

NDIA 48th Annual Fuze Conference
NAVAIR Fuze Overview
Naval Air Warfare Center Weapons Division
China Lake



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Warheads and Fuze Division



Approved for Public Release



Agenda

- **Fuzing Responsibilities**
- **Technology**
- **Free Fall Ordnance**
- **Missile Applications**
- **Future**





NAVAIR WD Fuzing Responsibilities

- Navy Energetics Enterprise Team member
- Ordnance Product Area Network:

Fuzing Systems			
NAVAIR	NAVSEA		
China Lake David Riggs	Crane Mike Ringwald	Dahlgren Scott Pomeroy	Indian Head John Hendershot

Primary focus - free fall and missile fuzing





NAVAIR WD Fuzing Responsibilities

- **Navy Energetic Energetics (Missile and Free Fall Fuzing)**
- **Safety Community Support**
 - Ordnance Hazard Evaluation Board
 - Weapon System Explosive Safety Review Board member
 - Fuze and Initiation System Technical Review Panel
 - Tri-Service Fuze Engineering Standardization Working Group
 - NATO AC310 fuze subgroup
- **Fuze Technology Development**
 - DOD Fuze IPT Member
 - Technical Coordination Group – X Advance Firing Systems
 - TTCP Fuze Subgroup – National Leader
- **Fuze Development (DA / TDA / Monitor Roles)**
- **In-Service Engineering**





Fuze Technology

- MEMS Based S-A
- Micro-Explosive Components
- High Performance EFI Detonators / Initiators
- Short Pulsed Laser TDD
- Littoral Fuzing
- Hypersonic Fuzing
- Integrated Warhead Fuzing



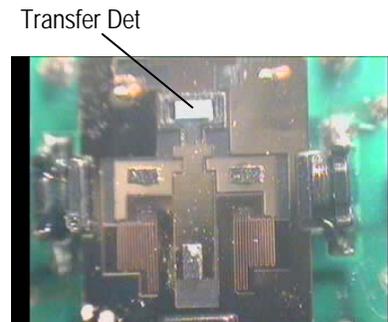
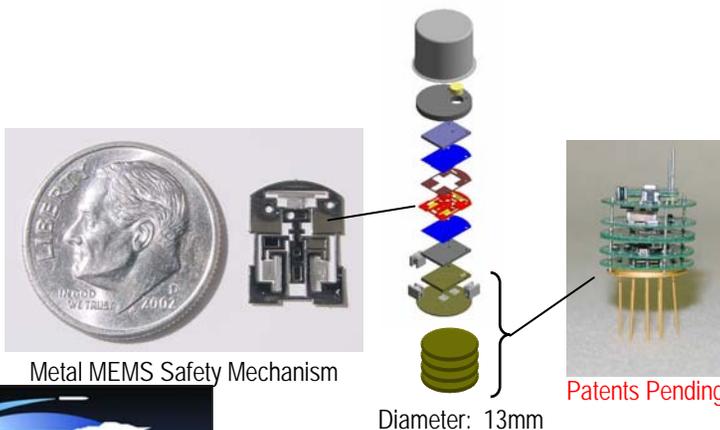
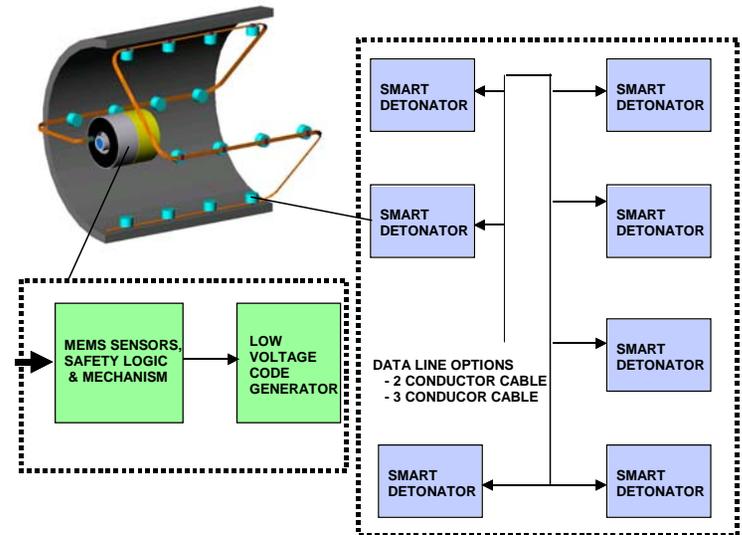
MEMS-Based Distributed S-A

