NDIA's 54th Annual Fuze Conference

NAVY OVERVIEW

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For Dr. Robert Gates

Technical Director, NAVSEA Indian Head Division

NEE IPT Lead

NAVAIR

NAVSEA
WARFARE CENTERS

Outline

- Naval Energetics Enterprise Overview
- Fuze Safety Review Process & Panel
- Navy Fuze Acquisition
- Navy Fuze Work Highlights
- Summary

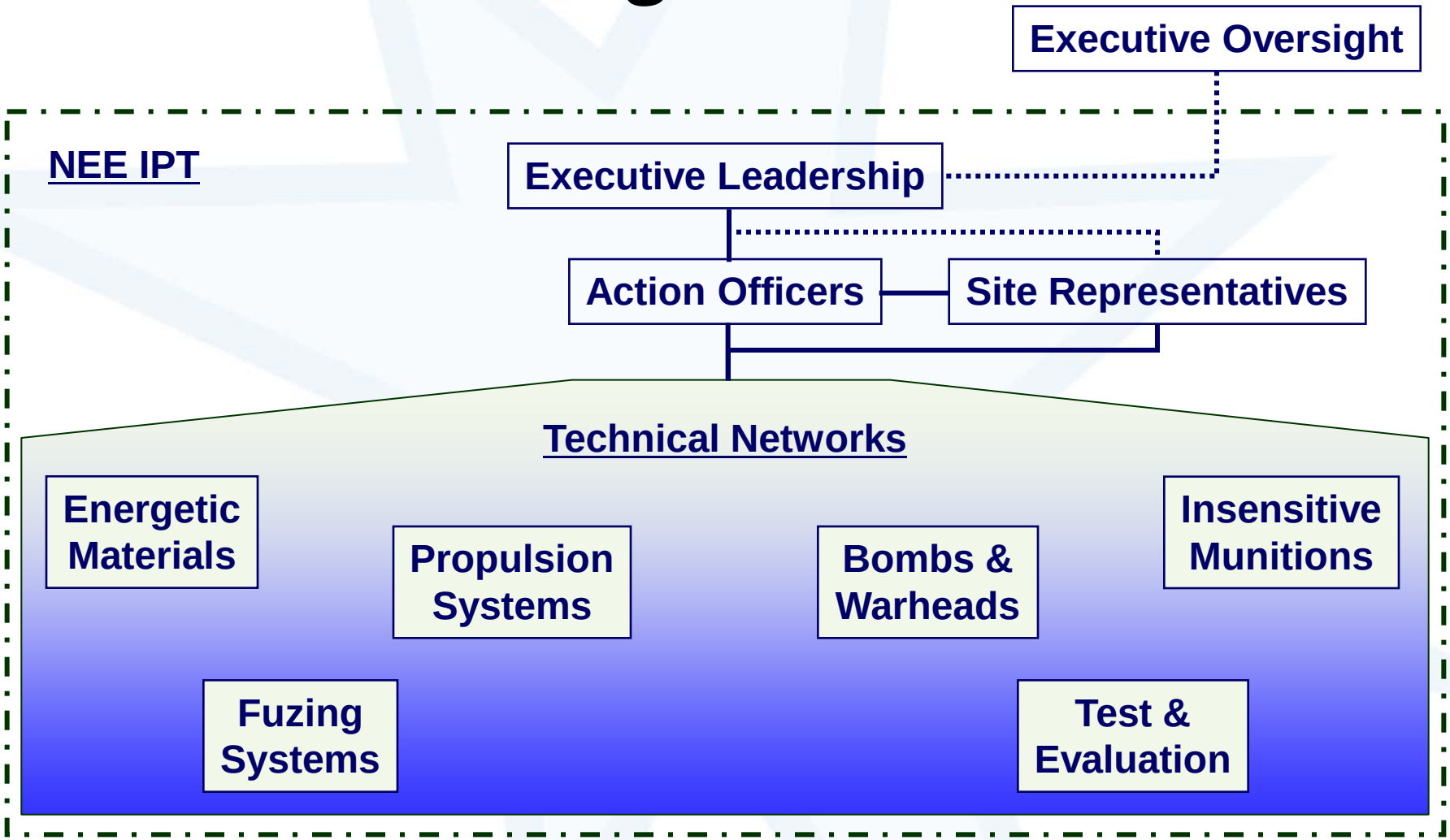
Navy Energetics Enterprise Vision

One Team

