Electric Firing Device for The PAN (Percussion Actuated Non-Electric) and RE1212 Disrupters

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Project Team

Sponsor:

Phil Thompson – Project Officer
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(Explosive Ordnance Disposal/Low Intensity Conflict)

Team Members

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Disrupter Overview

- PAN Disrupter developed by Sandia National Laboratories for the FBI Bomb Data Center
- A non-electric explosive ordnance disposal (EOD) tool designed to remotely disable and render-safe improvised explosive devices (IEDs) without initiating them
- Designed to provide general and specific disruption capabilities
- Device used by military and civilian EOD personnel
- RE1212 Disrupter designed by Richmond Electronics is similar to the PAN Disrupter except for recoilless action

Disrupter Overview

- Uses standard commercial 12 gauge blank shotgun shells and special modified loads depending on the application
- Diverse selection of projectiles (i.e. liquid, solid, shot, frangible) allow technicians to match projectiles to a given scenario
- Actuator is command initiated using shock tube
- Shock tube initiated by devices such as a blasting cap, detonating cord, or electrical shock tube initiator
- Equipped with collapsible adjustable stand or can be mounted on robots

Some Applications

General Disruption

- Shoot into general area without specific target acquisition
- Projectile (usually water) will open package and disrupt explosives and firing train

Pipe Bomb

- Requires skipping a projectile against sidewall of pipe and impacting cap with high velocity debris

Large or Sophisticated IED's

- Require use of two or more disrupters fired simultaneously or in sequence
- Capable of impacting two or more targets within 500 uS or less of each other
- Timing controlled by shock tube lengths and splitters

User Need

- Ability to initiate the PAN Disrupter at greater distances using various RF devices as well as on board signals from EOD robots
- Maintain the ability to use original initiation devices (i.e. det cord, blasting caps, shock tube)
- Device should be compatible with PAN and RE1212 Disrupters

ARDEC Involvement

- ARDEC Fuze Division responsible for electronic and mechanical hardware design, fabrication, assembly and testing for new firing device
- Project grew out of involvement with the M152 RAMS (Remote Activation Munitions System) RF Firing Device and development done for Shock Tube Initiators
- Funding: $100K through ARL
- Schedule
  - Kick-off meeting: 19 FEB 2004
  - Completion of 5 demonstration units: DEC 2004
  - Completion of 30 production units: FY05

