Hard Target Fuzing Solutions

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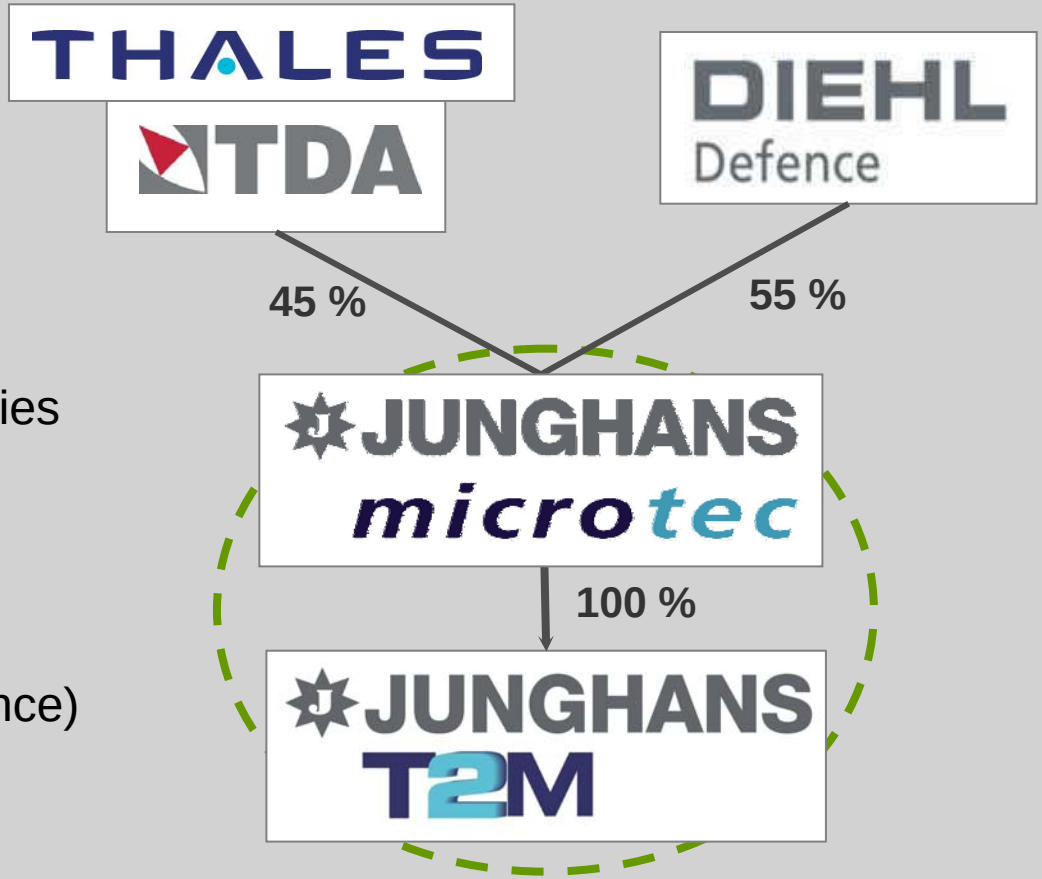
52nd Annual Fuze Conference
May 13 – 15, 2008 - Sparks, NV
"Smart Fuzing – Adding Intelligence To Fuzing Solutions"

OUTLINE

- Company Presentation
- Smart Fuzing / Target Detection Issues
- Hard Target Fuzing Background
- Hard Target Fuzing Issues
- JUNGHANS T2M Solutions
- Products and Projects

- **A global leader in the field of ammunition fuzes and S&A devices**



- Full range of products
- Key competences in fuzing technologies, ammunition electronics and micro-technologies
- Located in :
  - Seedorf (Germany)
  - La-Ferté-Saint-Aubin (France)

