NDIA's 51st Annual Fuze Conference
UNITED STATES NAVY OVERVIEW

Randy Cope

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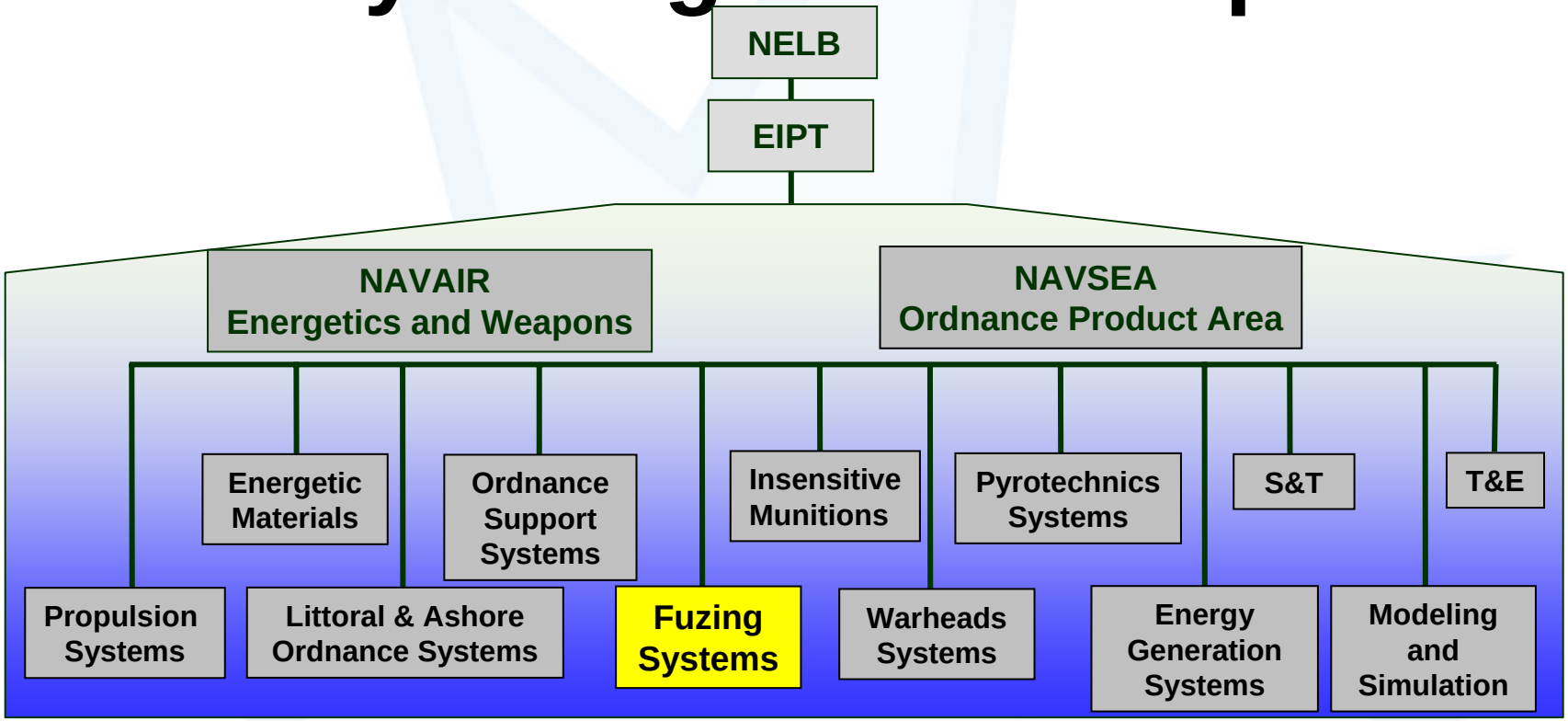
NAVAIR

