Guided Artillery Shell Applications

Why are Thermal Batteries the ideal source of power in artillery shells?

- A thermal battery is inert until activation making it ideal for applications requiring a long storage life before use,
- has a very wide operating temperature range,
- its inherently robust design means that it can withstand high levels of vibration/shock and acceleration before and during its operating life,
- is an electrical primary source that is available for the length of its shelf life, over 15 years,
- is totally maintenance free,
- has an exceptional reliability over 99.95 %,
- can be activated quickly, from 0.2 s, including under the effort of the firing acceleration,
- provides the highest Specific Power capability.

Several design examples are presented below. All of them have been fully qualified and are now in production.

EXAMPLE 1

Terminally Guided Munition

Characteristics:
- 16/23 Volt with taps (4 Voltage outputs)
- Up to 2 A for 55 seconds
- Voltage rise: less than 0.5 second
- Operating temperature range: -30°/+48°C
- Mass: 0.095 kg
- Percussion cap initiated
- Non-operating spin: from 20,000 rpm to 6,000 rpm
- Operating spin: from 6,000 rpm downwards

Mechanical environments:
- Before battery activation shock:
  18,000 g (longitudinal) – Battery not activated
- Spin rate (lateral acceleration):
  - > 2,000 g: battery not activated
  - > 1,500 g: active battery
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**EXAMPLE 2**

**Battery with striker mechanism**

Usually, thermal batteries are activated by an electrical impulsion initiating integrated igniters. A mechanical effort can also be used through a striker. ASB Group has developed a brand new technology which can be taken as an alternative to the common activation methods. Under the shape of common thermal battery, we use an inertial initiator permitting the activation under acceleration.

**The objectives are the following:**
- Provide an autonomous solution: there is no wire connection to the system (no wire or striker system) but the battery is "self activated"
- Provide a safety barrier to the system: the battery stays inert (non activated state) until the effective launch of the shell.
- Provide a reliable solution: the battery has to be activated under the minimal specified conditions (corresponding to "all-fire") but can be stored under the logistic conditions (corresponding to "no-fire").

This principle has been qualified within batteries from diameter 47 mm and can be declined to suit various acceleration requirements.

**EXAMPLE 3**

**Terminally Guided Munition**

**Characteristics:**
- Initiated by an electrical igniter
- 15/21 V, under 1 A, for 42 seconds

**Mechanical environments:**
- Before battery activation:
  > Launch shock, longitudinal: 18,000 g
  > Angular acceleration: 350,000 rad/s²
- Active battery:
  > Lateral acceleration: 50 g
  > Shock any axis: 1,000 g/1ms

Due to their construction, Thermal Batteries are the only energy source to be compatible with the rigorous mechanical environments, demanded by artillery applications. ASB-Group is at the forefront of design and manufacture; continuously optimizing, in order to provide the same capacity in ever smaller volumes, whilst still meeting the reliability requirements under harsh conditions.