United States Coast Guard
Recreational Boat Accident Mitigation Meeting:

- Propeller Accident Mitigation
- Carbon Monoxide Accident Mitigation

Miami International Boat Show Miami, FL
February 14th, 2008

Sponsored By:
United States Coast Guard
Office of Auxiliary & Boating Safety

Minutes Prepared By:
American Boat & Yacht Council, Inc. (ABYC)
613 Third Street, Suite 10
Annapolis, MD 21403
www.abycinc.org
Attendance is attached as Appendix A.

Dick Blackman began the meeting with a brief description of the USCG rental package (See presentation attached as Appendix B).

Dick Blackman introduced the presenters for the propeller guard test protocol portion of this update (Their presentation is attached as Appendix C).

Robert MacNeill – International Marine Consulting Associates

Clifford Goudey – Massachusetts Institute of Technology

Richard Akers – Small Craft Engineering, LLC.

Bob MacNeill began the presentation discussing general areas of the testing including the areas measured, variables, test set up and personnel.

Cliff Goudey explained the trim settings, and the testing procedures and results that could be observed.

Dick Akers discussed the sensors and software used to record the data.

Dick Blackman fielded any questions, there were none.

Carbon Monoxide Accident Mitigation

Dan McCormick handed out material attached as Appendix D.

The first handout lists commercially available marine CO detectors. This list will eventually be on the USCG website (www.uscgboating.org). Mr. McCormick briefly discussed a new test program that the Coast Guard will be working on in the spring and summer of 2008, to evaluate the feasibility of an after market underwater exhaust system for existing express cruisers. The testing on the underwater exhaust system is moving forward.
Kiko Villalon (ANCON Marine Consultants, Inc.) was asked to report on a carbon monoxide (CO) poisoning in Stockton CA where retired Grig. Gen. Stephen Vonderheide, age 61, was found dead on his 38 ft Chris Craft boat. His body was found near his CO detector alarm which was found on the kitchen counter, face down and with the batteries outside the device. Mr. Villalon believes that the focus is too much on equipment and not on the operator. Maintenance, operation etc. are the items that can solve most of these issues.

Mr. McCormick discussed a pocket CO detector that is commercially available with a digital readout that records the concentration of CO. Anecdotal evidence shows that users are not confident that a situation exists when the alarm sounds causing disconnection of the device. Perhaps we need to look into ways to stop this behavior.

Phil Cappel reported that a brochure may be coming out from NMMA on CO detectors. Tom Marhevko, Executive Director of BIRMC would entertain comments.

Question: Where can the hand-held unit be purchased and how much did it cost? The unit is roughly $129.00 and the company contact info is included in the handout.
Appendix A

Accident Mitigation Meeting Attendees – February 14, 2008

Larry Akins  Fireboy-Xintex, Inc.
Ken Bedsworth  Engineering Systems, Inc.
Bob Carttar  Pursuit Boat
David Collins  Buit, Moore, Smythe & McGee
Greg Davis  Davis & Company
Jack Flaig  J D Flaig
Charlie Game  E.C. Game Engineering
Fernando Garcia  BRP US, Inc
Michael Gonzalez  Seipp & Flick, LLP
Blaine Henry  Market Solutions, Intl.
Jim Kieckhefer  Kohler Co.
Don Keuny  Don F. Kueny PE, Inc.
Marcia Kull  Volvo Penta of the Americas
Todd Lemke  Mercury Marine
Frank Manchisi  Wilson Elser
Alex Marconi  Snell & Wilmer
Tom Marhevko  NMMA
Dave Marlow  Brunswick Boat Group
John Martino  ACT, Inc.
Randy Moore  Snell & Wilmer
Tim O’Connor  LEM Products, Inc.
Russ O’Daly  American Honda Motor Co.
Gavin O’Hare  CED/AAI
Dave Ortiz  Ken Cook Co.
Christina Paul  Rumberger, Kirk, & Caldwell
Scott Rolseth  EnviroProp Co.
Bruse Rowe  Forever Resorts
Cindy Squires  NMMA
Tom Sutherland  Westerbeke Corp.
Robert Taylor  Design Research Engineering
Mark Verwys  Plunkett & Cooney, PC
Kiko Villalon  ANCON Marine Cons.
Bob White  Imanna Lab
David Wolfe  Teleflex Marine
Ted Woolley  State of Utah
BOAT RENTAL/LIvery SAFETY BRIEFING PACKAGE

► TIGER TEAM
  ▪ FRED MESSMAN – BLA NEVADA
  ▪ PAM DILLON – BLA OHIO
  ▪ MARION IRVING DECRUZ – SPIN
  ▪ BRUCE ROWE – FOREVER RESORTS

► IN PRINTING – ETC MID MARCH

► “TEST MARKET” SPRING ‘08
BOAT RENTAL/LIVERY SAFETY BRIEFING PACKAGE

- DISTRIBUTION BY TIGER TEAM MEMBERS, OFFICE OF BOATING SAFETY, COAST GUARD AUXILIARY
- TRIAL DURING SUMMER RENTAL SEASON
- FEEDBACK, EDIT, PEER REVIEW
- PRINT FINAL FOR DISTRIBUTION IN SPRING ‘09
Appendix C

