Fire Fighting & CO Lecture

2016 Safety at Sea, USNA
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For a fire to exist, it has to have:

Fuel

And a Chemical chain reaction

Heat

Oxygen

Remove one of these, and you can put out a fire!

* Note items in “red” …you will need that information later!
Types of Fires: Class A

- **Materials which leave an Ash:**
  - Wood, cotton, fiberboard, cushions, sails

- **Effective extinguishers:**
  - Water *(Caution – load limits!)*
  - Dry Chemical
  - Carbon Dioxide

- **Concerns:**
  - Fire may be deeply embedded in materials and require “overhaul.” Ok, what is overhaul?
This was a covered marina made of wood!
See the boats?
Types of Fires: Class B

- **Flammable liquids (things that boil):**
  - Oil, gasoline, resin, paint, kerosene, diesel

- **Effective extinguishers:**
  - Sodium Bicarbonate (baking soda, *NOT* flour!)
  - Dry Chemical
  - Carbon Dioxide (denies O₂, short lived on B fires)
  - Halon replacements

- **Concerns:**
  - Water may spread the fire!
  - Liquids with high flashpoint may re-ignite (keep covered to avoid vapor release)
Would the fire extinguishers on your boat put this fire out? How hot is it on the bow of this boat...could you stand there?
Where would you go if this happened to you sailing offshore? Could you abandon your boat in two (2) minutes?
How would you get out of this boat if you were asleep in the v-berth? Do you think they had a smoke or CO detector?
**Types of Fires: Class C**

- **Electrical Fires (shorts):**
  - Wire insulation and adjacent materials

- **Tactics:**
  - Break circuit, **turn off main switch (first step!),** have circuit protection
  - Then extinguish according to what materials are involved
  - **Water is not a choice on Class C fires**

- **Concerns:**
  - Shock hazard (is the power off – are you sure?)
Shore Power Connections

This is one of the most common types of electrical fires boaters experience at a marina.

So, do you have a procedure to disconnect your shore power?

1) Turn off dock’s breaker to the pedestal and then the main AC breaker in boat;
2) Unplug shore power at pier;
3) Disconnect the shore power from boat receptacle;
4) Reverse the process when hooking into shore power and remember to verify polarity.
The power was still on to this plug when this picture was taken!
What is on fire here and how would you put it out? Can you breathe below deck on this boat when this picture was taken (hint low oxygen level!) and no visibility (dark)?
Types of Fires: Class D

- **Fires caused by burning metals:**
  - Flares are the main concern
  - Nickel Metal Hydride batteries (example is gaming devices)

- **Tactics:**
  - Get it off the boat
  - May use material to try to cool, isolate and smother

- **Concerns:**
  - Does not play nice with water!
Flame ripped through the hull of
world's biggest ocean racing
catamaran in Auckland yesterday
morning, sending crew scrambling
for safety and putting the imme-
diate future of the $8 million
$ million plan in doubt.
Fire broke out aboard Play-
sion while it was moored on the
western side of the Vestac Basin
on the Team New Zealand con-
cept. The extent of damage was
not yet last night.
Rupert Kirby, a tourist又称ing
for fire with his wife, said he
had two small explosions then
crew members scrambling from
the starboard
cockpit as forward hatch, sec-
tions before
flames shot out.
The crew
tried to fight the
blaze with ex-
tinguishers but
were forced
tack by the
heat.
Steve
Fossett
Senior Sta-
tion Officer Bar-
ton of the Fire Service said it
took firefighters about 10 minutes
to bring the fire under control. They
then flooded the hull.
The catamaran, owned by Ameri-
can adventurer Steve Fossett, was
in Auckland last year with the
aim of setting the world record
for crossing the Atlantic, scheduled
for June, but will have to be
shipped to America next weekend.
--- Tony Wall

