Aurora Fuze for PGB PWIV

R C D'A Clutterbuck

NDIA Fuze Conference 11 May 2006

Hard Target Fuzing Perspective

- Weapon Background and Capability
  - ➔Paveway™ IV
- Fuze Background
  - ➔MEHTF-PSFT
- Fuze Second Environment Sensing
- Programme Status

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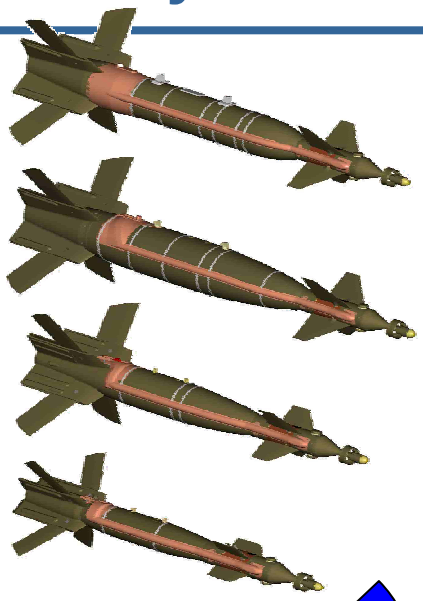
The Paveway™ IV Family Tree

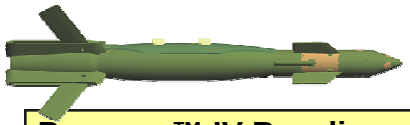
Raytheon Systems Limited

Paveway™ II
- Laser Guided Bomb family

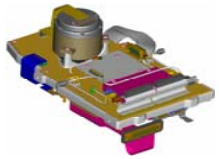
UK EPII UOR
- All-Weather
- Dual-Mode GPS & Laser Guided
- Combat Proven

EP II Lot 3
- All-Weather Dual Mode
- GPS A/J SAASM
- Mk 80 series/BLU 109

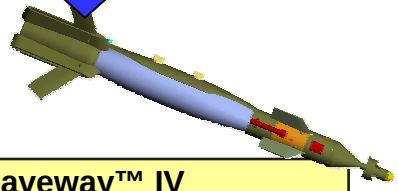




Paveway™ IV Baseline
- GPS A/J SAASM
- Air Burst
- Smart Fuze
- Mk 82 Improved Warhead with IM



Common Guidance Electronics
- Paveway Global Factory
- All manufactured by RSL in Glenrothes



Paveway™ IV
- All-Weather Dual Mode

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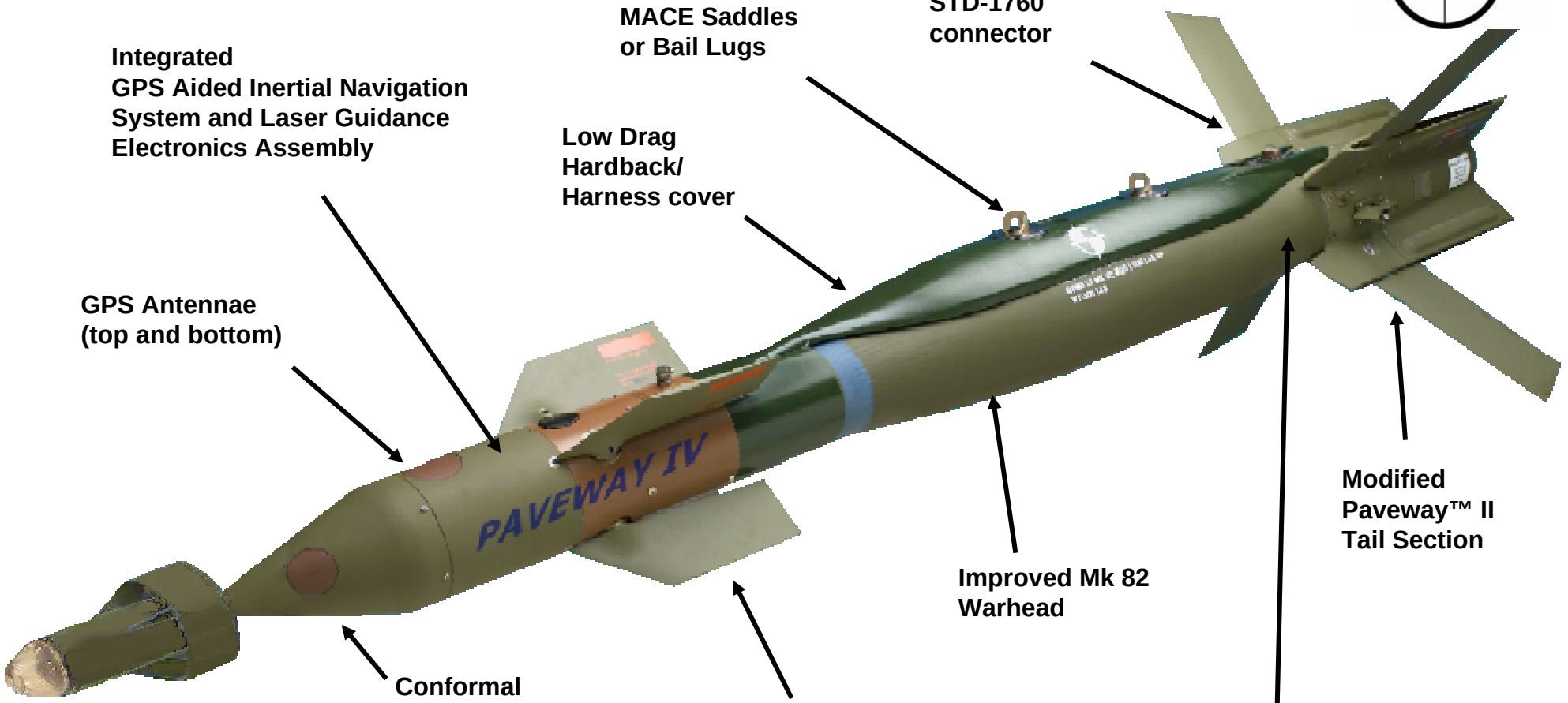
Paveway™ IV Components