**PROP INJURY MITIGATION DEVICE TEST PROTOCOL**

![Image](image.png)

**What is Performance How Does It Relate to SAFETY?**

- Straight-line speed vs. power
- Straight-line acceleration vs. power
- Deceleration at all-stop
- Maneuverability (Turning)
- Ride quality (Seakeeping)
- Fuel consumption
- ... and off-design performance in the above categories

**Eliminate the Operator As a Variable**

- A reliable test protocol that can be applied to a wide range of boats and power units must minimize the impact of
  - The operator's skill,
  - The operator's strength, and
  - The operator's nerve.
- To eliminate bias in results, and
- To provide repeatability.

**Measurements**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Desired Units</th>
<th>Electronically Logged</th>
<th>Sensor</th>
<th>Desired Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>Knots, RPM</td>
<td>Yes</td>
<td>GPS</td>
<td>+/- 1%</td>
</tr>
<tr>
<td>Engine speed</td>
<td>RPM</td>
<td>Yes</td>
<td>Tachometer</td>
<td>+/- 0 RPM</td>
</tr>
<tr>
<td>Acceleration</td>
<td>G's</td>
<td>Yes</td>
<td>Motions package</td>
<td>+/- 0.01 G</td>
</tr>
<tr>
<td>Turning radius</td>
<td>Feet</td>
<td>Yes</td>
<td>GPS</td>
<td>+/- 8 inches</td>
</tr>
<tr>
<td>Pitch</td>
<td>Degrees</td>
<td>Yes</td>
<td>Motions package</td>
<td>+/- 2 degrees</td>
</tr>
<tr>
<td>Roll</td>
<td>Degrees</td>
<td>Yes</td>
<td>Motions package</td>
<td>+/- 2 degrees</td>
</tr>
<tr>
<td>Yaw</td>
<td>Degrees</td>
<td>Yes</td>
<td>Angle sensor</td>
<td>+/- 1 degree</td>
</tr>
<tr>
<td>Rudder angle</td>
<td>Degrees</td>
<td>Yes</td>
<td>Strain gage load cell</td>
<td>+/- 1% full scale</td>
</tr>
<tr>
<td>Steering torque</td>
<td>Foot-pounds</td>
<td>Yes</td>
<td>Protractor</td>
<td>+/- 1 degree</td>
</tr>
<tr>
<td>Engine Trim</td>
<td>Degrees</td>
<td>No</td>
<td>Protractor</td>
<td>+/- 1 degree</td>
</tr>
<tr>
<td>Fuel consumption</td>
<td>GPM</td>
<td>Yes</td>
<td>Fuel flow meter</td>
<td>+/- 1% full scale</td>
</tr>
<tr>
<td>Tow line tension</td>
<td>Pounds</td>
<td>Yes</td>
<td>Strain gage load cell</td>
<td>+/- 1% full scale</td>
</tr>
</tbody>
</table>
Test Procedures

► Speed vs. RPM
► Acceleration / Deceleration
► Maneuverability Test (Serpentine)
► Bollard Test

Test Procedures: Preparation and General Conditions

► Preparation
  - Boat clean, dry, as-new
  - Fuel topped off, other tanks empty
  - Tabs up (unused)
  - Manufacturer-recommended propeller

► Tests conducted:
  - Wind speed below 10 knots
  - Wave / Wake < 6"
  - Current < 0.25 knots

Test Personnel

► Helm
  - Operate boat
  - Make decisions to continue or discontinue test runs
  - Should have minimum of 100 hours experience driving a similarly configured and powered boat

► Technician
  - Makes calls for turns, accelerations, etc.
  - Operates sensor systems to record data
  - Verifies that data has been recorded

Test Procedures: Test Matrix

► Each procedure executed six times
  - three propulsion system trim settings, and
  - with and without the propeller guard system

<table>
<thead>
<tr>
<th>Propulsion Trim Setting</th>
<th>Propeller Guard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trim Setting 1 (&quot;In&quot;)</td>
<td>Not Installed</td>
</tr>
<tr>
<td>Trim Setting 2 (&quot;Operating&quot;)</td>
<td>Test 1</td>
</tr>
<tr>
<td>Trim Setting 3 (&quot;Out&quot;)</td>
<td>Not Installed</td>
</tr>
<tr>
<td></td>
<td>Test 3</td>
</tr>
</tbody>
</table>
**Test: Speed vs. RPM**

**SAFETY - Can the boat achieve speeds with/without Can the boat plane?**

**Procedure:**
1. Head into wind at idle RPM. Once speed is steady, note RPM, speed, and fuel flow.
2. Increase engine RPM to first integer multiple of 500 RPM, achieve equilibrium. Note RPM, speed, and fuel flow.
3. Repeat Step 2 in 500-RPM increments until engine reaches maximum RPM. Run final test at maximum RPM.
4. If wind speed is greater than 5 knots, repeat Steps 1, 2 and 3 heading downwind.

