# FIRE

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This issue:

**Smoke**

**Fireboat Strategies at WTC**

# FIRE COMMAND AND CONTROL

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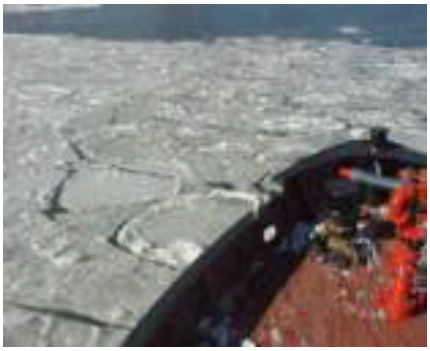
## What Else Can Fireboats Do?

We all know that large Fireboats are used to fight fires aboard ships. Their massive pumping capacities can be used to extinguish even the largest fires. Many of these fires are so severe that the firefighting forces are unable to even board the vessel for extinguishment. They will fight this fire from the safety of the deck of a fireboat until the fire can be "knocked down" enough to allow firefighters to initiate an attack onboard the vessel. Add the foam carrying capability and in each fireboat you have the equivalent of 20 land-based pumpers. However, what else are these giant water going pumpers of the sea good for? Aside from the most visible function of fireboats, providing spectacular water displays for arriving and departing ships, these vessels provide rescue capabilities to ships, boats, planes, and people in distress on the water. Many times these boats respond to the scene and lower their smaller rescue craft to assist a swimmer in trouble or someone who has attempted suicide by jumping from a bridge into the water. In colder climates these 200-300 ton steal hulled vessels have become ice breakers to rescue and free vessels that have become trapped by an ice flow. Although not originally designed for this function their heavy steel hulls have been able to withstand the crushing force of the more than four inch ice that accumulates in New York Harbor in the witer.



The photo abovet shows the Fireboat Governor Alfred Smith breaking through the ice which filled the Brooklyn navy yard. Without these steel hulled fireboats, there would be no marine response when the ice becomes thick. The thin, aluminum hull of the other boats could be breached by the jagged edges of some of these major ice flows.

At one incident a New York City Fireboat responded to the scene of a helicopter which had crashed into the water and was about to sink. The helicopter was secured to the hull of the fireboat and was held at the surface. At another incident, a small sea plane was unable to take off and was taking on water. A fireboat took the plane in tow back to the fireboat station. There, the water was pumped out

and the pilot was able to make arraignments to get his plane home the following day. Photo on above shows seaplane tied up at fireboat dock in the Brooklyn Navy Yard. Note the New York skyline in the background. That's the "Twin Towers" of The World Trade Center off in the distance. That was another operation where Fireboats received world wide attention for their non traditional but crucial actions on September 11, 2001 and the days that followed. The recent attack on the United States at the World Trade Center in New York City is a more recent example of a Fireboat's water supply capability to land-based units as well as structures. They ware also invaluable as a means of evacuation. After the collapse of the towers, many of the water mains in the surrounding area were knocked out. There were many large scale fires in hi-rise buildings that had to be extinguished so that those buildings could be searched for victims and to enable the rescue effort to progress. One photo of that day showed a firefighter standing near a burning auto. The hose stream in his hand only went about two feet out from the nozzle. In the background stood a high-rise hotel with more than ten floors involved in fire. Water was needed disparately. The first fireboat on the scene was the Fireboat John McKean of Marine Company 1. They responded to the initial call and were on the scene before the towers collapsed. Many of the civilians were trapped in the area south of the collapsed buildings. They were encrusted with dust and walking or running blindly toward the water. These people were frightened and dazed and did not know if a further attack was coming. When they reached the bulkhead hundreds of these desperate people jumped onto the deck of the Fireboat McKean (Marine 1) which then cast off and deposited its cargo of injured and dazed victims to a safe location. After unloading across the Hudson River in New Jersey, the McKean returned to the scene and started pumping water. They were joined by the FDNYs other two Fireboats, the Firefighter (Marine 9) and the small fireboat the SmokeII (Marine 6 spare boat). The Marine 6 "first line" boat the Kevin C. Kane was undergoing repairs in Staten Island when the first plane hit the tower. The crew of the Kane quickly placed their boat back in service and responded to the scene. This boat made several trips evacuating people from lower Manhattan. Ironocly, personnel from Marine 6 were involved in the rescue of Captain Al Fuentes, the Acting Chief of the Marine Division, who had been trapped and seriously injured in the collapse. Captain Fuentes was evacuated to a treiage center in Liberty State Park. Thankfully, Captain Fuentes is now recovering from his injuries and is expected to make a full recovery. Another boat joined, or rather re-joined, the fleet of fireboats that day.