Raytheon Systems Limited



Integrated GPS Aided Inertial Navigation System and Laser Guidance Electronics Assembly

Interoperable with MACE Saddles or Bail Lugs

Adjustable Mil-STD-1760 connector

Low Drag Hardback/ Harness cover

GPS Antennae (top and bottom)

Modified Paveway™ II Tail Section

Improved Mk 82 Warhead

Conformal Height of Burst Antennae (two places)

Modified Paveway™ II Control Section

Programmable Smart Fuze

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Company Background

TME is a Fuzing Company

Building hardened fuzes since 1914

World's first In service Proximity Fuze (710 Electro Optical Pistol) ('42)

World's first hardened and electronic multifunction bomb fuze (MFBF) - 1981

- **27,500 MFBF built**
- **Successful FCT trial at Eglin - 1992**
- **Used by RAF, RSAF and USAF in Desert Storm**
- **Kosovo data indicates >99% reliability for MFBF in 400+ releases**

Pioneer in modern fuze hardened electronics

1918 - Shell Fuzing

1940's - Airborne Radar, Shell Fuzing, Proximity Fuzing (Rockets)
Bomb Fuze for "Bouncing Bomb" etc.

1950's - Naval Proximity Shell Fuzing

1960's - No.907 RF Proximity Fuze for Bombs.

1970's - No.952 RF Proximity Fuze for Bombs.
Multi Role programmable Shell Fuze (MRF)

1980's - SG357 Runway Cratering Weapon
MFBF (No.960) Multi-Function Bomb Fuze

1990's - Intelligent Hard Target Fuzing Research
EPIFS

2000's - Intelligent Hard Target Fuzing.
MAFIS, HTSF, MEHTF
PGB/ABF
BDI/BDA
Fuzing in High Speed Impacts
Paveway IV

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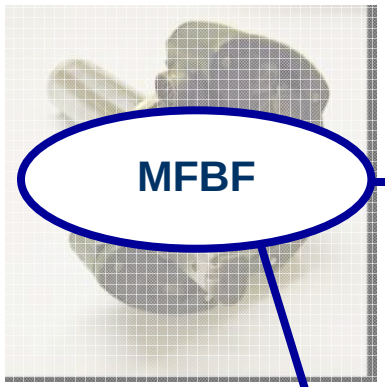
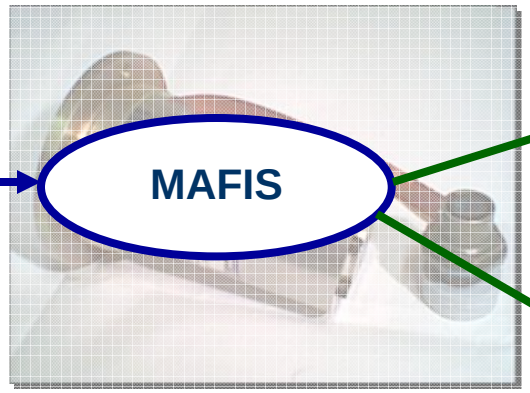
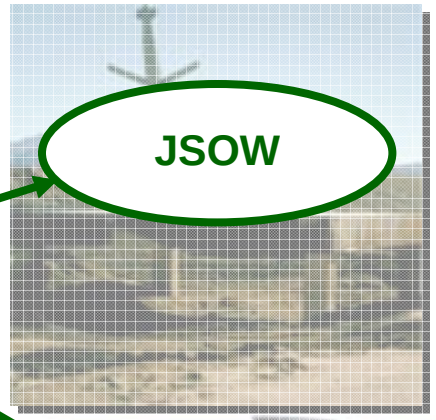
TME Bomb Fuzing Family Tree