NAVSEA
WARFARE CENTERS

OUTLINE

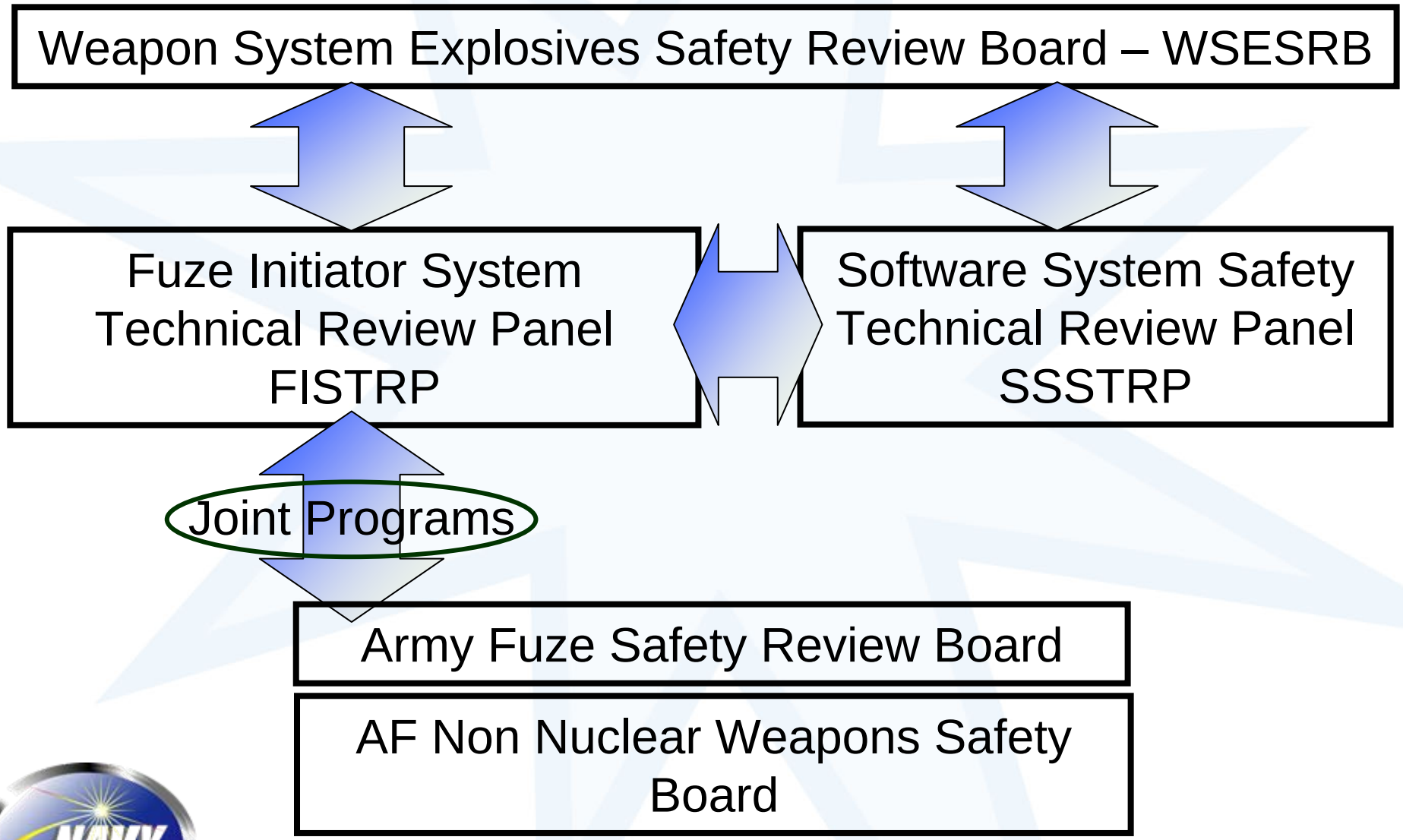
- Navy Energetic Enterprise – NEE
- Navy Safety Board Structure
- Air, Surface, Undersea Navy Programs
- Emerging Technology
- Summary

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



Fuze Initiator System Technical Review Panel

FISTRP

Panel Chair – Jack Waller

Panel Members –

Ralph Balestieri	Tinya Coles-Cieply
Randy Cope	Brad Hanna
John Hendershot	John Hughes
George Hennings	Dave Libbon
Scott Pomeroy	Gabe Soto
Brian Will	John Kandell
Ray Ash	Gene Marquis

Current Topics of Interest/Challenge

- Draft FESWG Logic Devices (PLD) Guidelines
- Built In Test (BIT)
- 500 Volt Electrical Insensitivity
  - Remote Firesets
  - Voltage Multipliers

