JUNGHANS Defence

New Generation Fuzes
to improve Munition Efficiency

PARARI 2017
Canberra, 21-23 Nov. 2017
1 - New operational requirements for munitions and fuzes

2 - The solution: New generation of fuzes
Complete range of fuzes for all types of munitions

Key competences in fuzing technologies, micro-technologies and ammunition electronics
Complete Fuze Product Range

- Artillery
- Mortar
- Air Bomb
- Missiles / Torpedoes

- Medium Caliber and Direct Fire
- Infantry Grenade
- AT, A/G, G/G Rockets

COMPETENCES
- EFI / ESAD Technology
- Mission Management
- Hard Target Smart Fuzing
- Safety Design
- Energetic Materials

Sensors
Signal Processing
Micro-Technologies Miniaturized Systems
Improvement of Conventional Munitions

NEW GENERATION FUZE

Better
- STRIKE EFFICIENCY
Better
- OPERATIONAL FLEXIBILITY
Better
- SAFETY & RELIABILITY

New operational requirements for munitions

⇒ Improvement of fuze functions and development of new technologies for fuzes

The fuze makes the performances of the munition
New operational needs

⇒ New requirements for new generation fuzes
Modern Fuze = Enhanced Terminal Effect

Cost Effectiveness
Collateral Damage Reduction
Logistic Footprint Reduction
Effect Optimization / Target Detection
Precision Enhancement
Course Correction
Proximity
Post-Impact
Airburst Direct Fire
Scalable Terminal Effect
"Smart Warhead"
Modern Fuze = Improved Operational Flexibility

Multi-Mission Multi-Function

Logistic Footprint Reduction

Fuze Setting

All parameters
Data-Link, Automatic

Activity Control (during the mission)

Mission Abort

Terminal Effect Control (Scalable)
Modern Fuze = Improved Safety and Reliability

Enhanced Safety
IM
Dual Safety Features

Modern Weapon severe Environment

Overhead / Overflight Safety

Mission Abort

Self Re-safing

Safe / eco Dismantling

Self-Destruct

Reliability for UXO Reduction
Terminal Effect Enhancement
Proximity Functions

- **Proximity Mode**
  - on surface targets

  ![Proximity Mode on surface targets](image1)

- **Proximity Mode**
  - on aerial targets

  ![Proximity Mode on aerial targets](image2)

**Significant increase of munition terminal effect and kill probability**

Video: FREMEN Naval artillery fuze firing test (no explosive munition, booster only)

Video: Artillery multi-function fuze firing test (live round)
Terminal Effect Enhancement
Impact Delay and Airburst Functions

- Post-impact Delay Mode

- Direct Fire – Airburst Mode

Video Post-impact delay – High-G hardening

Video Airburst – Infantry Grenade Fuze
JUNGHANS Defence provides state-of-the-art fuze technologies to meet these new requirements for all type of weapons and munitions.
Proximity and Multi-Option Fuzes for Artillery and Rifled-Mortar Systems

- Operating modes
  - Proximity
  - Post-Impact Delay
  - Point detonating
  - Time (for HE round)

- Operation mode parameters selection by inductive setting according to STANAG 4369 (with fuze setter)

<table>
<thead>
<tr>
<th>Enhanced Terminal Effect</th>
<th>Improved Operational Flexibility</th>
<th>Improved Safety</th>
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<tbody>
<tr>
<td>- Proximity mode</td>
<td>- Operational mode selection</td>
<td>- 200m safety distance</td>
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<tr>
<td>- PD SQ mode</td>
<td>- Mission parameters programmable (HoB, delay,..)</td>
<td>- IM compliance</td>
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<tr>
<td>- PD Delay</td>
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<td>- Overflight safety</td>
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<td>- Time</td>
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One fuze for all requirements
Proximity and Multi-Option Fuzes for Artillery

- Modern electronic fuzes fitted with
  - Smart radar sensor, for accurate HoB and jamming resistance
  - Improved safety functions
  - Improved operational capabilities

- Inductive setting: with STANAG 4369 AOP22 compliant setters (European Fuze setters and EPIAFS)

