communications

BT Fuze Products

NDIA 51st Annual Fuze Conference Low Cost p-SDF for ICM Rounds

Pyrotechnic Self Destruct Fuze

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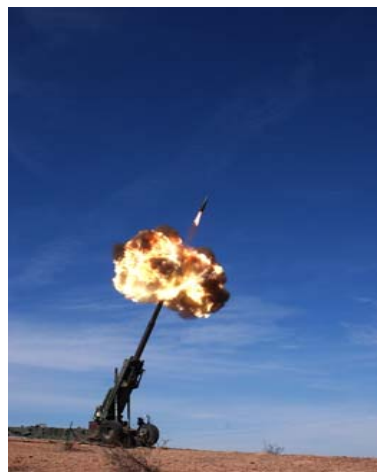


Pyrotechnic Self Destruct Fuze

History

- **Late 1990s – IRAD at BT Fuze**
  - Mechanical design
  - Pyrotechnic development
- **May 2000**
  - Concept Validation
  - Ballistic Testing (M483A1)
- **February 2002**
  - Formation of the IPT
  - Design improvements
  - Three(3) ballistic tests (M864)
- **May 2003**
  - Design changes for GMLRS
  - Ballistic test in GMLRS
- **June 2005**
  - Phase I Pre-Production Engineering
  - M864 recap prove-out
  - Two (2) series of ballistic tests (M864E2)
- **July 2005**
  - GMLRS PVT
- **July 2006**
  - 155mm/52 cal ballistic demo
- **October 2006**
  - Phase II Qualification of M864E2 (current contract)
- **December 2006**
  - 105mm IRAD effort (current)
- **April 2007**
  - GMLRS PQT (current contract)

Pyrotechnic Self Destruct Fuze

p-SDF Design Features

- Based on M223 Fuze Design
  - Arming screw, weight, slider, housing, cover
- Compatible with M42, M46, M77 and M80 Grenades
  - Functions with spin (XM1160, XM1162) or without spin (XM1161)
- Self-Destruct mode is independent of primary mode.
- All energetics are contained in slider
  - Stab ignitor, pyro delay, transfer element, M55 detonator
- Pyrotechnic delay is a standard mix
  - Tungsten/Barium Chromate/Potassium Perchlorate Composition (MIL-T-23132A)
- Compatible with existing LAP facilities

Pyrotechnic Self Destruct Fuze

Description of Applications

Application	Projectile	Grenade	Fuze Configuration
Cannon Artillery	M915 (105mm)	M80	XM1160
	M483A1 (155mm)	M42, M46	XM1162
	M864 (155mm)	M42, M46	XM1162
Rocket	GMLRS	M77	XM1161

Pyrotechnic Self Destruct Fuze

p-SDF Designations

XM1162 p-SDF for M864E2

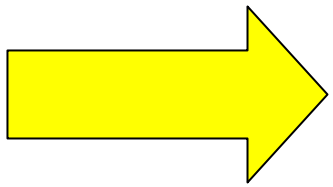
XM1160 p-SDF for M915E1

XM1161 p-SDF for GMLRS

Pyrotechnic Self Destruct Fuze

Application Evolution

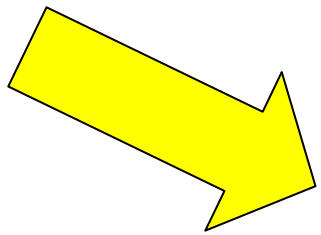
Original concept developed for M42/M46 grenade in 155mm application



Design modified for GMLRS non-spin application

M77 grenade has same footprint at M42/M46

Leverage initial p-SDF work and 155mm successes for low risk integration into additional systems

