



New Generation Artillery Proximity Sensor Application to Naval Fuzes

Max Perrin

**52nd Annual Fuze Conference
May 13 – 15, 2008 - Sparks, NV**

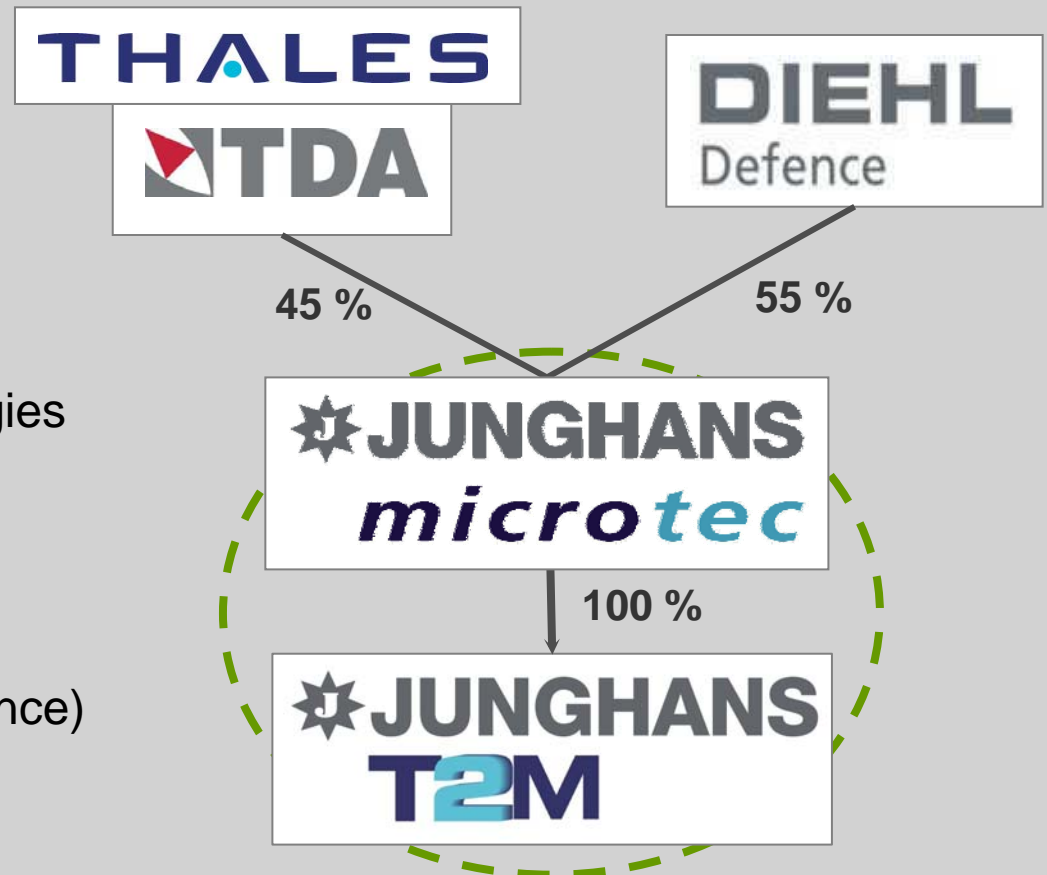
"Smart Fuzing – Adding Intelligence To Fuzing Solutions"

OUTLINE

- Company Presentation
- Smart Fuzing / Target Detection Issues
- Proximity Fuzing Background
- New Generation Proximity Sensor
- Use in FRAPPE Multifunction Fuze
- Use in Other Fuze Products
- Application to Naval Fuzes

- 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)