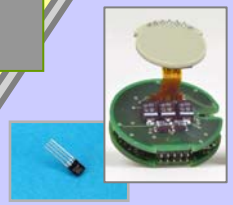
Product Range and Competences

Artillery

Mortar

Air Bomb

Missile SAD and ESAD



Sensors
Signal Processing

Micro-Technologies
Miniaturized Systems

COMPETENCES

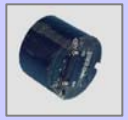
EFI / ESAD Technology

Medium Caliber and Direct Fire

JUNGHANS microtec
JUNGHANS T2M

Mission Management

Hard Target Smart Fuzing



Safety Design

Energetic Materials

dynITEC

Infantry Grenade

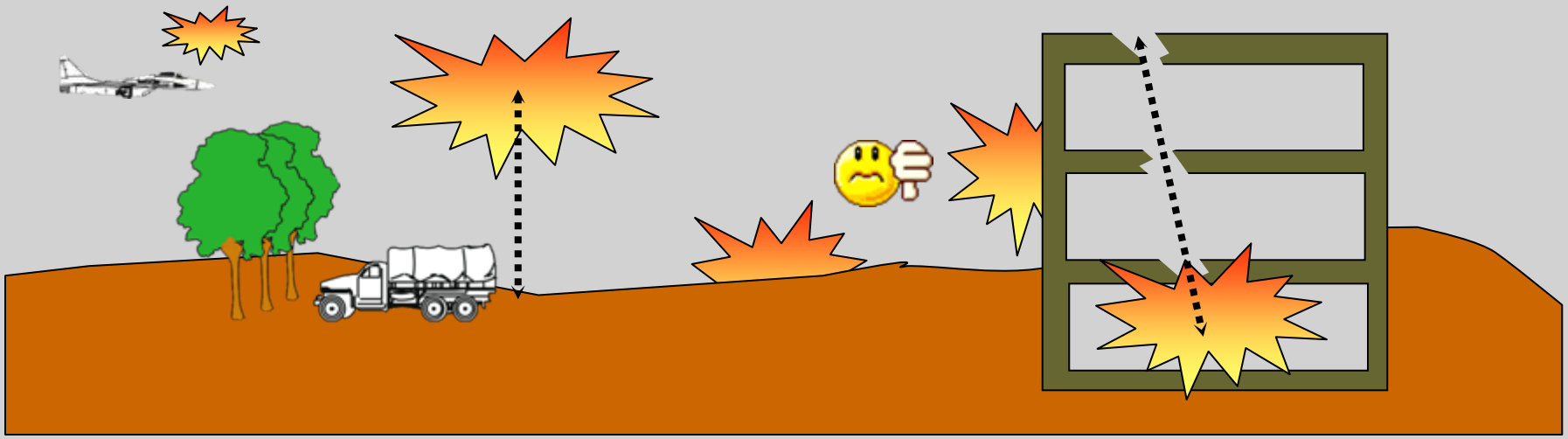
AT, A/G, G/G Rockets

Smart Fuzing / Target Detection

- Objective: Optimize terminal effect on target whatever the operational configuration is
- Solutions: Use sensors and processing to initiate the munition warhead on target at the optimum time

