

NDIA 50th Annual Fuze Conference UNITED STATES NAVY OVERVIEW

Stephen Mitchell
Co-Chair, Naval Energetics Enterprise

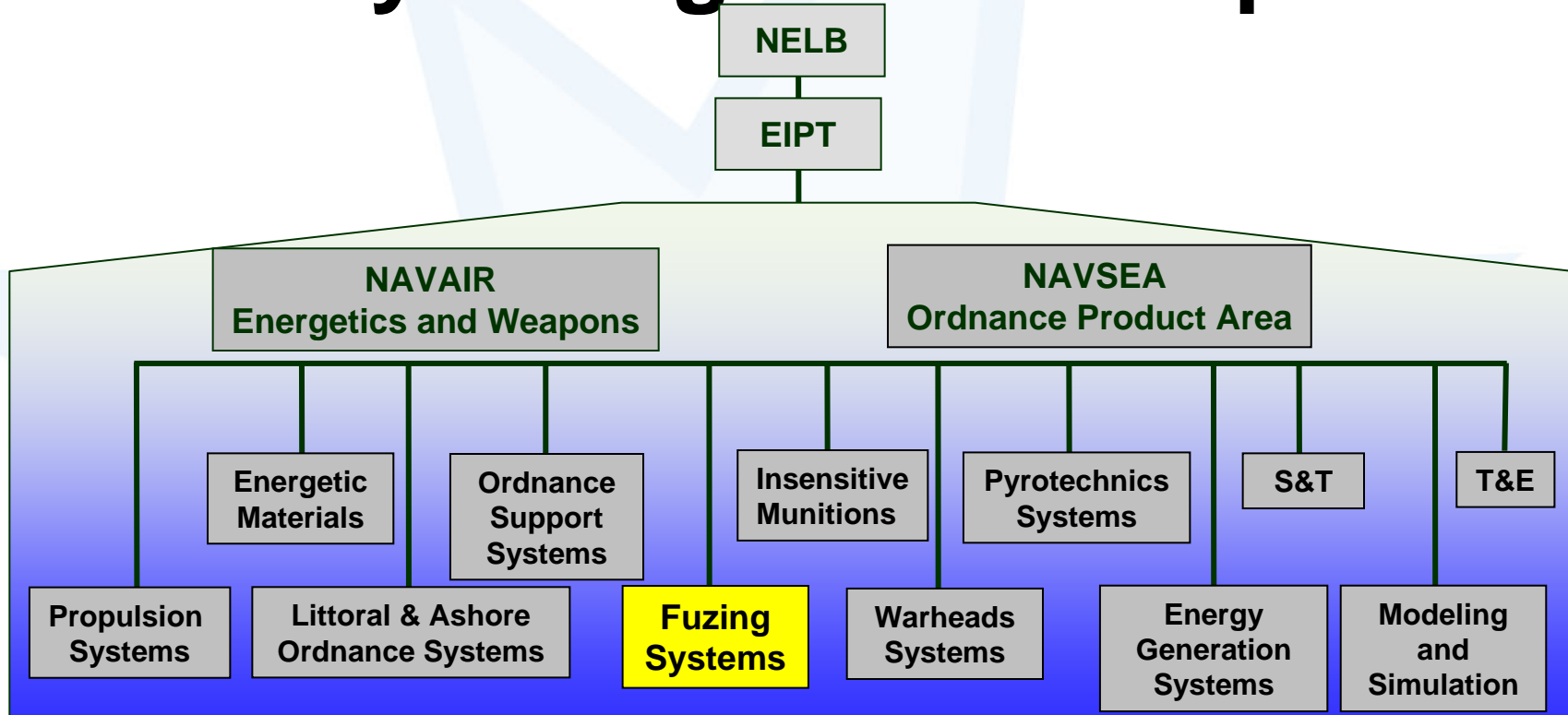


OUTLINE

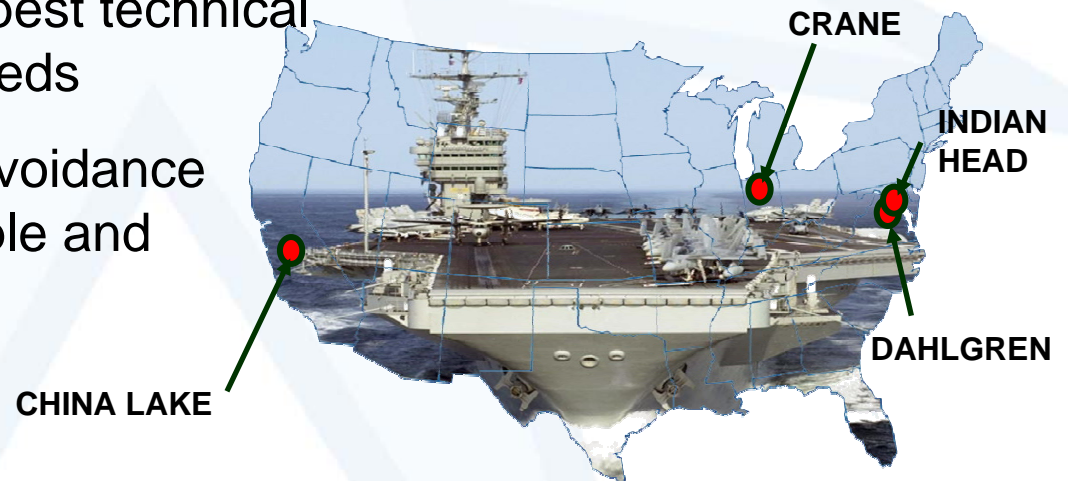
- **Navy Energetics Enterprise – NEE**
- **Navy Safety Board Structure**
- **Air, Surface, Undersea Navy Programs**
- **Emerging Technology**
- **Summary**



Navy Energetics Enterprise

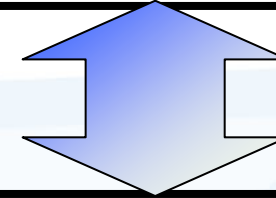
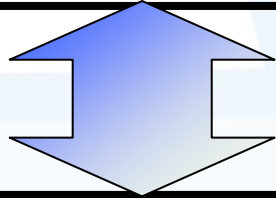


- Collaboration to provide best technical solutions for Warfighter needs
- Achieve long-term cost avoidance resulting from shared people and facilities

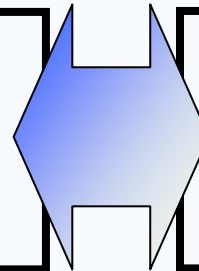


Navy Fuze Safety Review Process

Weapon System Explosives Safety Review Board – WSESRB



Fuze Initiator System
Technical Review Panel
FISTRP



Software System Safety
Technical Review Panel
SSSTRP

Joint Programs

Army Fuze Safety Review Board

AF Non Nuclear Weapons Safety
Board



Fuze Initiator System Technical Review Panel

FISTRP

Panel Chair – Jack Waller

Panel Members – Ralph Balestieri

Randy Cope

John Hendershot

Dave Libbon

Dave Riggs

Brian Will

Ray Ash

Tinya Coles-Cieply

Brad Hanna

George Hennings

Scott Pomeroy

Gabe Soto

John Kandell

Gene Marquis

Current Topics of Interest/Challenge

- **Evolving Requirements Definition (within FESWG)**
- **Move to STANAGS**
- **1901A/23659B – In-Line Ignition Safety Device (ISD)**
- **Programmable Logic Devices (PLD) Implementation**
- **Built In Test (BIT)**





FMU-139 Family Electronic Bomb Fuze



- **FMU-139C/B Currently Being Procured From KDI and ATK**
 - **Replenish Current Aging Inventory**
 - **Extended Operational Life With FFCS**





