

NDIA 45th Annual Fuze Conference
Ordnance Fuzing/Safety & Arming
Programs Overview



Anh N. Duong

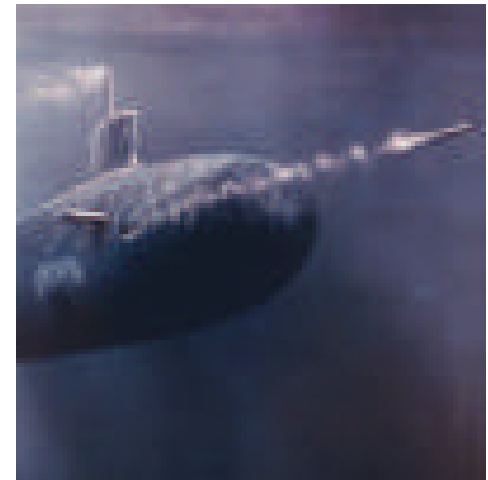
Explosives & Undersea Weapons Program Manager
NSWC - Indian Head

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OUTLINE

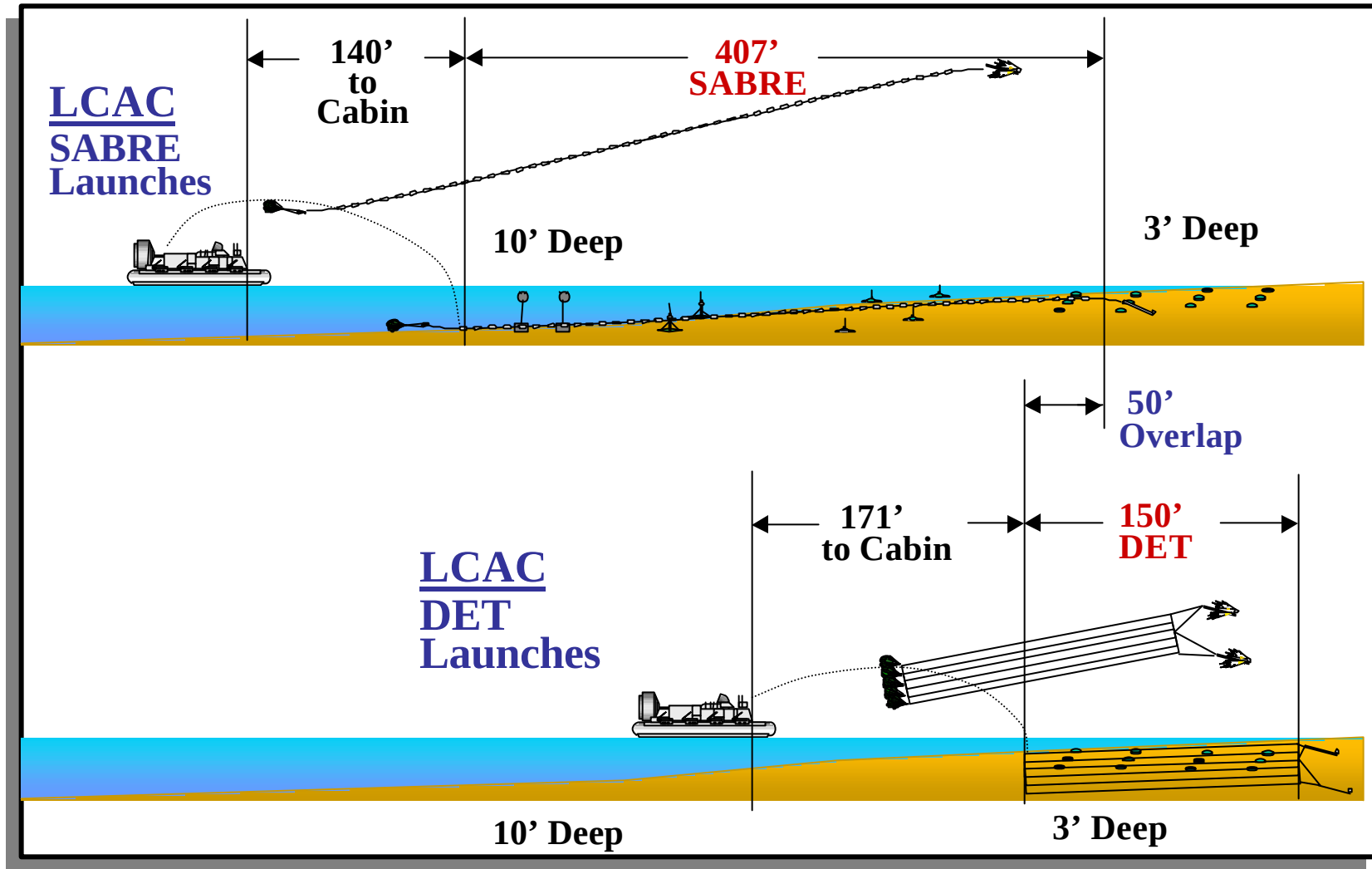
- ◆ **Current Development Programs**
- ◆ **Product Improvement Programs**
- ◆ **Applied MEMS Technology Programs**