Dedicated to providing ordnance solutions to the Warfighters

NAVAIR China Lake & Point Mugu
NAVSEA Indian Head, Dahlgren & Crane

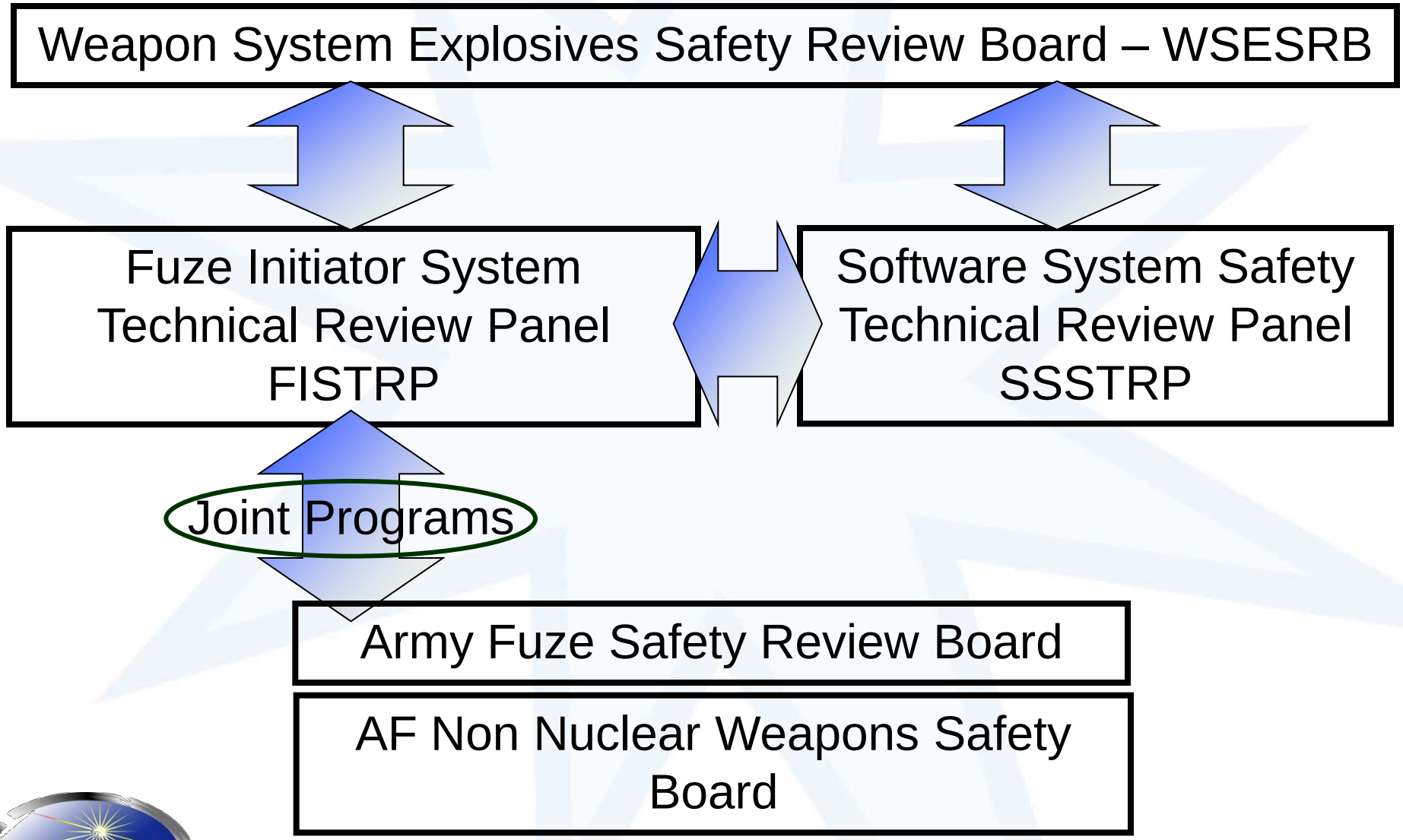
NEE Organization



NEE Goals

- Provide stewardship of unique Navy capabilities to ensure current and future Navy warfighting requirements are attainable and supportable
- Speak with a coordinated Navy voice
- Work together to improve efficiency and rationalize resources to provide responsive, safe and affordable ordnance solutions