FLASH FIRE: The $8 million catamaran that caught fire in Auckland yesterday holds the world record for sailing the longest distance in 24 hours. The New
PlayStation was due to be shipped to the US next weekend. The blaze has cast doubts over a challenge to the Atlantic crossing record in June.
What type of extinguisher would you use?
Sources of fires on boats #1

- 55% Poorly installed electrical systems (C)
  - 30% DC shorts and wiring
  - 12% DC engine voltage regulator
  - 4% AC appliance/heater
  - 4% AC shore power system
  - 2% AC wiring/panel
  - 2% DC battery charger
Corrosion caused heat....
Sources of fires on boats #2

- 24% Engine and Transmission Overheating
  - 19% engine overheating
  - 2% turbocharger overheat
  - 2% transmission overheat
  - 1% backfire
- 8% Gasoline fuel leak
  - 95% of fuel-related fires involve gasoline
- 1% Galley stoves
  - Declining compared to when alcohol stoves were popular
  - *(this happened to me – alcohol stove fire)*
- 12% Unknown or miscellaneous
ABC Covers ALL Classes of Fires Except “D” fires!
- Low toxicity
- Inexpensive
- Deploy quickly
- Messy clean up
**Tri-Class or Multipurpose Dry Chemical ("ABC"):**
- No worry about selecting the right extinguisher
- Forms a crust on Class A fires, making clean up challenging
- Need to turn upside down and shake it to loosen the powder on a regular basis!
- Needs to be recharged at least yearly (even if not used)!
- Old ones can be used for crew training but make a mess – nontoxic!
Check the gauge. Could it be stuck? Care and Inspection per NFPA 10
Carbon Dioxide
- Cools and suffocates
- Large extinguishers!
- Leaves no residue

Halon and its derivatives
- Halon 1211 and 1301 cannot be bought, but can be refilled
- Halotron 1 is a replacement
How to use most portable fire extinguishers

P - Pull the pin.

A - Aim at the base of the fire.

S - Squeeze the handle & lever.

S - Sweep from side to side.

- Pull & remove ring pin, breaking seal.
- Move to a safe position upwind of the fire.
- Remove hose nozzle from retention clip (if equipped).
- While keeping the extinguisher in a vertical position, aim nozzle at the base of the fire.
- Squeeze operating lever fully to discharge.
- Apply agent in side to side sweeping manner. Be careful not to splash or scatter the fuel.
- After fire is out, stand by and be prepared for any re-flash.
Fixed-Mount Extinguishers

- FM-200 Halon replacement
  - Mounted in the engine room
  - Heat causes "stinger" to activate

Stinger FM-200
“Fixed” System on a Navy 44’ Mark II

- Manual Lever/Cockpit
- Automatic Heat Coupler
- Alarm Sensor Harness
Fire Blanket on Navy MKII in Galley
Fire fighting tips

- Have extinguishers located in all occupied spaces of the boat, cockpit, and the engine room.
- Fight a fire quickly; fires are virtually impossible to put out if given a head start.
  - Fire volume can double every 7 seconds!!!!
- Use extinguishers to allow you to escape from below.
  - How could you get out of every stateroom, head or compartment if the main hatch was blocked?
- **PASS – Pull-Aim-Squeeze-Sweep** (Aim extinguisher low at base of fire and sweep across base of flames.).
- **Turn off all blowers and close vents to space with the fire!**
- **Engine fire**: blower off, engine off, power off and fuel valve off.
Fire fighting tips

- Install extinguishers above floor - keep them away from water!
- Have a back-up person assist; close at hand with the extra extinguishers!
- Use a flashlight and stay oriented;
- **Stay low** - avoid smoke (better visibility);
  - Smoke kills more people in fires than actual burns. Do a dry run, with a knit cap and try to get out of your boat without using the main hatch.
- Have an exit plan!
Federal Requirements for Recreational Boaters