Current Development Programs

Navy Assault Breaching Systems





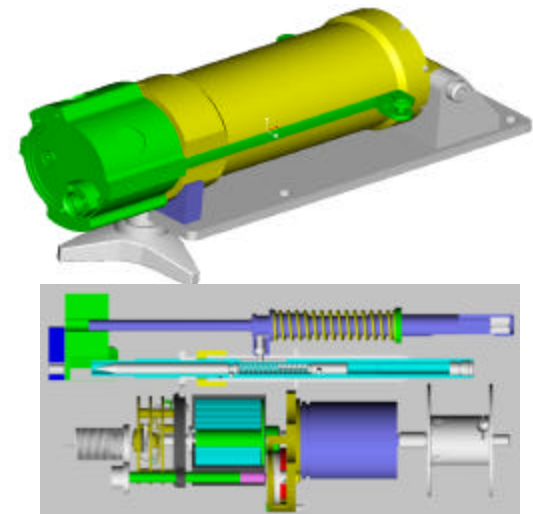
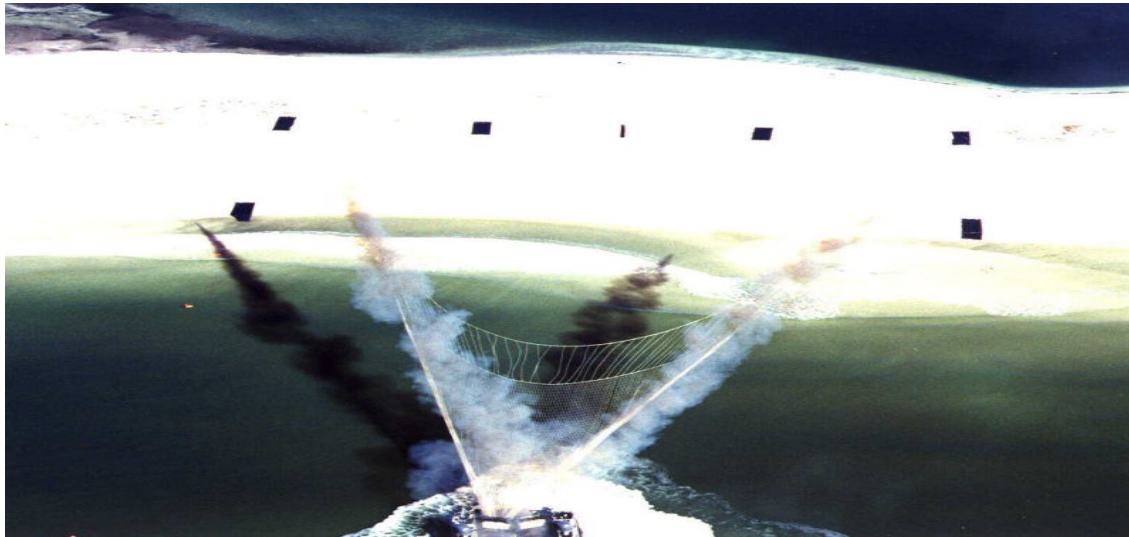
DET SURF ZONE MINE CLEARANCE SYSTEM TEST