Proximity Fuzing

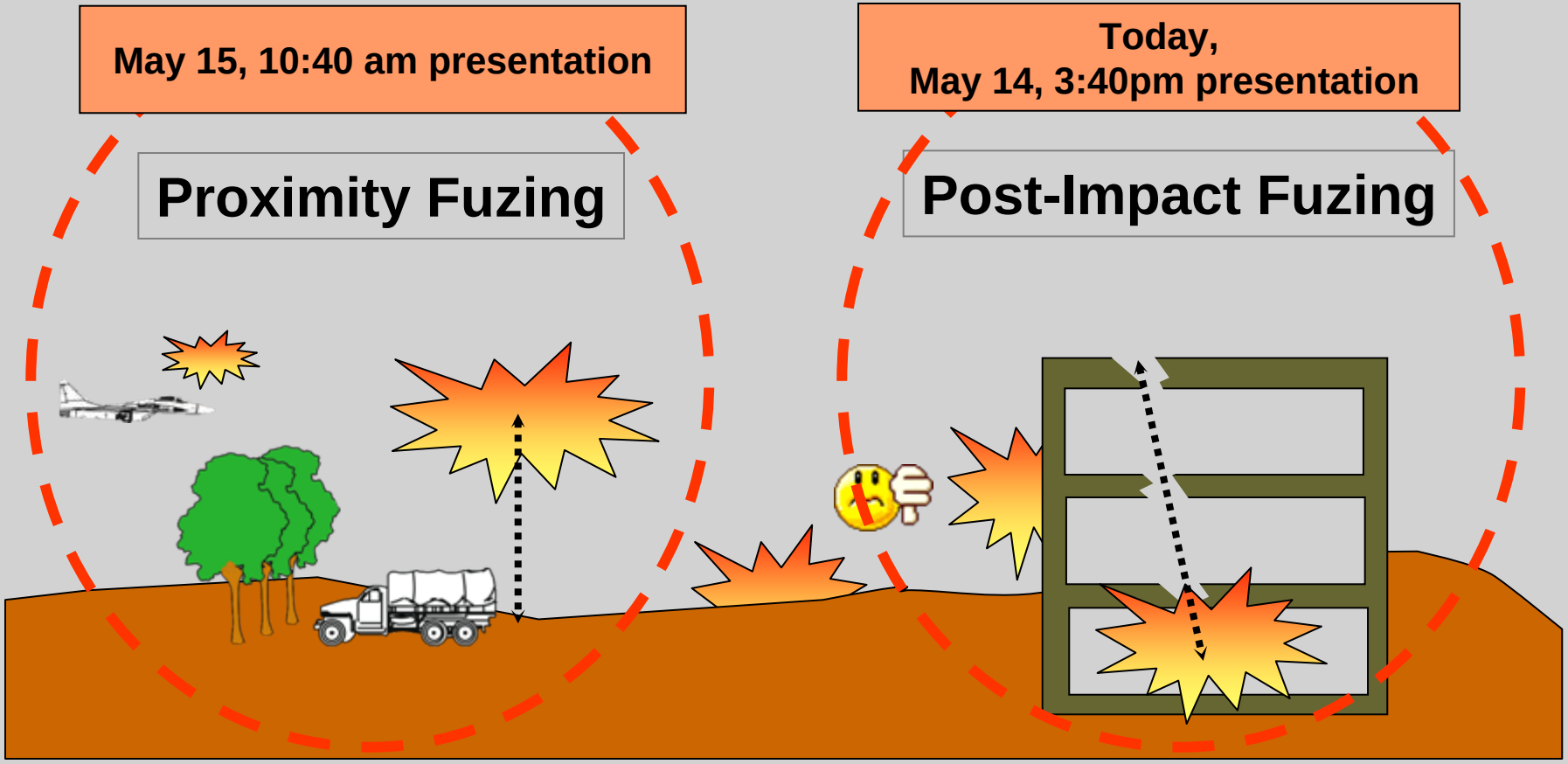
Post-Impact Fuzing



Smart Fuzing / Target Detection

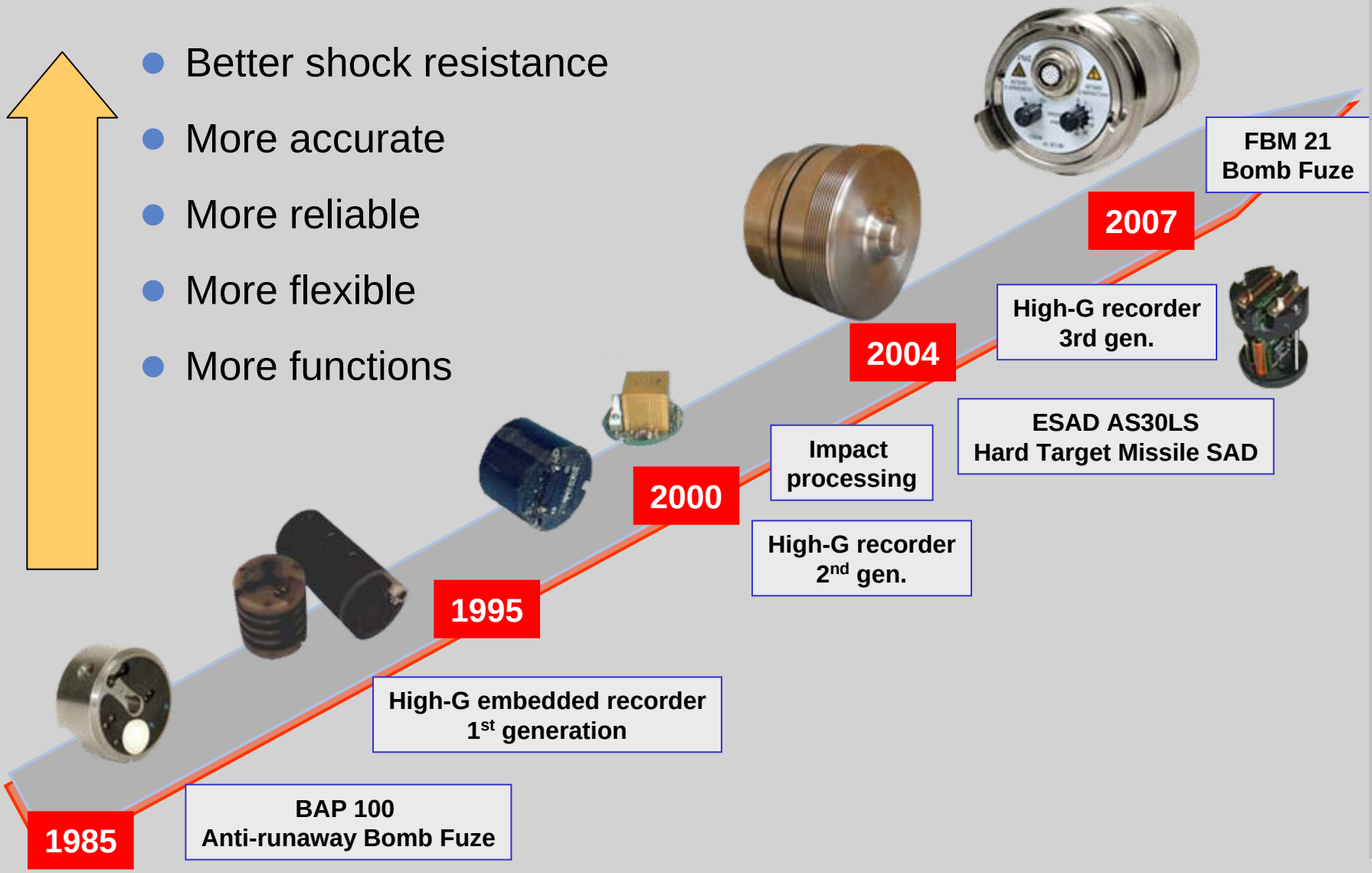
- Objective: Optimize terminal effect

JUNGHANS provides effective solutions for both applications



Hard Target Fuze Background

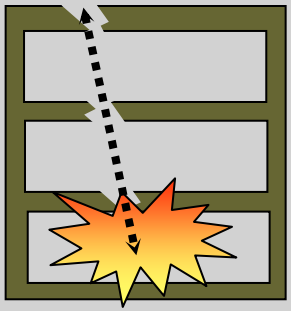
- Better shock resistance
- More accurate
- More reliable
- More flexible
- More functions



Hard Target Fuze – Main Missions

1. Make the fuze survive to impact and penetration stress
   - Keep fuzing function able to process initiation after shock, even if the fuze if partly damaged

2. Initiate the warhead at the right time to optimize terminal effect
   - Detonate at a desired point inside buried or reinforced concrete targets



Objective n°1:
High-g Impact resistance

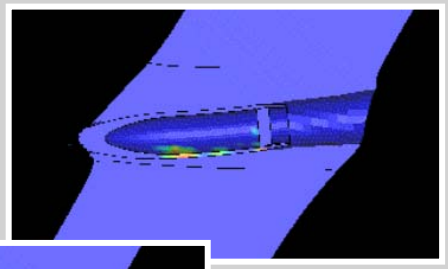
- Primary issues:
  - Being able to determine and specify shock applied on fuze (axial, transverse)
  - Search for, or design, a test mean representative of actual stress
  - Being able to calibrate test means thanks to actual full-scale shock recording

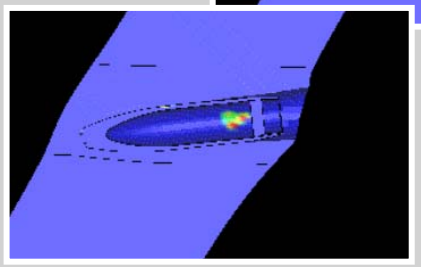
- Fuze design basics
  - Split functions in 2 separate sub-assemblies:
    - A post-impact module specially designed and protected to withstand shocks
    - A module integrating other functions operating before impact
  - Iterative process: Modeling / Testing
  - Take special care of component and material selection: shock absorber and filtering solutions
  - Validate design thanks to special test means and actual firings