New Generation Multi-function and Proximity Fuzes with enhanced performances to meet modern artillery requirements
Point Detonating Fuze for Artillery

- Point Detonating and PD-Delay fuzes with enhanced performances to meet new artillery system requirements
  - Automatic loading / flick-ramming systems
  - Extended range munition / long time of flight
  - IM (Insensitive Munition) requirements

New Generation Point Detonating Fuzes compatible with modern artillery systems and munitions
Complete the JUNGHANS new generation mortar fuze portfolio with a new generation proximity fuze

- Suitable for all mortar calibers, 60mm, 81mm and 120mm
- Cost effective, with optimized trade-off between operational performances, cost and technology
- Compliant with all modern standards in terms of safety and reliability: IM features, dual safety
- Implementing state-of-the-art solutions for radar proximity sensor, power generation and safety design

New generation fuze relying on JUNGHANS strong background in mortar fuzes and proximity fuzing
New Generation Dual Safety Fuzes for Mortar Ammunition

- DM183 (Mechanical Time) and DM111S (PD and PD Delay)
- Based on DM93 and DM111 fuzes, well known for their reliability and safety performances

- Dual safety features for STANAG 4187 compliance
  - 2nd safety: Sensing of munition flight condition by wind wheel

Unmatched safety and reliability performances
New Generation Naval Artillery Fuzes
FREMEN Fuzes

- Based on the new generation radar sensor fitted with smart signal processing (FMCW + spectrum analysis)
  - To provide the user with state-of-the-art multi-role fuzes, specifically designed for the optimization of terminal effect against both air and surface targets
  - To achieve a broad range of missions
    - Air defence
    - Surface warfare
    - Naval fire support
- Breakthrough in performances compared to former generation naval fuzes
  - Defeat any target, even in the most difficult attack conditions
    - See clutter rejection for better sea-skimmer missile detection
  - Autonomous mode selection (fire support or air-defence)
New Generation Naval Artillery Fuzes
FREMEN Fuzes

- **FREMEN**
  New generation naval multi-function fuze family
  - Developed for 100mm and 76mm in the frame of French MoD contracts (for development, qualification and mass-production)
  - Adaptation to 127mm (5") caliber

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| - Accurate target detection
  - Air-defence mode, proximity function on any type of targets and attack conditions
  - Fire support mode, HoB proximity function (shore bombardment)
  - HoB / Direct Fire mode against Fast Inshore Attack Crafts
  - Immunity to interferences and clutter: No early burst | - Multi-role fuze
  - Autonomous mode selection (aerial target or surface fire mode) by the sensor itself.
  No need of fuze setter
  - Operational Mode selection (PD, SD, Prox) manually or by standard fuze setting device | - Increased safety distance
  - IM compliance
  - ECM resistance |

FREMEN naval fuzes provide better target detection performances, ECM resistance and operational flexibility
Adaptation of FREMEN 100mm and 76mm to 127mm caliber and 127mm weapon system

- Re-use of electronic module, with same performances
- Re-packaging into 127mm mechanical/electrical interfaces
- Possible adaptation to various 127mm standards (2" or 2.35" threads)
Direct Fire - Tank Ammunition Fuze

- Tank ammunition fuze for 120mm smoothbore tank gun DM11 munition
- State-of-the-art programmable fuze with airburst, impact delay and self-destruct modes
- High-shock survivability for effective post impact delay operation

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| - User can select the optimum operational mode depending on the target type and configuration
  - Accurate airburst time function
  - High resistance and survivability to target penetration shock for delayed impact function | - Multi-function fuze
  - Operation mode selected and programmed at firing | - IM compliance
  - Self-destruct management
  - High reliability |

Significantly improves the efficiency of land combat operations, combat proven solution
Artillery "1D" Course-Correction Fuzes Precision Enhancement

- Improve performances of conventional munition stockpile at low cost
  - To reduce the range dispersion in artillery fires, in particular at long range
  - Standard size fuze / kit fitted in place of the usual fuze

- SPACIDO project
  - Trajectory monitoring: Muzzle velocity radar
  - Program status: Qualification complete