DET Fuze/S&A

- ◆ **Distributed Explosive Technology (DET)**
 - 180'x180' Explosive Net Used in Surf Zone Mine Clearance
- ◆ **All Mechanical Fuze/Safety and Arming Device**
- ◆ **DET Technical Evaluation Completed**
- ◆ **DET Operational Evaluation Currently on Hold**
 - May be Combined with SABRE OPEVAL Scheduled FY03





SABRE Fuze/S&A

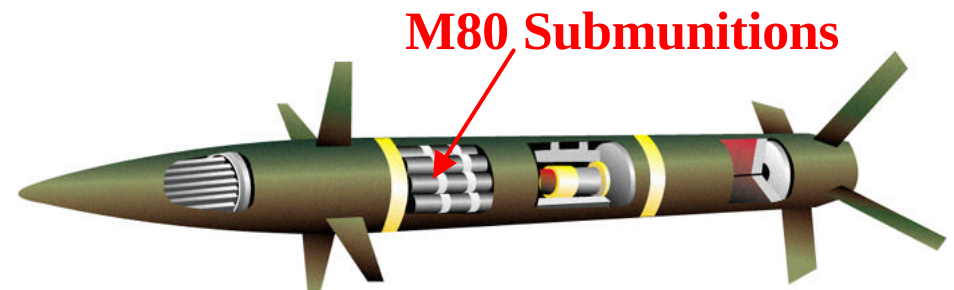
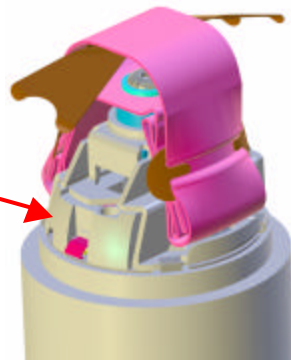
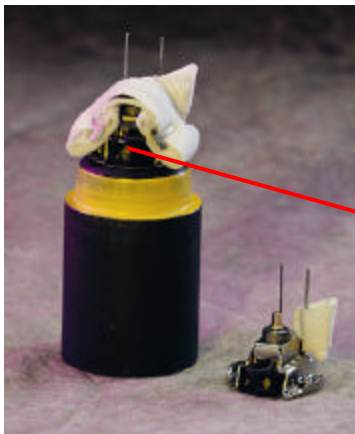
NEW START -- *New Fuze/S&A for Shallow-water Assault Breaching (SABRE) System*

- ◆ **Contractor Development - Contract Award in Process**
- ◆ **Fire-and-Forget Fuze/Safety and Arming System**
- ◆ **Requires Extremely High Reliability**
- ◆ **Support SABRE System MS III Production Decision of March 2003**



P3I Programs

◆ NSFS ERGM EX171 M80 Submunition PIP Proximity Fuze Insertion



◆ Next Generation Small Active Electromagnetic Torpedo Fuze



EM Fuzed Torpedo
Shell Section

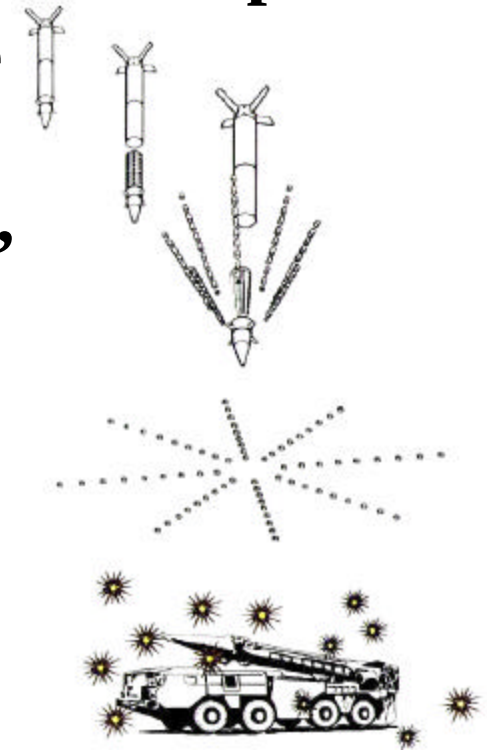


NSFS ERGM M80 Product Improvement Program (PIP)



