Programmable Initiators to Extend Functionality of Reserve Power Systems

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

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Thermal Batteries

- Ideal power source for many munitions
  - Long shelf life
  - Good temperature performance
  - High power capabilities
- Reserve battery
  - Initiated by a pyrotechnic device - Igniter
  - Heat generated melts electrolyte to activate the battery

Igniters

Main Functions

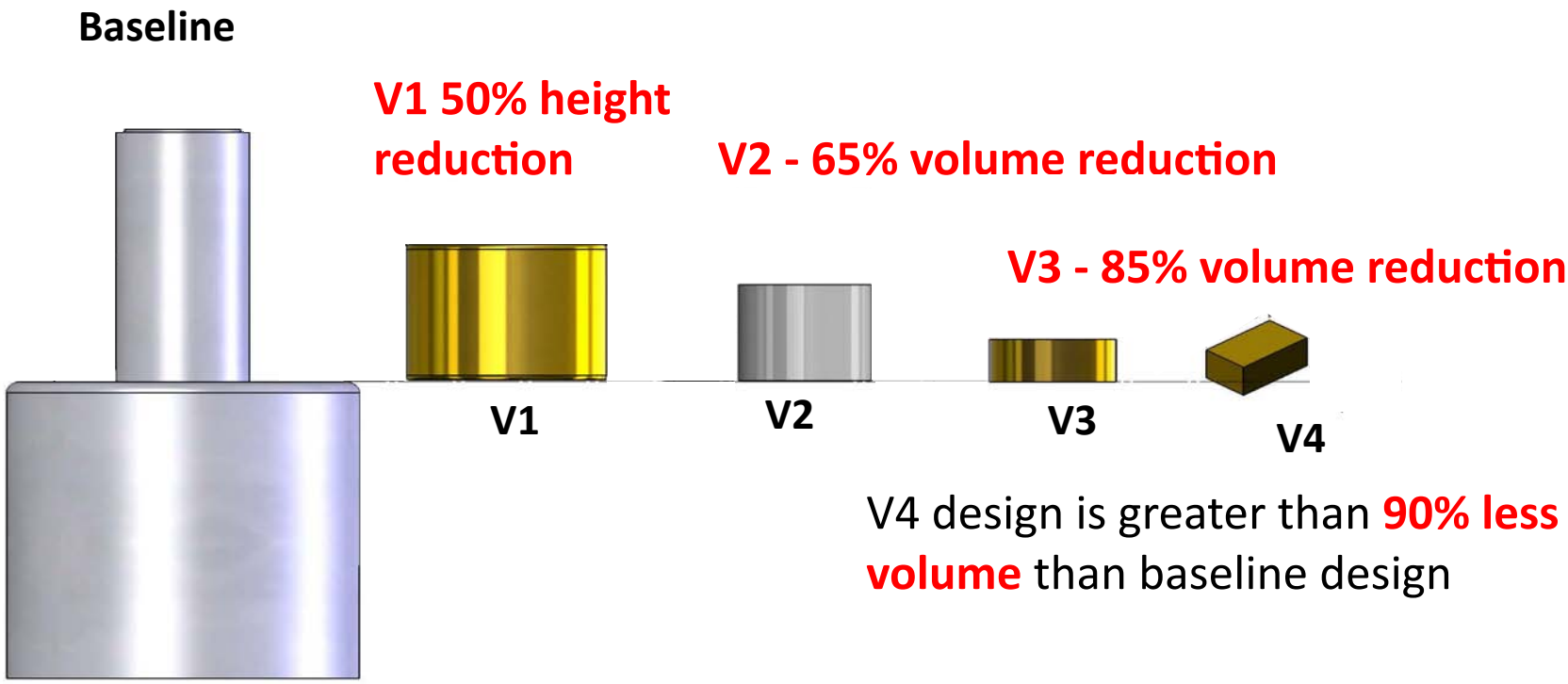
- Ignites pyrotechnics to heat up the battery
- Safety mechanism
  - Ideally the igniter only fires when shot from a gun
  - Differentiate between dropping events and gun launched events
    - Important to include magnitude and duration of impulse

- Classes of Igniters
  - Inertial Igniters – mechanically initiated pyrotechnics
  - Electrical igniters – electric matches, squibs – powered by some external power source and decision circuitry

Inertial Igniter Improvements

Family of Inertial Igniters

— Miniature, Scalable, Producible designs that can easily accommodate a wide variety of applications



V4 design is greater than **90% less volume** than baseline design

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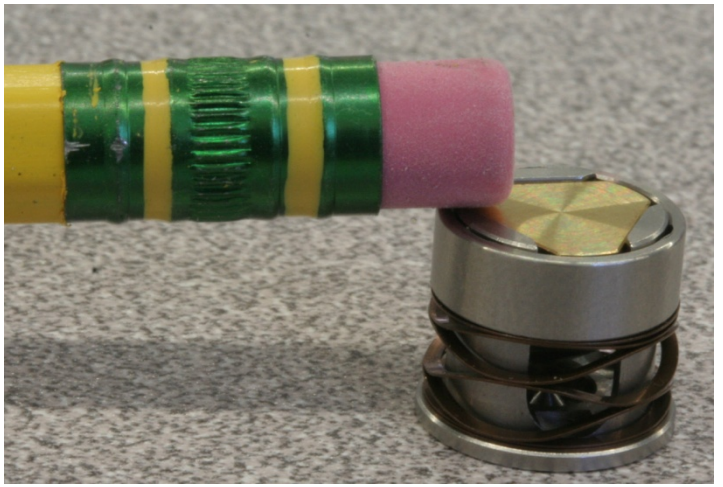
V2 Inertial Igniters

- V2 with Improved Producibility
  - Awarded Army CPP (Commercialization Pilot Program) to improve manufacturability
  - Reliability testing ongoing
  - ~ 65% smaller in volume w/ same functional requirements



V2 operation

V2 Inertial igniter operation

Locking sleeve under equilibrium

Under No-Fire acceleration locking sleeve will return back to equilibrium

Only under All-Fire does the locking sleeve unlock the striker.

Striker Released

Programmable Initiators

- Piezoelectric harvester converts forces from acceleration into electrical charge
  - Collected in main storage device
  - Activates safety circuit
    - Determines all-fire/no-fire levels
    - Enables power source to activate pyrotechnic device
- A simple counter could provide a delay of up to days after launch
- Acceleration inputs could also trigger events

Advantages of Programmable Initiators

- Inertial igniters activate upon setback - Turn battery on when it is actually needed allows for optimization of battery size
- No external power source/decision circuitry required
- Can easily satisfy a variety of all-fire & no-fire requirements
- Scalable – Flexible, low cost, and size

Summary

- Families of miniaturized igniters for thermal batteries are/have been developed
- Significant volume reduction of inertial igniters
- Programmable initiators offer significant gains in flexibility
- Improved igniters offer significant gains in miniaturization without affecting safety, reliability, functionality, or cost.