A 'Crushing' Victory: Fuel-Air Explosives and Grozny 2000

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Following a deliberate advance across the northern Chechen plains in October through December 1999, the Russian Army closed on the Chechen capital city of Grozny and the foothills of the imposing Caucasus mountains. There, the advance stopped. The Russians began the new century with a renewed assault on Grozny. The Russians continued their deliberate urban advance and, after forty days of fighting, the smoking ruins of Grozny were theirs. Unlike the first battle for Grozny (in late 1994-early 1995) or the recapture of the city by the Chechens (in 1996), the Russians now used quantities of fuel-air weapons, along with iron bombs, surface-to-surface missiles with high-explosive warheads, massed artillery and tank fire. These flattened large sections of the city and crushed the opposing force.

What is fuel-air?

Fuel-air weapons work by initially detonating a scattering charge within a bomb, rocket or grenade warhead. The warhead contents, which are composed of either volatile gases, liquids or finely powdered explosives, form an aerosol cloud. This cloud is then ignited and the subsequent fireball sears the surrounding area while consuming the oxygen in this area. The lack of oxygen creates an enormous overpressure. This overpressure, or blast wave, is the primary casualty-producing force. In several dozen microseconds, the pressure at the center of the explosion can reach 30 kilograms per square centimeter (427 pounds per square inch) – normal atmospheric pressure at sea level is 14.7 pounds per square inch with a temperature between 2,500-3,000 degrees Centigrade [4,532-5,432 degrees Fahrenheit]. This is 1.5 to 2 times greater than the overpressure caused by conventional explosives. Personnel under the cloud are literally crushed to death. Outside the cloud area, the blast wave travels at some 3,000 meters per second [9843 feet per second][1]. The resultant vacuum pulls in loose objects to fill the void.

As a result, a fuel-air explosive can have the effect of a tactical nuclear weapon without residual radiation.[2] Since a fuel-air mixture flows easily into any cavities, neither natural terrain features nor non-hermetically sealed field fortifications (emplacements, covered slit trenches, bunkers) protect against the effects of fuel-air explosives. If a fuel-air charge is fired inside a building or bunker, the cloud is contained and this amplifies the destruction of the load-bearing components

of the structure. Fuel-air can be an effective weapon against exposed enemy personnel, combat equipment, fortified areas and individual fighting positions. It can be used to clear minefields and to clear and prepare landing zones for assault forces and helicopters. It can be used to destroy communication centers and urban strong points. It can be used to defend against anti-ship missile attacks and against surface and submarine naval attacks. Fuel-air explosions can also be used as a herbicide, destroying crops and vegetation. [3]

Several countries, including the United States, China, India and Russia, have a variety of thermobaric weapons in their arsenals. Thermobaric is another term for fuel-air. [4] They were initially developed in the late 1960s. Russian thermobaric weapons are now third-generation.[5] Apparently, Soviet designers originally designed their thermobaric weapons for clearing mine-fields. When it became apparent that Soviet artillery, massed for break-through fires in Europe, was at risk, the Soviets designed thermobaric weapons designed to substitute for the thousands of rounds of artillery fire needed to force a gap in NATO's forward defensive positions. Later the Soviets applied the thermobaric principle to smaller tactical weapons to be used against point targets, such as bunkers and strong points. After the Soviets invaded Afghanistan, they combat-tested several of their thermobaric systems there.

At the 1993 Nizhny Novgorod arms show, the Russians spotlighted several weapons systems which are equipped with thermobaric warheads and are for sale. These included at leaset eight different weapons types[6] ranging from 500 kilogram bombs to rounds for the venerable RPG-7 launcher.[7] In addition to the thermobaric weapons for sale, there are more than half a dozen other Russian thermobaric weapons and warheads available.[8]

Russia used thermobaric weapons sparingly during the 1994-1996 war in Chechnya. These were employed outside the city of Grozny against villages and mountain positions. Only the RPO-A flame thrower, which has a thermobaric round, was used in fighting in Grozny itself. When the fighting rekindled in the fall of 1999, Russian forces bombed some villages in Dagestan with thermobaric bombs, but initially limited their use. When the Russian Army was committed, it slowly advanced across Chechnya's plains, preceded by conventional artillery fire. The advance, however, stalled when it finally reached Grozny and the mountains. Conventional artillery could not force out the Chechens and the Russian Army looked for other ways to move them. Two methods were apparently proposed -chemical weapons and thermobaric weapons. The Russian political leadership apparently vetoed the use of chemical weapons, but allowed the use of ground-delivered thermobaric weapons. Air-delivered thermobaric systems were only used outside the city.