MFBF

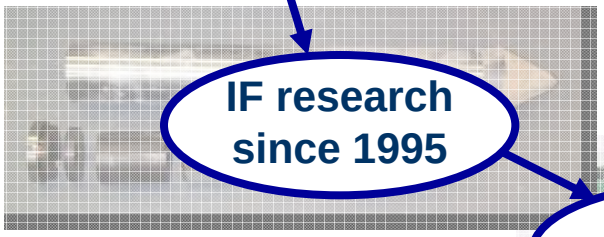


MAFIS



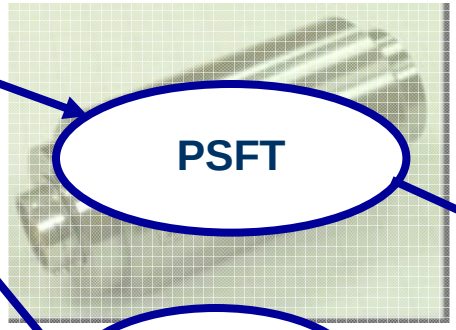
JSOW

Storm Shadow



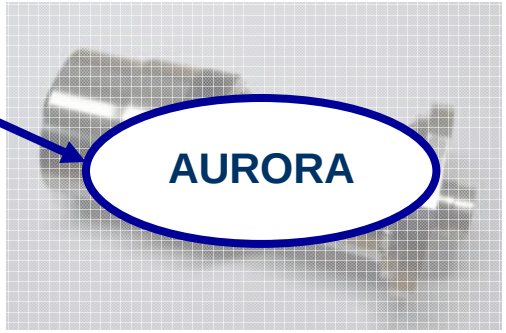
IF research since 1995

MEHTF



PSFT

FIBDID



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Background To PGB Fuze

MFBF

MAFIS

JSOW

Storm Shadow

IF research since 1995

MEHTF

PSFT

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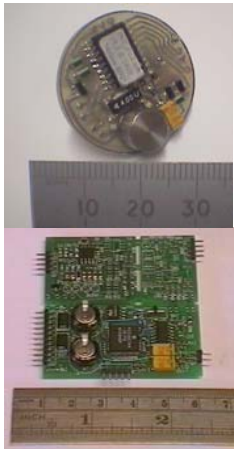
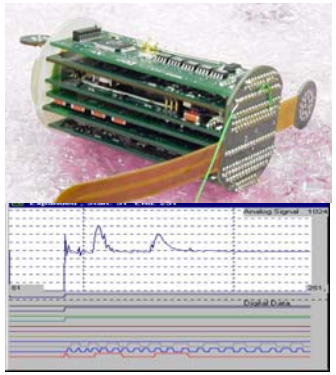
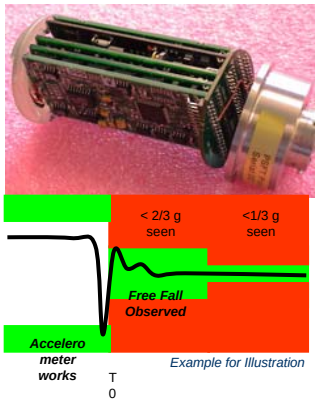
Paveway IV (PGB)







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Summary of Requirements for Safety Sensors:

1: Sense the Intentional Release from the launch platform

2: Confirm Weapon has been released into the expected environment

(Operation of at least one of the independent safety features shall depend on sensing an environment after first motion in the launch cycle or on sensing a post launch environment.) STANAG 4187 6b3

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Typical Sensors used in past

Air speed,

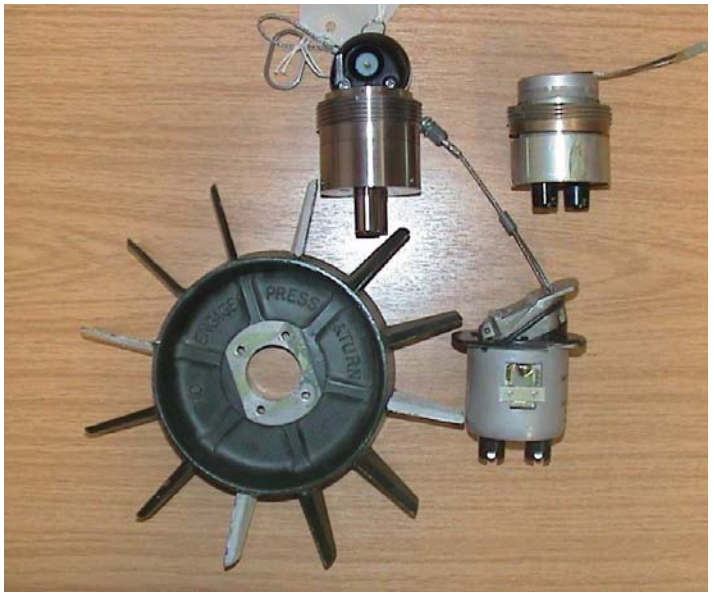
Can provide power sources

(Bigger Area :- More Power {& Drag!})

But: Senses an environment that is not totally unique to "release"

(mainly is "lanyard pulled")

Also issues with high altitude, thin air, Damage, drag etc.



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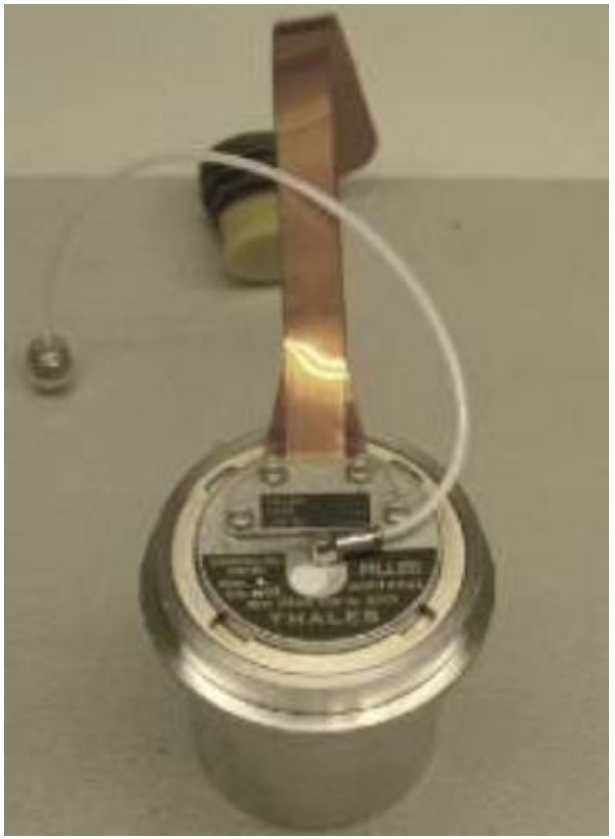
Typical Sensors used in past