Artillery

Mortar

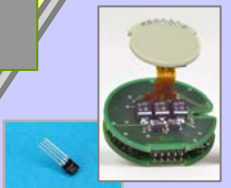
Air Bomb

Missile SAD and ESAD

Medium Caliber and Direct Fire

Infantry Grenade

AT, A/G, G/G Rockets



**Sensors
Signal Processing**



**Micro-Technologies
Miniaturized Systems**

COMPETENCES

**EFI / ESAD
Technology**



**Mission
Management**



**Safety
Design**



**Hard Target
Smart Fuzing**



Energetic Materials

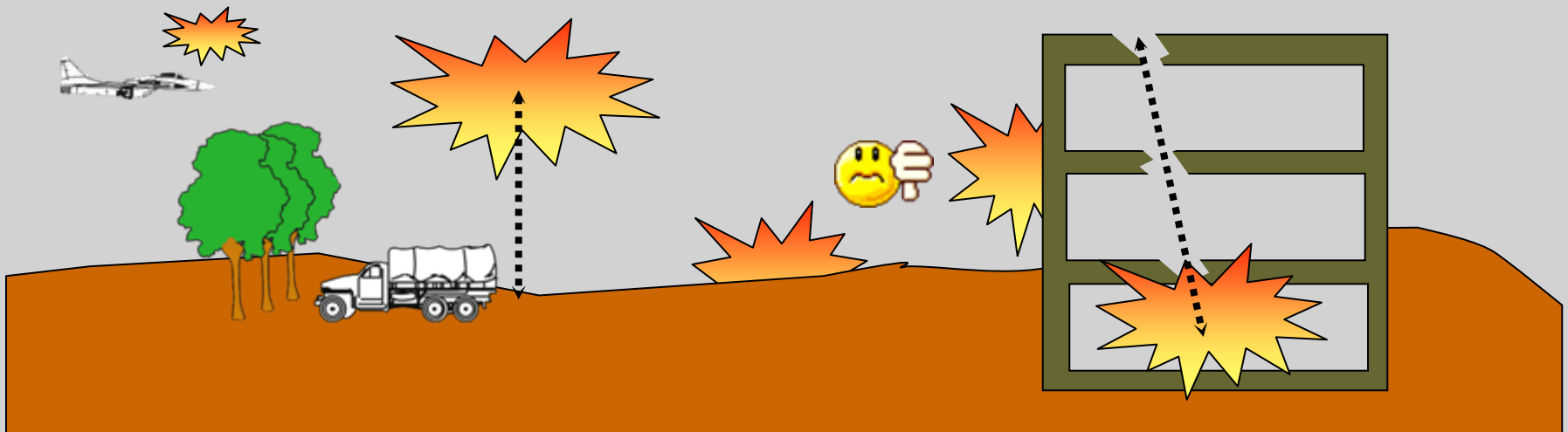


JUNGHANS
microtec
JUNGHANS
T2M

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

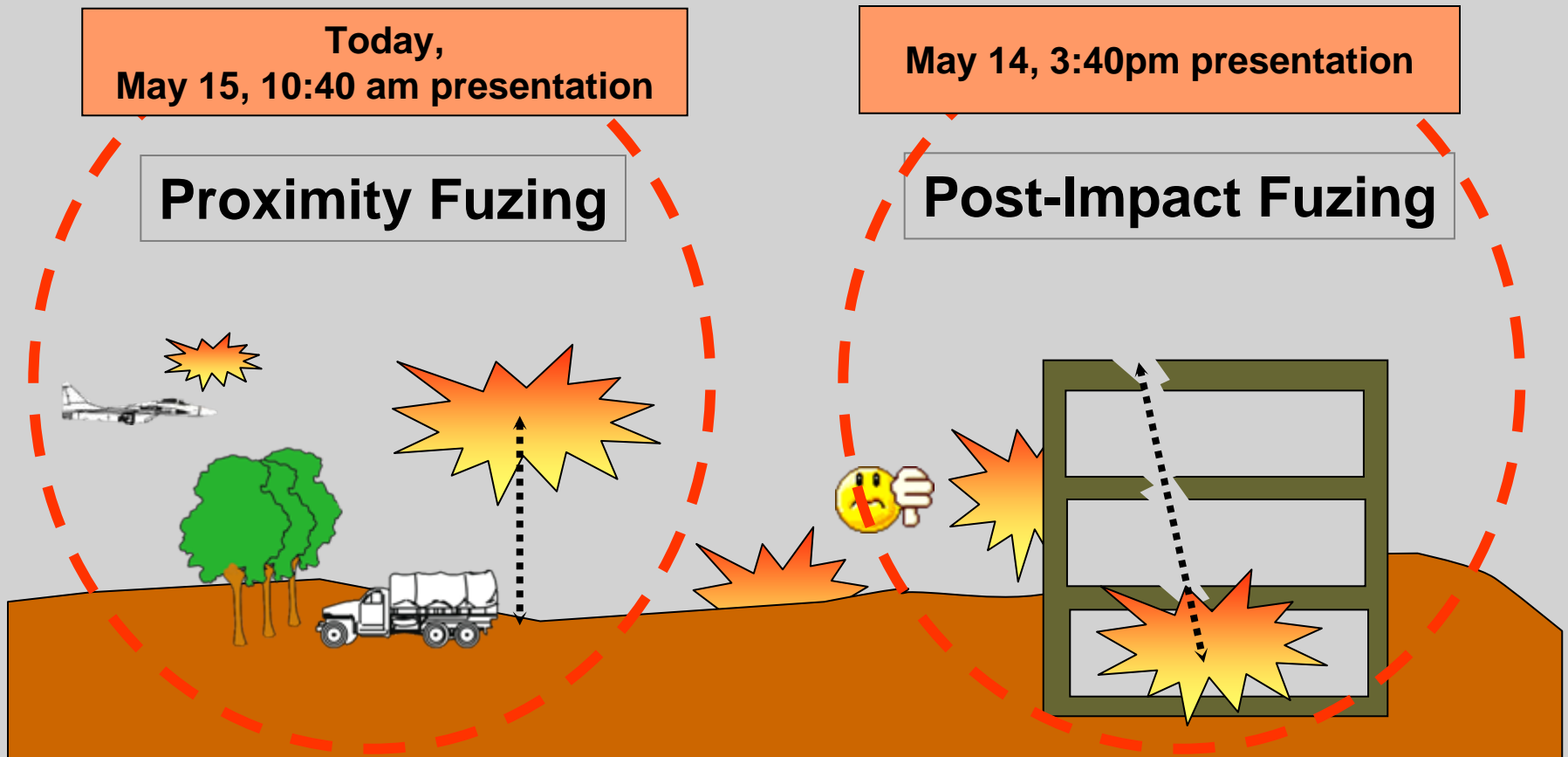
Proximity Fuzing

Post-Impact Fuzing

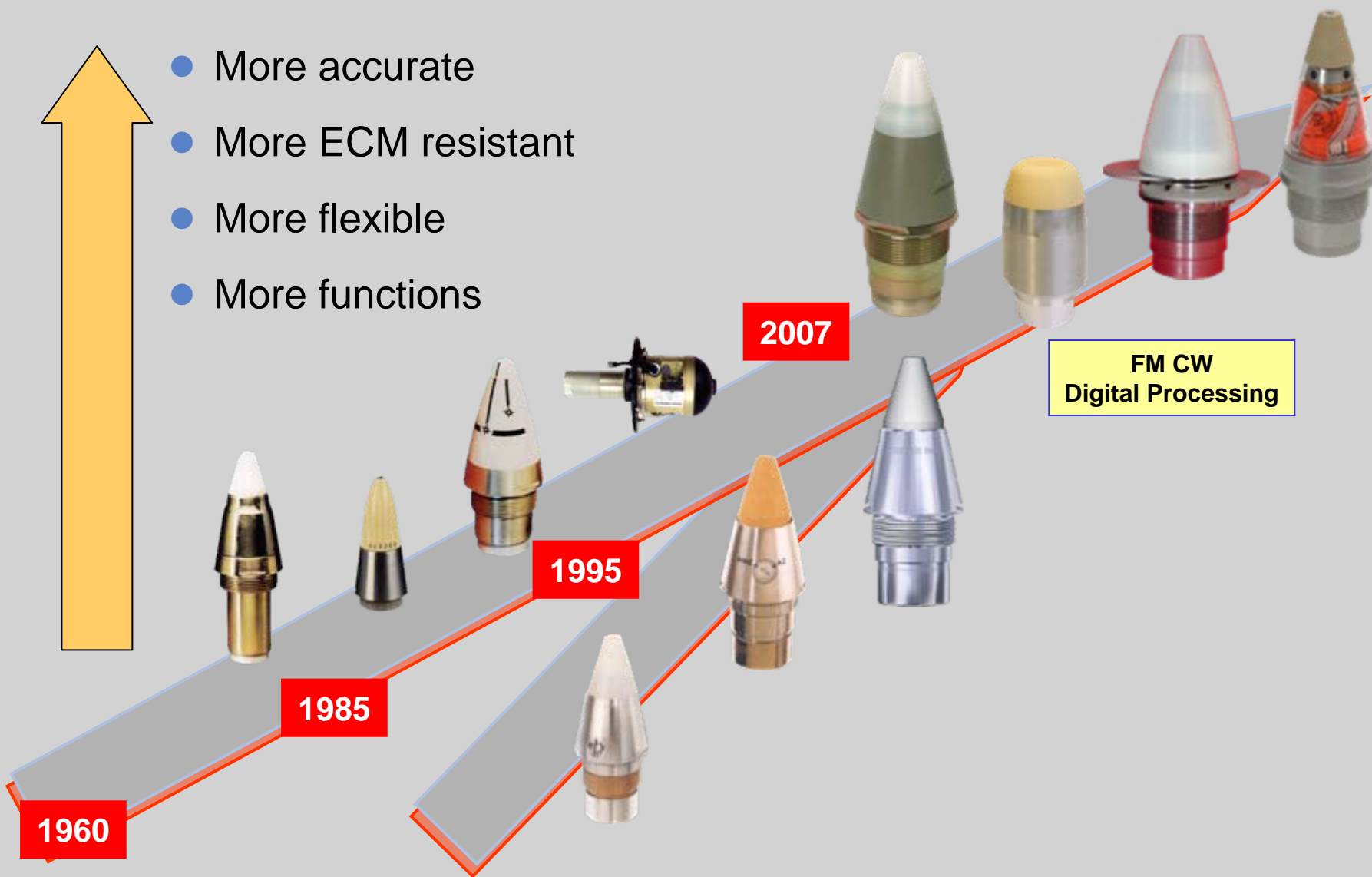


- Objective: Optimize terminal effect

JUNGHANS provides effective solutions for both applications

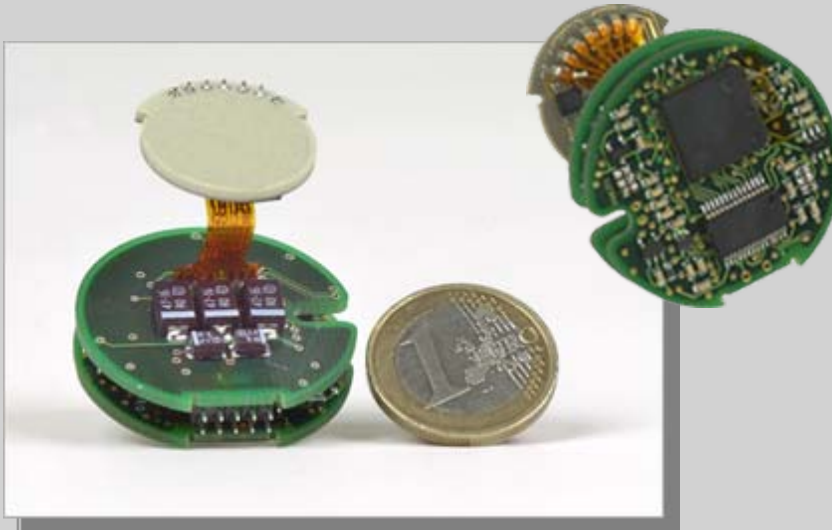