Enter the Buratino[9]

The "Buratino" was the main thermobaric delivery system that the Russians used against Grozny. It was first combat-tested in Afghanistan's Panjshir valley in the early 1980s during the Soviet-Afghan War. Built by the Omsk Transmash design bureau, Buratino is a 30-barrel 220mm multiple rocket launcher system mounted on a T-72 tank chassis. (See Figure 1a & 1b). It is found in the chemical troops' separate flame thrower battalions. It is an observed-fire system with a maximum effective range of 3.5 kilometers (other sources say it has a maximum range of five kilometers). The minimum range is 400 meters. The rocket mounts an incendiary or a

thermobaric warhead. The zone of ensured destruction from a Buratino salvo is 200 x 400 meters.[10] The official designation of the Buratino is the TOS-1.[11] The thermobaric warhead is filled with a combustible liquid. The liquid is most likely filled with powdered tetranite.[12] When the warhead explodes, the liquid is vaporized creating an aerosol cloud. When the cloud mixes with oxygen, it detonates, first creating a high temperature cloud of flame followed by a crushing overpressure.

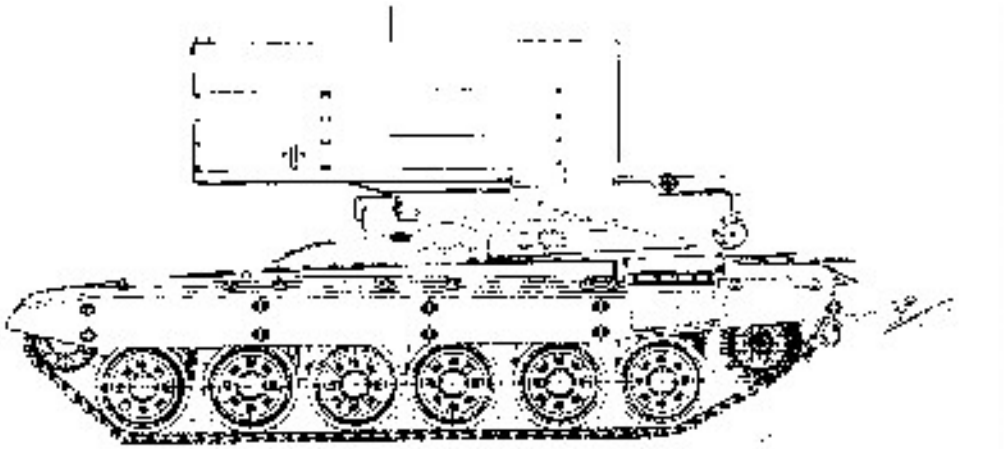

Figure 1a.

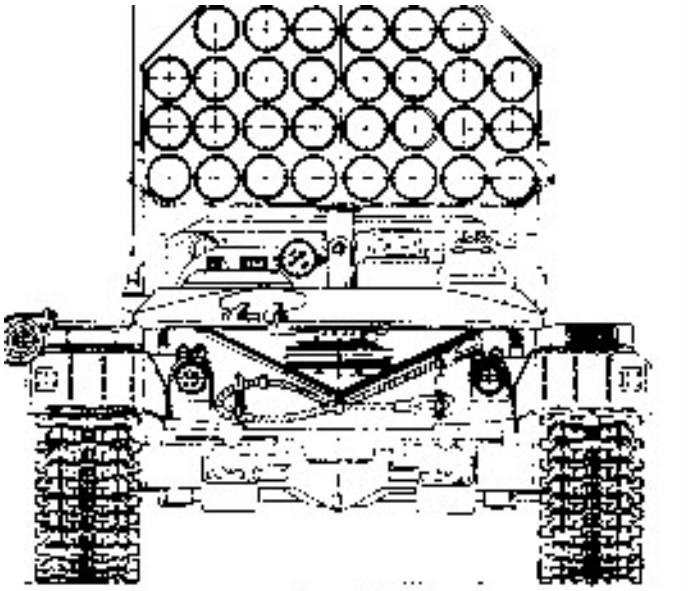

Figure 1b.