Description:

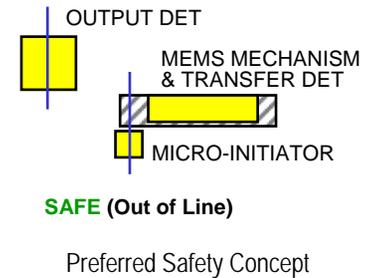
- Master control unit senses arming environments per MIL-STD-1316, then generates unique arming commands to selected "slave" detonators
- Each detonator contains MEMS mechanical locks to prevent inadvertent arming

Major Accomplishments

- Shown MEMS ability to move loads
- Proven basic in-line, out-of-line safety
- Shown transfer of small charges
- Significant size reduction of electronic



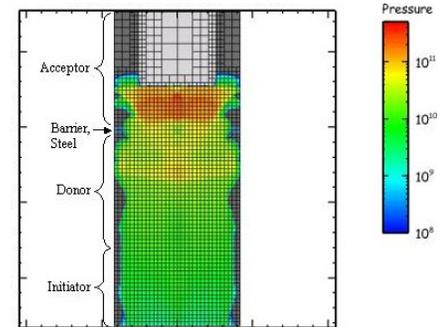
Arming Video



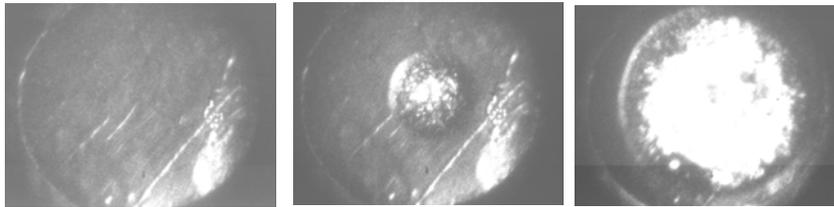


Micro Explosive Components

- Micro Components Development
 - Hydrocode modeling
 - Explosives identified and being evaluated
 - Conducting explosive tests



CTH Hydrocode Model

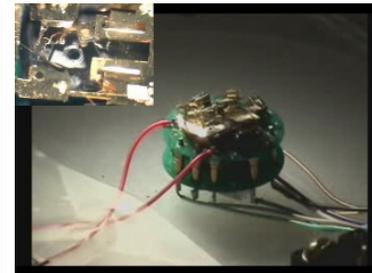
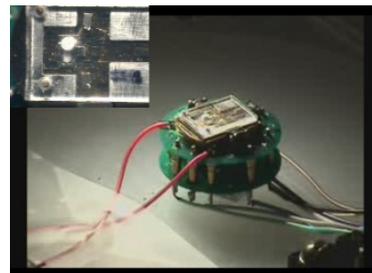
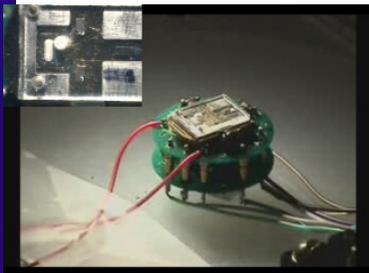


High-Speed Video of Thin Pellet Detonation
(Top View, 30ns/frame)

