Future Electronic Fuzing for Enhanced Effects

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Overview

- Definitions and History
- Fuze Functions and Categories
- Modern Electronic Solutions and Subsystems
- Power Supply
- Other Hurdles
- Summary and Conclusion
A little bit of (Fuze) History

Definition: “A Fuze is a Device that initiates an Explosive Function.” [1]

- 1990s, Sensor Fuzes
- 1980s, Electronic Multifunction Fuzes
- 1940, Proximity Fuzes [called VT-, variable time-]
- 1650, Percussion Fuze
- 1421, Time Fuze – pyrotechnical – [Siege of St. Boniface in Corsica]

Solid cannon balls did not need a fuze

Definition

Purpose of a fuze = enable and improve effect of munition

Safety

S&A-Device; two independent arming criteria

- mechanical
- electro-mechanical
- all electric (ESAD)

Performance

Timers and/or Sensors

- mechanical / pyrotechnical
- electric / electronic
- more electronic functions
Let’s look aside

1861

1983

1985

1989

2013

2013
Fuze Functions

Point Detonating (PD)

Point Detonating + Delay (PD + D)

Layer-/ Event-Counting

Airburst (T)
Fuze Functions

Self Destruct (SD)

Proximity (PX)

Target Detection
Fuze Functions

Course Correction

"Dial a Yield"
Selectable Warhead Function
Modern Electronic Solutions

- Miniaturized Systems

Cardiac Pacemaker

77 GHz Automotive Radar
Modern Electronics Subsystems

- Microcontroller
- 9-axis Motion Sensor
- GPS-Receiver
Modern Electronics Susystems

3D infrared time of flight sensor

80x60 LWIR camera

Actuator

Single chip W-band radar
Power Supply

- All new electronic Subsystems are
  - Low voltage 1.7 - 8.5 V*
  - Low current 5 - 110 mA*
  - Low power 10 - 300 mW*

- Typical combinations for medium caliber
  \[ P_{\text{Peak}} = 50 - 500 \text{ mW} \]

  flight times of 10 - 20 sec sum up to \( E = 0.5 - 10 \text{ J} \)

- Sophisticated Power management is required to lower Energy

* for the examples shown
Power Supply

- Set-Back-Generators are far too small for these applications
- Miniaturized Fuze Batteries can do *

**DEP-14103**
- 50 mW; 3 J

**DEP-14104**
- 75 mW; 10 J

**DEP-14202**
- 500 mW; 100 J

- TEPS plus a moderate size capacitor can do *

**DEP-15001**
- 100 mW; 100 mJ

**DEP-15030**
- 200 mW; 200 mJ

**DEP-15060**
- 1000 mW; 2000 mJ

* See #16520
Other Hurdles

- All examples shown are commercial temperature range, -40°C ÷ 80°C
- Fuzes are usually -46°C ÷ 63°C (C2, AECTP 200)
- How critical is the gap of -6°C
  - geographically (colder areas) x time-wise
    - Northern Norway (Scandinavia)
    - Prairie provinces of Canada
    - Tibet
    - Much of the (former) USSR
- We see various ways to solve this issue!
Summary

- Electronic Fuzing can significantly enhance Effectivity of Future Munition
- Everyday Commercial Electronic Systems demonstrate the functions which can be achieved today → almost no limits
- Electronic Commercial Subsystems are suitable for very advanced fuze functions
- Power Supplies with the right power and energy with very long shelf life are available
- The AECTP200, -6°C issue seems to be no show-stopper

Let’s do it!
Thank you for your attention!

Questions?
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