- More accurate
- More ECM resistant
- More flexible
- More functions



New Generation Proximity Sensor

- JUNGHANS T2M has designed and engineered a new state-of-the-art proximity sensor for the new generation artillery multifunction fuze **FRAPPE**.
 - FM-CW Microwave Radar Sensor
 - Full Digital Signal Processing



New Generation Proximity Sensor

Main Features

- Achieves better detection and discrimination performances

① Better detection accuracy

- HOB accuracy whatever the terrain configuration is
- Possibility to select various HOB

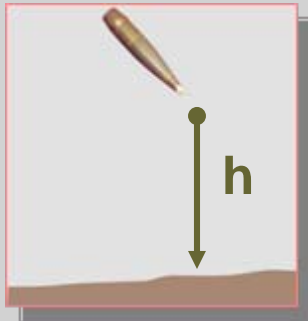
② Better resistance to jamming and electromagnetic countermeasures

thanks to smart digital signal processing:

- Spectrum analysis
 - Distance analysis (height of burst)
 - + Doppler analysis
- Extraction of trajectory parameters
- Analysis of the coherence of the data vs time
 - Tracking of the projectile height (distance) evolution



FRAPPE fuze fitted with embedded data recorder



Spectrum Analysis

Application on FRAPPE Multifunction Fuze

- New Generation Multifunction Fuze

- For new 155mm/52 calibre munitions
- Compliant with IM requirements
- Compliant with modern gun environments
- Provide better operational flexibility and better fuzing performances

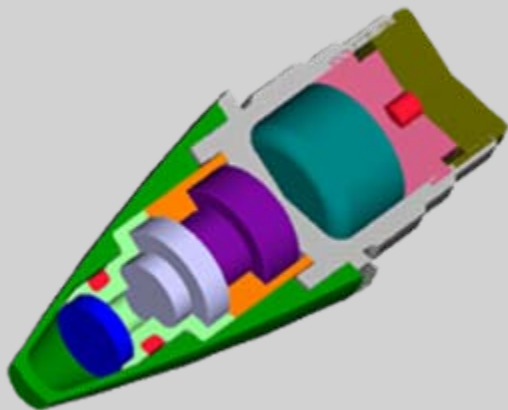
- Operating modes

- **Proximity**
Programmable HOB and inhibition time
- **Post-Impact Delay**
Programmable delay
- **Point detonating**
- **Time**
- **Inductive setting** according to STANAG 4369 / AOP22



