DIEHL & EAGLE PICHER
Batterie-Systeme

Future Electronic Fuzing for Enhanced Effects

57th Annual Fuze Conference
July 30th, 2014
Harald Wich
Diehl & Eagle Picher GmbH

Overview

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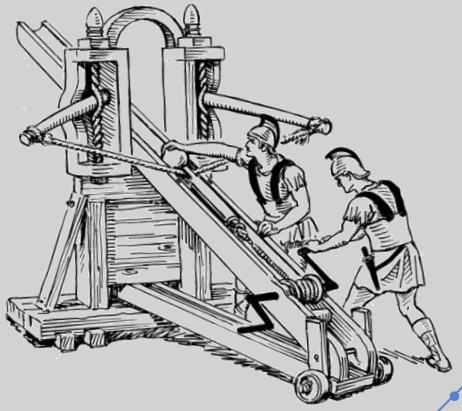
- Definitions and History
- Fuze Functions and Categories
- Modern Electronic Solutions and Subsystems
- Power Supply
- Other Hurdles
- Summary and Conclusion

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

[1] Wikipedia: „Artillery Fuze“

Definition

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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

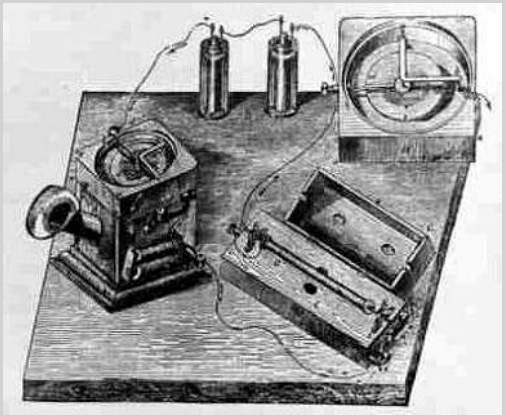
Timers and/or Sensors

mechanical / pyrotechnical

electric / electronic

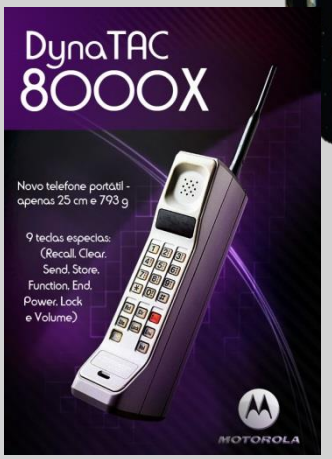
more electronic functions

Let’s look aside



1861

1985



1983

1989

2013

2013

Fuze Functions

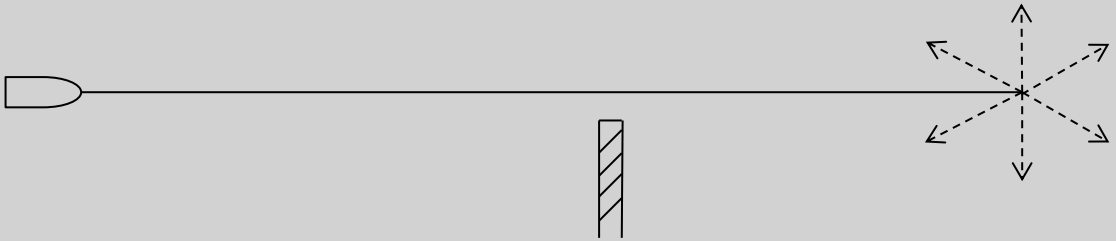
Point Detonating (PD)

Point Detonating + Delay (PD + D)

Layer-/ Event-Counting

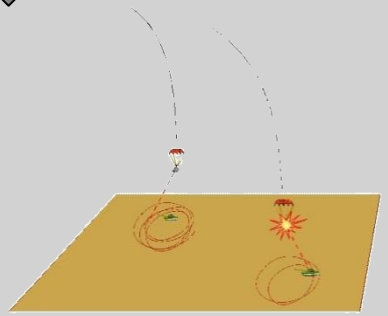
Airburst (T)

