Rebreather Mask-- New Tool for SOC

by Battalion Chief Joseph R. Downey

The New York City Fire Department has made great strides in preparing and training its members for all fire and emergencies encountered in the five boroughs. The Special Operations Command (SOC) also has been proactive in acquiring tools and equipment to handle the technical rescues and complex incidents to which they respond on a daily basis.

The need to operate on air for longer durations at fires and emergencies in confined spaces, under-river tunnels, sub-cellar fires, below-deck ship fires and large commercial buildings has been identified. FDNY members have been limited with the Scott 4.5 Positive Pressure SCBAs to a 60-minute cylinder, which provides varying amounts of operational time--depending on the individual. Most members' operational time will be fewer than 40 minutes. A few of the factors that determine how much air is used are degree of physical activity, physical conditioning of the user and emotional factors, as well as the training and experience that the user has with the mask. At times, members are required to interrupt rescue and search operations and leave the hazardous area to change cylinders. This has caused delays and may determine if a victim survives.

The Special Operations Command also can deploy Supplied Air Respirators, which are fed by hose-lines from an Air Source Cart. Air supply is unlimited, but members are restricted to a maximum of 300 feet from point of entry. Line management can be problematic, too. The Fire Department needed something more than the Scott 4.5 Positive Pressure SCBAs and the Supplied Air Respirators to enhance capabilities by providing increased operational time. Draeger Safety has designed a mask that can be used for extended respiratory protection in immediately dangerous to life and health (IDLH), oxygen-deficient and toxic atmospheres. Draeger Safety invented the first Rebreather mask in 1903 and now has the Draeger BG-4 Extended Duration SCBA (EDSCBA), which supplies up to four hours of breathable air.

The Draeger BG-4 EDSCBA has been in operation around the world and has had success when used in the following kinds of incidents: fires, chemical and biological emergencies, search and rescue, decontamination lines, SWAT missions and long-duration military deployments. The Draeger BG-4 EDSCBAs or Rebreather mask provides operational time currently not attainable with the standard Scott 4.5 Positive Pressure SCBA. The Rebreather mask is a tremendous asset at incidents where long, continuous, on-air time is essential. The member wearing a Rebreather mask now has the ability to penetrate remote areas, perform search and rescue and still have plenty of air to exit the hazardous environment.

The Incident Commander (IC) must think out of the box and be proactive when it comes to requesting the Rebreather masks. The Rebreather mask can provide members with the needed air to search longer and deeper at tunnel fires and emergencies. This is a concern in New York City due to the hundreds of miles of underground subway tunnels. The Rebreather mask should be considered at large high-rise or warehouse fires where individuals are lost or missing.

The Rebreather mask is flame-tested to NFPA open-circuit standards, but it is not designed for routine structural firefighting or underwater operations. NIOSH has not approved the Rebreather mask for structural firefighting because of the use of pure oxygen. There is a concern about an atmosphere that has open flame and high heat. At this time, there is no standard for positive pressure, closed-circuit, self-contained breathing apparatus using a breathing gas of pure oxygen. Additionally, there is worry that leakage might occur in the facepiece area near an open flame.

The Draeger BG-4 EDSCBA has a much different design than the standard Scott 4.5 Positive Pressure SCBA. The weight is comparable to the Scott 4.5 Positive Pressure SCBA, at less than 32 lbs. The dimensions of the mask are 23 inches long, 18 inches wide and $6\frac{1}{2}$ inches deep. The mask shell is made from a lightweight carbon composite and holds a small, 3000-psi oxygen cylinder. This oxygen cylinder delivers approximately 1.5 L/min. of oxygen, which mixes with the wearer's exhaled air that has been scrubbed through a filter (contained within the Rebreather mask) to remove the carbon dioxide. This closed-circuit breathing apparatus allows the wearer to re-use his/her exhaled air. Exhaled air contains 17 percent oxygen and four percent carbon dioxide. After the carbon dioxide scrubber removes the carbon dioxide, a small amount of oxygen is added from the cylinder to replace the oxygen the wearer consumed. The continuous recirculation of the wearer's exhaled air allows up to four hours of operational time.