High-g Impact Resistance
JUNGHANS T2M Solutions

- Testing / Modeling / Design process:
  - Get the appropriate test means:

➡ Collect actual data and replicate actual shock





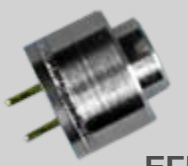
High-g Test Means Video

High-g Impact Resistance
JUNGHANS T2M Solutions

- Design Solutions :

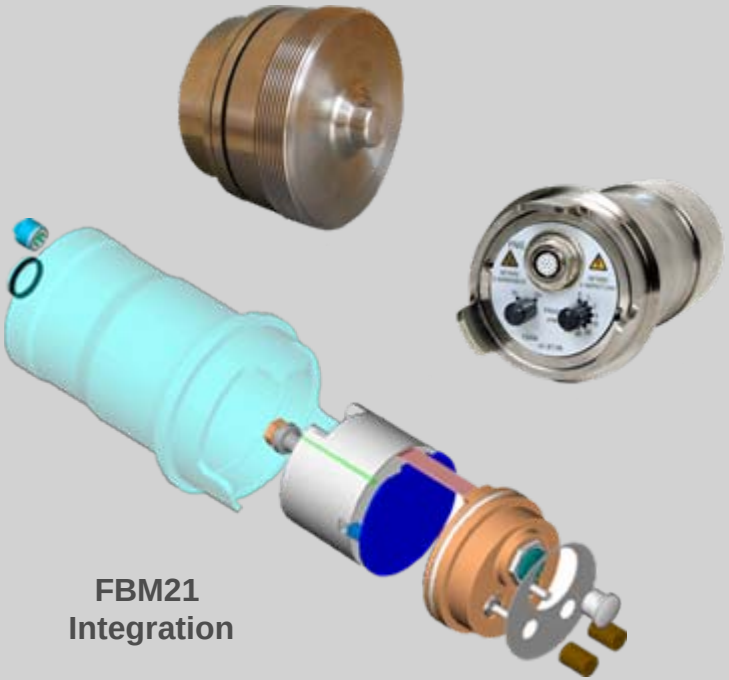
➡ Use of ESAD technology to achieve S&A and firing functions: Full electronic S&A device - "in-line" technology.

➡ Use of specific design + encapsulating and potting compounds + absorber materials



EFI

ESAD Fire set

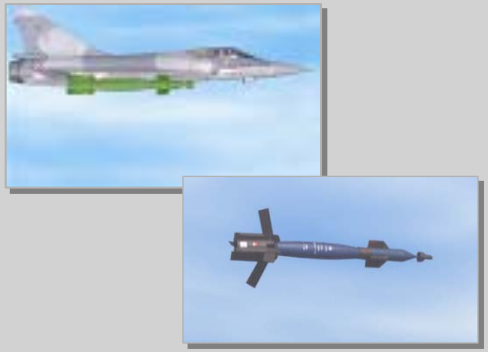


FBM21
Integration

Objective n°2:
Optimize Post-Impact Operation

- Time delay
  - Preset time:
    - hand settable
  - Time value, programmable
    - by external fuze setter

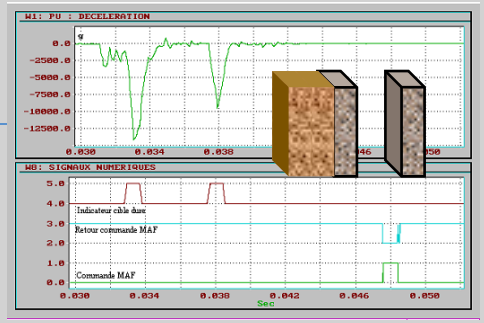
    or
    - by the weapon system
      - from the cockpit
      - during free flight