The Fireboat Harvey had been retired and sold to a group of dedicated marine enthusiasts who spent their own time and money refurbishing the "old girl". (Photo above shows civilians and Firefighters jumping aboard the Harvey several days later when fear of another collapse caused the order to evacuate again. Photo by: Huntley Gill. When the radio reports of the attack were received, the civilian crew fired up the engines and responded to the scene. Over the course of the next 3 days, three large fireboats would pump twenty four hours a day to supply almost 60,000 gallons of water per minute. The Firefighter supplying numerous large diameter supply lines. Their water supplied pumpers, manifolds, and building standpipes. Without the pumping capabilities of these old boats the fires in the surrounding hi-rise building as well as the dozens of cars and emergency vehicles which were burning could not have been attacked. After the third day the retired Fireboat Harvey and her crew of dedicated civilians was released with the thanks of a grateful FDNY. The two other active

Fireboats continued to pump for several days. Throughout the pumping operations, the fireboats were resupplied and refueled by an Army Corps of Engineers vessel. During the days of pumping the dedicated engineering crew had to perform maintenance and emergency repairs as the engines and pumps were racing at full capacity. Bearings were overheating and had to be constantly "iced down" to keep them from burning up! The crews of the boats split their time between maintaining the boat and helping to dig in the rescue efforts.

Many other recent disasters have caused the water supply to a portion of a city to be destroyed. The earthquake and fire in California that we all watched during the World Series baseball game a few years ago was another good example. Fires raged in the Marina district of this city. Firefighters had to stand and watch as the fires spread and their fire hoses remained dry. This lasted until the arrival of the fireboat. Water had to be pumped from the bay by that city's Fireboat to supply the firefighting forces. Once again a waterfront city was saved by the fireboat. If your city is located on the water then your Fire Department should have a fireboat. If your Fire Department does have Fireboats, then these should be adequately maintained and fully manned by a competent full time marine crew. Past history has proven that these Fireboats are needed. Let's learn from history. These boats may not be used very often but when they are needed they are indispensable. On September 11, 2001 many things in our lives and in our world changed. I hope that one of those changes involve the knowledge that Fireboats are an interical part of any port city Fire Department's disaster planning. May God bless those who were lost in the attack on our country and may He comfort their families. May He also give us all the courage to handle the uncertain months and years ahead and protect our armed forces.

**FDNY Deputy Chief Vincent Dunn Ret.**

## Smoke is the most deadly product of a fire.

It kills more firefighters than flames, heat or fire gases. Smoke inhalation accounts for three-fourths of all fire deaths in America each year.

What is smoke? How does it kill and injure? Smoke is defined as finely divided particles of soot and suspended liquid droplets known as aerosols. It is formed during incomplete combustion - burning in an oxygen-deficient atmosphere. Smoke can also be defined as a mixture of hot vapors and gases produced by the combustion process.

Smoke is the first and most deadly hazard to appear during a fire, and it kills and injures in several ways. Smoke causes disorientation due to its blinding and irritating effects on the eyes; hot smoke causes burns to the throat and lungs; toxic smoke kills by asphyxiation; and smoke explodes.

## Irritating smoke

Soot in smoke irritates the nerve endings in the eyes, causing pain, blinking and tearing. To reduce this discomfort people trapped in smoke close their eyes. This loss of vision can cause immobilization long enough for toxic gas or flame to overtake them. Plastic furnishings, such as rugs, chairs, drapes and beds (especially plastic foams used in pillows, cushions and mattresses) generate large quantities of smoke during a fire. This smoke is dense, sooty and black, and it quickly obscures vision. Tests reported by the National Fire Protection Association (NFPA) show foamed plastics produce more smoke than wood.

Firefighters entering burning buildings wear self-contained breathing apparatus (SCBA). The SCBA facemasks not only protect them from toxic gas inhalation, but also from the eye-irritating effects of smoke. Even with mask protection, firefighters crouch when entering a burning hallway to improve vision. Smoke density is greater at the upper levels of a room, so even when wearing a mask a searching firefighter is blinded by smoke and may be unable to locate an exit. Eventually the SCBA cylinder will run out of air and the trapped freighter will be killed by flame, heat or toxic gases.

