Hybrid and CNG Bus VBIED

A Review of Alternate Power Bus Emergency Procedures, Fire Operations and Terrorism Awareness

by Lieutenant Michael Doda

In 2007, *WNYF* readers were introduced to the *Clean Air* Hybrid Bus used by the Metropolitan Transportation Authority (MTA). The technology, developed in other municipalities, was new to New York City. This hybrid drive system uses a combination diesel generator and electric traction motor. Basic fire and emergency operations were outlined. The popularity and practicality continue to make these buses very cost-effective and, as a result, their numbers have grown even faster than projected. Operations involving these buses, including major motor vehicle accidents and a small number of fires aboard buses in Staten Island and Brooklyn, have taken place across the boroughs.

There is, however, one type of bus emergency--not yet experienced by the FDNY--for which Department members have been training. It is a vehicle-borne improvised explosive device (VBIED) attack. This type of attack on an alternate fuel-powered bus; i.e., compressed natural gas (CNG) or hybrid, would have another hazardous material element that would add to an already complicated situation for first-arriving units. The FBI Office of Homeland Security has evidence that shows that alternately powered buses make attractive targets due to added destructive effects and hazardous materials. The object and goal of a terrorist or terrorist group is to inflict the greatest psychological and injurious damage.

Hybrid electric buses are replacing the rest of the alternative power bus fleet. The MTA has experimented with methanol-, propane- and CNG-fueled vehicles. CNG buses constitute the greatest number and biggest investment for the MTA. CNG buses are identified by the long cylinders on the roof of the bus. The rounded cover runs almost the full length of the bus. (See Photos #1 and #1A.)

Photos #1 and #1A, left and above--Long cylinders on top of the bus identify it as a CNG (compressed natural gas) bus.

In addition to the fleet, the MTA has had to invest in the infrastructure; i.e., fueling stations, which have their own inherent dangers and require special training. Emergencies involving leaks can be mitigated by eliminating ignition sources, evacuating the immediate area, stretching a fog line for protection and possibly directing the lighter-than-air vapors and stopping the leak by identifying and using an emergency shut-off (many kinds exist). Emergencies involving fire are handled in much the same way, while using streams to cool cylinders and protect exposures.

This year, New York City will have the largest diesel electric hybrid bus fleet, reaching 1600 units. (See Photo #2.) Approximately 50 percent of all buses will be hybrid with the remaining 50 percent other or mostly CNG. The BAE HybriDrive™ propulsion system on the newer models is basically the same. New features, such as a lower floor in the rear and more torque for City driving applications, have been added. A full description of this system is outlined in the 4th/2007 issue of *WNYF*. Most importantly, fire and emergency operations are the same.

FDNY response to all accidents requires:

- The main power disconnect (right rear) and vehicle master switch (driver dash) turned off. (It will take a minimum of four minutes for undercarriage components to de-energize.)
- Inspection of propulsion system and covers for damage.
- Check for fuel leaks.

A major accident involving exposed wires and structural damage to the vehicle will require members to *...immediately remove all passengers from the vehicle and avoid these exposed danger areas.* There is always high voltage (600 v DC) on the roof and these batteries and cables cannot be de-energized. Small electrical fires on the bus, like the one that broke out aboard a parked bus at the St. George Ferry Terminal on March 14, 2009, and in Flatbush, Brooklyn, on January 13, 2009, are best extinguished with dry

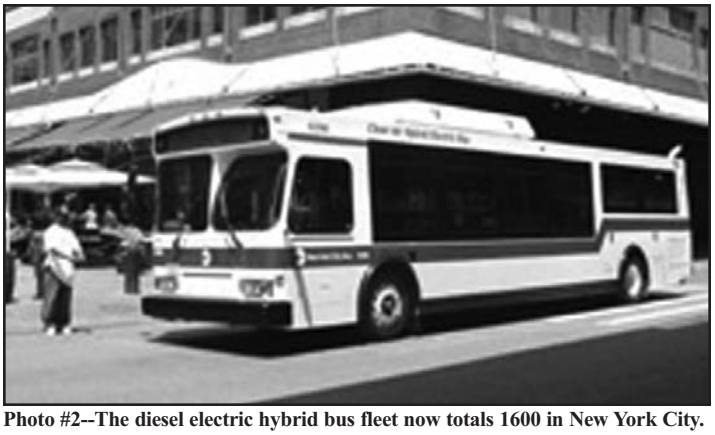

Photo #2--The diesel electric hybrid bus fleet now totals 1600 in New York City.

Members are urged to review the following references:

- *Fire Tactics and Procedures*: Hazardous Materials 1, Pages 1-20 (Alternate Fuels).
- *Safety Bulletin 86.*
- *Emergency Response Guide*--Orion Bus Industries, Inc., 2006.
- *Material Safety Data Sheet*--Hawker Enersys Energy Products, Inc.
- *All Units Circular (AUC) 207*: Subway and Railroad Track Operations, Sec. 5.1, 5.2, 7.
- *Training Bulletins*: Emergencies #3 and Fires #8.
- "Hybrid Vehicles," by Captain John M. Miles, in the 4th/2007 issue of *WNYF*.
- "The Hybrid Electric Bus," by Lieutenant Michael Doda, in the 4th/2007 issue of *WNYF*.
- Chandler, K., Barnitt, R., 2006, New York City Transit Hybrid and CNG Transit Buses: Final Evaluation Results, National Renewable Energy Laboratory, Golden, CO. Technical Report NREL/TP-540-40125.

chemical extinguishers.