Navy Fuze Safety Review Process



Fuze and Initiation Systems Technical Review Panel (FISTRP)

Panel Chair – Gabriel Soto

Panel Members –

Raymond Ash	Ralph Balestieri	Brian Will
Randy Cope	Micheal Demmick	Bradley Hanna
John Hendershot	John Hughes	George Hennings
John Kandell	David Libbon	Eugene Marquis
Scott Pomeroy	Tinya Coles-Cieply	
Melissa Milani		

Current Topics of Interest/Challenge

- 1978 Joint Fuze Management Board Policy on Safe Separation Analysis
- Emerging FESWG Guidance on Charge-Based Memory

MIL-STD-1316 STANAG 4187
MIL-STD-1901 STANAG 4368
MIL-STD-1911 STANAG 4497

Navy Fuze Acquisition

FMU-164

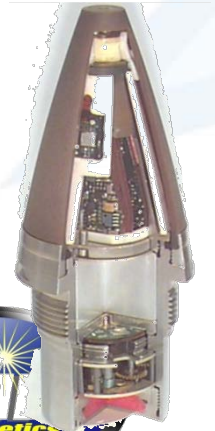
- Requirements
  - Improved reliability - 97% @ 90% confidence
  - Backward compatible to FMU-139 interfaces
  - Hard target penetration
    - FMU-143 specification
  - New arming & function delay times
    - Serial data interface programmability

- Schedule
  - RFP released on 22 December 2009
  - Source selection starting April 2010
  - Contract award scheduled 4th Qtr 2010
  - IOC scheduled in 2017

5”/54 Gun Fuzes

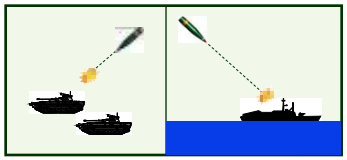
- MK 432 Electronic Time (ET)
  - First production 2002
  - ET only, no PD backup
  - KE-ET & HE-ET

- MK 437 Multi Option Fuze Navy (MOFN)
  - Design Initiated 2002
  - ET, PD, PD Delay & HOB
  - Lacks AAW capability
  - Land Attack & ASuW

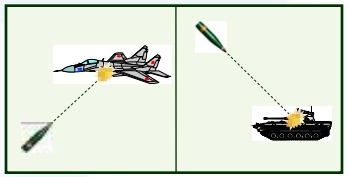


- MK419 Multi-Function Fuze (MFF)
  - Design Initiated 1995
  - USN Unique Fuze
  - ET, HOB, PD, AIR Prox, AUTO
  - Selectable HOB
  - Rain Reliability
  - Sea Clutter Filter – AIR
  - Land Attack, ASuW, & AAW

Electronic Time (ET)

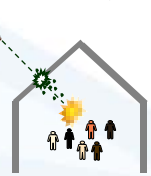


Point Detonating (PD)

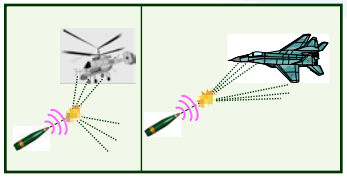


Surface Proximity (HOB)

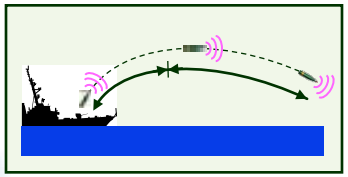
PD Delay



Air Proximity (AIR)



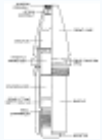
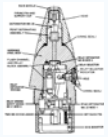
Autonomous (AUTO)



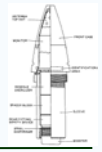
5”/54 Gun Fuze Roadmap

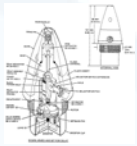
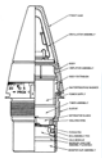
PAST | 2003 | CURRENT | FY15 | BYND FYDP