FMU-139 PIP Efforts



- **Currently Being Conducted at KDI and ATK**
 - **Enhanced Capabilities Demonstration**
 - **Serial Data Interface**
 - **Increased Penetration**
 - **In-Line Explosive Train**
 - **Increased Reliability**

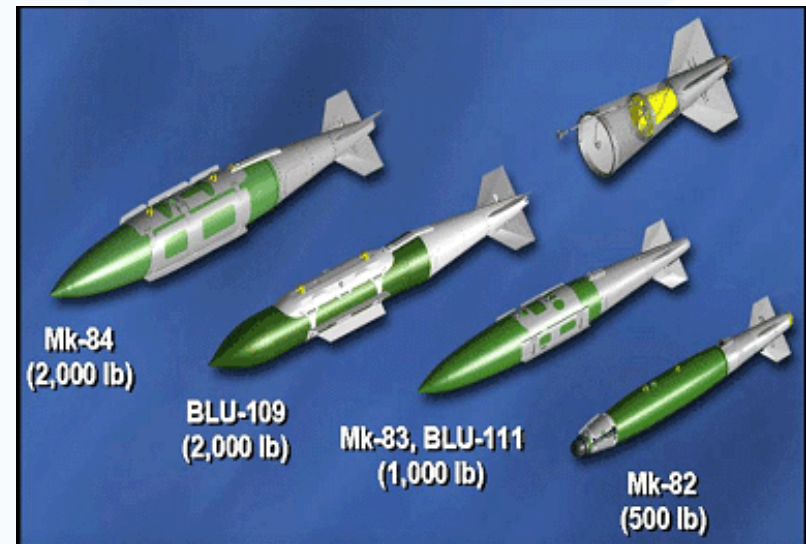




FMU-139D/B



- Next Version of FMU-139
 - ✓ Enhanced Capability
 - ✓ Enhanced Reliability



**Planned Full & Open Competition
RFP Release Late FY-06**





HI-REL FUZE

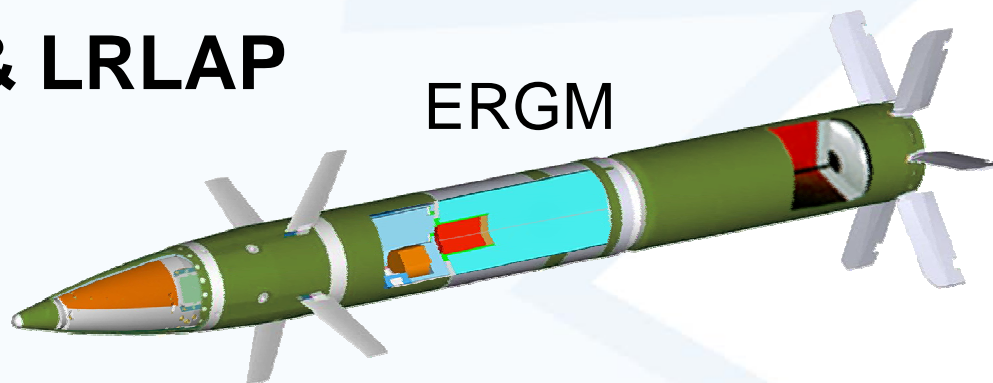
- Next Generation Fuze For Precision Guided Munitions
 - Dual Mode LGB, JDAM
- Higher Reliability
 - Eliminate external devices such as Fuze Function Control Set (FFCS), Mk-122 Arming System Switch, M 70 Series Cable, and associated electrical and mechanical connections (i.e. lanyard)
 - Incorporate Pre-Release Checks
- Safety Architecture Integral With MIL-STD-1760 Interface and Weapon Guidance Control Unit
- NAWCWD Conducting Tests to Evaluate Compliance of Approach with MIL-STD-1316





