

## Advanced Propellants

### Ultra-High Explosive Burst Generators

#### Army Issues and Technology Impact

A revolutionary propulsion system could dramatically change warfighting and be a critical element in the Army's Transformation objectives. This system uses the physics of nano-to-macro-scale explosive burst generation from pretensioned metastable fluids as simple as water. This new propulsion system can produce energy outputs 500% higher than the energy produced using conventional nitrocellulose. Additional benefits to the Army include

- on-demand, variable control of velocity from the same platform and the same charge;
- precision control of propulsion stages for transport of a variety of projectiles; and
- radical improvements in the field of insensitive munitions.

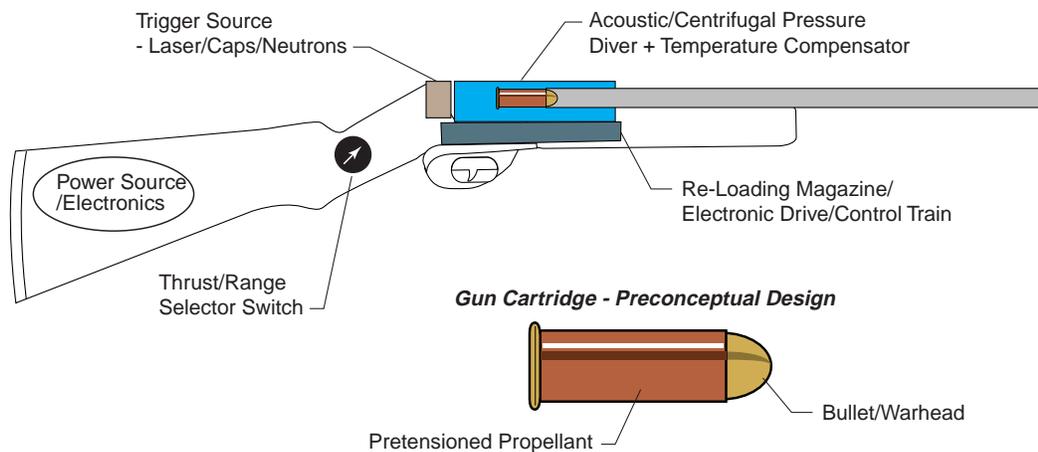
Ultra-high explosive burst generators have applications beyond that of propellants—they could be used as explosives and to destroy chemical or biological agents. The use of pretensioned fluids will allow generation of energy bursts in a range that is lower than as well as higher than the output of any known explosive or propellant.

#### Technical Concept

The concept of nano-scale burst propellant is to stretch liquids like a spring to desired levels and then use neutrons to safely trigger explosive bursts. The neutrons act as a nano-scale trigger to release energy from critical-sized vapor pockets in the liquid. The growth and collapse of the vapor pockets creates intense heat ( $\sim 10^6\text{K}$  to  $10^8\text{K}$ ) and localized shock waves.

#### Development Approach

Researchers at ORNL have completed proof-of-principle investigations that support this method of attaining nano-to-macro-scale explosive bursts. The next phase of development will be to conduct engineering, testing, and development of a gun system that makes use of this technology. For the sake of illustration, a 20-mm platform is used (see illustration).



*Conceptual schematic of nano-to-macro-scale triggered, ultra-high kinetic energy, controlled thrust, metastable, propellant and gun system.*



### **ORNL Facilities**

ORNL has laboratory and staff devoted to further innovation and development of the key principles involved in using metastable fluids to produce ultra-high explosive bursts.

### **Related Programs**

Development of this ultra-high explosive burst generation technology is compatible with ORNL's development of a high-energy, variable-thrust cartridge.

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