Fuze Functions



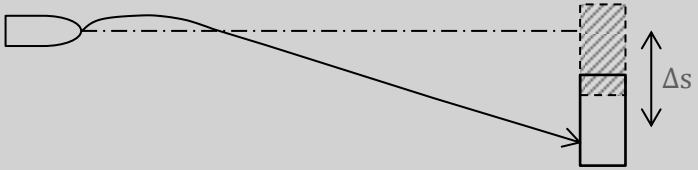
Self Destruct (SD)

Proximity (PX)

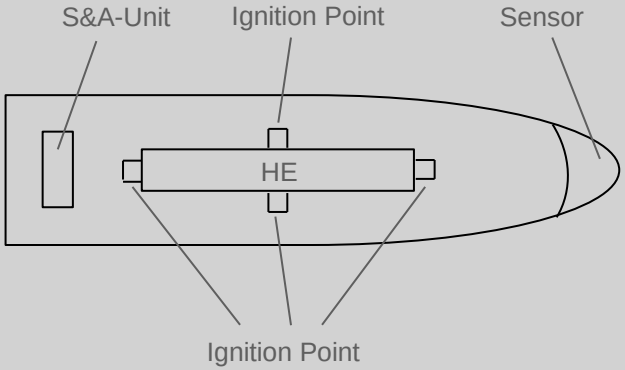


Target Detection

Fuze Functions



Course Correction



“Dial a Yield”
Selectable Warhead Function

Modern Electronic Solutions

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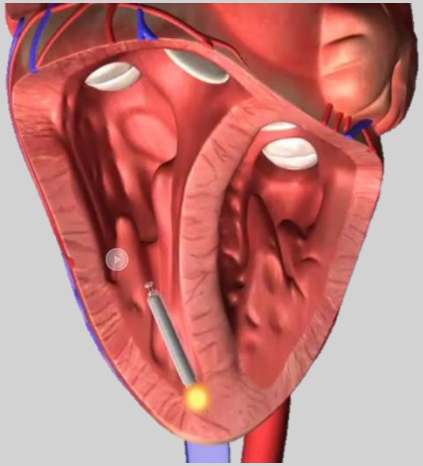
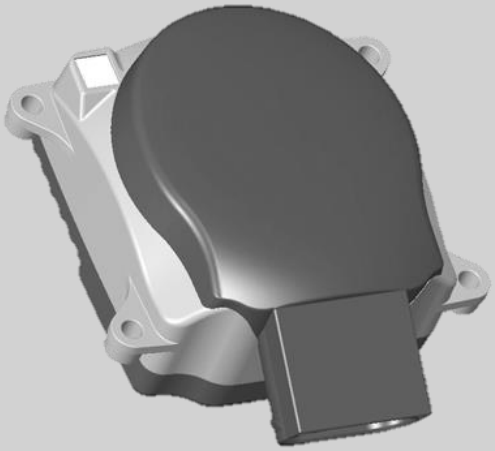
- Miniaturized Systems



Cardiac Pacemaker



77 GHz Automotive Radar

Modern Electronics Subsystems

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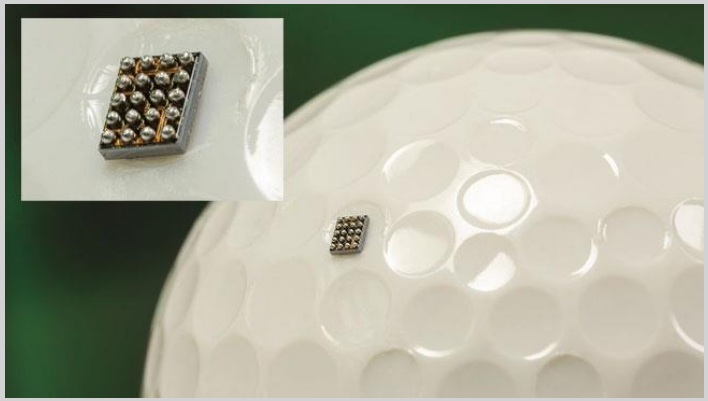