- ECF project
  - Trajectory monitoring: Embedded GPS

Cost effective solution to improve artillery firing precision with conventional munition
Multi-role fuze: General purpose, penetration and proximity (with external sensor)
- For use with 3" fuze pocket bombs, dumb or guided bombs, Paveway II & III, Enhanced Pw II & III, AASM (Hammer), JDAM

Incorporates state-of-the-art full solid state electronic design based on ESAD / EFI technology

Combat-proven bomb fuze
- Qualified on all French Air Force / Navy aircraft and weapon configurations, and selected by German Air Force for Tornado and Typhoon (cockpit programming)

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| - High resistance and survivability to extreme penetration shock  
- Settable delays for optimum effect on target  
- Can be used with proximity sensor (airburst HoB mode) | - Multi-purpose fuze  
- Mission parameters programmable by the user before flight or from cockpit through the weapon system | - IM compliance  
- ESAD/EFI technology |

The only modern STANAG 4187 fully compliant bomb fuze on the market
Airburst Fuze for 40mm Infantry Grenades (HV/ MV)

- **Airburst programmable fuze, to complete 40mm infantry grenade fuze product range (PD-SD)**
  - PD function, mechanical and electronic
  - Self-destruct (electronic with electro-mechanical backup)
  - **Airburst time function programmable by induction**, at muzzle exit
  - Programming device easy to integrate in the weapon, without major modification

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<td>- Airburst function for optimum effect on target</td>
<td>- Programmable fuze, at firing - Weapon system integration easy to implement</td>
<td>- Impact backup - SD function, with backup - Muzzle safety distance (mechanical) - High reliability</td>
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New generation accurate fuze for high/ medium velocity Infantry Grenade
Shoulder-Launched Rocket "Effector 90" Fuze

- Fuze for the RGW 90 Long Range Multipurpose weapon "Wirkmittel 90", effective against light armoured vehicles, field positions and targets behind shelter

- Multi-mode Programmable fuze
  - Airburst: 20 to 1200m
  - Impact and impact-delay modes
  - Self-destruct

- Airburst function with burst time correction (range deviation correction / flight conditions)
  - To achieve high accuracy (+/-3 m at 1,200 m range)
  - Embedded electronics to measure acceleration and initial velocity

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<td>- Airburst function, with bursting point correction for optimum effect on target</td>
<td>- Selectable Mode according to the threat</td>
<td>- SD function, with backup</td>
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Objective: Provide enhanced performances to medium caliber munitions (safety and terminal effect)

- New Generation Point Detonating fuze
- Proximity fuzes for munitions fired from aircraft and helicopter guns (gun-launched, rockets)
  - Several options (directive or non directive sensor) depending on the specific requirements and operational configurations
Enable "Counter Rocket, Artillery, Mortar" or anti-UCAV missions for gun-based or rockets system

Munition warhead initiation at target proximity
- either with proximity fuzes
- or with Airburst / in-flight programmable fuzes (data-link with ground station)
- Relying on
  - New generation naval artillery fuze, featuring high performance detection on small/high speed targets (FREMEN)
  - Background in embedded antenna/receiver in fuzes for in-flight programmable fuze
    - Airburst (time programmable) fuzes
    - Course Correction Fuzes (SPACIDO)
Beyond complete fuzes, JUNGHANS Defence possesses and provides all state-of-the-art fuzing technologies:

- Safety and Arming Devices technologies
  - Electromechanical SAD
  - Miniaturized SAD
  - Electronic SAD (EFI technology)
- Proximity sensors for surface or aerial target detection
  - Low cost, miniaturized radar sensors
- Airburst fuzing solutions
- Micromechanical systems
- Embedded fuzing electronics solutions

These technologies are offered to fuze/munition/missile partners, designers and manufacturers, to be implemented in their product and to achieve improved performances.

JUNGHANS is keen to provide fuzing technologies and fuzing modules to industrial partners in the munition and missile field.
New customers requirements for munitions, guided munitions and missile fuzing systems are increasingly demanding improved safety, greater flexibility and enhanced terminal effects.

JUNGHANS is today able to offer a broad range of products and technologies to provide high performance fuzing functionality to modern munitions. The company aims at being a key strategic supply partner to munitions/missiles manufacturers and weapon systems companies.
Thank you for your attention.

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