The Buratino fire control system consists of a sight, laser range finder, ballistic computer and roll sensors.[13] Although it is a chemical troop system, two or four Buratinos were often attached to artillery battalions or brigade artillery groups during the fight for Grozny. (See Figures 2a and 2b). The armored chassis would allow the Buratino to approach relatively close to the Chechen defenders if infantry soldiers provided a security screen. The Buratino proved a devastating system during the fight for Grozny.

You can tell by the Schmel

The RPO-A *Schmel* [Bumblebee] was also widely used in the third battle for Grozny. Another veteran of Afghanistan, the RPO-A flamethrower is a shoulder-fired, single-shot, disposable weapon with a maximum range of 1,000 meters, a maximum effective range of 600 meters and a minimum range of 20 meters. The round is 93 mm in diameter. It has three types of projectile: thermobaric (RPO-A), incendiary (RPO-Z) and smoke (RPO-D).[14] It weighs 11 kilograms (24.25 pounds). (See figure 3). The Schmel's zone of destruction is 50 square meters in the open and 80 cubic meters inside a structure.[15]

Figure 3.

The RPO-A is also a chemical troop system and is found in chemical troop flamethrower platoons. These platoons are attached to motorized rifle battalions as needed. In Afghanistan, RPO-A flamethrower platoons were permanently attached to motorized rifle battalions. The Russian Army is considering making a flamethrower platoon part of every motorized rifle battalion. The proposed flamethrower platoon would consist of a platoon leader, 2 drivers, 2 vehicle/squad commanders, 14 gunners, 2 armored personnel carriers, 10 portable radios and 28 RPO launchers.[16]

The RPO-A is best used as a bunker buster. It's two-kilogram warhead readily knocks out bunkers and strongpoints. However, when used against dispersed troops in the open, it will normally kill no more than one or two per burst. When the RPO-A is used against armored vehicles, it usually damages the vehicle, but the crew survives and is able to return fire. The Russians learned to assign an RPG-7 gunner with an RPO flamethrower gunner when operating as a "hunter-killer" team. The RPG-7 gunner stops the enemy vehicle and then the RPO gunner uses the RPO-Z incendiary round to set the vehicle on fire.[17]

Surviving a thermobaric strike

Units are far more concentrated in a city fight than when deployed in the countryside. Therefore, a thermobaric strike on a unit in an urban fight is likely to be very bloody. Those personnel caught directly under the aerosol cloud will die from the flame or overpressure. For those on the periphery of the strike, the injuries can be severe. Burns, broken bones, contusions from flying debris and blindness may result. Further, the crushing injuries from the overpressure can create air embolism within blood vessels, concussions, multiple internal hemorrhages in the liver and spleen, collapsed lungs, rupture of the eardrums and displacement of the eyes from their sockets.[18] Displacement and tearing of internal organs can lead to peritonitus. Most military medics are well trained in stopping the bleeding, protecting the wound and treating for shock. Many of the injuries caused by thermobaric weapons are internal and may not be initially noticed by the medic or doctor.

Medical units will have to practice triage in treating thermobaric casualties. Thermobaric detonations will create three "zones" of injury. The first is the central zone where most will die immediately from blast overpressure and thermal injuries. Casualties in the second zone will survive the initial blast and burns, but will have extensive burns and those internal injuries listed above. From a medical stand point, some second zone casualties might be able to be saved with extensive care and sufficient resources, but, in reality, between the resources required and the low salvage rate, little can be done beyond providing morphine and other pain relief. In the third zone, patients will have had some protection from flying debris, but may have experienced some blast effect. Kevlar armor may protect soldiers from lethal missile injuries, but not from the blast effect. Surprisingly, many of the patients with internal injuries will survive and do reasonably well providing that acute hemorrhaging is stopped, perforated bowels are sealed off and long-term care provided. Although eardrum examination is not part of a typical field medic/corpsmen exam, looking at the eardrums can tell a lot. If there is fluid or blood behind the eardrums, it is a very good clinical predictor of late pulmonary complications from blast injuries. Most of the injuries are caused from the pressure wave passing a tissue/fluid-air interface. That's why the bulk of the thermobaric injuries are pulmonary or gut (air filled viscous organs).

Injuries to the extremities and eyes will be common in the third zone. Simply using goggles, safety glasses or protective face shields can prevent many of these eye injuries. Burns will also be usual in the third zone. Burn care training and treatment will need special emphasis when preparing for combat where thermobaric weapons may be employed.