PROGRAM GOALS:

- ◆ **Develop an Add-on Proximity Fuze System**
 - Inserted within the M234 SD Fuze Envelope
 - Minimal Impact to M234 SD Fuze High Rate Production Equipment
 - Meet ERGM Safety, Performance, Environmental, & Life Cycle Requirements



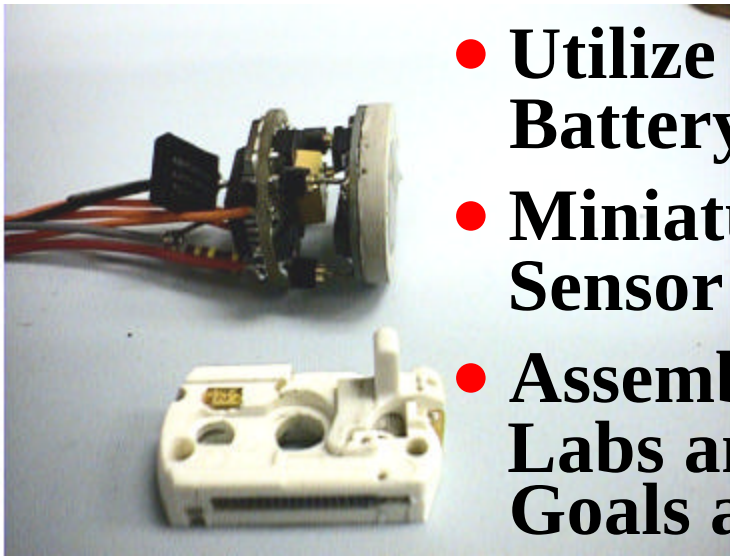


NSFS ERGM M80 PIP

Proximity Fuze System Insertion

TECHNICAL APPROACH:

◆ One-for-One Replacement of the M234 Self-Destruct (SD) Fuze Slide Assembly

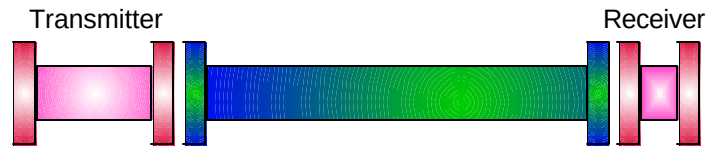
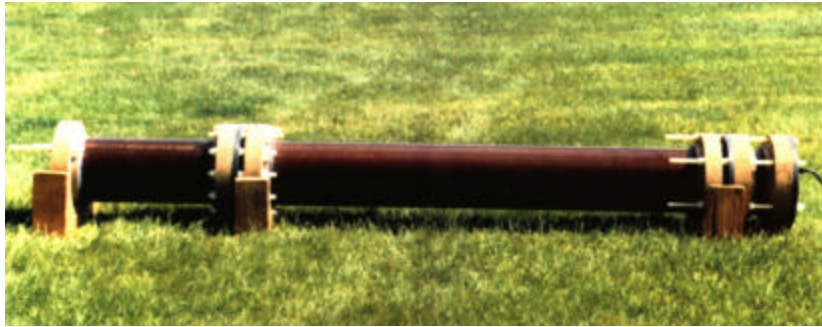


- Utilize Gun Launch Environment for Battery Activation
- Miniaturize the FM/CW RF Proximity Sensor of the M734A1 Mortar Fuze
- Assemble Expertise from Army / Navy Labs and Industry to Achieve Technical Goals and Reduce Critical Risk Areas