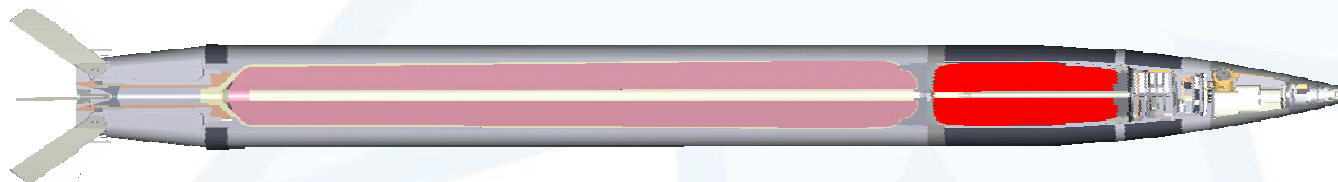
Gunnery Programs

- Long Range Guided Projectiles in Development:
 - ERGM, BTERM, & LRLAP
 - 41nmi+

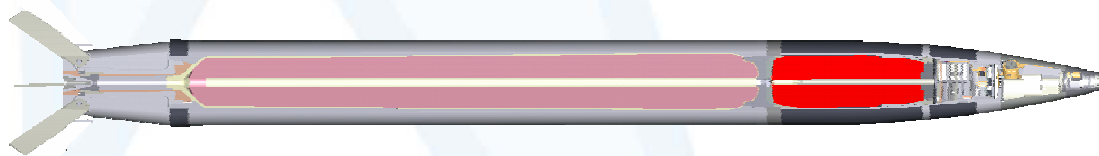


ERGM

LRLAP



BTERM



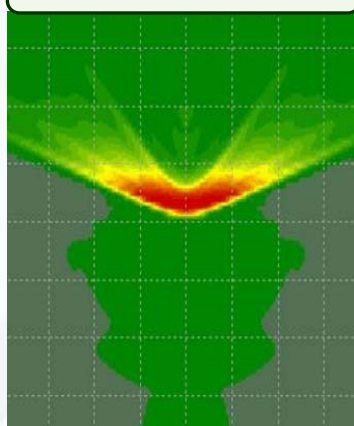


Gunnery Programs

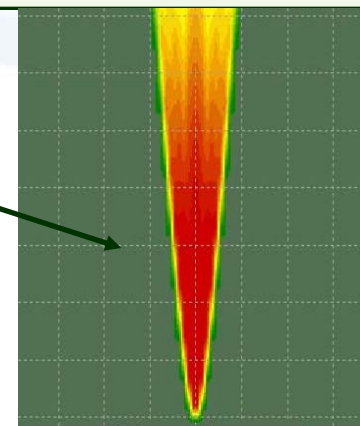
- **Short Range Self-Defense Projectiles:**
 - **5" Guns Have 3 New Projectiles: KE-ET, HE-ET, HE-MFF**
- **Minor/Medium Caliber Guns**
 - 25mm
 - 30mm
 - 57mm
 - 76mm