Air pressure:

- **Pitot (air speed)**
- **Motor operating**



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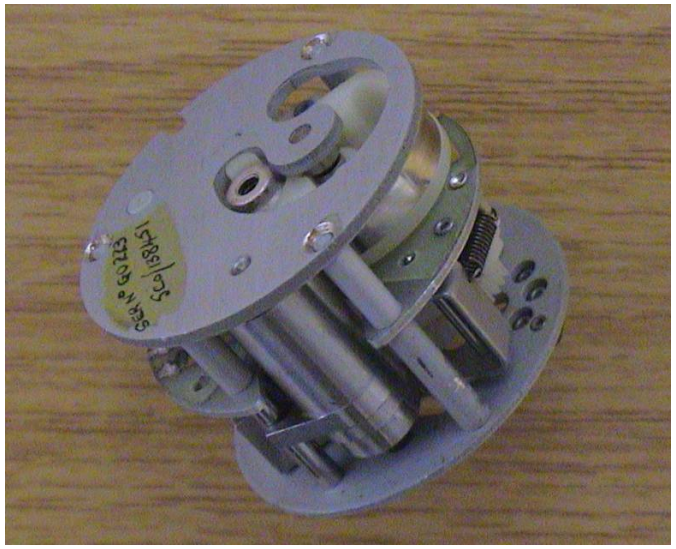
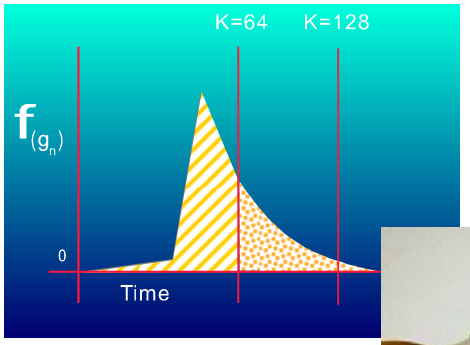
Typical Sensors used in past

Acceleration sensing:

Parachute operation detection

(Both Mechanically and Electrically)





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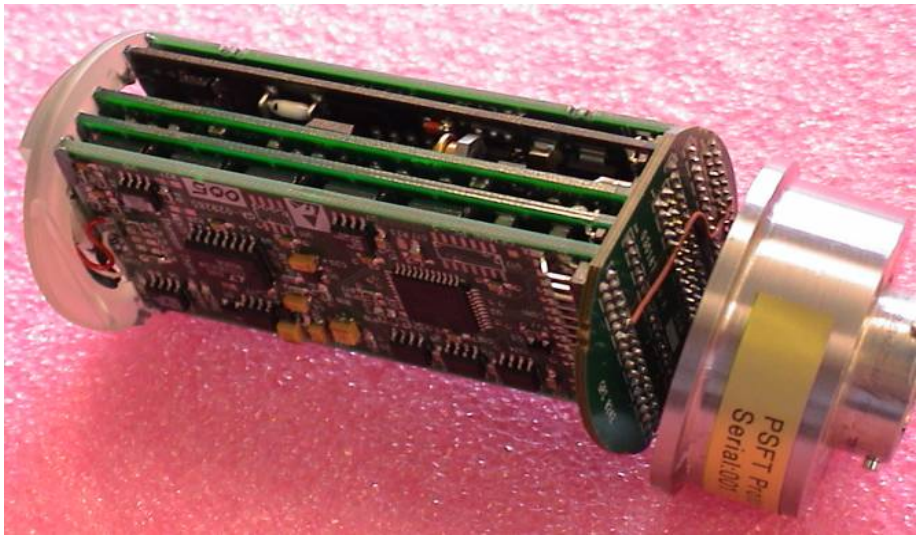
PSFT Phase II Research added Improvements on MEHTF



- **Improved Safety Architecture**
  - ➔ **Late Arm**
  - ➔ **Potential for different Arming sensor suites**
    - **Release Environment Observation**