<table>
<thead>
<tr>
<th>Classification (type-size)</th>
<th>Foam (minimum gallons)</th>
<th>Carbon Dioxide (minimum pounds)</th>
<th>Dry Chemical (minimum pounds)</th>
<th>Halon (minimum pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-I</td>
<td>1.25</td>
<td>4</td>
<td>2</td>
<td>2.5</td>
</tr>
<tr>
<td>B-II</td>
<td>2.5</td>
<td>15</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vessel Length</th>
<th>No Fixed System</th>
<th>With Fixed Extinguishing System Installed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 26'</td>
<td>(1) B-I</td>
<td>0</td>
</tr>
<tr>
<td>26' - 40'</td>
<td>(2) B-I or (1) B-II</td>
<td>(1) B-1</td>
</tr>
<tr>
<td>40' - 65'</td>
<td>(3) B-I or (1) B-I AND (1) B-II</td>
<td>(2) B-1 or (1) B-II</td>
</tr>
</tbody>
</table>
Carbon Monoxide (CO) Facts

- “Carbon monoxide is an odorless, tasteless, [and] initially non-irritating, gas created by incomplete fossil fuel combustion … in appliances like gas-powered electrical generators, propane stoves or heaters, or your boat’s propulsion engine.” The Danger to Boaters from Carbon Monoxide, Tom Burden, West Marine, West Marine Advisor.

- “Carbon Monoxide (CO) is lighter than propane or gasoline vapor, without smell or taste, its presence remains undetected by humans.” Id.

- “CO is easily absorbed into the bloodstream (combining with hemoglobin 200 times more easily than oxygen) where it reduces the blood’s oxygen-carrying ability, leading to hypoxia and causing “suffocation” by the victim.” Id.
Carbon Monoxide (CO) Facts

Continued

- “…[s]ymptoms of CO poisoning resemble those of other common conditions (e.g., alcohol consumption, motion sickness, heat stress, and nonspecific viral illness), poisonings often go unrecognized.” CDC, MMWR, December 15, 2000. Or for us, seasickness!

- “CO has a molar mass of 28.0, and air has an average molar mass of 28.8. The difference is so slight that CO is found to evenly distribute itself indoors.” Carbon Monoxide Facts, Healthy Building Science.

- “The National Fire Protection Association says CO detectors “shall be centrally located outside of each separate sleeping area in the immediate vicinity of the bedrooms.” Additionally, each CO detector “shall be located on the wall, ceiling or other location as specified in the installation instructions….” ”
USCG’s Tips To Avoid CO Exposure

- Operate combustion devices (stoves, heaters, generators) in well-ventilated areas;
- Supplement natural ventilation with fans or forced air. Keep forward-facing hatches open to allow fresh air circulation in accommodation spaces, even in inclement weather;
- Close the hatches and set your course away from the path of exhaust fumes when motoring downwind in a following sea;
- Install CO detectors in each cabin and/or space. It’s the most effective defense against a potentially fatal problem;
- Avoid any activity on the rear deck, swim platform, and around exhaust pipes while the engine or generator is running;
- CO exposure danger also exists on deck, especially when a boat idles at the dock or seawall where exhaust can accumulate. Even when not running your engine, beware of CO accumulation from other boats.
Have a fire escape plan and practice it;
Install CO and smoke alarms in each compartment;
Remember, CO is the silent killer!
Change your smoke alarm and CO alarm batteries yearly (at least);
Make sure everyone knows how to call for help;
Have fire extinguishers readily available and make sure everyone knows how to use them.
Recommended Gloves and Gear:

- Lineman Gloves for thunderstorms (ANSI/ASTM certified) (“may help you if you have to be at the helm”);
- Fire Fighter Gloves (NFPA certified) for Class D fires ...moving hot/burning items (better then non-insulated gloves);
- Smoke Hoods (they do NOT provide air!);
- Fire extinguishers, fire blanket, CO and smoke alarms, etc.
The end....

- Questions?

  - Ok, time to go outside and have some fun:
    - 1) Fire Safety Trailer;
    - 2) Electrical Short Simulator.