TOMAHAWK FUZE

- Provide production support for the FMU-148A/B Warhead Fuze
  - Used in Tomahawk Block III and Block IV Missiles
- Conduct Lot Acceptance Testing
  - Maintain independence for safety critical component
- Conduct Quality Evaluation
  - Ensure continued safe and reliable use in Fleet

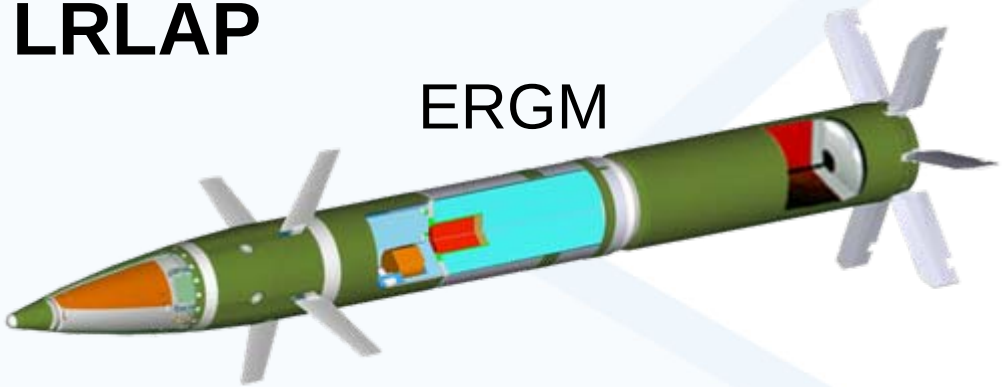
Gunnery Programs

- R&D Thrusts
  - Long Range – 41nmi+
    - Soften the Beach Plus Hit Inland Targets
  - Short Range
    - Self Defense VS. Asymmetric Attack
- Production/Lifecycle Thrusts
  - Maintain Fleet Capabilities at Lower Costs
  - Replenish & Maintain Existing Stockpile

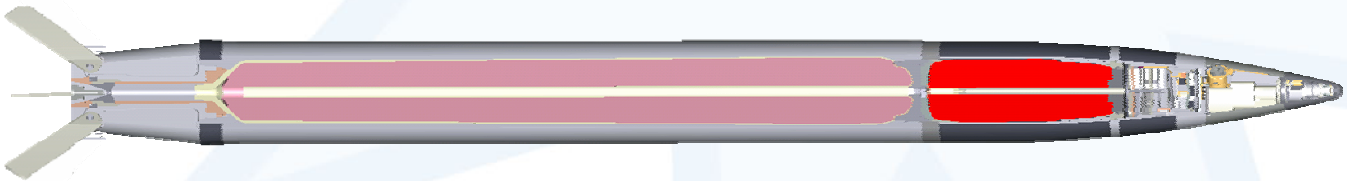
Gunnery Programs

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

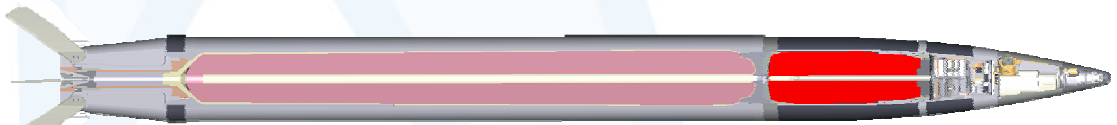
ERGM



LRLAP



BTERM



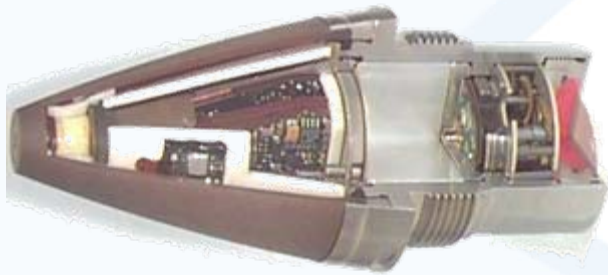
Gunnery Programs

- **Short Range - Self-Defense Projectiles –**
  - **“BB” round KE-ET & HE-ET both with the Mk 432 fuze**
  - **HE-MFF results shown below**

Gunnery Programs
Production/Lifecycle Efforts

PIPs:

- **MOFN for Most Threat Scenarios**

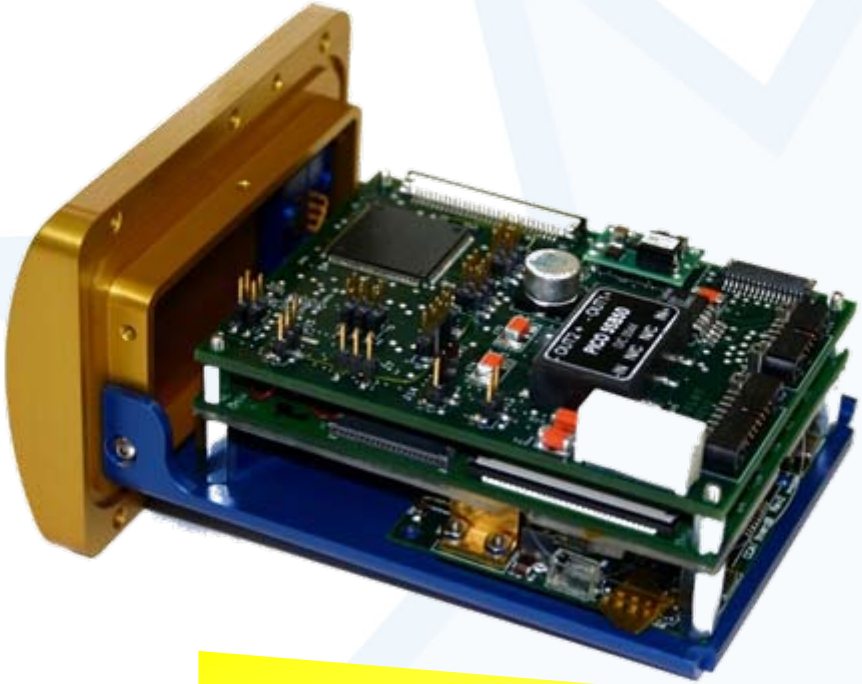


- **Diehl battery down-selected for MFF**

Production:

- **Mk 432 ET Fuze, MOFN Fuze, along with 25mm, 30mm, 40mm and 57mm Fuzing**

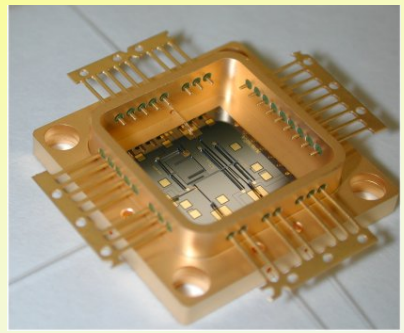
Future Undersea Weapon S&A



- Multi-Mission Capable
  - Single S&A configuration for multiple missions & platforms
  - Multi-point warhead initiation
  - Communication with Weapon Control Area Network (CAN)
- Safety Features
  - IMU based Safe Separation System
  - MEMS optical interrupt

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

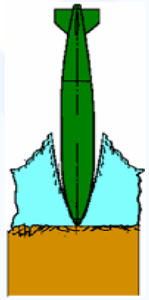


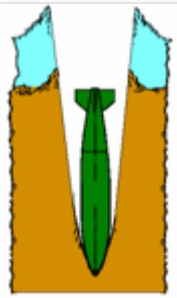
Packaged MEMS S&A Chip

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

Data Recorder

Shock Hardened Recorder Redundancy

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

ANTI-SWIMMER GRENADE (ASG)