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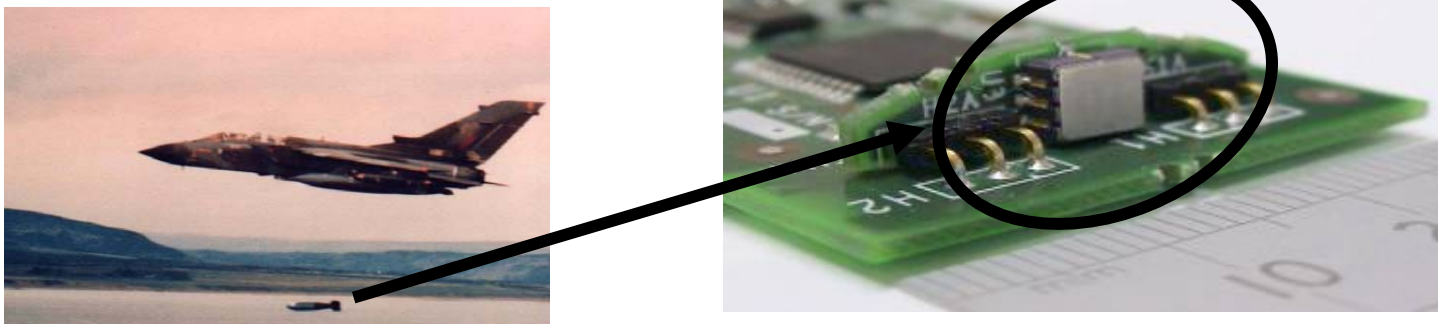
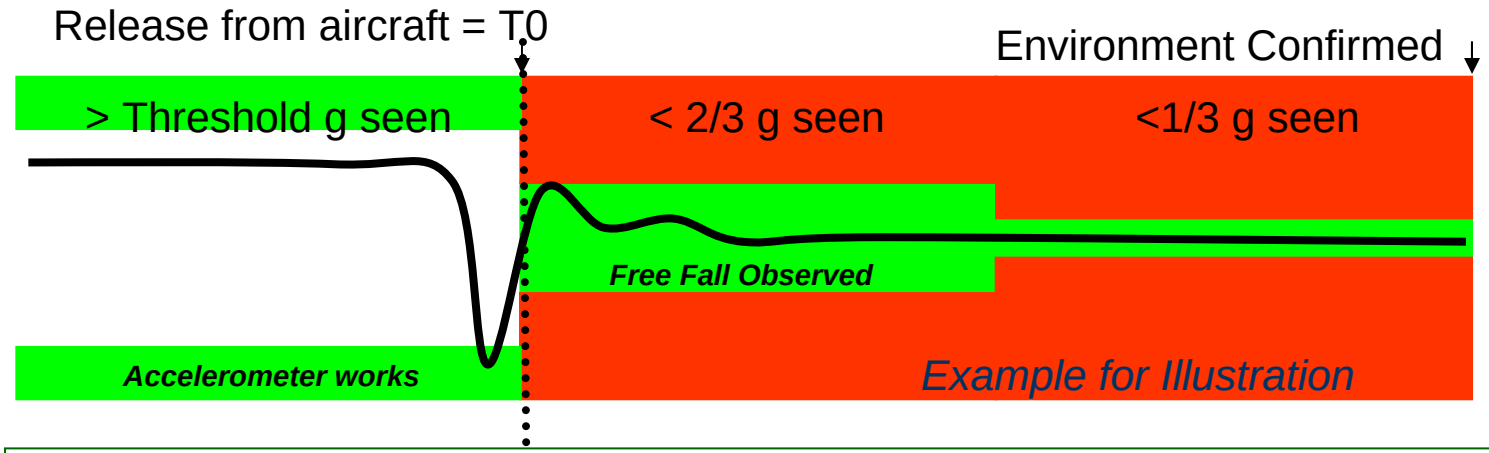
PSFT Fuze Internal “Second” Environment Sensing

- PSFT introduced crossed axis MEMS Accelerometers and Processor to sense Post Release Environment





EXAMPLE : Internal Fuze Accelerometers monitor unique post launch zero g environment to confirm post launch environment.
: Accelerometer confirmed OK by sensing release & or carriage loads

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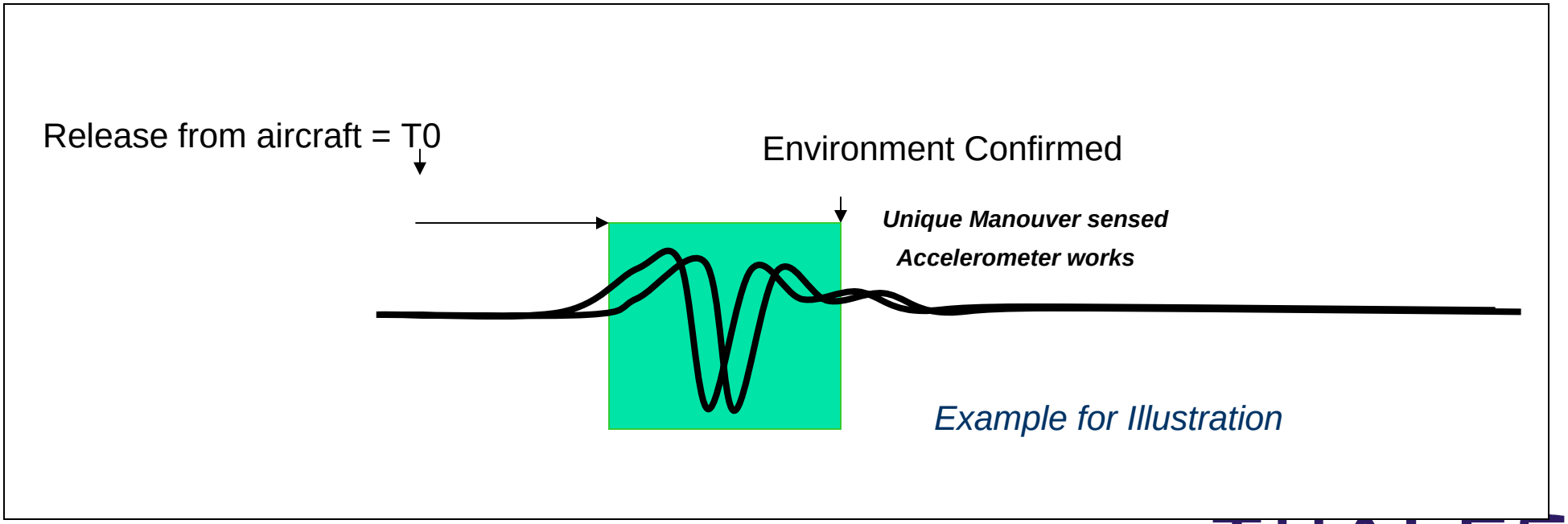
Develop, qualify & manufacture, 2003 - 2006