FRAPPE Fuze – Qualification Test Results

- More than 450 FRAPPE fuzes fired in all weapon and environment conditions.
- Qualification tests completed: December 2007
- 150 firings : 100% successfull – No failure
- Program Status
 - Initial Production



**Ordered by the
French Army**



FRAPPE Fuze Sensor – HOB tests



Application on SPACIDO Fuze

- SPACIDO Course Correction Fuze
 - Artillery 1D Course Correction System
 - Trajectory monitoring with muzzle velocity radar
 - Correction signal sent by the radar to the fuze
 - Course correction by air brake deployment
 - GPS independent
- SPACIDO Fuze integrates
 - FRAPPE Sensor and subassemblies
 - Air Brake device
 - Reception antenna and electronics
- Programme status
 - Validation firings (2007)
 - Full Development Phase
 - ISD 2011



In cooperation with

 nexter
MUNITIONS

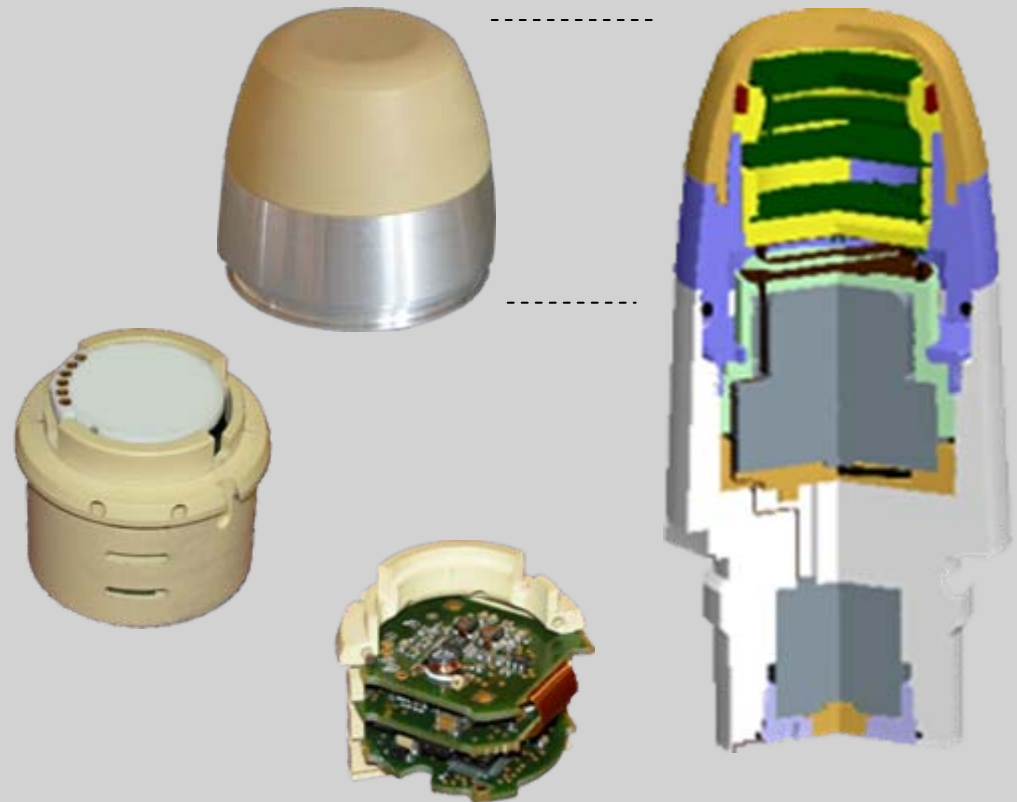
- New Generation Mortar Multifunction Fuze under development by JUNGHANS Microtec for German Army (BWB)

- Operating Modes

- **Proximity**
Programmable HOB
- **Post-Impact Delay**
Programmable delay
- **Point detonating**
- **Time**