MK91 Mod 1: Infra-Red
MK399 Mod 0: Point Detonate

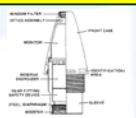



MK73 Mod 11/13: Variable Time
MK342 Mod 1: Mechanical Time/Point Detonate
MK407 Mod 1: Point Detonate/Delay
M732: Controlled Variable Time



MK404 Mod 1: Infra-Red



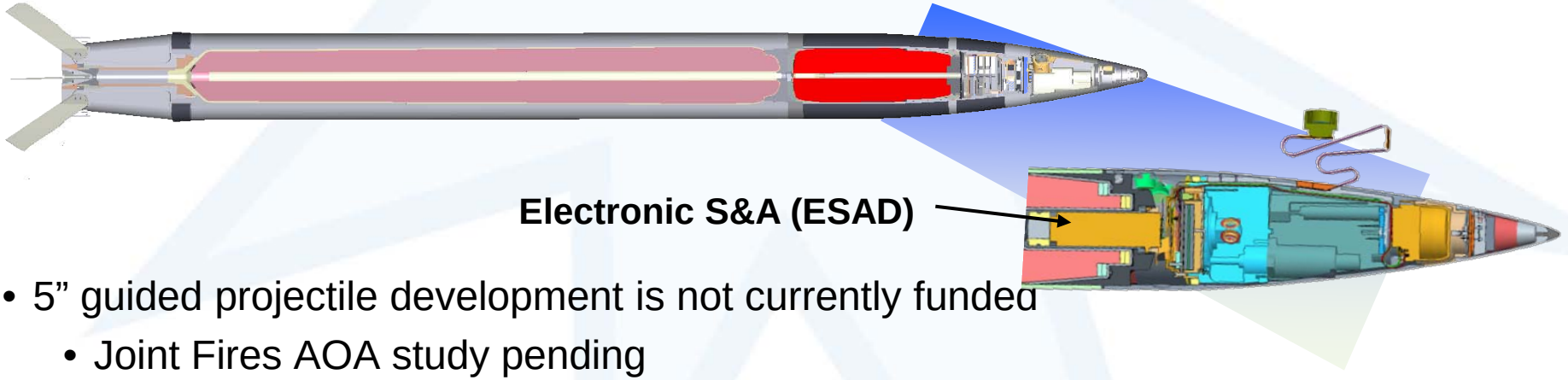
MK419 Mod 0: Multi-Function Fuze
MK432 Mod 0: Electronic Time


OBSOLETE
OBSOLESCENT/SUSTAINMENT
ACTIVE/FUTURE

MK419 Mod 1: Multi-Function Fuze
MK437 Mod 0: Multi-Option Fuze Navy


Navy Guided Projectiles

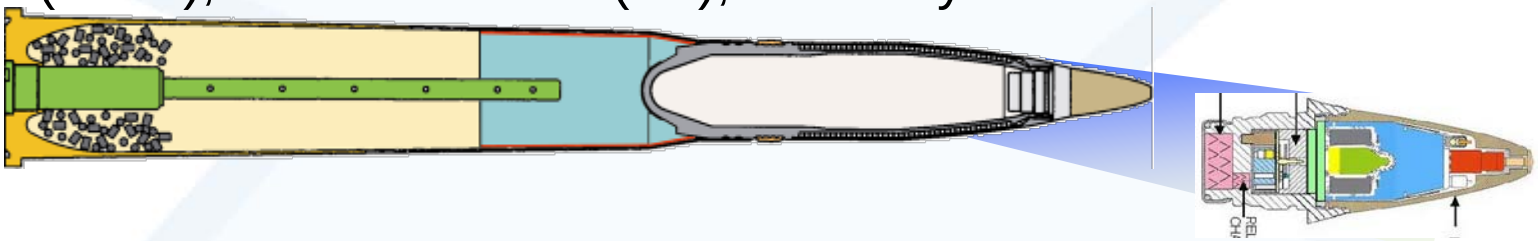
- 155mm Long Range Land Attack Projectile (LRLAP)
  - Gun-launched, rocket-assisted guided projectile
  - Currently in EMD phase as part of the Advanced Gun System on DDG-1000 Class destroyers
  - Qualification and guided flight testing underway, completion scheduled in 2012
  - LRIP to begin in FY13
  - Range > 63nmi
  - Electronic S&A and electro-mechanical ISD



