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High Fuze Reliability and Safety Today and in the Future

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"Next Generation Fuzing - Maximum Advantage for the Warfighter"

Company Presentation

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- **A global leader in the field of ammunition fuzes and S&A devices**
- **Full range of products**
- **Key competences in**
  - Fuzing technologies
  - Micro-technologies
  - Ammunition electronics

UN-Protocol V:

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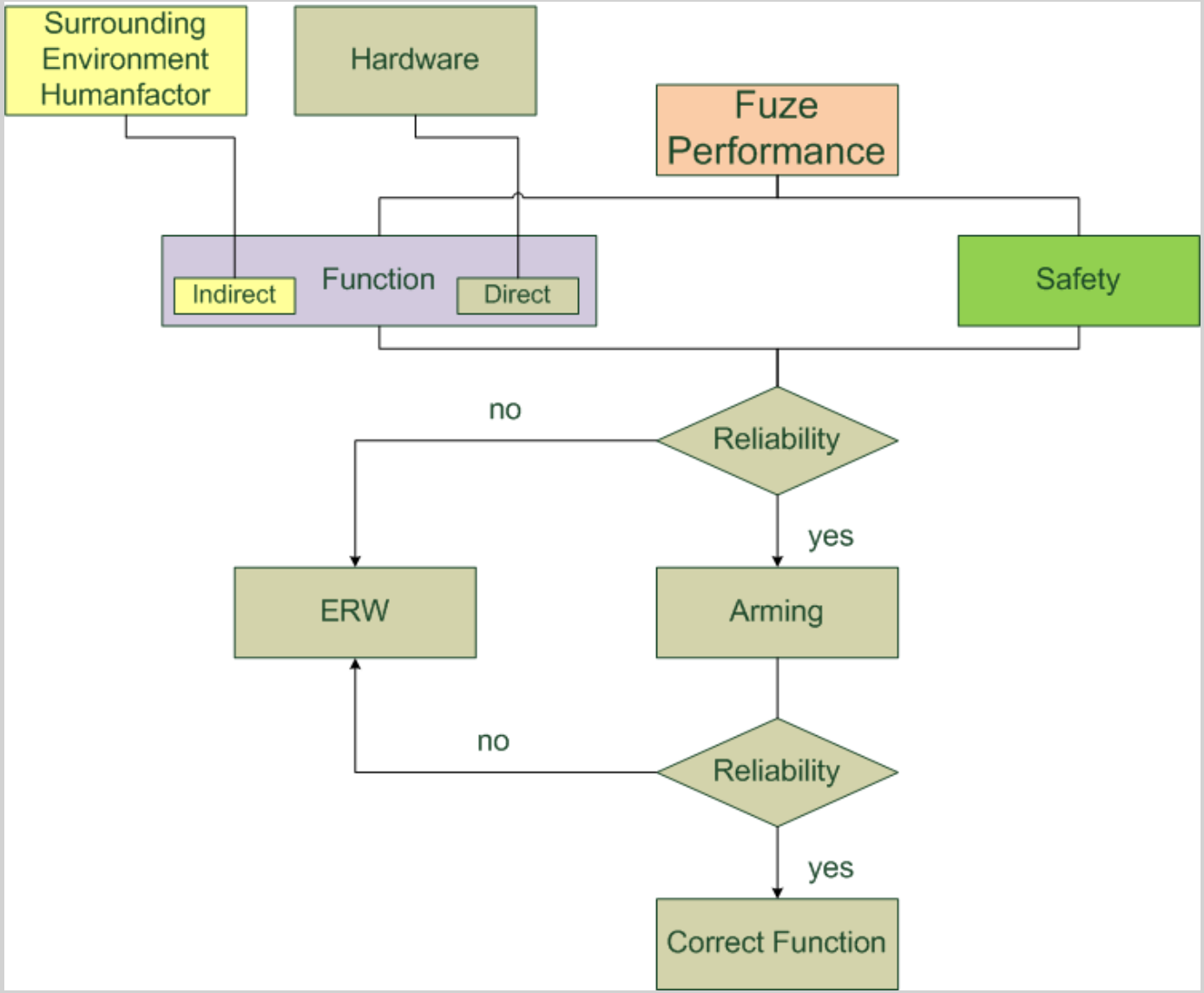
Extraction UN-Protocol V:

OBJECTIVES

The Protocol recognizes the serious post-conflict humanitarian problems caused by explosive remnants of war and addresses post-conflict remedial measures of a generic nature in order to minimize the occurrence, effects and the risk of explosive remnants of war.