(Left) Rear view of Draeger BG-4 Extended Duration SCBA (EDSCBA). (Above) Internal components of the EDSCBA. (Right) Note the slim profile of the Rebreather.

The air being recirculated within the closed-circuit system requires cooling. This is accomplished by passing the airflow over a block of ice that is installed in the Rebreather Unit immediately prior to use. Each Rebreather mask requires assembly before a member can operate with it.

The Rebreather Unit and the Officers and Firefighters assigned to the two Rebreather Response Vehicles are responsible for daily maintenance and assembly of the Rebreather masks. The Rebreather Unit operates out of Fort Totten, with two Lieutenants and two Firefighters assigned. Both Rebreather Response Vehicles are staffed by two full-duty SOC Firefighters, who are trained in the maintenance, deployment and use of the Rebreather masks. Rebreather Response Vehicle 1 responds from the quarters of Ladder 20 and Rebreather Response Vehicle 2 is quartered at the Special Operations Command on Roosevelt Island. Each Rebreather Response Vehicle carries 36 Rebreather masks, as well as spare cylinders, tools and miscellaneous parts for the masks.

If the Incident Commander or the Rescue Operations Battalion determines there is a need for the Rebreather masks at an incident, he/she will special-call a Rebreather Response Assignment. The Rebreather Response Assignment consists of the nearest available Rebreather Response Vehicle, Rescue and Squad Company, plus two additional Rebreather-trained units. These Rebreather-trained units could be Rescues, Squads, HMTU Engines or SOC Support Ladder companies, whose members have had the Rebreather training. The Rescue Operations and Safety Battalions also respond. If the Rescue Operations Battalion is not available, another trained Battalion Chief assumes his duties. At large-scale operations, the Incident Commander may need to call in additional Rebreather-trained units and

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Lessons Learned at Rebreather Drills

by Lieutenant James McQuade

Officers plan the Rebreather drill in Manhattan. Electric motorized rail cart is used to push the emergency rail cart in the foreground.

FDNY members prep for January 27, 2008, drill.

Rebreather-equipped Firefighters are ready to remove any victims encountered at the MTA's 63rd Street under-river tunnel at inter-agency drill.

The FDNY continues to be proactive in enhancing the operational capabilities of its members. In the summer of 2003, the Special Operations Command (SOC) and the Research & Development Unit conducted extensive testing on Draeger's BG-4 Extended Duration SCBA (EDSCBA) Rebreather Mask at Randall's Island. This comprehensive evaluation process involved participation by the Division of Safety, Bureau of Health Services, Bureau of Training, Bureau of EMS and Technical Services Division, as well as members of the Uniformed Fire Officers Association and Uniformed Firefighters Association. The acquisition of Rebreathers will greatly enhance the FDNY's search and rescue operations in the event of a terrorist incident.

The FDNY, in conjunction with Draeger Safety, initially trained 118 members of the Special Operations Command in August 2004 in preparation for the Republican National Convention, which was held at Madison Square Garden. This training continued in November as the remaining SOC members received their initial training.

In 2007, the FDNY made the decision to expand the number of companies whose members were to be trained on the Draeger BG-4 Rebreather. Beginning in June, the Officers and members of SOC Support Ladders, HMTU Engines and select Battalions began to receive their Level 1 Operational Training. To date, more than 1000 members of the FDNY have been trained to Level 1 in the use and operation of the Rebreather.

Recent worldwide events have shown the vulnerability of mass transit systems. Both subways and above-ground railways are prime terrorist targets, as witnessed in London, Madrid and Moscow. The FDNY must be ready to deal with such a catastrophic attack in New York City. The Center for Terrorism and Disaster Preparedness (CTDP), along with SOC members, have been conducting training exercises to help prepare FDNY units for such an event.