Electrical panels are found on the bus behind the driver's barrier and at the rear of the bus. These access panels run onboard systems; i.e., computers, and are transformed to *low voltage*. Investigations have revealed that a misplaced metal stud, installed during the manufacturing process, was making contact with 24-volt wires. The problem has been corrected on both new and older types of hybrid buses.

The best rule of thumb is *when the fire is large enough to require a hand-line…,* the MST should be replaced with a fog tip and a minimum of 10 feet should be kept between the nozzle team and any high-voltage areas. This may seem overly cautious for a low-voltage electrical panel, but if the fire has progressed to a volume requiring a hand-line, it may have compromised other *high-voltage* areas. High-voltage cables run from the batteries on the roof, travel along within the roof and branch off to many undercarriage components. (See Diagram #1.)

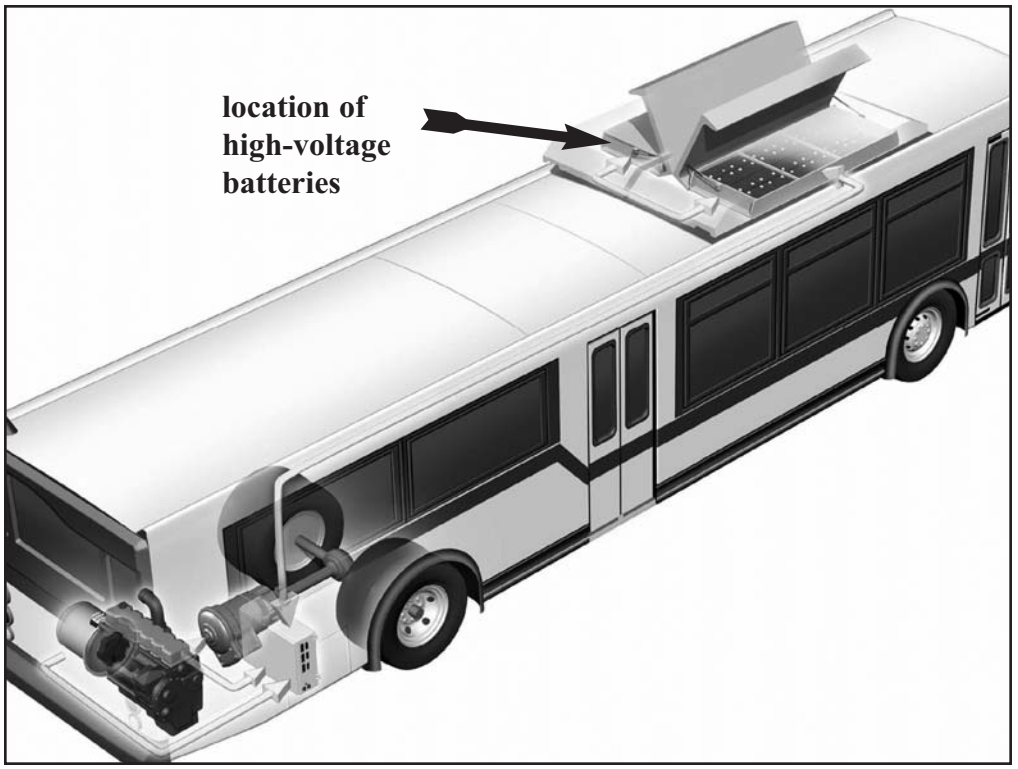

Diagram #1--The high-voltage batteries on the roof of a hybrid bus cannot be de-energized.

SCBA use is extremely important, especially if the actual batteries on the roof are involved in the fire. The electrolyte contained in the batteries, when burned, will create a corrosive vapor and this vapor will be in significant concentration in the smoke produced. Irritation, in the form of wheezing and shortness of breath, will result and inhalation burns are possible.

A *dashboard survey* of a unit arriving at the scene of a bus bombing will, in all probability, reveal all of the problems outlined thus far. (See Photo #3.) Fire can be expected, possibly in more than one location. Structural damage to the bus will be present. The damage will be far greater than what can be expected during regular *over-the-road* emergency/fire operations. Compressed gas cylinders will be compromised and damaged on a CNG bus. A hybrid bus will reveal high-voltage components exposed with compromised battery packs leaking electrolyte.

Photo #3--A bombing will cause greater damage than what Firefighters encounter during a typical over-the-road emergency/fire operation, as a scene from the Terrorism Awareness Drill depicts.

Most of the threat analysis by a joint homeland security assessment by the FBI and Department of Homeland Security has focused on *the implementation of gas cylinders as components of vehicle-borne explosive devises*. On April 11, 2002, al Qaeda detonated a small fuel transportation truck containing pressurized gas cylinders outside a synagogue, killing 20 people. The three vehicles associated with the June 2007 attempted bombing of the London Entertainment District and Glascow International Airport contained propane tanks. The key findings of the FBI and DHS were that *the terrorist use of compressed gas cylinders is to increase the destructive effects of attacks*. These incidents, coupled with the numerous examples of *bus bombings* all around the world, have led to the conclusion that CNG buses are a viable target.

Hybrid bus technology is too new to have any documented studies or focused assessments. It is apparent, however, that all agencies watching terrorist groups are concerned about *terrorist ingenuity and the ability to fashion weapons from commonly available items*. Hazardous materials and toxic chemicals have been added to attacks to add to the *psychological effect*. On February 20, 2007, a chlorine VBIED exploded in Taji (12 miles from Baghdad). Several people were killed and, in this case, many more were injured by exposure to the chlorine.

Situational awareness is the cornerstone of the new *Bus Bomb Terrorism Awareness Drill* at the Fire Academy at Randall's Island and it is the basic premise presented here. A cautious approach, with emphasis on member safety, is the best way to plan for and deal with the dangers Firefighters will face in the future.

About the Author...

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