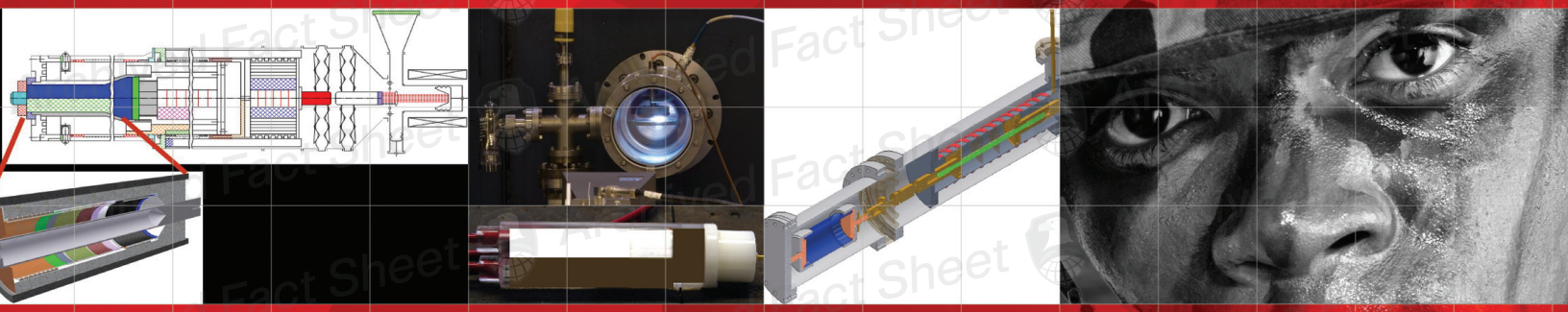
EPP

Explosive Pulsed Power For Munitions and Warheads



Summary

- Enabling technology for advanced munitions and warheads
- Meets form factor requirements of current small munitions
- Can be adapted to power a wide variety of payloads on multiple types of platforms
- Currently being used in development of munitions to support current theaters of operation

Explosive Pulsed Power (EPP) is an enabling technology for developing a new generation of enhanced munitions and warheads.

The development of compact munitions with enhanced effects and/or less-than-lethal munitions requires advanced power systems. Traditional power supplies cannot meet the volume and mass constraints imposed by current and future munitions. To meet these imposing requirements, explosive pulsed power devices have been developed and are being utilized. In addition, these power supplies are being adapted for other applications including mineral and oil exploration, powering special test equipment at test sites, nonlethal rounds for law enforcement, rapid charging of capacitors, propulsion, lightning simulators, and electromagnetic launchers.

EPP

Technical Center

Explosive Pulsed Power For Munitions and Warheads

Overview

Explosive pulsed power (EPP) consists of those devices that convert the chemical energy stored in explosives into electrical energy or that use the shock waves generated by explosives to release energy stored in materials such as ferromagnetics and ferroelectrics. While EPP has been around since the early 1950s, it has only recently, due to advances in materials and a consistent experimental effort, been applied to developing new types of munitions for the Army and the other Services, as well as several commercial applications.

Benefits for Tomorrow's Defense

EPP will provide the Army with a new class of munitions with either enhanced lethality or less-than-lethal capability. This technology is adaptable for use in munitions ranging in size from 40 mm to 155 mm, submunitions for cargo rounds such as Non Line of Sight – Transport (NLOS-T) cargo round, and warheads ranging from the Hydra-70 to Multiple Launch Rocket System (MLRS). By modifying the source of power and/or power conditioning circuits, the EPP can be used to drive a variety of loads such as high power microwave and ultra wideband sources for defeating electronics, lasers for blinding sensors, and transmitters for doing bomb damage assessment and for burst communications.

Technical Concept

There are 3 general classes of EPP sources. They are the flux compressing generator (FCG), which is a high energy source, the ferroelectric generator (FEG), which is a high voltage source, and the ferromagnetic generator (FMG), which is a high electric current source. The FCG uses the explosives to trap and compress a magnetic field initially created by a seed power source such as a capacitor bank, battery, or another FCG. The compression of the field multiplies the seed current and energy. There are many types of FCGs; the shape of the conductors determines the type of FCG and its output parameters. The FEG uses the explosives to shock depolarize a pre-polarized ferroelectric ceramic material. Certain ceramics such as lead zirconate titanate will store electrical charge or energy when subjected to an external electrical field when heated and subsequently cooled. The shock wave from the explosives depolarizes the material and releases this energy as electrical energy. The FMG uses the explosives to shock demagnetize a permanent magnet. When magnets are magnetized, they store energy in their magnetic field. The shock wave from the explosives demagnetizes the magnet and releases the stored energy as electrical energy.

The type of generator used will depend on the input requirements of the payload, the volume and mass constraints of the platform, and the desired effects on the target. One scenario is the FCG driven high power microwave source. A primary power source (battery or capacitor bank) sends an electric current to the FCG to create a seed magnetic field. An explosive charge is then used to drive an armature that compresses the magnetic field and multiplies the current in the stator. This amplified current then passes through a power conditioning network to shape the electrical pulse into the best waveform for powering the microwave tube. The microwaves that are generated are then radiated onto a target area to damage electronics.

Another application is pulsed telemetry. The concept is to use permanent magnets to create the initial magnetic field in a FCG and to integrate the FCG with an antenna. This compact simple telemetric system could be used to transmit a radio frequency (RF) signal under certain conditions to provide information on the status of a larger system, such as a missile, upon impact.

As the development of compact explosive pulsed power technology continues to evolve, other applications will be identified in both the military and commercial market places. The Army Space and Missile Defense Technical Center, working with other DOD partners, continues to move the technology forward.

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