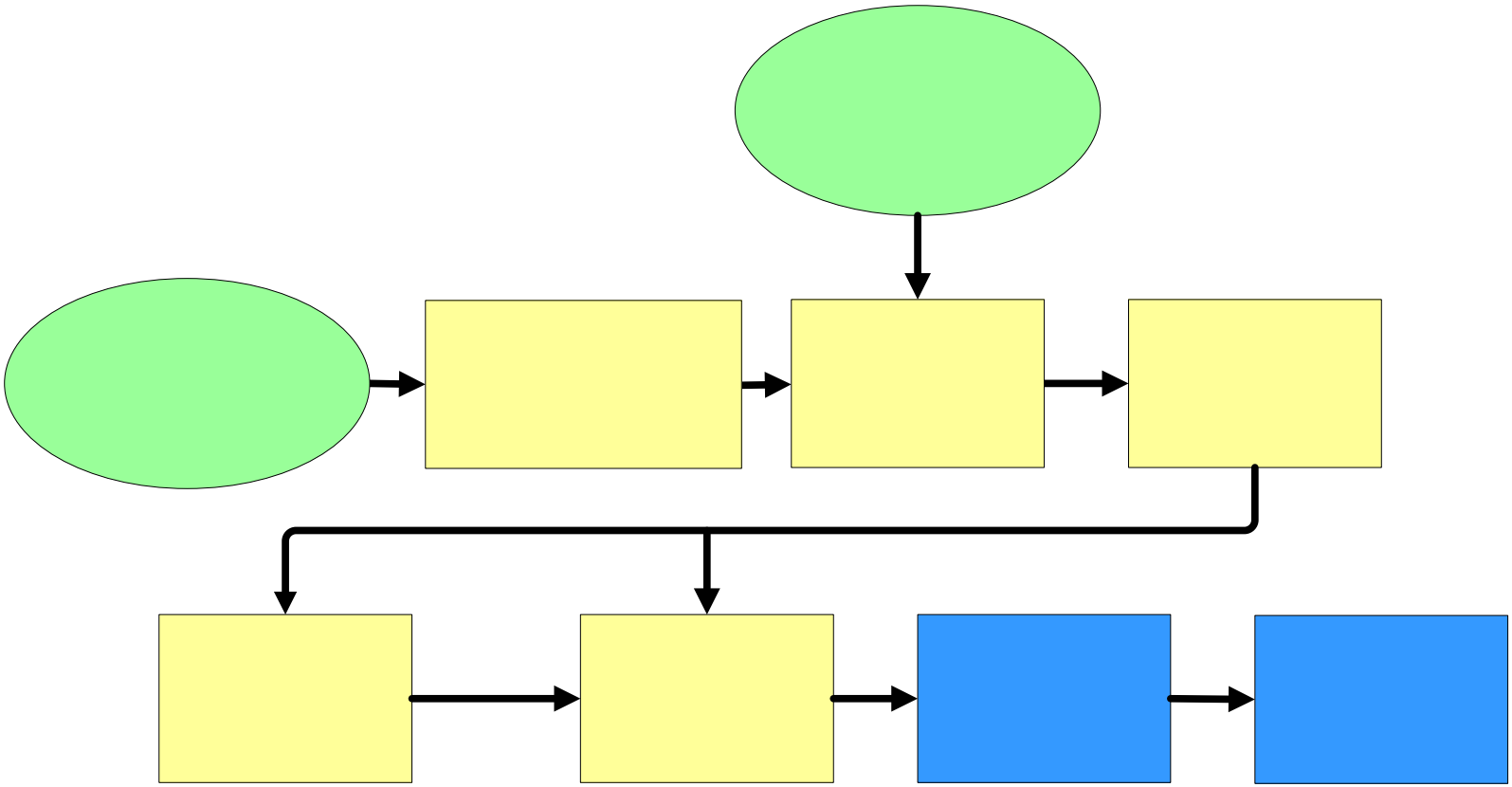
Derived Technology

- **UIASIC**
  - Developed by ARDEC for M152 RAMS
  - Implements 5 minute safe separation timer for hand emplaced demolition devices
  - Adequate to provide needed safety for safe/arm functionality at a reasonable cost
- **Solenoid & Capacitor Approach**
  - Derived from previous work done by ARDEC for EOD on Shock Tube Initiators
  - Low cost approach compared to previous implementations

Derived Requirements

- Accept input signals from various RF firing devices (i.e. MK186, MX22 and M152 RAMS) in addition to existing initiators currently being used
- Device should contain internal power supply capable of providing output discharge
- Safe separation timeout required due to stored energy in firing device
- Capable of initiating blank commercial 12 gauge shotgun shell
- Compatible with both PAN and RE1212 Disrupters
- Compatible with small caliber disrupters (.22cal and 9mm)

System Block Diagram



Technical Approach

- 3 State arming switch

Switch Position	Device Status	Indicator Status
0°	OFF	OFF
90°	Power Up	BLINK
180°	Arm	SOLID during safe separation OFF when armed

0°

90°

180°

Technical Approach

- Power source
  - **Two 9V batteries in parallel**
- Window comparator monitors input pulses for qualification
  - **Input must be minimum of 7ms in duration**
  - **Voltage must be between 16V and 400V DC**
  - **Ensures that both inputs from RF receivers and existing initiators accepted**
- UIASIC (Universal Initiator Application Specific Integrated Circuit) for Safe & Arming
  - **Implements 5 minute safe separation timer for hand emplaced demolition devices**
  - **Developed by ARDEC for M152 RAMS**