Built on PSFT:

Decided to make system independent of release shocks:

Initially: use a Timed Manoeuvre



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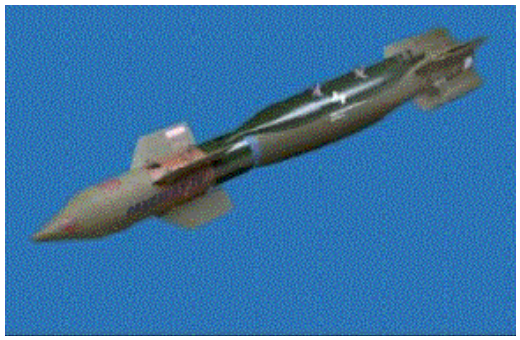
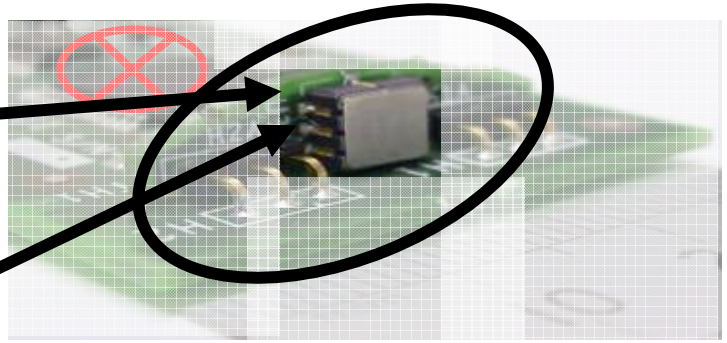
AURORA Fuze for PGB (Paveway IV)

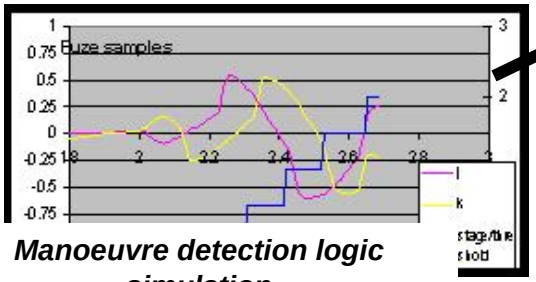
PGB PSFT Accelerometers and New Hardware to sense Timed, Co-operative Weapon Post Release Manoeuvre