Existing HIFRAG



Shotgun Projectile



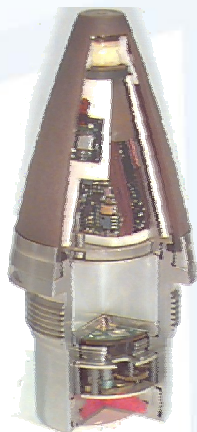
*Twice
the
Lethal
Area*



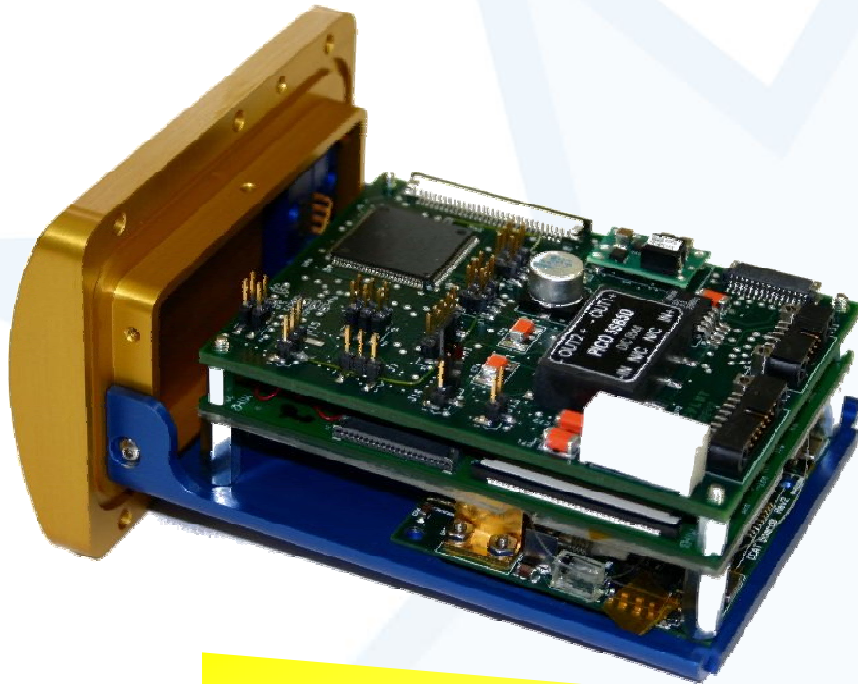


Gunnery Fuze Production Programs

- **Low Cost Fuzing**
 - **MOFN Instead of MFF for Most Threat Scenarios**
- **Producible Fuzing:**
 - **Need Battery for Next Production of MFF**
 - **Testing Diehl/Eagle Picher Batteries**



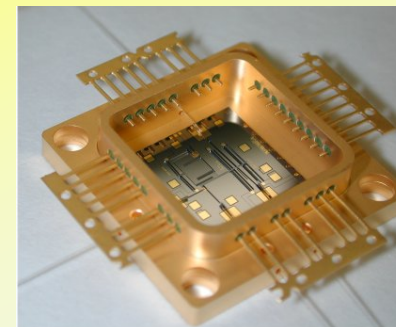
Future Undersea Weapon S&A



- **Multi-Mission Capable**
 - Single S&A configuration for multiple missions & platforms
 - Multi-point warhead initiation
- **Safety Features**
 - IMU based Safe Separation System
 - Safe-arm indication, safing switch

MEMS S&A package

- Miniaturization of safety and arming and initiation components
- Enables common S&A for multiple platform deployment
- Ruggedness demonstrated in harsh environments



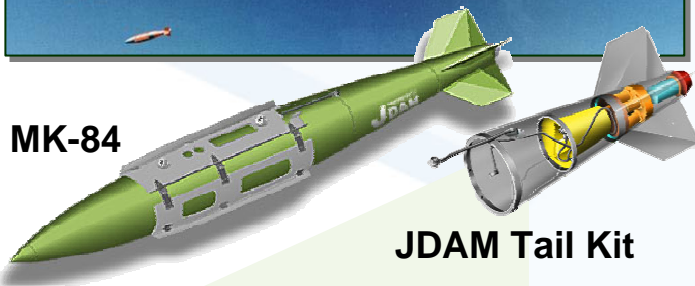
Packaged MEMS
S&A Chip



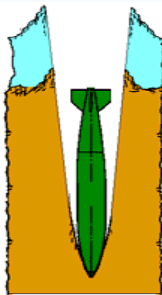
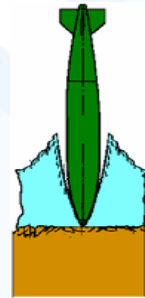
JDAM Assault Breach System JABS



MK-84



JDAM Tail Kit



- Fuze (FMU139) with pre-selected delay times to increase bomb effectiveness against mines / obstacles in the surf zone