**Measurements:**
- Engine RPM (noted for each increment)
- Boat speed (displayed value from differential GPS display)
- Fuel consumption rate (displayed / logged)
- Static pitch angle of boat (displayed / logged values)

**Metrics: Speed vs. RPM**

**Over full range of RPM:**
- Average of % differences in speed
- Average of % differences in fuel consumption
- Average of % differences in NMPG

**All Data**
- % difference in maximum pitch angle
- % difference between top speed with / without propeller guard

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**Results: Speed vs. RPM**

![Graph showing speed vs. RPM](image)

**Test: Acceleration / Deceleration**

**Safety - Can the boat avoid unsafe circumstances?**

**Procedure:**
1. From full stop condition, maneuver boat into wind. Go to full throttle in less than 1/2 second. Accelerate to top speed (speed within 0.5 knots for 2 seconds).
2. Reduce throttle(s) to idle in less than 1/2 second. Decelerate until speed < 1.0 knot.
3. Repeat Steps 1 and 2, heading away from wind.

**Measurements:**
- Engine RPM at beginning, end of run, and at top speed
- Boat speed (from differential GPS display)
- Acceleration/Deceleration in forward direction
- Time to “Test Speed” (post processing from GPS data)
- Pitch angle of boat
Results: Acceleration / Deceleration

Test: Maneuverability Test

SAFETY – Have the characteristics changed? Could this contribute to unsafe handling? Increase on Operator Fatigue? Are new skills required to operate safely?

► Serpentine Test
► Tests transition between Port/Stbd turns
► Finds turning radius
► Avoids crossing own wake

Procedure:
1. Set RPM for low-speed. Steer in direction of test. Adjust wheel for constant heading, mark with tape (different for each speed)
2. When speed is steady, turn wheel 360° to Stbd or to wheel lock in < 1 second
3. Hold wheel steady until boat turns 90° (rel. to original heading)
4. At 90° from start heading, turn wheel to port 720° (two full turns) or to wheel lock in < 2 seconds (called "shift rudder")
5. Turn 180°. At 90° from original course "shift rudder" again
6. Repeat steps 4, 5 through 6 half-turns. During turns, adjust throttle to maintain engine RPM
7. Document anomalies such as propeller ventilation during turns
   - If instabilities or difficulty in controlling boat, abort test

Results: Maneuverability Test
Test Procedures: Bollard Test

SAFETY – Does the boat have the power it once did?

- Measures static thrust delivered by immobile boat/load system
  - E.G., initial thrust to pull skier out of water
- Water depth > 1/2 boat length
- Towing Line
  - 4x to 8x boat length
  - Breaking strength that exceeds larger of:
    - 2x weight of vessel under test, or
    - 2x total engine HP x "30 lb. per BHP"
- Line from test vessel to load kept low and level
  - Tow point below 25% of boat's maximum beam

Procedure:
1. Set engine(s) to idle RPM. Once boat position has steadied, increase RPM setting to first integer multiple of 500 RPM. After boat has steadied, hold RPM setting for 10 seconds
2. Increase throttle setting to next integer multiple of 500 RPM.
3. Repeat Step 2 until maximum RPM is reached.

Measurements:
- Engine RPM noted for each increment.
- Tension in towing line.

Metric: Average of % difference over RPM range

Sensors & Software

- There are commercially available “packages” for recording the data suggested here.
- The following slides show what we decided to use based on:
  - Contractor experience on other projects
  - Flexibility
  - Cost

GPS

- Trimble Pathfinder® ProXT™ GPS receiver
  - Integrated SBAS receiver for sub-meter accuracy in real time
  - Data logged using Trimble’s TerraSync™ software
  - Data post processed with Trimble® GPS Pathfinder Office software
  - Need clear access to sky
  - Mounted on 6-ft mast
  - Data from nearby reference station (from internet) corrects to 8” accuracy
  - 1-second sample rate
Solid State Inclinometer
- Pitch, Roll, Yaw rate
- Surge, Sway, Heave acceleration
- Wireless
- USB Receiver/Base Station

Outboard/Outdrive Deflection
- Cherry AN101 angular position sensor
- Mounted in waterproof case
- Rotating magnet portion of sensor linked to outboard/outdrive
- Microstrain V-Link® Wireless Voltage Node
- Small battery pack for both sensor and wireless transmitter

Steering Wheel Torque
- Needle bearing between helm shaft and wheel
- Load cell positioned between arms to shaft and to wheel
- 2,000-pound capacity load cell
- Arms are 3.5" 583 foot-pounds capacity
- Microstrain SG-Link® Wireless Strain Node mounted in hub
- Provides the 10VDC excitation for load cell
- Battery pack mounted on torque arm

Custom Sensor Software
- Requirements
  - Support wide range of sensors
  - Time-Stamped Data
  - Convert Data Units (e.g., volts to degrees)
  - Integrate with video
  - Save raw data in real time
  - Don’t want to develop GUI from scratch
- Conclusion
  - Use LabView for GUI, instrument drivers, data management
  - "Program" using graphical interface in LabView
Custom Sensor Software

Graphical Human Interface, built using LabView

Disposition of Report

- 45 Day Comment Period
- Evaluate Comments
- Consider Comments
- Publish Revised Draft
- Document Will Remain a Draft Until Project Is Complete.

