Israel Military Industries Ltd. (IMI)

Munition Systems Division


# Electronic Fuze Device (EFD) and ESA

Oran Zeldin

# Background

- IMI is investing in the development of smart munition systems (tank, mortar and artillery munitions).
- Smart fuzes are required to enhance system capabilities and effectiveness.
- Under this perspective IMI started in 2004 the development of the Electronic Fuze Device (EFD).

# Main Design Guidelines

- ***Generic Design as possible*** – The design should enable easy compatibility to wide range of applications (including dimensions).
- ***Electronic Safe and Arm (ESA)*** – The design should be based on electronic safe and arm using an inline EBW/LEEFI detonator.
- ***MEMSization*** – In order to get a miniature, generic fuze and high survivability the design should make maximum use of MEMS components (sensors, detonator etc.). MEMS technology enables high functionality and high integration capabilities in small dimensions and as a result high survivability.
- ***Communication Interfaces*** – The hardware design should enable the use of various communication interfaces – standards or customized to the clients performance requirements

# Main Design Guidelines

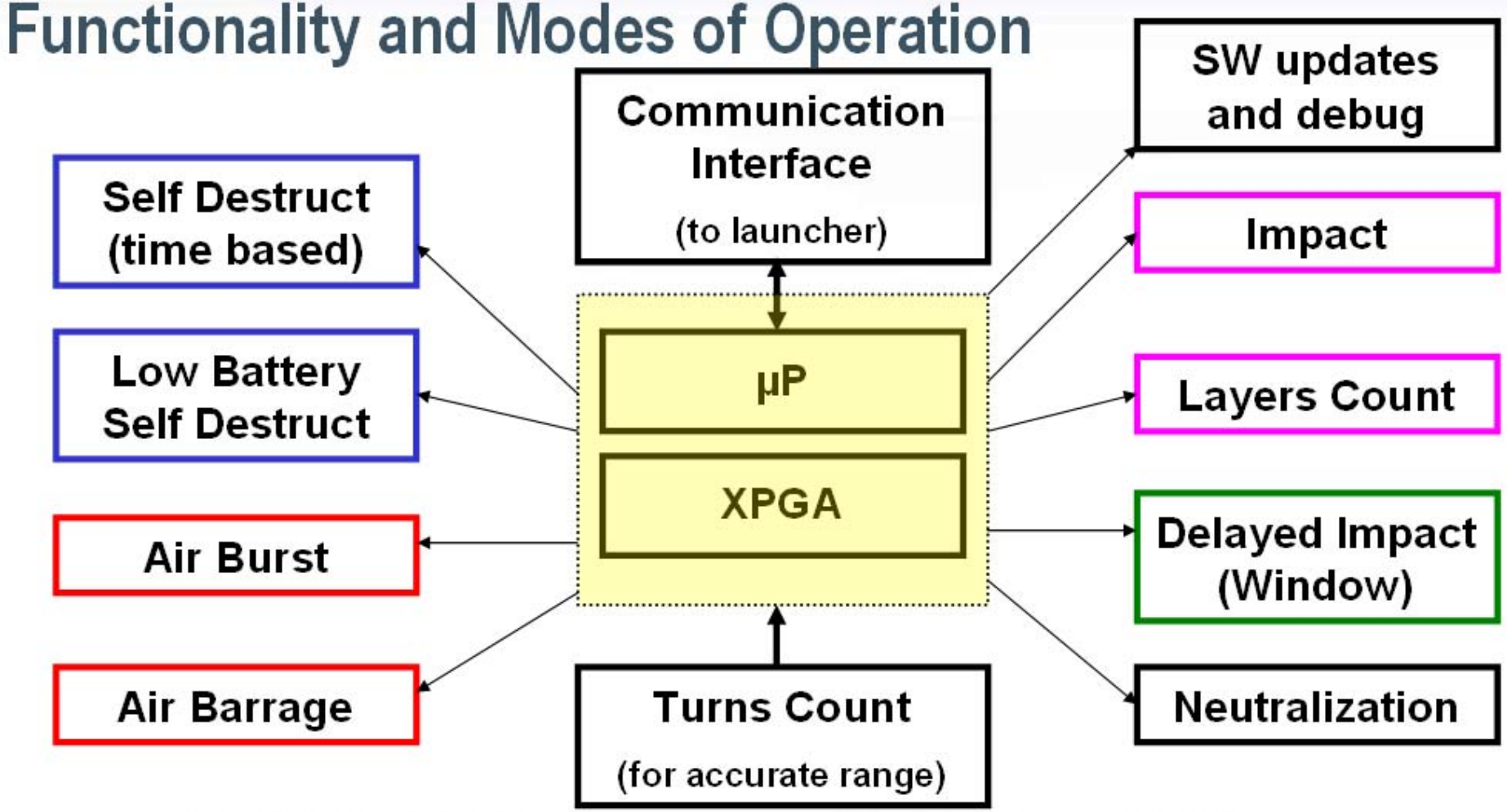
- ***Data Logging*** – The EFD should consist of logging capability of all the firing process events such as safe range, sensors inputs, time for detonation, time for self destruct and more. This function should be used mainly in development firing tests.
- ***Compliance with MIL-STDs and Stanags*** – The EFD should comply with all relevant mil-std and stanags including the following: mil-std1316, stanag 4187 and mil-dtl 23659.