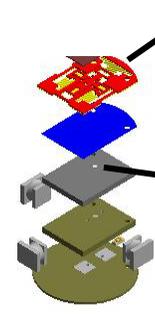
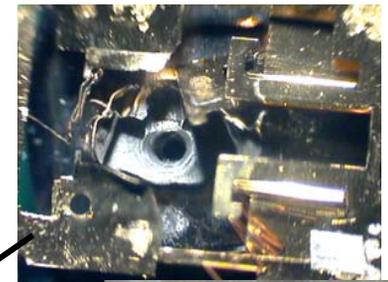
SAFE (Out-of-Line)

ARMED (In-Line)

Fired



Arm-Fire Test of Out-of-Line Micro-Explosive Train (Sept. 2003)



Patents Pending



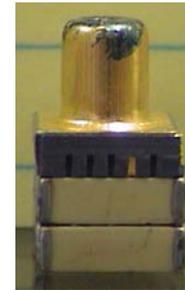
Dent from Transfer Det



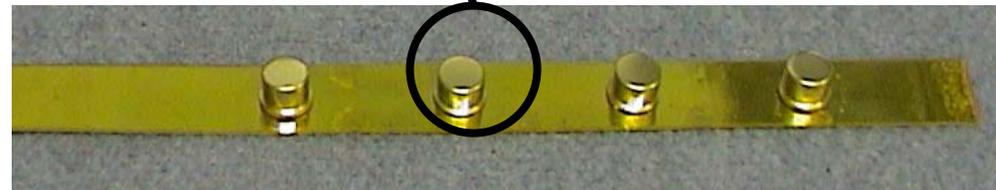
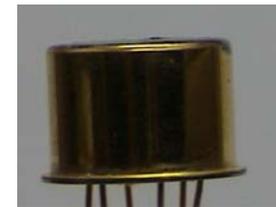


High Performance Low Energy EFI Technology

- Low Energy Exploding Foil Initiators
- Alternative Explosive Materials
- Increase Energy Output
- Tested per MIL 23659 Appendix A
- Detonator and Squib applications



HIPER EFI+ Fireset (.055in³)



Flexible Multipoint designs



Ligniter



Short Pulse Laser

GOAL:

- **Develop Technology to Extend Operational Capability of Active Optical Fuzing to Include Adverse Weather Performance and Low Altitude Clutter Operation.**

CHALLENGE:

- **Aerosol Backscatter Target Return Discrimination**
- **Single Transmitter & Single Detector Concept**
- **Narrow Pulse Processing**
- **Distributed Target**





