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Electrothermal-Chemical (ETC) Technology Weaponization Issues

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Outline

- ETC Process
- Propellants
- Pulse Power
- Plasma Devices
- Power Connection
- Fire Control
- Munitions Interface/Integrated Round
- System Integration

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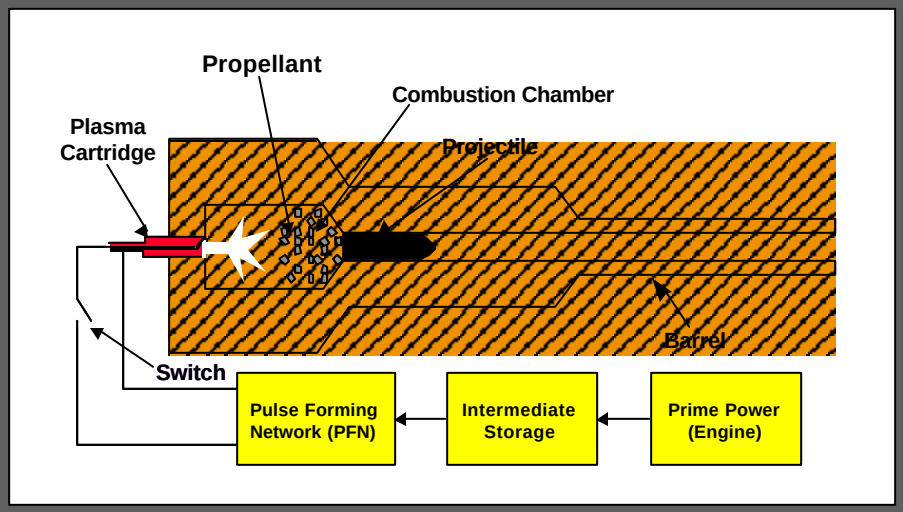
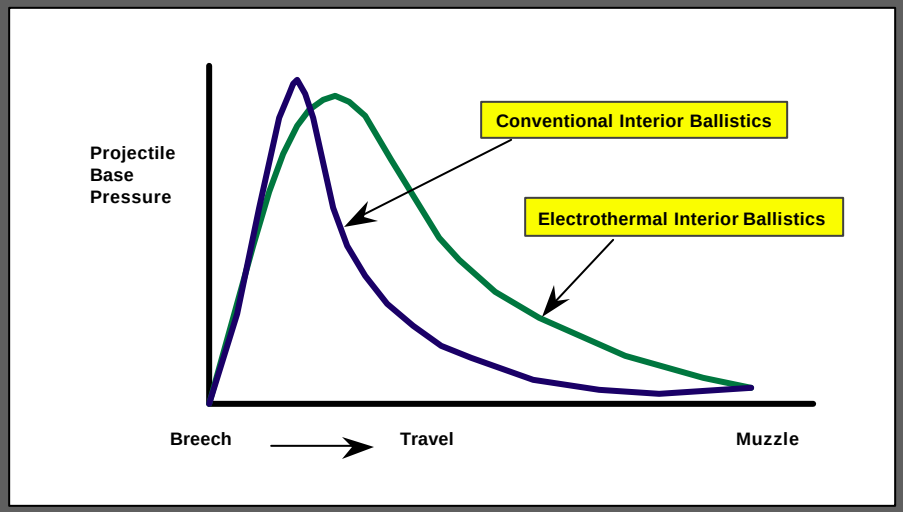
ETC Process





DESCRIPTION

ETC utilizes electrical energy to augment/control the release of chemical energy from existing/new propellants to achieve significant performance enhancements using existing conventional guns.