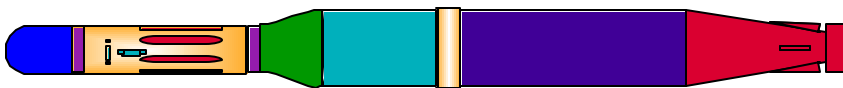


Reduced Power Active EM Fuze Underwater Torpedo Applications



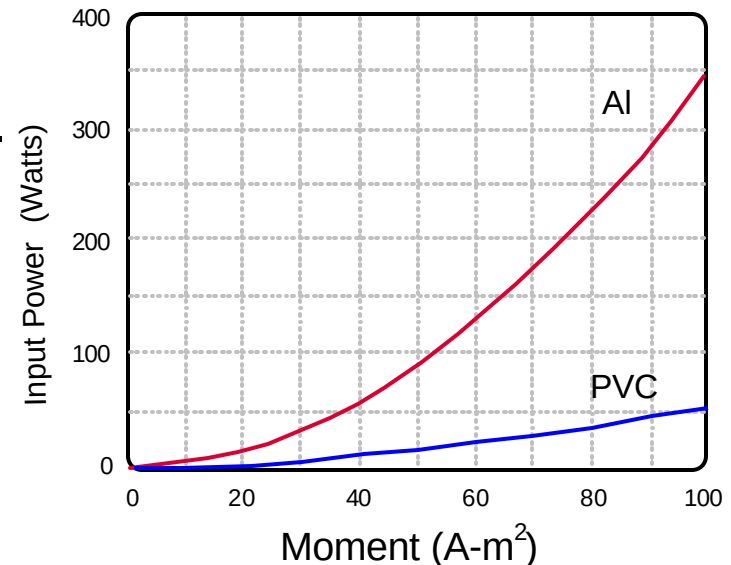
Successful Torpedo Sea Run Tests

- Dynamic Environments
- Target Detection
- Model Validation



Proof-of-Principle Demonstrated

- 7:1 Reduction Input Power
- Multiple Transmitter Designs
- Suitability of EM Fuzing for Small Diameter torpedoes

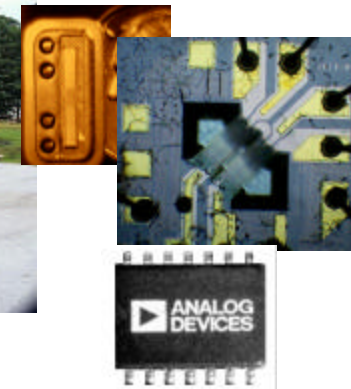
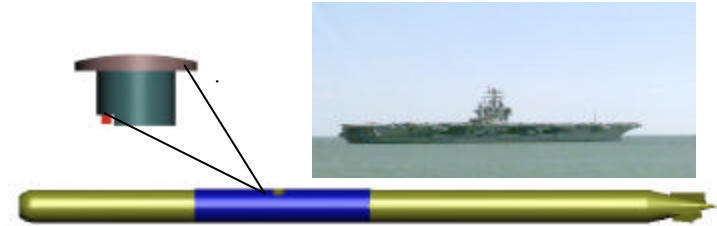




Applied MEMS Technology



- ◆ Surface Ship ATT F/S&A Device
- ◆ Standard Missile Embedded Sensors
- ◆ Ordnance Inventory & Surveillance





NAVY MEMS-BASED F/S&A PROGRAM



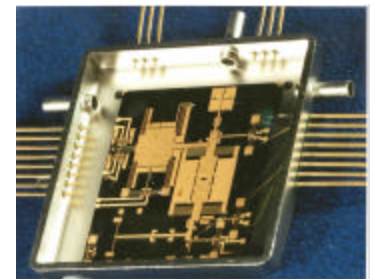
OBJECTIVE:

- ◆ **Apply & Transition MEMS Technology to Undersea Weapon F/S&A Systems**



APPROACH:

- ◆ **Capitalize on the MEMS Industrial Base**
 - Commercial (COTS) Sensors & Devices
- ◆ **Leverage DARPA Funded Infrastructure**
 - Design, Modeling & Analyses Capability
- ◆ **Demonstrate MEMS F/S&A Reliability**
 - Assure Weapon Safety with Miniaturized Modular Architecture