# Weapon Application

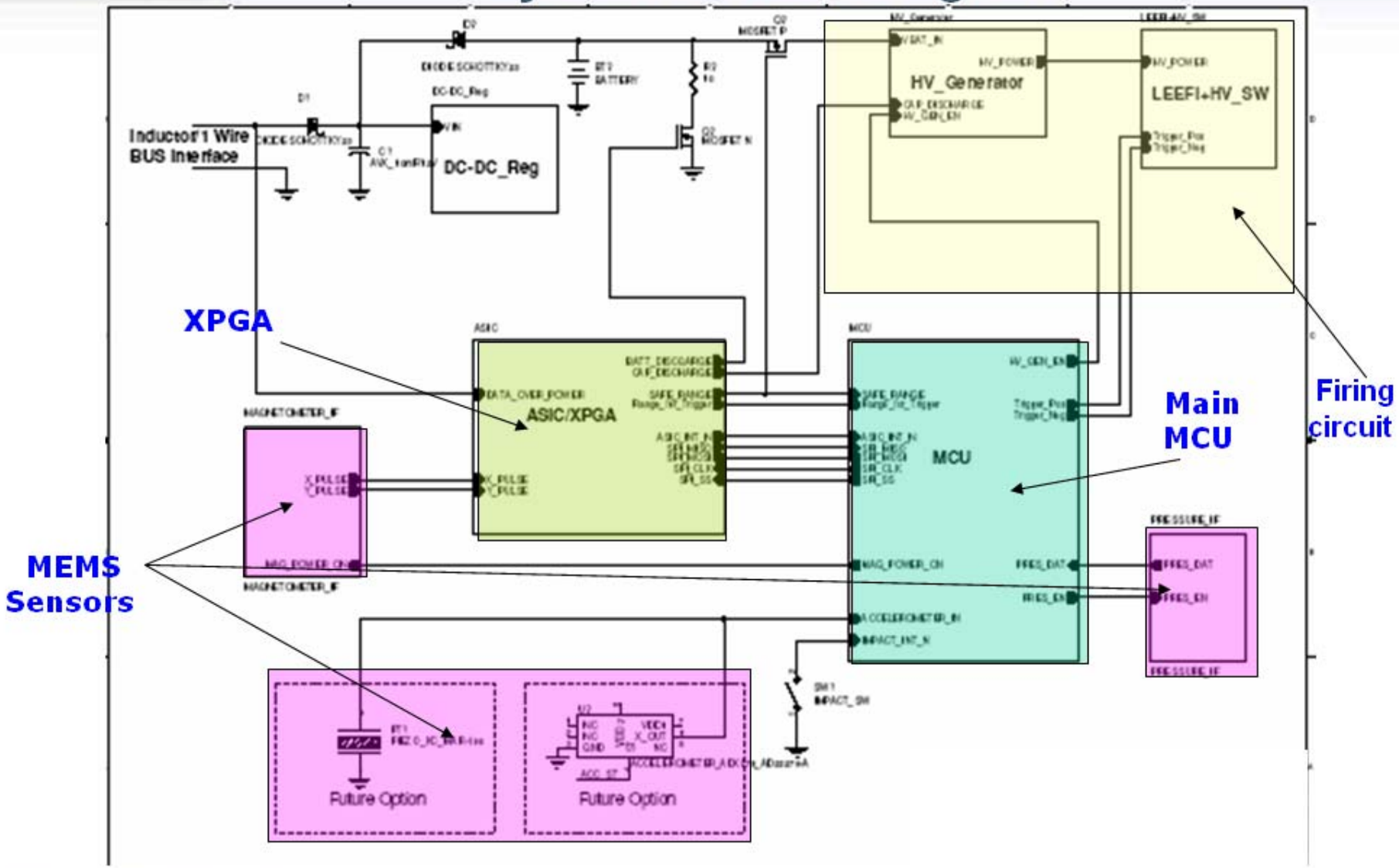
- The first chosen weapon application was M203 (40 mm Rounds).
- This application enables testing of different operation modes and high functionality.
- Safety conditions –
  - **Acceleration (sensed by mechanical g-switches at first phase of development)**
  - **Spin (Sensed by either MEMS magnetometer or mechanical g-switch)**
- Impact is sensed by MEMS accelerometer enabling layers count or target identification.

