A Hybrid Water/Nitrogen Mist Extinguishing Technology Used for Fire-Fighting Bomb Development

Joseph Perry

Private R&D Consultant, Ramat-Hasharon, Israel

josephperry@bezeqint.net

Joseph Perry is a retired Dr. of Mechanical Engineering graduated at Ben-Gurion University in Beer-Sheva and Tel-Aviv University, Israel. Currently he acts as a private consultant in the area of various large and sophisticated mechanical systems. His specializations and an abroad grade experience helped him to develop the "Innovative Fire Fighting Strategy" of which the "Fire-Fighting Bomb" is a part.

Abstract

Hybrid media is a combination of an inert gas, typically nitrogen, and atomized water that creates an atmosphere that does not support combustion. By using inert gases, some of the hybrid systems produce droplets of the order of 10 μm. The diameter of classic water mist droplets is on average 10 times larger. This results in better heat absorption, resulting from a much larger evaporation surface, which increases the extinguishing efficiency. The superior fire suppression capability of water mist is based on evaporation: when tiny water mist droplets turn into vapor, a great amount of energy is absorbed from the fire. Water mist fights fire in three ways; cooling effect, high velocity wetting and oxygen displacement. The cooling effect of water mist takes place when the water mist droplets absorb the heat radiation from the fire. Nozzles discharge fine water mist at high velocity wetting the fuel and the area around the fire. The pressure employed in the water mist fire protection system is a key aspect in the fire extinguishing quality of water mist. Oxygen displacement happens at the heart of the fire when the water mist droplets turn into vapor and take oxygen from the fire. These beneficial water mist attributions were used for Fire-Fighting Bomb (FFB) development.

The combination of climate changes and the expanding human development in the wildland-urban interface create devastating fires that are burning and spreading more quickly than they did 20 years ago. To retard those fires, fire-retarding material is typically dropped into, or in front of the advancing fire from aircraft such as helicopters or airplanes. To be effective, the conventional Aerial Firefighting dropping must be performed from an altitude no higher than 60 m above the treetops. But such low flights are extremely difficult and dangerous, particularly at night. Most of the aviation-related wild-land firefighting fatalities results from failure to maintain clearance from terrain, water, or objects. The FFB will be dropped from any appropriate altitude and be activated at the most effective distance above the fire.

The basic Fire Fighting Bomb structure will be similar to the conventional aerial bomb (see Fig. 1). The explosive fill will be replaced by a solid propellant (Sodium-azide) and a bulk of water. The heavy high fragmentation steel body will be replaced by biodegradable material or aluminum shell. Sodium-azide is the gas-generating (nitrogen) component in many car airbag systems. The airbag control unit triggers the

ignition of the gas generator to rapidly inflate a fabric bag. Once the requisite threshold has been reached or exceeded, the FFB fuse activates the detonator which ignites the solid propellant resulting in a gas bursts into the water tank. The generated gas is mixed with the fire-retarding material, increasing the internal pressure that forces the bomb shell to open. The opened FFB will release a huge fire-retarding aerosol cone precisely at an optimal level above the fire (see Fig. 2), resulting in effective rapid extinguishing, while using significantly less water as compared to conventional methods.

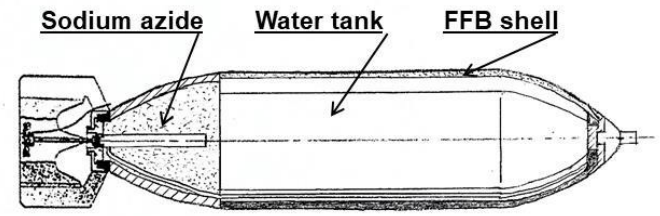

Fig. 1 The Fire Fighting Bomb basic structure

Fig. 2 FFBs opens on an optimal level above the fire

The hybrid water/nitrogen mist technology used in the FFB intensifies the extinguishing effectiveness eight folds as compared to present methods. This means that a medium category, low cost, firefighting aircraft (Air-Crane helicopter) will be virtually converted into a super heavy category aircraft (747-400 Supertanker), which is very expensive and difficult to operate.

Keywords: hybrid water mist, water mist technology, fire-fighting bomb, aerial firefighting dropping.