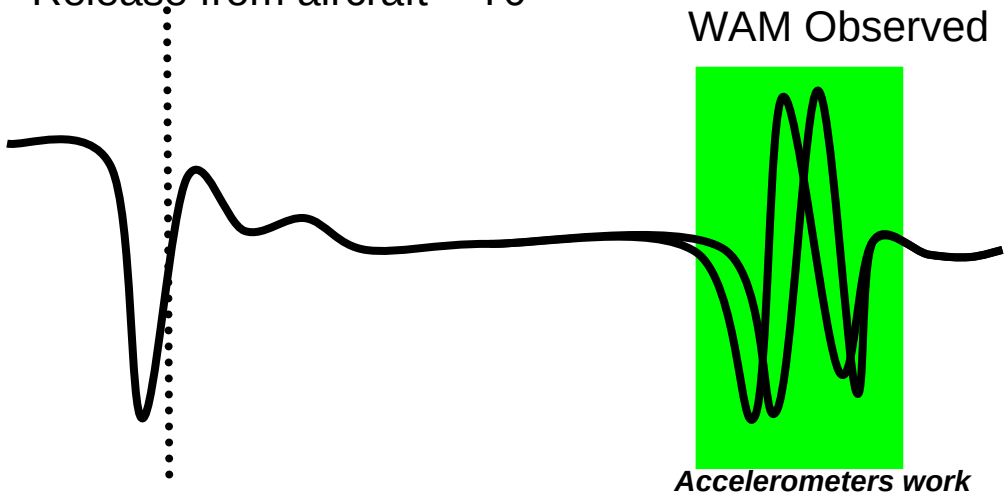


Release from aircraft = T0

WAM Observed

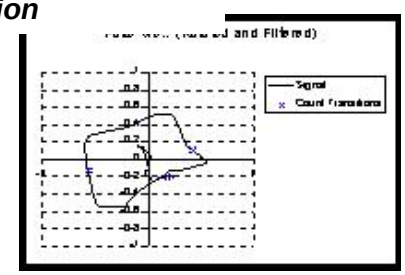


Manoeuvre detection logic simulation



Accelerometers work

WAM Timing and Phase Observed



Modelling undertaken of of 1000 simulated releases

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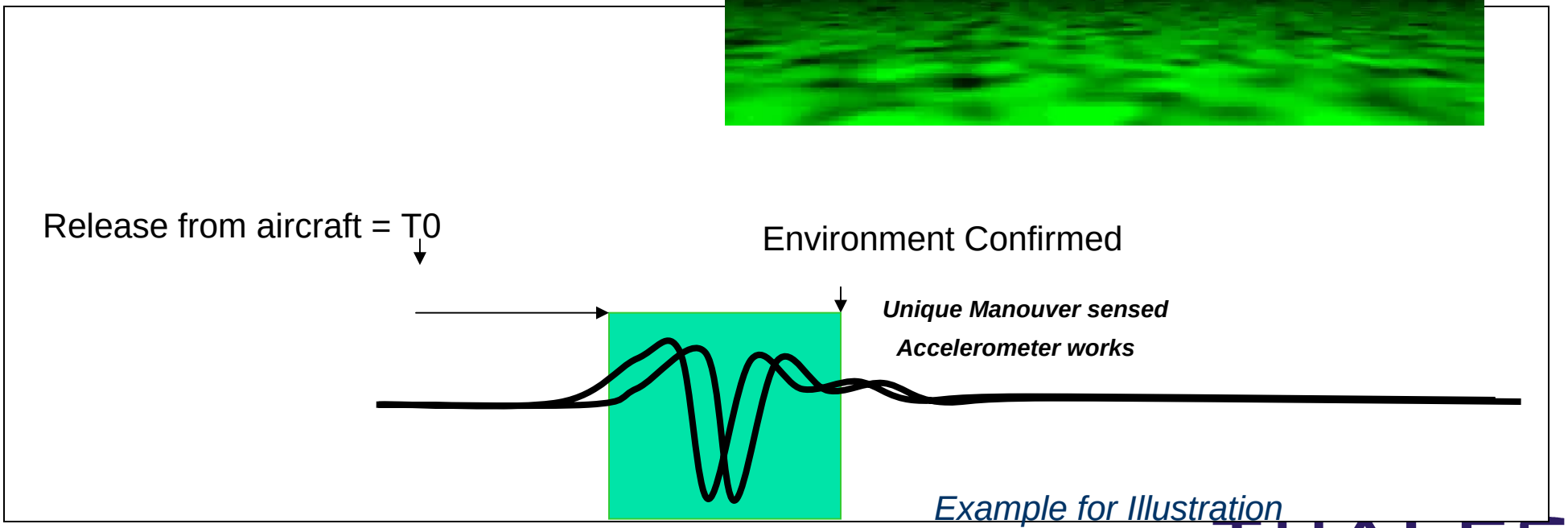
WAM Option
Initial Concept



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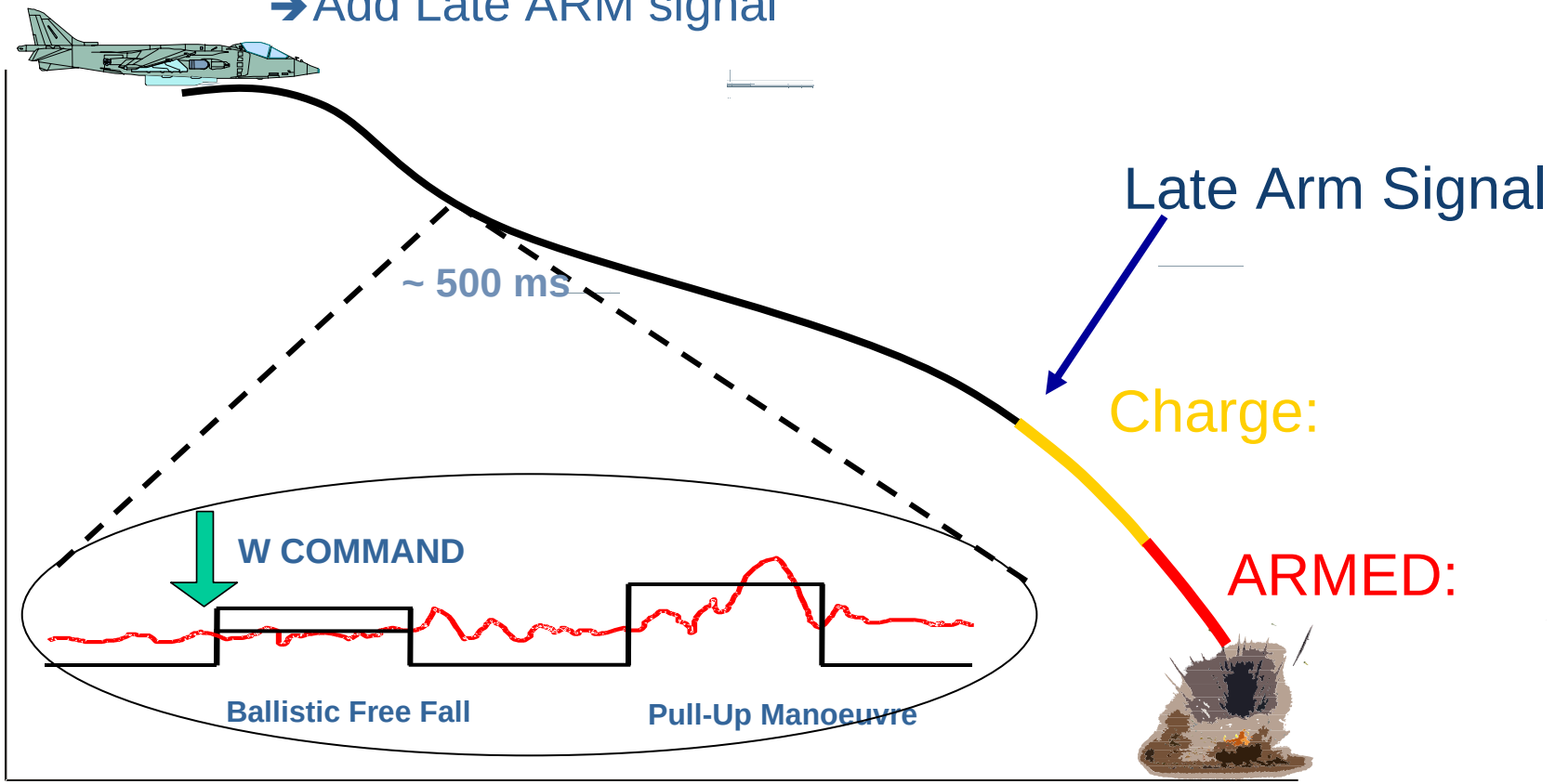
AURORA Fuze for PGB (Paveway IV) 'WAM' / 'WAD'