Designed to protect assets from attack by SCUBA swimmers

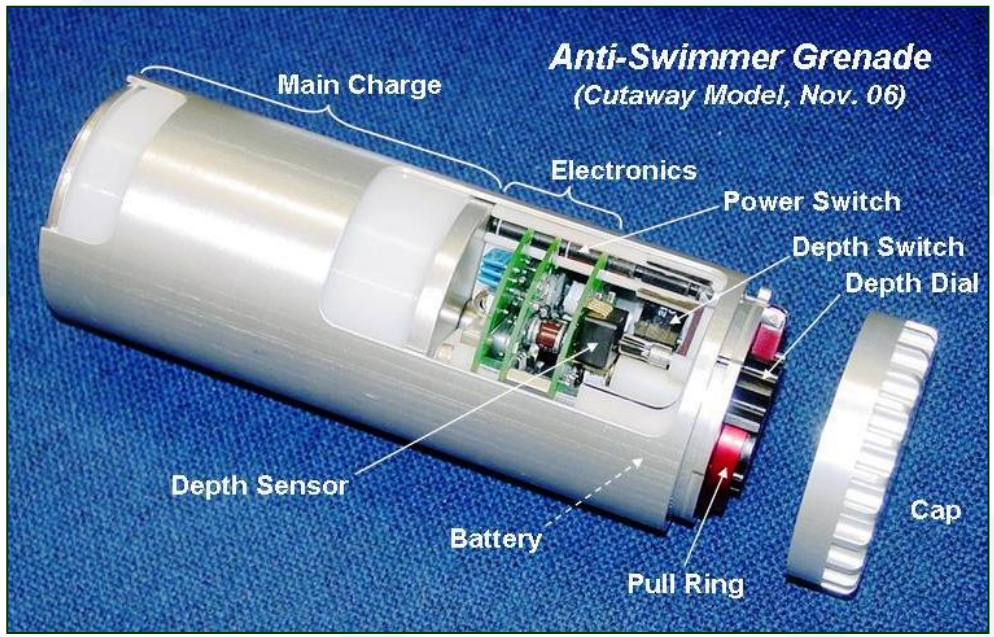
- *Critical Asset Defense*
- *Force Protection*
- *Port Security*

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 (no primary explosives)
- Hand-Emplaced Ordnance design meets MIL-STD-1911
- User-selectable function depth (10-ft to 100-ft in 10-ft increments)
- 1.5-lb Main Charge

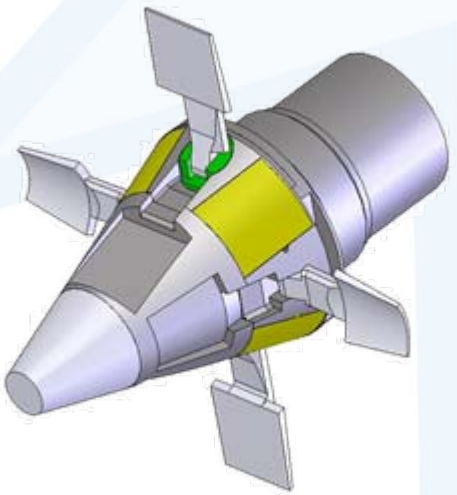


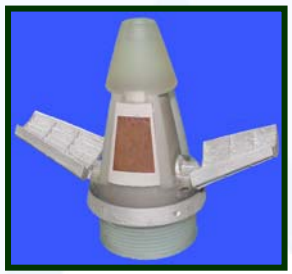
NAVY Energetics

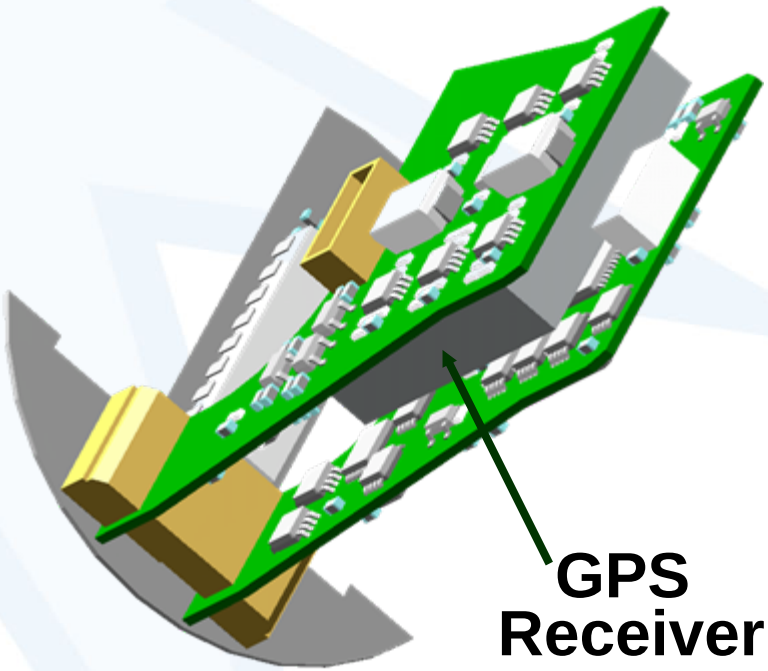
Gunnery Programs

Long Range Gunnery Technology

- **Guidance Integrated Fuze - GIF**
  - **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
- FY07: in-water tests of IMU sensors