I.D. Scientific test plant

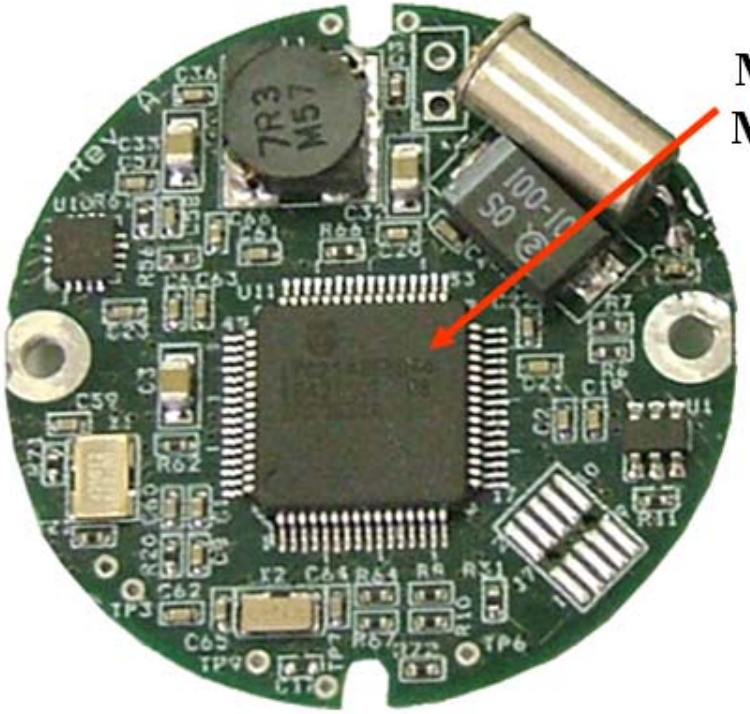
# Functionality and Modes of Operation

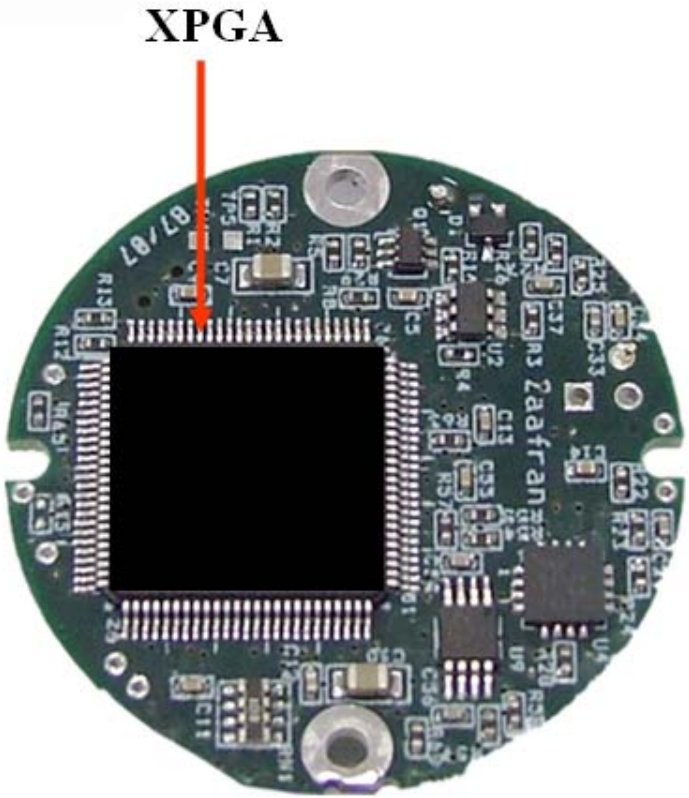