MEMS F/S&A TECHNOLOGY

COTS / Modular Components



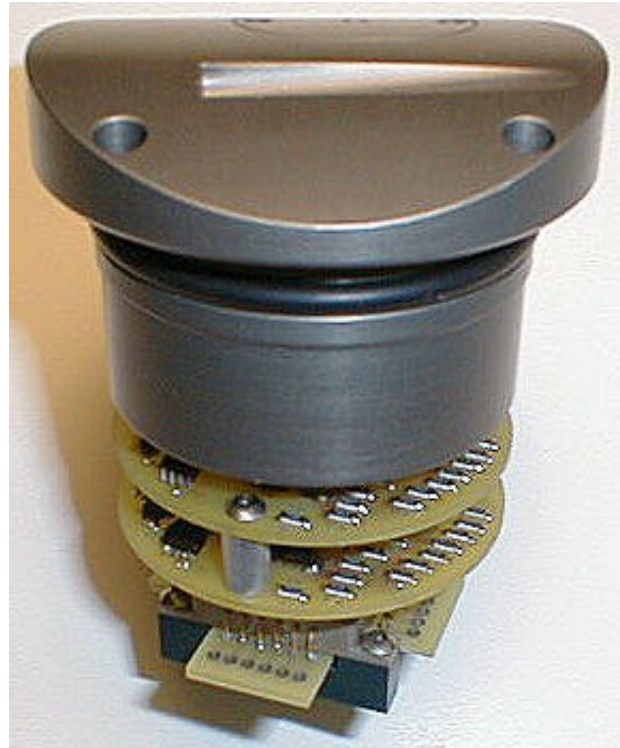
Impact Sensor



**Flow Sensor:
Pressure Differential**



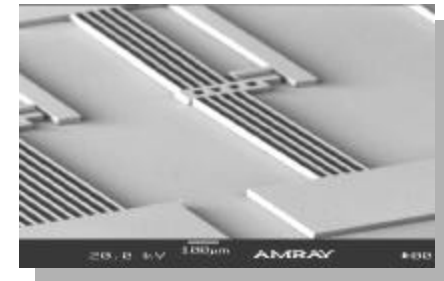
**Inertial Measurement
Rate Sensor**



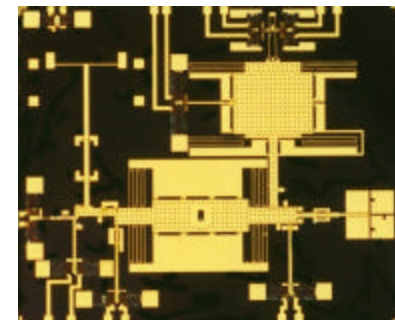
**Typical Building Block Components
for MEMS-Based Exploder**



**Initiation System
Slapper, Fire-set & Optical
Charging Circuit**



DRIE MEMS CHIP



LIGA S&A Chip



TORPEDO MEMS F/S&A



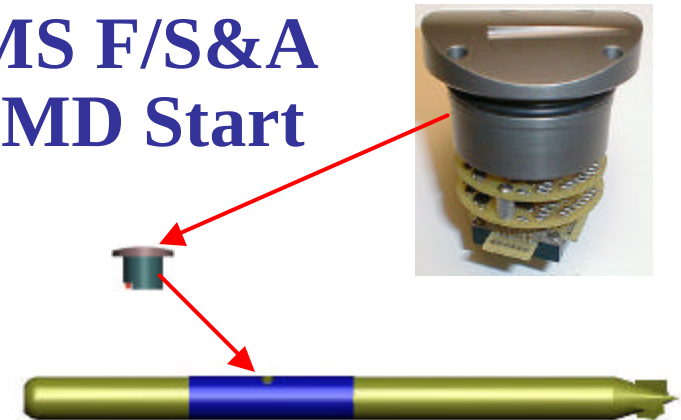
Main Objective: Transition MEMS F/S&A
Technology for FY 02 CCAT E&MD Start

Technology Focus:

- ◆ MEMS Fabrication
- ◆ Packaging Reliability and Robustness
- ◆ Inertial Sensor (IMU) Technology
- ◆ Remote Initiation Systems
- ◆ Optical Interruption

Prototype Development:

- ◆ Develop/Build 15 S&A Prototypes
- ◆ Conduct Environmental and Field T&E
- ◆ Utilize IHD MEMS Clean Room for MEMS S&A Prototypes Packaging, Assembly, & Test