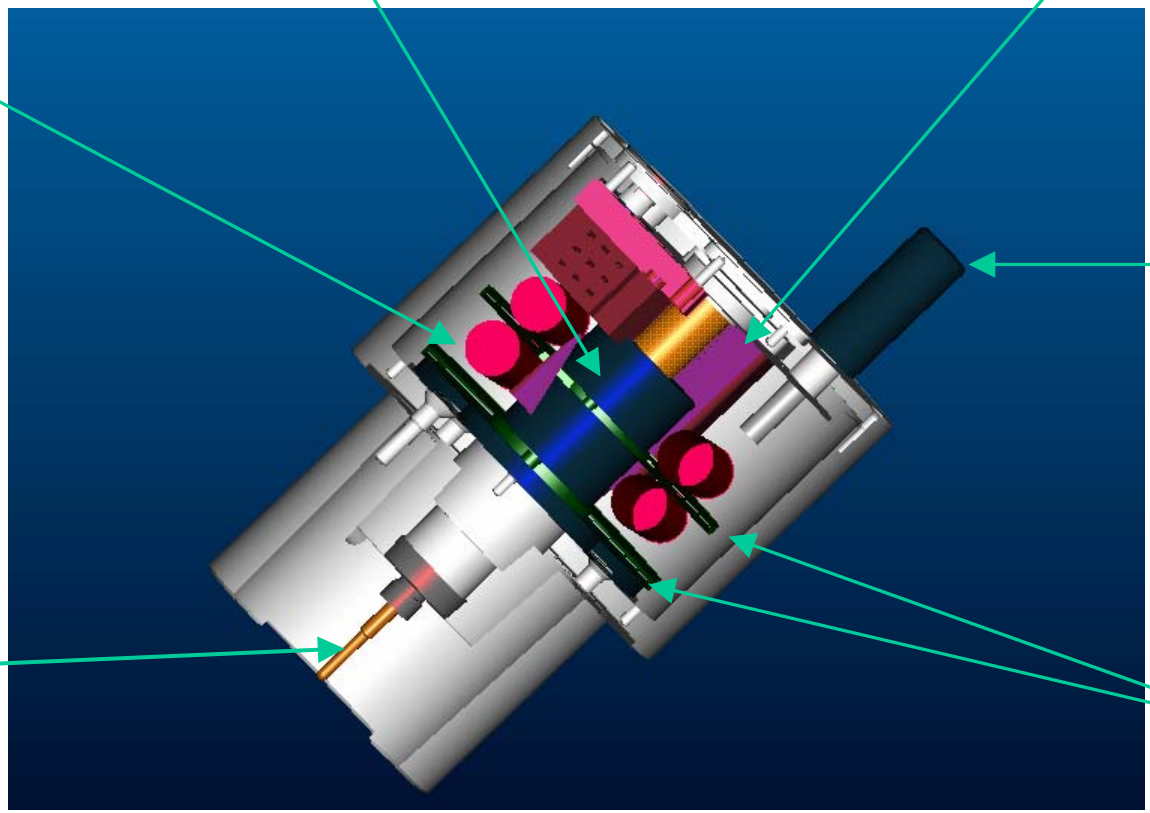
Technical Approach

- DC-DC converter
  - **charges 350uF photoflash capacitor bank from 9V to 200V DC**
- MOSFET trigger circuit
  - **discharges stored energy into solenoid when stored energy reaches 200V DC**
- Solenoid used to perform electrical to kinetic energy conversion
- Mechanical Housing Design
  - **Designed to fit baseline PAN cannon**
  - **Adapter needed to fit RE1212**

Firing Sequence

1. Turn ARM Switch to 90° position allowing circuit power-up (LED indicator Blinks)
2. Complete turn of ARM Switch to 180° position beginning safe separation timeout (LED Solid)
3. After 5 minutes, LED turns off and device waits for input
4. External fire command from remote electrical firing device begins photoflash capacitor charging
5. When capacitor bank reaches 200VDC, energy is dumped into solenoid

