1.02	1.19	1.26	High
Operator #4	3.25	3.00	1.75	2.66	High
Operator #5	2.18	1.31	1.57	1.68	Low
Operator #6	2.70	2.20	1.80	2.23	Medium
Operator #7	3.40	2.19	3.11	2.90	High
Operator #8	2.30	1.57	2.40	2.09	High
<b>Average Total</b>	<b>2.61</b>	<b>2.11</b>	<b>1.85</b>	<b>2.19</b>	

#### *With Lanyard*

Operator ID Number	Test #1 (sec.)	Test #2 (sec.)	Test #3 (sec.)	Mean Average (sec.)	Boating Experience Level
Operator #1	8.25	8.15	6.25	7.55	Low
Operator #2	11.30	11.38	18.75	13.81	High
Operator #3	7.25	9.07	7.24	7.85	High
Operator #4	15.00	11.41	16.20	14.20	High
Operator #5	8.30	7.16	8.22	7.89	Low
Operator #6	11.53	9.09	10.06	10.22	Low
Operator #7	8.25	23.05	18.53	16.61	High
Operator #8	10.25	8.75	7.25	8.75	High
<b>Average Total</b>	<b>10.01</b>	<b>11.00</b>	<b>11.56</b>	<b>10.85</b>	

**Lanyard Test #1**

23' Sea Doo Jet Boat

August 19, 2011

Start-Stop Test

*Sea Doo Start-Stop test only recorded data with lanyard attached.*

<b>Operator ID Number</b>	<b>Test #1 (sec.)</b>	<b>Test #2 (sec.)</b>	<b>Test #3 (sec.)</b>	<b>Average (sec.)</b>	<b>Boating Experience Level</b>
Operator #1	4.49	5.00	4.43	4.64	Low
Operator #2	1.50	2.00	1.18	1.56	High
Operator #3	4.19	5.83	5.44	5.15	High
Operator #4	4.97	5.28	4.75	5.00	High
Operator #5	6.07	5.00	4.75	5.27	Low
Operator #6	12.12	5.84	6.75	8.23	Medium
Operator #7	17.03	9.37	13.06	13.15	High
<b>Average Total</b>	<b>7.19</b>	<b>5.47</b>	<b>5.76</b>	<b>6.14</b>	

For Test 2 the Operator Lanyard Switch Test, two operators were required to stand at the helm, with one simulating operation of the vessel underway and the other as lookout or passenger. The technician measured the amount of time it took for the operators to switch positions. The following are the full results for the Operator Lanyard Switch Test:

**Lanyard Test 2**

23' Sea Doo Jet Boat

August 19, 2011

Operator Lanyard Switch Test

Operator ID Number	Test #1 (sec.)	Test #2 (sec.)	Test #3 (sec.)	Average (sec.)
Operator #1 to Operator #2	10.81	8.41	6.53	8.58
Operator #2 to Operator #1	12.94	7.12	7.12	9.06
				<b>8.82</b>

Operator ID Number	Test #1 (sec.)	Test #2 (sec.)	Test #3 (sec.)	Average (sec.)
Operator # 3 to Operator #9	9.06	7.16	7.15	7.79
Operator #9 to Operator# 3	9.13	7.09	8.10	8.10
				<b>7.94</b>

Operator ID Number	Test #1 (sec.)	Test #2 (sec.)	Test #3 (sec.)	Average (sec.)
Operator #4 to Operator #5	7.34	7.22	8.88	7.81
Operator #5 to Operator #4	8.87	7.03	6.50	7.46
				<b>7.63</b>

Operator ID Number	Test #1 (sec.)	Test #2 (sec.)	Test #3 (sec.)	Average (sec.)
Operator #7 to Operator #8	15.66	13.62	12.28	13.85
Operator #8 to Operator #7	13.75	10.91	15.69	13.45
				<b>13.65</b>

Operator ID Number	Test #1 (sec.)	Test #2 (sec.)	Test #3 (sec.)	Average (sec.)
Operator # 8 to Operator #6	12.06	10.34	16.47	<b>12.95</b>

### Lanyard Test 2

19' Mako with 175 Evinrude  
August 19, 2011  
Operator Lanyard Switch Test

*Test conducted with Life Jacket being worn.*

Operator ID Number	Test #1 (sec.)	Test #2 (sec.)	Test #3 (sec.)	Average (sec.)
Operator #2 to Operator #1	7.6	6.2	8.3	7.36
Operator #1 to Operator #2	7.0	5.4	7.4	6.6
				<b>6.98</b>

*Test conducted without life jackets being worn.*

Operator ID Number	Test #1 (sec.)	Test#2 (sec.)	Test #3 (sec.)	Average (sec.)
Operator #2 to Operator #1	8.1	10.0	7.1	8.4
Operator #1 to Operator #2	4.9	6.1	7.5	6.16
				<b>7.28</b>



*Test conducted with life jackets being worn.*

<b>Operator ID Number</b>	<b>Test #1 (sec.)</b>	<b>Test #2 (sec.)</b>	<b>Test #3 (sec.)</b>	<b>Average (sec.)</b>
Operator #4 to Operator #5	3.8	2.43	2.85	3.02
Operator #5 to Operator #4	3.22	2.56	3.90	3.22
				<b>3.12</b>

*Test conducted without life jackets being worn*

<b>Operator ID Number</b>	<b>Test #1 (sec.)</b>	<b>Test #2 (sec.)</b>	<b>Test #3 (sec.)</b>	<b>Average (sec.)</b>
Operator #4 to Operator #5	10.93	9.00	6.72	8.88
Operator #5 to Operator #4	5.40	7.00	6.91	6.43
				<b>7.65</b>