Microcontroller

9-axis Motion Sensor

GPS-Receiver

Modern Electronics Susystems

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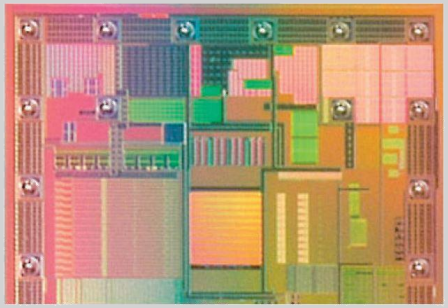
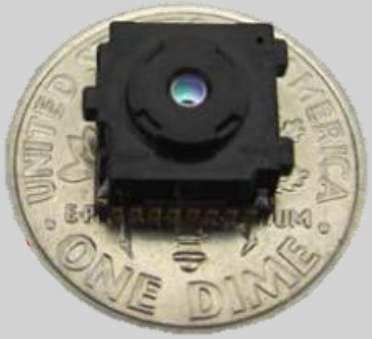
3D infrared time of flight sensor

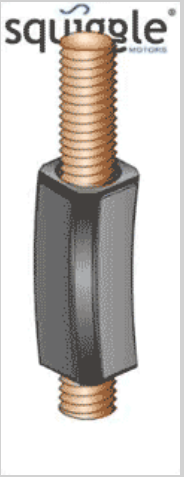


Single chip W-band radar



80x60 LWIR camera

Actuator



Power Supply

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- 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_{Peak} = 50 - 500 mW

flight times of 10 - 20 sec sum up to E = 0.5 - 10 J

- Sophisticated Power management is required to lower Energy

** for the examples shown*

Power Supply

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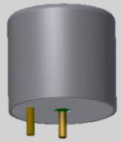
- Set-Back-Generators are far too small for these applications
- Miniaturized Fuze Batteries can do *

DEP-14103



50 mW; 3 J

DEP-14104

75 mW; 10 J

DEP-14202

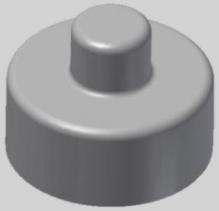
500 mW; 100 J

- TEPS plus a moderate size capacitor can do *

DEP-15001

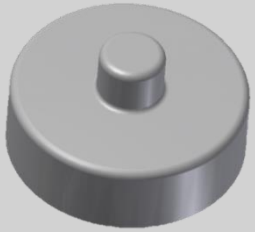
100 mW; 100 mJ

DEP-15030



200 mW; 200 mJ

DEP-15060



1000 mW; 2000 mJ

* See #16520

Other Hurdles

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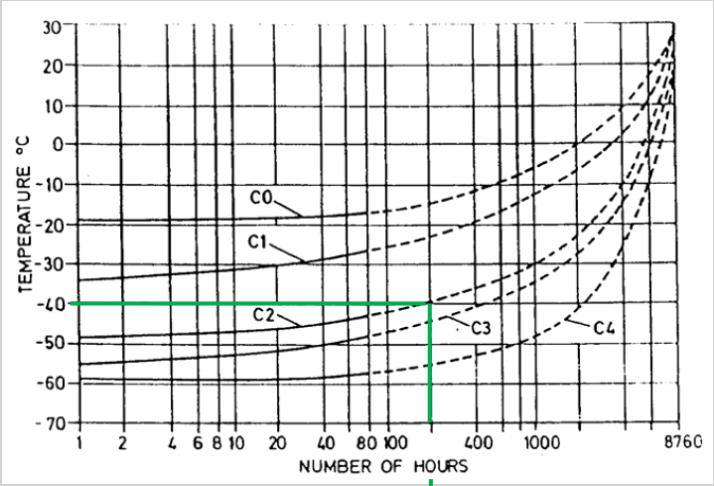
- All examples shown are commercial temperature range, -40°C ÷ 80°C
- Fuzes are usually -46°C ÷ 63°C (C2, AECTP 200)
- How critical is the gap of -6°C
  - geographically (colder areas) x time-wise
    - Northern Norway (Scandinavia)
    - Prairie provinces of Canada
    - Tibet
    - Much of the (former)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



200 hours of a year

Summary

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- 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 !