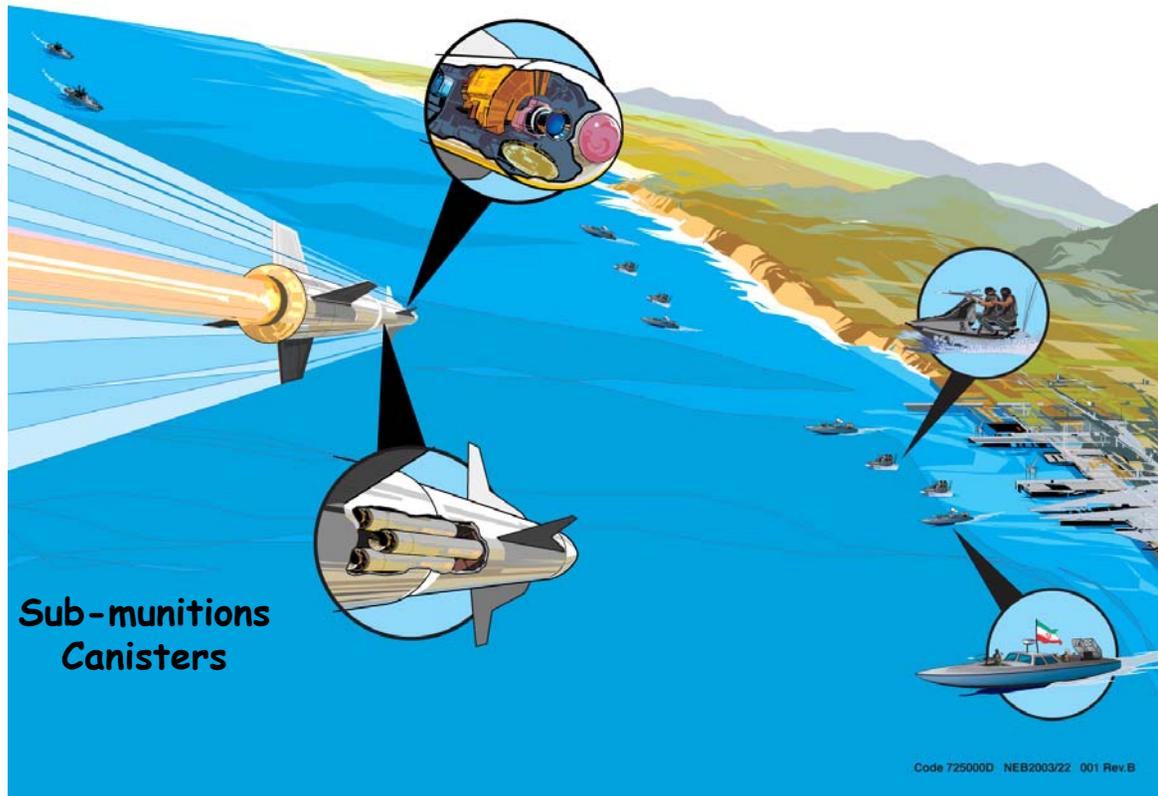
Littoral Fuzing

GOAL:

- Develop A Fuze System to Meet the Challenge of a Cluttered Littoral Coastal Environment With Asymmetric Threats

CHALLENGE:

- Target Clutter discrimination
- Asymmetric Threats
- Weapon Reconfiguration
- Collateral Damage
- Dial-a-Yield





Hypersonic Fuzing

GOAL:

- **Develop Fuze Technology For Utilization In the Hypersonic Environment (High Speed-Quick Response- Target Variety)**

CHALLENGE:

- **Time Critical Targets**
- **High Heat Soak**
- **Surface and Penetration Capability**
- **Target/Clutter Discrimination**
- **Aim Point/Time Selection**
- **Cavity Counting**
- **Limited Collateral Damage**
- **BDI**

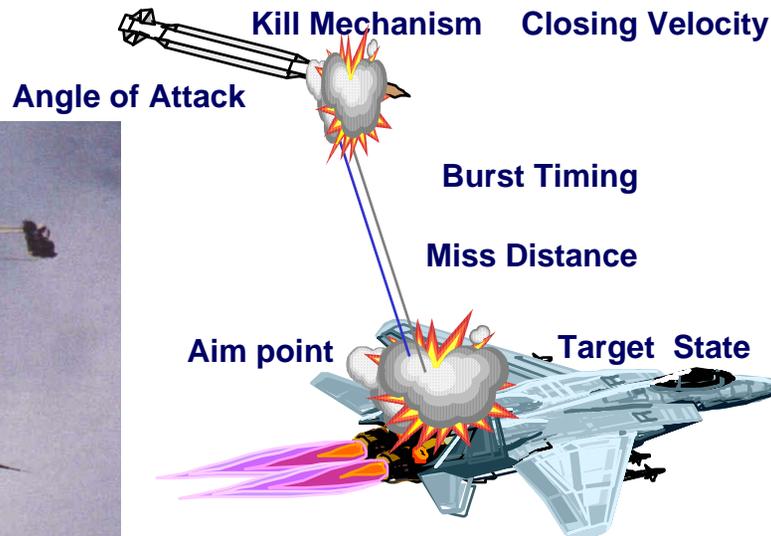




Integrated Warhead Fuzing

GOAL:

- Dual Role Air and Surface Targets
- Systems Approach
- Integrate Ordnance Technology
 - Optimize Burst Point (TDD)
 - New Kill Methodology (WH)
 - Advanced Initiation (S&A)