## Hot smoke

The energy-efficient apartments and homes built during the oil shortages of the 1970s are creating a new hazard to firefighters: hot smoke. These apartments and homes are tightly sealed to conserve heat during winter. Rooms have double-pane windows, insulated walls and ceilings, and airtight doors.

When a fire occurs inside such an energy-efficient space it is contained and burns for a long period before smoke or flame are visible and discovered. When a fire burns in a tightly sealed room for long periods the smoke is heated. Smoke temperatures can reach 1,200 to 1,400 degrees Fahrenheit. Hot smoke can bum a firefighter.

Smoke generated at a fire can be divided into two general areas: a hot smoke zone and a cool-smoke zone.

A hot-smoke zone includes those areas in a burning building where the temperature of the smoke is high and smoke movement is caused by the heat. Heated air expands, becomes lighter than the surrounding air and rises. The hot-smoke zone exists in the room of fire origin and the adjacent corridors, stairs and shafts.

A cool-smoke zone includes those areas distant from the fire in a burning building where the heated smoke has been cooled by entrained air and wall and ceiling heat absorption. Smoke that has stratified or is being moved by the stack effect, wind or mechanical air moving systems is in a cool-smoke zone. (Warning: Smoke in a cool-smoke zone may not burn a firefighter but it may contain carbon monoxide or other toxic products of combustion.)

## Toxic Smoke

Firefighters require air to stay alive. The life-giving part of air is oxygen. Air contains 21 percent oxygen. If the amount of oxygen in air is reduced, displaced by smoke, the human body suffers. If a firefighter does not wear SCBA and the oxygen in a burning room drops from 21 to 17 percent motor coordination becomes impaired; at 10 to 14 percent oxygen fatigue and faulty judgment take place; and at six to 10 percent oxygen content a firefighter loses consciousness and dies.

In addition to displacing oxygen, smoke contains deadly toxic gases. Carbon monoxide (CO) and hydrogen cyanide are two common toxic gases found in smoke that kills firefighters. It is not possible to tell the toxicity of smoke by its color or quantity, so assume the worst and wear your mask. White smoke, dark smoke or brown-colored smoke may all contain toxic gases.

CO is the most abundant toxic gas that is found mixed with smoke. It is not the most toxic gas found in smoke, but a room fire generates large quantities of CO and so it becomes the major threat. The toxicity of CO is due to its affinity to combine with hemoglobin in the blood. Instead of the hemoglobin bringing oxygen to the blood, called an oxyhemoglobin, it brings CO, called a carbohemoglobin. A carbohemoglobin amount in the blood above 30 percent is potentially deadly to most humans. A saturation of 50 percent carbohemoglobin is likely to be deadly.

Hydrogen cyanide is about 20 times more toxic than CO. It is produced from the burning of materials containing nitrogen. Polyurethane, nylon, acrylonitrile, wool and silk produce hydrogen cyanide when burned. This toxic gas does not combine with the hemoglobin like carbon monoxide. Instead, it inhibits the use of oxygen by the body cells. This is called histotoxic hypoxia.

## Exploding smoke

During a fire you can witness a smoke updraft, a smoke downdraft or a smoke backdraft. Backdraft is a term used by firefighters to describe a smoke explosion. A smoke explosion is a combustion explosion. The same chemical reaction and explosive ingredients are present in a smoke explosion as are in any ordinary combustion explosion - fuel, oxygen and heat. The fuel in a combustion engine explosion powering an automobile is gasoline. The fuel in a backdraft is smoke, more specifically CO, which has an explosive range of 12 to 74 percent when mixed with air.

Smoke explosions do not happen often. In fact, most explosions at fires are caused by leaking gas, container ruptures and flammable vapors from an arso ist's accelerant, not smoke. However, a backdraft can occur anytime there is smoke and heat in a partially closed room.

During a fire explosive CO is generated as follows: In a burning room, when ceiling temperatures reach 1,200 to 1,400 degrees Fahrenheit, carbon dioxide generated by the fire reacts with the carbon present in the smoke to produce CO. The chemical combination of carbon dioxide and CO can occur in the growth, or first, stage of a fire before flashover or it can occur in the third, or smoldering, stage. At some fires the oxygen combines with the CO and heat, resulting in a smoke explosion.

## Lessons learned

To reduce the dangers of smoke at a fire ventilate the smoke filled area. Venting deadly smoke by opening windows, doors, skylights, scuttle covers saves lives and prevents injures.