PROP INJURY MITIGATION DEVICE TEST PROTOCOL

- PART 2 OF 3 UNDER CONTRACT
  - HUMAN FACTORS
  - DOES A DEVICE IN USE REDUCE THE PROBABILITY OF A PERSON IN THE WATER BEING INJURED BY THE PROPELLER?
  - ACCIDENT ANALYSIS TO DEVELOP CRITERIA FOR TESTING
Learn how to prevent accidents, injuries, and fatalities while boating. Review safety tips, news, recalls, defects, and laws and regulations you should know.

The Main Channel

- Carbon Monoxide - Status Update (THAT SILENT KILLER)
- Education Requirement for Rec Boat Operators
- America’s Waterway Watch
- TWIC and the Recreational Boater
- Strategic Plan of the National RBS Program

Beacons

- GROCO Through Hull Valve Recall
- Nobletec Navigation
- Software Defect
- BFA Life Raft Recall
- Carbon Monoxide Advisory (Hand-Held Showen)
- Viking Liferaft Recall
- Fire Extinguisher Recall
- Non-serviceable uncellular team PFD
- Burner Tube Recall
- Service Bulletin Safety Recall
- 100-Yard-Approach
- Carbon Monoxide Advisory (Generator Exhaust)
- Port Closures & Restrictions

Alerts!

Welcome to the official website of the U.S. Coast Guard's Boating Safety Division!
<table>
<thead>
<tr>
<th>Company Contact Information</th>
<th>Illustration of Product</th>
<th>Description of Product</th>
</tr>
</thead>
</table>
| **Fireboy®- Xintex®**<br>O-379 Lake Michigan Dr NW ·<br>Grand Rapids, MI USA 49534<br>Phone: 616-735-9380<br>Fax: 616-735-9381<br>Toll-free: 866-350-9500<br>http://www.fireboy-xintex.com/co-detectors.html | ![CMD-1M-9V & CMD-1MR-9V Carbon Monoxide Detector](image) | **Model: CMD-1M-9V & CMD-1MR-9V Carbon Monoxide Detector**<br>This carbon monoxide detector is a 9 V battery powered and uses an advanced biomimetic sensor to determine CO levels. Time Weighted Average sensor technology is used to eliminate false alarms. Manufacturer recommends installing one unit in every sleeping area, galley, and confined space for adequate protection.  
- Operating temperature: 40°F to 100°F (4.4°C to 37.8°C).  
- Storage Conditions: (Not identified) Ceiling or wall mount  
- Dimensions: 4.75” diameter x 1.5” depth  
- 9 V battery operations (battery included)  
- Extremely low battery consumption – only .016 mA.  
- UL 2034 Listed for Marine use  
- List Priced: $146.38 |
| **Fireboy®- Xintex®**<br>O-379 Lake Michigan Dr NW ·<br>Grand Rapids, MI USA 49534<br>Phone: 616-735-9380<br>Fax: 616-735-9381<br>Toll-free: 866-350-9500<br>http://www.fireboy-xintex.com/co-detectors.html | ![CMD-4MR-RLY Carbon Monoxide Detector](image) | **Model: CMD-4MR-RLY Carbon Monoxide Detector**<br>This carbon monoxide detector is the most advanced CO detector available from Fireboy-Xintex. Features include the capability to automatically shutdown the generator when dangerous CO levels are detected. Also include multiple location warning, allowing up to six detectors to be linked in series. When one detector alarms, all connected detectors will alarm to alert boat inhabitants in other locations to the presence of CO. This detector has a state-of-the-art sensor that is unaffected by common cleaning solvents.  
- Operating temperature: 32°F to 120°F (0°C to 49°C).  
- Storage Conditions: -40°F to 131°F (-40°C to 55°C).  
- Dimensions: 3.5” H x 2.4” W x 1.3” D  
- 12 VDC operations  
- Current draw: 46 mA average.  
- Alarm points: Time Weighted Average Alarm at 10% COHb.  
- Alarm dB: 85 dB at 10 ft.  
- UL 2034 Listed for Marine use.  
- List Priced: $189.95 |
| **Fireboy®- Xintex®**<br>O-379 Lake Michigan Dr NW ·<br>Grand Rapids, MI USA 49534<br>Phone: 616-735-9380<br>Fax: 616-735-9381<br>Toll-free: 866-350-9500<br>http://www.fireboy-xintex.com/co-detectors.html | ![CMD-4MR Carbon Monoxide Detector](image) | **Model: CMD-4MR Carbon Monoxide Detector**<br>Manufacturer recommends installing this carbon monoxide detector for single sites when generator shutdown is NOT desired. This detector has a state-of-the-art sensor that is unaffected by common cleaning solvents.  
- Operating temperature: 32°F to 120°F (0°C to 49°C).  
- Storage Conditions: -40°F to 131°F (-40°C to 55°C).  
- Dimensions: 3.5” H x 2.4” W x 1.3” D  
- 12 VDC operations  
- Current draw: 16 mA average.  
- Alarm points: Time Weighted Average Alarm at 10% COHb.  
- Alarm dB: 85 dB at 10 ft.  
- UL 2034 Listed for Marine use.  
- List List Priced: $156.95 |
### Listing of CO Detectors (USCG Update as of February 2008)

