Navy Fuze S&T and Acquisition Strategy

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Outline

• Navy Fuze Acquisition and S&T Overview

• Navy Fuze Efforts and NDIA Presentations
Navy Surface Gun Fuzing Roadmap

**PAST**

- **155mm Projectile**
  - LRLAP: Long Range Land Attack Projectile
  - Electronic S&A and electro-mechanical ISD

- **5" Fuze**
  - MK437 Mod 0: Multi-Option Fuze Navy

- **Railgun/5" Subcaliber Projectile**
  - ONR Future Naval Capability Project
  - HVP: Hyper Velocity Projectile
  - Height of Burst Sensor Development
  - MEMS S&A Development

**CURRENT**

- **57mm Fixed Ammunition**
  - MK442 Mod0/1: 3P (Prefragmented, Programmable, Proximity) Fuze

**FY16**

**BYND FYPD**

- DEVELOPMENT
- PROCUREMENT
Navy Fuze S&T
Navy Fuze Technology

S&T Funding

ONR

Joint Fuze Technology Program

Industry

Gov

Joint and Leveraging Fuze S&T Efforts

DOE-DoD Technologies

Partnering

S&T Transitions

Weapon Fuzing R&D and Acquisition
Selected Navy Fuze S&T Efforts

- Integrated Switch Slapper Progress (IIIB)
- JFTP Unpowered Cannon and Railgun Environment Validation (IVB)
- JFTP Stacked MOSFET and IGBT Pulse Discharge Switch (IVB)
- JFTP DoD MEMS Fuze Reliability Evaluation (VA)
- JFTP MEMS Retard & Impact Sensor (VB)
- ONR High Reliability DPICM Replacement (VB)
- JFTP Freefall Energy Harvesting and Sensor Design (VB)
- ONR Hyper Velocity Projectile Fuze
- JFTP Advance Proximity Sensing
- JFTP Hard Target Survivability – Modeling & Simulation, Testing, Encapsulation, Materials
- JFTP Metal Free Primary Explosives for MEMS
High Reliability DPICM Replacement (HRDR)

- Developing technologies to enable electrical signal distribution in a weapon system with large numbers of submunitions
  - Minimize disruption to the dispense event
  - Maintain robust mechanical and electrical interfaces

Closed Session VB briefing provided by Daniel Pines
HRDR - Synergistic Fuzing S&T Investments

Technical Challenges
1. Increase submunition fuze and explosive train reliability to >99%
2. Develop multi-layer potting compounds to protect electronic/MEMS fuzes
3. Construct safety compliant, distributed fuzing architecture and power system

Capability Realized
- Maintain area effectiveness of canon fired cluster munitions and meet OSD UXO Policy

Investment Sources
- Office of Naval Research
  - Code 30
  - Future Naval Capability
- Joint Fuze Technology Program
  - FATG II, III and IV
- Naval Innovative Science and Engineering (219)

Intellectual Property
- Navy Case number 102,421, “Distributed Fuze Architecture for Highly Reliable Submunitions”

Underlying Science
- Physics based explosive transfer models and experiments
- Predicting and measuring material failure under acceleration
- Arming signal/power surety under very high spin rates
MEMS Fuze for Hypervelocity Projectile (HVP)

- Guided round for Navy Railgun
- MEMS-based fuze under development by NSWC Indian Head
DoD MEMS Fuze Reliability Evaluation

- Calculate estimated reliability for the explosive trains for both Army and Navy MEMS systems
- Measurements of MEMS flyer velocity and statistical variation (100 point data set)
- Characterize shock initiation EDF-11 used as explosive lead

Open Session VA briefing provided by Dan Lanterman
MEMS Retard and Impact Sensors

- Exploit existing MEMS micro-fabrication and packaging technologies to obtain higher-performance DoD retard and impact sensors.
- Improved G-sensor performance for existing and future fuzes.
- Metal (LIGA) and Silicon (DRIE)
- Small lot of both metal and silicon retard sensors will be manufactured, tested and submitted to fuze vendor for evaluation.
- DOTC contract established with ATK to evaluate and qualify MEMS G-sensors.

Closed Session VB Briefing provided by Mr. Randy Drobny
Freefall Energy Harvesting and Sensor Design

- Developing drop event detection technologies for future Gravity Dropped Weapon ESAF
  - Lanyard pull energy harvesting and drop event detection
  - Smart kinematic sensor drop event detection
  - Targeting application in general purpose bomb and future miniature munitions.

Closed Session VB briefing provided by Mr. Paul E. Anderson
Demonstrating a novel pulse discharge switch topology based around a series stacked MOSFET or IGBT.

- Built around COTS MOSFET/IGBT switches
- Aiming for 40-60% cost reduction over NMCT
- Live Fire testing planned
- Targeting application in any ESAF
Unpowered Cannon and Railgun Environment Validation

- Addresses the challenge of using ESADs in guns
- Energy harvesting and analog signal processing
- Measures setback magnitude and duration
- Stores spin state change
- Measures magnetic field profile
- Gun tests in FY16 to validate circuits
  - 57mm/70 cannon
  - 16MJ railgun

Closed Session IVB briefing provided by Mr. Michael Haddon
Metal-Free Primary Explosives for MEMS Detonators

- Develop metal-free, primary explosive with nitramine-like output and lead azide sensitivity for low-energy, out-of-line systems.
- Investigate and characterize CL-30, a novel high-output organic primary for MEMS devices.

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Summary

• Navy R&D fuze activity focused on ESADs and MEMS

• Detailed, Navy centric briefs to follow as part of the 58th fuze conference