

## Russia's Use of Thermobaric Weapons in Ukraine

On February 28, 2022, the Ukrainian ambassador to the United States [confirmed](#) that Russia had used a “vacuum bomb,” [killing 70 soldiers](#), as part of its illegal invasion of Ukraine. Two days prior, *CNN* [reported](#) that Russian TOS-1 rocket launchers, which can launch up to 30 rockets armed with thermobaric warheads, were mobilized in eastern Ukraine. Thermobaric weapons have been described as the biggest non-nuclear bomb, but there is a massive leap in the destructive power to a weapon of mass destruction.

### What are thermobaric weapons?

Thermobaric weapons are a [subclass](#) of volumetric weapons, a family that includes thermobaric weapons and fuel air explosives. They [consist](#) of a fuel container and two separate explosive charges. When a volumetric weapon is dropped or launched, the first charge detonates to disperse the fuel particles. The second charge ignites the dispersed fuel and oxygen in the air, creating a blast wave of extreme pressure and heat that has the potential to reverberate and to [create](#) a partial vacuum in an enclosed space. They are [likely](#) to cause civilian casualties due to their indiscriminate and uncontained nature.

The effects of thermobaric bombs are compounded in enclosed spaces, making them highly effective in buildings. Russia's unanticipated struggle with urban warfare thus far might explain its reported usage. The International Criminal Court (ICC) has [decided to open](#) an investigation into potential war crimes in Ukraine, which [could include](#) the use of thermobaric weapons.

### Comparison to nuclear weapons

There is a massive difference between a thermobaric weapon and a nuclear weapon, but neither weapon is new. Fuel-air explosives were [developed](#) by the United States in the 1960s and used in Vietnam. They were also previously [used](#) by Russia in Chechnya in the 1990s, reportedly against China during a 1969 border conflict and most recently, in the conflict in [Syria](#) and possibly by the Syrian regime itself. It is believed that China and India also have these bombs. However, the United States and Russia have continued to improve them and [billed them](#) as a substitute to the vastly more destructive nuclear bombs in order to breach hardened military targets.

Russia's [largest thermobaric weapons test](#) in 2007 had a yield of 44 tons, while the U.S. B61 tactical nuclear weapons, which are deployed in Europe, at their lowest yield are [~300 tons](#). For greater comparison, U.S. strategic nuclear weapons have varying yields from around [50,000 tons to 1.2 megatons](#). Thermobaric bombs are not in the same class by any means.

### Misconceptions and Misinformation

Russian President Vladimir Putin appears to be pushing the limits of conventional warfare to break the will of the Ukrainian people. Thermobarics have extremely limited utility against military targets; their primary use has been against civilian areas. They still fall far short of nuclear weapons. A better comparison for thermobarics is to incendiary munitions, cluster munitions and barrel bombs. There is a [legal argument](#) that thermobaric weapons may be prohibited under the Convention on Certain Conventional Weapons if they count under [Protocol III](#): Prohibitions or Restrictions on the Use of Incendiary Weapons, but they are not explicitly listed. Further, since the United States also keeps them in its military inventory, it is unlikely that they will be explicitly listed or that there will be a treaty banning their use.

The claim about fuel-air explosives being comparable to low-yield nuclear weapons seems to have come in part from an [article](#) by a Russian scientist and a [statement](#) from a Russian official after the test in 2007. While articles like those listed distinguish between thermobaric weapons and fuel-air bombs as separate classes under the larger umbrella of volumetric weapons, some news stories like [this one](#) and even [this book](#) explicitly state that thermobaric weapons, fuel-air bombs, and vacuum bombs are all synonymous. This [patent](#) lays out the differences, which seem to come down to stages of anaerobic versus aerobic reactions.