Further Improved concept:

- ➔Allow weapon to determine when to make manoeuvre:
- ➔Simplify Manoeuvre into 2 Stages:
- ➔Add Late ARM signal



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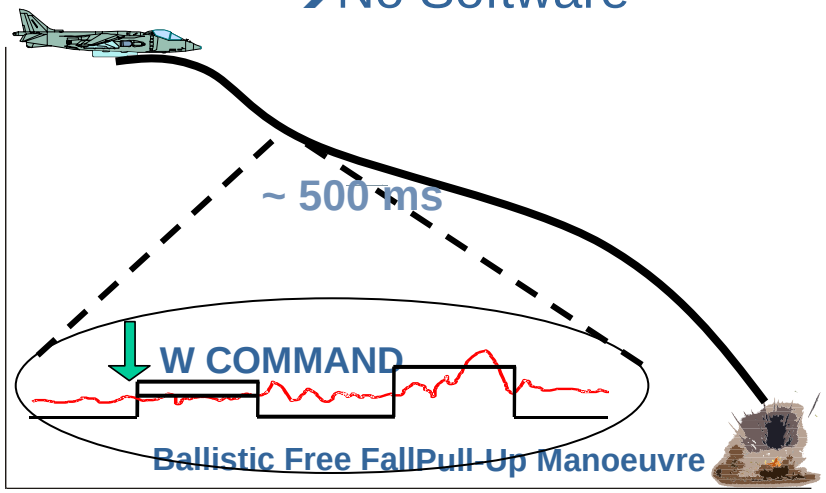
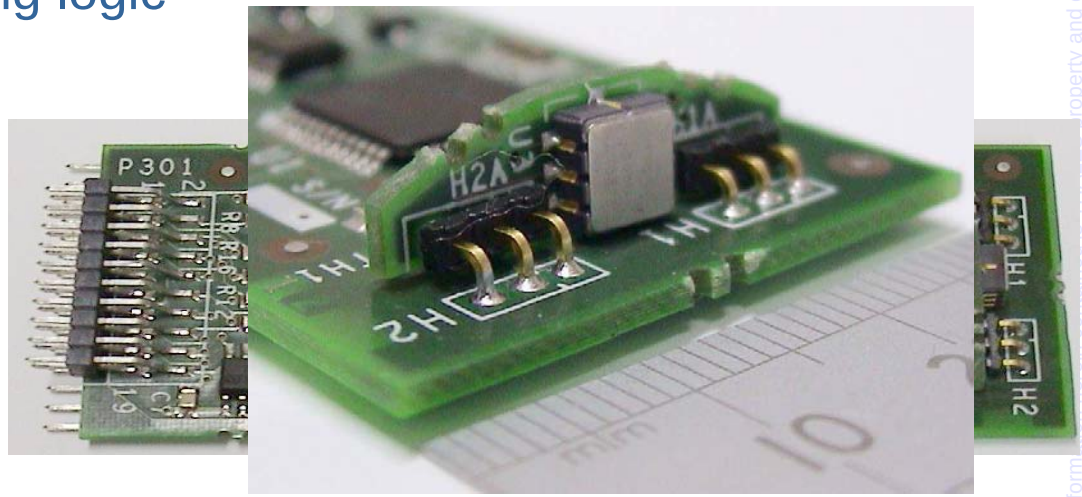
AURORA Fuze for PGB (Paveway IV) 'WAM' / 'WAD'

Advantages:

- Manoeuvre is at commanded time:
  - ➔Can be delayed to Lower Altitudes
  - ➔When convenient to Weapon
  - ➔Expands release envelope
- Is simpler to detect
  - ➔All "Hardware" checking logic
  - ➔No Software





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