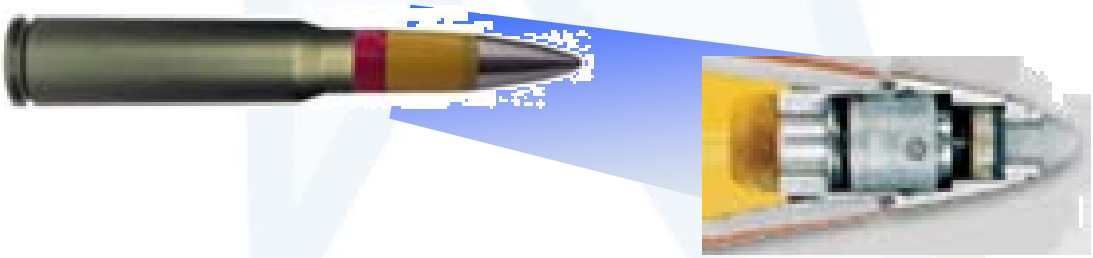
- 5” guided projectile development is not currently funded
  - Joint Fires AOA study pending

Additional Navy Gun Ammunition

- 57mm/L70 MK 295 Mod 0 – High Explosive – 3P Cartridge (HE-3P)
  - Pre-fragmented explosive projectile with programmable, proximity fuze
  - 6 Fuze Modes:
    - Time Gated Proximity (TGP), Time Gated Prox with Impact Priority (TGIP), Point Detonating (PD), Point Detonating Delay (PD/D), Electronic Time (ET), Proximity with Self Destruct



- 30mm X 173 MK266 Mod 1 – High Explosive Incendiary – Traced (HEI-T)
  - Super Quick FMU-151 Fuzed PBXN-5 projectile
  - High Order Blast/Fragmentation w/ Incendiary Effects



Navy Fuze Work Highlights

- **NAVAIR: Impact Switch Investigation**
- **NAVAIR: Dynamic Impact Simulation of “High G Hardened Fuzes”**
- **Joint JFTP / NAVSEA PMS495: MEMS Fuzing for High Reliability Systems**
- **Joint NAVSEA PMS495 / ONR: Versatile Explosive Train Integrated into a MEMS S&A Device**
- **ONR: MEMS Fuze for Marine Corp Flight Control Mortar**
- **JIMTP: Extremely Insensitive Detonating Substance (EIDS) Initiation System**
- **JFTP: MEMS Retard & Impact Sensors**

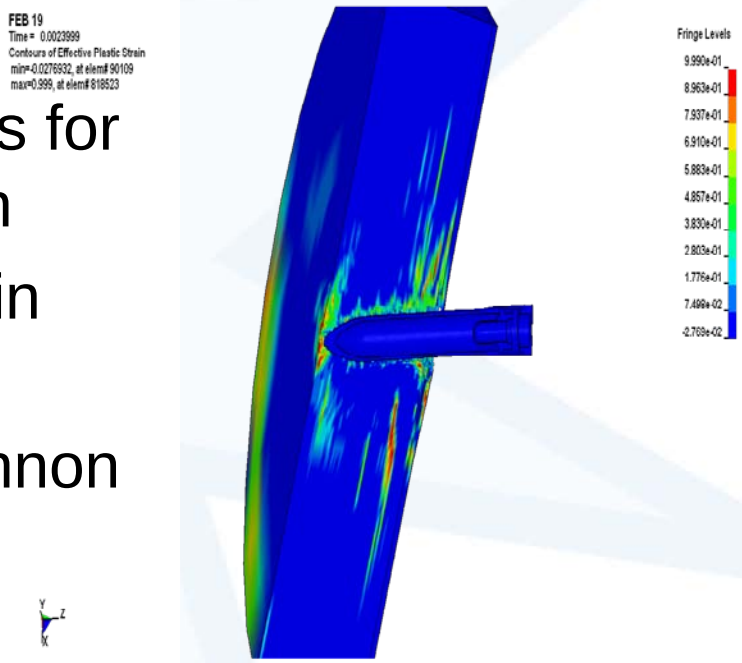
Impact Switch Investigation

- Investigation objective is to characterize switch vibration response
- FY09 start schedule for FY10 completion
- Switch becoming more sensitive to vibration as exposure is accumulated
- Switch characterization conducted using flight test vibration levels
- Reporting on preliminary results