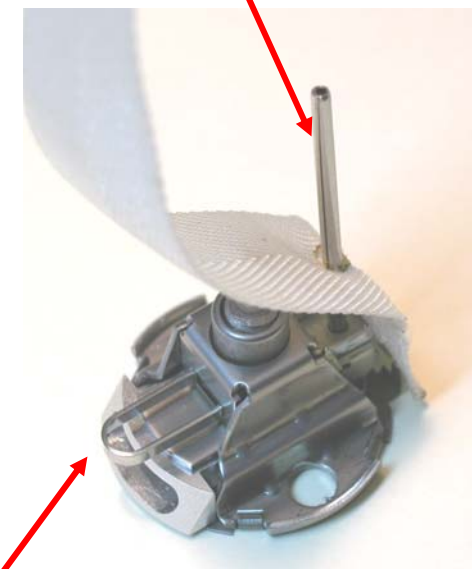


Design modified for smaller M80 grenade

Pyrotechnic Self Destruct Fuze

XM1162 for M42/M46

XM1161 for M77



Safety Pin

Safety Clip

SAME SAFETIES

IDENTICAL FUNCTIONAL INTERFACES

LOW RISK – BALLISTICALLY PROVEN DESIGN

Pyrotechnic Self Destruct Fuze

XM1162 for M42/M46

XM1160 for M80

SAME SAFETIES

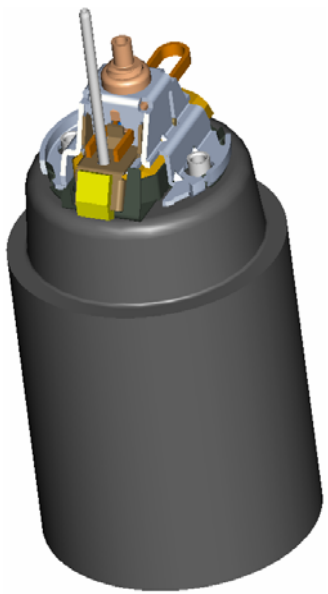
IDENTICAL FUNCTIONAL INTERFACES

LOW RISK – BALLISTICALLY PROVEN DESIGN

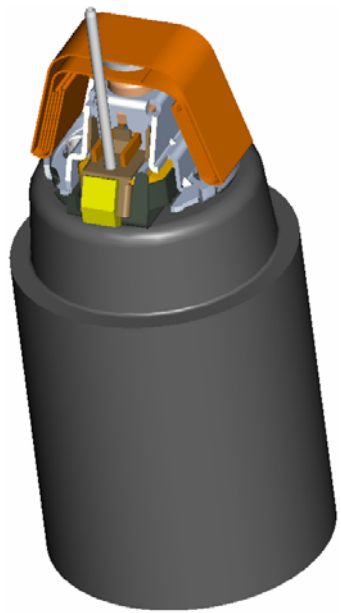
Pyrotechnic Self Destruct Fuze

p-SDF Safeties (XM1162 shown)

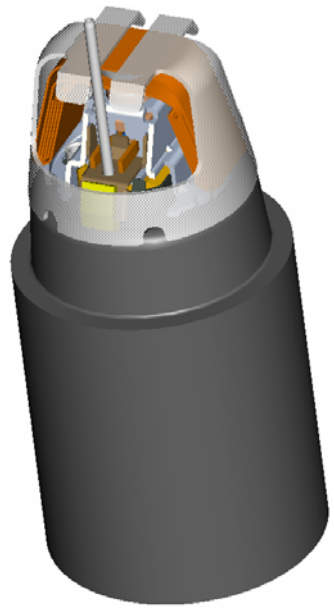
Safety Pin and Safety Clip installed at BT Fuze and remain in place while fuze is staked to grenade



Safety Pin and Safety Clip remain in place while ribbon is staked to fuze



Safety Pin and Safety Clip remain in place while ribbon furled and slider lock installed



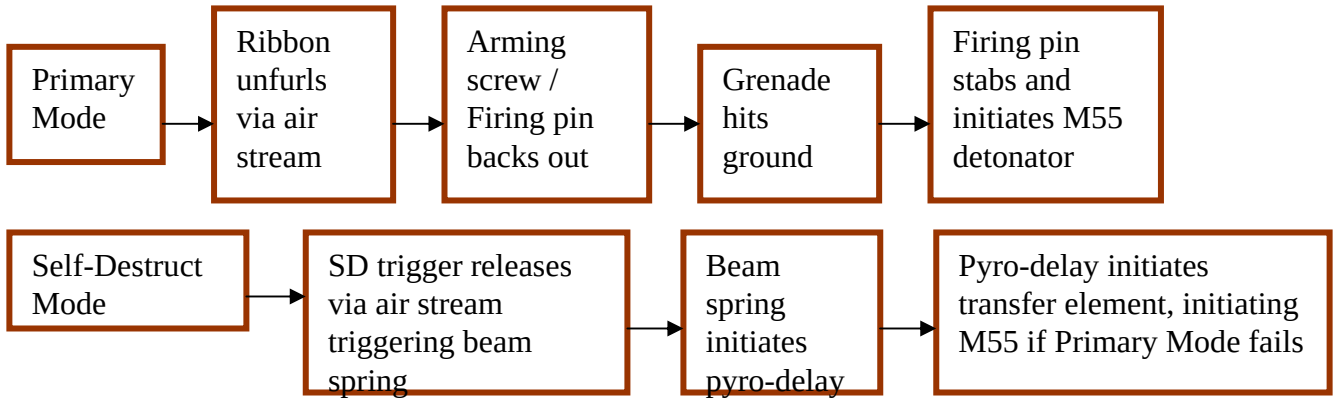
Pyrotechnic Self Destruct Fuze

Safety Testing / Milestones Completed

- Mil-STD-331
- Out of line Safety/Progressive Arming
- Stacked Body Loading Test
- New Energetic Compatibility approvals
- Energetic Safety approvals in progress
- EOD: Supportability documents submitted
- AFSRB: Interim Safety Certification Presentation (March 07)