CHALLENGE:

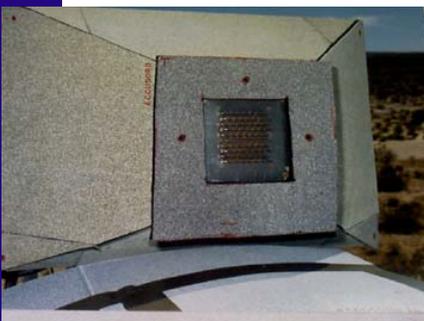
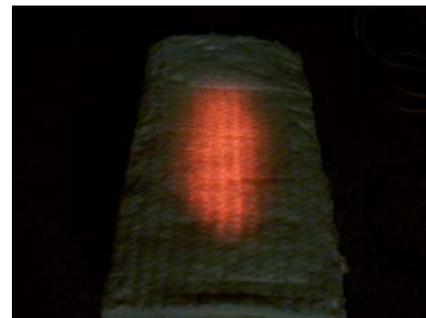
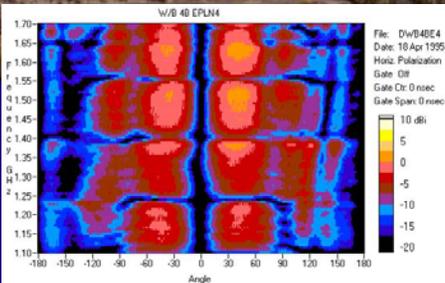
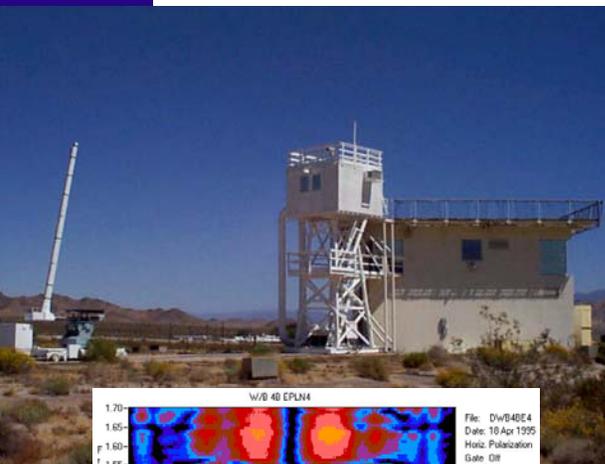
- Sensor Fusion
- Intercept Control
- Small
- Precision
- Catastrophic Kill
- Dial a Yield
- Integrated System



Antennas'

CAPABILITY:

- Electromagnetic Computer Predictions
- Subsystem Concept Development
- Hardware Development
- RF/Microwave Components
- RCS & Antenna Measurements
- Outdoor Antenna Range
 - 100MHz to 60 GHz
- Diagnostic Chamber
- Portable Measurement - RCS MHSR