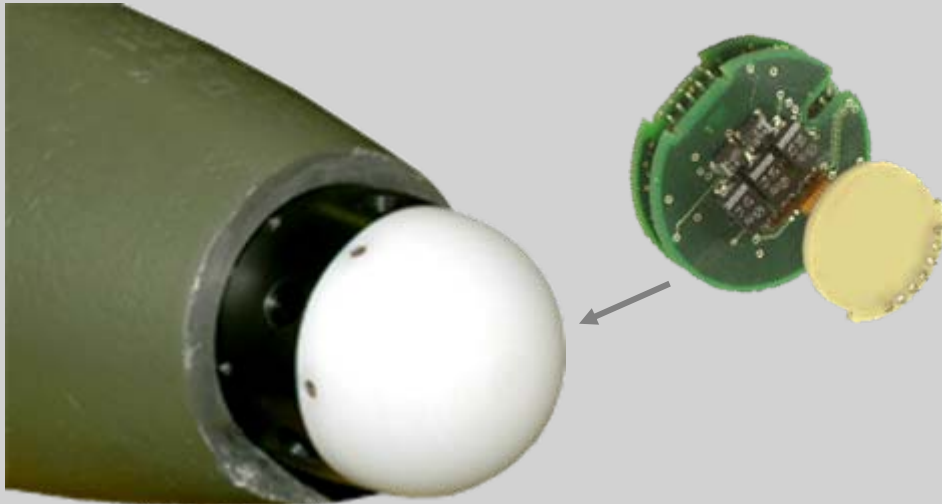
- Program Status

- Full Development Phase
- Qualification End 2009




Sensor Application: Air Bomb Proximity Sensor

- Nose prox demonstrated in flight

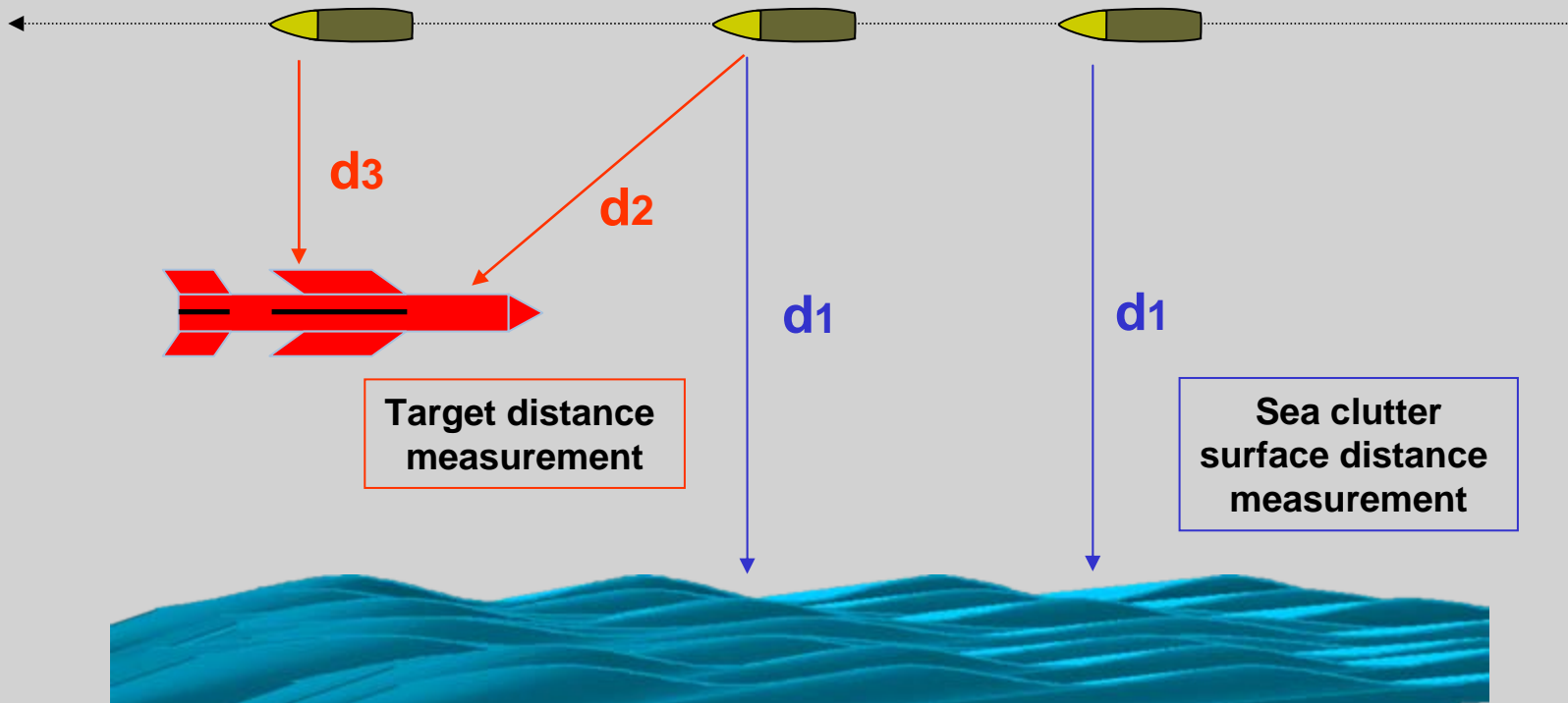


- Purpose:
 - Adapt the new generation FM-CW sensor to air target detection mission
- Issue:
 - Current sensor is designed for surface detection
- Objectives:
 - Keep current sensor hardware and architecture
 - Cope with:
 - Sea clutter disturbance
 - Target Radar Cross Section