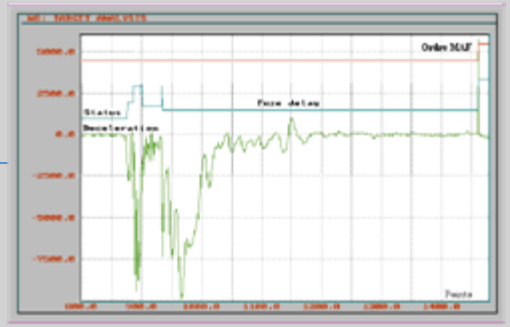


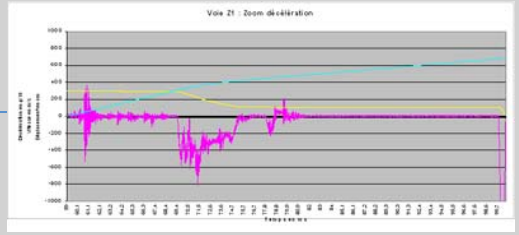
Optimize Post-Impact Operation
Impact Processing

- "Smart Fuzing": Impact Processing
  - Embedded sensors + signal processing
  - To detect and discriminate target characteristics
  - To process exact position of the munition after target penetration

- JUNGHANS T2M Background
  - Void Sensing
  - Layer Counting / Target Recognition
  - Depth of Burial
  - Simulation + validations on numerous actual firings
  - Mature for implementation on current fuzes





