Pyrotechnic Bomblet
Self Destruct Fuze (SDF) for GMLRS

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by Rudolf Harbrecht
Locations

Schramberg: administration, sales and machine shop for components

Seedorf: R&D and assembly shop
Organisation and Management Structure

Diehl VA Systeme
W. Reinl: CEO      R. Ott: CFO

Defence Systems
- Bodenseewerk Geräteotechnik
- Diehl Munitions - Systeme
- AEG Infrarot-Module
- Diehl VA Systeme

Vehicle Systems
- Diehl Remscheid
- IWS Industriewerke Saar
- JUNGHANS Feinwerktechnik

Avionics
- Diehl Avionik Systeme
- Diehl Luftfahrt Elektronik

Human Resources
Quality Management
Liaison Offices
Purchasing / Customs / Compensation
Organisation / Information Technology
Public Relations
Export Control
Security
Controlling

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Diehl VA Systeme
Wide Product Range at JUNGHANS Feinwerktechnik:

Mechanical and Electronic Fuzes For:
- Artillery Ammunition
- Mortar Ammunition
- Tank Ammunition
- Anti-Tank Ammunition
- Medium Calibre Ammunition
- Rockets
- Submunition
- Safety & Arming Devices
• Company Experience in MLRS and Self destruct Fuzes for Grenades
Electronic Time Fuze for European MLRS AT2

- From 1993 to 1997 production of more than 10,000 fuzes
Bomblet Fuze DM 1384

- Self destruct Fuze for 155mm Artillery Shell (15 sec delay)

- in production from 1988 to 1992
- more than 12 mio produced maximal daily rate of 20,000 SDF
- actual firings do not show any degradation in performance
Development of a Self-Destruct Fuze for M77 Grenades with a delay time of 25 seconds.
Co-Operation Partners

• JUNGHANS Feinwerkechnik and GIAT Industries have teamed in their experiences to provide a Self Destruct Fuze (SDF) for GMLRS bomblets
Development Phase

- **JUNGHANS** started the development in December 2001. The major requirements for the development of the SD-Fuze are:
  
  - **the weight:**
    - the SDF weight should be less than 20g
  
  - **the impact functioning rate**
    - more than 95%
  
  - **the hazardous dud rate:**
    - less than 1% (desired 0.1%)
  
  - **the delay time:**
    - within temperature range: \( T \geq 25 \text{ sec} \)
  
  - **the temperature range:**
    - function: from -32°C to +60°C
SDF DESIGN (1) Design

- upper fuze body
- locking pin
- safety pin
- delay chain
- slider
- spring
- lower fuze body
- firing pin
- nut
- weldingcup
- rotor assembled
- torsion spring
SDF DESIGN (2)

Hazardous Classification:
in packaging  1.4 D
out of packaging  1.4 D

- ribbon assembled
- welding cup
- safety pin
- lower fuze body assembled
- upper fuze body assembled
- rotor assembled
- spring
SDF DESIGN (3)

- lower fuze body
- output relay
- slider
- rotor assembled
- torsion spring
- delay cord
- input relay
Bomblet Body with SD - Fuze

SD-Fuse on inert Bomblet:
Hazardous Classification:
- in packaging: 1.4 D
- out of packaging: 1.4 D

Laser Welding
Functioning Modes of the SDF

1. **Bomblet Dispense**
   - Ribbon unfolded, locking pin pulled

2. **Slider Travels Forward**
   
3. **Slider Releases Rotor**
   
4. **Ribbon Winds**
   - Firing pin

5. **Firing Pin Releases Rotor**
   
6. **Rotor Armed**
   - NO
   - YES

7. **Target Hit (Impact Mode)**
   
8. **Target Impact**
   - NO
   - YES

   a. **Firing Pin Initiates Detonator M55**
   
   b. **Bomblet Detonates**

9. **Neutralisation (SD-Mode)**
   - Output relay initiates detonator M55
   - Bomblet neutralised

10. **Destruction (SD-Mode)**
    - Output relay initiates detonator M55
    - Bomblet detonates

11. **Ignition of SD Mode**

   - Yes
   - No
**Functional Characteristics**

1st step after dispense:

⇒ ribbon unfolded  
    (aerodynamical effect)

⇒ locking pin removed

⇒ slider unlocked
Functional Characteristics

2nd step:
- Slider moves in armed position and initiates input relay
- Slider released rotor to arm
- SD - mode active

Rotor in unarmed position

Spring

Slider
Functional Characteristics

3rd step:
⇒ ribbon unscrews the firing pin (left handed thread)
⇒ rotor is unlocked
4th step:

⇒ rotor turns in armed position

⇒ fuze is armed

marking with red colour, "armed position"

rotor in armed position
Functional Characteristics

• Firing Pin Initiates the M55 Stab Detonator
  ⇒ Primary Mode: Impact

5th step:
⇒ target impact
⇒ firing pin initiates M55 stab detonator
Functional Characteristics

- Output Relay Initiates the M55 Stab Detonator

⇒ Secondary Mode: SD - Mode (complete Bomblet)
Functional Characteristics

- Output Relay Initiates the M55 Stab Detonator of an unarmed SDF
  ⇒ Back up Mode: Neutralization - Mode (complete Fuze)
General Schedule

• **Demonstration Phase**
  – May 2000 to November 2001
  – Status: performed on schedule

• **Development Phase**
  – December 2001 to December 2004
  – GMLRS - Qualification forth quarter 2004

• **Industrialisation Phase**
  – on customer request
  – possible start July 2004
Draft updated Test Plan for Development Phase

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Results of BFT5 and BFT5a Flight Tests (1)

- **BFT5 at Meppen Proving Ground**
  - Scheduled November 16th 2003
  - 3 MLRS rockets
  - SDF Design with 25 sec. Delay Element
  - range: 2 rockets on approx. 11 km, one rocket on approx. 20 km
  - temperature: 1 rocket at +60°C, 1 rocket at +51°C, 1 rocket at -32°C

**Results:**

- a dud rate less than 1% could be proved
- a reliability of more than 97% for the delay chain could be proved
- the required impact functioning rate of more than 95% was missed
Results of BFT5 and BFT5a Flight Tests (2)

- **BFT5a at Meppen Proving Ground**
  - Scheduled March 15th 2004
  - 1 MLRS rocket
  - SDF Design three configurations, impact functioning mode only
  - range: approx. 11 km
  - temperature: ambient

**Results:**
- an impact functioning rate of 95% could be proved with one configuration
- an overall arming reliability of more than 99% could be proved
- dud rate was not subject for prove
Upcoming Tasks

• **Flight Test DVT3 / Fly-Off2 at WSMR**
  - scheduled June 2004
  - 2 GMLRS Rockets
  - each rocket is equipped with 404 bomblets from two vendors, 202 from each
  - 50% of the bomblets are w/o delay chains for impact functioning rate prove, 50% of the bomblets are fully equipped for proving full functioning rate, dud rate and UXO rate
  - Temperature: hot (60°C/140°F)
  - Range: approx. 20 km

• **PQT**
  - scheduled October 2004
  - 9 GMLRS Rockets with 404 bomblets each,
  - 50% impact functioning mode only, 50% full functioning mode
  - full STANAG environmental Ground Tests