- Bomb detonates at optimum position in range of water depths
- Increase lethality against mines and obstacles

- FY07 Evaluate JABS lethality in the Very Shallow Water (VSW)

FY06 JABS S&T

- Flight tests with instrumented Fuzes
- Record water impact signature
- Monitor response of (FMU139) impact switches

Shock Hardened Recorder Redundancy

- Two Recorders per Bomb
- Two Accelerometers per Recorder
- Non-Volatile Memory

Data Recorder



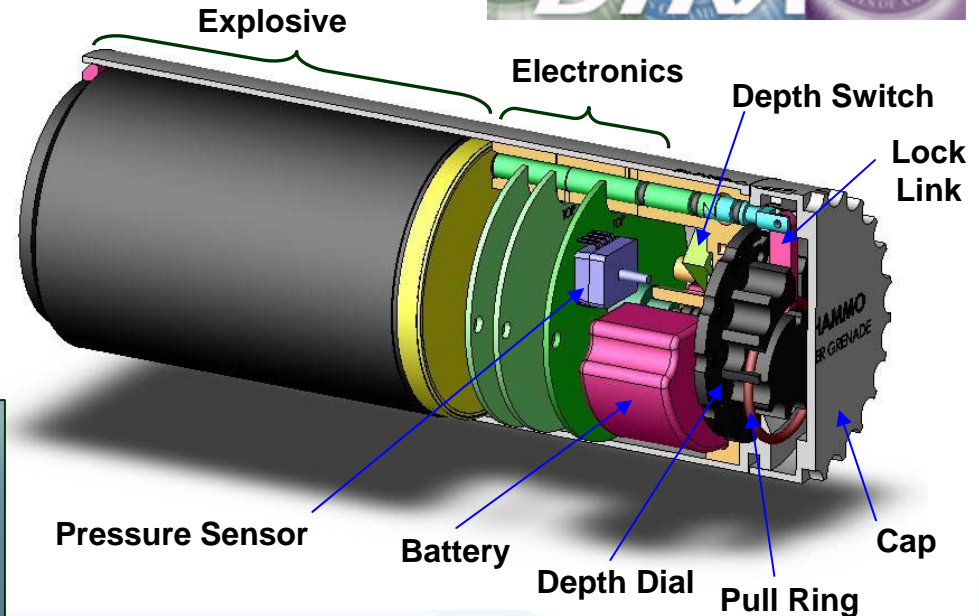
ANTI-SWIMMER GRENADE (ASG)



Force Protection



- Designed to protect assets from attack by SCUBA swimmers



Safety

- ASG will detonate only underwater beneath a predefined safety depth
- Will harmlessly render itself safe if it is activated but fails to see the correct arming environments