Two exercises involving under-river tunnels have taken place within the past year. At each exercise, an FDNY Box was transmitted for a train involved with an explosion, fire and subsequent smoke condition. At each incident, the location of the train was unknown and victims were encountered. The first was a full-scale exercise held at the Metropolitan Transit Authority's (MTA) 63rd Street under-river tunnel on January 27, 2008. The second was an inter-agency drill involving the Port Authority of New York and New Jersey, which took place on November 23, 2008, at the PATH's World Trade Center station in Manhattan.

Although each of these scenarios presented its own unique characteristics--such as construction and location--the issues addressed with regard to Rebreather operations were similar:

- Most important is to be proactive in identifying the need for deployment of Rebreathers as FDNY's SCBA operating capabilities would be very limited in this kind of real-life scenario.
- Rebreather personnel were proficient at setting up and assisting members with donning the Rebreathers.
- Rebreather-trained units were given the opportunity to operate in under-river tunnels.
- Members identified and mitigated the challenges they encountered.
- Use of the emergency rail cart (also known as the Nolan Rail Cart) can be a tremendous asset in transporting tools and equipment long distances.
- The emergency rail cart can significantly help with the removal of victims.
- Victim removal--although difficult--was successful.

Additionally, there were other points from which members can learn:

- Tunnel characteristics--such as depth, overall length and lack of ventilation--dictate the need for Rebreather operations.
- It is important to familiarize FDNY members with the capabilities of Rebreathers.
- The Safety Management Team must be cognizant of the build-up of core body temperatures of members on Rebreathers. Relief for these members must be considered early in the operation.
- Identifying an incident requiring Rebreather deployment as early as possible is important to avoid delayed response of Rebreather Units and required specially trained units.

These exercises were designed by the CTDP as interactive exercises, to challenge responding agencies' procedures in a realistic and stressful environment. These and future exercises demonstrate the FDNY's commitment to preparing its members for the growing threat of manmade and natural disasters. Units responding to subway incidents should expect the unexpected and use extreme caution. The presence of a secondary device or multiple attacks is a real possibility.

About the Author...

Lieutenant James McQuade is a 24-year veteran of the FDNY. He is assigned to the Special Operations Command, detailed to the Rebreather Unit. Prior assignments include Engine 287, Ladder 136 and Divisions 11 and 7. He is a member of FEMA NYTF-1. This is his first article for WNYF.

Members are urged to review "Emergency Rail Carts," by Deputy Chief Peter J. Hart (retired), in the 4th/2008 issue of *WNYF*.

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Battalion Chiefs.

The operational strategy and tasks--such as firefighting, search, rescue and victim removal--are no different with Rebreather masks. The procedures and tactics with Rebreather masks, however, differ. Rebreather-trained units are given one of the following assignments at an incident; entry team or operational unit, a support unit, FAST unit, standby unit or part of the safety management team. The entry team is supervised by the entry team leader, preferably the Rescue Operations Battalion. This team consists of the Officer and four Rebreather-trained members, who perform their operational tasks at the fire or emergency. The entry team is responsible for getting to the operational area and performing the life and safety actions of search, rescue and evacuation. The fifth member of the entry team is part of the safety management team.

The support unit works with the entry teams and provides the equipment and tools needed by the entry teams. Once the support units deliver the equipment to the entry teams in the operational area, they stand by in an area free from immediate hazards. The members of the support unit operate with Rebreather masks and serve as the communication link between the entry teams and Command Post. The support unit should secure a Post radio from a Battalion Chief on the scene to provide this communication relay. The support units will be on air, but they should not engage in operations that would expend their air supply as they are in standby mode. In addition to the Post radio, the support unit transports a cooler with spare ice containers, lights, light sticks, spare batteries for entry team handie-talkies, thermal imaging cameras and other battery-operated tools. One member of the support unit is assigned to the safety management team.