<table>
<thead>
<tr>
<th>Company Contact Information</th>
<th>Illustration of Product</th>
<th>Description of Product</th>
</tr>
</thead>
</table>
| **Fireboy®- Xintex®**  
O-379 Lake Michigan Dr NW  
Grand Rapids, MI USA 49534  
Phone: 616-735-9380  
Fax: 616-735-9381  
Toll-free: 866-350-9500  
**CMD-3M**  
**Carbon Monoxide Detector** |
|   | ![CMD-3M Carbon Monoxide Detector](image) | **Model: CMD-3M Carbon Monoxide Detector**  
The computer-controlled CMD-3M is a basic carbon monoxide detector designed for the harsh marine environment. Its capabilities include Time Weighted Averaging, which virtually eliminates false alarms, while providing unmatched protection.   
**Operating temperature:** 32°F to 150°F (0°C to 66°C)  
**Storage Conditions:** -40°F to 158°F (-40°C to 70°C)  
**Dimensions:** 4” H x 3” W x 1.5” D  
**12 VDC operations. Current draw:** 230 mA average.  
**Alarm points:** Time Weighted Average Alarm at 10% COHb.  
**Alarm dB:** 85 dB at 10 ft.  
**Surface mount. UL 2034 Listed for Marine use.**  
**List Priced:** $96.99 |
| **MariTech Industries**  
6680 Lockheed Dr.  
Redding, CA 96002-9003  
Phone: 530-226-7414  
Fax: 530-226-9516  
Email: [info@powerboatsafety.com](mailto:info@powerboatsafety.com)  
**Carbon Monoxide Protection System (COPS)**  
**Automatically takes action when unsafe carbon monoxide levels are detected by sounding an alarm and shutting down the CO producing source — usually the generator.**  
**Features:**  
Self check circuitry to ensure reliability  
Time weighted averaging circuitry virtually eliminates false alarms  
Instantaneously shutting down the CO producing source, usually the generator  
**Operates on all 12V DC systems**  
**List Priced:** $189.00 each, additional alarms $89.00 each |
| **Marine Technologies Inc.**  
Unit 301  
31632 N Ellis Dr  
Volo, IL 60073 USA  
Phone: 800-383-0269  
Fax: 847-487-4952  
[www.safe-t-alert.com](http://www.safe-t-alert.com)  
**Safe-T-Alert Carbon Monoxide Detector with Alarm (Model: 60-541)**  
This carbon monoxide detector is made to the new UL standard for Marine CO Detectors. Two level alarm not only warns of immediate CO danger, but also warns of any CO build up that occurs over time. Peak Alarm level memory stores CO level at time of alarm.  
**Operating temperature:** -40°F to 158°F (-40°C to 70°C)  
**Storage Conditions:** -40°F to 158°F (-40°C to 70°C)  
**Dimensions:** 3”H x 5.5”W x 1.3”D  
**12 VDC operates**  
**Current draw:** less than 60 mA.  
**Alarm points:** Time Weighted Average Alarm at 10% COHb.  
**Alarm dB:** 85 dB at 10 ft.  
**Surface mount. UL 2034 Listed for Marine use.**  
**List Priced:** $49.99 |
<table>
<thead>
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<th>Description of Product</th>
</tr>
</thead>
</table>
| **Marine Technologies Inc.**  
Unit 301  
31632 N Ellis Dr  
Volo, IL 60073 USA  
Phone: 800-383-0269  
Fax: 847-487-4952  
www.safe-t-alert.com | ![Safe-T-Alert Carbon Monoxide Detector](image_url) | Safe-T-Alert Carbon Monoxide Detector (Model: 60-542)  
This carbon monoxide detector is made to the new UL standard for Marine CO Detectors. Two level alarm not only warns of immediate CO danger, but also warns of any CO build up that occurs over time. Peak Alarm level memory stores CO level at time of alarm. Operating temperature range is from relative humidity (RH) range from 15 to 93%.  
Operating temperature: -40°F to 158°F (-40°C to 70°C).  
Storage Conditions: -40°F to 158°F (-40°C to 70°C).  
12 VDC operations.  
Current draw: less than 60mA.  
Dimensions: 3.5”H x 6.5”W x 1.25”D.  
Alarm points: Time Weighted Average Alarm at 10% COHb.  
Alarm dB: 85 dB at 10 ft.  
Flush mount.  
UL 2034 Listed for Marine use.  
List Priced: $49.99 |
| **Quantum Group Inc (COSTAR)**  
7737 Kenamar Ct  
San Diego, CA 92121 USA  
Phone: 800-432-5599  
Fax: 858-566-9974  
Email: cs@qginc.com  
http://www.qginc.com/products.html | ![COSTAR Model 9Marine](image_url) | COSTAR Model 9Marine  
Use solid-state Infrared (SIR) sensor with reservoir system.  
Operating temperature: 40°F to 100°F (4.4°C to 37.8°C),  
Storage Conditions: -22°F to 158°F (-30°C to 70°C)  
9 volt battery operations (Duracell MN1604 included).  
Current draw: Operates more than one year with 9-volt battery.  
Dimensions: 5” diameter x 1.75” depth.  
Alarm points: Time Weighted Average Alarm at 10% COHb.  
Alarm dB: 85 dB at 10 ft.  
Surface mount.  
UL 2034 Listed for Marine use.  
List Priced: $75.48 |
| **Quantum Group Inc (COSTAR)**  
7737 Kenamar Ct  
San Diego, CA 92121 USA  
Phone: 800-432-5599  
Fax: 858-566-9974  
Email: cs@qginc.com  
http://www.qginc.com/products.html | ![COSTAR Model 12Marine](image_url) | COSTAR Model 12Marine  
Use solid-state Infrared (SIR) sensor with reservoir system.  
Operating temperature: 40°F to 100°F (4.4°C to 37.8°C),  
Storage Conditions: -22°F to 158°F (-30°C to 70°C)  
12 VDC operations.  
Current draw: less than 60mA.  
Dimensions: 5” diameter x 1.75” depth.  
Alarm points: Time Weighted Average Alarm at 10% COHb.  
Alarm dB: 85 dB at 10 ft.  
Surface mount.  
UL 2034 Listed for Marine use.  
List Priced: $89.50 |
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<th>Company Contact Information</th>
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| **CCI Controls**            | ![Model 3400 Carbon Monoxide Detector](image) | **LECO Carbon Monoxide Detector (Model 3400)**  
CCI Controls designed the Model 3400.7 & 3400.77 specifically for the marine use. It is designed to provide an early warning alert prior to dangerous build-up of deadly carbon monoxide.  
- Operating temperature: 40°F to 100°F (4.4°C to 37.8°C).  
- Storage Conditions: -40°F to 100°F (-40°C to 37.8°C).  
- 12 VDC operations.  
- Current draw: 50mA maximum.  
- Dimensions: 3.5"H x 7"W x 1.625"D.  
- Alarm points: Time Weighted Average Alarm at 10% COHb.  
- Alarm dB: 85 dB at 10 ft.  
- Flush mount.  
- UL 2034 Listed for Marine use.  
List Priced: $84.74 |
| 5052 Cecelia ST             |                         |                        |
| South Gate, CA 90280 USA    |                         |                        |
| CCI Controls will soon have available a Carbon Monoxide Alarm for Recreational Marine Vessels |                         |                        |