BENEFITS

- Improved accuracy/hit probability with precise ignition timing
- Maximum performance at all conditions with temperature compensation
- Increased lethality and range with higher muzzle velocity
- Soft launch potential
- High velocity potential

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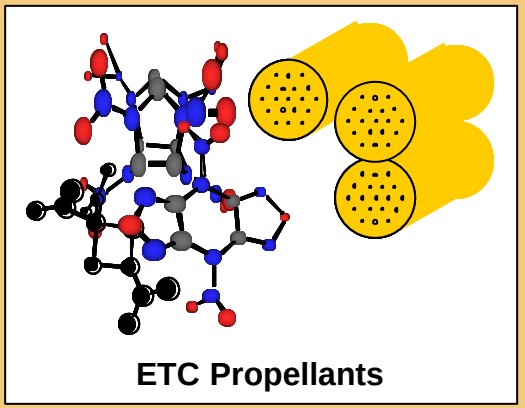
Propellants

- Performance
- Plasma/propellant interaction
- Hot/cold propellant capability (temperature sensitivity)
- Residue
- IM
- Excessive barrel wear
- Safety in handling (shock, vibration, drop tests)
- Shelf life
- Non toxic
- Producibility
- Cost
- Safe operation during plasma device fault (base ignition)



ETC Propellants

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Pulse Power

- Battery safety and performance in military environment
- Capacitor efficiency, energy density, survivability, allowable voltage reversal
- Field free inductor development
- Cost
- Architecture development and definition
- Fault mode isolation
- Safety
- Reliability, maintenance
- EMI/EMC
- All weather operation
- High action/High rep-rate switching
- Optimum PFN Voltage
- Optimum power profile
- Robust power conditioning

Pulse Power

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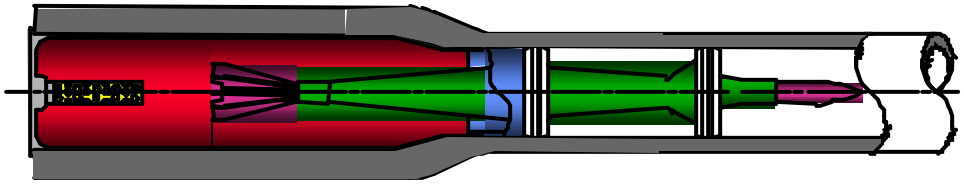
Plasma Device

- Coaxial connection (elimination of “stub case” or case from return path)
- Optimum plasma arc length
- Manufacturability
- Design for safe round operation during fault
- High reliability
- Leave behinds



Plasma Devices

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Power Connection

- Coaxial in nature
- “Automatic” operation
- Number of electrical contacts
- Electrical contact force management
- Magnetic forces management
- Current return path control
- Electrical contacts must be kept clean and protected from moisture
- Magnetization of gun components
- Allows firing of conventional munitions (interface with conventional primers)

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Fire Control

- Precision ignition
- Temperature compensation
- Precision aim techniques
- Reduction in temperature dependent jump
- Impact of longer gun tubes
- Pulse power interface
- Ammo temperature measurement

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Munitions Interface/Integrated Round

- Ability of plasma device to interface with a variety of munitions
- Fin damage (if fins)
- Tracer damage
- Interface with combustible, consumable or non-combustible case
- Understand high muzzle velocity on spin-stabilized rounds, increased loads on rifling
- Impact on fuzes
- G-sensitive munitions
- Ease of LAP

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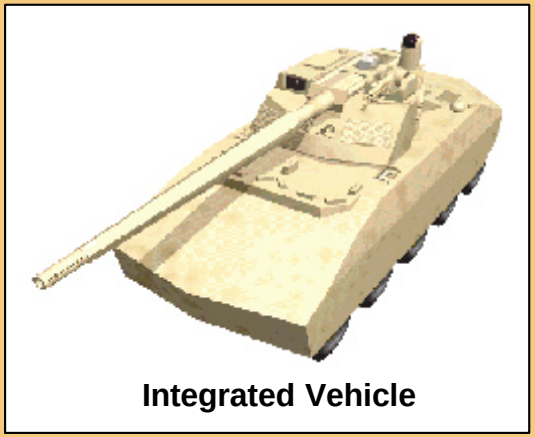
System Integration

- Independent of tube – smooth bore or rifled
- Slip rings
- Location of pulse power components (close to breech is good)
- Turret balance
- Maintenance ease
- Hybrid electric versus conventional prime power and mobility



Integrated Vehicle

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Concluding Remarks

- **ETC Technology has been under development for a long time**
- **Significant performance gains have been realized**
- **ETC weapon systems will some day be a reality**

Must address critical weaponization issues now!

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