The FAST unit operates with Rebreather masks and accompanies the entry teams and support unit to the vicinity of the operation to obtain a size-up of conditions. The FAST unit then retreats to a safe area determined by the support unit, remains on air and monitors the handie-talkie communications for *urgent* and *mayday* messages. If they need to respond to a call for help, the FAST unit deploys and, if needed, the support unit assists with the *urgent* or *mayday*. In addition to their normal tools, the equipment carried by the FAST unit includes a stokes stretcher with a long back board and sked, thermal imaging camera and spare battery, two search ropes, spare handie-talkie battery for each member of the FAST unit, CFR-D equipment--including a defibrillator, extra Rebreather mask and Fast Pak. One member of the FAST unit is assigned to the safety management team.

A safety management team is established prior to operating with Rebreather masks. The Safety Battalion supervises the safety management team, consisting of the Chief and one member from each company operating with Rebreather masks. Additional personnel, such as the Firefighters from the Rebreather Response Vehicle, also work with the safety management team. The safety management team is responsible for completing the EDSCBA and Entry Team control sheets. The EDSCBA control sheet documents on-air time and projected exit time for each Rebreather Unit operating. Operational plans should not exceed three hours and 30 minutes. Each Rebreather mask has a warning alarm to notify the wearer that there is 60 minutes of operational time remaining. The safety management team determines when the entry teams should conclude operations and begin their exit, based on how far the unit has penetrated and how long it will take to get back to a safe location.

The Entry Team control sheet is similar to a BF-4 riding list, identifying the unit and members operating. The Entry Team control sheet is filled out in triplicate. One copy each is given to the entry team leader and FAST unit; the safety management team retains the third copy. The non-entry team member from each unit assigned to the safety management team is responsible for performing an operational check on each Rebreather mask his/her unit wears. Safety management team members must account for all members of the entry team and track their remaining air time. The Rebreather Response Vehicles have extra-large eraser boards to document and identify all units operating with Rebreathers and their assigned tasks and to track members' on-air times.

With their Rebreathers in place, FDNY members practice at the Fire Academy on Randall's Island.

The Officers and Firefighters assigned to the Rebreather Unit and Rebreather Response Vehicles have 48 hours of Draeger training and are certified to train other FDNY units. Below is a breakdown of the Rebreather training:

Level I Operations Training--Eight hours, originally given by trained Draeger instructors. Currently, it is taught by FDNY "Train the Trainer" Instructors.

Level II Maintenance Training--Sixteen hours, given by Draeger Maintenance Instructors.

Oxygen Booster Pump Training--Eight hours of training on how to refill oxygen tanks at the Fort Totten facility and the onboard vehicle pumping stations. These onboard vehicle pumping stations are located on each Rebreather Response Vehicle.

Draeger "Train the Trainer" Program--Sixteen-hour class. Members must have the 32 hours of Draeger training mentioned above, as well as Educational Methodology, prior to participating in this program. Educational Methodology is a required course to become an instructor and is given by the First Line Supervisor's Training Program (FLSTP).

By the end of 2009, all Rescues, Squads, Haz-Mat, HMTU Engines, SOC Support Ladder Companies and selected Battalions will have Level I operations training. A refresher for these companies will be given every three years. The Rescue, Squad and Haz-Mat units complete a practical Rebreather evolution at the Division of Training during their Annual Education Day.

The Officers and Firefighters assigned to the Rebreather Unit and Rebreather Response Vehicles have devoted a tremendous amount of time and energy to make this program successful. Every day, these members are training or performing maintenance on the Draeger BG-4 EDSCBAs. ICs must have confidence in this equipment and the members who will be operating in the Rebreather masks. Incident Commanders should recognize that there are times when the Rebreather masks are needed at an extended-duration operation where members are required to save lives. Commanders should be confident in their use because the FDNY has trained and prepared its members to operate with them.

About the Author...

Battalion Chief Joseph R. Downey is a 24-year veteran of the FDNY. He is assigned to the Rescue Operations Battalion of the Special Operations Command. He served as a Lieutenant in Rescue 2 and was Captain of Squad 18. He is one of the Task Force leaders for NY-TF1. He holds a BBA degree in business/computers from Hofstra University. This is his third article for WNYF.