Next to general regulations to reduce the hazard of explosive remnants of war Protocol V covers the commitment to mark and to dispose of conventional unexploded ordnance devices. Furthermore the function reliability of munition should be improved on a unsolicited basis. Protocol V is an important amendment to the UN weapon convention.

Fuze Performance



Explosive Remnants of War (ERW)

- High fuze reliability decreases ERW

- Interactions between Fuze safety and Fuze reliability
  - Fuze function depends on reliability
  - Fuze handling depends on fuze safety
  - Fuze safety is defined in STANAG 4187
  - Till the fuze arming safety is relevant
  - After arming function reliability is relevant

- Modern fuzes should have high reliability and high safety

Mechanical Mortar Fuzes (in service)
as an example for high reliability

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MTSQ DM93 (M776)

More than 4.5 mio. produced

PD DM111A4

More than 12 mio. produced

Initial Situation:
MTSQ DM93 - Mechanical Time Super Quick

type classified in USA as M776

Weapon

- all common smooth bore mortars (51 mm - 120 mm)

Further information

- more than 4.5 million units produced
- numerous customers including UK, Germany, Switzerland, USA (M776 and variant M772) and Canada
- tailored to customer requirements: more than 50 variants available (3gr or 5gr expulsion charge, MT or MTSQ, 54sec. or 67sec. ,…)

Initial Situation:
MTSQ DM93 - Mechanical Time Super Quick

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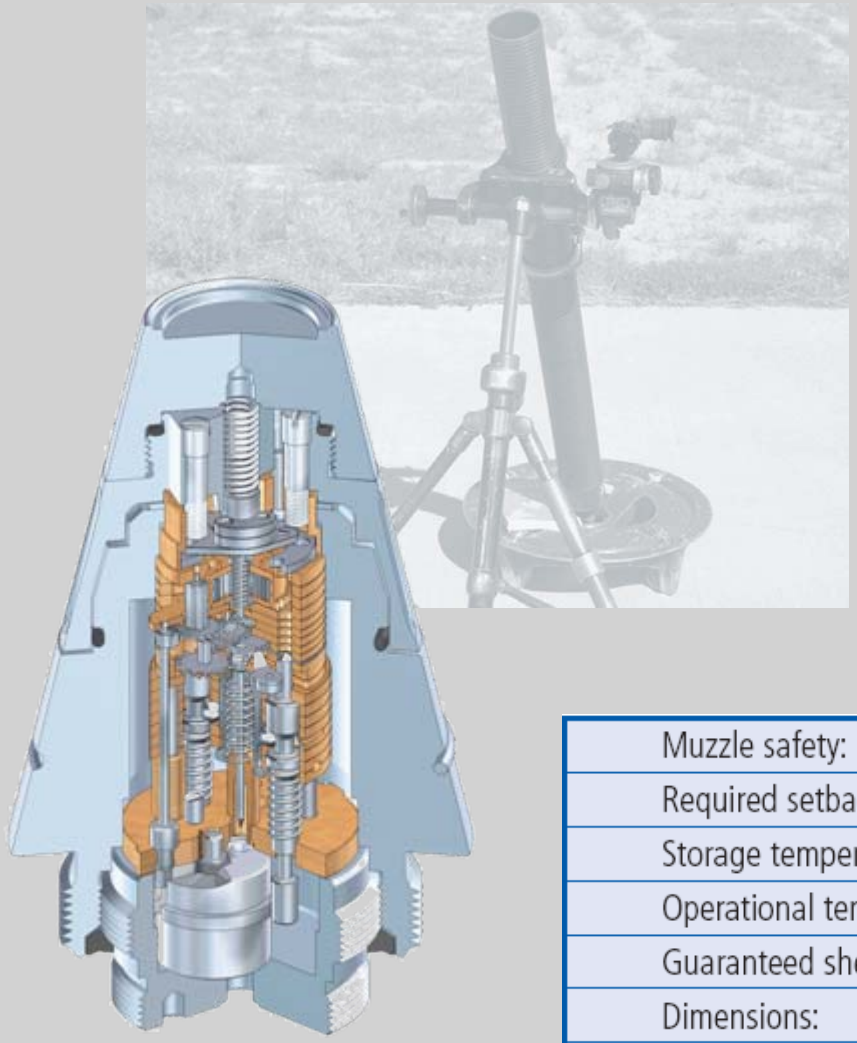