| **KWJ Engineering Inc.**    | ![Pocket CO Model 200](image) | **Pocket CO Model 200 - Loud Alarm**  
Small carbon monoxide detector. The Pocket CO detector can protect you from dangerous levels of CO. Its loud alarm and bright red light will warn you of dangerously high levels. It is simple to use, weighs less than an ounce, and fits on a key chain. Also, Pocket CO's digital readout allows you to monitor even low levels of CO.  
- **Features:**  
  - Digital carbon monoxide detector  
  - Dimensions: 2.4 by 1.4 by 0.65 in.  
  - Display CO exposure levels between 5 to 500 PPM  
  - 5 minute inspection mode, up to 8 hr collection mode  
  - 2 yr limited instrument, sensor warranty  
  - 1 yr battery warranty  
- **Alarms:**  
  - 85 decibel alarm at 2 feet  
  - Flashing red LED alarm  
  - Alarm points: 25 ppm; 125 ppm; & 400 ppm  
List Priced: $129.00 |
| 8440 Central Ave. -Unit 2D  |                         |                        |
| Newark, CA 94560            |                         |                        |
| Phone: 877-794-4296         |                         |                        |
| Email: sales@kwjengineering.com |                         |                        |

| **KWJ Engineering Inc.**    | ![Pocket CO Original Model 100 Quiet Beep](image) | **Pocket CO Original Model 100 - Quiet Beep**  
Small carbon monoxide detector. The Pocket CO detector can protect you from dangerous levels of CO. Has a quiet beep for its alarm, similar to a wrist watch alarm, to warn you of dangerously high levels. It is simple to use, weighs less than an ounce, and fits on a key chain. Also, Pocket CO's digital readout allows you to monitor even low levels of CO.  
- **Features:**  
  - Digital carbon monoxide detector  
  - Dimensions: 2.4 by 1.4 by 0.65 in.  
  - Display CO exposure levels between 5 to 500 PPM  
  - 5 minute inspection mode, up to 8 hr collection mode  
  - 1 yr warranty  
- **Alarms:**  
  - Alarm points: 25 ppm; 125 ppm; & 400 ppm  
List Priced: $129.00 |
| 8440 Central Ave. -Unit 2D  |                         |                        |
| Newark, CA 94560            |                         |                        |
| Phone: 877-794-4296         |                         |                        |
| Email: sales@kwjengineering.com |                         |                        |
### EvrSafe ISS-1040 Integrated Safety System

The EvrSafe Integrated Safety System is a proactive toxic gas detection system. The sensors are installed in various areas of the boat, including the helm, engine room, galley and bedrooms. All sensors are connected back to the central processing unit (CPU), which incorporates a LCD display showing readouts from individual sensors. The processor is comparatively sophisticated in relation to other systems on the market, in that it is able to detect and measure a variety of toxic gases, including CO, nitrogen dioxide (generated by diesel engines), hydro carbons, LPG, butane and smoke.