Open Session VA Briefing provided by Mr. Sam Tuey

Dynamic Impact Simulation of "High G Hardened Fuzes"

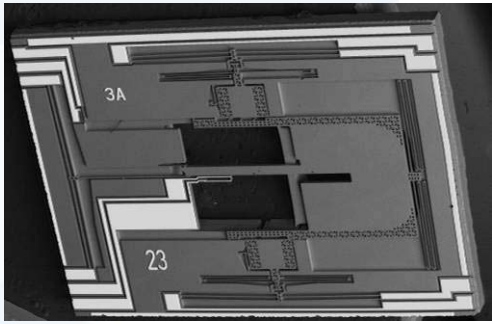
- Evaluation of latest LS-DYNA Impact Simulation Software
- Creating LS-DYNA input templates for hard target penetration application
- Impact deceleration, stress & strain calculated for penetrator Fuzes
- Results compared to NAVAIR cannon and sled test data

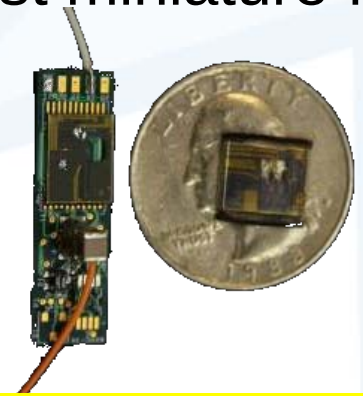


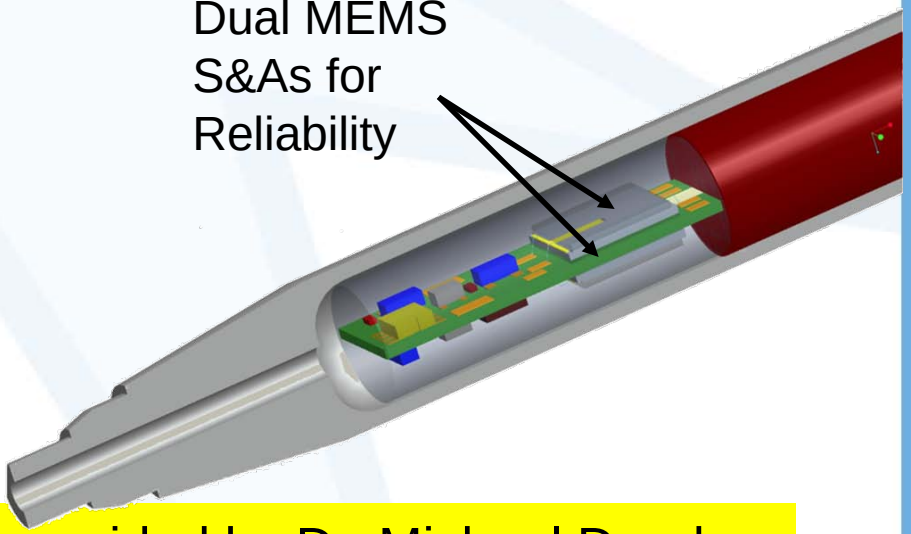
Open Session IIIA Briefing provided by Dr. Paul Glance

MEMS Fuzing for High Reliability Systems

- Development of G-hardened miniature Fuze component technology mine defeat penetrator application
  - Silicon on Insulator (SOI) MEMS S&A
  - Micro detonator
  - MEMS initiator
  - Low-cost miniature fire-set





