

FROM: The Safety at Sea Committee of The Sailing Foundation
TO: Interested parties, Man Overboard Safety at Sea

SUBJECT: Report of findings, Man Overboard Light Tests, 1994, 1995 and 1996

This report and its recommendations are the result of on-the-water testing of currently available Man Overboard lights by our Committee over the past several years. Other timely articles and reports and publicly available data were also researched.

Visible range, location and battery endurance were tested for 13 different personal jacket-type lights and three floating Man Overboard lights at three on-the-water test sites varying from sheltered to relatively open ocean waters. Lights tested were both strobes and incandescents, many of them supplied to us by their manufacturers. Battery endurance was tested ashore.

Our principal conclusion is that major improvements in Man Overboard lights should be a priority for all concerned with safety at sea, for reasons given in our report.

The following report sections are based on specific data from our test files. Information on different makes and types of lights - their visibility, ease of use, battery replacement, construction, etc., etc, was not the principal purpose of our testing, however detailed test data forms the basis for the report and its conclusions.

TEST SCENARIOS

Three on-the-water test sites were used, the first being Port Madison Bay in Puget Sound, the second, Barkley Sound - a large inlet of the North Pacific on the West Coast of Vancouver Island and the third, San Juan Channel in the San Juan Islands (used for two tests). The fifth test, battery endurance, was conducted ashore.

Of the 16 lights tested, eight were personal jacket-type strobe lights, five were incandescent personal lights and three were floating Man Overboard strobe lights. Lights were from six different manufacturers. Six lights were tested three times on-the-water, six more were tested twice and four tested once. All were tested ashore for battery endurance.

Test equipment and conditions were as follows:

1. **PORT MADISON BAY** - One test boat with one observer boat at one mile and a second varying its position from 2 to 3 miles. Conditions tested were calm with some shore lights in the background. Lights were tested in line astern groups of three or four lights of similar type per group, spaced approximately 50 feet apart. A light common to all groups gave brightness comparisons.
2. **BARKLEY SOUND** - One test boat and three observer boats (sail, power, sail) holding station with GPS at 1-1/2, 3 and 4 miles with height of eye 7', 13' and 7' respectively. Conditions - 1' to 3' ocean swells, a clear night, dark ocean horizon with a quarter moon 30 degrees to the left of the test area. Lights were tested independently, floating 6 inches above the surface in a test rig designed to approximate wearer height in the water.
3. **SAN JUAN CHANNEL** - Two tests of strobe and incandescent lights, some in "combination." One test boat (Whaler type) with shore observation, 1-1/2 miles apart. Good visibility, dark land background and calm seas.

VISIBLE RANGE

A correlation of the test results shows the following:

1. All lights were visible at 3/4 mile with the naked eye - the degree of brightness varied significantly. (All test sites)
2. At 1-1/2 miles, 10 lights were rated "bright" to "good" with the naked eye, two were rated "adequate" and the remainder were "weak" to unseen. All rated "good" were strobe lights. (All test sites)
3. At 3 miles, four lights (all strobes) were seen - one with the naked eye and three with 7X50 binoculars, the rest were unseen.
4. At 4 miles observers believed they might have seen four lights (all strobes) very faintly and intermittently. Sweeping a horizon sector proved a much better search technique rather than trying to focus on where the light apparently was last seen.

ATTENTION, LOCATING AND RANGING

Immediately following the Barkley Sound tests a one and one-half hour debriefing was held with all test observers, many of whom were experienced ocean sailors, resulting in these observations:

1. The strobe light, a certain attention-getter, is poor for locating and ranging due to the short duration and nature (blue-white light) of its flash even when close aboard. It is difficult to visually acquire and reacquire from any distance particularly in a swell condition which causes random flashes due to obscuration. The large floating Man Overboard lights "bob" at varying angles, resulting in random flashes. Constant eye scanning is helpful for location purposes. Observers have reported that stand-alone masthead strobe lights on other vessels provide very little range estimation. Some in-the-water wearers of personal strobe lights have reported a "hypnotic" effect from long-term exposure to their flashes.
2. A white or colored steady or intermittent light is far better than a strobe light for ranging and locations as borne out by brightly-lighted buoys, light houses, range lights, etc.
3. Current state-of-the-art personal Man Overboard lights appear to give "naked-eye" visibility of approximately two miles for strobe lights and 1-1/2 miles for a steady white light. These ranges can probably be increased by 50 percent with 7X50 binoculars under good conditions.