**Features:**
- Detection of: carbon monoxide, LPG & butane, nitrogen dioxide, hydro carbons.
- Display of thermal readings
- Multiple language support
- Connects up to 130 separate sensors
- Vessel checklist
- Multiple integration
- Interfaces with existing equipment
- 12V system

**List Priced:** TBD

### Standards

#### STANDARD HOUSEHOLD DEVICES

1. UL 2034 Section 80 h) for standard household unit states:
   
   "h) An indication that the device shall not be installed in locations where the normal ambient temperature is below 4.4°C (40°F) or exceeds 37.8°C (100°F), unless the alarm has been determined to be acceptable for installation at a higher or lower ambient temperature."

2. UL 2034 Section 45.1.1 (Under - Operation in high and low ambient) for standard household unit states:
   
   "45.1.1 An alarm shall operate for its intended signaling performance when tested at ambient temperatures of 0°C and 49°C (32°F and 120°F) at a relative humidity as indicated below. Two alarms, one at maximum and one at minimum sensitivity, are to be maintained at both ambient temperatures for at least 3 hours so that thermal equilibrium is reached. The units then are to be tested for sensitivity while connected to a source of supply that is in accordance with 34.3.1."

3. UL 2034 Section 45.2.2 (Under - Effect of shipping and storage) for standard household units states:
   
   "45.2.2 Two alarms, in point of purchase packaging, one at maximum and one at minimum sensitivity, are to be subjected, in turn, to a temperature of 70°C (158°F) at 50 ±30 percent RH for a period of 24 hours, allowed to cool to room temperature for at least 1 hour, exposed to a temperature of minus 40°C (minus 40°F) for at least 3 hours, and then warmed up to room temperature for at least 3 hours. The same two samples are then to be subjected to 50 ±30 percent RH for 45 days. The alarms then are to be tested for sensitivity while connected to a source of supply in accordance with 34.3.1."

#### ADDITIONAL HIGH & LOW TEMPERATURE REQUIREMENTS FOR MARINE USE DEVICES

4. UL 2034 Sections 72A.2.3 and 72A.2.4 (Under – Operation tests) for Marine Use states:
   
   "2A.2.3 Three sample alarms are to be placed in an air-circulating oven maintained at 70 ±2°C (158 ±4°F) for 24 hours.

72A.2.4 Immediately following the conditioning specified in 72A.2.3 and the calibration check specified in 72A.2.1, the same alarms are to be placed in a cold chamber maintained at minus 30 ±2°C (minus 22 ±4°F) for 24 hours."
Carbon Monoxide – Status Update

CO Detector Update:
The Coast Guard has conducted an investigation to determine what carbon monoxide (CO) detection devices are available to recreational boaters, such that, when installed and activated could reduce the risk of being exposed to high levels of CO - THAT SILENT KILLER. A variety of technologies is available for detecting the presence of CO on boats and should be considered by recreational boaters to reduce their risk of injury or death while boating. ...more>>

Teak Surfing Update:
Teak surfing (a.k.a. platform dragging or bodysurfing) is associated with carbon monoxide poisoning from the boat's exhaust whereby participants can be overcome by exhaust fumes and go unconscious which could lead to drowning.

California - On January 1, 2005, California was the first state to outlaw “Teak Surfing.” The Anthony Farr and Stacey Beckett Boating Safety Act of 2004, (AB 2222), was signed into law by Governor Schwarzenegger and imposes a fine of up to $100 on anyone who operates a vessel’s engine or generator while a person is holding on to the swim platform, swim ladder, or swim step on a boat. The law provides exceptions for briefly assisting with the docking or departure, exiting or entering the vessel, or engaging in law enforcement or emergency rescue activity. ...more>>

Oregon State – The 2005 legislature passed Senate Bill 56 making teak surfing (a.k.a. platform dragging) illegal beginning in 2006. more>>

State of Washington - On March 20, 2006, the State of Washington enacted the “Jenda Jones and Denise Colbert safe boating act” (Senate Bill 6364). This legislation went into effect on January 1, 2007 and outlawed teak surfing, platform dragging, or bodysurfing behind a motor boat. ...more>>

NASBLA - On September 21, 2005, the National Association of State Boating Law Administrators (NASBLA) approved the current version of the NASBLA Model Act for Safe Practices for Boat-Towed Watersports. .....more>>

Background: This act was originally adopted by NASBLA on Oct. 29, 2003. However, the original act had a provision prohibiting the use of a tow rope of 20 feet or less, which would have precluded the popular sport of wake surfing. In response, during 2004, the NASBLA Committees on Law Enforcement and Boats and Associated Equipment revised the language and narrowed the act to apply to teak surfing (platform dragging) and body surfing – water sports that pose potential dangers to the participant both because of proximity to the boat’s propeller and because of the possibility of carbon monoxide poisoning. The amended act was approved by the NASBLA membership on Sept. 15, 2004. Then in 2005, those committees reviewed, approved and recommended to the NASBLA membership the current version as part of the Association’s Model Act Review and Standardization Project. The act was approved in revised form by the membership on Sept. 21, 2005.