Pyrotechnic Self Destruct Fuze

XM1162 Fuze Operation



Safe Condition

Self-Destruct Mode Initiated, Primary Mode Safe

Self-Destruct Mode Initiated, Primary Mode Armed

Pyrotechnic Self Destruct Fuze

Performance Testing

- Delay Time Spin Test
- High G Shock
- Extreme Temperature
- Spin Gun Test

Same Pyrotechnic Delay is used in all applications

(XM1160, XM1161, and XM1162)

Delay time requirement = 16 seconds minimum (M864E2)

XM1162 fully satisfies delay time requirement under all test conditions

Pyrotechnic Self Destruct Fuze

M864 Recent Ballistic Testing

Current Contract Phase I : All Recapped Grenades

- **BET I:**
  - 21 Rounds Fired for down select of design
  - Results of down selected design:
    - Primary Mode Reliability: 212 / 215 = 98.6% (97% req)
    - Self Destruct Mode Reliability: 326 / 329 = 99.1% (95% req)

- **BET II: Worn Tube, SOD, Tactical Vibration, Zone 8**
  - 29 Rounds Fired: Various fuze configuration
  - 1 Hazardous Dud out of 1047 (down selected design)
  - Baseline design SD reliability = 98.0%
  - Tactical reliability = 98.2%
  - Testing conducted at extreme temp and gun launch environment.

GMLRS STATUS

- Completed Design Verification Testing
- Production Verification Testing Scheduled for Fall 2007

Pyrotechnic Self Destruct Fuze

Most Recent Ballistic Testing

Final Demonstration / Proof 52 Cal gun tube

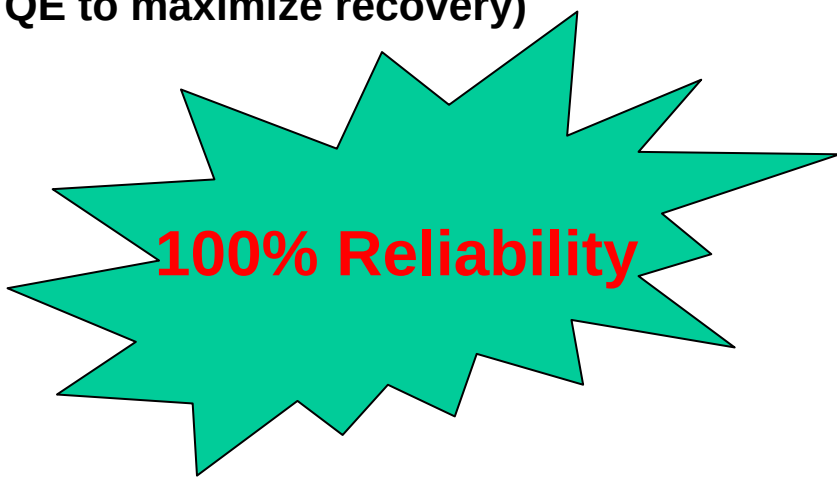
Ballistic Test Date: 20 July 2006

- **Five rounds M864 rounds tested**
- **Rounds conditioned to 70 deg F**
- **Cannon: XM282E1, Charge 6, M232MACS**
- **Fired at a Quadrant of Elevation (QE) of 615 mils**
- **Range 31.3 Km using MACS 6 propelling charge**

  (39K Range capability…shot at lower QE to maximize recovery)

Summary of Results:

- **360 grenades flown**
- **354 grenades recovered**
- **354 fully functioned**



Exceeded TLFC Requirements !

Pyrotechnic Self Destruct Fuze

Producibility

- p-SDF Component Parts
  - High volume production tools and processes are all in place
- Slider Assembly
  - Modular slider loading work cells in place and proven-out at BT Fuze.
  - Tooling designed to be adaptable to automated high rate equipment
- Grenade & Rocket LAP
  - Configurations similar to M223 Fuze that has been loaded previously in production.

Pyrotechnic Self Destruct Fuze

Current Status of Programs

- XM1160 p-SDF Demo in M915E1 scheduled for June 2007
- XM1162 p-SDF Qualification testing in M864E2 begins summer 2007
- XM1161 p-SDF PQT in GMLRS scheduled for September 2007

- Production capability for up to 10,000 units per month is in place (production rate verification completed May 2007)
- High volume component part tooling is in place

Pyrotechnic Self Destruct Fuze

Summary

- Satisfies minimum delay time requirement
- Robust p-SDF design and recap process verified via Strength of Design (SOD) ballistic testing
- Continued performance improvement resulting from successful IPT interaction
- Low rate production (10k/mo) available now
- Modular assembly line expandable by simple duplication
- Qualification/TC testing for M864E2 and GMLRS in 2007