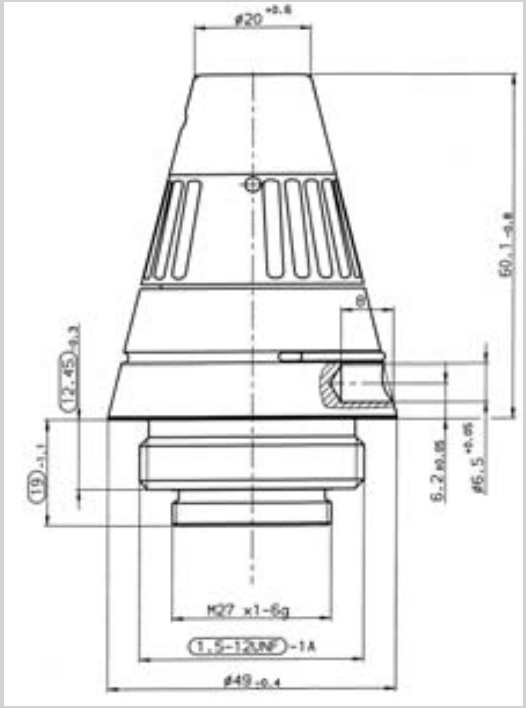

Muzzle safety:	≥ 40 m (≥ 0,8 s)
Required setback for arming:	≥ 650 g
Storage temperature range:	-54°C to +71°C
Operational temperature range:	-46°C to +63°C
Guaranteed shelf life:	10 years
Dimensions:	STANAG 2916
Weight:	225 g
Setting time	6 to 54 s (67 s)

compliance with MIL-STD 331 B

DM93 Fuze Family Lot Acceptance Tests (LATs) since 2006* as an example for high reliability of in service fuzes

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- 2006: LATs 1,038 / 0 (1,038 firings, 0 failures)
- 2007: LATs 668 / 0
- 2008: LATs 432 / 0
- 2009: LATs 200 / 0

- Total: 2,338 / 0

- These LATs represent a production of more than 750,000 Fuzes

*** 2006: start of electronical documentation**

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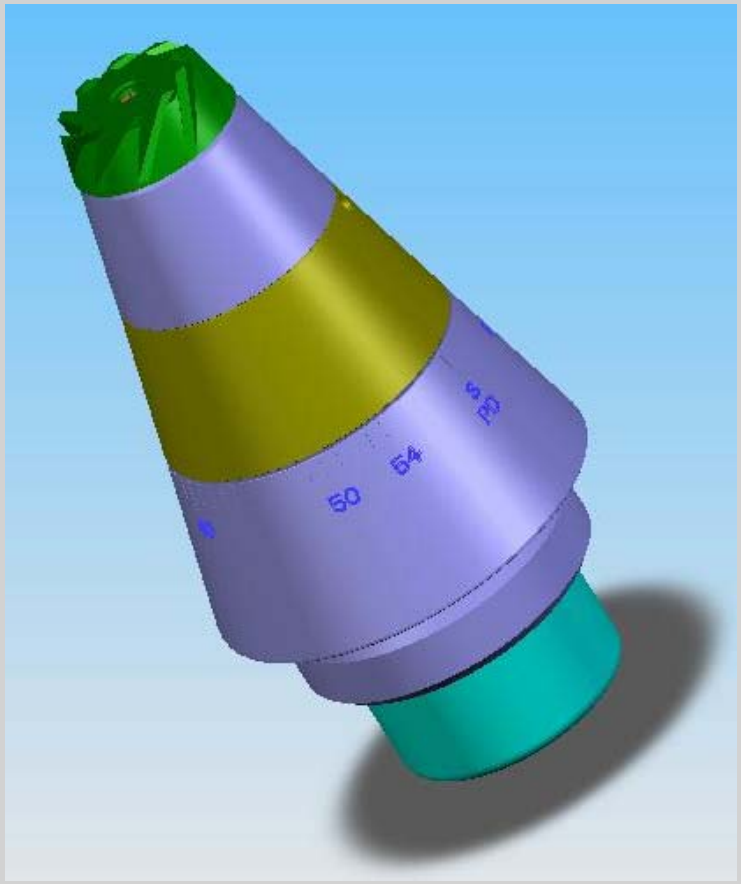
Design DM93-S:



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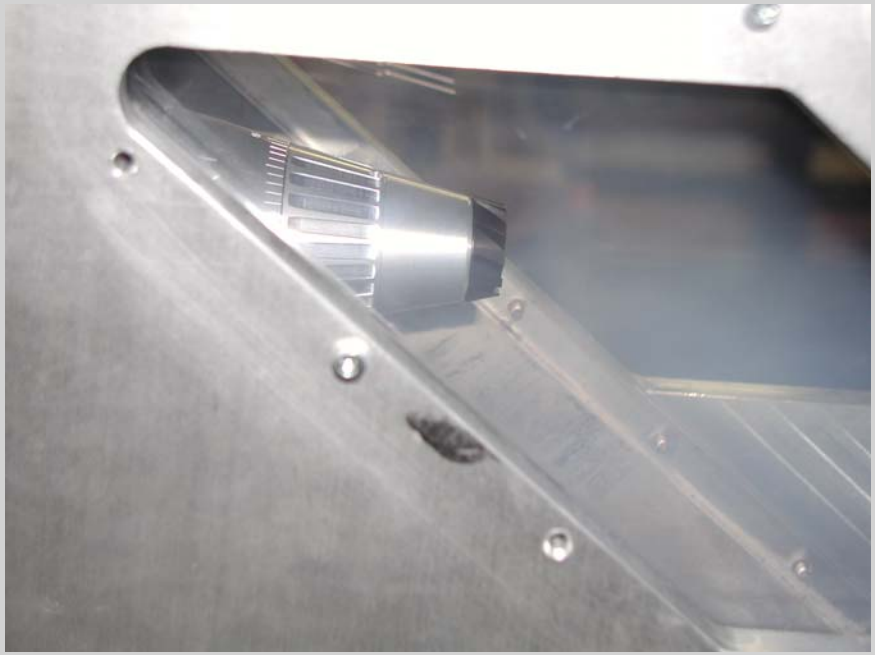
Concept DM93-S:

- MTSQ DM93 modified with a 2nd Safety Criteria
  - Fuze adapted with an external wind wheel and a centrifugal system
  - Creating a spin relation w.r.t. airflow in a non spinning munition
  - A 2nd Double Bolt System implemented to pre arm and unseal the System
  - For Arming the Centrifugal System needs 7.000 rpm

- Advantages
  - Fuze need no Safety Pin
  - Closed System
  - Fuze need no additional Cover (Protection against Dust, Water,…)
  - Due to the Pre Arming System the Fuze is insensitive against soiling, Freezing,..
  - 2nd Safety Criteria according STANAG 4187
  - System modular for other Mortar Fuzes e.g. DM111

Detail Results DM93-S



- Wind Tunnel Test for validation of
  - Drag performance
  - Revolution forces
  - Design optimization
  - Release behaviour

Detail Results DM93-S

- Question: Is there an influence to the timework and the preset time with high rotating wind wheel?

  Response: no influence

- Question: Is there a possibility to change the preset time with increased pressure on the nose?

  Response: no influence

STANAG Compliance DM93-S

- STANAG 4187: compliant
- STANAG 2916: compliant with dimensions of electronically Time fuze
- MIL-STD 331B: 12 m drop and 1.5 m drop fulfilled
- Environment: all Tests fulfilled

Summary DM93-S as an example of combination of Reliability and Safety

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- Same handling i.a.w. preset Time
- New Safety aspect
- Safety requirement fulfilled up to launch increased safety
- No Safety Pin required

- Company Qualification fulfilled
- World wide no comparable solution available
- **In service fuzes can be further improved i.a.w. STANAG 4187**

Conclusion

- JUNGHANS Product shows a combination of
  - High Reliability (e.g. DM93 Fuze Family)
  - Second Safety Criteria (e.g. DM93-S)
- High Safety improves Handling and Flight Safety
- High Reliability provide Arming
- Reliable Arming and Firing results in decrease of ERW



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Thank you for your kind attention!

Questions?