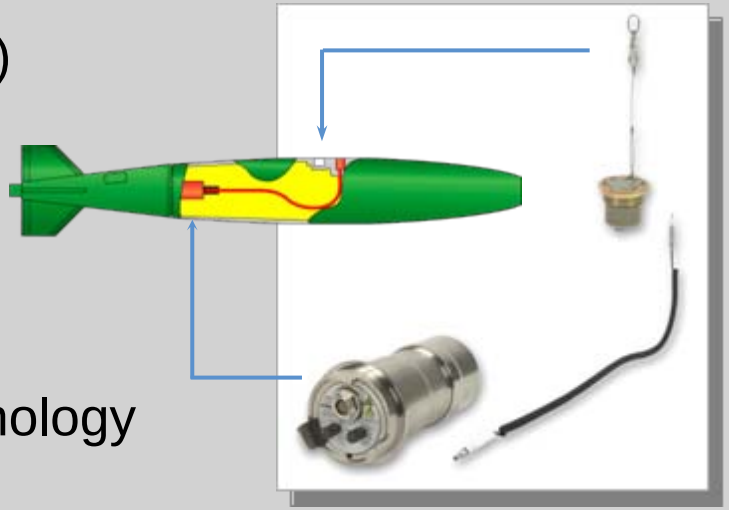


Hard Target Fuzing Products and Projects

- FBM21 Multifunction Fuze
- AS30LS Missile S&A Device
- Impact Processing

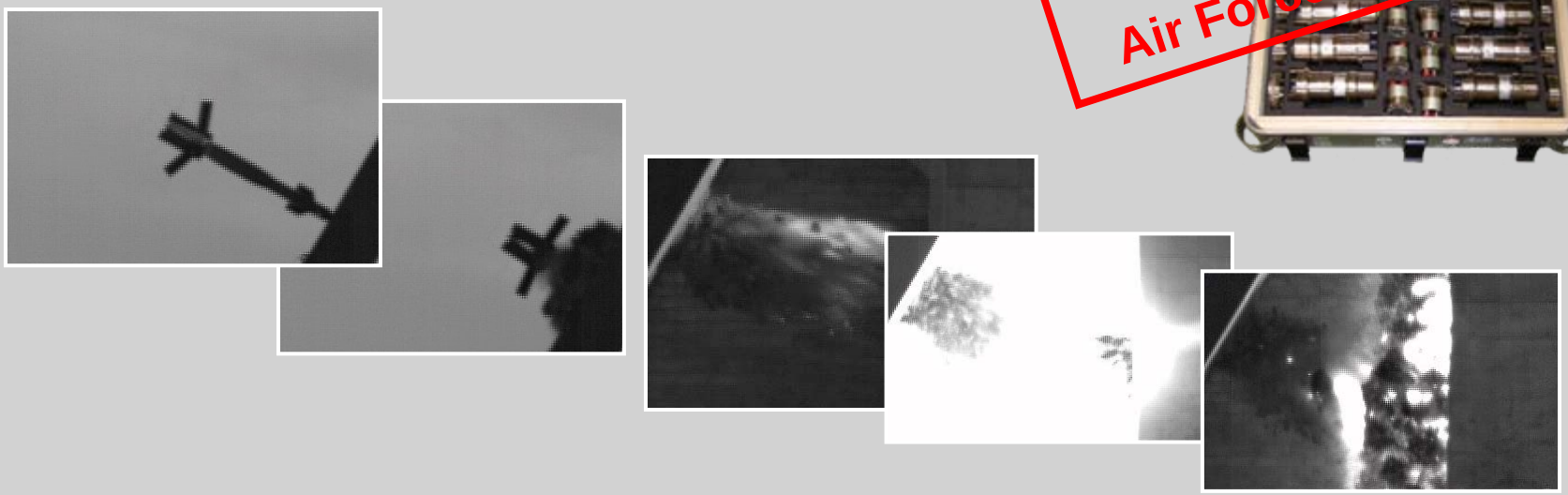
FBM 21 Multifunction Bomb Fuze

- Single Multirole Fuze :
  - General Purpose, Proximity & Penetration
- For use with 3" fuze pockets:
  - General Purpose (Mk80 series, …)
  - Penetration bombs (BLU109, CBEMS,…)
  - Compatible with guidance kits : Paveway II & III, Enhanced Pw II & III, AASM, JDAM
- Compliant with Insensitive Munitions (IM) requirements
- High altitude delivery
- Hardened to severe environments
- Full electronic design - ESAD / EFI technology