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Thank you for your attention!

Questions?

Backup

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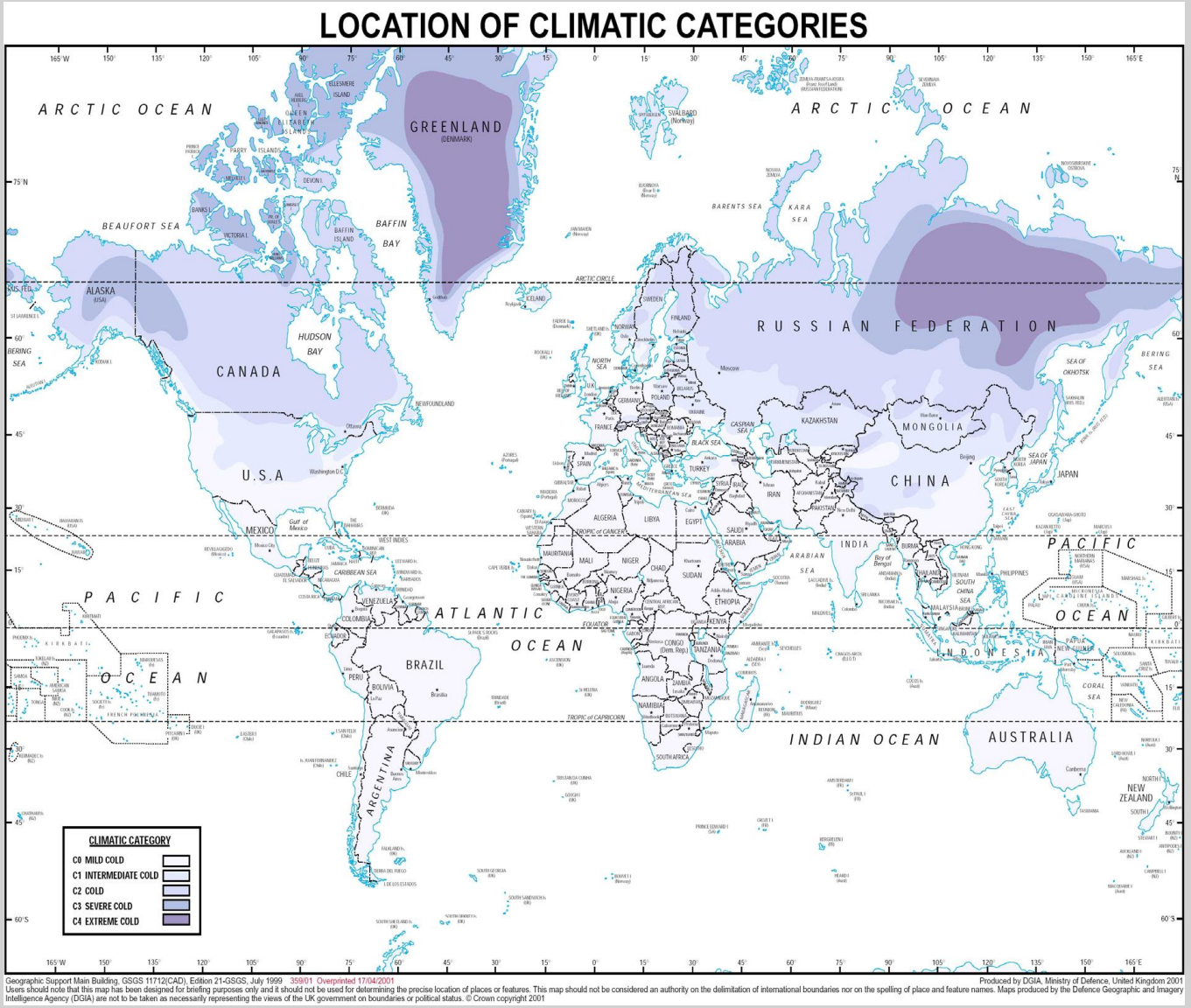

Diehl & Eagle Picher Contact

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