Standard Missile

- ◆ Installing Temperature Data Loggers to Canisters
- ◆ Funded to Develop Embedded Stress Gauges
- ◆ Funded to Develop Embedded Ultrasonic Sensors





Advanced Technology Ordnance Surveillance (ATOS)

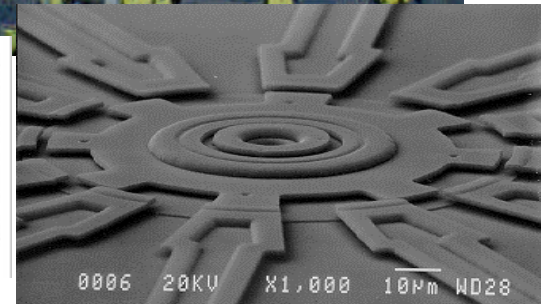
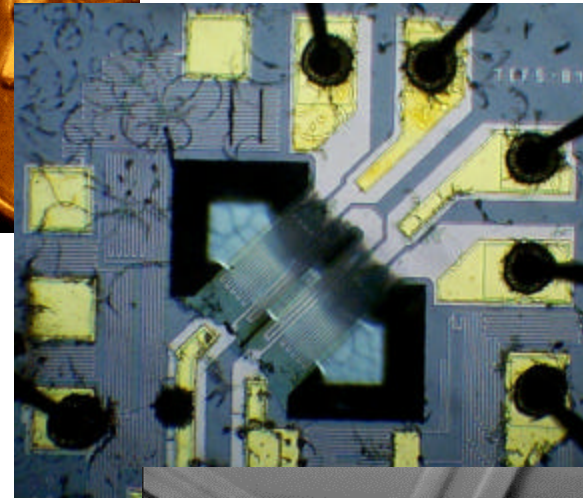
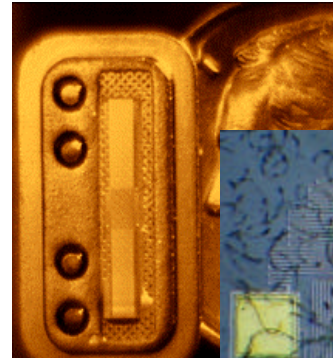


- Selected by OSD as an FY 01 Advanced Concept Technology Demonstration
- Demonstrate operational utility of miniature radio frequency identification (RFID) tags coupled with micro-electromechanical sensor (MEMs) technology for use in tracking/monitoring critical items:
 - Joint “high dollar/low density” munitions
 - Category I munitions (high potential of theft/terrorist use)
 - Future Potential: Medical and biological supplies, perishable substance and other environmentally sensitive commodities, DU munitions, etc.



MEMS Sensors

- Temperature
- Humidity
- Stress/Strain
- Acceleration
 - Shock/Vibration History
- Chemistry Lab on a Chip
 - Presence of Degradation Products
 - Stabilizer Depletion

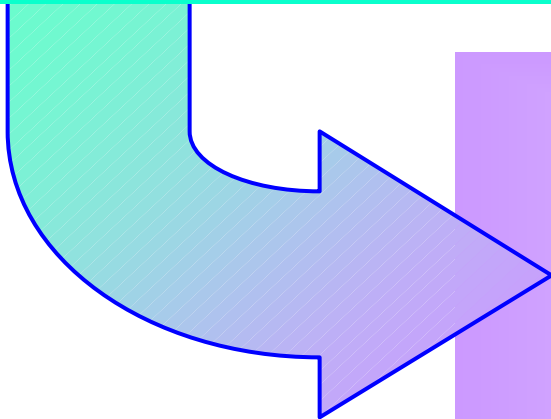




FUZE / SAFE & ARMING FOR THE 21ST Century

. Challenges / Opportunities

- Shrinking DOD budgets / downsizing
- Affordable weapon systems / reduced LCC
- Smarter, multipurpose weapon systems
- Acquisition reform
- Maintain critical smart F/S&A core within DOD
- Miniaturization



. Approach

- Focus on electronics & emerging MEMS technology in industry
- Increase joint service collaborative efforts
- Develop “building Block” approach for universal application