BATTERY ENDURANCE

A battery endurance test of the lights was undertaken ashore. The test was terminated at 72 hours with these results:

1. All three of the large floating Man Overboard lights tested (all with 6 volt alkaline lantern batteries) and two personal lights (one strobe and one incandescent) were still flashing intermittently at 72 hours. All utilized alkaline batteries and showed signs of slowing flash rates when the test was terminated.
2. The remaining 11 (all "personal" lights) went out in a range varying from a low of 7-1/2 hours to a high of 60 hours.
3. As a generality, although there were exceptions, the larger the battery, the longer the light lasted - as could be expected. D cells outlasted C cells, which outlasted AA's, etc. Two personal strobes and one incandescent utilized lithium batteries which lasted between 14 and 23.5 hours, They were outlasted by seven lights powered by alkaline cells. It was observed that some alkaline-powered lights would "recover" and operate again for periods of one to two hours after being

switched off for 6 to 24 hours. This could be of some value to a victim awaiting rescue for a long period of time.

OBSERVATIONS AND CONCLUSIONS

By far the majority of experienced sailors seem to agree that strobe lights are the best type of light for attention-getting and extremely poor for distance ranging. Rescue helicopter pilots have indicated that strobes get them to the scene but spoil depth perception. They would like to have a steady light on the victim for exact location and height judgment for actual pickup.

It seems apparent that the lighting employed by aircraft may point the way for research and development of better Man Overboard lights at this time. Commercial and General Aviation aircraft combine the strobe light with the bright fixed incandescent light, giving both location and ranging to all observers. Our tests of existing off-the-shelf Man Overboard lights indicate that current standards for naked eye visibility under good conditions can be 1-1/2 miles for personal strobe lights and up to 3 miles with binoculars for both personal and floating strobe lights. Some fixed white incandescent personal lights may meet a 1-1/2 mile standard at this time.

LIGHT TEST SPECIFICS

| Manufacturer, Model, Type | Visibility (miles) | | | Battery Endurance Type Cell/Hours |
|---|--------------------|-----------|-----------|--------------------------------------|
| | 1.5 | 3.0 | 4.0 | |
| | | | | |
| Personal Incandescent Lights | | | | |
| ACR 731 (fixed) | Weak | Unseen | Unseen | 1 D alk./72 |
| Guest 378C (fixed) | Weak | Unseen | Unseen | 1 9V alk./7.5 |
| Guest 378B (blinking) | Weak | NT | NT | 1 9V Alk./34 |
| Fulton 101 (fixed) | Weak | NT | NT | 1 3V lith./14 |
| Stearns RescueMate (fixed) | Adequate | NT | NT | 4 AA alk./20 |
| | | | | |
| Personal Strobe Lights | | | | |
| ACR Firefly 1 | Bright | *Good | *Faintly? | Special/20.7 |
| ACR Firefly 2 | Good | *Adequate | Unseen | 2 AA alk./13.5 |
| ACR Firefly Plus | Bright | Unseen | Unseen | 2 AA alk./13.5 |
| ACR 733 | Bright | Unseen | Unseen | 1 D cell/72 |
| Forespar RL2 | Good | Unseen | *Faintly? | 1 C cell/22.5 |

| | | | | |
|--|----------|----------|-----------|-----------------|
| Forespar RL2 SOLAS | Bright | Adequate | NT | A 3V lith./23.5 |
| Guest 380A | Good | *Good | Unseen | A 6V lith./18.7 |
| Jotron AQ4 | Good | NT | NT | 1 C cell/60 |
| | | | | |
| Man Overboard Strobe Lights | | | | |
| ACR 566 | Bright | Unseen | *Faintly? | 1 6V lant./72 |
| Forespar SOLAS | Adequate | Unseen | *Faintly? | 1 6V lant./72 |
| Guest 326A | Bright | Unseen | Unseen | 1 6V lant./72 |

SUMMARY

As a result of our testing, the Sailing Foundation Safety at Sea Committee has experimented with the concept of a "combination" personal Man Overboard strobe and fixed white light. Tests were conducted utilizing existing lights of each type placed in immediate juxtaposition with one another, floating approximately 6' above the water. Naked-eye range of approximately 1-1/2 miles was obtained by the "combined" white light with the strobe visible for a longer distance.