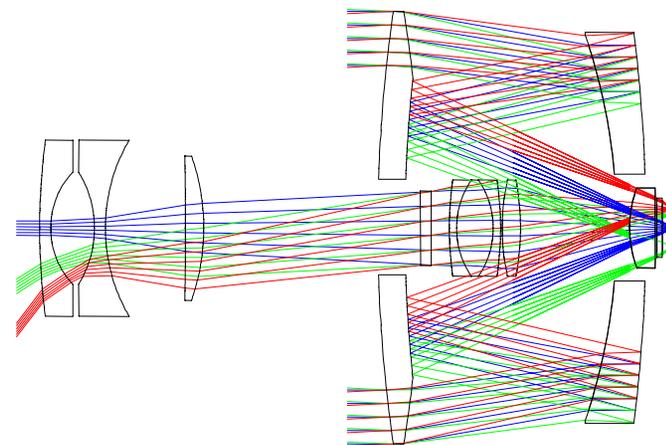
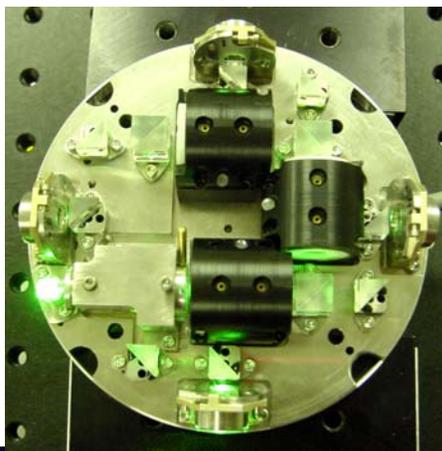
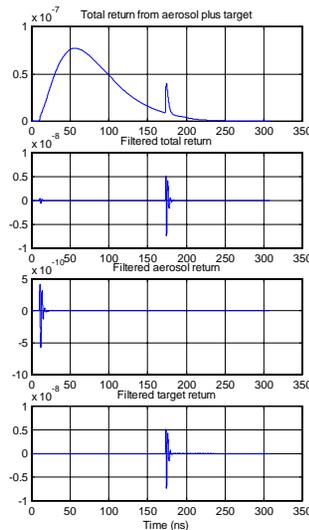




EO/IR/OPTICS

CAPABILITY:

- Sensor Prototypes from Concept to Test
- Active Optical Target Detecting Devices
- Optical Design
- Systems Analysis
- Optical Sensors in Obscurants
- Modeling & Simulation
- UXO Discrimination





Free Fall Ordnance

- FMU-139 B/B Electronic Bomb Fuze
- FMU-143 E/B Penetrator Fuze
- DSU-33 B/B Proximity Sensor
- FMU-140/B Dispenser Proximity Fuze
- Hydro-static Sensor
- Depth Grenade



Hydro-Static Sensor Firing Device

The HSFD, combined with the existing MK-32 Arming Device, the Mk-59 booster and the MK-82 bomb with high drag tail, give the Navy a new Depth bomb capability for use in Littoral waters.

Faceplate

Bomb Cable Connector



Drop Test



Status:

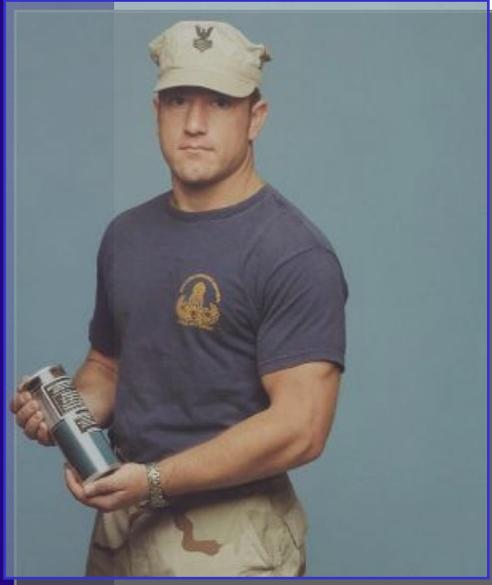
In Second Phase of Flight testing

Awaiting Production Decision



Anti-Swimmer Depth Grenade

Combines Hydro-Static Sensor and Low Cost ESAD Technologies



- Dial-in depth selection 10ft to 100ft
- Back-up timer
- Separate high voltage, control and power conditioning boards
- Flexible electronic programming available