# System Block Diagram



# Logic Circuit



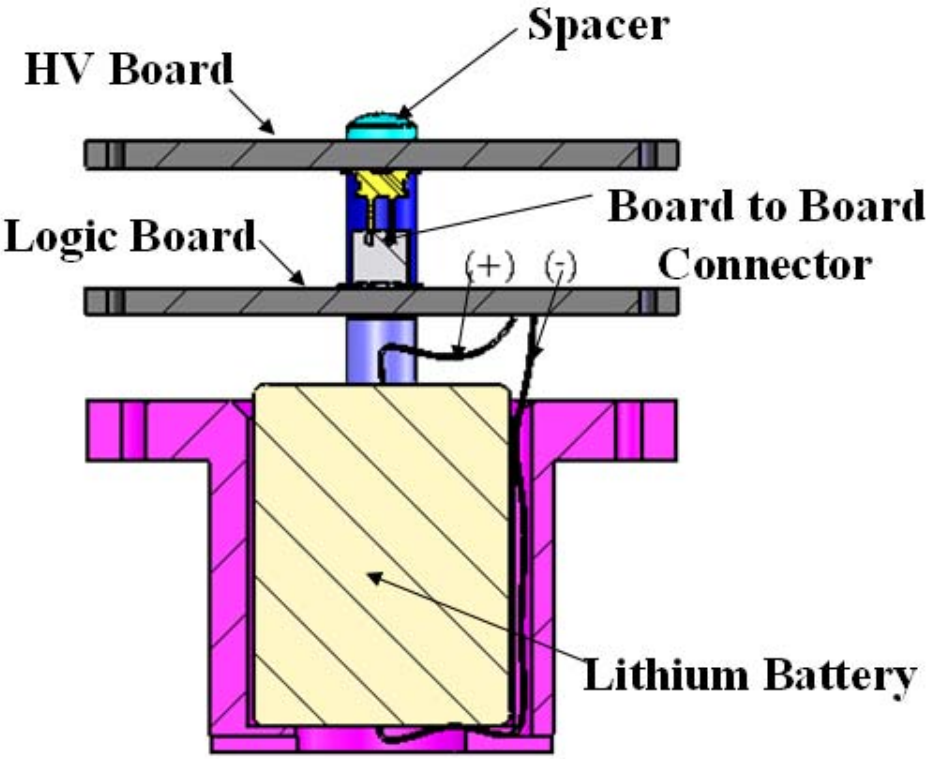

*Diameter: 34.7 mm*

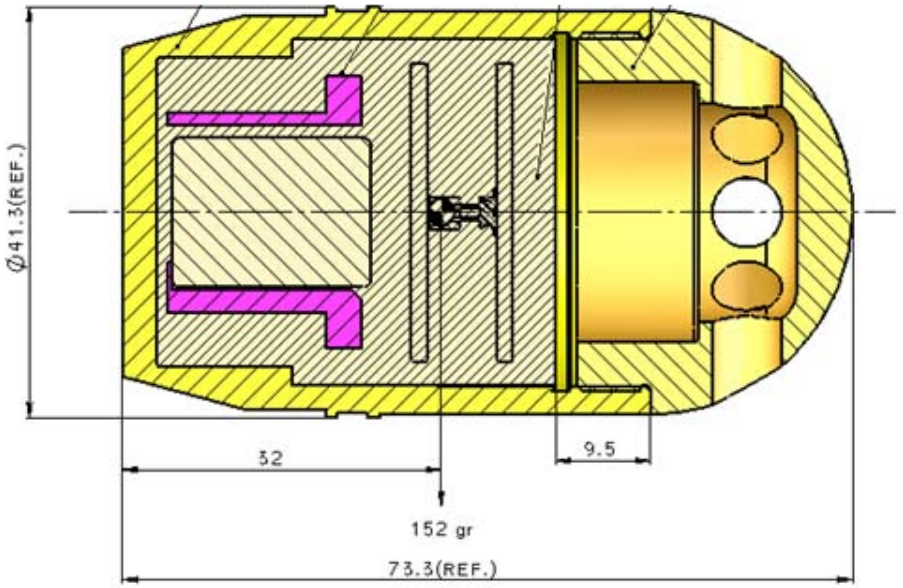
# High Voltage (HV) circuit characteristics