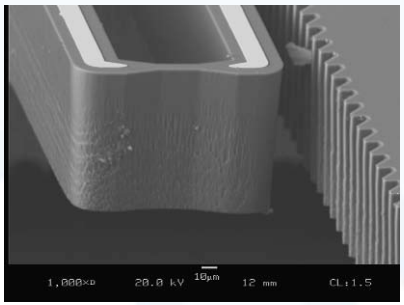


Closed Session IVB Briefing provided by Dr. Michael Deeds

A Versatile Explosive Train Integrated into a MEMS S&A Device

- Development of integrated initiation and explosive train component technology for MEMS based S&A application
- Developed for small volume applications turning tight corners
- Employs Cl-20 based explosives RSI-007 & EDF-11 ink

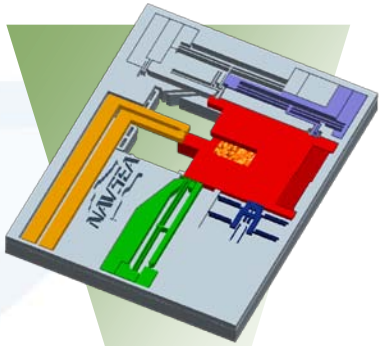
Vaporization of an IHDIV MEMS initiator

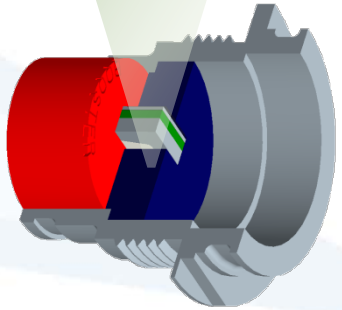


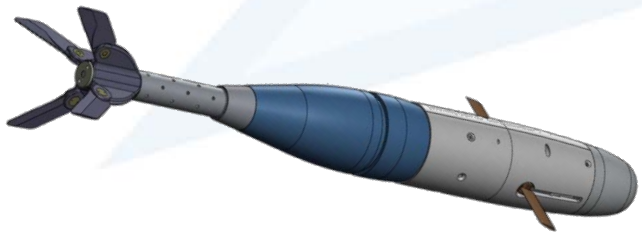
Closed Session IVB Briefing provided by Mr. Alex Parkhill

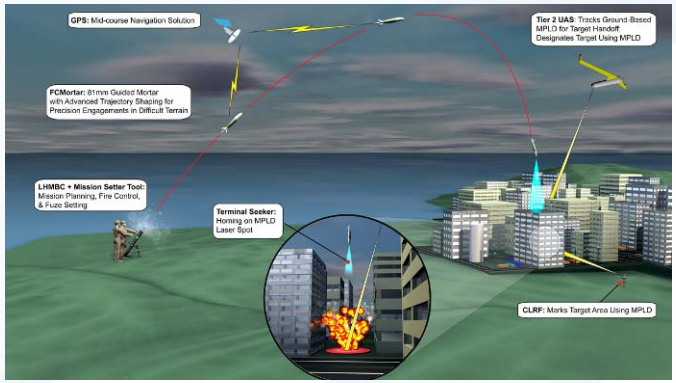
Navy MEMS Fuze
For Marine Corp Flight Control Mortar

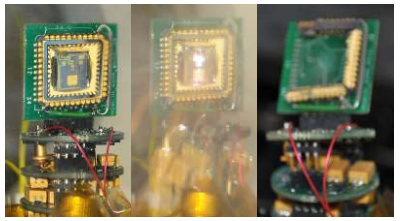
- S&A for 81 mm Precision Urban Mortar Attack (**PUMA**) – Future Naval Capability (FNC)
  - Joint Navy / Army S&T system development
  - Supports Marine Corps Conventional Weapons (CW) Science & Technology Objectives
  - System demonstration in FY14
- MEMS based S&A