Features

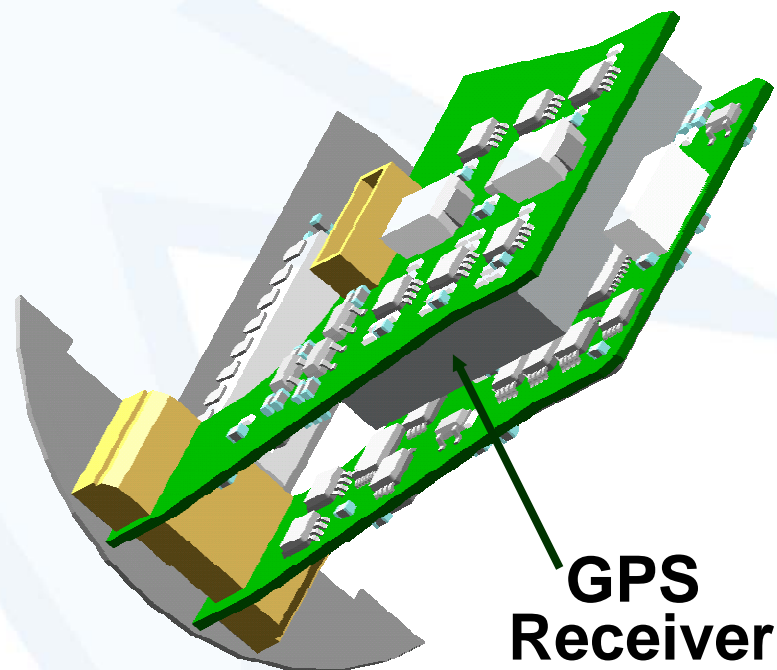
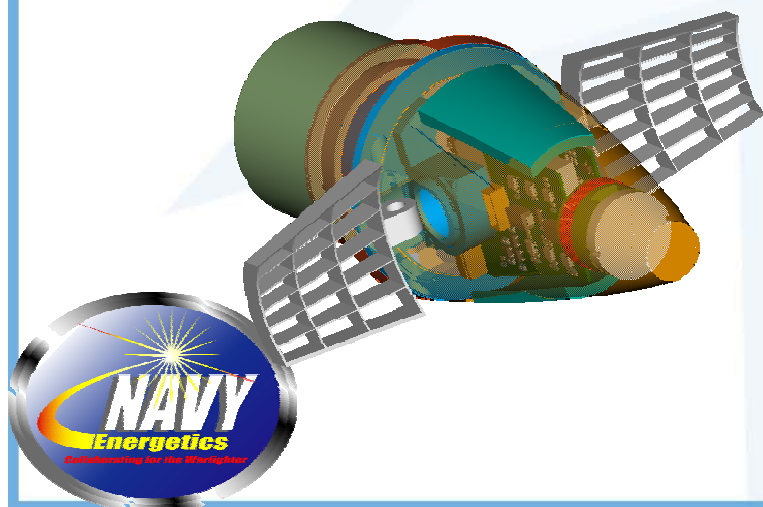
- Electronic In-Line Safe-Arm Device
- Hand-Emplaced Ordnance design meets MIL-STD-1911
- User-selectable function depth (10-ft to 100-ft in 10-ft increments)





Gunnery Technology Fuzing Thrusts

- **Low Cost Guidance:**
 - **GIF & PGK**
 - **Developing Next Generation GPS Receiver**
 - **Small Size (<1.5 in²)**
 - **Low Cost (<\$500)**
 - **Low Power (<1 Watt)**



ONR Future Naval Capability (FNC) Program

IMU Based Safe Separation System



- **Miniature (MEMS based) Inertial Measurement Unit (IMU) embedded in S&A to measure safe separation distance**
- **Flexible IMU-based safety algorithm that incorporates:**
 - **Weapon post-launch position determination independent of guidance system**
 - **Two independent parallel algorithms for fault tolerance**
- **COTS IMU sensor integrated into S&A**
- **FY06: in-water tests of IMU sensors**



ONR Discovery & Invention (D&I) S&T Program

MEMS S&A Technology



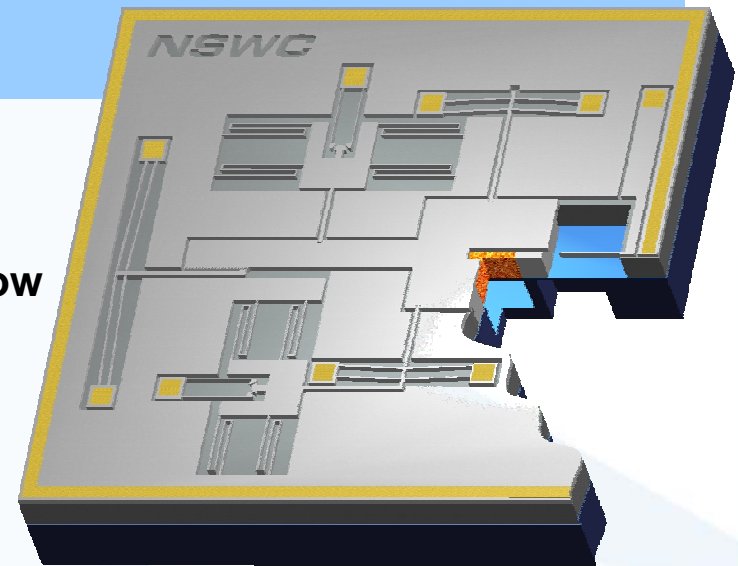
- Capitalizes on commercially available IC large scale batch fabrication techniques
- Enables weapon system integrated fuzing for multi-mission and scaled effect capability
- Reduces fuze cost and size