- Charging duration - 300 msec maximum.
- Capacitor charging voltage - up to 1200V.
- Super quick discharge – 10KA at 1µsec
- Diameter: 34.7 mm.
- Height: 10-15mm

# 40 mm Assembly

Tested under 13000 g's axial and spin rate of 50Hz (in operation).



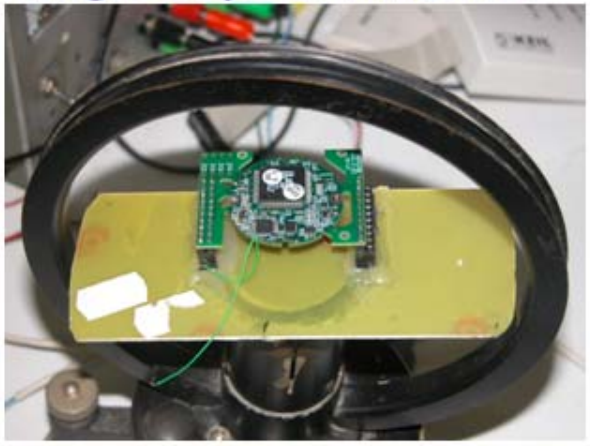
# Test Results for 40 mm

## *Logger Results*

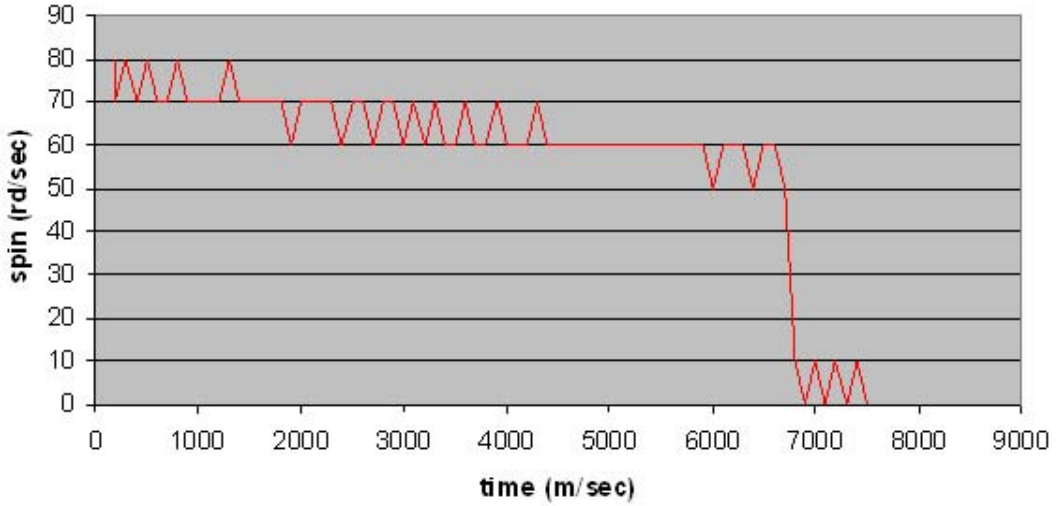
***195msec Safe Range clr***
***300msec Safe time for arm***
***1000msec Trigger***
***14000msec Time to self destruct***
***14000msec Trigger***
***16005msec Capacitor Discharge***
***31005msec Batteries Discharge***