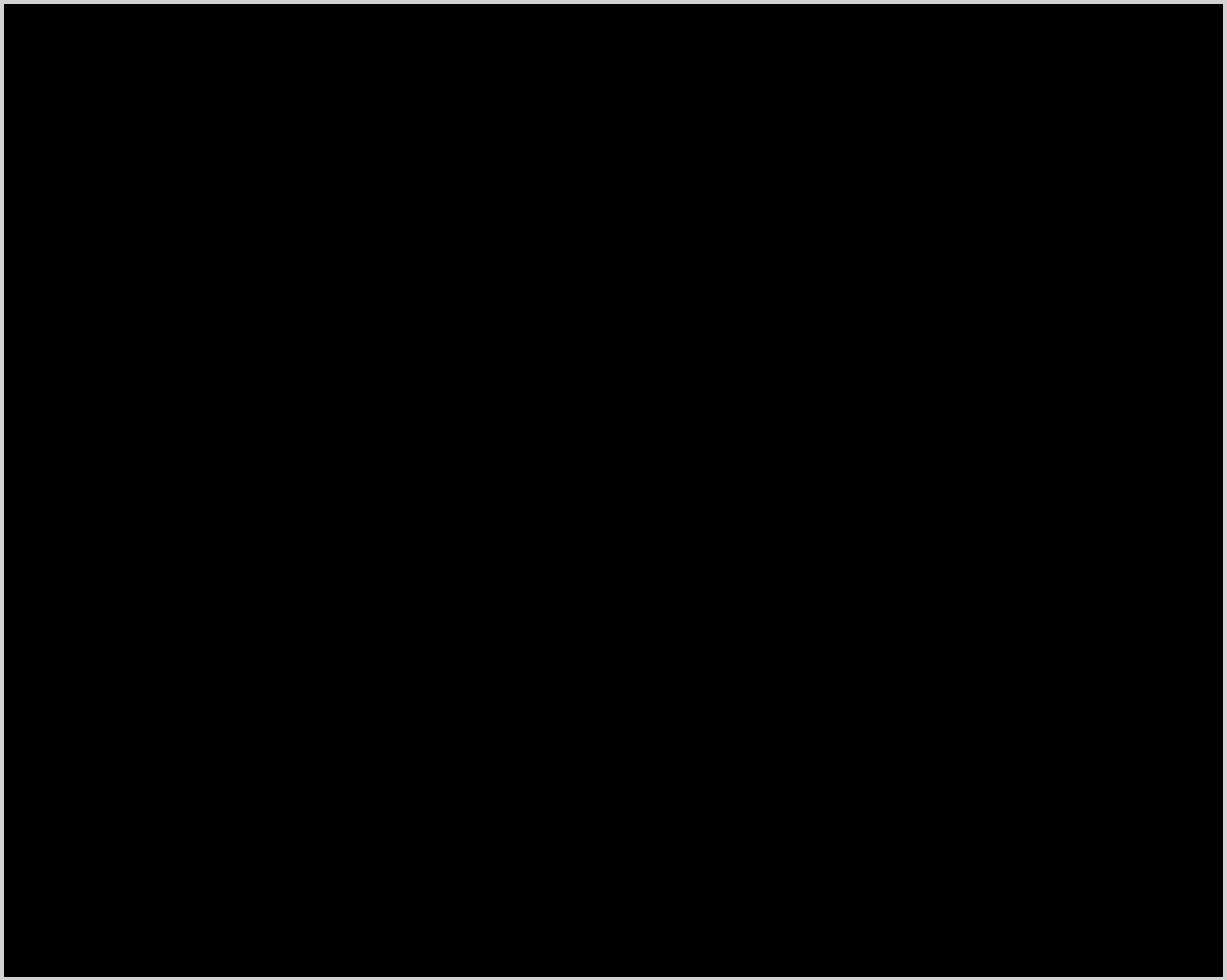


FBM 21 Multifunction Bomb Fuze

- Qualification tests completed in October 2007 including full-scale tests on reinforced concrete targets at various angles and various temperatures
  - Air gun tests
  - Sled tests
  - Flight trials: penetration bombs fitted with Paveway II kit



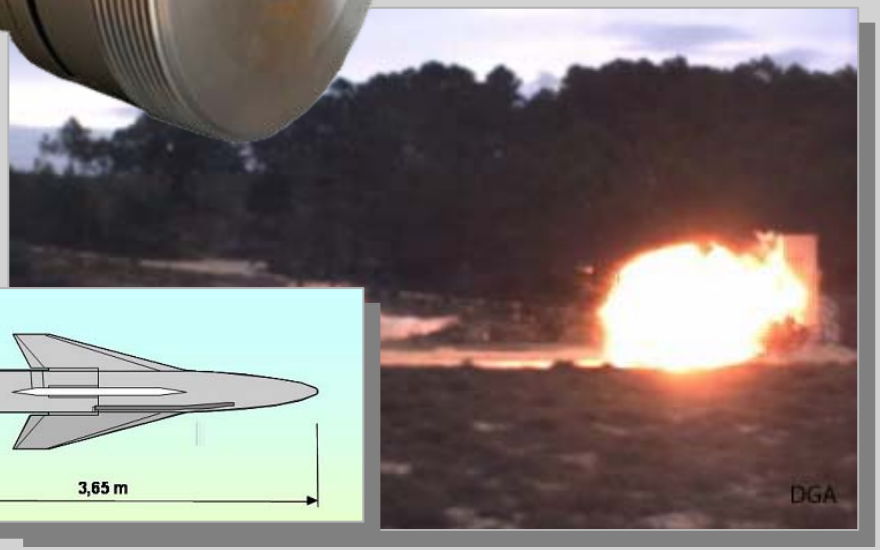
FBM 21 Multifunction Bomb Fuze



Flight Test Penetration Bomb with PWII

AS30LS Hard Target Missile ESAD

- Laser Guided Air-to-Surface Missile
  - Objective: High value / Hardened targets
  - Weight: 524 kg
  - Warhead weight : 240 kg
  - Fligh speed : Mach 1,4
- New SAD designed for IM version, compatible with nuclear CDG aircraft carrier environments
- Safer and more reliable
- Stress on SAD **> 80,000g**



Impact Processing

- High-g recorder embedded in penetrators
- Penetration trials on multiple layer reinforced concrete targets
- DGA CEG (Centre d'Etudes de Gramat) facilities. CEG programme

Video from CEG

DGA

Smart Fuzing – Hard Target Fuzing

- JUNGHANS Hard Target Fuzing technology

⇨ Makes fuzes "smarter"

  - More accurate bursting point in target
  - More reliable and resistant to very high penetration shocks
  - More flexible to use

⇨ For better | Strike efficiency | Operational flexibility

"Smart Fuzing – Adding Intelligence To Fuzing Solutions"

Hard Target Fuzing Solutions

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