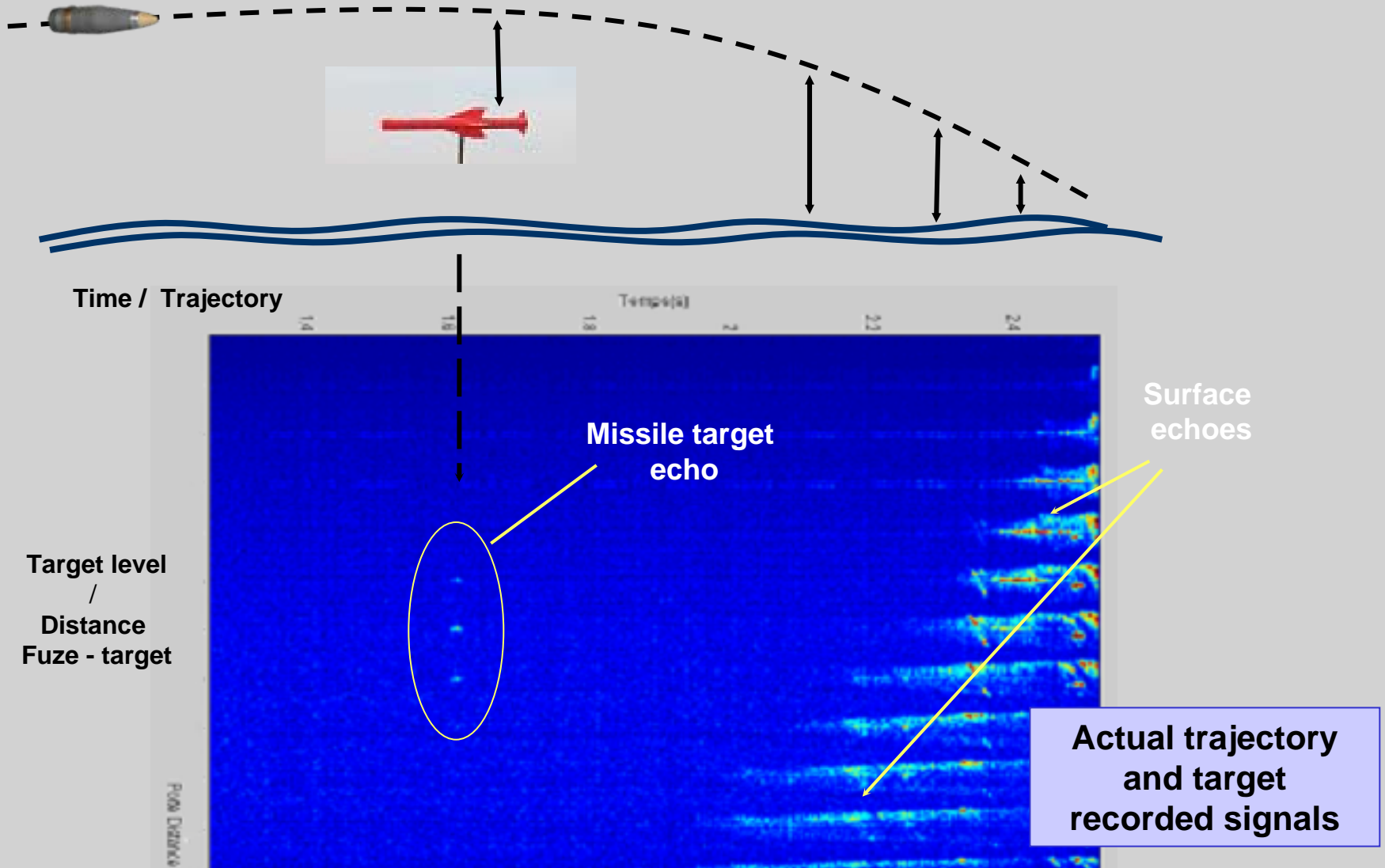
 Implement specific signal processing software