## *Launching riffle*

## *Magnetic field simulator*



## *Projectile spin*



# Field Tests

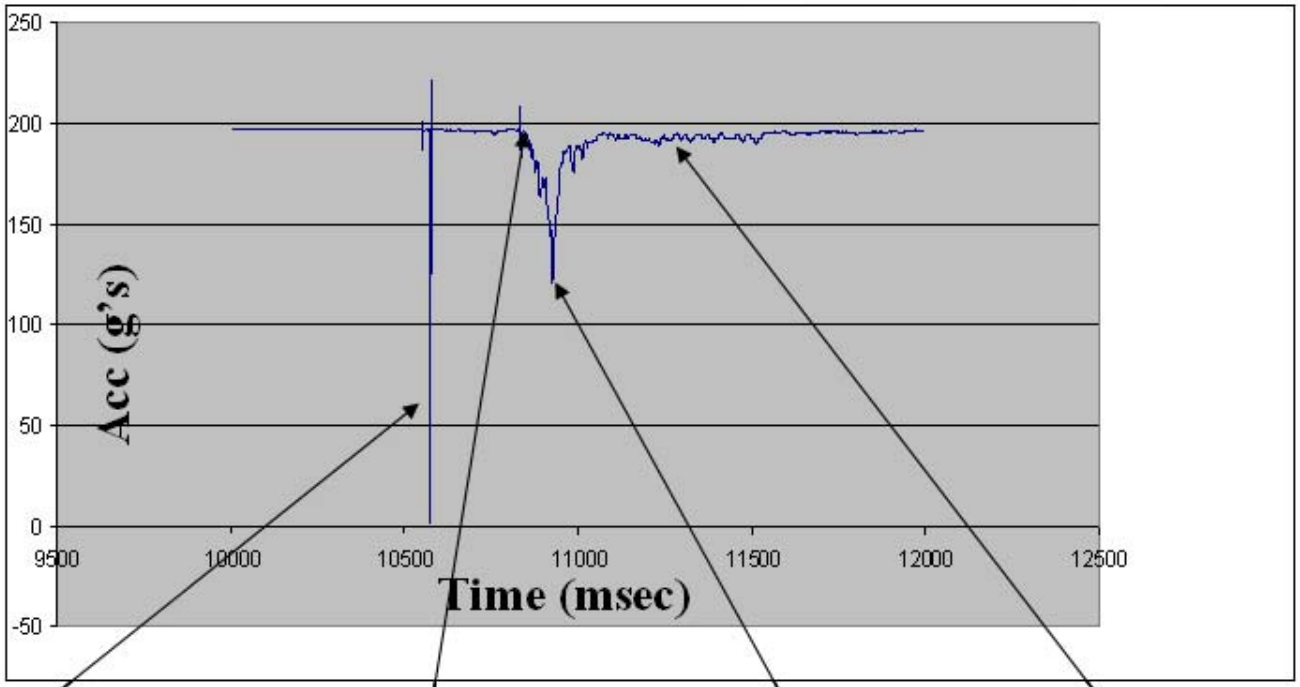
*Tests barrel*

*(enables pressures measurements)*

*Mission Load station for tests*

# Tests results – Accelerometer on 120mm SRV mortar bomb

Tests were conducted on other platforms as well




***Body Separation (saturation)***

***Parachute begins to Open***

***Parachute fully Open***

***Velocity Stabilized***

# EFD Road Map

Kickoff

Feasibility Study

Laboratory Prototype

40 mm Prototype

Firing Tests

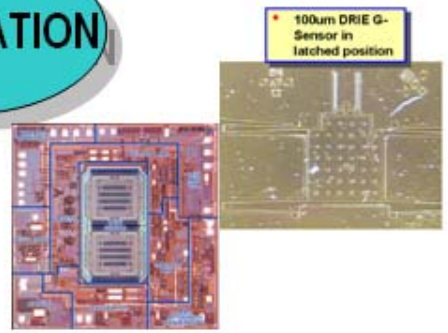
QUAL

Performance Improvements

Fuze On Chip

MEMSIZATION

Applications




2004 | 2005 | 2006 | 2007 | 2008 | 2009 and on