Missile Applications

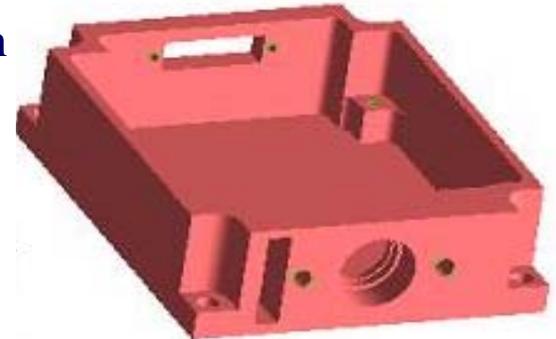
- JAMI ESAD Flight Termination Safe-Arm Device
- FMU-155/B SLAM ER
- MK-54 S-A STANDARD MISSILE
- FMU-111/B HARM
- FMU-148/B Tomahawk
- MK-33 Sparrow
- MK-88 ESSM ESAF
- MK-13 Sidewinder
- FSU-25/B AIM-9X ESAD
- MK-20 Mod 2 AOTD RAM
- DSU-34 TDD Sea Sparrow
- DSU-15 AOTD Sidewinder
- MK-45 TDD STANDARD MISSILE





JAMI FTSA

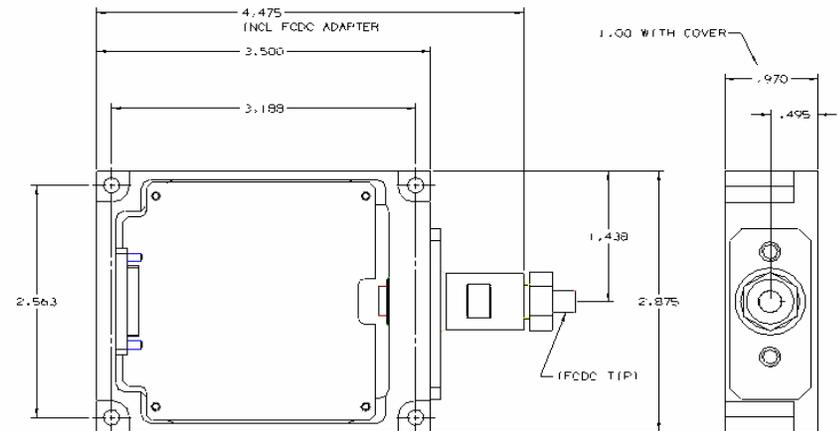
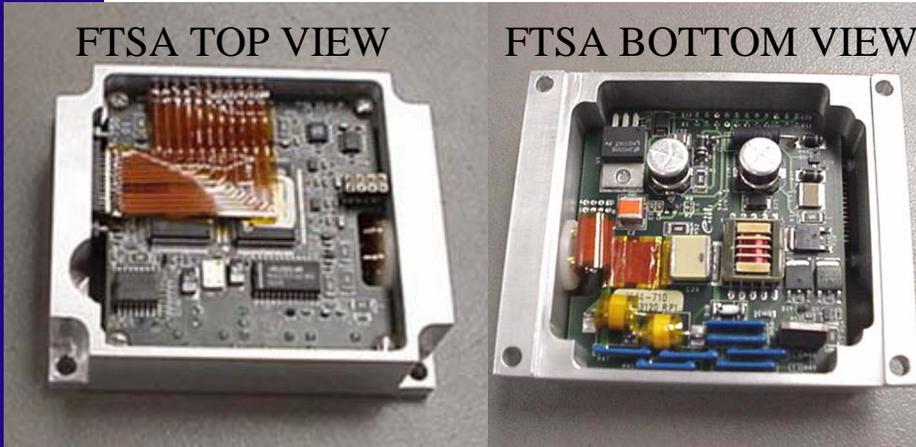
- All- Electronic Design With In-Line Explosive Train
- Flexible Programmable Design
- External Triggering Capability



LEEFI

FTSA TOP VIEW

FTSA BOTTOM VIEW



PROPOSED CONCEPT W/O EXTERNAL PROGRAM ROMT

COVER REMOVED FOR CLARITY

Photos and drawings courtesy of KAMAN





Future Direction

- **NAVAIR working with NAVSEA under the Navy's Energetic IPT to provide full-spectrum Fuzing capability from technology to fleet support**
 - **Navy's Laboratories working together**
 - **Unique facilities to support fuze R&D**
 - **Actively teaming with Industry**