- FM-CW sensor actually measures object distances

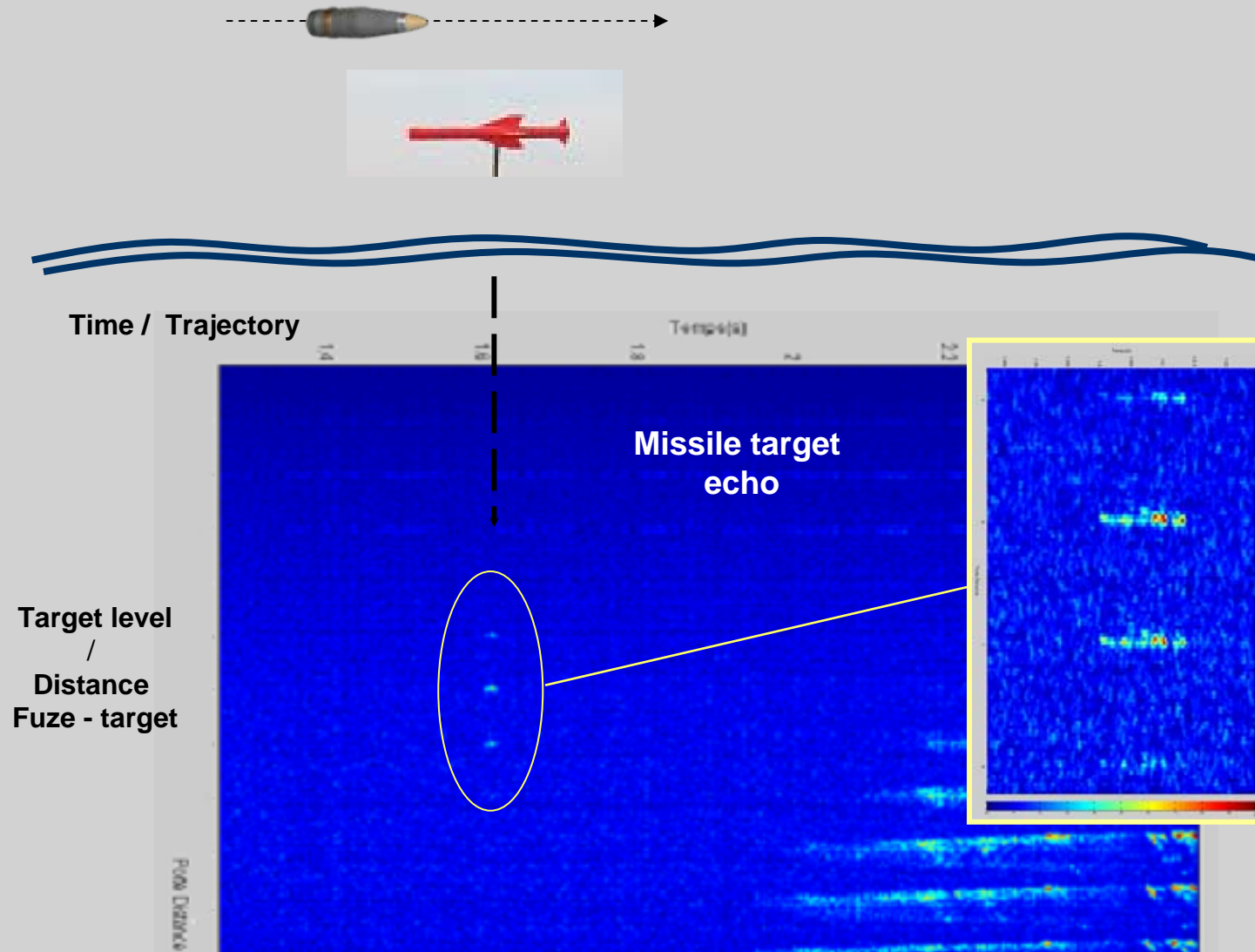
➔ Makes possible discrimination between reflected signals:
Range gated processing to isolate sea-clutter from valid targets



Sea-Skimmer Detection



Sea-Skimmer Detection



Smart Fuzing – Proximity Fuzing

- JUNGHANS new proximity sensor technology

 Makes fuzes "smarter"

- More accurate on target
- More resistant to counter-measures
- More flexible to use



For better

Strike efficiency

Operational flexibility

"Smart Fuzing – Adding Intelligence To Fuzing Solutions"

New Generation Artillery Proximity Sensor Application to Naval Fuzes



Max PERRIN
Chief Technical Officer

max.perrin@junghans-t2m.fr