Nevada & Pennsylvania - Using similar language as contained in the NASBLA model act, “Teak Surfing” has been banned through boating regulations in Nevada, and Pennsylvania.

Nevada ...more>>
Pennsylvania ...more>>
Generator Set Update:
There are currently two manufacturers producing low carbon monoxide (CO) emission generator sets: Westerbeke and Kohler. The National Institute for Occupational Safety and Health (NIOSH) has tested both manufacturers’ generator sets at Lake Mead. With the cooperation of Forever Resorts, the U.S. Coast Guard arranged for NIOSH to test these manufacturers’ generator sets following installation on houseboats in Forever Resort’s rental fleet. As noted below, NIOSH did confirm the manufacturers’ claims of low CO emission.

**Westerbeke “Safe-CO™”** series generators slash carbon monoxide emissions by more than 99% to greatly improve boating safety and reduce pollution. Westerbeke has employed patented, innovative engineering, in combination with electronic fuel injection, to achieve dramatic reductions in carbon monoxide emissions. In March 2005, NIOSH successfully tested Westerbeke’s new low emission generator and confirmed their claims of low CO emission. In November 2006, NIOSH returned to test the Westerbeke generators after two full seasons of rental use. Test results indicate similar findings with the March 2005 test results. These tests were for a 14 KW generator with 4,656 hours (plugs changed at 2000 hours) and a 20 KW generator with 2836 hours. During the test of the 14 KW generator NIOSH evaluated the old catalyst and then replaced it and evaluated the generator with a new catalyst.

**Kohler Power Systems** has developed a new line of marine generator sets that the company claims reduces carbon monoxide emissions by as much as 99%. The new low-CO generator sets, models 5ECD and 7.3ECD, are the result of Kohler adapting new and innovative technologies to its products. The Kohler low-CO generator sets are each powered by a two-cylinder engine incorporating Kohler-designed intakes, fuel mixing manifolds and exhaust systems, and the carburetor has been replaced by a computer-controlled electronic fuel injection system that reduces carbon monoxide emission. In September 2007, NIOSH successfully tested Kohler’s new low emission generator and confirmed their claims of low CO emission.

Propulsion Engine Update:
Currently Indmar Products Company is the first manufacturer of a propulsion engine with catalytic technology resulting in low CO emissions. In December of 2006 NIOSH successfully tested Indmar’s new low emission propulsion engine and confirmed their claims of a reduction of CO emission (measured directly into the exhaust opening) of 92%.

Starting in 2008, California Environmental Protection Agency (Air Resources Board) has new certification requirements for inboard and sterndrive boat regulations. See the following website for details of this rulemaking:
[http://www.arb.ca.gov/regact/boatregs/boatregs.htm](http://www.arb.ca.gov/regact/boatregs/boatregs.htm)

Hand-Held Shower Update:
On August 30, 2007 the Coast Guard issued an advisory to recreational boaters on carbon monoxide hazards caused by using a shower on a boat at the swim platform when the boat’s engine or generator set is running. The Coast Guard advised owners and operators of boats not to use hand-held showers at or near the swim platform if either the gasoline-powered propulsion engine(s) and/or generator set are in use. The Coast Guard further advises that the owner should never connect a hand-held shower system to the engine's
raw water open cooling system. The Coast Guard is concerned about the serious health risk from carbon monoxide poisoning and seeks to prevent loss of life and personal injury. To view this Safety Alert, select “Carbon Monoxide Advisory (Hand-Held Shower)” at the following Coast Guard Website: http://www.uscgboating.org  

**National Case Listing of CO Poisoning April 2007 Update:**
The Double Angel Foundation, a non-profit corporation, in addition to working to increase awareness of the dangers that carbon monoxide poses to recreational boats; has continued to update the National Case Listing of CO Poisonings. The National Case Listing was originally developed at the request of the U.S. Coast Guard, through an interagency team comprised of representatives of the National Park Service, the US Department of Interior, and the National Institute for Occupational Safety and Health. This interagency team investigated boat-related CO poisoning and compiled a listing of CO Poisonings occurring across the United States. The last interagency update of the listing was dated October 2004. Since that time the Double Angel Foundation has updated this listing and posted the update on their website at: www.doubleangel.org.  

**NIOSH Test Reports:**
NIOSH has established a Topic Page website which includes a compilation of NIOSH Health Hazards Evaluations (HHE), NIOSH Engineering Reports and other resources, see website: http://www.cdc.gov/niosh/topics/coboating/  

**NASBLA Recommended Model Acts:**
For the model act language that NASBLA wishes for states to pass into law, see: http://www.nasbla.org/portal.php?target=MODELACTS