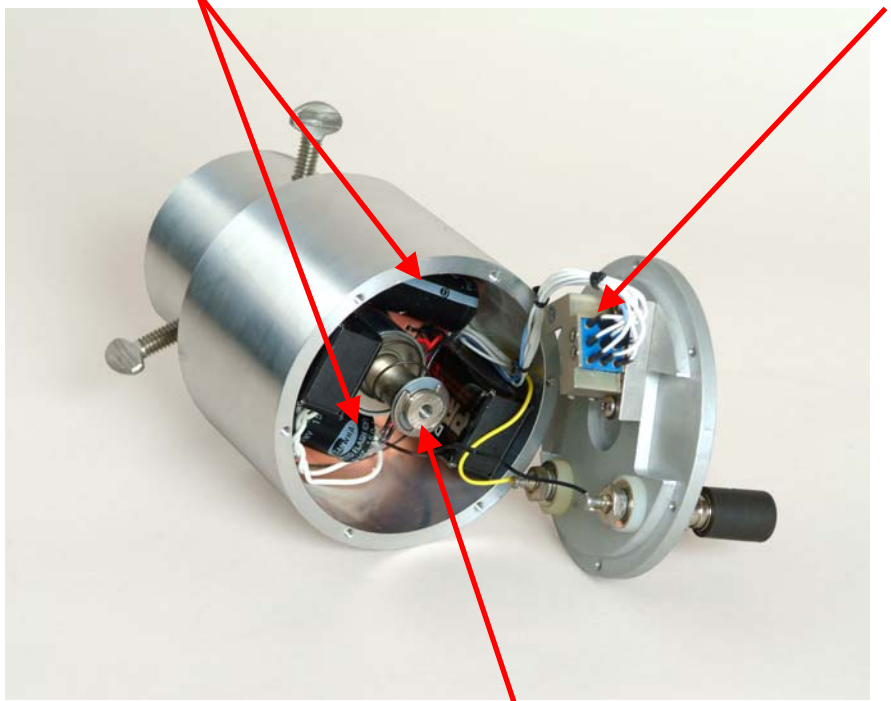
Device Drawing

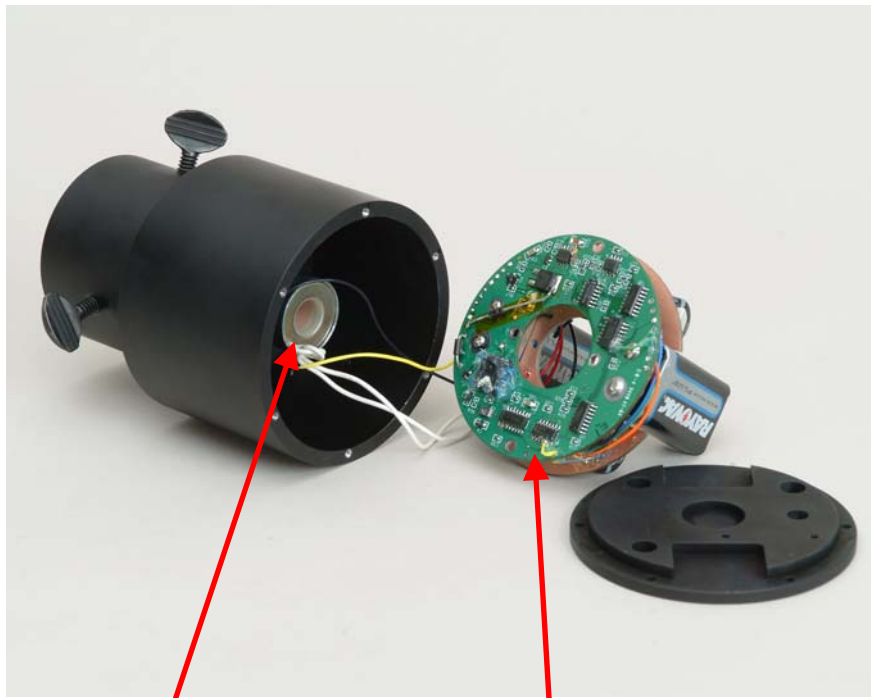


Firing Device Hardware

Photoflash Capacitors

3 position switch connections





AFT end of firing pin

Solenoid

Electronics Assembly

PAN Hardware

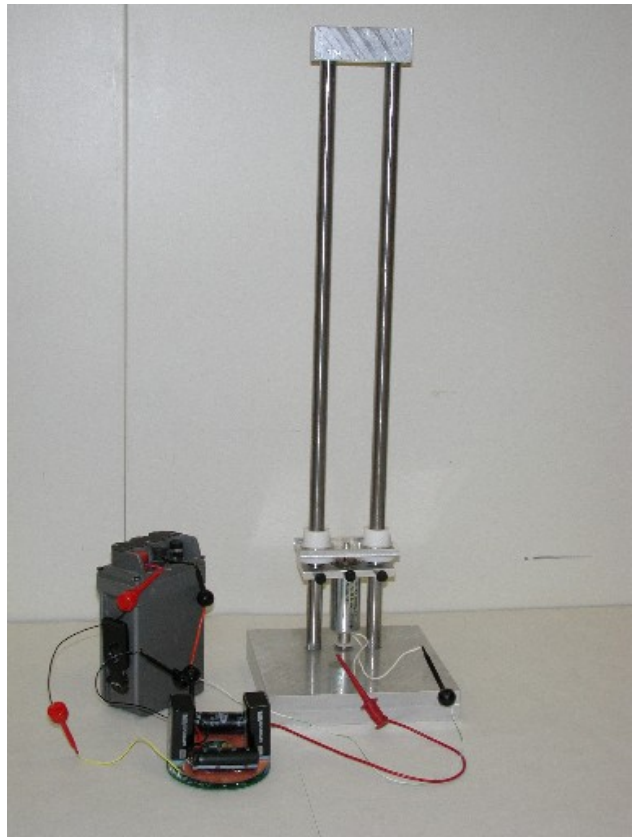
PAN with new firing device attached

Firing Device with firing pin showing

Tests & Results

First test:

- Using a steel plunger, 2oz. test sled must travel minimum of 16 inches
- 24V solenoid and a 350uF photoflash capacitor bank
- MOSFET trigger circuit from the baseline PAN used to trigger experimental shots



Tests & Results

Second Test:

- Tactical configuration of PAN Disrupter.
- RAMS RF firing device
- Initiated shotgun shell primers
- 3 shots fired
- 100% initiation success

Current Status

- Successful demonstration of prototype systems with PAN Disrupter
- 5 prototype units completed and ready for delivery
- Compatibility testing for small caliber disrupters in planning stages
- Currently completing new PCB layout to include modifications and upgrades from demo units
- Redesign required on RE1212 Adapter due to water from recoilless action. Testing to be completed.
- Fabrication of metal parts completed
- 30 production units in assembly

Summary

- PAN Disrupter allows civilian and military EOD personnel to reliably disable IEDs without initiating them
- Compatible with existing remote electrical firing devices such as M152 RAMS
- 5 Demonstration units fabricated, assembled, and tested
- 30 Production units currently completing fabrication and beginning assembly process
- Designed to be simple and inexpensive while maintaining compatibility with other EOD disrupter tools