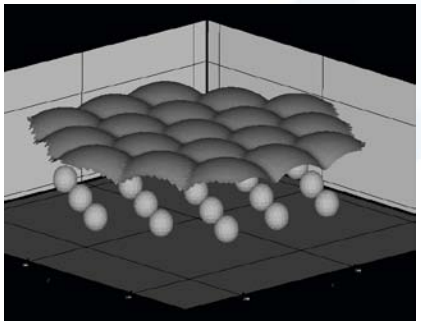


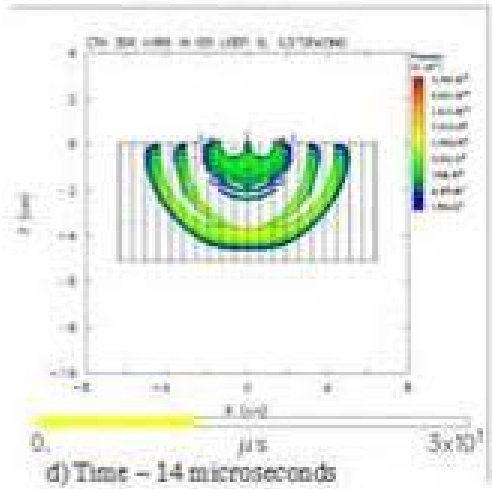


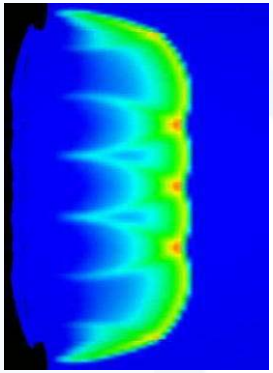
Closed Session IVB Briefing provided by Dr. Dan Jean

Extremely Insensitive Detonating Substance (EIDS) Initiation System

- An Initiation System that emulates large diameter boosters for use in initiating EIDS materials
- OSD funded through Joint Insensitive Munition Technology Program
- Joint Navy (NEE) led effort with Air Force, Army, & Los Alamos participation
- Improved IM performance through elimination of large, relatively sensitive booster
- System requires simultaneous initiation of multiple detonation points







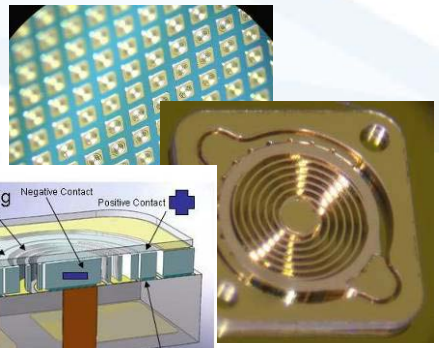
Closed Session IIIB Briefing provided by Mr. Brad Hanna

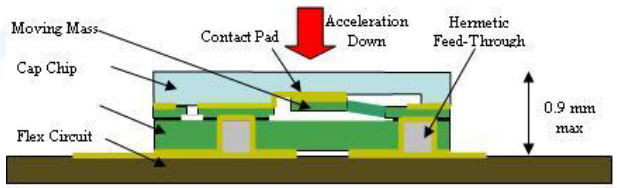
MEMS Retard & Impact Sensors

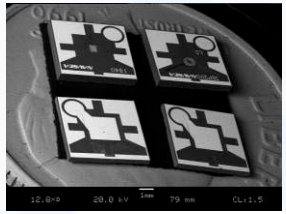
- ***Objective: Obtain DoD retard and impact sensors with precision, reliability, producibility and cost effectiveness by exploiting existing MEMS micro-fabrication and packaging technologies***
- ***Traditional coil spring-mass technology:***
  - *Wide performance variability per mechanical spring tolerances*
  - *Difficult to precisely sense low G's with "macro world" springs*

- ***MEMS technology appears well-suited for making improved low-G sensors per DoD exploratory work to date:***
  - *NAWCWD: precision-electroplated G-sensors*
  - *NSWCIH: silicon G-sensors and packaging*
  - *ARDEC: metal G-sensors and packaging*
- ***FY10 Focus: low-G impact sensors (<100G) & very low-G retard sensors (<5G)***

Illustration and Photograph Courtesy of NAWCWD







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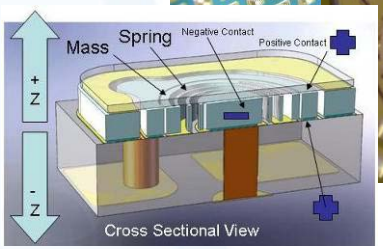

Illustration and Photographs Courtesy of ARDEC

Closed Session IVA Briefing provided by Mr. Walt Maurer

Summary

Today's Navy

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