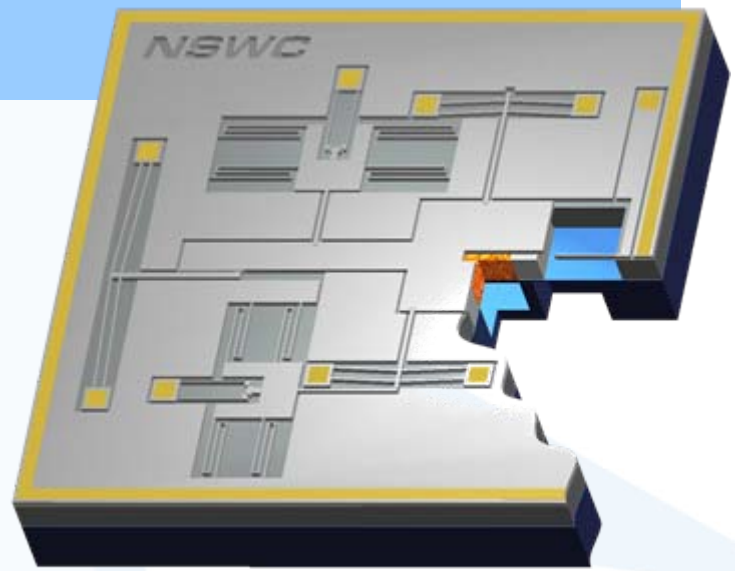
ONR S&T Program

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

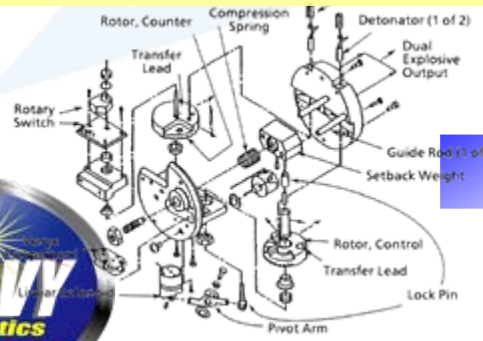
Status:

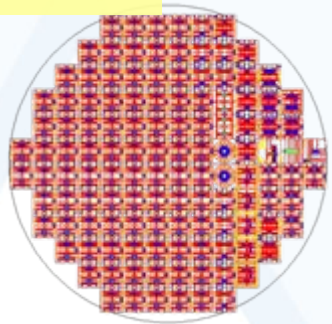
- Completed laboratory testing of 2nd generation S&A components and devices
- Preparing for FY07 TRL-5 demonstration flight tests



S&A Chip

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



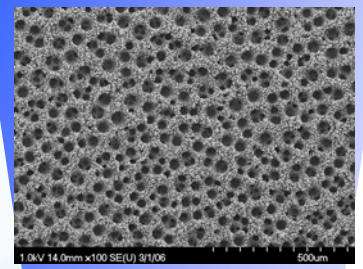


From tens of mechanical parts per fuze to 100's of fuze chips per single wafer

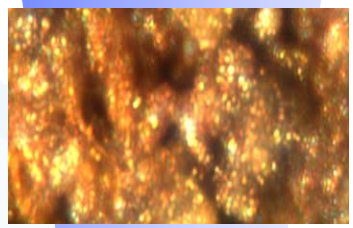
ONR Discovery & Invention (D&I) Program

In-Situ Micro Detonator Technology

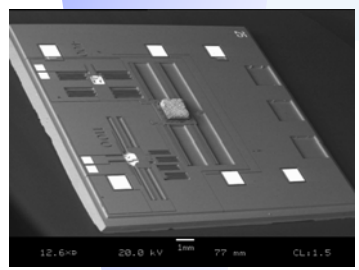
- Energetics formed in-situ after MEMS fabrication
- No energetic waste material
- No processing equipment exposed to energetics



Porous Metal



Azide Explosive



S&A Device with Micro Explosive

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

Summary

- Today's Navy
  - Leveraging the abilities of multiple installations
    - NEE
  - Safety conscious
    - FISTRP / FESWG / Joint Reviews
  - Cradle to grave support of the warfighter
    - Concept
    - Advanced Development
    - Research and Development
    - In-Service Support
    - Quality Assurance

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