Status;

Completed characterization of 1st prototype S&A components and devices in laboratory ... long throw actuators, G sense locks & impact sensors

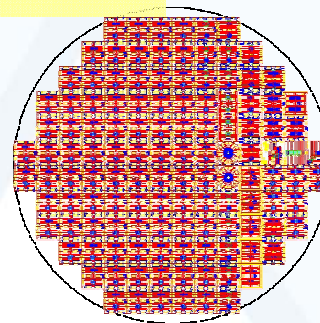
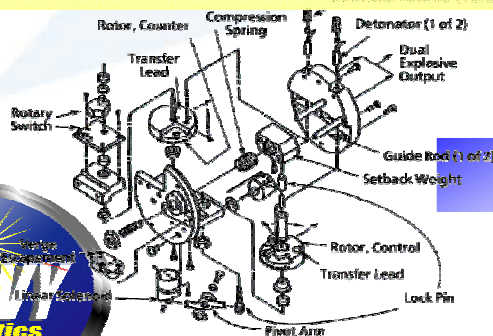
Designed & fabricated hermetic cap chips

MEMS in-situ detonator based S&A device technology currently TRL 4



S&A Chip

From tens of mechanical parts per fuze to 100's of fuze chips per single wafer



ONR Discovery & Invention (D&I) Program In-Situ Micro Detonator Technology



- Energetics formed in-situ after MEMS fabrication
- No energetic waste material
- No processing equipment exposed to energetics

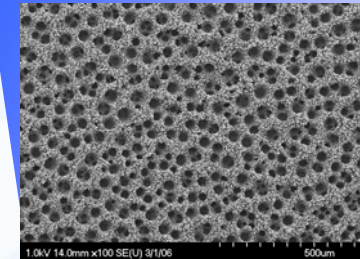
Status;

Developed in-situ (dry) conversion process

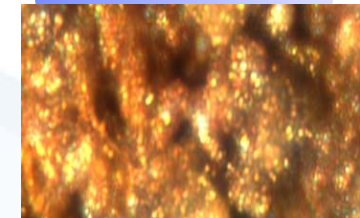
Demonstrated explosive transfer to qualified booster materials; RSI-007, PBX-N5 & Comp A-5

Currently conducting detonation characterization experiments

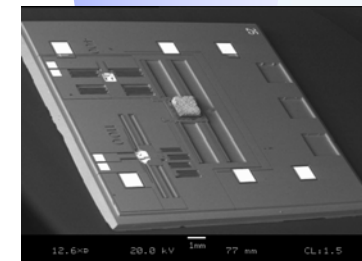
MEMS in-situ micro detonator technology currently TRL 4



Porous Metal



Azide Explosive



S&A Device with Micro Explosive



Summary

The Path Forward ...

Joint Fuze Technology Program

- **Navy PM/PEO community validated weapon requirements and needs that fed into the Joint Fuze Technology Program (DoD Fuze IPT)**
 - **Joint Fuze Technology Program will leverage on Navy S&T efforts and advancements**
- **Examples of Navy Future Capabilities Needed**
 - **Hard and Deeply Buried Target Fuzing**
 - **Increased reliability to reduce UXO**
 - **Multi-mission selectable fuzing**
 - **Advanced initiation for controlling lethal effects**

Navy Energetic Enterprise