Conclusion

The Russian use of tactical, ground-launched thermobaric weapons has taken the wraps off of an effective weapons type that is currently being purchased or developed by a variety of countries. Thermobaric weapons will be present on future battlefields. They will present particular problems for defending units or units bunched up on complex terrain such as forest, jungle or cities. Medical units will face problems treating mass burn and crushing injuries. Technology offers no quick counters, so unit survival may depend on tactics and drills, improved counter-battery procedures and use of camouflage and deception measures.

ENDNOTES:

1. V. Frolov, "Boepripas ob"emnogo vzryva" [Fuel-air munitions], Voennye zhaniya [Military knowledge], November 1995, 23.

2. Peng Guangqian: "Controllable Wars: Trends of Future Warfare" Article Analyzes Future Warfare Trends", Jeifangjun Bao in Chinese, Beijing, 24 February 1999, 6. [FBIS translation].

3. Frolov.

4. The Russians use fuel-air and thermobaric interchangeably though there may be a technical distinction in the scientific community.

5. Anatoliy Obukhov, "Oruzhie kovat'-ne 'snikersami' torgovat'" [Forging weapons is not the same as peddling sneakers], Armeyskiy sbornik [Army digest], June 1996, 55.

6. V. V. Belyayev and V. Ye. Ilin and edited by V. V. Belyayev, "Russian Military Equipment and Arms at 'Arms. Military Equipment. Konversiya-93' International Exhibition-Fair Novosti zarubezhnoy nauki i tekhniki, seriya: aviatsionnaya i raketnaya tekhnika: tekhnicheskaya informatsiya, [FBIS translation]

7. Nayden Iliev: "United States Stops Our Arms Deals With Syria and Sudan", Chasa , 29 May-4 June 1998, 18. [FBIS translation] . The authors do not know whether or not the Russians used the RPG-7 thermobaric round in the fighting in Grozny. The Russian TBG-7V thermobaric warhead is blunt-nosed, is 105mm in diameter and weighs 4.5 kilograms (10 pounds). It has a maximum effective range of 200 meters and a maximum range of 700 meters. It has a two-meter lethal radius. The Bulgarian designation is GTB-7BG. Terry J. Gander, Jane's Infantry Weapons 1998-1999, Surrey: Jane's Information Group, 1998, 354-355.

8. Vladimir Nuyakshev and Vadim Manenkov, " Chechnya: Aviation Chief Denies Using Vacuum Bombs", ITAR-TASS in English, 1226 GMT 15 February 2000 and Human Rights Watch, "Backgrounder on Russian Fuel Air Explosives ("Vacuum Bombs"), http://www.hrw.org/hrw/press/2000/02/chech0215b.htm, February 2000.

9. Buratino is a wooden puppet in a Russian fairy tale. Although Buratino resembles Pinochio, Buratino must rescue his creator from a castle dungeon by finding a golden key. After several adventures, a helpful turtle finds the key in the castle moat and Buratino is able to rescue his creator.

10. Materials furnished to Mr. Grau from Russian General Staff archives.

11. *Tyazhelnaya ognemetnaya sistima* [heavy flame-thrower system], Pavel Felgengauer, "Pavel Felgengauer Commentary of the Week, 2 January 2000: Heavy Rocket-Propelled Flamethrower in Chechnya.", Ekho Moskvy, 2 January 2000. [FBIS translation]

12. Probably tetranitromethane $C(NO_2)_4$ or pentaerithrityl tetranitrate (PETN). V. V. Belyayev and V. Ye. Ilin.

13. Igor Korotchenko, "Trends: VTTV-OMSK-99-The largest review of the defense industry's advanced achievements: Russia's regions are reaching the international level of marketing work in the military-technical cooperation sphere", *Nezavisimoye voyennoye obozreniye* [Independent military review], 16-22 July 1999, Number 27, 7. [FBIS translation]

14. For another use of thermobaric weapons, see Lester W. Grau and Ali Ahmad Jalali, "Underground Combat: Stereophonic Blasting, Tunnel Rats and the Soviet-Afghan War", Engineer, November 1998.

15. Human Rights Watch.

16. Igor Boyko, "Ty chey, ognemetchik" [Who do you belong to, flamethrower gunner?], Armeyskiy sbornik [Army digest], September 1996, 43.

17. Ibid.

18. Frolov.

19. Thanks to Commander Charles J. Gbur Jr, MC, US Navy Reserve, Regimental Surgeon to the 24th Marine Regiment.